Garlock

an EnPro Industries family of companies

GAR-SPRING

This technology provides the answer in difficult operating conditions

Europe, Middle East and Africa

Leaders in Sealing Integrity

Table of Content

GAR-SPRING

Spring energized PTFE seals

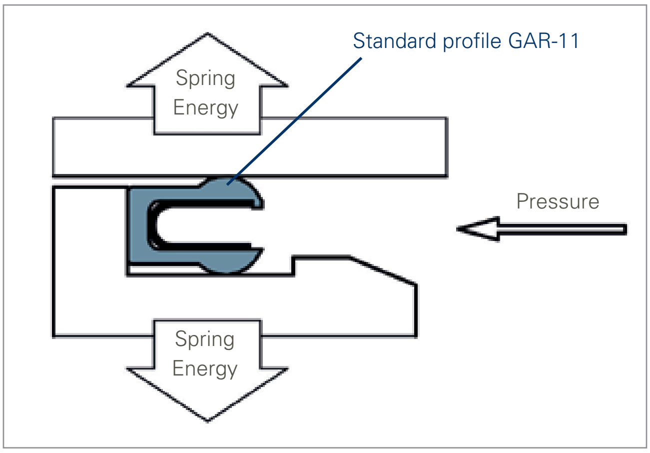
The GAR-SPRING product line stands for reliable sealing of rotating, linear and static equipment in highest requirement applications. Their characteristic structure is a PTFE jacket material that is energized by a steel spring. GAR-SPRING products are designed to withstand temperatures from cryogenic down to -260°C and up to +340°C and are available in incremental sizes of 0,1 mm starting from 2 mm up to 2.000 mm rod diameter. The PTFE material offers outstanding chemical resistance, can deal with highly abrasive media and is attributed with industry specific certifications and qualifications.

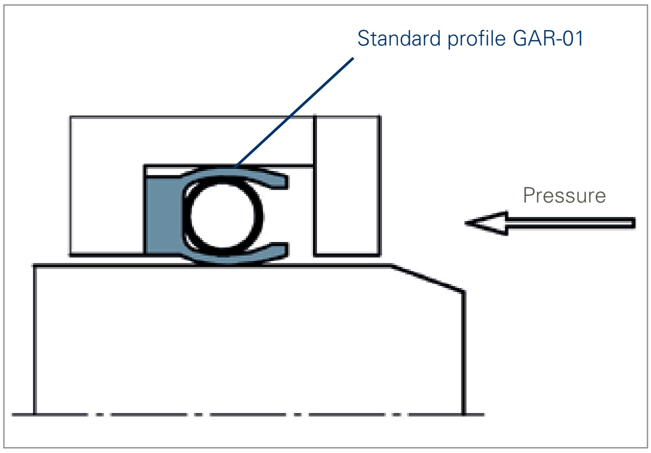
GAR-SPRING products are suitable for many different applications in a variety of industries, especially in the oil and gas industry, chemical and pharmaceutical industry as well as food and pharma segments.

Advantages at a glance

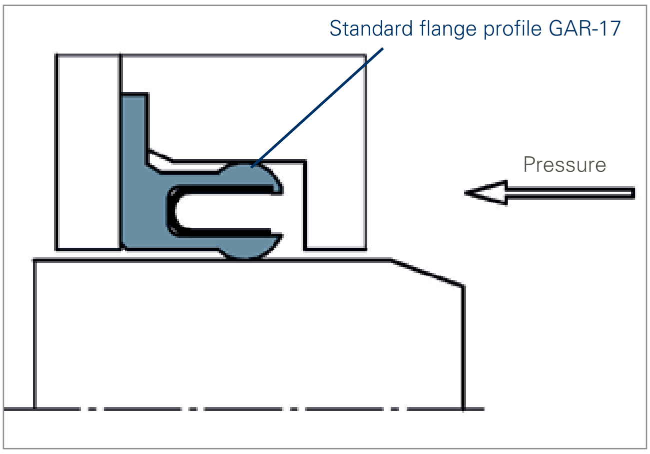
» Suitable for static, rotating and linear applications
» Withstands temperatures from -260°C up to +340°C
» Available in sizes from 2 mm up to 2.000 mm
» Outstanding chemical resistance
» Minimal housing size requirements
» Available in 0,1 mm incremental sizes
» Useable in food and pharmaceutical applications
» Certificates available on request

Operating principle





With flange



The spring provides the basic force onto the PTFE jacket material in the early stage when there is no or only slight system pressure to enable proper sealing.

After the system pressure is applied GAR-SPRING products act as a self-enhancing sealing system:
The higher the system pressure, the higher the radial force onto the PTFE jacket and therewith the sealing performance.

GAR-SPRING Styles

Helicoil Springs

Radial seals
Radial seals for static and dynamic applications, usable as rod and piston seals. The medium to relatively high spring load provides great sealing abilities, with only a slight increase in seal friction. Helicoil Springs are suitable for medium to high pressures.

Radial flange seals
Due to clamping of the flange the seal will be prevented from turning with the shaft. This can happen with standard designs due to thermal expansion and other effects with dynamic applications.

Axial seals
Axial seals do not seal radially. They are commonly mounted on the shaft and seal axially against a stationary housing or plate.

FDA Helicoil Springs

FDA Helicoil Springs (GAR-01 to GAR-10)
FDA compliant version that comes with an O-ring instead of the Helicoil Spring. More information is available on page 8.

GAR-SPRING Styles

U Springs

Radial seals

U springs are designed for dynamic applications, usable as rod and piston seals. The spring has a low load going along with high banding. This enables a friction optimized sealing solution. U Springs are suitable for low to medium pressure and speed applications.

Radial flange seals

Due to the clamping of the flange the seal will be prevented from turning with the shaft. This can happen with standard designs due to thermal expansion and other effects with dynamic applications.

Axial seals

Axial seals do not seal radially. They are commonly mounted on the shaft and seal axially against a stationary housing or plate.

U Finger Springs

Axial U Finger Springs

U Finger Springs are axially working face seals. They employ a heavy duty, high load spring that is recommended for extreme sealing conditions both static and dynamic.

FDA U Springs

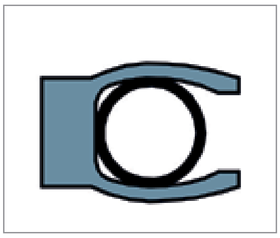
FDA U Springs (GAR-11 to GAR-20)

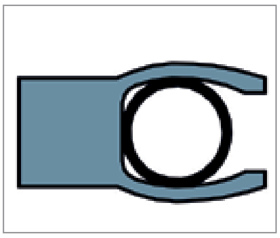
FDA compliant version that comes with a silicone filled spring chamber. More information is available on page 8.

GAR-SPRING Profiles

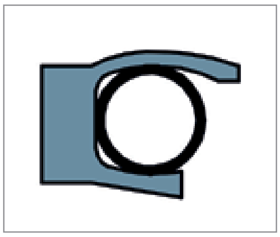
Helicoil Springs

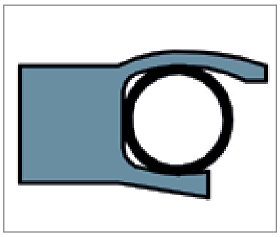
Radial seals


GAR-01


GAR-02

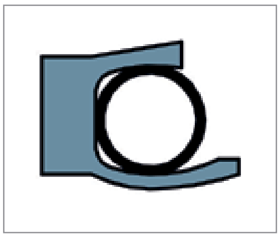
GAR-01: Standard Profile
GAR-02: As GAR-01 + extended heel for high pressure

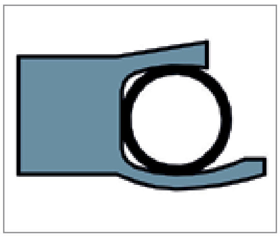

GAR-03


GAR-04

As GAR-01 but with a scraper on the inside diameter.
Suitable for reciprocating movement only.

GAR-03: Standard Profile
GAR-04: As GAR-03 + extended heel for high pressure

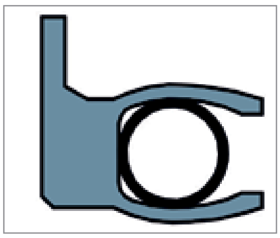

GAR-05

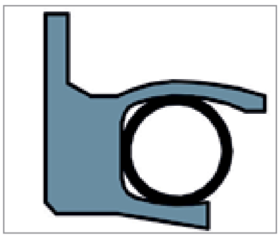

GAR-06

As GAR-01 but with a scraper on the outside diameter.
Suitable for reciprocating movement only.

GAR-05: Standard Profile
GAR-06: As GAR-05 + extended heel for high pressure

Radial flange seals

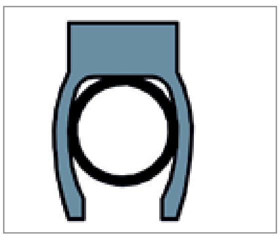

GAR-07

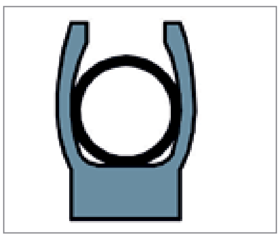

GAR-08

As GAR-01 but with a flanged heel.

GAR-07: Standard flange profile
GAR-08: As GAR-03 but with a flange,
suitable for reciprocating movements only

Axial seals


GAR-09

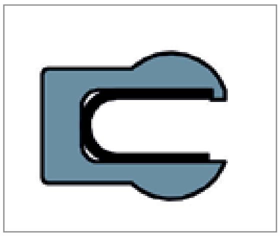

GAR-10

GAR-09: Axial seal mostly for static applications, inside face seal
GAR-10: As GAR-09 but as outside face seal configuration

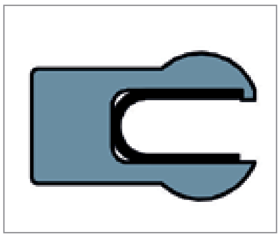
GAR-SPRING Profiles

U SPRINGS

Radial seals

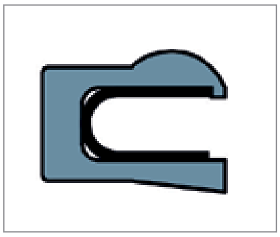


GAR-11

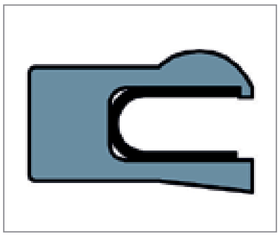


GAR-12

GAR-11: Standard Profile
GAR-12: As GAR-11 + extended heel for high pressure



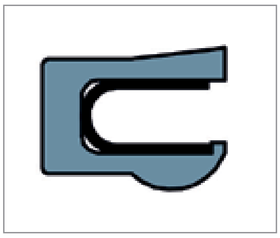
GAR-13



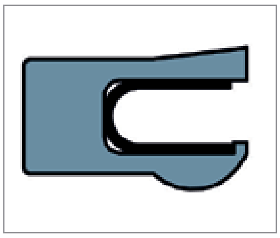
GAR-14

As GAR-11 but with a scraper on the inside diameter.
Suitable for reciprocating movement only.

GAR-13: Standard Profile
GAR-14: As GAR-13 + extended heel for high pressure



GAR-15

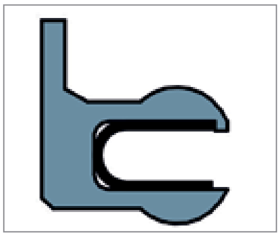


GAR-16

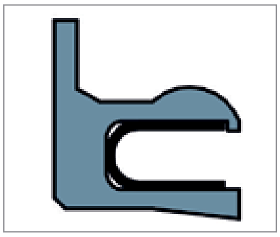
As GAR-11 but with a scraper on the outside diameter.
Suitable for reciprocating movement only.

GAR-15: Standard Profile
GAR-16: As GAR-15 + extended heel for high pressure

Radial flange seals



GAR-17

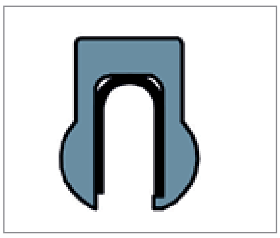


GAR-18

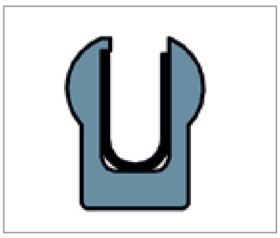
As GAR-11 but with a flanged heel.

GAR-17: Standard flange profile
GAR-18: As GAR-13 but with a flange,
suitable for reciprocating movements only

Axials seals



GAR-19



GAR-20

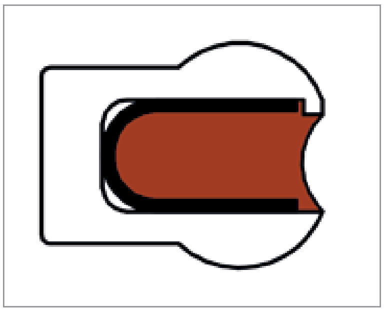
GAR-19: Axial seal mostly for static applications, inside face seal
GAR-20: As GAR-19 but as outside face seal configuration

GAR-SPRING Profiles

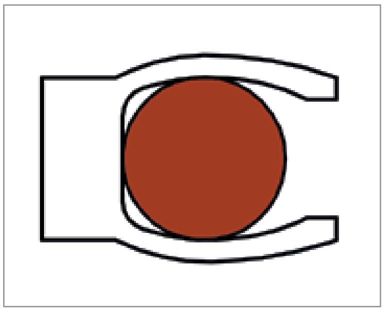
For food, beverage, cosmetics and pharmaceutical applications

Introduction

Garlock´s spectrum of FDA compliant seals is designed specifically for food, beverage, cosmetics and pharmaceutical applications where possible contamination has to be prevented.



Our U Spring profiles (GAR-11 to GAR-20) can be modified to a FDA compliant version by filling the cavity with silicone (see illustration on the left). The silicone surface is very smooth and sealed thus preventing dirt and contamination from getting trapped. The silicone is available in red, white and transparent color.



Our Helicoil Spring profiles (GAR-01 to GAR-10) can also be adjusted to an FDA compliant version. Therefore the spring gets replaced by an O-ring (see illustration on the left) that fills the cavity to prevent contamination from getting trapped there.

Additional certificates (e.g. EC 1935/2004) are available on request.

Recommended FDA Materials

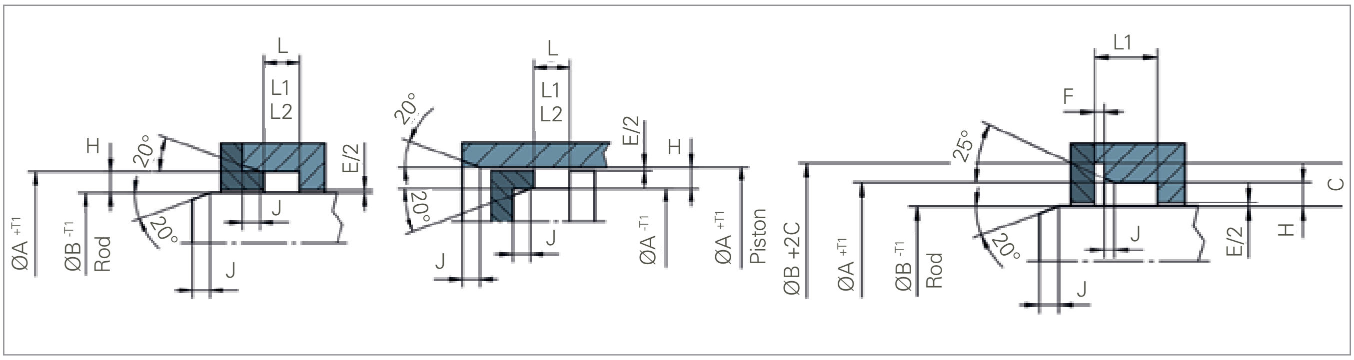
Code	Description	Color
01	Virgin PTFE	White
10	UHMW-PE	White
15	Filled PTFE	White
22	Modified PTFE	White

The temperature rating will decrease due to the temperature limits of silicone. Please contact Garlock´s technical department for further information.

GAR-SPRING Hardware Design

Hardware design for Helicoil and U Springs

Radial seal: Hardware design

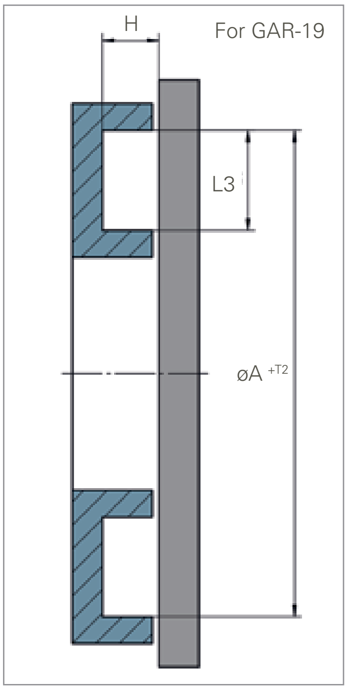


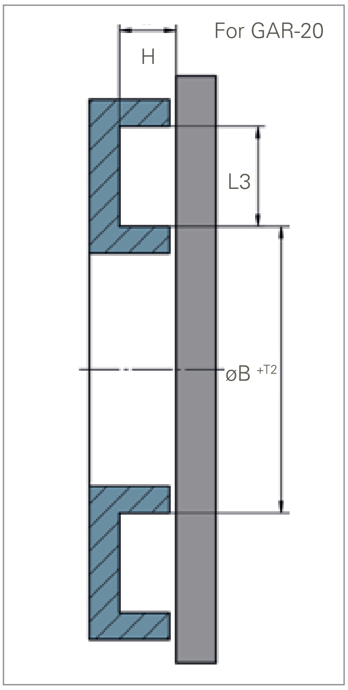
Cross section*	H	T1	L +0,3/-0	L1 +0,3/-0	L2 +0,3/-0	C +/-0,15	F +/-0,05	J +/-0,15	E NOM
1	1,42 / 1,47	0,05	2,4	3,8	5,3	3,4	0,40	1,0	0,10
2	2,26 / 2,31	0,05	3,6	4,6	6,2	4,3	0,85	1,0	0,13
3	3,07 / 3,12	0,05	4,8	6,0	7,7	5,5	0,70	1,5	0,15
4	4,72 / 4,78	0,06	7,1	8,5	10,8	8,5	0,80	2,0	0,18
5	6,05 / 6,12	0,07	9,5	12,1	14,7	11,5	1,20	2,5	0,20
6	9,35 / 9,40	0,08	13,5	15,0	18,0	15,5	1,60	3,5	0,24

*Please see page 14 for selecting a suitable cross section depending on rod and bore diameter

All statements in mm

Axial seal: Hardware design





Cross section	H	T2	L3 MIN
1	1,42 / 1,47	0,13	2,4
2	2,26 / 2,31	0,13	3,6
3	3,07 / 3,12	0,15	4,8
4	4,72 / 4,78	0,15	7,1
5	6,05 / 6,12	0,20	9,5
6	9,35 / 9,40	0,25	13,5

All statements in mm

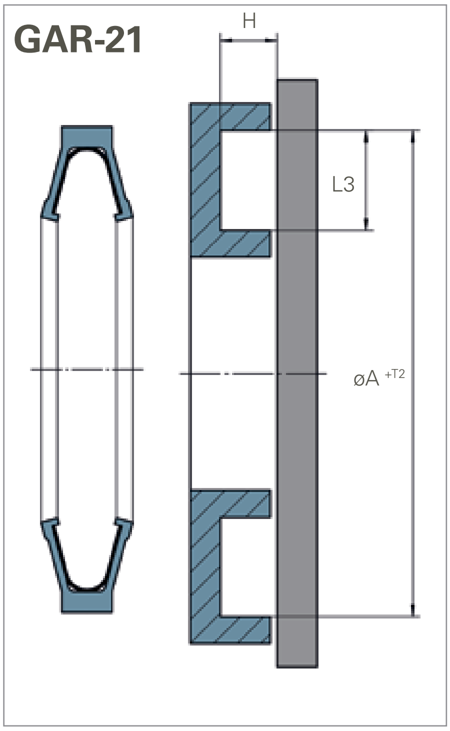
ØA= nominal OD (outer diameter)
ØB= nominal ID (inner diameter)

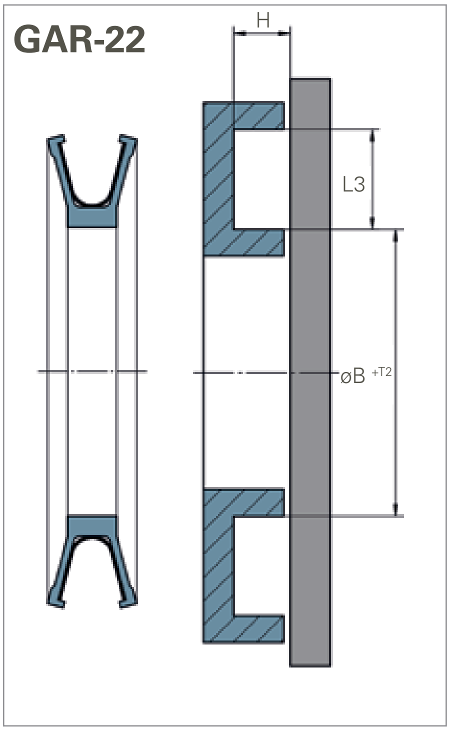
GAR-SPRING Specials

U Finger Springs

GAR-21 and GAR-22

The Axial Face Seals – GAR-21 and GAR-22 – employ a heavy duty, high load spring, recommended for extreme sealing conditions in static and dynamic applications. They are ideal for marine loading arm swivels and similar applications where high torque and clamping forces are present. Recommended for cryogenic applications, ultra-high vacuum and other thin gases.



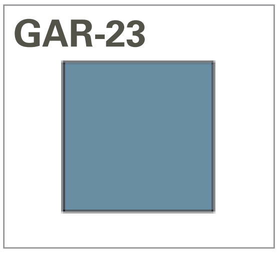


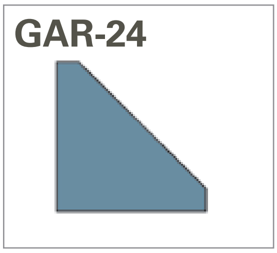
Cross Section	H	T2	L3 Minimum
3	3,07 / 3,12	0,15	4,8
4	4,72 / 4,78	0,15	7,1
5	6,05 / 6,12	0,20	9,5
6	9,35 / 9,40	0,25	13,5
7	12,40 / 12,45	0,30	16,5

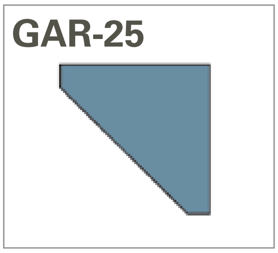
All statements in mm

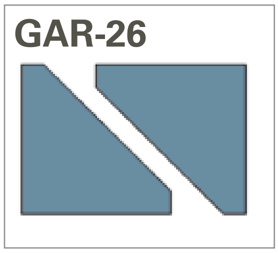
ØA= nominal OD (outer diameter)
ØB= nominal ID (inner diameter)

Back-up rings

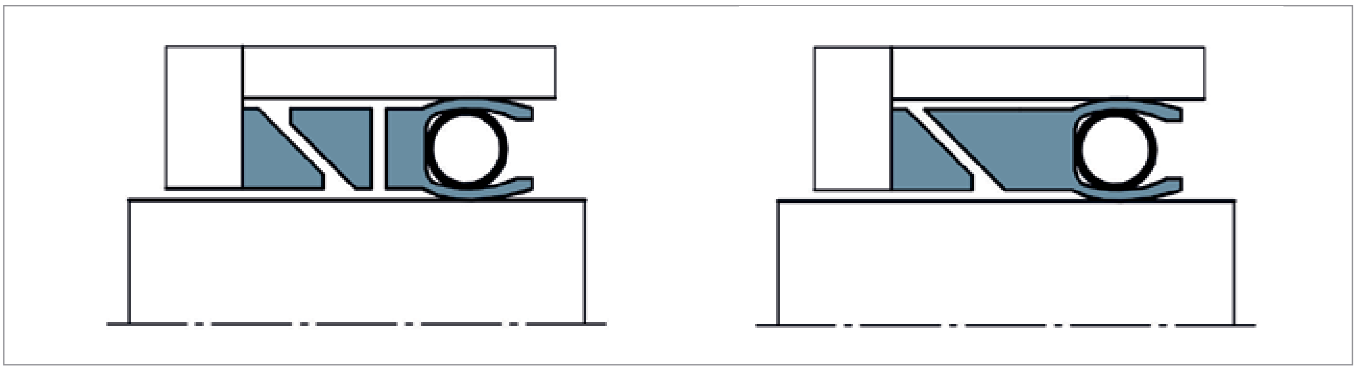








Back-up rings can be added to all GAR-SPRING styles. They are used in combination with axial and radial seals when the extrusion gap is too big for the required pressure and temperature (see table on page 13 for more information). The illustration below shows an exemplary setup of back-up rings in combination with our Helicoil Spring Style GAR-01.



GAR-SPRING Materials

Jacket Materials

Garlock offers a wide range of seal jacket materials, mainly based on PTFE resins. PTFE is resistant to most chemicals except chlorine trifluoride/fluorine gas at high temperatures and molten alkali metals. However, as many sealing applications use filled PTFE resins to improve performance, care should be taken that the filler will not be attacked by the sealed medium. Stainless steel and NACE approved springs are available as is a range of elastomeric energizers. When using elastomers, consideration of temperature/chemical compatibility should be taken into account. At temperatures below -40 °C, PTFE and many other jacket materials will harden and shrink.
This behavior feature imposes higher loads on the energizer and may compromise sealing efficiency. Face seals (Axial Seals) are less affected than Radial Seals but we recommend to consult our technical department for seal designs working at -40 °C and below.

Code	Description	Color	Application	Temp °C	Friction Coeff.	Wear factor
01	Virgin PTFE	White	Excellent for light dynamic and static service. Low gas permeability. Good cryogenic properties. FDA approved	-260 +200	0,09	>1000 (High)
02	Premium PTFE	Blue	Similar properties to code 01 but with improved wear resistance	-260 +200	0,09	150
03	PTFE/Carbon/Graphite	Black	Excellent material for heat and wear resistance. Recommended for dry and poorly lubricated applications, suitable in water and steam service.	-260 +300	0,09	10
04	PTFE/Glass/MoS_2	Grey	Recommended for high pressure hydraulic service, steam and water. Abrasive against soft metal in dynamic applications under high pressure.	-200 +260	0,08	10
05	PTFE/Carbon/Graphite	Black	Similar to code 03 but increased wear resistance. Excellent in steam and water under severe conditions. Very good extrusion resistance at high temperature. Excellent material for back up rings.	-250 +320	0,10	6
06	Premium PTFE	Black	Excellent material for extreme dynamic conditions. Combinations such as high temperature, pressure, speed and dry run. Excellent in water and water based solutions. Abrasive against soft metals.	-250 +300	0,09	1
07	PTFE/Bronze	Brown	Good abrasive resistance. Excellent in hydraulic applications. Not recommended for rotary applications.	-150 +290	0,08	5
08	PTFE/Polyester	Tan	Special compound for high temperature applications. Recommended for low to medium speed applications running against soft metals.	-240 +300	0,13	4
09	Econol filled PTFE	Brown	Special compound with superior heat and wear resistance characteristics. Non abrasive. Recommended for low to high speed running against soft metals. Not good in water.	-250 +340	0,15	3

GAR-SPRING Materials (continued)

Jacket Materials

Code	Description	Col	Application	Temp °C	Friction Coeff.	Wear factor
10	UHMW-PE	White	Excellent wear material but limited heat and chemical resistance. Excellent for cryogenic temperatures. FDA approved.	-250 +80	0,11	4
11	PTFE/Glass/MoS_2	Grey	Similar to code 04 but softer for improved sealing at lower pressure. Can be abrasive running against soft metals.	-250 +300	0,09	1
12	PTFE/Graphite	Black	General purpose material with good heat and wear characteristics. Good in water, non lubricating fluids and compatible with all hydraulic fluids and most chemicals.	-250 +300	0,09	20
13	PEEK	Tan	A high modulus material with excellent high temperature resistance. Excellent for back-up rings only.	-70 +250	N/A	N/A
15	Filled PTFE	White	A food/drug compatible blend. Application tests should be carried out for prolonged use in water. FDA approved.	-250 +300	0,11	3
17	15% Glass Filled PTFE	White	Typically used for backup rings. Abrasive in dynamic applications running against soft metals.	-200 +270	0,10	3
21	Moly Filled PTFE	Dark Grey	Typically used in dynamic vacuum applications and in rotary duty in electronics industry.	-200 +250	0,09	10
22	Modified PTFE	White	Excellent for static applications, particularly good in cryogenic duty using thin gases, FDA approved.	-260 +230	0,09	10
23	Carbon/Peek Filled PTFE	Dark Tan	Useful high pressure/ high temperature material.	-120 +300	0,10	5

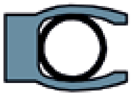
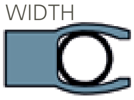
Spring Materials

Code No	Description	Name
01	AISI 301 1.4301	Standard for U Springs, commonly used in food & pharma applications
02	Elgiloy	Commonly used in oil and gas applications
03	Phynox	Standard for Helicoil Springs
04	17/7 ph	Special spring material

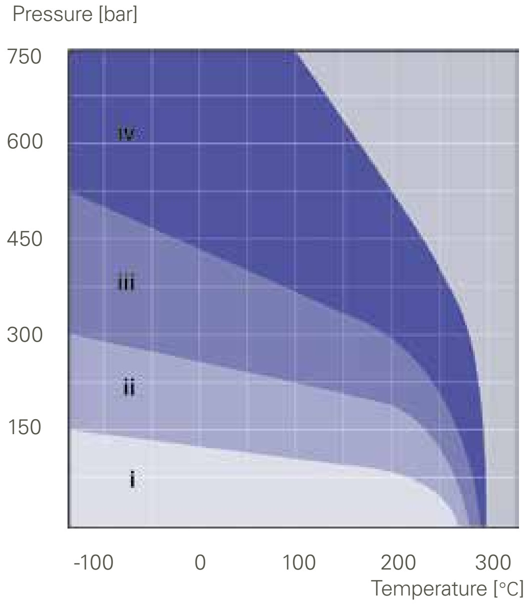
Elgiloy is a registered TM of the Elgiloy Co.

Technical Specifications

Height of extrusion gap depending on pressure and temperature

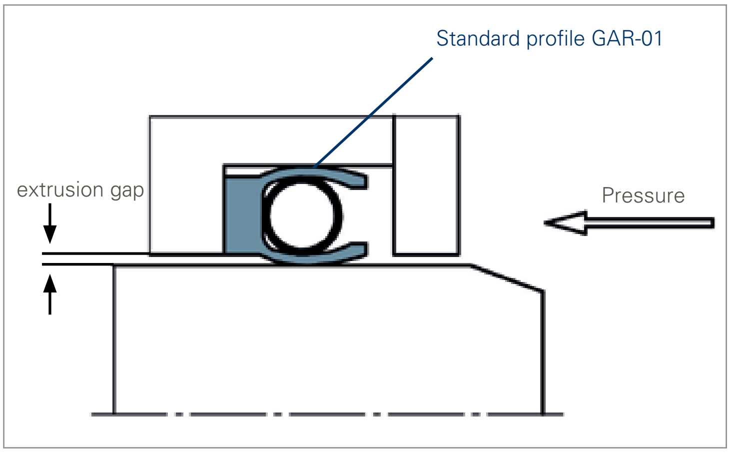
	Material	i	ii	iii	iv
L WIDTH 	Unfilled Filled PTFE	0,10 0,15	0,07 1,10	0,05 0,07	-
L1 WIDTH 	Unfilled Filled PTFE	0,15 0,20	0,10 0,15	0,07 0,10	0,07
L2 WIDTH 	Filled Back-up Peek Back-up	0,20 0,20	0,15 0,15	0,10 0,10	0,07 0,07

All statements in mm



Maximum recommended diametrical extrusion gaps

When sealing high pressure and/or temperature the clearance between the hardware, the so called “extrusion gap” (see table above and illustration on the right), becomes very important. At high pressure and/or temperature the jacket material can extrude into the gap causing premature sealing failure. The extrusion gap should be held to the minimum practical or should not exceed above values. Back-up rings are manufactured of a harder material than the seal material.



Surfaces Finish and Hardness

Dynamic

The quality of the surface finish influences the relative wear of the cover material. The transfer of a thin film of PTFE from the seal cover to the mating dynamic surface will improve seal life. Relatively rough finishes wear the cover material too rapidly, too smooth surfaces result in insufficient material transfer to form a thin film.

As a general rule, the higher the sealing surface hardness the better the seal performance. Higher hardness reduces wear and increases seal life. A 40 HRC or higher is recommended for slow to moderate movements. The ideal hardness is between 60 and 70 HRC.

Static

The surfaces for static face seals must be concentric.

Media being sealed	Surface finish [μm]	
	Dynamic	Static
cryogenics helium gas hydrogen gas freon	0,05 to 0,2 Ra	0,1 to 0,3 Ra
air nitrogen gas argon gas natural gas fuel	0,15 to 0,3 Ra	0,3 to 0,8 Ra
water hydraulic oil crude oil sealants	0,2 to 0,4 Ra	0,4 to 1,6 Ra

Assembly Notes

Seal diameter details

Helicoil Spring, GAR-01 to GAR-08 C/S (Cross section)	Minimum Rod	Minimum Bore
1	2	5
2	4	9
3	7	13
4	15	25
5	60	72
6	85	105

Axial seal (all Springs), GAR-09, -10, -19 and -20 C/S (Cross section)	Minimum I.D.	Minimum O.D.
1	6	10
2	12	15
3	20	26
4	45	50
5	85	95
6	100	110

U Spring, GAR-11 to GAR-18 C/S (Cross section)	Minimum Rod	Minimum Bore
1	5	8
2	10	15
3	12	18
4	16	26
5	65	77
6	100	120

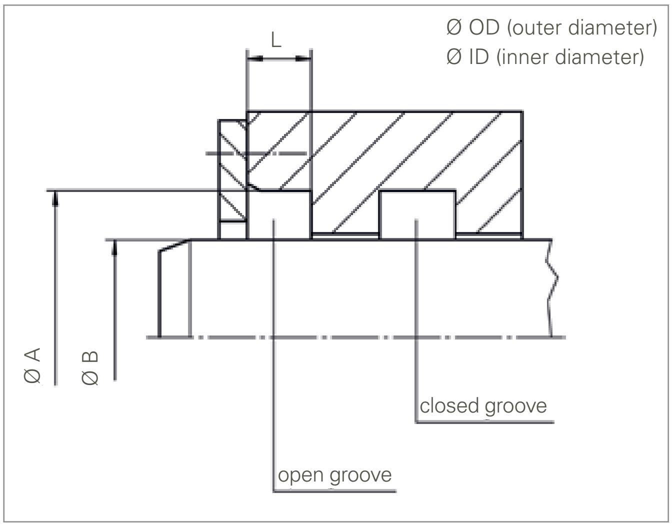
U Finger Spring, GAR-21 and -22 C/S (Cross section)	Minimum I.D.	Minimum O.D.
3	20	26
4	40	45
5	85	95
6	100	120
7	120	150

All statements in mm

Special attention should be given to the assembly of PTFE seals. The diagram below shows possible installation designs for GAR-SPRING in open and closed grooves. Due to easier and safer installation open grooves should be used wherever possible.

It is not recommended to fit U Spring models GAR-11 to GAR-16 into closed grooves as the spring can be damaged. In special circumstances, Helicoil Spring models GAR-01 to GAR-06 can be fitted into closed grooves and Garlock will be happy to advise on suitability and offer advice about fitting tools.

Light, clean oil or grease may be used to assist assembly. Grease with fillers should not be used, and compatibility with sealed media should be considered.



Application Data Sheet

Service

Of course you can contact Garlock for an application-specific seal construction any time. To get this service as fast as possible, please order our application data sheet, which also can be found on our website www.garlock.com.

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Application Data Sheet: GAR-SPRING

Contact Information

Company:

Name:

Phone:

Email:

Country:

Demand:

Annual Demand:

Other manufactures Information

Company:

Idem code.:

Seal model:

Lip material:

Housing material:

Garlock ID:

Application Data

Type of motion: linear ☐ rotary ☐ static ☐

Shaft diameter d [mm]:

Housing diameter D [mm]:

Depth w [mm]:

Shaft speed [m/s]:

Shaft deflection [mm]:

Shaft misalignment [mm]:

Dry running: Yes ☐ No ☐

FDA: Yes ☐ No ☐

Medium, Side A:

Medium, Side B:

Absolute pressure, [bar(a)], Side A:
1 bar(a) ≙ ambient pressure

Absolute pressure, [bar(a)], Side B:
1 bar(a) ≙ ambient pressure

Temperature [°C], Side A:

Temperature [°C], Side B:

Surface roughness

Ra

Rz

Rmax

Surface hardness

(HRC)

Remarks:

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Note:
Properties/applications shown throughout this brochure are typical. Your specific application should not be undertaken without independent study and evaluation for suitability. For specific application recommendations consult Garlock. Failure to select the proper sealing products could result in property damage and/or serious personal injury. Performance data published in this brochure has been developed from field testing, customer field reports and/or in-house testing. While the utmost care has been used in compiling this brochure, we assume no responsibility for errors. Specifications subject to change without notice. This edition cancels all previous issues. Subject to change without notice GARLOCK is a registered trademark for packings, seals, gaskets, and other products of Garlock.

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