NEWMAKE ENGINEERING

- REFINERIES
- PETROCHEMICALS
- FERTILIZERS
- POWER GENERATION
- FOOD & PHARMA

- PUMPS
- COMPRESSOR
- AGITATORS
- BLOWERS

www.newmake.in

INTRODUCTION

Newmake Engineering has been promoted by team of young technocrats having more than twenty years of experience in the field of rotary equipments.

"Newmake" started the separate unit of manufacturing mechanical seals in the year 2012 and have the ultra modern manufacturing facilities.

All the manufacturing operations are carried out in-house including machine shop, grinding & lapping facilities of silicon carbide, tungsten carbide, ceramic, carbon etc. A well laid down lapping and testing facilities are in place. “Newmake” ensures total quality philosophy in its products. Large shaft diameter mechanical seals are tested under running trials at simulated operating conditions. Major international standards are followed such as is, DIN & API.

"Newmake" commands lot of respect among its INDIAN & foreign buyers for its quality and timely deliveries. All the critical seal face raw materials are imported from EUROPE and USA. "Newmake" is holding reasonable level of inventories of these raw materials to meet the emergency delivery schedules of its customers.

Apart from offering mechanical seals as a proprietary designs under the brand name of "Newmake", the company is capable of offering customized seals as per the design & dimensions of international brands such as Durametallic, Crane, Burgmann, Sealol etc so as to have complete interchangeability. We, at "Newmake" offer, excellent after sales service with installation services during project implementation stage and also impart training to maintenance staff.

Our “design & application engineering cell” studies the customer requirements based on the inputs made available to us and the vast data base on behavior of the fluids to arrive at the right selection of design and seal face combination suitable for a particular application prior to the final recommendations.

MISSION AND VISION

We tend to work in close co-ordination with our clients to offer fluid handling solutions with ultimate & unique packaging solutions. Also, we aim to fulfill our commitment of providing superior quality products to our clients at the optimum cost.

QUALITY

Made by premium quality raw material, our products offer continuous operation and flawless performance. In our QC&A (Quality Control and Assurance) Department, all the products are manufactured under the guidance and supervision of our trained professionals. We strictly follow stringent quality control measures at the various stages of production. Our products are ready to dispatch after they are approved from QC&A department.

OUR TEAM

Our team comprises of qualified and experienced professionals, who continuously work for the development of the company. Apart from this, we have highly dedicated workforce, who are committed towards their work. Our marketing team professionals work in close co-ordination with the clients, to offer the products as per their specifications.

QUALITY CONFIDENCE

NEWMAKE

a promise... and a pledge

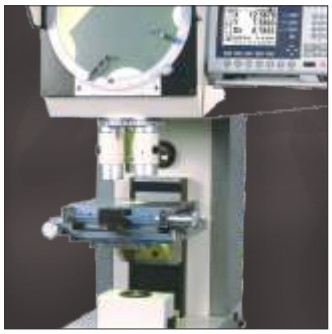
It is the policy of Newmake Engineering to distinguish itself as the industry leader by providing superior, cost effective quality products and services to its customers. To archive this we will :

Provide each Associate with training, skills , and motivation to produce the high quality products and services which meet or exceed our customer's needs.

Empower the work force so that everyone is responsible and accountable for achieving the goal of superior quality products and services.

Give quality and customer service the same emphasis as the financial and productivity aspects of the business.

Newmake Engineering



Product development and manufacture strictly following the company's philosophy.

- Using and developing key performance indicators.
- Being innovative
- Investing in new technology
- Continually developing the expertise, professionalism and integrity of our people.

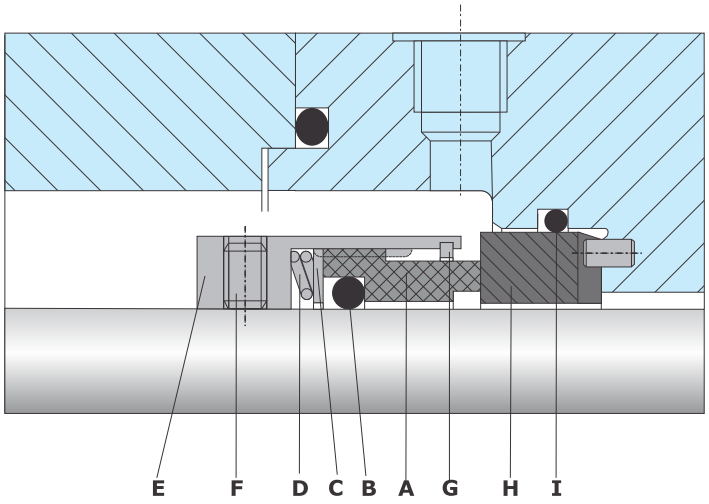
Multi Spring Seal

Type P-91/P-92

Type P-91/P-92 are multi spring, pusher type unbalanced seals used for universal applications. The seals are compact in design suiting all types of rotating equipments, pumps and mixers. Drive lugs in the retainer will provide torque transmission and reduce slippage on shaft and sleeve. A snap ring holds all components together, helping in easy installation. The parts are interchangeable, P-91 can be converted to P-92 by just changing the seal ring and the secondary member.

Type P-93/P-94

Type P-93/P-94 mechanical seals are multi spring pusher type balanced seals suitable for high pressure application.



Part No.	Description
A	Seal Face
B	O-ring
C	Thrust ring
D	Spring
E	Retainer
F	Grub Screw
G	Snap ring
H	Stationary Seat
I	O-ring

Seal Characteristics

Single Seal
Unbalanced
Independent of direction

Materials

Seal Faces : Carbon, SiC, Tung. Carbide
Metal Parts : SS316, Hastelloy-C, Alloy 20
O-rings :Elastomers / PTFE Wedge

Performance Range

Shaft Diameter	d1	: 18...200mm
Pressure	p	: 10 bar (max) - P-91/92 25 bar (max) - P-93/94
Temperature	t	: -20...220^{0}C
Velocity	v	: 20 m/sec

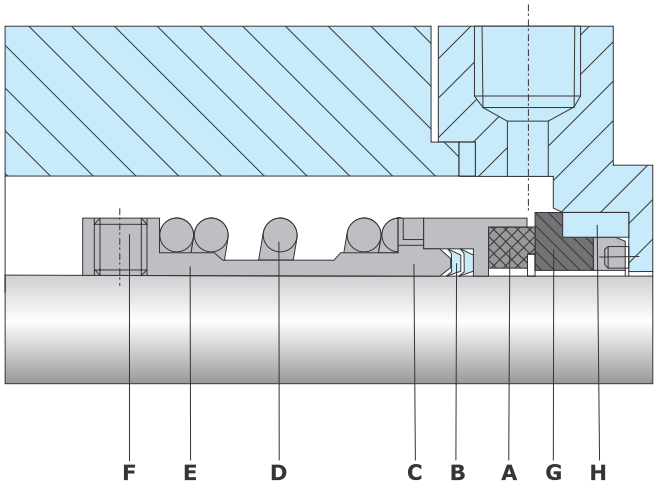
Applications

General Chemicals
Petrochemicals
Refineries
Light hydrocarbons, Water

Single Coil Spring Seal

Type SH-12

Type SH-12 is single coil spring seal developed for light contamination, dirty media and clogging type application. The mechanical drive of this seal is realised by grub screw which lock onto the shaft. Seal is not dependent on direction of shaft rotation.



Part No.	Description
A	Seal Face
B	V-Packing
C	Seal Adapter
D	Spring
E	Drive Collar
F	Grub Screw
G	Stationary Seat
H	Stationary Packing

Seal Characteristics

Single Seal
Balanced/Unbalanced
Helical Coil spring
Independent of direction of rotation

Applications

General Chemicals
Petrochemicals
Light hydrocarbons, Water

Performance Range

Shaft Diameter	d1	: 10...150mm
Pressure	p	: 20 bar (max)
Temperature	t	: -20...140^{0}C
Velocity	v	: 15 m/sec

Materials

Seal Faces : Carbon, Ceramic, SiC, Tung. Carbide
Metal Parts : SS304, SS316, Special Alloy
O-rings :Elastomers, PTFE

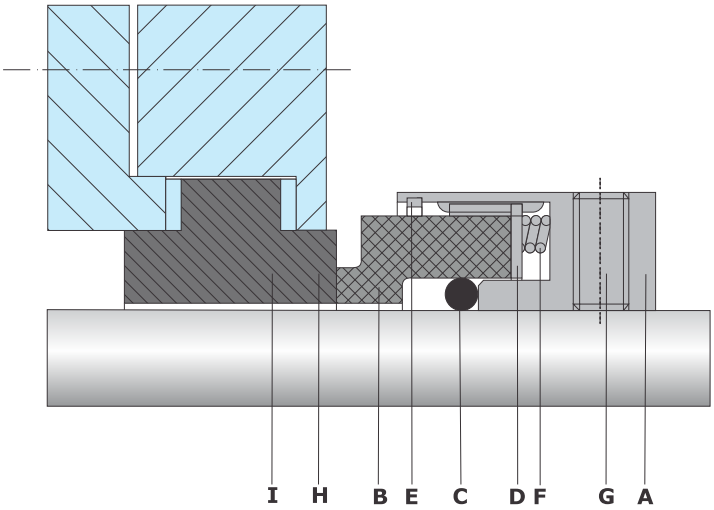
Type S-52

Solid seal ring construction

Reverse Balance Seal

Type EB2

Type EB2 multi spring, pusher type unbalanced seals used for universal applications. The seals are compact in design suiting all types of rotating equipments, pumps and mixers. It is externally mounted completely out of the fluid area and are not exposed to any corrosive action. Seal is inherently balanced, hence no need for stepping shaft or sleeve.



Part No.	Description
A	Retainer
B	Seal Ring
C	O-Ring
D	Thrust Ring
E	Snap Ring
F	Spring
G	Grub Screw
H	Stationary Seat
I	Stationary Packing

Seal Characteristics

Single Seal
Unbalanced
Independent of direction of rotation

Materials

Seal Faces : Carbon, SiC, Tung. Carbide
Metal Parts : SS316, SS304
O-rings : Elastomers, PTFE Wedge

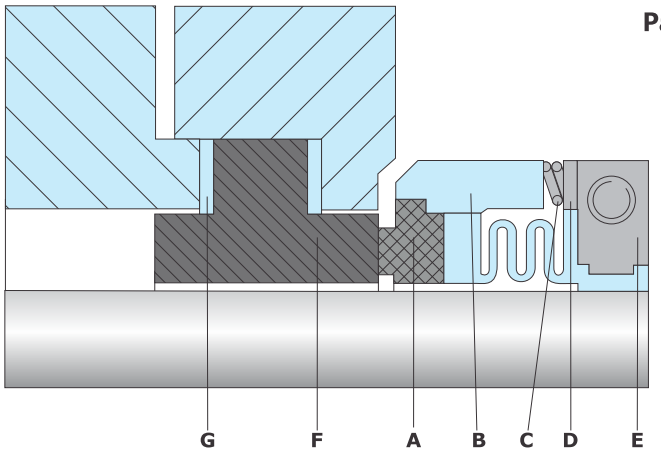
Performance Range

Shaft Diameter	d1	: 18...200mm
Pressure	p	: 12 bar (max)
Temperature	t	: -20...180^{0}C
Velocity	v	: 20 m/sec

Applications

General Chemicals
Petrochemicals
Refineries
Light hydrocarbons, Water

PTFE Bellow Seals



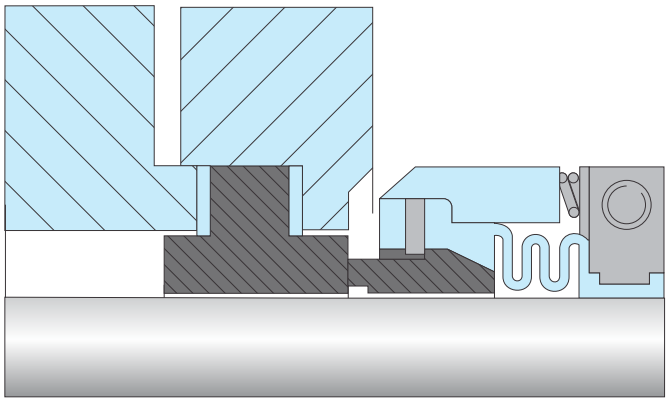
Part No.	Description
A	Bellows
B	Spring Holder
C	Spring
D	Thrust Ring
E	Clamp Ring
F	Stationary Seat
G	Gasket

Type TB-20/TBR-20

Type TB-20 & TBR-20 are external mounted seal designed for extremely corrosive application such as acids, salts, organic compounds and reducing agents. All materials coming in contact with the liquid are made of chemically inert material. Metallic components are isolated from the liquid.

Type TB-20

Seal faces not replaceable. Glass field PTFE face is composite moulded with flexible PTFE bellow.



Type TBR-20

Seal faces replaceable and can be supplied with hard materials suitable for abrasive services.

Seal Characteristics

Single Seal
Outside Mounted
Independent of direction of rotation

Performance Range

Shaft Diameter	d1	: 18...120mm
Pressure	p	: 6 bar (max)
Temperature	t	: -45...120^{0}C
Velocity	v	: 20 m/sec

Materials

Seal Faces : GFT, SiC, Ceramic
Metal Parts : SS304, SS316, Hast-C
O-rings : PTFE Bellow

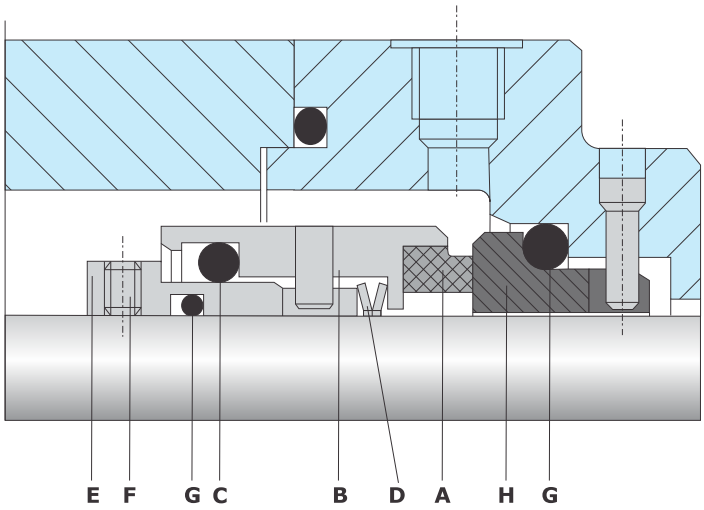
Applications

Extremely Corrosive application

Capsulated Spring Seals

Type SL-250

Type SL-250 is the balanced seal without need for step sleeve. This seals are designed for media containing solids or with high viscosity. The springs are protected from media, thus no clogging of springs or springs compartment, resulting in high reliability.



Part No.	Description
A	Retainer
B	Seal Ring
C	O-Ring
D	Thrust Ring
E	Snap Ring
F	Spring
G	Grub Screw
H	Stationary Seat
I	Stationary Packing

Seal Characteristics

Single Seal
Balanced
Capsulated Spring
Independent of direction of rotation

Materials

Seal Faces : Carbon, SiC, Tung. Carbide
Metal Parts : SS304, SS316, Hasetlloy-C, Alloy 20
O-rings : Viton, Nitrile

Performance Range

Shaft Diameter	d1	: 18...150mm
Pressure	p	: 25 bar (max)
Temperature	t	: -20...140°C
Velocity	v	: 20 m/sec

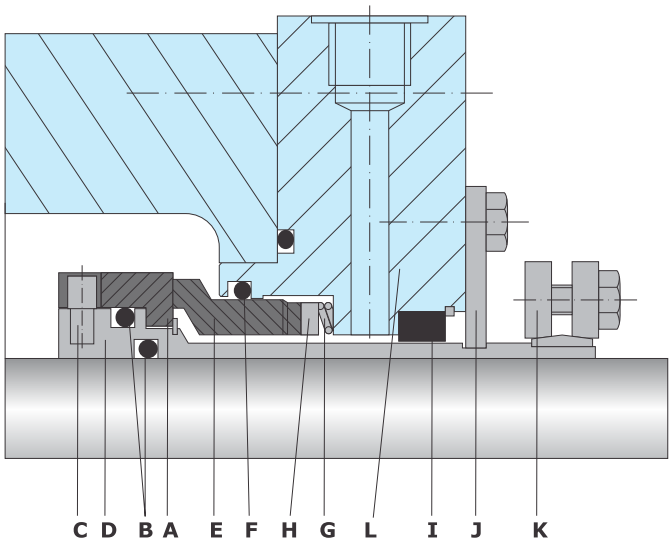
Applications

General Chemicals
Food Industries
Media Containing Solids

Slurry Seals

Type CT-100

Type CT-100 is a compact cartridge balanced seal specially developed for handling slurries, sludge, thick syrups and polymerising fluids. In the cartridge construction the springs are isolated from the fluid enhancing the seal life. After detaching of the location plates provided, the seal can be easily installed straight away without setting measurements. Type CT-100 is a study, robust, seal capable of maintenance free runs for years together.



Part No.	Description
A	Seal Face
B	O-RIng
C	Pin
D	Sleeve
E	Stationary Seat
F	O-Ring
G	Spring
H	Washer
I	Throttle Bush
J	Assembly Fixture
K	Shrink Disc
L	Gland

Seal Characteristics

Single Seal
Balanced
Cartridge Unit
Dependent of direction of rotation

Materials

Seal Faces : Carbon, SiC, Tung. Carbide
Metal Parts : SS304, SS316, Hasetlloy-C, Alloy 20
O-rings : Viton, Nitrile

Performance Range

Shaft Diameter	d1	: 20...150mm
Pressure	p	: 25 bar (max)
Temperature	t	: -20...180^{0}C
Velocity	v	: 20 m/sec

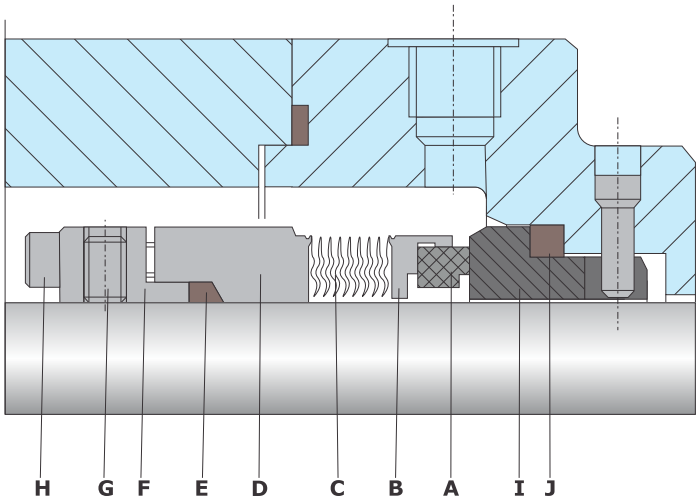
Applications

Pulp & Paper
Slurry pumps
Sludge pumps

Metal Bellow Seal

Type MB-96

Type MB-96 seals specially designed for high temperature application and suitable for high start-up toque since the bellows unit is independent of torque transmission. Grafoil is used as a secondary member having excellent temperature range upto 400°C. Shrunk fit seal face design minimize face distortion restricting leakage and wear rate to very low level under a wide range of condition.



Type MB-96

Part No.	Description
A	Seal Face
B	Face Housing
C	Bellows
D	Collar
E	Packing
F	Drive Collar
G	Grub Screw
H	Head Screw
I	Stationary Seat
J	Packing

Type MB-91

Type MB-91 seals are widely used in refinery, petrochemicals and chemical industries. Static o-ring is used as a secondary member. The absence of dynamic o-ring prevents possibility of seal hang-up. Centroid loaded face design increases seal life by avoiding seal face distortion caused due to thermal expansion and also ensures optimum face flatness over a wide operating condition. As a standard, Am350 bellow cores are used. For chemical compatibility Alloy C-276 or Alloy 718 bellow cores can be used.

Seal Characteristics

Single Seal
Balanced
Metal Bellows
Independent of directions of rotation

Materials

Seal Faces : Carbon, SiC, Tung. Carbide
Metal Parts : SS316, SS304, Carpenter-42, Inconel825, Hastelloy-C
O-rings : Grafoil, Viton & PTFE

Performance Range

Shaft Diameter	d1	: 18...100mm
Pressure	p	: 10 bar (max)
Temperature	t	: -20...400°C (MB-96)
		-20...200°C (MB-91)
Velocity	v	: 20 m/sec

Applications

High temperature applications
Petrochemicals
Refineries

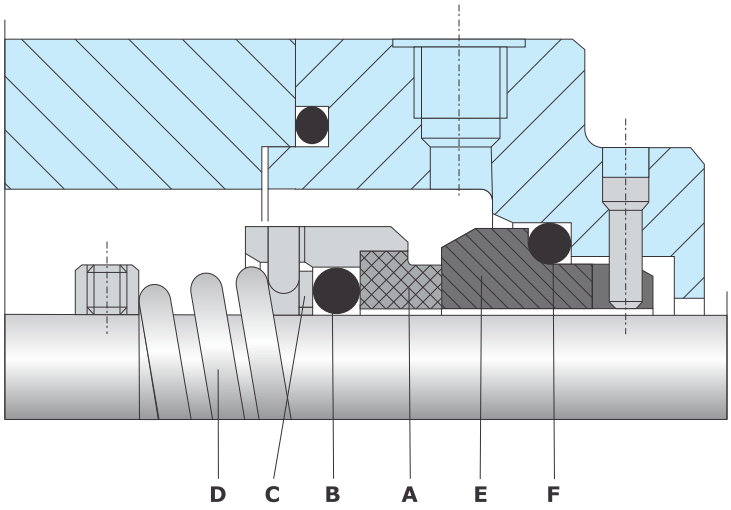
Type MB-91

Part No.	Description
A	Seal Face
B	Face Housing
C	Metal Bellows
D	Collar
E	O-Ring
F	Grub Screw
G	Stationary Seat
H	O-Ring

Conical Spring Seals

Type SM-31

Type SM-31 is single conical spring, unbalanced seal with O-ring provided for secondary sealing. Since the Torque transmission is done by the single coil springs the seals are dependent on the directions of rotation, which is seen from the drive end of the shaft. Right handed spring and left handed springs are provided for clockwise and anticlockwise rotating shafts respectively. These seals can carry a variety of seals faces, serving application in submersible, sewage, chemical transfer, water pumps etc.



Part No.	Description
A	Seal Face
B	O-ring
C	Thrust ring
D	Right Hand Spring
E	Stationary Seat
F	O-ring

Seal Characteristics

Single Seal
Unbalanced
Conical spring
Dependent on directions of rotation

Materials

Seal Faces : Carbon, Ceramic, SiC, Tung. Carbide
Metal Parts : SS304, SS316
O-rings : Elastomers, TTV

Performance Range

Shaft Diameter	d1	: 10...200mm
Pressure	p	: 10 bar (max)
Temperature	t	: -20...180°C
Velocity	v	: 10 m/sec

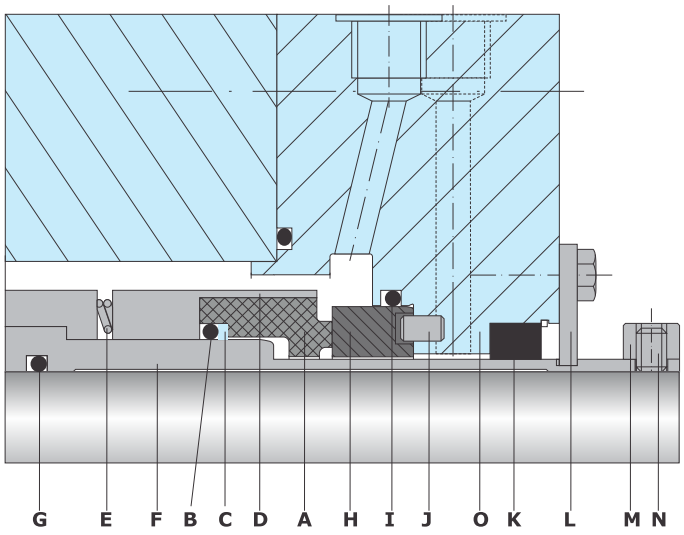
Applications

Water pumps
Submersible pump
Sewage pump

High Pressure Seal

Type HP-108

Type HP-108 mechanical seals are designed for heavy duty service involving high pressure and sliding velocities. This seal has positive drive arrangement and sturdy construction making the seal suitable for high pressure application. Multiple spring design provides uniform face loading. The seal is supplied as a cartridge unit and can be directly bolted to stuffing box. These seals are normally used in main oil pipelines, water injection pumps and boiler feed water pumps.



Part No.	Description
A	Seal Face
B	O-ring
C	Backup ring
D	Retainer
E	Spring
F	Sleeve
G	O-ring
H	Seat
I	O-ring
J	Pin
K	Throttle bush
L	Assembly fixture
M	Drive Collar
N	Grub Screw
O	Gland

Seal Characteristics

Single Seal
Balanced
Independent of direction of rotation

Performance Range

Shaft Diameter	d1	: 25...150mm
Pressure	p	: 80 bar (max)
Temperature	t	: -20...220^{0}C
Velocity	v	: 20 m/sec

Materials

Seal Faces : Carbon, SiC, Tung.- Carbide
Metal Parts : SS316, SS304, Hastelloy-C, Alloy 20
O-rings : Elastomers

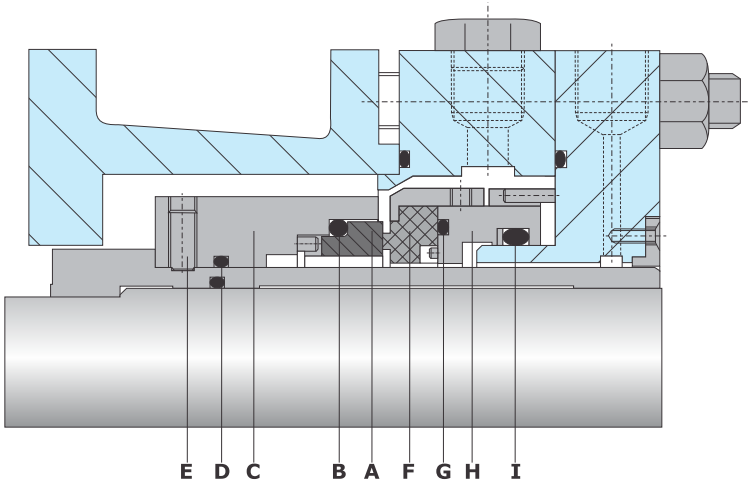
Applications

Main Oil Pipeline
Water Injection Pumps
Boiler Feed Water Pumps

High Pressure Seal

Type HP-104

Type HP-104 series are designed to handle liquids of varying containment including slurries, sludge, sewage, viscous or abrasive media etc. The Type HP-104 Cartridge Seal combines the advantage of easy installation and simple maintenance with total reliability. The Compactness of the design ensure that the seal fit all ANSI and DIN stuffing boxes. This Seal is specially design for high pressure application.



Part No.	Description
A	Seal Face
B	O-ring
C	Seal Ring Housing
D	O-Ring
E	Grub Screw
F	Stationary Unit
G	Stationary Packing
H	Stationary Shell
I	Stationary Shell Packing

Seal Characteristics

Single Seal
Balanced
Independent of directions of rotation

Materials

Seal Faces : Carbon, SiC, Tung. Carbide
Metal Parts : SS316, SS304, Hastelloy-C, Alloy 20
O-rings : Elastomers

Performance Range

Shaft Diameter	d1	: 21...150mm
Pressure	p	: 70 bar (max)
Temperature	t	: -20...220°C
Velocity	v	: 20 m/sec

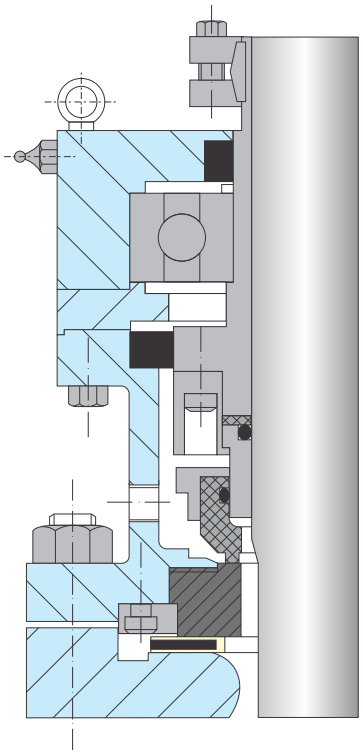
Applications

Main Oil Pipeline
Water Injection Pumps
Boiler Feed Water Pumps

Reactor-Agitator-Mixer Seal

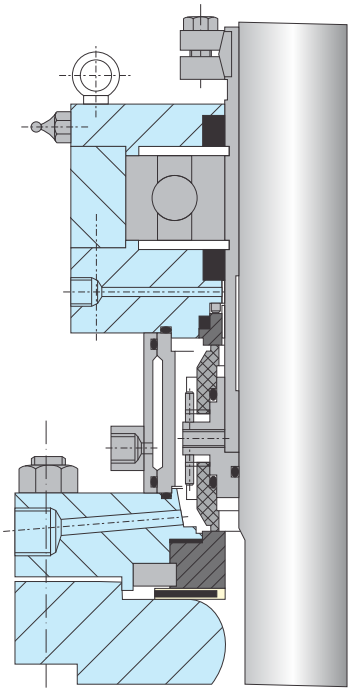
Type AGS-100CT
Type AGS-200CT

Type AGS-100CT are preset factory assembled cartridge seals for use in Agitators, Mixers and Reactor Vessels. The seal construction varies slightly for top entry vessels, side entry vessels and bottom entry vessels. The seals are designed to the shortest shaft length and the bearings are located as close to the vessel body to minimize the deflection.



Type AGS-200CT

Double seal back to back



Seal Characteristics

Single Seal / Double Seal
Unbalanced / Balanced
Independent on direction of rotation

Materials

Seal Faces : Carbon, SiC, Tung, Ceramic
Metal Parts : SS316, Hastelloy-C Alloy 20
O-rings : Elastomers, PTFE

Performance Range

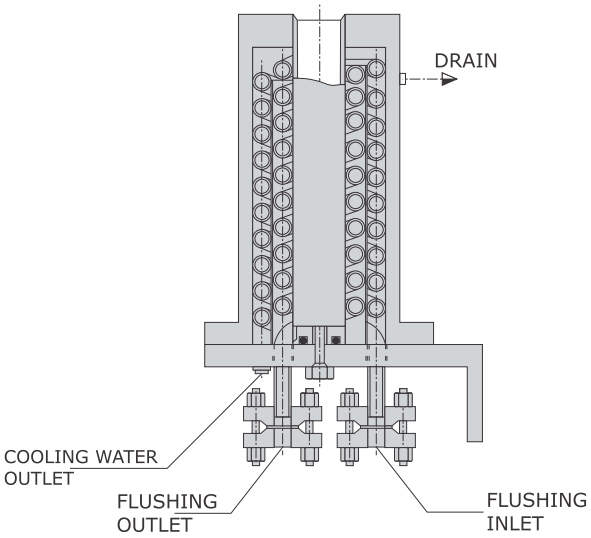
Shaft Diameter	d1	: 25...250mm
Pressure	p	: vaccum....70 bar (max)
Temperature	t	: -20...220^{0}C
Velocity	v	: 4 m/sec

Applications

General Chemicals and its vapours.
Petrochemicals and its vapours.
Light Hydrocarbons and its vapours.

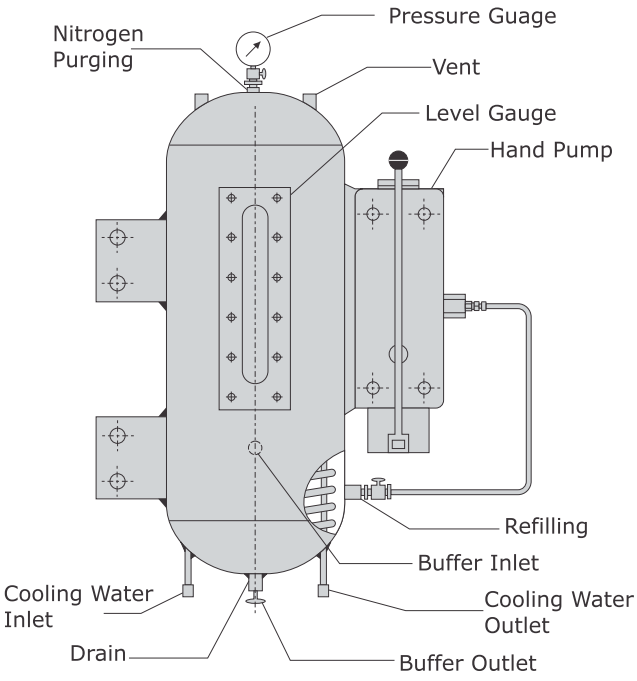
Heat Exchanger

Newmake Heat Exchangers are incorporated in API Plans 21,23,41 to bring down the temperature of buffer fluid before it enters into seal chamber. Heat Exchanger may be mounted either vertically or horizontally, the vertical mounting being preferred because of better thermosyphon effects.



Thermosyphon

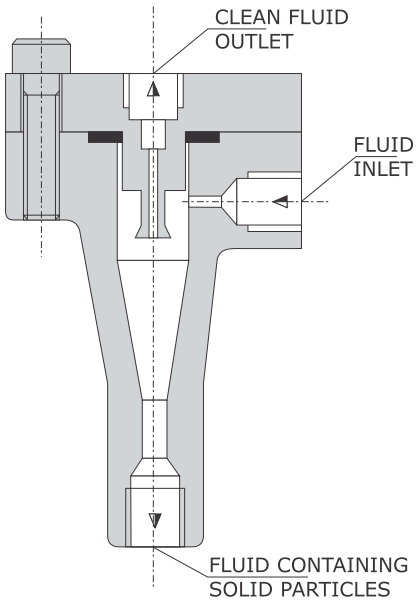
With Newmake's Thermosyphon system it is possible to supply barrier fluid to double seal arrangement. The pressure of barrier fluid is higher than the pressure of the fluid being sealed. Thus seal faces remain in contact with each other and sealing area temperature is controlled. Thermosyphon system is as per API 682.



Cyclone Separator

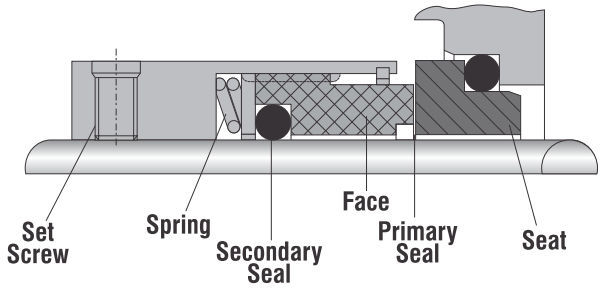
Cyclone Separator are designed for removing dirt, sand and solid particles from injection flow to mechanical seal. The separation is obtained by centrifugal force generated by differential pressure across the cyclone.

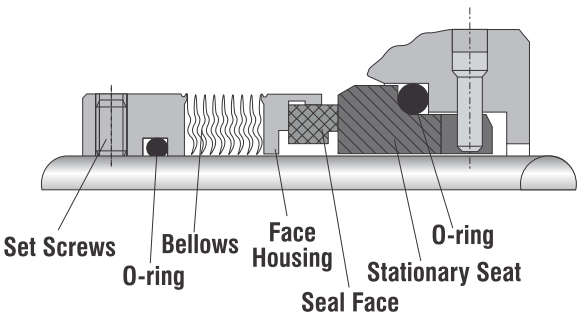
Size	: 1/2"NPT/1/2"BSP
Pressure	: 120 bar
Temperature	: 200^{0}C



SEALING TECHNOLOGY

The technology has come off the age and proved to be environmental protection system. API 682 standard is devoted standard for mechanical seals. The new sealing technologies are based on advanced computer programs used to optimize the seal designs. Combined with advancements in the seal face materials the equipment availability and reliability has increased substantially. Other related standards are: API 610, DIN 24960, ISO 3609, DIN EN 12756 and ISO 21049.





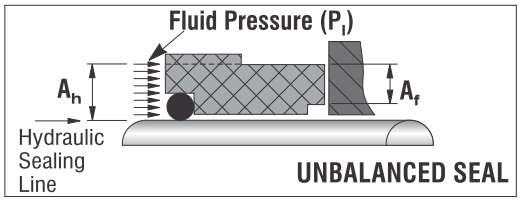
BASIC SEAL CONSTRUCTION

Sealing Mechanism: Two lapped faces, one rotating with shaft and another stationary in gland are bought in contact with each other by means of spring force. The surfaces are separated by micron thickness of film of fluid being sealed. The generation of this film is automatic due to micro asperities on the lapped surfaces.

Thus the film acts as a lubricant and reduces the friction and heat generation well within the limits of seal face materials. Generally the lubrication regime is mixed one. Typical coefficient of friction is 0.07 for general purpose seals and 0.015 for well designed high pressure seals.

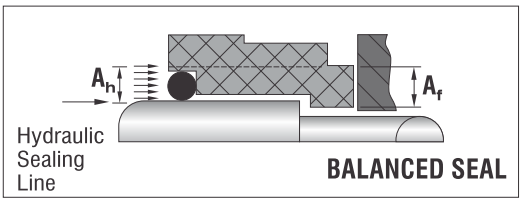
Seal Balance $= \frac{A_h}{A_f}$ and is > 1

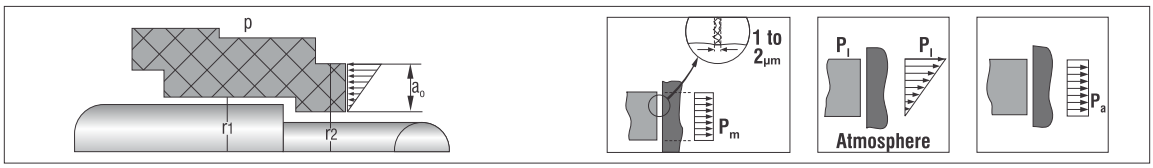
Seal is unbalanced because a high proportion of the hydraulic load is applied to the fluid film.



Seal Balance $= \frac{A_h}{A_f}$ and is < 1

Seal is balanced because a lower proportion of the hydraulic load is applied to the fluid film.





Seal Balancing: For seal to perform, the seal faces must be in contact with each other in dynamic conditions. The heat generation due to interface pressure load must not vaporize the liquid film. Seal balancing is a geometrical feature provided to seal face that avoids such condition.

Interface Pressure = Pf = $\Delta p(b-k)+Psp$
Diff. Pressure acroos seal = Δp
k = Seal face press. Variation constant = 0.5 generally
Psp = Spring load pressure on face = 1.8 to 2.8 kg/cm^2

MATERIALS

Most of the seal designs have stood the test of time and are still in regular usage. The improvements, however, have been tremendous in the seal face materials. The development of superior and highly reliable resin impregnated carbon as also antimony impregnated carbon has enable successful seal operation even in marginal lubrication conditions particularly in light hydrocarbon and high temperature water applications.

For corrosive liquids resin impregnated carbon and sintered silicon carbide grades have proved the ideal solutions. The hardness and thermal conductivity of silicon carbide is extremely high as shown in the table below.

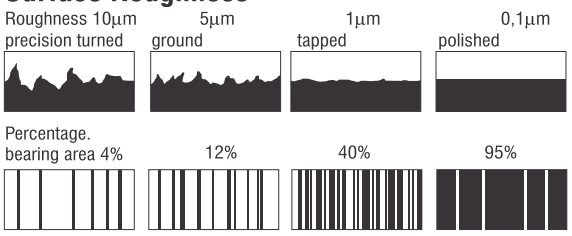
ELASTOMERS

Generally seal face materials easily withstand high temperatures, typically 330°C. However temperature limitations on the part of secondary elastomers decide the seal temperature capability. So while selecting the seal these limits are to be taken into account

Material description	Temperature limits min	max
Fluoroelastomer	0°F/-18°C	400°F/204°C
Ethylene Propylene (EPDM)	-40°F/-40°C	300°F/149°C
Neoprene	-40°F/-40°C	300°F/140°C
Nitrile Butadiene (Buna N)	-40°F/-40°C	300°F/125°C
Kalrez® 1050LF	240°F/-7°C	550°F/288°C
PTFE	-100°F/-73°C	450°F/232°C
Flexible graphite	-320°F/-196°C	800°F/427°C
Chemraz®	-20°F/-29°C	450°F/310°C

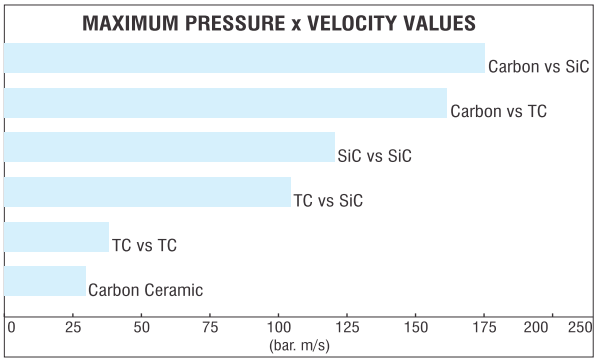
Material	Compressive Strength N/mm²	Density g/cm³	Modulus elasticity of kN/mm²	Coeff. of Thermal Expansion x10-⁶/°C	Thermal Conductivity W/m°C	Hardness
Carbon, resin impregnated	250	1.83	234	2.88	6	100*
Carbon, antimony impregnated	350	2.15	262	3.96	8	115*
Tungsten Carbide	4750	15	635	5	100	1500*
Silicon Carbide	2750	3.1	365	4.5	145	2400*
Alumina Oxide	2620	3.9	385	4.32	25	1800**

Surface Roughness



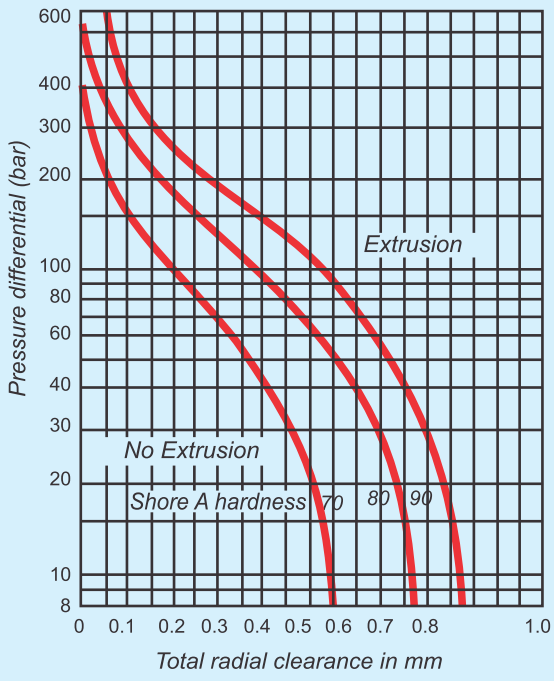
Lapped sliding face made out of different materials having the following average, arithmetic mean roughness values (Ra)

Tungsten carbide	0.01µmm
Silicon carbide	0.04µmm
Carbon graphite	0.10µmm
Aluminium oxide	0.15µmm

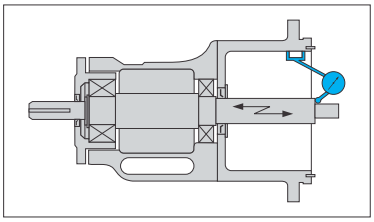


Extrusion characteristics of elastomeric O-rings

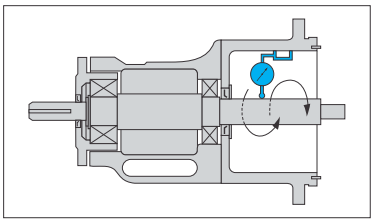
The extrusion resistance of elastomeric O-rings can be greatly enhanced by use of support rings.



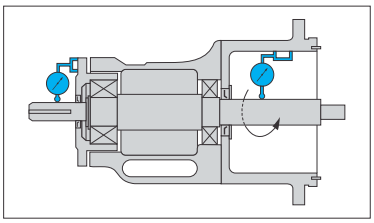
Equipment Checkpoints



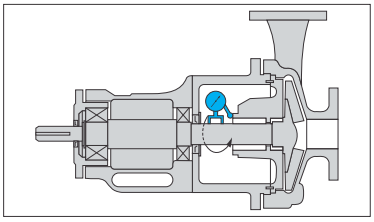
Shaft end play - Axial shaft movement (end play) must not exceed 0.004" (0.10 mm) full indicator movement (F.I.M.) on ball type thrust bearings.



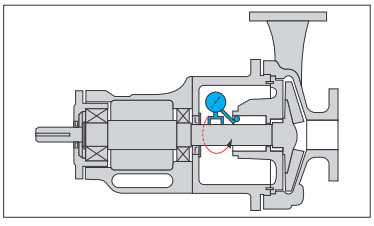
Shaft radial deflection - must not exceed 0.002" (0.5 mm) full indicator movement at any point along the shaft.



Shaft run out - must not exceed 0.002" (0.5 mm) full indicator movement at any point along the shaft.



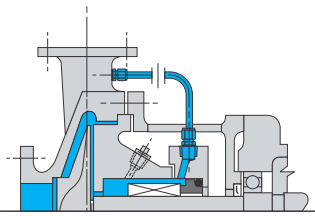
Seal Chamber face run out - Seal Chamber face should be square to shaft centre line within 0.005" (0.13 mm) full indicator movement.



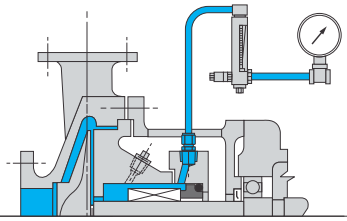
Seal Chamber bore concentricity - Shaft concentricity to seal chamber bore should not exceed 0.005" (0.13 mm) full indicator movement.

API Flush Plans

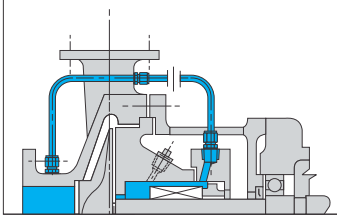
Plan 11
Circulation from discharge through orifice.



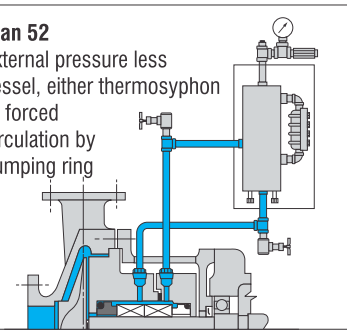
Plan 32
Flush from external source



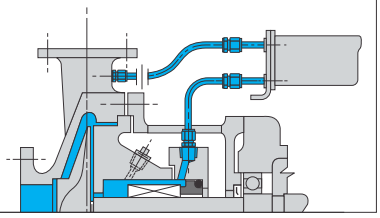
Plan 13
Circulation from seal cavity through orifice to suction.



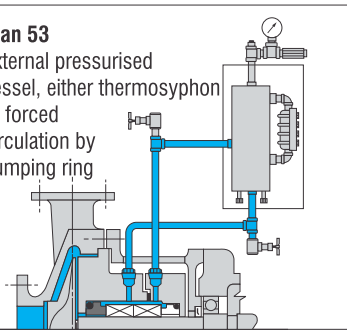
Plan 52
External pressure less vessel, either thermosyphon or forced circulation by pumping ring



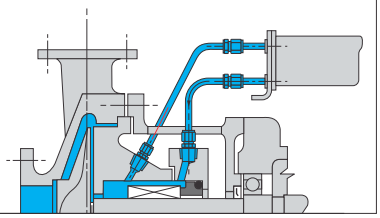
Plan 21
Circulation from discharge through orifice and cooler.



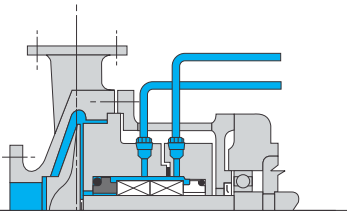
Plan 53
External pressurised vessel, either thermosyphon or forced circulation by pumping ring



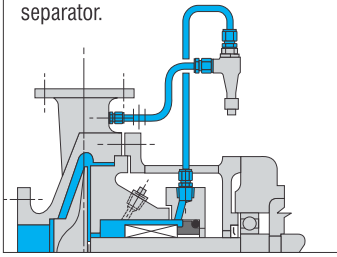
Plan 23
Forced circulation through cooler, back to seal, by pumping ring.



Plan 54
Forced barrier circulation from external system.



Plan 31
Circulation from discharge through cyclone separator.



Plan 61
Plugged quench and drain ports

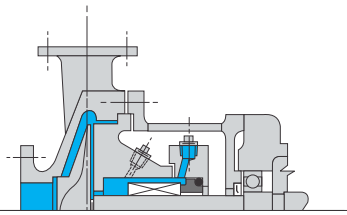


TABLE OF MATERIALS

CODE	MATING RING	SEAL RING	SECONDARY SEAL	SPRING	HARDWARE
A	TC/SS304	TC/SS304	PTFE	SS316	SS316
B	TC/ALLOY-20	TC/ALLOY-20	----------	ALLOY-20	ALLOY-20
B1	TC/TITANIUM	TC/TITANIUM	----------	----------	----------
C	TC/HAST-C	TC/HAST-C	----------	SS304	SS304
D	SIL.CAR./HAST-C	SIL.CAR./HAST-C	EPR (PTFE Coated)	MONEL	MONEL
E	SS410	SS410	EPDM	HASTELLOY-C	HASTELLOY-C
F	VELCHROME	VELCHROME	----------	SS410	SS410
G	NIRESIST	NIRESIST	NEOPRENE	----------	----------
H	CAST IRON	CAST IRON	----------	----------	STEEL / C.I.
I	VELBRO	VELBRO	BUTYL	----------	----------
J	CHROME OXIDE/SS316	CHROME OXIDE/SS316	EPR	----------	CHROME OXIDE/SS316
K	STELLITE (Co.)	STELLITE (Co.)	----------	AM 350	----------
L	STELLITE (Ni.)	STELLITE (Ni.)	----------	----------	HASTELLOY-B
L1	SIL. CAR./SS904L	SIL. CAR./SS904L	----------	----------	SS904L
M	SIL. CAR./SS316	SIL. CAR./SS316	----------	----------	NICKLE
M1	SIL. CAR/SS316L	SIL.CAR./SS316L	----------	----------	----------
N	TC (Co.) /SS316	TC (Co.) SS316	VITON	----------	SS316L
O	TC (Ni.)/SS316	TC (Ni.)/SS316	VITON (PTFE Coated)	----------	----------
O1	SIC/NICKLE	SIC/NICKLE	----------	----------	----------
P	SIL.CAR. SOLID	SIL.CAR. SOLID	SILICON	SS316 (PTFE Coated)	----------
Q	TC (Co.) SOLID	TC (Co.) SOLID	----------	----------	----------
R	TC (Ni.) SOLID	TC (Ni.) SOLID	NITRILE (BUNA-N)	----------	CARP. 42/17-4PH
R1	TC /17-4PH	TC/17-4PH	----------	----------	----------
S	CERAMIC	CERAMIC	----------	----------	----------
T	CARBON-M	CARBON-M	FEP	----------	BRONZE
T1	CARBON-M/SS316	CARBON-M/SS316	----------	----------	----------
U	CARBON-R	CARBON-R	----------	----------	SS304L
U1	CARBON-R/SS316	CARBON-R/SS316	----------	----------	----------
V	CARBON-R/HAST-C	CARBON-R/HAST-C	----------	----------	TITANIUM
V1	CARBON-R/NICKLE	CARBON-R/NICKLE	----------	----------	----------
V2	CARBON-R/ALLOY-20	CARBON-R/ALLOY-20	----------	----------	----------
W	GFT	GFT	GFT	----------	----------
X	SIL.CAR,/SS304	SIL.CAR/SS304	----------	----------	M.S,
Y	SIL.CAR,/ALLOY-20	SIL.CAR/ALLOY-20	----------	----------	----------
Y1	SIL.CAR./TITANIUM	SIL.CAR./TITANIUM	FLEXIBLE GRAPHITE	----------	----------
Y2	CARBON-R/TITANIUM	CARBON-R/TITANIUM	----------	----------	----------
Z	RULON	RULON	KALREZ & CHEMRAZ	----------	NON-METALLIC
Z1	CFT	CFT	----------	----------	----------

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