Research Institute of Magnetic Fluid

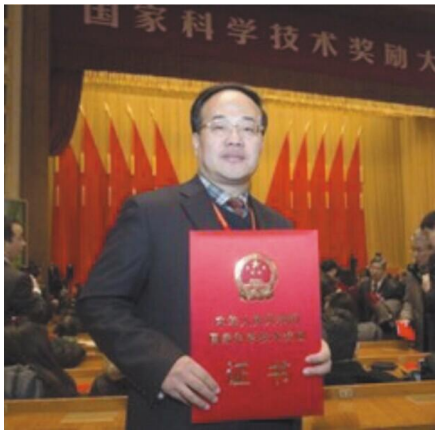
Research Institute of Magnetic Fluid is part of School of Mechanical, Electronic and Control Engineering of Beijing Jiaotong University, Which is the only specialized research institute researching the theory and applications of magnetic fluid in China. Theoretical research, experimental research and application of magnetic fluids in our group have all achieved first-class at home and abroad. There are 1 distinguished professor of "Changjiang Scholars Program", 1 associate professor, 2 lecturers, 1 post-doctoral, 13 Ph.D. graduates and 11 master graduates in our group. Decai Li, the academic team leader, professor, doctoral mentor at Beijing Jiaotong University, he was honored with distinguished professor at "Changjiang Scholars Program" by the Ministry of Education in 2011, and also elected to the "New Century Talents Project" in 2013. The project named "The key technologies and applications of magnetic fluid sealing in complex conditions," hosted by professor Li was honored the second prize of National Technology Invention (ranking first). The program named "Design and application of the magnetic fluid seals" hosted by professor Li was honored the first prize of Beijing Science and Technology Award (ranking first) .

Magnetic fluid (also named ferrofluid or magnetic fluid) is a new type of functional nanomaterial, mainly consists of magnetic nanoparticles, surfactant and base liquid. Coated by appropriate surfactant, the magnetic nanoparticles are dispersed in base liquid to form a stable colloidal system, which can keep long-term stability even in gravity field or strong magnetic field. As a result of their composition, magnetic fluids possess unique combination of fluidity and mgnetism in magnetic field, which make them have a wide range of applications.

With the background of applications in aerospace, industry, navigation and civilian, our institute integrates the subjects of mechanical engineering, fluid transmission and control, electromagnetics, and materials science to establish 8 research fields, as follows:

1. The theory and applications study of magnetic fluid seals
2. The preparation and characterization of magnetic fluids
3. The numerical simulation of ferrohydrodynamics
4. The research of magnetic fluid dampers
5. The research of magnetic fluid sensors
6. The reseach of heat transfer characteristics research of magnetic fluids
7. The theory and applications of magnetorheological fluid
8. The research of Mechanical & Electronic & Hydrodynamics & Magnetics integration

Introduction of the research institute leader



Decai Li, professor and doctoral mentor at Beijing Jiaotong University, the manager and academic leader of the magnetic fluid research institute of Beijing Jiaotong University. He was honored with distinguished professor at "Changjiang Scholars Program" by the Ministry of Education in 2011, and also also elected to "New Century Talents Project" in 2013. The project named "The key technologies and applications of magnetic fluid seals in complex conditions" hosted by professor Li was honored the second prize of the State Technology Invention Award (ranking first)". The program named "Design and application of the magnetic fluid seals" honored the first prize of Beijing Municipal Science & Technology Awards (ranking first).

Awards-winning

1. Distinguished Professor of "Changjiang Scholars Program" of the Ministry of Education in 2011

2. "New of Century Talents Project" in 2013

3. Project " The key technologies and applications of magnetic fluid seals in complex conditions " won the second prize of the State Technological Invention Award

4. Project "Design and Application of the magnetic fluid seals" won the first prize of Beijing Municipal Science & Technology Awards

5. Patent "Low-temperature large diameter magnetic fluid sealing arrangement" won the second prize of Beijing Invention Patent Award

6. Patent "Assembling method for seal components in magnetic fluid seal device" won the excellent prize of China Patent Award

7. Patent "Low-temperature large diameter magnetic fluid sealing arrangement" won the excellent prize of the eleventh China Patent Award

8."Magnetic fluid mechanical seal" won the 2011 China International Industry Fair Bronze Award

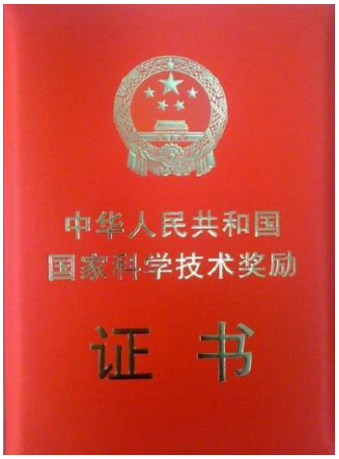
9."Large diameter magnetic fluid sealing device used in low temperature" won the 2009 China International Industry Fair Technology Innovation Award

10. The major special projects of Chinese PLA General Armament Department "The Experimental study of the flange structure of the static magnetic fluid seals used in the nuclear explosive device" won the third prize of the Military Technology Progress Award

11. Patent "Assembling method for seal components in magnetic fluid seal device" won the third prize of Beijing Invention Patent Award

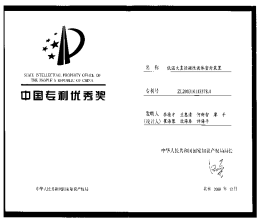
12. Project "Research of mechanism and application of magnetic fluid seal" won the third prize of Science and Technology Progress Award of Science and Technology Department of Hebei Province

Certificates of honor



Second prize of State Technological Invention Award

First prize of Beijing Municipal Science& Technology Awards



National Patent Award

National Patent Award

National Patent Award

Beijing Patents Award

2011 China International Industry Fair Bronze Award

Beijing Patents Award

Third prize of the Military Technology Progress Award

Third prize of Science and Technology Progress Award of Science and Technology Department of Hebei Province

Authorized patents

Patent names	Time	Patent type
Device for reducing resistance of magnetic fluid at section abrupt change position of pipeline	2013-04-20	Patent of invention
Magnetic fluid sealing device with heating by electromagnetic waves	2013-02-27	Patent of invention
Magnetic fluid sealing device with heating by electromagnetic waves	2012-10-31	Patent of invention
Bubble removing device for magnetic fluid	2012-10-31	Patent of invention
Magnetic fluid damping device	2012-07-11	Patent of invention
Magnetic fluid sealing device with self-cleaning function	2012-06-27	Patent of invention
A large-diameter static magnetic fluid seal structure clearance	2012-02-01	Patent of invention
Sealing device with uniformly distributed magnetic fluid	2012-01-11	Patent of invention
A method for preparing a package of gold magnetic fluid preparation of magnetic particles	2011-12-11	Patent of invention
Reciprocating sealing performance test bed for magnetic fluid sealing device	2011-09-21	Patent of invention
Magnetic fluid static sealing device of large-diameter flange plates	2011-07-20	Patent of invention
Double-shaft magnetic fluid sealing structure	2011-06-22	Patent of invention
Method for improving sealing life and effect of water nozzle type magnetic fluid sealing device	2011-06-22	Patent of invention
Reciprocating shaft magnetic fluid sealing structure	2010-08-03	Patent of invention
Assembling method for seal components in magnetic fluid seal device	2009-05-06	Patent of invention
Assembling method for seal components in magnetic fluid seal device	2007-05-23	Patent of invention
Sealing anti-drip device of high temp magnetic fluid	2006-04-18	Patent of invention
Sealing device with uniformly distributed magnetic fluid	2003-12-10	Patent of invention
Low-temperature large diameter magnetic fluid sealing arrangement	2003-11-18	Patent of invention
Magnetic liquid static sealing set in use for flange with super large diameter	2003-10-24	Patent of invention
Engraving, milling and grinding electric main shaft sealing structure	2009-09-16	Utility model
Sealing structure of tank panoramic sight	2009-07-22	Utility model
High temperature magnetic fluid seal water-cooling device	2006-06-16	Utility model

Sealing anti-drip device of high temp magnetic fluid	2006-04-18	Utility model
Magnetic fluid performance display device	2004-06-07	Utility model
Magnetic fluid upward movement device	2004-05-26	Utility model
Magnetic fluid climbing apparatus	2004-04-19	Utility model
Magnetic fluid sealing device of reducing radial space size	2003-12-12	Utility model
Device of increasing magnetic fluid sealing pressure durable abilities of reciprocating shaft	2003-12-01	Utility model
Magnetic fluid sealer with guiding structure	2003-11-24	Utility model

Scientific research of magnetic fluids

Our research institute has been studying on magnetic fluids from 1989 to now. Main achievements are shown as follows:

Papers:

He have published more than 160 papers in international journal already, among them, more than 110 have been indexed by SCI, EI, ISTP.

Patents:

There are more than 120 invention patents mentioned by Professor Li as the first inventor, and 44 invention patents have been authorized by the State Intellectual Property Office of P.R.China.

Works:

Decai Li, *Theory and Application of Magnetic Fluid* [M]. China Science Press, 2003

Decai Li, *The Theory and Application of Magnetic Fluid Seals* [M]. China Science Press, 2010.02

Decai Li, *Magnetic Fluid Seal* [M]. Springer (in print)

Decai Li, *The Functional Material Dictionary*[M], China Science Press, 2002.01 (Participated in compilation)

Decai Li, *Mechanical Principle*[M], Science Press, 2010.03 (Participated in compilation)

Decai Li, *Mechanical Principle Teaching Guidance and Problem Solutions*[M], science press, 2010.06 (Participated in compilation)

Decai Li, *Mechanical Design*[M], Mechanical Industry Press, 2007.3 (Participated in compilation)

The preparation of magnetic fluids

● Water-based, kerosene-based, engine oil-based, diesters-based and fluorocarbon -based magnetic fluids with fine stable property were prepared.

The experimental research of magnetic fluids

1. The only magnetic fluid reciprocating seal experimental table in China has been

designed. Lots of experiments and theory researches on the relationship between anti-pressure and stroke & velocity of magnetic fluid reciprocating seal have been carried out.

2. The magnetic fluid rotating seal experiment table has been designed. Lots of experiments and theory researches on magnetic fluid static and rotating seal have been carried out.
3. The only magnetic fluid damper experiment table has been designed. Deep research on theory and applications of magnetic fluid dampers have been carried out.
4. Several types of magnetic fluid sensors have been designed. Deep research on theory and applications of magnetic fluid sensors have been carried out.

The applications of magnetic fluid

● The magnetic fluid sealing problems of roots vacuum pumps CJ-150, CJ-300, CJ-600 and monocrystalline silicon stoves TDR-62，TDR-72，TDR-80 were solved in domestic for the first time.

● The magnetic fluid sealing problems of USA monocrystalline silicon stove 860D have been solved in domestic for the first time, and the magnetic fluid sealing problems of the magnetic fluid sealing equipments made by USA, Germany have been solved for many times

● Many types of magnetic fluid sealing structures have been designed to meet different needs of Chinese PLA General Armament Department and COSTIND.

● Magnetic fluid sensors were designed and manufactured, such as acceleration sensors, micro-pressure sensors, which filled the blank of China in magnetic fluid sensors area.

● Magnetic fluid inertia damper were designed.

● Some exhibits for teaching were designed and manufactured , such as magnetic fluid interface instability display instrument, magnetic floating tellurion, magnetic fluid slope climbing apparatus and so on.

● We have designed thousands of magnetic fluid sealing devices and saved billions of dollars for our country for more than 20 years.

It’s worth indicating that our research institute also can produce reciprocating sealing devices of magnetic fluid besides rotating sealing devices of magnetic fluid. Our research institute has reached the international advanced level in magnetic fluid sealing aspects.

The research institute of magnetic fluid of Beijing Jiaotong University combines research, manufacture and sales of magnetic fluid seals products. It had established a long-term technical cooperation with some famous universities and companies at home and abroad.

Our research institute mainly engages in the research and manufacture of products, such as preparation of magnetic fluid，magnetic fluid sealings, magnetic fluid sensors, magnetic fluid inertial dampers, magnetic fluid teaching equipments, etc.

Our research institute has provided rotating and straight magnetic fluid seals for monocrystalline silicon stoves, coating equipments, thermal treatment stoves whose

sizes range from a few millimeters to thousands of millimeters, and there are various kinds of structures for different requirements of vacuum equipments. Our research institute possesses the most advanced manufacturing equipments of magnetic fluid preparation and magnetic fluid products, such as more than 60 machine tools including five-axis-cooperating numerically-controlled machine tools here..

The magnetic fluid seals produced by our research institute have been widely applied to the sealing parts of various vacuum equipments at home and abroad, such as vacuum stoves, sintering stoves, brazing stoves, quenching stoves, thermal treatment stoves, monocrystalling silicon stoves, vacuum pumps, coating machines, chemical vapor deposition equipments, centrifugal beam etching machines, molecular pumps, ultra-high-speed centrifuges, etc. Hundreds of magnetic fluid seals were exported from our research institute in 2013.

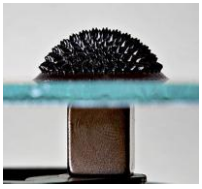
It's worth emphasizing that our research institute has made great contributions to our national defense career. The magnetic fluid prepared by our research institute has been successfully applied to the aerospace, main battle tanks, space exploration, warships and other fields.

▲Aerospace

▲Main tank

▲Space exploration

▲Aircraft carrier



The state of the magnetic fluid under the action of external magnetic field

◆ Exclusive production of large stroke, high reciprocating speed magnetic fluid sealing device.

◆The desflurane oil-based magnetic fluid which can resist acid and alkali has been developed successfully, it opens up a new era in the field of magnetic fluid seals.

◆The successful research and development of the magnetic fluid seals which can bear the temperature of -60℃ fills the gaps in military field.

◆Many products have been used in the domestic key engineering and military industry.

◆The heat transfer property of the equipments which used magnetic fluid increases 2~3 times and the resistance decreases 2 times. These equipments have already been applied in military industry.

◆Profession wins reputation, ten years quality assurance for minimum.

The magnetic fluid sensors developed by our research institute possess the advantages of high sensitivity, high precision, small size, low cost, impact resistance,

etc. They have been widely used in military and civilian fields.

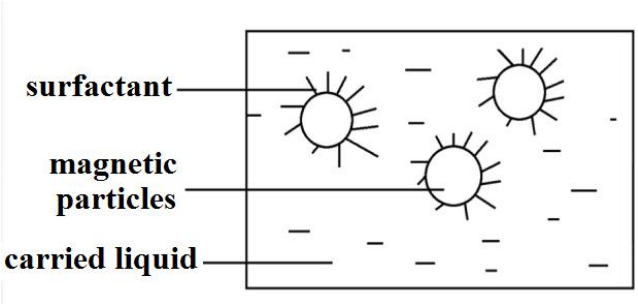
The magnetic fluid dampers have been widely used in computers, peripherals, high-precision handling equipments and medical robots.

The teaching equipments and exhibits of magnetic fluid developed by our research institute are shown as follows: Magnetic fluid suspension apparatus, magnetic fluid pole climbing apparatus, magnetic fluid interface instability display instrument, magnetic fluid slope climbing apparatus, etc.

The cooperation of research

- Our research institute has been engaged in the theory and applications research of magnetic fluid together with the magnetic fluid experts in USA, Japan, Russia，Belarus, etc.
- Up to now, more than 500 people have been trained on magnetic fluid preparations and applications for various mining enterprises and corporations by our research institute.
- Our research institute is willing to train people on magnetic fluid preparation and applications for various mining enterprises and corporations. Training content contains the preparation of magnetic fluid , the design of magnetic fluid seals, etc.
- There are advanced equipments in our research institute. We can afford performance test on magnetic fluid and conduct experiments on magnetic fluid applications such as magnetic fluid sealing devices.
- Our research institute is willing to provide various consultations on magnetic fluid for corporations.

What is magnetic fluid



Magnetic fluid is a new kind of functional materials. It is a stable colloidal dispersion, which is made of nano-scale magnetic particles, surfactant and carried liquid. Its compositions are shown on the left. Magnetic fluid not only possesses the property of the liquid’s liquidity but also the magnetism of solid magnetic materials. For this reason, it has a high academic value and wide application.

Magnetic fluids prepared by our research institute

For more than 20 years, the water-based, coal oil-based, machine oil-based, double ester-based and fluorocarbon-based magnetic fluid have been prepared in our research institute, which are widely used in sealings, sensors, dampers and other fields. They win

widespread high praise for their low price and excellent performance.

Model and physical parameters of the magnetic fluid prepared in our research institute

Type	MFW	MFK	MF01	MF02	MF03	MF04	MFZ	MFF
Carried liquid	Water	Kerosene	Machine-oil	Machine-oil	Machine-oil	Machine-oil	Diester	Fluorocarbon
Color	Black	Black	Black	Black	Black	Black	Pitchy black	Black
Saturation magnetization (Gs)	200±20	450±10	450±50	450±50	450±50	450±50	450±20	100±50
Density （kg/m^3）$\times 10^3$	1.18	1.48	1.23	1.30	1.32	1.31	1.27	2.05
Viscosity （cp）（25℃）	1－10	3－25	20	100	200	260	100－1000	2500
Carried liquid saturated vapor pressure （Pa，20℃）	2.3×10^3						4×10^{-2}－10^2	
Vapor pressure (the temperature of designated value)/ （1mmHg℃/760 mmHg℃）	/100	77/	77/	77/	77/	77/	138/ 324	
Evaporative capacity / （g/cm^2 h)(80℃)							5.1×10^{-6}	
Initial susceptibility / （m/H）	0.6	0.4	0.8	0.8	0.8	0.8	0.25	
Surface tension / （N/cm）	26×10^{-5}	28×10^{-5}	28×10^{-5}	28×10^{-5}	28×10^{-5}	28×10^{-5}	32×10^{-5}	18×10^{-5}
Thermal conductivity （$W\cdot m^{-1}k^{-1}$）	0.59	0.16	0.15	0.15	0.15	0.15	0.16	0.20
Specific heat / （$KJ\cdot m^{-3}k^{-1}$）	4184		1715	1715	1715	1715	3724	1966
Thermal expansion coefficient /($m^3\cdot m^{-3}\cdot\times k^{-1}$)	5.2×10^{-4}		9.0×10^{-4}	9.0×10^{-4}	9.0×10^{-4}	9.0×10^{-4}	8.1×10^{-4}	10.6×10^{-4}

Some equipments in research research institute

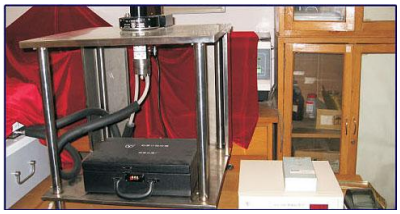
◆Magnetic fluid preparation and testing equipments

Analytical balance

Helium mass spectrometer leak detector

Microscopic three-dimensional console Iron spectrum microscope readout

Revolving viscometer



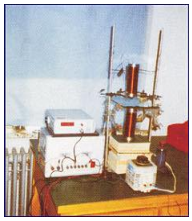
Magnetic viscosity meter

Cone-and-plate viscometer

Constant temperature bath

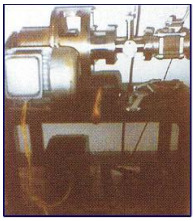
Iron spectrum microscope readout

Magnetic fluid rheometer



Magnetic fluid performance test platform

Vacuum drier

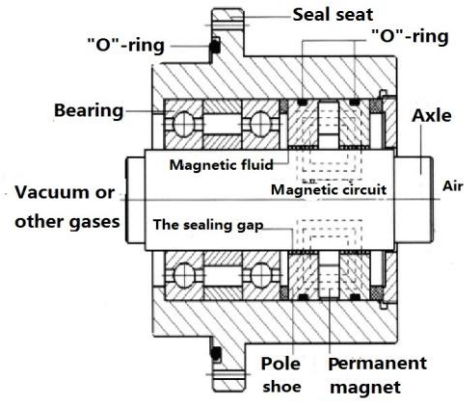


Magnetic fluid rotating seal platform

◆Experimental devices for magnetic fluid seals

◆Processing equipments of magnetic fluid seals

Principle of magnetic fluid seal



Magnetic fluid seal takes advantages of the response of magnetic fluid to applied magnetic fields. Inject magnetic fluid into the magnetic circuit formed by the high-performance permanent magnet, pole pieces and shaft, then the magnetic fluid forms a number of liquid "O"-rings. When magnetic fluid is affected by the differential pressure, it will move in the non-uniform magnetic field. At the same time, the non-uniform magnetic field will force magnetic fluid to generate magnetic force against the differential pressure and reach a new equilibrium. In this way, magnetic fluid plays a role in seals.

Advantages of magnetic fluid seal compared with traditional seal

●Unmeasured leakage rate: In the static and dynamic measurement, use the mass spectrometry method to evaluate the helium seal, helium leak is less than 10^{-12} Pa · m^3 · s^{-1} in normal temperature and pressure, it has important significance for sealing the materials of high toxic, flammable, explosive, radioactive, especially for the valuable materials and high purity materials.

●Long life: Sealing with fluid "O"-rings, there is no contact between pole pieces and shaft, so no solid wear occurs between them. Moreover, magnetic fluid has no corrosive effect on the shaft, so the service life is long. In the performance evaluation, sealing parts can be in operation for over ten years with no maintenance.

●High reliability: The magnetic fluids sealing device contains a simple permanent magnet, pole pieces and a little of magnetic fluid. The only part that may subject to wear is bearings, so it has high reliability

●Non-contaminating: Since there is no mechanical wear, there is no particle produced to pollute the system. In addition, low vapor pressure magnetic fluid maintain seal reliability even in high vacuums to more than10^{-6} Pa.

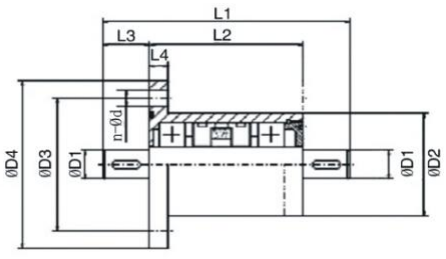
●High rotate speed bearing capability: Magnetic fluid seal has low power consumption and strong ability to bear high speed.

●The best torque transmission: torque of the shaft can 100% transmit without power loss, and can provide homodromy continuously.

●Low viscous friction: The low viscous friction of the magnetic fluid is independent of the pressure applied of the seal, this assures its smooth operation.

The seal mediums of the magnetic fluid sealing apparatus produced by our research institute are gas or parts of liquid, the leakage rate is less than $10^{-12} Pa \cdot m^3 \cdot s^{-1}$. Generally pressure resistance of single stage is 0.2 atmosphere, and applied temperature range is 0 to 200℃ (temperature could be higher with the addition of special treatment).Our research institute has manufactured hundreds of magnetic fluid apparatuses for all walks of life till now. Some representational products are shown as follows. Our research institute can manufacture rotary seal, reciprocating seal or rotary-reciprocating compound seal, and the apparatus combined magnetic fluid seal with traditional seal. We can also produce specific seal products to meet the special demand of clients.

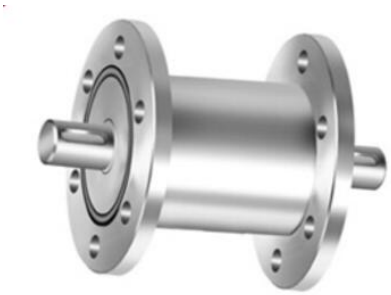
➢ Solid Shaft Flange Mount Feedthroughs

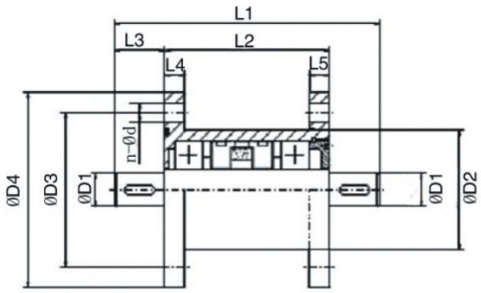


Type	Shape size	Bearing type

	D1	D2	D3	D4	n-Φ d	L1	L2	L3	L4	
JD06	$6h7\left(^{0}_{-0.012}\right)$	40	55	70	4-Φ7	102	66	18	8	6200
JD10	$10h7\left(^{0}_{-0.015}\right)$	44	60	75	4-Φ7	120	70	25	8	6201
JD12	$12h7\left(^{0}_{-0.018}\right)$	48	65	85	4-Φ9	124	74	25	10	6202
JD16	$16h7\left(^{0}_{-0.018}\right)$	58	75	95	4-Φ9	132	82	25	10	6204
JD20	$20h7\left(^{0}_{-0.021}\right)$	63	85	105	6-Φ9	152	92	30	12	6205
JD25	$25h7\left(^{0}_{-0.021}\right)$	75	95	115	6-Φ9	165	105	30	12	6206
JD30	$30h7\left(^{0}_{-0.021}\right)$	85	105	125	6-Φ9	180	110	35	12	6207
JD35	$35h7\left(^{0}_{-0.025}\right)$	95	120	140	6-Φ11	185	115	35	15	6208
JD40	$40h7\left(^{0}_{-0.025}\right)$	100	125	145	6-Φ11	200	120	40	15	6209
JD45	$45h7\left(^{0}_{-0.025}\right)$	105	130	150	8-Φ11	215	125	45	15	6210
JD50	$50h7\left(^{0}_{-0.025}\right)$	115	140	160	8-Φ11	230	130	50	15	6211
JD55	$55h7\left(^{0}_{-0.03}\right)$	125	155	180	8-Φ13	245	135	55	18	6212
JD60	$60h7\left(^{0}_{-0.03}\right)$	135	165	190	8-Φ13	260	140	60	18	6213
JD65	$65h7\left(^{0}_{-0.03}\right)$	140	170	195	8-Φ13	275	145	65	18	6214
JD70	$70h7\left(^{0}_{-0.03}\right)$	145	175	200	8-Φ13	290	150	70	18	6215
JD75	$75h7\left(^{0}_{-0.03}\right)$	160	195	230	8-Φ17	300	160	70	20	6216
JD80	$80h7\left(^{0}_{-0.03}\right)$	170	205	240	8-Φ17	310	170	70	20	6217
JD85	$85h7\left(^{0}_{-0.035}\right)$	180	215	250	8-Φ17	340	180	80	20	6218
Characteristic parameters		Vacuum				Leakage rate				
		10^{-6}Pa				10^{-12}Pa ṁ^3 s^{-1}				

- Hollow Shaft Double Flanges Mount Feedthroughs

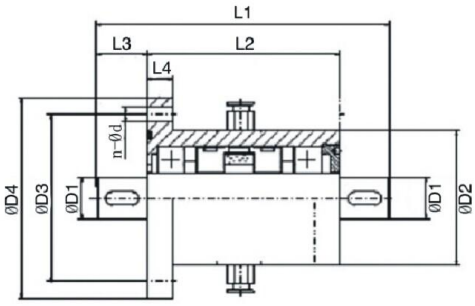




Type	Shape size										Bearing type
	D1	D2	D3	D4	n-Φ d	L1	L2	L3	L4	L5	
JD06	$6h7\left(^{0}_{-0.012}\right)$	40	55	70	4-Φ7	97	82	10	10	10	6200
JD10	$10h7\left(^{0}_{-0.015}\right)$	44	60	75	4-Φ7	97	82	10	10	10	6201
JD12	$12h7\left(^{0}_{-0.018}\right)$	48	65	85	4-Φ9	107	92	10	12	12	6202
JD16	$16h7\left(^{0}_{-0.018}\right)$	58	75	95	4-Φ9	120	105	10	12	12	6204
JD20	$20h7\left(^{0}_{-0.021}\right)$	63	85	105	6-Φ9	125	110	10	12	12	6205
JD25	$25h7\left(^{0}_{-0.021}\right)$	75	95	115	6-Φ9	130	115	10	15	15	6206
JD30	$30h7\left(^{0}_{-0.021}\right)$	85	105	125	6-Φ9	139	120	14	15	15	6207
JD35	$35h7\left(^{0}_{-0.025}\right)$	95	120	140	6-Φ11	144	125	14	15	15	6208
JD40	$40h7\left(^{0}_{-0.025}\right)$	100	125	145	6-Φ11	149	130	14	15	15	6209
JD45	$45h7\left(^{0}_{-0.025}\right)$	105	130	150	8-Φ11	154	135	14	18	18	6210
JD50	$50h7\left(^{0}_{-0.025}\right)$	115	140	160	8-Φ11	159	140	14	18	18	6211
JD55	$55h7\left(^{0}_{-0.03}\right)$	125	155	180	8-Φ13	164	145	14	18	18	6212
JD60	$60h7\left(^{0}_{-0.03}\right)$	135	165	190	8-Φ13	171	150	16	18	18	6213
JD65	$65h7\left(^{0}_{-0.03}\right)$	140	170	195	8-Φ13	181	160	16	20	20	6214

JD70	70h7$\left(^{0}_{-0.03}\right)$	145	175	200	8-Φ13	191	170	16	20	20	6215
JD75	75h7$\left(^{0}_{-0.03}\right)$	160	195	230	8-Φ17	201	180	16	20	20	6216
JD80	80h7$\left(^{0}_{-0.03}\right)$	170	205	240	8-Φ17	170	70	20	20	20	6217
JD85	85h7$\left(^{0}_{-0.035}\right)$	180	215	250	8-Φ17	180	80	20	20	20	6218
Characteristic parameters		Vacuum				Leakage rate					
		10^{-6}Pa				10^{-12}Pa m^3 s^{-1}					

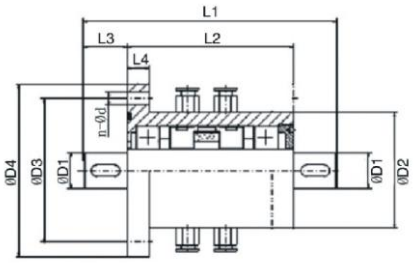
➢ Solid Shaft Flange Dual Water Nozzles Feedthroughs



Type	Shape size									Bearing type
	D1	D2	D3	D4	n-Φd	L1	L2	L3	L4	
JD10	10h7$\left(^{0}_{-0.015}\right)$	50	68	85	4-Φ7	135	85	25	8	6201
JD12	12h7$\left(^{0}_{-0.018}\right)$	53	73	90	4-Φ9	135	85	25	10	6202
JD16	16h7$\left(^{0}_{-0.018}\right)$	65	85	105	4-Φ9	155	105	25	10	6204
JD20	20h7$\left(^{0}_{-0.021}\right)$	70	90	110	6-Φ9	170	110	30	12	6205
JD25	25h7$\left(^{0}_{-0.021}\right)$	80	100	120	6-Φ9	175	115	30	12	6206
JD30	30h7$\left(^{0}_{-0.021}\right)$	92	110	130	6-Φ9	188	118	35	12	6207
JD35	35h7$\left(^{0}_{-0.025}\right)$	100	125	145	6-Φ11	192	122	35	15	6208

JD40	40h7$\left(^{0}_{-0.025}\right)$	105	130	150	6-Φ11	208	128	40	15	6209
JD45	45h7$\left(^{0}_{-0.025}\right)$	110	135	155	8-Φ11	220	130	45	15	6210
JD50	50h7$\left(^{0}_{-0.025}\right)$	120	145	165	8-Φ11	240	140	50	15	6211
JD55	55h7$\left(^{0}_{-0.03}\right)$	130	160	185	8-Φ13	255	145	55	18	6212
JD60	60h7$\left(^{0}_{-0.03}\right)$	140	170	195	8-Φ13	270	150	60	18	6213
JD65	65h7$\left(^{0}_{-0.03}\right)$	145	175	200	8-Φ13	285	155	65	18	6214
JD70	70h7$\left(^{0}_{-0.03}\right)$	150	180	205	8-Φ13	300	160	70	18	6215
JD75	75h7$\left(^{0}_{-0.03}\right)$	165	200	235	8-Φ17	310	170	70	20	6216
JD80	80h7$\left(^{0}_{-0.03}\right)$	180	215	250	8-Φ17	320	180	70	20	6217
JD85	85h7$\left(^{0}_{-0.035}\right)$	190	225	260	8-Φ17	350	190	80	20	6218
Characteristic parameters		Vacuum				Leakage rate				
		10^{-6}Pa				10^{-12}Pa ṁ^3 s^{-1}				

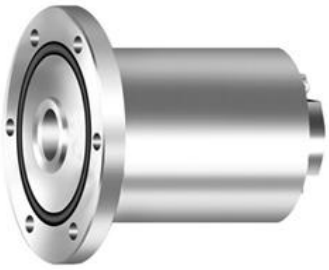
➢ Solid Flanged Axis Four Nozzles Water Feedthroughs

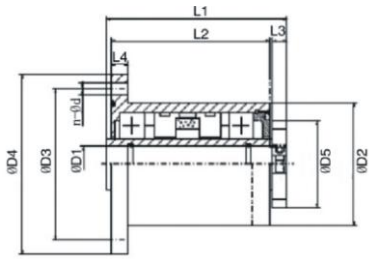


Type	Shape size									Bearing type
	D1	D2	D3	D4	n-Φd	L1	L2	L3	L4	

JD10	$10h7\left(^{0}_{-0.015}\right)$	50	68	85	4-Φ7	135	85	25	8	6201
JD12	$12h7\left(^{0}_{-0.018}\right)$	53	73	90	4-Φ9	135	85	25	10	6202
JD16	$16h7\left(^{0}_{-0.018}\right)$	65	85	105	4-Φ9	155	105	25	10	6204
JD20	$20h7\left(^{0}_{-0.021}\right)$	70	90	110	6-Φ9	170	110	30	12	6205
JD25	$25h7\left(^{0}_{-0.021}\right)$	80	100	120	6-Φ9	175	115	30	12	6206
JD30	$30h7\left(^{0}_{-0.021}\right)$	92	110	130	6-Φ9	188	118	35	12	6207
JD35	$35h7\left(^{0}_{-0.025}\right)$	100	125	145	6-Φ11	192	122	35	15	6208
JD40	$40h7\left(^{0}_{-0.025}\right)$	105	130	150	6-Φ11	208	128	40	15	6209
JD45	$45h7\left(^{0}_{-0.025}\right)$	110	135	155	8-Φ11	220	130	45	15	6210
JD50	$50h7\left(^{0}_{-0.025}\right)$	120	145	165	8-Φ11	240	140	50	15	6211
JD55	$55h7\left(^{0}_{-0.03}\right)$	130	160	185	8-Φ13	255	145	55	18	6212
JD60	$60h7\left(^{0}_{-0.03}\right)$	140	170	195	8-Φ13	270	150	60	18	6213
JD65	$65h7\left(^{0}_{-0.03}\right)$	145	175	200	8-Φ13	285	155	65	18	6214
JD70	$70h7\left(^{0}_{-0.03}\right)$	150	180	205	8-Φ13	300	160	70	18	6215
JD75	$75h7\left(^{0}_{-0.03}\right)$	165	200	235	8-Φ17	310	170	70	20	6216
JD80	$80h7\left(^{0}_{-0.03}\right)$	180	215	250	8-Φ17	320	180	70	20	6217
JD85	$85h7\left(^{0}_{-0.03}\right)$	190	225	260	8-Φ17	350	190	80	20	6218
Characteristic parameters		Vacuum				Leakage rate				
		10^{-6}Pa				10^{-12}Pa m^3 s^{-1}				

- Hollow Shaft Flange Mount Feedthroughs

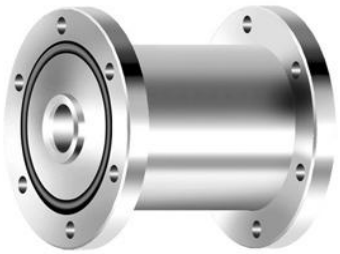


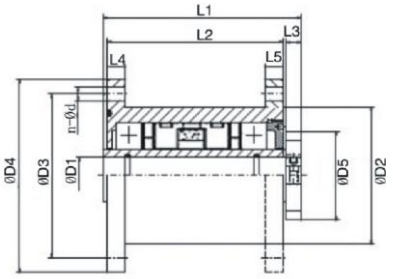


Type	Shape size										Bearing type
	D1	D2	D3	D4	D5	n-Φ d	L1	L2	L3	L4	
JD10	$10F8\left(^{+0.035}_{+0.013}\right)$	58	75	95	45	4-Φ9	97	82	10	10	6204
JD12	$12F8\left(^{+0.043}_{+0.016}\right)$	58	75	95	48	4-Φ9	97	82	10	10	6204
JD16	$16F8\left(^{+0.043}_{+0.016}\right)$	63	85	105	52	6-Φ9	107	92	10	12	6205
JD20	$20F7\left(^{+0.041}_{+0.02}\right)$	75	95	115	55	6-Φ9	120	105	10	12	6206
JD25	$25F7\left(^{+0.041}_{+0.02}\right)$	85	105	125	60	6-Φ9	125	110	10	12	6207
JD30	$30F7\left(^{+0.041}_{+0.02}\right)$	95	120	140	67	6-Φ11	130	115	10	15	6208
JD35	$35F7\left(^{+0.05}_{+0.025}\right)$	100	125	145	77	6-Φ11	139	120	14	15	6209
JD40	$40F7\left(^{+0.05}_{+0.025}\right)$	105	130	150	82	8-Φ11	144	125	14	15	6210
JD45	$45F7\left(^{+0.05}_{+0.025}\right)$	115	140	160	87	8-Φ11	149	130	14	15	6211
JD50	$50F7\left(^{+0.05}_{+0.025}\right)$	125	155	180	92	8-Φ13	154	135	14	18	6212
JD55	$55G7\left(^{+0.04}_{+0.01}\right)$	135	165	190	99	8-Φ13	159	140	14	18	6213
JD60	$60G7\left(^{+0.04}_{+0.01}\right)$	140	170	195	105	8-Φ13	164	145	14	18	6214
JD65	$65G7\left(^{+0.04}_{+0.01}\right)$	145	175	200	113	8-Φ13	171	150	16	18	6215
JD70	$70G7\left(^{+0.04}_{+0.01}\right)$	160	195	230	118	8-Φ17	181	160	16	20	6216
JD75	$75G7\left(^{+0.04}_{+0.01}\right)$	170	205	240	125	8-Φ17	191	170	16	20	6217
JD80	$80G7\left(^{+0.04}_{+0.01}\right)$	180	215	250	130	8-Φ17	201	180	16	20	6218

Characteristic parameters	Vacuum	Leakage rate
	10^{-6}Pa	10^{-12}Pa ṁ^3 s^{-1}

➢ Hollow Shaft Double Flanges Feedthroughs

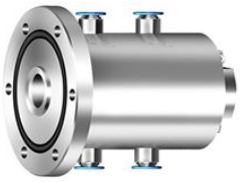


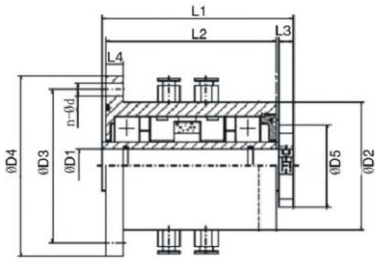


Type	Shape size											Bearing type
	D1	D2	D3	D4	D5	n-Φd	L1	L2	L3	L4	L5	
JD10	$10F8\left(^{+0.035}_{+0.013}\right)$	58	75	95	45	4-Φ9	97	82	10	10	10	6204
JD12	$12F8\left(^{+0.043}_{+0.016}\right)$	58	75	95	48	4-Φ9	97	82	10	10	10	6204
JD16	$16F8\left(^{+0.043}_{+0.016}\right)$	63	85	105	52	6-Φ9	107	92	10	12	12	6205
JD20	$20F7\left(^{+0.041}_{+0.02}\right)$	75	95	115	55	6-Φ9	120	105	10	12	12	6206
JD25	$25F7\left(^{+0.041}_{+0.02}\right)$	85	105	125	60	6-Φ9	125	110	10	12	12	6207
JD30	$30F7\left(^{+0.041}_{+0.02}\right)$	95	120	140	67	6-Φ11	130	115	10	15	15	6208
JD35	$35F7\left(^{+0.05}_{+0.025}\right)$	100	125	145	77	6-Φ11	139	120	14	15	15	6209
JD40	$40F7\left(^{+0.05}_{+0.025}\right)$	105	130	150	82	8-Φ11	144	125	14	15	15	6210
JD45	$45F7\left(^{+0.05}_{+0.025}\right)$	115	140	160	87	8-Φ11	149	130	14	15	15	6211
JD50	$50F7\left(^{+0.05}_{+0.025}\right)$	125	155	180	92	8-Φ13	154	135	14	18	18	6212
JD55	$55G7\left(^{+0.04}_{+0.01}\right)$	135	165	190	99	8-Φ13	159	140	14	18	18	6213
JD60	$60G7\left(^{+0.04}_{+0.01}\right)$	140	170	195	105	8-Φ13	164	145	14	18	18	6214

JD65	65G7$\left(^{+0.04}_{+0.01}\right)$	145	175	200	113	8-Φ13	171	150	16	18	18	6215
JD70	70G7$\left(^{+0.04}_{+0.01}\right)$	160	195	230	118	8-Φ17	181	160	16	20	20	6216
JD75	75G7$\left(^{+0.04}_{+0.01}\right)$	170	205	240	125	8-Φ17	191	170	16	20	20	6217
JD80	80G7$\left(^{+0.04}_{+0.01}\right)$	180	215	250	130	8-Φ17	201	180	16	20	20	6218
Characteristic parameters		Vacuum					Leakage rate					
		10^{-6}Pa					10^{-12}Pa ṁ^3 s^{-1}					

➢ Flange Hollow Shaft Four Water Nozzles Feedthroughs

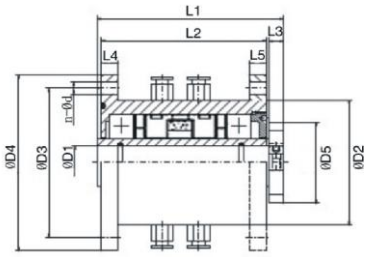




Type	Shape size										Bearing type
	D1	D2	D3	D4	D5	n- Φ d	L1	L2	L3	L4	
JD10	10F8$\left(^{+0.035}_{+0.013}\right)$	65	85	105	45	4-Φ9	120	105	10	10	6204
JD12	12F8$\left(^{+0.043}_{+0.016}\right)$	65	85	105	48	4-Φ9	120	105	10	10	6204
JD16	16F8$\left(^{+0.043}_{+0.016}\right)$	70	90	110	52	6-Φ9	125	110	10	12	6205
JD20	20F7$\left(^{+0.041}_{+0.02}\right)$	80	100	120	55	6-Φ9	130	115	10	12	6206
JD25	25F7$\left(^{+0.041}_{+0.02}\right)$	92	110	130	60	6-Φ9	133	118	10	12	6207
JD30	30F7$\left(^{+0.041}_{+0.02}\right)$	100	125	145	67	6-Φ11	137	122	10	15	6208
JD35	35F7$\left(^{+0.05}_{+0.025}\right)$	105	130	150	77	6-Φ11	147	128	14	15	6209
JD40	40F7$\left(^{+0.05}_{+0.025}\right)$	110	135	155	82	8-Φ11	149	130	14	15	6210

JD45	45F7$\left(^{+0.05}_{+0.025}\right)$	120	145	165	87	8-Φ11	159	140	14	15	6211
JD50	50F7$\left(^{+0.05}_{+0.025}\right)$	130	160	185	92	8-Φ13	164	145	14	18	6212
JD55	55G7$\left(^{+0.04}_{+0.01}\right)$	140	170	195	99	8-Φ13	169	150	14	18	6213
JD60	60G7$\left(^{+0.04}_{+0.01}\right)$	145	175	200	105	8-Φ13	174	155	14	18	6214
JD65	65G7$\left(^{+0.04}_{+0.01}\right)$	150	180	205	113	8-Φ13	181	160	16	18	6215
JD70	70G7$\left(^{+0.04}_{+0.01}\right)$	165	200	235	118	8-Φ17	191	170	16	20	6216
JD75	75G7$\left(^{+0.04}_{+0.01}\right)$	180	215	250	125	8-Φ17	201	180	16	20	6217
JD80	80G7$\left(^{+0.04}_{+0.01}\right)$	190	225	260	130	8-Φ17	211	190	16	20	6218
Characteristic parameters		Vacuum					Leakage rate				
		10^{-6}Pa					10^{-12}Pa ṁ^3 s^{-1}				

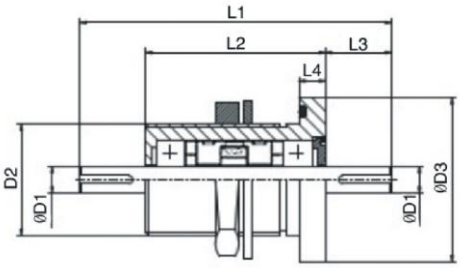
➢ Hollow Shaft Double Flanges Four Water Nozzles Feedthroughs



Type	Shape size											Bearing type
	D1	D2	D3	D4	D5	n-Φd	L1	L2	L3	L4	L5	
JD10	10F8$\left(^{+0.035}_{+0.013}\right)$	65	85	105	45	4-Φ9	120	105	10	10	10	6204
JD12	12F8$\left(^{+0.043}_{+0.016}\right)$	65	85	105	48	4-Φ9	120	105	10	10	10	6204
JD16	16F8$\left(^{+0.043}_{+0.016}\right)$	70	90	110	52	6-Φ9	125	110	10	12	12	6205
JD20	20F7$\left(^{+0.041}_{+0.02}\right)$	80	100	120	55	6-Φ9	130	115	10	12	12	6206

JD25	$25F7^{(+0.041}_{+0.02)}$	92	110	130	60	6-Φ9	133	118	10	12	12	6207
JD30	$30F7^{(+0.041}_{+0.02)}$	100	125	145	67	6-Φ11	137	122	10	15	15	6208
JD35	$35F7^{(+0.05}_{+0.025)}$	105	130	150	77	6-Φ11	147	128	14	15	15	6209
JD40	$40F7^{(+0.05}_{+0.025)}$	110	135	155	82	8-Φ11	149	130	14	15	15	6210
JD45	$45F7^{(+0.05}_{+0.025)}$	120	145	165	87	8-Φ11	159	140	14	15	15	6211
JD50	$50F7^{(+0.05}_{+0.025)}$	130	160	185	92	8-Φ13	164	145	14	18	18	6212
JD55	$55G7^{(+0.04}_{+0.01)}$	140	170	195	99	8-Φ13	169	150	14	18	18	6213
JD60	$60G7^{(+0.04}_{+0.01)}$	145	175	200	105	8-Φ13	174	155	14	18	18	6214
JD65	$65G7^{(+0.04}_{+0.01)}$	150	180	205	113	8-Φ13	181	160	16	18	18	6215
JD70	$70G7^{(+0.04}_{+0.01)}$	165	200	235	118	8-Φ17	191	170	16	20	20	6216
JD75	$75G7^{(+0.04}_{+0.01)}$	180	215	250	125	8-Φ17	201	180	16	20	20	6217
JD80	$80G7^{(+0.04}_{+0.01)}$	190	225	260	130	8-Φ17	211	190	16	20	20	6218
Characteristic parameters		Vacuum					Leakage rate					
		10^{-6}Pa					10^{-12}Pa m^3 s^{-1}					

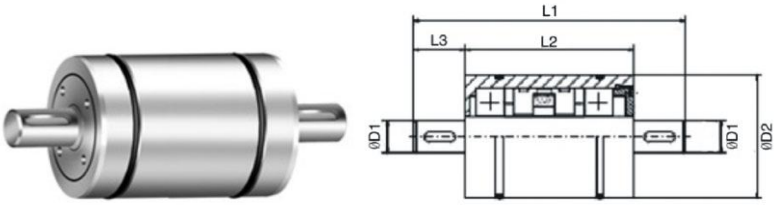
➢ Nut Mount Feedthroughs



Type	Shape size	Bearing type

	D1	D2	D3	L1	L2	L3	L4	
JD06	$6h7\left(^{0}_{-0.012}\right)$	M30×1.5	48	80	50	15	8	626
JD10	$10h7\left(^{0}_{-0.015}\right)$	M42×1.5	64	118	68	25	10	6200
JD12	$12h7\left(^{0}_{-0.018}\right)$	M42×1.5	64	120	70	25	10	6201
JD15	$15h7\left(^{0}_{-0.018}\right)$	M48×1.5	72	125	75	25	10	6202
JD20	$20h7\left(^{0}_{-0.021}\right)$	M60×1.5	84	142	82	30	10	6204
JD25	$25h7\left(^{0}_{-0.021}\right)$	M64×1.5	88	145	85	30	12	6205
JD30	$30h7\left(^{0}_{-0.021}\right)$	M76×1.5	102	150	90	30	12	6206
Characteristic parameters		Vacuum			Leakage rate			
		10^{-6}Pa			10^{-12}Pa m^3 s^{-1}			

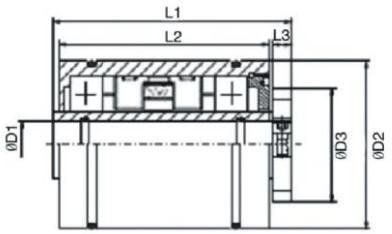
➢ Solid Shaft Sleeve Mount Feedthroughs



Type	Shape size					Bearing type
	D1	D2	L1	L2	L3	
JD06	$6h7\left(^{0}_{-0.012}\right)$	42	102	66	18	6200
JD10	$10h7\left(^{0}_{-0.015}\right)$	44	120	70	25	6201
JD12	$12h7\left(^{0}_{-0.018}\right)$	48	124	74	25	6202
JD16	$16h7\left(^{0}_{-0.018}\right)$	60	132	82	25	6204
JD20	$20h7\left(^{0}_{-0.021}\right)$	66	152	92	30	6205

JD25	$25h7\left(^{0}_{-0.021}\right)$	78	165	105	30	6206
JD30	$30h7\left(^{0}_{-0.021}\right)$	88	180	110	35	6207
JD35	$35h7\left(^{0}_{-0.025}\right)$	97	185	115	35	6208
JD40	$40h7\left(^{0}_{-0.025}\right)$	102	200	120	40	6209
JD45	$45h7\left(^{0}_{-0.025}\right)$	107	215	125	45	6210
JD50	$50h7\left(^{0}_{-0.025}\right)$	118	230	130	50	6211
Characteristic Parameters		Vacuum		Leakage rate		
		10^{-6}Pa		10^{-12}Pa m^3 s^{-1}		

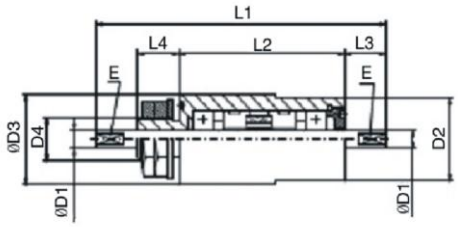
➢ Hollow Shaft Sleeve Mount Feedthroughs



Type	Shape size						Bearing type
	D1	D2	D3	L1	L2	L3	
JD10	$10F8\left(^{+0.035}_{+0.013}\right)$	60	45	97	82	10	6204
JD12	$12F8\left(^{+0.043}_{+0.016}\right)$	60	48	97	82	10	6204
JD16	$16F8\left(^{+0.043}_{+0.016}\right)$	66	52	107	92	10	6205
JD20	$20F7\left(^{+0.041}_{+0.02}\right)$	78	55	120	105	10	6206
JD25	$25F7\left(^{+0.041}_{+0.02}\right)$	88	60	125	110	10	6207
JD30	$30F7\left(^{+0.041}_{+0.02}\right)$	97	67	130	115	10	6208
JD35	$35F7\left(^{+0.05}_{+0.025}\right)$	102	77	139	120	14	6209

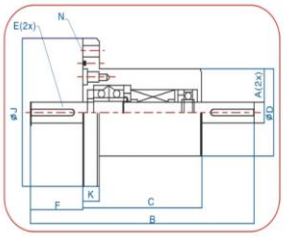
JD40	40F7$\left(^{+0.05}_{+0.025}\right)$	107	82	144	125	14	6210
JD45	45F7$\left(^{+0.05}_{+0.025}\right)$	118	87	149	130	14	6211
JD50	50F7$\left(^{+0.05}_{+0.025}\right)$	128	92	154	135	14	6212
Characteristic parameters		Vacuum			Leakage rate		
		10^{-6}Pa			10^{-12}Pa ṁ^3 s^{-1}		

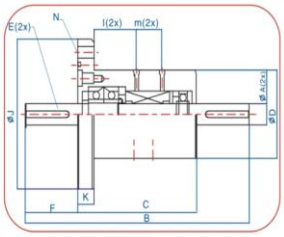
➢ Solid Shaft Nut Mount Feedthroughs



Type	Shape size									Bearing type
	D1	D2	D3	D4	L1	L2	L3	L4	E	
JD04	4h7$\left(^{0}_{-0.012}\right)$	21	22	M10	84	48	12	12	0.5×8	634
JD05	5h7$\left(^{0}_{-0.012}\right)$	23	25	M12×1.5	84	48	12	12	0.5×8	625
JD06	6h7$\left(^{0}_{-0.012}\right)$	25	27	M12×1.5	89	50	12	15	0.5×8	626
JD07	7h7$\left(^{0}_{-0.015}\right)$	28	30	M14×1.5	93	54	12	15	1×8	627
JD08	8h7$\left(^{0}_{-0.015}\right)$	30	32	M14×1.5	97	58	12	15	1×8	628
Characteristic parameters		Vacuum				Leakage rate				
		10^{-6}Pa				10^{-12}Pa ṁ^3 s^{-1}				

➢ Solid Shaft Double Flanges Overloaded Feedthroughs





The Specifications of Solid Shaft Double Flanges Overloaded Magnetic Fluid Seal

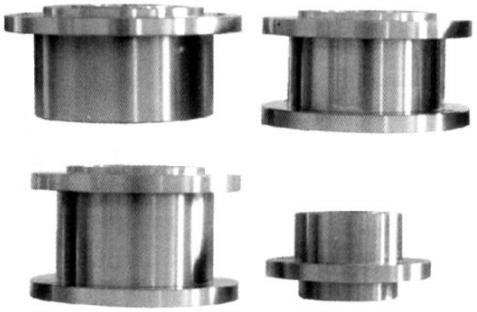
Diameter	20	25	30	40	50
A	$20^{+0}_{-0.033}$	$25^{+0}_{-0.033}$	$30^{+0}_{-0.033}$	$40^{+0}_{-0.039}$	$50^{+0}_{-0.039}$
B	255	288	321	357	406
C	135	138	141	157	166
D	85	95	105	125	140
E	6W×3.5Dp×50Lg	7W×4Dp×63Lg	10W×5Dp×80Lg	12W×5Dp×90Lg	14W×5.5Dp×110Lg
F	60	75	90	100	120
J	145	160	160	185	210
K	18	18	20	22	24
L	48	50	50	55.5	59.5
M	29	29	29	33	33
N	PD120/6-Φ12	PD135/6-Φ12	PD135/6-Φ12	PD130/6-Φ12	PD185/6-Φ12

The Technical Indicators of Solid Shaft Double Flanges Overloaded Magnetic Fluid Seal

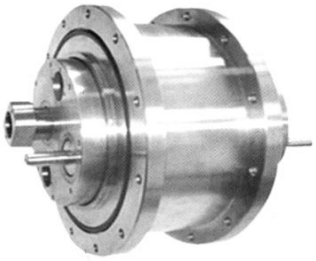
Type	JD020	JD025	JD030	JD040	JD050
Permitted torque transmission[kg cm]	585	1013	1621	3242	5801
Vacuum resistance[Pa]	10^{-6}				
Permitted He leakage[Pa m^3 s^{-1}]	$<10^{-12}$				
Pressure resisitance[kg cm^{-1}]	2.5				
Temperature range[℃]	-10~90 (Water cooling structure can be used beyond this range)				
Gas	Non-reactive gases				
Bearing type	7206 6205	7207 6206	7208 6207	7210 6209	7212 6211

Application examples

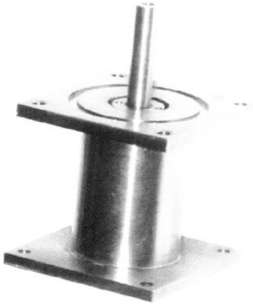
◆Magnetic fluid seals for monocrystalline silicon stove



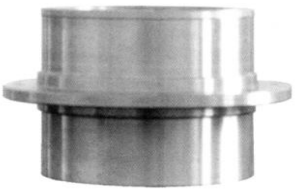
◆Multi-axes magnetic fluid seal



◆Magnetic fluid seal for medical apparatus



◆Large-diameter magnetic fluid seal for militarv industrv



Coating equipment

Web coating equipment

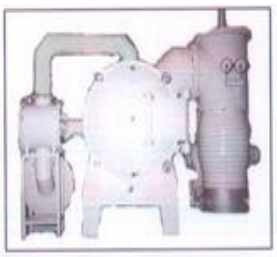
Vacuum switch

Diffusion equipment

Ion etching equipment

Ion implantation equipment

Vacuum heat treatment equipment



Vacuum sintering equipment

Installation & Precautions

◆Avoid solvents (acetone, ethanol, etc.) flowing into the magnetic fluid sealing devices in order to avoid any sealing failure.

◆Before water-cooling magnetic fluid sealing devices work, the cooling water(cooling water can be ordinary tap water, chloride with concentration of 200mg / L， and the pressure less than 0.3MPa) should be connected first, and then start rotating to avoid sealing failure due to overheat.

◆In the case of first use or long term no use， the vacuum value of the sealing devices will suddenly rise(which is an inherent phenomenon of the devices, due to the overflow of the residual air when the internal pressure reaches a new equilibrium).When it suddenly rotates and vacuumizes after remaining stationary .The vacuum value will decrease and remain stable after roating for a time(depending on the working condition it can be 15 minutes to half an hour)

◆Products are tested stringently before delivery, so they have high reliability. If in doubt of the sealing devices, please phone or mail the manufacturers and do not disassemble the seals. The manufacturers will detect the malfunction and dispose it. When take the leak detection, do not use ethanol, acetone, etc. It is recommended that use the helium mass spectrometer leak detector.

◆The sealing devices can not be used at high-speed roating before watering. Its lifetime depends on the bearing life.

◆Please contact our technical staff when apply magnetic fluid sealing devices to the following conditions.

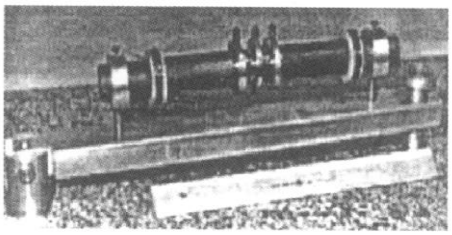
▲High temperature, low temperature, high pressure, high speed conditions

▲Suspended dust particles conditions

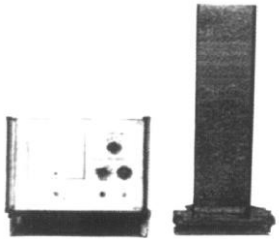
▲Overloaded (axial， radial) conditions

▲ High frequency, high electric field, strong magnetic field conditions.

Magnetic fluid sensor



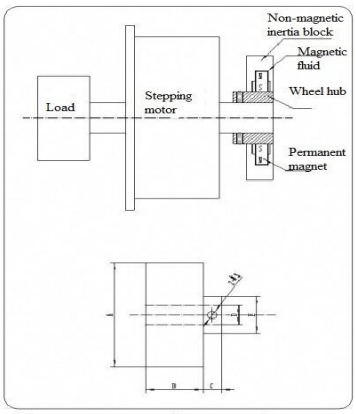
Magnetic fluid acceleration sensor



Magnetic fluid pressure difference sensor

Magnetic fluid sensor is a new type of sensor. It has a wide application range not only in military industry field, but also in civil field. This new type sensor possesses lots of advantages that the traditional sensor doesn't possess, such as high sensitivity、high precision、small size、low cost、impact resistence and so on. The pictures above demonstrate magnetic fluid sensors developed by our research institute.

Magnetic fluid inertia damper



The structure of magnetic fluid inertia damper

Magnetic fluid inertia damper is composed by a non-magnetic inertial block, a wheel hub fixed with a permanent magnet and a certain amount of magnetic fluid. The magnetic fluid inertia damper is widely used at present, such as computers, peripherals, high-precision handling systems, medical facilities, robots and so on. The basic principle of the magnetic fluid inertia damper is shown as follows. Inject magnetic fluid into the gap between the wheel hub and the non-magnetic inertial block， forming a magnetic fluid layer between the non-magnetic inertial block and the permanent magnet under the effect of the strong magnetic field caused by the permanent magnet, so that the non-magnetic inertial block is able to float on the magnetic fluid layer, and the magnetic fluid takes efficacy of the hydrodynamic bearings. The best damping effect is produced because of the viscosity of magnetic fluid and the effect of the magnetic field makes it unnecessary to worry about the leakage. In practical applications, fix the wheel hub and the shaft of step-motor together first, when the motor speed up or slow down, the amplitude of motor at its responance frequency domain is inhibited due to the inertia effect of the non-magnetic inertial block, the stabilization time is shorten significantly. When the motor rotates at a constant speed, the wheel hub and the non-magnetic inertial block rotate synchronously, therefore there's almost no energy loss.

The specifications of the magnetic fluid inertial dampers produced by our research institute

Type	Size (mm)					Inertial of hub （g • cm^2）	Inertial of non-magnetic block（g •cm^2）	Damping coefficient （g • cm^2）
	A	B	C	D	E			
MF013AS	37	13	5	6.35	15	19.4	135	121
MF013BS	37	13	5	6	15	19.4	135	121
MF035A	44	13	5	6.35	15	19	348	288
MF035AS	45	13	5	6.35	15	19.4	360	288
MF035B	44	13	5	6	15	19	348	288
MF035BS	45	13	5	6	15	19.4	360	288
MF035GS	45	13	5	8	15	19.3	360	288
MF035GS-70	45	13	5	8	15	19.3	360	1416
MF035GS-100	45	13	5	8	15	19.3	360	
MF140C	62	13	5	9.725	18	74	1400	460
MF260C	71	13	5	9.725	18	74	2550	1140
MF750C	92	13	5	9.725	18	74	7535	1140

Magnetic floating tellurion

Magnetic floating globe balances the gravity of the globe by controlling the electromagnet, and the strength of the current. So that the globe is able to not only steadily suspended in the air, but also spin under magnetic or other driving force. The real globe of 2-meter-diameter is illustrated as the left figure.

This product is series, the globe diameter ranges from 80mm to 2000mm, suspension distance ranges from 10mm to 100mm, rotation form ranges from perpendicular to 23.5 °tilted. The product is made not only for the museum exhibits, but also for the hotel lobby and the office desk decorations.

Magnetic fluid slope Climbing apparatus

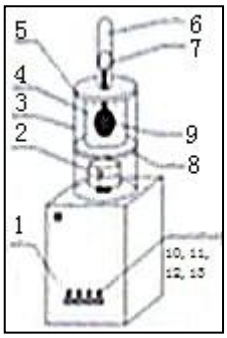
Under the effect of the magnetic field, the magnetization of magnetic fluid increases with the external magnetic field intensity until saturation. The external magnetic field enables the magnetic fluid to flow to any location. Making use of the effect, we can demonstrate a phenomenon of "water flows upwards", which makes people understand the characteristics nature of the new function

material differed from others, magnetic fluid and think about the mechanism of "water flows upwards".

The device works by controlling buttons. The manual button on the operation panel decides the break-make of the coil and the "1", "2" ... "7" and the "Auto" button controls the magnetic fluid climbing slope. The movement of magnetic fluid will occur when magnetic field changes. In this case, with the external magnetic field (coil groups) changes from low to high, from generation to disappearance, the magnetic fluid climbs from bottom to the top under the role of magnetic force, after which return to the bottom according to the procedure. When the "Auto" button is pressed, the magnetic fluid will climb to the top and then return to the bottom automatically in order. The real V-arm magnetic fluid climbing device is illustrated in the left figure.

Magnetic fluid suspension apparatus

Magnetic fluid suspension device is a high-tech product which contains mechanicals, electronics and chemicals in one. The series products have characteristics of small size, light weight, and perfect demonstration, etc. The electrical part and the body, can not only be devided into two parts but also can be set in one. It is a wonderful exhibition that demonstrates complicated physical phenomena in the museum, and also an excellent teaching equipment in the academies and scientific research departments. It is popular with scientific researchers and institutions. The real device and its composition are shown in the left figure.



Name of structure in the previous diagram

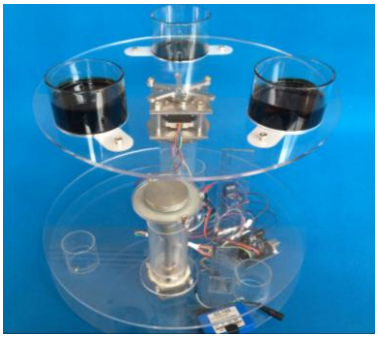
1 Body 2 Permanent magnet 3 Organic glass cover 4 Magnetic fluid
5 Beaker cover 6 Support cover 7 Red ball 8 Beaker pallets 9 Aluminum ball
10 Adjustment button 11 Run button 12 Control switch 13 Power LED

Magnetic fluid interface instability displayer

Magnetic fluid interface instability display is a device that shows the special characteristics of magnetic fluid. When the motor is electrified, the permanent magnet will start reciprocating motion up and down and form a changing of magnetic field in the bottom of the container, so that the surface of magnetic fluid changes with the position of the permanent magnet. Once power is cut off, the small thorns processing in the magnetic fluid surface will stay in a certain location under the constant magnetic field. In this device, the phenomenon of instability in the magnetic

fluid surface is indicated under strong magnetic field, which drives people to think about the cause, mechanism and application of the instability of magnetic fluid interface. The structure and the effect of the magnetic fluid interface instability displayer are illustrated in the left figure.

Magnetic fluid interface instability display instrument



The function of magnetic fluid interface instability display instrument is showing three properties of magnetic fluid the interface instability, the second-order buoyancy principle, and the asymmetry of the internal stress. Liquid surface instability refers to the phenomenon that the surface of the magnetic fluid will generate spikes under the action of the magnetic fluid field. Magnetic fluid second-order buoyancy principle refers to the phenomenon that magnetic fluid can suspend the non-magnetic object which is denser under the action of a magnetic field. Magnetic fluid asymmetry of internal stress refers to the stress asymmetry of the magnetic fluid under the action of varying magnetic field, macro performance of which is that magnetic fluid can produce micro vortex under the effect of varying magnetic field.

The magnetic fluid performance display instrument reaches a one-key-display function by control system. As long as a switch, it can automatic progressive display the above three properties of magnetic fluid.

The height of the display instrument is 394 mm, the bottom width of which is 400 mm, which is convenient for the teacher's presentation in class .Using beakers whose diameter is 78 mm, height is 60 mm, the performance of magnetic fluid can be good to see. The entire device is cheap, which is beneficial to be used and promoted a wide range.

Magnetic fluid fountain

Magnetic fluid fountain is a kind of device which displays the particularity of magnetic fluid. By using the principle of herodias fountain，the device can produce strange phenomenon of magnetic fluid ejecting from central apertures .And you can control the up and down movement of the magnet by mechanical structure .And with the remote control device you can control the motor rotation speed and rotation direction, so as to make the magnetic fluid of magnetic fluid fountain presenting different shapes .It not only shows the flow characteristics of magnetic fluid, but also shows the magnetic response of magnetic fluid.

This device is simply operated， and the phenomenon is lively and interesting. So it is popular with teachers and schoolmates.

The principle of magnetic transmission seal

Magnetic rotating component is made up of both inner and exterior magnetic rotor. Separation sleeve separates inner magnetic rotor and magnetic media from the outside rotor. Exterior magnetic rotor is driven by the motor, and the characteristics of magnetic coupling drives inner magnetic rotor to rotate, completing the non-contact torque transmission, thereby to achieve the purpose of transmission pump.

Magnetic drive pump is different from other mechanical seal pumps, without dynamic seals, just only static seals. This solves problems of mechanical seal pumps fundamentally, such as running, emitting, dripping, leaking, then realize no leakage.

The structure of the magnetic drive pump is simple and compact, possessing adopts a unique lubrication and cooling circuit, and some parts of which are self-lubricating fluid and cooling transfer components. This structure eliminates complex cooling, washing, and quenching pipeline system in mechanical seal pump. The designed maximum pressure of the entrance is 30MPa, while mechanical seal pumps could hardly achieve that.

Magnetic drive pump is safe, reliable, low noise, no leakage, clean and safe, so it is the real industrial environmentally friendly products.

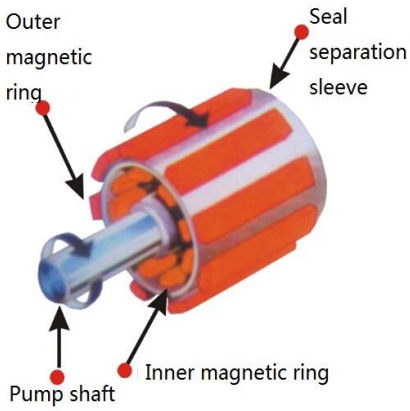
The application of magnetic transmission seal on magnetic drive pump

With more and more global attention paid to the environmental protection and promulgation and implementation of corresponding environmental regulations, Because of the properties of no leakage, strict seal and low noise of magnetic drive pump, and the effect of solving problems during pumping volatile materials in the industrial system, so it is known as an environment-friendly high-tech product. In recent years, magnetic drive pump have a strong momentum of development, it is widely used to transport flammable, explosive, toxic harmful and corrosive medium without solid particles and the media that does not allow seal pollution in oil fields, refineries, petrochemicals, chemicals, fertilizers, nuclear power, metallurgy, food products and pharmaceutical industrial systems.

Products in our research institute

- Anticorrosive magnetic-force drive centrifugal pumps
- Fluoroplastics magnetic-force drive centrifugal pumps
- Multistage high-pressure transmission Magnetic-force drive centrifugal pumps

- Magnetic-force drive turbine pumps
- Magnetic-force drive heat conduction oil pumps
- Magnetic-force drive centrifugal oil pumps
- Magnetic-force drive self-priming pumps
- Magnetic-force drive pipeline pumps
- Vertical multistage magnetic-force drive centrifugal pumps
- Magnetic-force drive gear pumps
- High viscosity magnetic-force drive gear pumps
- Magnetic-force drive internal engaged gear pumps
- Magnetic-force drive liquefied petroleum gas pumps
- Aerospace industry pumps
- Carbon dioxide extraction pumps
- High-pressure pipeline magnetic-force drive emulsification pumps
- Hydrocarbon mixture cryogenic pumps
- Single-stage double suction magnetic-force drive centrifugal pumps



Others

- Magnetic-force filter
- Magnetic-force hydraulic pressure gauge
- Magnetic-force-force valve
- magnetic-force agitating apparatus
- Magnetic-force-force agitating vessel