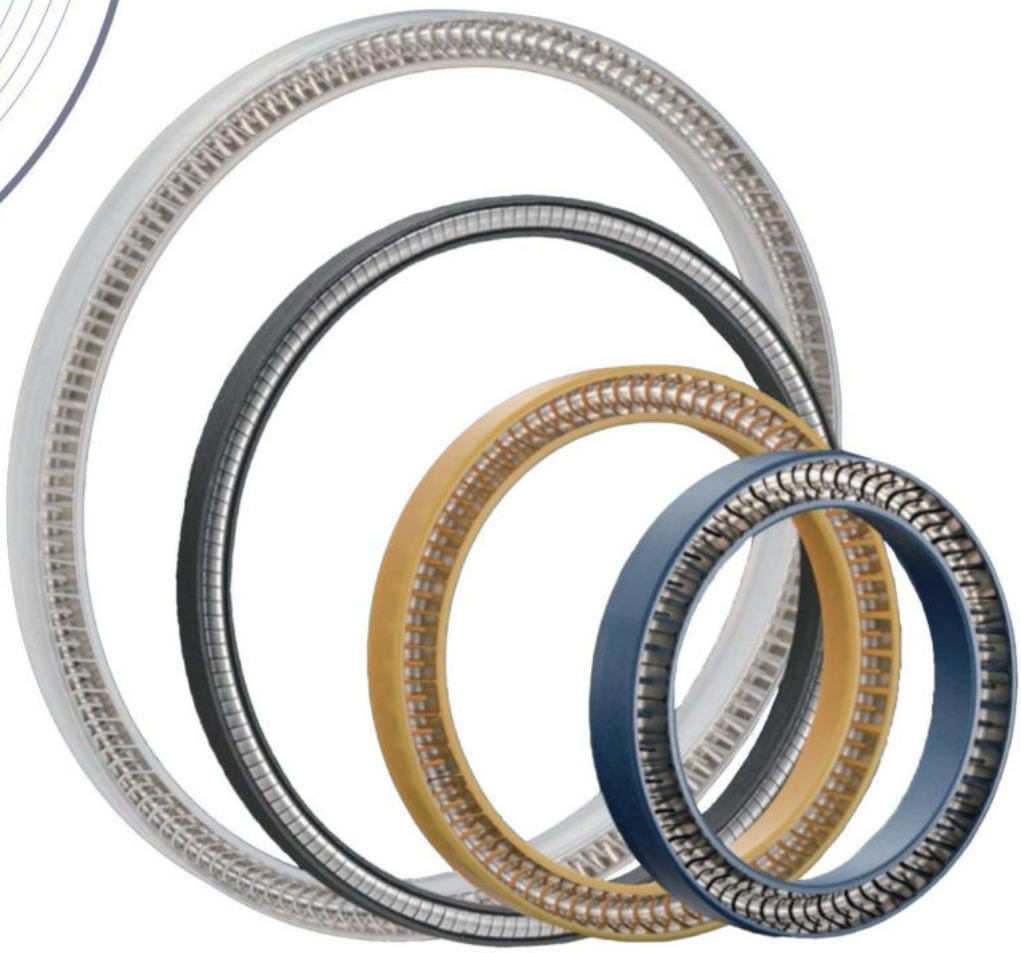
PULIM

Spring Energized Seals

type selection manual



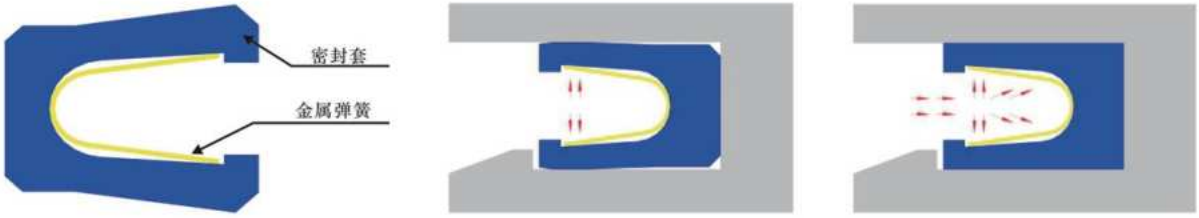
Suzhou Pulim Sealing Technology Co., Ltd

Catalogue

Introduction to spring storage seal

Spring energy storage seal structure

Energy storage seals, generally made of PTFE or PTFE compounds and special engineering plastics assisted by springs. It is a single acting high performance seal that can be used for dynamic and static motion. The spring elasticity can overcome the eccentricity of the groove fit and compensate the material wear of the lip of the seal sleeve. By the appropriate spring force and the system fluid pressure, the lip of the seal sleeve is opened and pressed against the sealed metal surface to produce a very excellent sealing effect.



Spring energy storage seal performance characteristics

Energy storage seal is a special seal developed for high temperature corrosion, difficult lubrication, low friction application environment, the combination of different sealing materials and metal springs, can meet the diversity of needs, suitable for the requirements of good resistance to chemical media, or require the seal to work at extreme temperatures, and for the need for good extrusion and compression properties.

The structure of the energy storage seal is varied, depending on the working conditions and the form of the spring selected, by choosing different spring materials, you can ensure the compatibility of the energy storage seal medium and a wide range of temperature resistance, by choosing different spring loads can ensure that the energy storage seal in a variety of extreme conditions under the application of:

- ◆ Excellent sealing performance;
- ◆Good extrusion resistance;
- ◆Very good dry friction characteristics;
- ◆Compact structure, simple installation;
- ◆Low friction coefficient;
- ◆Good dynamic and static sealing;
- ◆Good resistance to high and low temperatures;
- ◆Good corrosion resistance;

Product application field

Industrial control valve

Petroleum petrochemical

Liquefied natural gas

aerospace

rail traffic

Mechanical equipment

Product application scenario

valve

Feed gun

piston

Dispensing valve

Dry gas seal

Crane tube

Cryogenic pump

Air spring

Self-developed self-made PTFE raw materials

Self-developed formula mixed powder processing


Pipe pressing



Sintering forming


Constant temperature and humidity storage


Jacket processing



Product testing



Product sealing test



Spring self-made custom processing

H-type spring machine

V-type spring machine

Muffle furnace

Laser welding machine

Friction and wear machine

Commonly used materials for spring energy storage seals

List of commonly used jacket materials

Code	Material content or grade	Name	Colour	Design applicable temperature (℃)	Friction coefficient	Wear-resistant	Crushing resistance	Peculiarity	Apply	Remark
PM-1	MPTFE	Modified teflon	transpa rent	-196～+180	<0.1	-	√	Good pressure resilience and low temperature properties, limited wear resistance	Mainly suitable for ultra-low temperature sealing and medium to extreme vacuum applications	Ultralow temperature
P-11B	PTFE+CF	PTFE+Carbon fiber	taupe	-50～+230	<0.15	√	√	Excellent wear resistance and resilience under high load	Especially suitable for hydraulic systems and PR2 Wellhead equipment	High pressure, dynamic seal
P-5	PTFE+Ekonol	PTFE+Polyphenyl ester	yellow	-50～+280	<0.17	√	√	Excellent self-lubrication, compressive resilience and wear resistance, both thermal and electrical insulation properties, but low strength	Suitable for dynamic seal, gas seal, low pressure and low temperature, high temperature and other applications	
PK-1	PEEK	Polyether ether ketone	sepia	-50～+260	<0.25	√	√	Excellent mechanical properties, resistance to compression rebound and heat, good self-lubrication and chemical resistance	Recommended for use as a support ring or other special applications (such as high temperature and high pressure applications)	Gate valve seat seal
P-1	PTFE	Pure teflon	white	-50～+150	<0.1	-	√	Excellent physical and chemical properties, limited resistance to wear and pressure resilience	Suitable for static applications, low speed, low pressure dynamic seal; It is often used in the production of stoppers	Regular flooding and retainer
P-13	PPL	para-polyphenol	sepia	-180～+300 (320 To be verified)	<0.2	√	√	It has high temperature resistance, very low friction coefficient and good wear resistance, and is widely used as sealing materials in high temperature environment. Very high chemical stability	Sealing ring, valve body, valve seat application in high temperature environment	
PK-2	CT200	PAEK polymer	green	-196～+260	<0.25	√	√	Suitable for dynamic sealing applications at extremely low temperatures	Ultra-low temperature sealing, seat applications	
PM-2	MPTFE+GF	modified PTFE+Glass fiber	white	-100～+230	<0.15	√	√	Excellent wear resistance, good pressure resilience and chemical resistance	Mainly suitable for dry gas sealing and other applications	Regular flooding and retainer
P-2	PTFE+GF+Mo S2	PTFE+Glass fiber+Molybdenum disulfide	Ash black	-100～+230	<0.13	√	√	Excellent wear resistance, good pressure resilience and chemical resistance	Dynamic seal, high temperature and high pressure seal	
P-9	MPTFE+PI	MPTFE+Polyimide	Ash black	-196～+260	<0.13	√	√	Excellent resistance to high and low temperatures, good pressure resilience and wear resistance	Suitable for ultra-low temperature and high temperature occasions	hyperthermia
PE-1	UHMW-PE	Ultra high molecular weight polyethylene	white	-196～+50	<0.23	√	√	Excellent chemical and wear resistance, limited heat resistance and pressure resilience	Suitable for water lubricated media sealing applications and grinding media, long wear life under difficult conditions	Liquid gun, dispensing machine
P-4	PTFE+Carbon	PTFE+toner	Ash black	-50～+200	<0.1	√	√	Good wear resistance and thermal conductivity, while with anti-static effect, and high hardness	Recommended for use as crane tube and other applications	Crane tube
PI	PI	Polyimide	brown	-200～300 (380℃ Be used with caution)	<0.29	√	√	Very low temperature resistance, excellent mechanical properties, radiation resistance; Weak corrosion resistance, non-toxic can be used in the food industry.	Suitable for static sealing under high or low temperature conditions, not recommended for dynamic sealing; Medium and high pressure condition	High temperature seal, seat
P-3	PTFE+CU	PTFE+Copper powder	green	-50～+200	<0.13	√	√	Excellent thermal conductivity, wear resistance and pressure resilience, but corrosion resistance is reduced	It is mainly used for sealing parts such as piston and bearing of sports machinery; Not suitable for some chemical applications	Guide ring and wear ring

◆ Friction depends on pressure, contact surface area, speed and lubrication.

◆ Chemical compatibility depends on the material itself and the type of additive material added.

◆ The low temperature limit depends on the seal design and the thermal shrinkage of the material. The high temperature limit depends on the strength and plastic deformation of the sealing material.

◆Wear resistance depends on the material itself and the additives of the material, which affect the mechanical and physical properties of the material. The additives in the material include but are not limited to bronze, graphite, carbon, carbon fiber, glass fiber and molybdenum disulfide, which can improve resilience, improve wear resistance, reduce thermal expansion and be extremely resistant to wear.

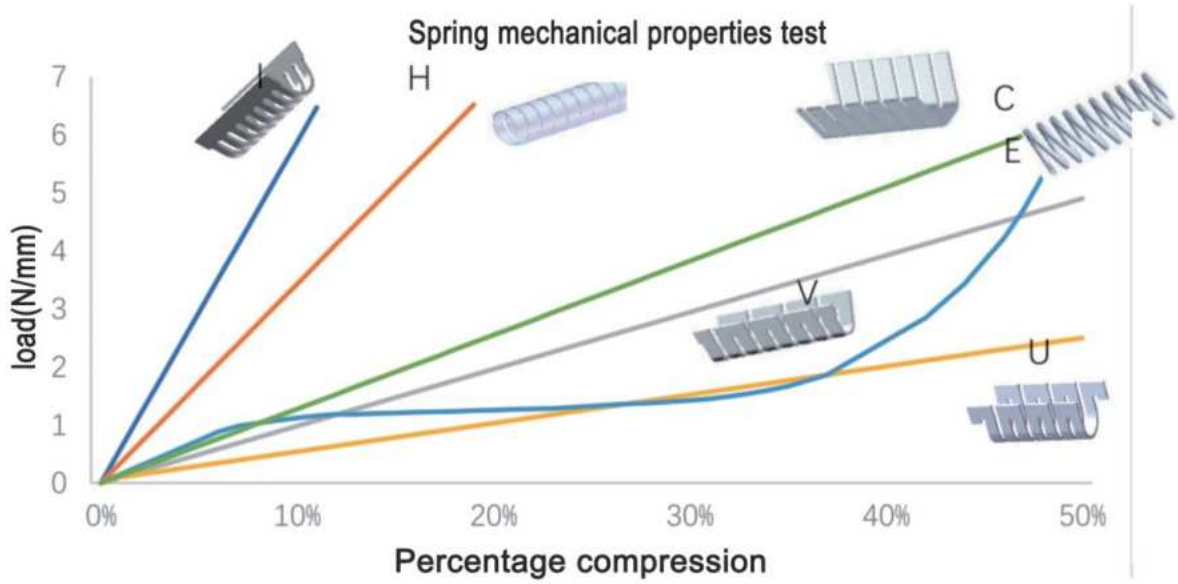
List of commonly used spring materials

Code	Material	Colour	Basic performance
D1	Elgiloy Cobalt-based alloy	silver	In the range of -253 ~ 1100℃ has excellent inertia, oxidation resistance, corrosion resistance, very excellent spring material
D2	Elgiloy Cobalt-based alloy	Golden yellow	In the range of -253 ~ 1100℃ has excellent inertia, oxidation resistance, corrosion resistance, thermal fatigue resistance, very suitable for ultra-low temperature conditions
D3	Inconel718 Nickel-based alloy	silver	-253～700℃ High temperature alloy, oxidation resistance, corrosion resistance, low temperature mechanical properties are good
D4	SUS316 Stainless steel	silver	Resistant to weak acid, seawater, atmospheric corrosion, high temperature corrosion resistance
D5	SUS301 Stainless steel	silver	Usually used for room temperature sealing, suitable for oil, water, air and other media
D6	Hastelloy C-276	silver	High temperature resistance to inorganic acid, organic acid, seawater
D7	SUS304 Stainless steel	silver	Atmospheric corrosion resistance, suitable for normal temperature conditions and food industry
D8	17-7PH Stainless steel	silver	High strength, hardness, corrosion resistance is better than 300 series stainless steel

◆The metal spring is installed inside the energy storage seal jacket. When there is no pressure in the system, the initial sealing force is provided by the metal spring interference, so that the sealing lip is close to the sealing surface, and the elasticity is not affected by the change of working temperature, pressure or medium.

◆ In addition to the corrosion resistance of the metal, the two most important characteristics of the spring are the load value and deformation range. The spring load affects the sealing capacity, friction and wear rate of the seal. The deformation range determines the ability of the storage seal to withstand wear and compensate for changes in groove size.

Performance comparison of different spring forms



List of commonly used spring shapes

Energized Seal Spring Selection Table

Form of spring	Code	Name	Sizing specification	Feature description	Material
	H	Helical spring	Any size diameter between 1-15mm	Provides high load spring force at very little elastic deformation. Can provide excellent spring sealing force	300-series of stainless steel 17-7PH Elgiloy
	V	V-spring	Step dimensions within 1.2-14mm	Large compression volume, medium and high load spring force. Suitable for low speed and medium speed moving seals	Inconel718 Elgiloy 300-series of stainless steel
	U	U-spring	Step dimensions within 1.2-14mm	Large compression volume, low-load spring force. Suitable for medium and high-speed dynamic sealing	Inconel718 Elgiloy 300-series of stainless steel
	C	Independent-support spring	Step dimensions within 10-30mm	Has a large compression and opening size while providing heavy load spring force. For both dynamic and static seals	Inconel718 300-series of stainless steel
	I	Full contact spring	8 standard size springs are available	Heavy, high load spring, provide continuous spring contact, recommended for low pressure, low temperature conditions, vacuum or light medium conditions	Inconel718 300-series of stainless steel
	E	Slant coil spring	Any size diameter between 1.3-8mm	In a large range of compression, provide constant spring force without plastic deformation. Very suitable for high-speed moving sealing conditions	300-series of stainless steel 17-7PH Elgiloy C276 Other alloys

Common form of spring storage seal

List of commonly used sealing forms

Form of section	Code	Optimum sealing application	Recommended compressionMpa	Characteristic specification
	RHY	Static, room temperature - ultra-low temperature	≤48	At a lower compression, it provides a larger sealing force and can achieve a higher sealing performance
	THY	Low speed rotation and reciprocation	≤48	1、no starting power requirements, can achieve high sealing performance under low-speed working conditions 2、the flange can prevent the seal from moving with the shaft
	RVY	Rotation and reciprocation, static	≤48	1、It can provide higher compression, smaller sealing force, and compensate the loss of sealing surface to the greatest extent. 2、Low starting power allows for a certain range of shaft jumps
	TVY	Rotation and reciprocation	≤48	With the RUY feature, the flange prevents the seal from moving with the shaft, improving seal performance and life
	WVD	Static, high pressure	≤160	1、The unique seal lip design with high performance V-spring provides good sealing performance at higher pressures 2、Large compression, can correct a small amount of shaft jump.
	NVD	Static, high pressure	≤160	It has the same features as WUD
	RVM	Reciprocating, rotating, high pressure conditions	≤160	Through multiple sealing lips, multiple sealing effect is formed, which can provide good sealing performance under high pressure
	SHY	Static bidirectional seal, ultra-low temperature condition	≤48	Bidirectional seal, providing ultra-high spring sealing force, B support ring can correct the compression of the inner and outer diameter sealing surface to ensure the sealing force. Smaller diameter springs provide greater sealing force
	SVY	Static bidirectional seal, room temperature or low temperature conditions	≤48	Two-way seal, high pressure shrinkage, low sealing force, generally used in room temperature and some low temperature conditions
	AVY	Reciprocating, rotating, high pressure conditions	≤180	1、Combined seal, pan plug seal as the main seal, multiple V-shaped ring auxiliary seal, sealing performance is better 2、Large compression, can correct a small amount of shaft jump
	RCD	Static, deep groove, low temperature	≤30	1、The special structure of the independent support spring can have a large opening size, which is very suitable for deep grooves 2、Large compression, large sealing force, suitable for some low temperature conditions
	REY	Rotation, low starting power	≤30	1、Inclined coil spring has the characteristics of low load, large compression and uniform sealing force, which is very suitable for rotary sealing 2、The seal lip is allowed to wear properly to compensate for certain shaft jumps and offsets。
	RUY	Dynamic seal, low starting power	≤48	1、The seal lip is allowed to wear properly to compensate for certain shaft jumps and offsets 2、Corrects for small shaft jumps and seal wear

Other parts of the sealed form list

Form of section	Code	Applicable condition	Form of section	Code	Applicable condition
	RVYT	Back pressure condition		RHYC	Back pressure condition
	RVYTD	There is back pressure, large occlusal gap or high temperature, high pressure conditions		RHYCD	There is back pressure, large occlusal gap or high temperature, high pressure conditions
	RVYD	No back pressure, large occlusal gap or high temperature, high pressure conditions		RHYD	No back pressure, large occlusal gap or high temperature, high pressure conditions
	RVY-L	No back pressure, high pressure		RHY-L	No back pressure, high pressure
	RVG	Scraper lip, can play a wiping role on the sealing surface, suitable for impurities or dust media		AUM	Multi-lip plug + V-type combination seal, suitable for ultra-high pressure conditions

Special seal customization

Special structural form	Nstructions
	Multi-spring structure design, suitable for large section sealing
	Group V plus plug combination sealing form, suitable for ultra-high pressure rod sealing conditions, the pressure can reach 15000 psi
	Group V plus plug combination sealing form, suitable for ultra-high pressure rod sealing conditions, the pressure can reach 20000psi
	Special root design, for the design of special parts structure, suitable for ultra-low temperature end face special structure design
	V-shaped combination seal, suitable for high pressure reciprocating rod sealing conditions
	Suitable for LNG discharge arm rotary seal

◆ Puli can design different structural forms of seals according to user requirements to suit different types of working conditions

Spring energy storage seal commonly used grooves

Seal type

◆ **Static seal and dynamic seal**

◆ The two basic types of sealing applications are static sealing and dynamic sealing

◆ For static sealing, there is basically no relative movement between the sealing ring and the mating part

◆ For dynamic seals, the two sealing surfaces move relative to each other. Typical examples include the sealing of piston rods and pistons in hydraulic cylinders. The dynamic seal includes two forms of motion: reciprocating motion (linear motion) and rotating motion (including swing).

◆ Sometimes static and dynamic seals are used together

◆ **Radial and end seal**

◆ According to the configuration of the matching parts and the location of the sealing groove, the seal can be divided into radial or end (axial seal) two kinds

◆ The radial seal contains a sealing groove in the radial compression seal. The convex groove is turned on the shaft and the concave groove is turned in the hole. Radial seals are usually dynamic seals, but there are exceptions. We also offer piston rod seals and piston seals for these applications

◆ The end seal comprises a groove that compresses the seal parallel to the axis of the seal ring. The end face of the matching part is machined with a sealing groove. Face seals are usually static seals, but there are exceptions. We can provide internal and external face seals for such applications.

Detailed design of occlusal space

◆ Sealed occlusal Spaces under high pressure and/or high temperature conditions are very important

◆ The bite gap is the gap between the mating parts. Parts without bearings or centering devices must have the gap in diameter as the maximum bite gap.

◆ The occlusal gap should be kept to a minimum and should not exceed the values listed in the table. Increasing the thickness of the back end of the seal improves the bite.

◆ An independent back pressure ring device can also be used to reduce the occlusal gap.

		Temperature range: -129~204℃ pressure range: within 2000psi	Temperature range: -129~204℃ pressure range: within 2000~4000psi	Temperature range: -129~204℃ pressure range: within 4000~6000psi	Temperature range: -129~204℃ pressure range: within 6000~10000psi
Standard	unfilled	0.10mm	0.07mm	0.05mm	—
	Fill in	0.15mm	0.10mm	0.07mm	—
Extend	unfilled	0.15mm	0.10mm	0.07mm	—
	Fill in	0.20mm	0.15mm	0.10mm	0.07mm
Back pressure	unfilled	0.25mm	0.20mm	0.15mm	0.10mm
	Fill in	0.35mm	0.25mm	0.20mm	0.15mm

◆ Occlusion is determined by the following factors: the size of the occlusal gap, temperature, pressure, surface velocity (reciprocating motion)

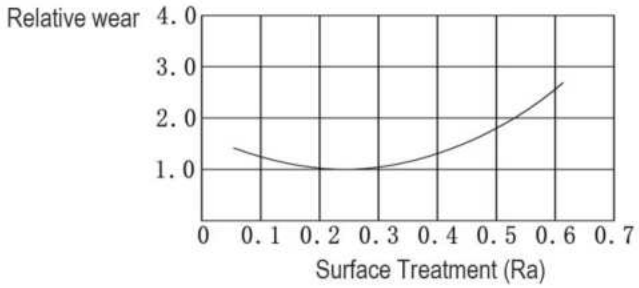
◆ Under pressure, PTFE material in the sealing ring easily flows into the bite gap. Dynamic reciprocating motion increases occlusion. Under static conditions, when the pressure, temperature and bite gap are below a certain limit, the bite will stop once the pressure generated by friction in the bite gap is equal to the system pressure. However, circulation conditions can lead to persistent bite and premature seal failure.

Match parts, surface roughness and hardness

◆ Dynamic fit part surface roughness

◆ The surface finish of the material in contact with the energy storage seal will affect the wear and service life of the sealing sleeve material. The contact surface is too rough to create leakage channels and cause the seal to wear

◆ In general, relatively smooth surface finish (lower Ra value) has less wear, longer sealing life and better overall sealing performance. The life of the seal is extended by the transfer of the self-storage seal jacket and the coating of the PTFE film on the fit dynamic surface. A relatively rough dynamic surface will quickly wear the sealing material, and an extremely smooth surface will not be able to form a film due to insufficient transfer



◆ Surface roughness of static mating parts

◆ In most static sealing applications, good overall sealing performance can be achieved with a smooth sealing surface. In most static seal applications, the optimal surface finish is 32μin(0.8 μm)Ra or higher. The surface layer of the static end seal shall be concentric. The polished or machined surface should be round.

◆ Surface hardness

◆ For reciprocating motions at slow to moderate speeds, a hardness of 40 Rockwell C or higher is recommended

◆ The ideal hardness for moderate to high speed linear or rotational motion is Rockwell hardness 58 to 62. The hard surface after anodizing shall be polished

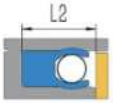
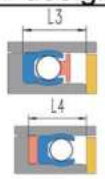
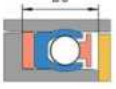
◆ Fit parts surface roughness recommended

Dielectric seal	Surface roughness	
	Dynamic surface	Static surface
Low temperature, helium, hydrogen, freon	4 - 8μin (0.1- 0.2 μm) Ra	8μin (0.2 μm) Ra max
Air nitrogen, argon, natural gas, fuel (aircraft, automobiles)	6 - 12μin (0.15 - 0.3 μm) Ra	16μin (0.4 μm) Ra max
Water, hydraulic oil, crude oil sealant	8 - 16μin (0.2 - 0.4 μm) Ra	32μin (0.8 μm) Ra max

Typical trench design

◆ Trench size selection recommended

Radial seal design parameters

							d(groove inside diameter) tolerance	D (trench outside diameter) tolerance	remark
		≤600LB	≤900LB	L3 600LB L4 900LB	1500~2500LB				6D
【1.5, 10)	1.5	2.5	3.9	5.4	6.9	≥1	0/-0.03	+0.03/0	
【10, 25)	2.25	3.6	5	6.5	8.5	≥1	0/-0.05	+0.05/0	
【20, 55)	3	4.7	6	7.8	10	≥1.5	0/-0.05	+0.05/0	
【50, 105)	4.7	7.1	8.8	10.8	13.5	≥2.5	0/-0.05	+0.05/0	
【85, 160)	5	7.5	9	11.5	15	≥3	0/-0.05	+0.05/0	
【150, 280)	6.1	9.5	12.5	15	18.5	≥4	0/-0.08	+0.08/0	
【260, 600)	7.5	11	13	17	22	≥4.5	0/-0.08	+0.08/0	
【550, 1000)	8.5	12	14	18.8	24.5	≥5	0/-0.13	+0.13/0	

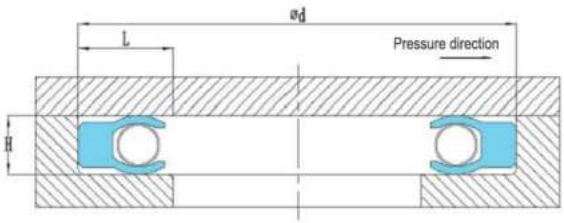
◆ remark:

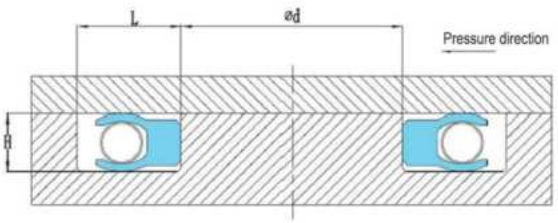
◆ 【1.5, 10) Indicates the size range of the groove inner diameter, "【" Representation includes, ") " Do not include

◆ L3、L5 Suitable for environments with back pressure

◆ 6A valve seal please consult PULIM

End seal design parameters





d	allowance	H	L
【10, 15)	+0.03/0	1.5	2.5
【15, 30)	+0.05/0	2.25	3.6
【30, 60)	+0.05/0	3	4.7
【60, 200)	+0.05/0	5	7.5
【200, 600)	+0.08/0	6.1	9.5
【600, 1000)	+0.13/0	7.5	11

d	allowance	H	L
【10, 15)	0/-0.03	1.5	2.5
【15, 30)	0/-0.05	2.25	3.6
【30, 60)	0/-0.05	3	4.7
【60, 200)	0/-0.05	5	7.5
【200, 600)	0/-0.08	6.1	9.5
【600, 1000)	0/-0.13	7.5	11

Instructions for installation, storage, and use

Seal ring installation guide

◆ Spring energy storage sealing ring installation method

The first step is to check the appearance of the spring energy storage seal ring, check the position of the seal lip, and check whether there are bumps and scratches in the process of storage and receiving by the user.

If you find any bumps and scratches in the sealing lip position, please contact us in time.

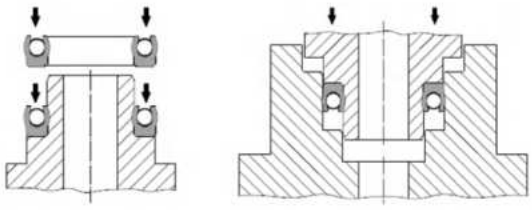
If any part of the sealing ring is found to have dust or stains, soak the dust-free paper in 90% concentration of ethanol, and hold the sealing ring unsealed lip with your hand to fix it. The wiping method can be partially lengthened in one direction instead of repeatedly wiping locally, or wipe clockwise along the circumference of the sealing ring until the stain disappears.

Note: The sealing ring has gone through a strict appearance inspection procedure before our delivery, to ensure that there is no quality problem in the appearance of the sealing ring from the factory to the customer.

The second step is to check the appearance of the groove of the equipment. Check whether the appearance of the sealing ring to be installed is bruised or scratched. If any appearance quality problems are found, it is recommended that the customer stop the installation and return the equipment to the factory for repair.If there is no quality problem in the sealing position, it is recommended that the customer purge the sealing position with compressed air before installing the sealing ring. After the purge is completed, the dust-free paper is soaked in 90% concentration of ethanol for wiping the sealing surface.

Note: When checking the appearance of the sealing surface of the sealing equipment, pay attention to whether the installation chamfer has burrs. If so, please stop the installation in time and return to the factory for maintenance.

The third step, install the seal ring in the corresponding position of the shaft diameter (seat, stem, flange, etc.) and ensure that the seal ring is completely pushed to the bottom, align the shaft and the seal ring into the hole to ensure that the shaft hole is concentric and not tilted, apply uniform pressure in the direction, and press the seal ring into the designated position of the groove.



◆Storage of spring energy storage seals

Improper storage of the seal will greatly affect its installation and sealing performance, so we recommend the following storage conditions:

1、The storage environment of the seal ring is best within the range of 10-30 ° C to avoid large size changes in the product caused by too high or too low temperature;

2、Avoid squeezing and bumping, prevent the deformation and damage of the sealing ring, affecting the installation and use performance.

3、Try to avoid the deformation caused by the long-term storage of the seal ring, our company's supply capacity can meet the customer's delivery time of 1 month in advance, to help customers achieve zero inventory.

◆Spring energy storage seal diameter adjustment

The coefficient of thermal expansion of polytetrafluoroethylene materials is 7 times that of metal, which is very easy to change the size due to changes in ambient temperature, and eventually the installation of sealing rings is difficult.

If the size change affects the installation, it is recommended that the customer place the flooding seal ring in an environment of +20 ° C, place it for 10-20 minutes (depending on the product specifications), take it out after temperature adjustment and try to install it. If the installation is still unable to be achieved, please contact us in time.

Application data sheet

Company Name: _____

Contact person: _____ Phone: _____ Fax: _____ Email: _____

Working condition

☐ static Medium/fluid _____

☐ rotate Rotational speed _____ RPM ☐ clockwise ☐ anticlockwise

☐ Linear/reciprocating speed _____ journey _____

Friction force Instantaneous friction Constant friction _____

stress operation _____ Minimum pressure Impact pressure _____

temperature operation _____ Maximum temperature _____ Minimum temperature _____

Hole/shaft misaligned _____ Jump axle _____

Life requirement _____ Allowable leakage _____

Groove parameter

Seal trench type _____

☐ Grooving static surfaces ☐ Groove dynamic surface

Materials _____ _____

hardness _____ _____

Surface treatment _____ _____

Surface machining accuracy _____ _____

Can you provide a sketch of the trench dimensions? ☐ 是 ☐ 否

Can I change the dimensions of the sealing groove? ☐ 是 ☐ 否

Address: No.155 Huayang Road, Xiangcheng District, Suzhou, P.R. China, 215143
Tel:+86(512)66333588 Fax:+86(512)66333988
Website: www.pulim.cn

Suzhou Pulim Sealing Technology Co., Ltd

VISION: Commitment to becoming a world-leading manufacturer of engineering polymer products.

MISSION: Providing the highest quality of sealing materials to help the industry to achieve sustainable.