

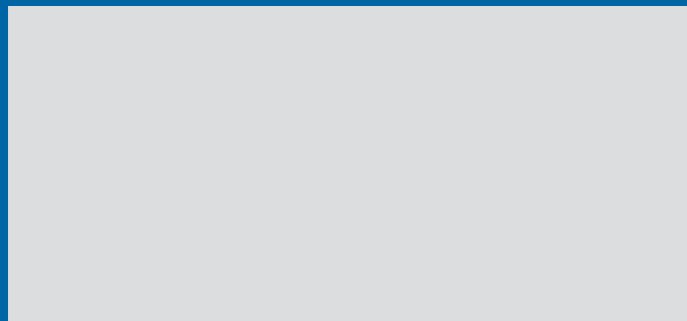
Non-Contact Seals

GMN Paul Müller Industrie GmbH & Co. KG
Äußere Bayreuther Str. 230 · D-90411 Nuremberg
Phone: +49 911-5691-0 · Fax: +49 911-5691-221
www.gmn.de

Non-Contact Seals:

Phone: +49 (0) 911-56 91-616 · Fax: +49 911-5691-569
Mail: vertrieb.at@gmn.de

Official GMN Representative:



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GMN Non-Contact Seals

The machine tool industry and its end users are continuously demanding the most in quality in every aspect of their machine. Highly specialized components are resulting in shorter process time, higher rotating speed, flexible material characteristics and a huge range of operating conditions. Simultaneously, new energy-saving solutions and maintenance-free characteristics are increasing economic efficiency of modern machine systems.

Based on decades of experience, GMN has specialized in producing extremely high quality machine tool components. Through this strategy, GMN manufactures a wide range of standard non-contact seals and customized solutions.

The frictionless, no-wear characteristics of GMN Non-Contact Seals offer effective, economical and ecological solutions for modern applications in and outside of the machine tool industry.

Seals Classification

Non-Contact Seals vs. Contact Seals

Classification

Varying industrial processes and demands require specialized sealing systems which could be classified into several product groups.

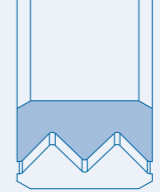
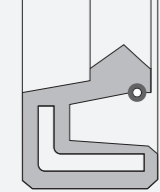
GMN Non-Contact Seals

GMN provides efficient, economical, quality sealing components made of metal or plastic for concentric rotating parts.

The design of GMN Non-Contact Seals offers – compared to conventional contact seals – operation without any friction, an essential advantage for many seal applications.

| Seals (Classification) | | | | | |
|-----------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Dynamic seals | | | | Static seals | |
| Linear movement | | Rotary movement | | | |
| Rod, piston, linear guided seals | | Shaft seals | | | |
| Non-Contact | Contact | Non-Contact | Contact | Non-Contact | Contact |
| Gap Special solutions Sealing air | Grooved ring Wiper ring Edge sealing ring Compact seal | GMN Labyrinth Seal - Metal - Plastic Special solutions | Felt ring Compression gland Slide ring seal Radial shaft seal | Ventilation | O-Ring Sealing mass Bellow-type seal Profile seal Flat seal Membrane seal High pressure seal Cutting ring seal |

Comparisons of Non-Contact Seals vs. Contact Seals

| Characteristic |  | |  | |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
| | GMN Non-Contact Seals | Contact Seals | | |
| Seal wear | Absolutely no wear of any component Minimal maintenance | Rubbing wear due to relative movement (rotation) at the sealing lip | | |
| Power loss | No power loss Increases the possibility for smaller drives | Power loss due to friction | | |
| Speed limit | At high speed rotation only, the inner-ring can lift-off from the shaft due to its weight combating centrifugal forces | Limited applications for high speed rotation due to the increased wear | | |
| Contamination / abrasion | Absolute no contamination A key factor for food, electro-technical and electronic industries | Micro-wear due to friction Wear may turn into contaminant | | |
| Lifetime | Unlimited lifetime | Lifetime/function is limited due to wear | | |
| Lubrication of the seal | Not necessary | Often recommended | | |
| Mating components - Hardening and grinding | No hardening or grinding of the mating parts Simple turning quality (IT6) is sufficient | Shaft must be hardened and ground in most applications | | |
| Increase of temperature | No increase of temperature | Increase of temperature due to friction | | |
| Temperature range | High operating range Due to the steel and aluminium construction; 392° F [200° C] Plastic (POM) is rated to 140° F [60° C] | Narrow operating range Because of materials such as various rubbers and elastomers. | | |

Non-Contact Seals Basics

Function

In correlation with the application's design, non-contact seals also:

- Protect/shield inner workings of the application
- Throttling/switching
- Back transport of application medium(s)
- Optional draining within the seal design

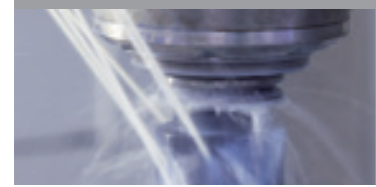



The seal itself as well as the specific design encompassing the seal satisfies only parts of the sealing requirement.

The maximum efficiency of a GMN labyrinth seal is achieved with an optimised interaction of the seal-component and the surrounding construction/design.

Sealing function at machine standstill

The functions of protecting, shielding, throttling and switching are effective even when the shaft stands still. The seal functions of back transport and draining require the shaft to be rotating.

Functions of the seal and the surrounding construction in an application

| | | |
|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Components encompassing the seal</p>  | <p>Protecting/ Shielding</p> | <p>The sealing gap is protected against direct contamination with a customized housing/shaft design. Specifically, the design in front of the seal's entrance area is important to the seal's efficiency. The architecture of the GMN series CF shows excellent repelling and shielding characteristics.</p> |
| <p>GMN seal component</p>  | <p>Throttling/ Switching</p> | <p>The tight sealing gap throttles (reduces) the flow and minimizes possible penetration by any contamination. The labyrinth geometry creates an efficient barrier against liquids and dust.</p> |
| <p>GMN seal component</p>  | <p>Back transport of application medium(s)</p> | <p>If heavy splashing liquids are penetrating the gap, drain grooves in the outer ring and a ring groove inside the housing can provide back transport when the shaft is rotating. This is commonly used for heavy coolant or oil splashing where saving the medium is key to the application (Type SA and M).</p> |
| <p>Surrounding components to the seal</p>  | <p>Draining</p> | <p>Grooves in the housing will effectively drain the medium. GMN engineers are available to help with waste gate design. Particularly, the GMN CF-labyrinth seals ensure absorbing and draining characteristics in case of heavy splashing liquids.</p> |



Gap height

The theory of non-contact seals is based on the gap height between inner and outer rings. The tighter the gap height, the smaller the area (annular gap) where liquid could penetrate the seal. Depending on amount, direction and speed (intensity) of the contamination, an additional protection against direct splashing liquids is recommended.

As an additional supporting effect inherent in a non-contact seal, tight gaps create an air cushion inside the gap. This air cushion increases in correlation to rotational speed. With the constant gap height of only 0.2 to 0.5 mm. The complete product line of GMN Labyrinth Metal Seals achieves the highest efficiency.

Labyrinth

The labyrinth geometry acts as a barrier against any liquids or dust. Particles entering the Labyrinth seal bump against the labyrinth, therefore any media is slowed. The shifts in direction inside the labyrinth make passing the seal almost impossible.



Metal seals provide 2 to 4 labyrinth steps (depending on size) in a mini-sized space. GMN's proprietary manufacturing process guarantees 100% conformity of inner- and outer ring's labyrinth geometry to each other.

The M-type are enable to drain the penetrated liquids through the grooves at the outerring out of the annular groove at the mating parts.



In the S10 version, the GMN CF seals are made of hardened and ground steel in high precision and are particularly used for sealing of spindle bearings.

The aluminum version A0 also has the highly effective CF profile and is specially designed for standard bearings.

The CF seal profile is a combination of radial and axial gaps.

Radial gaps create a reverse flow effect due to centrifugal force when the shaft rotates.

Axial gaps impede the flow of using capillary forces.

A catching groove at the end of the profile ensures a high level of leak-tightness even when the shaft is at a standstill.



Plastic seals are providing 3 to 4 labyrinths steps depending on size. With this type, the conical gap design increases sealing efficiency due to centrifugal forces of rotation.

Penetrated media is transported back to the larger gap diameter when the shaft is rotating. The larger gap diameter always faces the contamination.

In case of heavy splashing liquids, type M and SA with drain grooves are preferred.

GMN Non-Contact Seals Benefits and applications

Benefits

The specific design of GMN Labyrinth Seals allows operation without any friction. Many different applications are taking advantage of this major benefit:

Technical benefits

- No wear
- Rated for high rotating speeds
- Sealing efficiency is independent from direction of rotation
- No abrasion, no contamination

Thermal benefits

- No frictional heat increase
- No thermal effects to the surrounding application

Functional benefits

- Maintenance free
- Constant sealing efficiency during operation
- No adjustment required
- No lubrication required (approved for dry operation)

Economic benefits

- No hardening or grinding of mating parts
- Unlimited lifetime – no replacement due to the Non-Contact design
- Cost saving component instead of expensive self made labyrinth
- Less maintenance results in higher machine yield
- No frictional loss results in reduced demand to engine output

Ecological benefits

- Operation without friction saves energy

Applications

- High-speed
(no-wear operation)
- Sealing against dust
(Pre-greased GMN Labyrinth Seal made of plastic)
- High cleanliness
(Freedom from any wear)
- Positioning without resistance
(No opposing forces during operation)
- Protection for lip seals
(Guarding against wear from chips and abrasive particles)

Practical examples



Textile / paper industry

Sealing against dust

The sealing of fine textile fibres is a challenge for any sealing system. Fibres and micro-fibres have the tendency to cling to the sealing gap of a lip seal. As a result, friction and wear are increasing with use. With time, the fibres are making their way to the bearings. In applications like this, pre-greased GMN Labyrinth Seals made of plastic are providing an established, proven alternative.

Examples in the textile industry are; carding engines, spinning machines, coiling machines, mechanical looms, knitting machines, cutting machines, etc..

Similar applications can be found in the paper industry. Pre-greased GMN Labyrinth Seals made of plastic are providing high efficiency sealing alternatives against fine paper dust.



Machine tool industry, spindle heads

High-speed applications

The maximum speed of contact seals is limited because of temperature, wear and resultant life expectancy.

GMN Non-Contact Seals protect spindle bearings against cooling fluid and metal/wood chips. They are operating free from wear and any frictional contact. Unlimited life, no temperature increase from operation, freedom from maintenance and no loss of power provide a perfect economic solution.



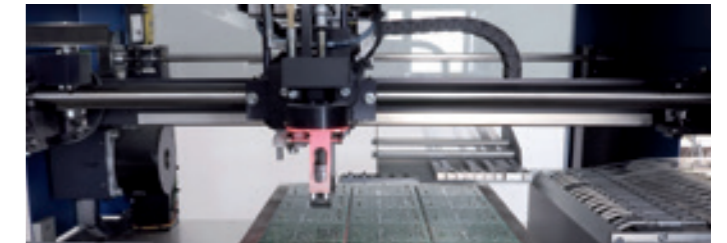
Food / chemical / electronic industries

High cleanliness

Cleanliness and freedom from wear is essential in the food industry. Every contact seal is operating with some kind of relative movement between two different components being in contact continuously. With this friction, small amounts of wear (i.e. rubber material) have to be accepted, it could never be fully excluded. In the worst case, this wear could contaminate food.

A Non-Contact Seal is absolutely free from any friction contact and free from any wear. There is no risk for any kind of contamination.

An additional advantage of our GMN Labyrinth Plastic Seals is the resistance against many acids (i.e. lactic acid), chemicals (cleaning processes) and fungi; the material (POM) is already FDA-approved.

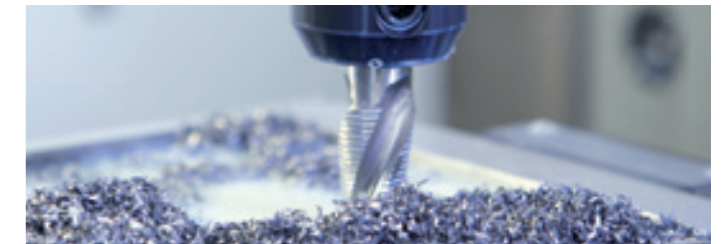


Highly accurate positioning

Positioning without resistance

Sophisticated optical or magnetic systems have to be reliably protected against any external contamination.

Encoders are exposed to high dynamic accelerations at an already high speed. With GMN Non-Contact Seals encoders could be positioned without resistance to the highest accuracy. This is a requirement of many high-tech performance applications.



Sealing against chips and abrasive contaminations

Protection for a lip seal

Lip Seal life is extremely limited with contact of chips and abrasive particles. This contact greatly accelerates the wear of the rubber material.

An optimal solution is the combination of both seal systems: In a first step the GMN Non-Contact Seal keeps chips and abrasive particles away from the lip seal. In this scenario the contact seal is protected and the lifetime of the complete sealing system increases greatly.

The additional investment for the GMN Non-Contact Seal is minimal compared to the lost time to repair and/or replace worn seals.

Characteristics of sealing systems

The performance of any seal in various machines is extremely important to the life and efficiency of the complete system.

Because of this, GMN prefers to help customers early in the design phase to ensure that everything will perform as planned and the correct design choices are made.

Different applications require specialized and individual solutions; there is a large variety of products on the market.

The table below includes some general information to help find the best seal for your application.

In many cases the combination of different sealing systems provides the perfect solution. An additional GMN Non-Contact Seal could protect a standard contact seal against chips to increase the lifetime of the complete sealing system.

| | GMN Metall | GMN CF | GMN Plastic | Shield | Radial shaft seal | Sliding shield | Felt ring | Packed gland | Face seal |
|---------------------------------------------|------------|--------|-------------|--------|-------------------|----------------|-----------|--------------|-----------|
| Suitable for high rotational speed | ++ | ++ | ++ | ++ | + - | + | -- | - | ++ |
| Suitable against splashing liquids | ++ | ++ | ++ | - | ++ | ++ | ++ | + - | + - |
| Suitable against dust | + | + | ++ | - | - | + | + | + - | + - |
| Suitable against water | + - | ++ | ++ | + - | + | + - | ++ | ++ | ++ |
| Suitable against chemicals | -- | ++ | ++ | - | + - | + - | + - | + | ++ |
| Suitable for food industry | --- | ++ | ++ | - | + - | + - | - | + - | + |
| Suitable against liquid levels | --- | --- | --- | -- | + | + - | + - | + | ++ |
| Suitable against pressure differentials | --- | --- | --- | -- | + - | - | - | + | ++ |
| Suitable in high temperature applications | ++ | ++ | -- | + - | + | + | - | + | ++ |
| Power efficiency | ++ | ++ | ++ | ++ | + - | + | - | -- | -- |
| Life time | ++ | ++ | ++ | ++ | + - | ++ | - | -- | + - |
| Thermal effects to surrounding construction | keine | keine | keine | no | low | low | middle | high | high |
| Requirements to the mating parts | gering | gering | gering | middle | middle | low | middle | high | high |
| Maintenance | keine | keine | keine | no | middle | low | low | high | middle |

Limits of use

GMN Non-Contact Seals are providing solutions for a wide field of applications. However, in certain cases the use of GMN seals is also limited.

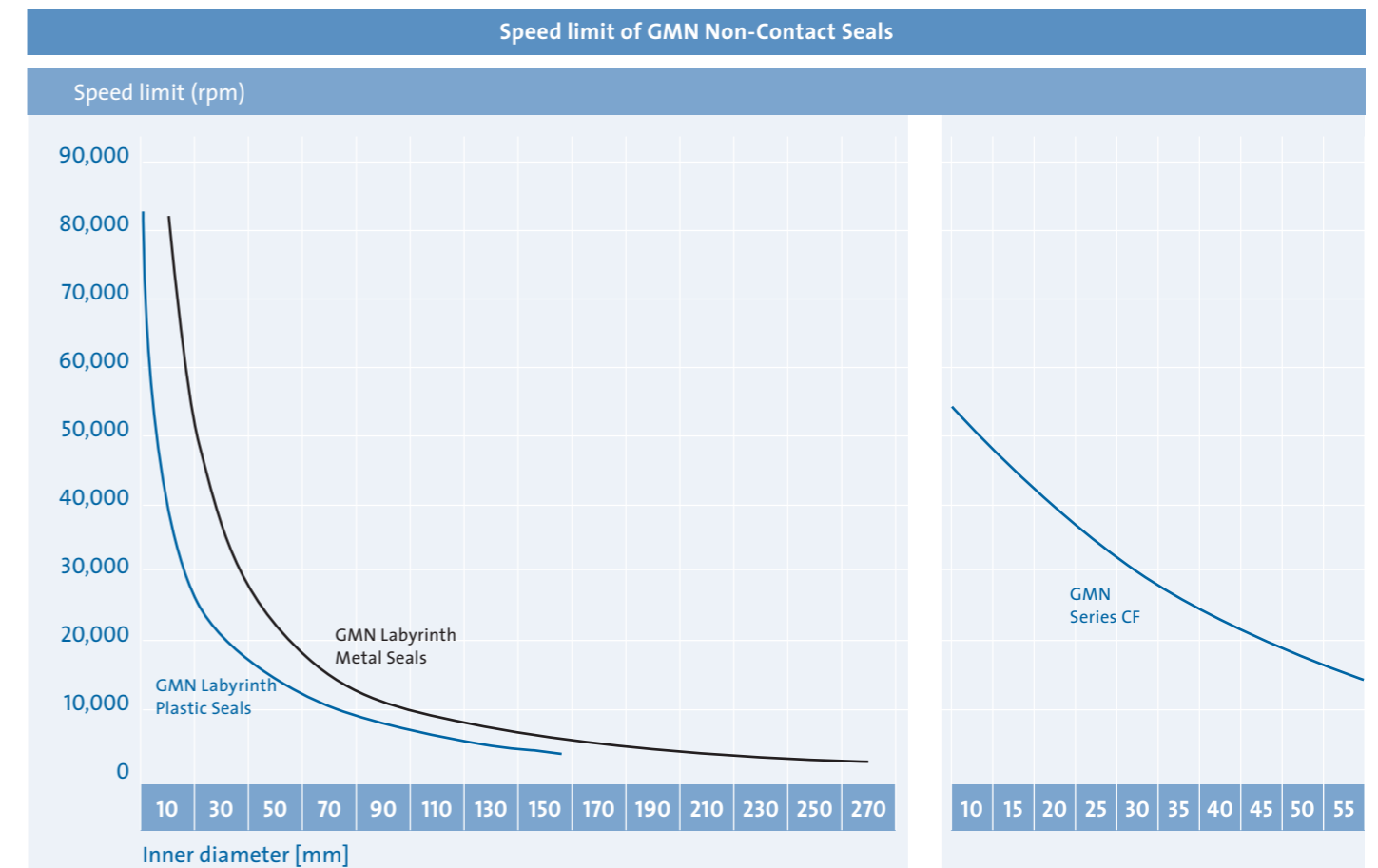
Liquid levels and pressure differentials

The design of a GMN Non-Contact Seal requires a gap between the outer and the inner ring. With this gap liquid levels and any difference of pressure could be reduced, but not sealed.

Speed limit

With increasing rotational speed the press-fit inner ring on the shaft has the tendency to lift-off due to centrifugal forces (lift-off speed). Most applications are far below this speed limit.

In certain cases the speed limit could be increased with increased press fit. We recommend contacting a GMN engineer when you feel that this may happen in your application.

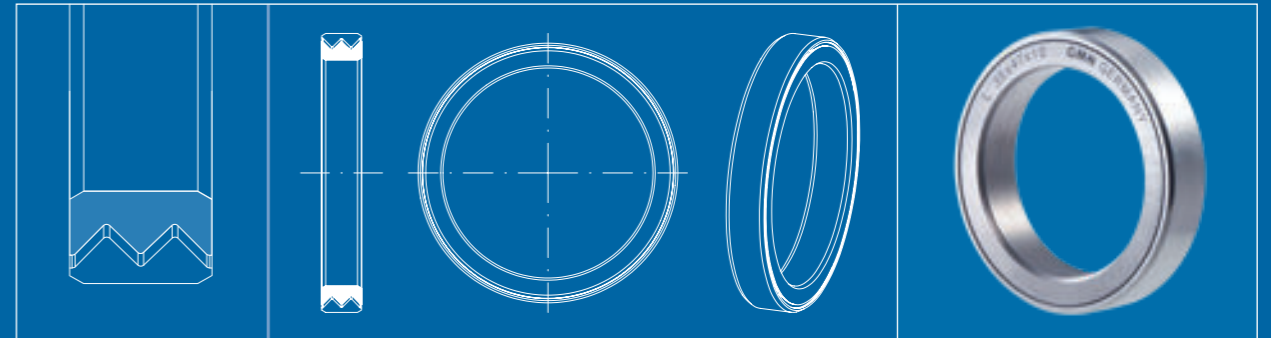


The maximum circumferential speed is (depending on the size) $v = 35-60$ m/s for GMN Labyrinth Plastic Seals and $v = 45-70$ m/s for GMN Labyrinth Metal Seals.

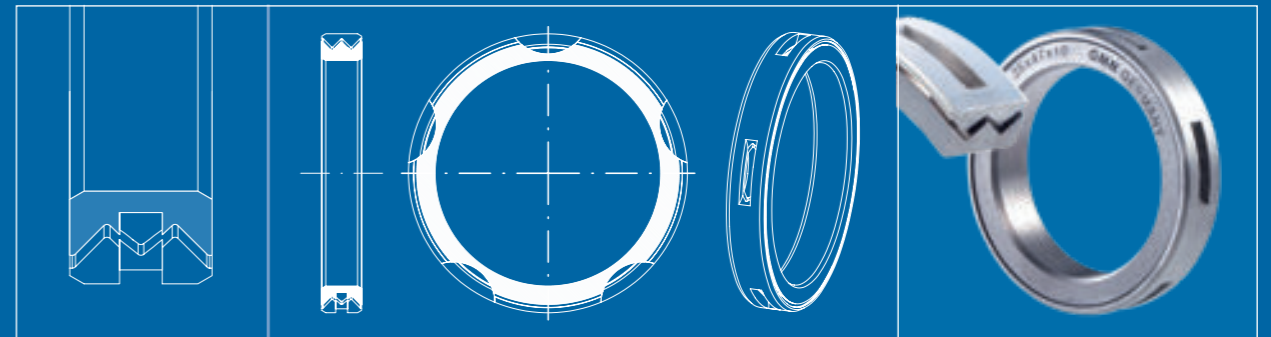
Speed limit of CF series A0 (The series CF 60/619...S10 shows no speed limit in the axial interference fit)



GMN Labyrinth Metal Seals Type L and M



Type L
Against splashing liquids for
rotating shafts and housings



Type M with drain grooves
Against heavy splashing liquids (optimized
back transport) for rotating shafts only

Mounting tolerances (mating parts)

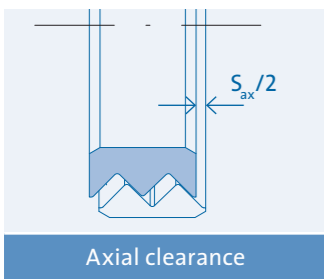
Technical data

Material

Outer ring: Aluminium (GD AISi 12)
 Inner ring: Non-alloy steel
 Range of temperature: -40°–390°F (-40°–200°C)

Design

Shaft diameter: 15–210mm
 Width: 10, 14, 15, 20, 22 mm (depending on size)
 Gap height: Constantly 0.2–0.5mm (depending on size)
 Sealing gap: Horizontal
 Axial clearance: S_{ax} (see table of dimensions) = total axial movement of the seal's inner and outer ring in relation to each other; from one end position to the other.
 Increased axial clearance: On request all types are also available with increased axial clearance: $S_{ax} = 1.5 \times S_{ax}$ (order example: L d x D x B with increased axial clearance)
 Radial clearance: $S_{rad} = S_{ax} / \tan(42.5^\circ)$
 Type M: Heavy and direct splashing liquids could be drained through a certain number of grooves in the outer ring into a circular groove inside the housing;



Axial clearance



Type M

The interlocked labyrinth design keeps inner- and outer ring together as an inseparable unit.

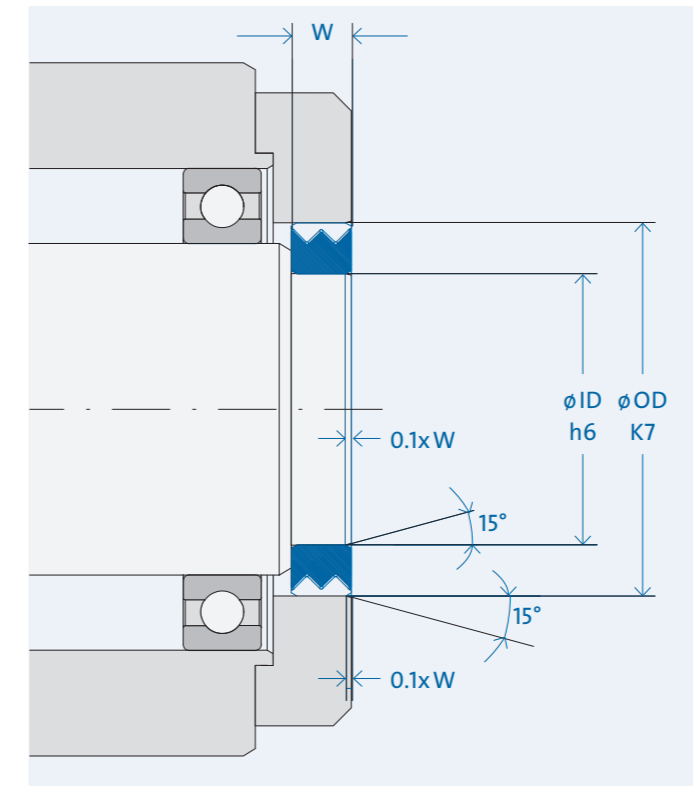
Characteristics

Material

- Robust: Metallic materials of GMN seal components guarantee highest resistance against coarse and fine contamination.
- Well suited for high temperature applications: Metallic materials are suitable for temperatures up to 200°C (392°F).

Design

- No friction: GMN-Seals guarantee operation without any frictional contact.
- No wear: GMN-Seals operate without any kind of wear, unlimited life possibilities.
- No abrasion: The Non-Contact design of GMN-L-Seals guarantees operation without any metallic abrasion. The L-Seal is suitable for the highest demands of cleanliness.
- Effective: The small distance between outer and inner ring of approx. 0.2-0.5 mm offers high sealing efficiency and effective protection against contamination.
- No increased temperatures: No friction means no thermal effects to the surrounding parts and/or the lubricant.
- Power saving performance: The specific design of the GMN Labyrinth Seal allows operating conditions without any power loss. The result is the highest efficiency and power saving performance in high speed applications.
- Compact design: GMN Labyrinth Seals are offering 2 to 4 labyrinth steps within a tight space.
- Efficiency: The small gap height creates an air cushion inside the gap at high rotating speeds which helps increase efficiency.
- Back transporting: Drain grooves on the outer ring are draining liquids with great effectiveness (Type M).



Tolerances

Surrounding constructions (mating component)

Fits
 Housing: K7
 Shaft: h6
 Surface: Rz ≤ 16µm; Ra ≤ 3.2µm

Assembly

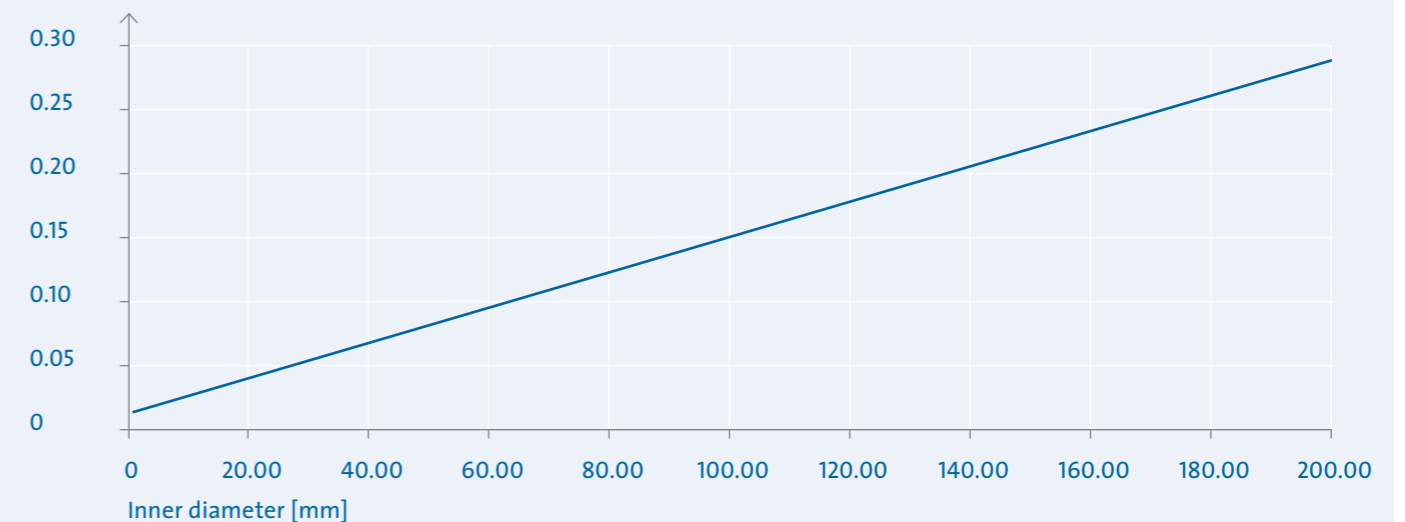
“l” Length (chamfer of housing and shaft) depending on the width “W”: l = 0.1 x W

Aluminium outer ring

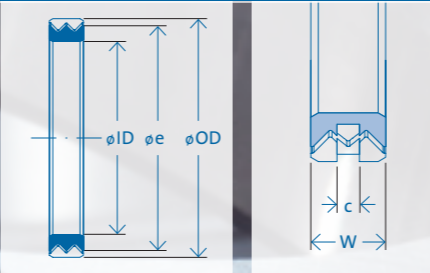
The softer aluminium outer ring may be deformed during transport and arrive out of roundness. When the seal is then pressed into the housing, the outer ring easily re-forms to the circular housing.
 The outer ring could also be wider by max. 0.1mm than the inner ring.
 GMN Metal Seals are pressed through a round steel ring to calibrate the outer ring. After this process the outer ring widens again a little bit due to its elasticity.

Outer ring after calibrating

Plus-tolerance OR (mm)



Labyrinth Metal Seals



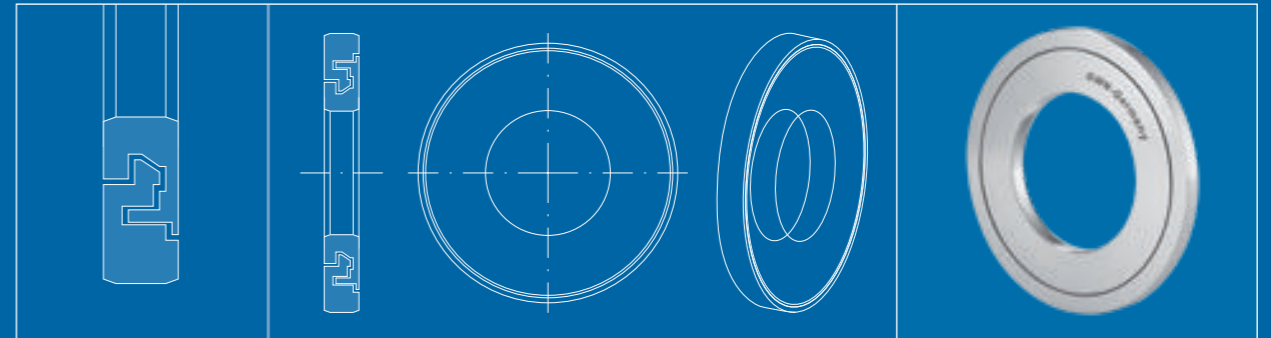
| ID | OD | W | c | e | S _{ax} | max. speed | Weight | Type L | | | Type M (with groove) | | |
|----|----|----|-----|------|-----------------|------------|--------|--------|----------|----------------|----------------------|----------|----------------|
| | | | | | | | | Type | Part no. | Part name | Type | Part no. | Part name |
| 15 | 26 | 8 | 2.5 | 24 | 0.35 | 63,500 | 0.020 | L | 301171 | L 15 x 26 x 8 | M | 301337 | M 15 x 26 x 8 |
| 18 | 28 | 10 | 3 | 26 | 0.38 | 56,800 | 0.020 | L | 301176 | L 18 x 28 x 10 | M | 301341 | M 18 x 28 x 10 |
| 20 | 28 | 10 | 3 | 26 | 0.38 | 81,000 | 0.010 | L | 301178 | L 20 x 28 x 10 | M | 301343 | M 20 x 28 x 10 |
| | 30 | 10 | 3 | 28 | 0.38 | 70,700 | 0.010 | L | 301180 | L 20 x 30 x 10 | M | 301345 | M 20 x 30 x 10 |
| 22 | 30 | 10 | 3 | 28 | 0.38 | 71,400 | 0.010 | L | 301182 | L 22 x 30 x 10 | M | 301347 | M 22 x 30 x 10 |
| 25 | 37 | 10 | 3 | 34 | 0.38 | 50,600 | 0.030 | L | 301185 | L 25 x 37 x 10 | M | 301349 | M 25 x 37 x 10 |
| 28 | 39 | 10 | 3 | 36 | 0.38 | 45,700 | 0.030 | L | 301187 | L 28 x 39 x 10 | M | 301351 | M 28 x 39 x 10 |
| 30 | 42 | 10 | 3 | 39 | 0.38 | 48,900 | 0.030 | L | 301189 | L 30 x 42 x 10 | M | 301353 | M 30 x 42 x 10 |
| 32 | 45 | 10 | 3 | 42 | 0.40 | 43,300 | 0.040 | L | 301192 | L 32 x 45 x 10 | M | 301355 | M 32 x 45 x 10 |
| 35 | 47 | 10 | 3 | 44 | 0.40 | 39,800 | 0.040 | L | 301194 | L 35 x 47 x 10 | M | 301357 | M 35 x 47 x 10 |
| 40 | 52 | 10 | 3 | 49 | 0.40 | 33,300 | 0.040 | L | 301199 | L 40 x 52 x 10 | M | 301360 | M 40 x 52 x 10 |
| 42 | 55 | 10 | 3 | 52 | 0.40 | 30,100 | 0.050 | L | 301204 | L 42 x 55 x 10 | M | 301364 | M 42 x 55 x 10 |
| 45 | 55 | 10 | 3 | 52 | 0.40 | 30,700 | 0.030 | L | 301206 | L 45 x 55 x 10 | M | 301366 | M 45 x 55 x 10 |
| | 62 | 10 | 3 | 59 | 0.40 | 24,800 | 0.080 | L | 301210 | L 45 x 62 x 10 | M | 301369 | M 45 x 62 x 10 |
| 48 | 62 | 10 | 3 | 59 | 0.40 | 24,500 | 0.060 | L | 301215 | L 48 x 62 x 10 | M | 301371 | M 48 x 62 x 10 |
| 50 | 62 | 10 | 3 | 59 | 0.40 | 28,300 | 0.050 | L | 301217 | L 50 x 62 x 10 | M | 301373 | M 50 x 62 x 10 |
| 52 | 68 | 10 | 3 | 65 | 0.40 | 24,200 | 0.090 | L | 301220 | L 52 x 68 x 10 | M | 301376 | M 52 x 68 x 10 |
| 55 | 68 | 10 | 3 | 65 | 0.40 | 24,100 | 0.070 | L | 301222 | L 55 x 68 x 10 | M | 301378 | M 55 x 68 x 10 |
| 58 | 72 | 10 | 3 | 68.5 | 0.40 | 22,100 | 0.070 | L | 301226 | L 58 x 72 x 10 | M | 301384 | M 58 x 72 x 10 |
| 60 | 72 | 10 | 3 | 68.5 | 0.40 | 22,300 | 0.060 | L | 301228 | L 60 x 72 x 10 | M | 301387 | M 60 x 72 x 10 |
| | 80 | 10 | 3 | 76 | 0.40 | 18,900 | 0.130 | L | 301230 | L 60 x 80 x 10 | M | 301389 | M 60 x 80 x 10 |
| 63 | 80 | 10 | 3 | 76 | 0.40 | 18,700 | 0.100 | L | 301234 | L 63 x 80 x 10 | M | 301392 | M 63 x 80 x 10 |

| ID | OD | W | c | e | S _{ax} | max. speed | Weight | Type L | | | Type M (with groove) | | |
|-----|-----|----|---|-------|-----------------|------------|--------|--------|----------|------------------|----------------------|----------|------------------|
| | | | | | | | | Type | Part no. | Part name | Type | Part no. | Part name |
| 65 | 80 | 10 | 3 | 76 | 0.40 | 18,600 | 0.090 | L | 301237 | L 65 x 80 x 10 | M | 301394 | M 65 x 80 x 10 |
| | 85 | 10 | 3 | 81 | 0.42 | 17,000 | 0.140 | L | 301240 | L 65 x 85 x 10 | M | 301396 | M 65 x 85 x 10 |
| 68 | 85 | 10 | 3 | 81 | 0.42 | 16,800 | 0.110 | L | 301243 | L 68 x 85 x 10 | M | 301400 | M 68 x 85 x 10 |
| 70 | 85 | 10 | 3 | 81 | 0.42 | 16,700 | 0.140 | L | 301247 | L 70 x 85 x 10 | M | 301404 | M 70 x 85 x 10 |
| | 90 | 10 | 3 | 86 | 0.42 | 15,300 | 0.150 | L | 301250 | L 70 x 90 x 10 | M | 301406 | M 70 x 90 x 10 |
| 72 | 90 | 10 | 3 | 86 | 0.42 | 15,200 | 0.130 | L | 301254 | L 72 x 90 x 10 | M | 301409 | M 72 x 90 x 10 |
| 75 | 90 | 10 | 3 | 86 | 0.42 | 15,100 | 0.100 | L | 301257 | L 75 x 90 x 10 | M | 301411 | M 75 x 90 x 10 |
| 80 | 100 | 10 | 3 | 95 | 0.42 | 14,500 | 0.160 | L | 301266 | L 80 x 100 x 10 | M | 301420 | M 80 x 100 x 10 |
| 85 | 100 | 10 | 3 | 95 | 0.42 | 14,500 | 0.110 | L | 301270 | L 85 x 100 x 10 | M | 301426 | M 85 x 100 x 10 |
| 90 | 110 | 10 | 3 | 105 | 0.42 | 12,300 | 0.180 | L | 301272 | L 90 x 110 x 10 | M | 301428 | M 90 x 110 x 10 |
| 100 | 120 | 10 | 3 | 115 | 0.42 | 10,600 | 0.190 | L | 301278 | L 100 x 120 x 10 | M | 301433 | M 100 x 120 x 10 |
| | 120 | 14 | 4 | 115 | 0.70 | 11,100 | 0.250 | L | 301282 | L 100 x 120 x 14 | M | 301437 | M 100 x 120 x 14 |
| 110 | 130 | 15 | 5 | 125 | 0.70 | 11,700 | 0.290 | L | 301285 | L 110 x 130 x 15 | M | 301439 | M 110 x 130 x 15 |
| 120 | 140 | 15 | 5 | 135 | 0.70 | 10,400 | 0.310 | L | 301293 | L 120 x 140 x 15 | M | 301445 | M 120 x 140 x 15 |
| 130 | 150 | 15 | 5 | 145 | 0.70 | 9,200 | 0.330 | L | 301297 | L 130 x 150 x 15 | M | 301449 | M 130 x 150 x 15 |
| 140 | 170 | 15 | 5 | 165 | 0.70 | 7,500 | 0.650 | L | 301301 | L 140 x 170 x 15 | M | 301453 | M 140 x 170 x 15 |
| 150 | 180 | 15 | 5 | 175 | 0.70 | 6,800 | 0.700 | L | 301304 | L 150 x 180 x 15 | M | 301455 | M 150 x 180 x 15 |
| 160 | 190 | 20 | 5 | 184.5 | 0.80 | 6,200 | 0.950 | L | 301306 | L 160 x 190 x 20 | M | 301457 | M 160 x 190 x 20 |
| 170 | 210 | 20 | 5 | 204.5 | 0.80 | 5,400 | 1.500 | L | 301309 | L 170 x 210 x 20 | M | 301460 | M 170 x 210 x 20 |
| 180 | 210 | 20 | 5 | 204.5 | 0.80 | 5,300 | 1.070 | L | 301312 | L 180 x 210 x 20 | M | 301463 | M 180 x 210 x 20 |
| 190 | 230 | 20 | 5 | 224.5 | 0.80 | 4,700 | 1.660 | L | 301316 | L 190 x 230 x 20 | M | 301468 | M 190 x 230 x 20 |
| 200 | 230 | 20 | 5 | 224.5 | 0.80 | 4,600 | 1.180 | L | 301318 | L 200 x 230 x 20 | M | 301470 | M 200 x 230 x 20 |
| 210 | 250 | 22 | 5 | 244.5 | 1.00 | 4,000 | 1.960 | L | 301321 | L 210 x 250 x 22 | M | 301473 | M 210 x 250 x 22 |

ID = Inner diameter [mm] W = Width [mm] c = Groove width [mm] S_{ax} = Axial clearance [mm]
 OD = Outer diameter [mm] e = Gap diameter [mm] Max. speed [rpm] Weight [kg]



GMN Labyrinth Metal Seals Series CF



Series CF 60/619...S10
Steel
Series CF 62...A0
Aluminium

Labyrinth Metal Seals Series CF 60/619...S10

GMN series CF 60/619...S10 for spindle bearings

GMN Labyrinth Seals of type CF 60 and CF 619 are manufactured in the dimensions of the ball bearing series 60 and 619 and are made of nitrided steel, hardened and face-ground. The spindle bearing could be directly preloaded through the inner ring of the seal.

Technical data

Material

Outer- and inner ring: Steel
Hardness: ≥ 45 HRC
Plan parallelism: $\leq 5 \mu\text{m}$
Range of temperature: $-40^\circ - 170^\circ\text{C}$

Design

Shaft diameter: CF 60: 20–100 mm
CF 619: 40–80 mm
Width: 6 mm (0/-20 μm)

Sealing Gap

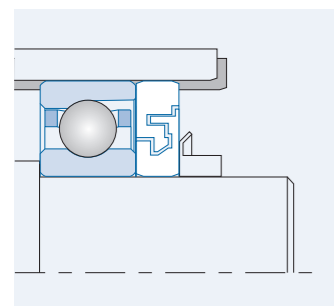
Axial clearance:* $S_{ax} = 1 \text{ mm}$
Radial clearance:* $S_{rad} = 0,5 \text{ mm}$

*total axial respectively radial movement.

Tolerances of the seal

| Bore inner ring d [mm] | | | | | |
|----------------------------------|-----|-----|-----|-----|--|
| above | 18 | 30 | 50 | 80 | |
| to | 30 | 50 | 80 | 120 | |
| max. tolerance [μm] | 20 | 22 | 24 | 26 | |
| min. tolerance [μm] | 0 | 0 | 0 | 0 | |
| Outer diameter outer ring D [mm] | | | | | |
| above | 30 | 50 | 80 | 120 | |
| to | 50 | 80 | 120 | 150 | |
| max. tolerance [μm] | 0 | 0 | 0 | 0 | |
| min. tolerance [μm] | -22 | -24 | -26 | -28 | |

Installation



Series CF...S10 seals are positioned between the spindle bearing and the shaft nut without any axial mobility. For this reason there is no speed limit in this specific adjustment.

CF 60/619...S10 Characteristics

- **Insensitive to temperature**
For operating temperatures up to 170°C .
- **Resilient**
The hardened material is extremely resistant to abrasive particles and chips.
- **No friction**
Non-contact design of inner and outer ring
- **No wear**
Unlimited lifetime
- **No abrasion**
meets the highest purity requirements
- **Unlimited speed**
No axial movement between the spindle bearing and shaft nut
- **No increased temperature**
No thermal strain to the seal and to the surrounded components
- **Power efficient**
Frictionless operation without loss of performance meets the highest ecological and economical requirements
- **Compact design**
Narrow width of 6 mm for all shaft diameters enables space-saving solutions
- **Effectively**
High sealing efficiency against heavy splashing liquids over a wide speed range – even when the shaft stands still
- **Easy to assemble**
Could be mounted directly next to the spindle bearing in an axial interference fit assembly

The seal is designed to be assembled directly in contact to the spindle bearing. Inner- and outer ring must be secured axially. The spindle bearing could be preloaded directly through the seal.

Orientation

The bigger gap diameter (e_2) of the CF-Seal always faces the splashing liquids/contaminations. The groove in the outer ring must be positioned downwards.

Series CF 62...A0

GMN series CF 62...A0 for deep groove ball bearings

Effective sealing of standard deep groove ball bearings with the GMN labyrinth seals of type CF 62 made of aluminum with un-ground plane surfaces in the dimensions of the bearing series 62.

Technical data

Material

Outer- and inner ring: Aluminium
Range of temperature: $-40^\circ - 200^\circ\text{C}$

Design

Shaft diameter: 10–50 mm
Width: 6 mm

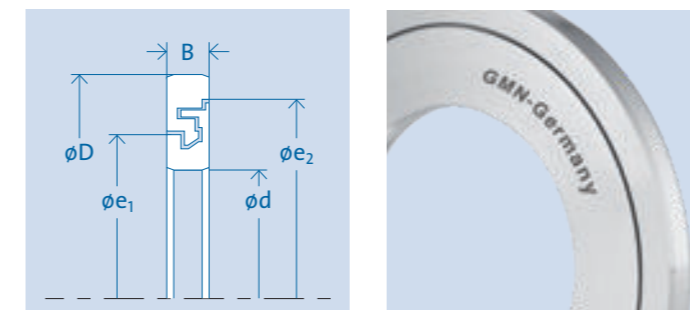
Sealing Gap

Axial clearance:* $S_{ax} = 1 \text{ mm}$
Radial clearance:* $S_{rad} = 0,5 \text{ mm}$

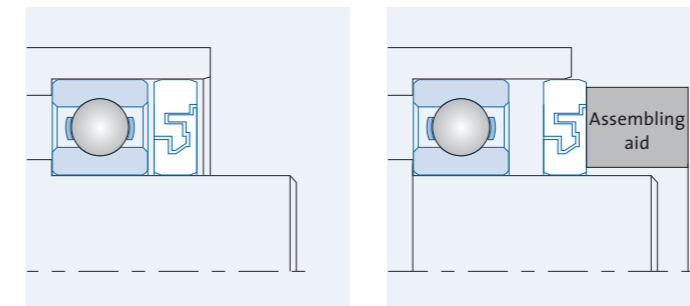
*total axial respectively radial movement.

Tolerances

Seal Width: 6 mm (-50/+50 μm)
Connecting parts: Shaft k5; Housing J6



Installation



CF 62...A0 Characteristics

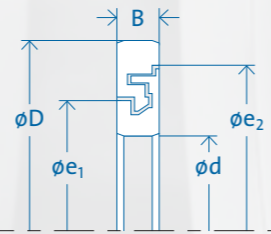
- **Insensitive to temperature**
For operating temperatures up to 200°C .
- **Suitable for high speed**
Low mass of the inner ring at rotating shaft
- **No friction**
Non-contact design of inner and outer ring
- **No wear**
Unlimited lifetime
- **No abrasion**
Meets the highest purity requirements
- **No increased temperature**
No thermal strain to the seal and to the surrounded components
- **Power efficient**
Frictionless operation without loss of performance meets the highest ecological and economical requirements
- **Compact design**
Narrow width of 6 mm for all shaft diameters enables space-saving solutions
- **Effectively**
High sealing efficiency against heavy splashing liquids over a wide speed range - even when the shaft stands still
- **Easy to assemble**
No adjustment of the connecting parts is required (like different diameters tolerances, hardness, shaft collar, etc ...).

Chamfer of min. $0.8 \times 15^\circ$ is requested.

Orientation

The bigger gap diameter (e_2) of the CF-Seal always faces the splashing liquids/contaminations. The groove in the outer ring must be positioned downwards.

Labyrinth Metal Seals Series CF 60/619...S10



Series CF 62...A0

Series CF 60...S10

| Type | d [mm] | D [mm] | B [mm] | e ₁ [mm] | e ₂ [mm] | n _{max} [min ⁻¹] | Weight [kg] | Art. No. |
|-------------|--------|--------|--------|---------------------|---------------------|---------------------------------------|-------------|----------|
| CF 6004 S10 | 20 | 42 | 6 | 28 | 38 | - | 0,051 | 307082 |
| CF 6005 S10 | 25 | 47 | 6 | 33 | 43 | - | 0,059 | 307085 |
| CF 6006 S10 | 30 | 55 | 6 | 39 | 49 | - | 0,079 | 307089 |
| CF 6007 S10 | 35 | 62 | 6 | 45 | 55 | - | 0,097 | 307093 |
| CF 6008 S10 | 40 | 68 | 6 | 50 | 60 | - | 0,113 | 307097 |
| CF 6009 S10 | 45 | 75 | 6 | 55 | 65 | - | 0,134 | 307101 |
| CF 6010 S10 | 50 | 80 | 6 | 60 | 70 | - | 0,145 | 307105 |
| CF 6011 S10 | 55 | 90 | 6 | 67 | 77 | - | 0,189 | 307109 |
| CF 6012 S10 | 60 | 95 | 6 | 72 | 82 | - | 0,202 | 307113 |
| CF 6013 S10 | 65 | 100 | 6 | 77 | 87 | - | 0,215 | 307117 |
| CF 6014 S10 | 70 | 110 | 6 | 83 | 93 | - | 0,268 | 307121 |
| CF 6015 S10 | 75 | 115 | 6 | 89 | 99 | - | 0,283 | 307125 |
| CF 6016 S10 | 80 | 125 | 6 | 94 | 104 | - | 0,343 | 307129 |
| CF 6017 S10 | 85 | 130 | 6 | 100 | 110 | - | 0,360 | 307133 |
| CF 6018 S10 | 90 | 140 | 6 | 107 | 117 | - | 0,428 | 307137 |
| CF 6019 S10 | 95 | 145 | 6 | 112 | 122 | - | 0,447 | 307141 |
| CF 6020 S10 | 100 | 150 | 6 | 117 | 127 | - | 0,465 | 307145 |

Series CF 619...S10

| | | | | | | | | |
|--------------|----|-----|---|----|-----|---|-------|--------|
| CF 61908 S10 | 40 | 62 | 6 | 48 | 58 | - | 0,084 | 307149 |
| CF 61909 S10 | 45 | 68 | 6 | 53 | 63 | - | 0,097 | 307153 |
| CF 61910 S10 | 50 | 72 | 6 | 58 | 68 | - | 0,100 | 307157 |
| CF 61911 S10 | 55 | 80 | 6 | 63 | 73 | - | 0,126 | 307161 |
| CF 61912 S10 | 60 | 85 | 6 | 68 | 78 | - | 0,135 | 307165 |
| CF 61913 S10 | 65 | 90 | 6 | 73 | 83 | - | 0,144 | 307169 |
| CF 61914 S10 | 70 | 100 | 6 | 80 | 90 | - | 0,190 | 307173 |
| CF 61915 S10 | 75 | 105 | 6 | 85 | 95 | - | 0,201 | 307177 |
| CF 61916 S10 | 80 | 110 | 6 | 90 | 100 | - | 0,212 | 307181 |

Sries CF 62...A0

| Type | d [mm] | D [mm] | B [mm] | e ₁ [mm] | e ₂ [mm] | n _{max} [min ⁻¹] | Weight [kg] | Art. No. |
|------------|--------|--------|--------|---------------------|---------------------|---------------------------------------|-------------|----------|
| CF 6200 A0 | 10 | 30 | 6 | 17 | 27 | 66.420 | 0,010 | 306787 |
| CF 6201 A0 | 12 | 32 | 6 | 19 | 29 | 54.330 | 0,011 | 306791 |
| CF 6202 A0 | 15 | 35 | 6 | 22 | 32 | 46.100 | 0,013 | 306795 |
| CF 6203 A0 | 17 | 40 | 6 | 25 | 35 | 50.200 | 0,017 | 306799 |
| CF 6204 A0 | 20 | 47 | 6 | 29 | 39 | 45.580 | 0,023 | 306803 |
| CF 6205 A0 | 25 | 52 | 6 | 34 | 44 | 36.570 | 0,026 | 306807 |
| CF 6206 A0 | 30 | 62 | 6 | 42 | 52 | 32.270 | 0,037 | 306811 |
| CF 6207 A0 | 35 | 72 | 6 | 48 | 58 | 28.090 | 0,050 | 306815 |
| CF 6208 A0 | 40 | 80 | 6 | 54 | 64 | 24.810 | 0,061 | 306819 |
| CF 6209 A0 | 45 | 85 | 6 | 58 | 68 | 21.980 | 0,066 | 306823 |
| CF 6210 A0 | 50 | 90 | 6 | 63 | 73 | 19.810 | 0,071 | 306827 |

d = Inner diameter [mm]
D = Outer diameter [mm]

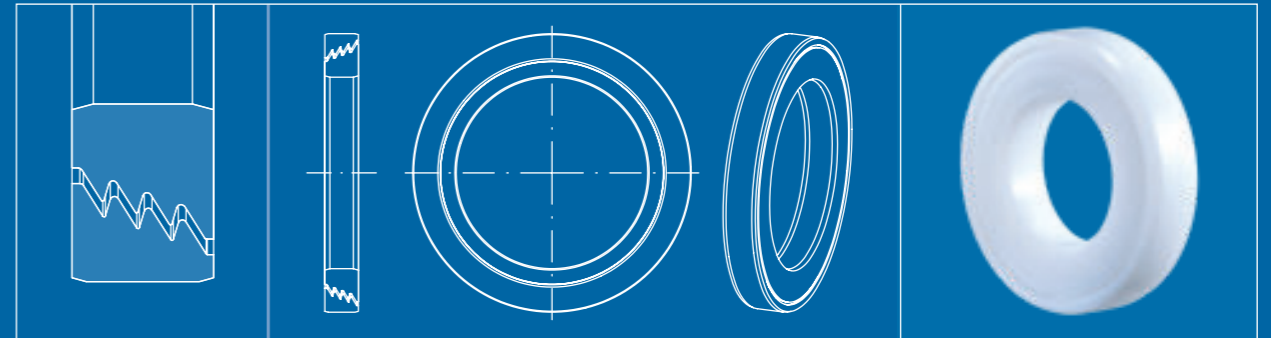
B = Width [mm]
e₁ = Gap diameter [mm]

e₂ = Gap diameter [mm]
n_{max} = Max. speed [rpm]

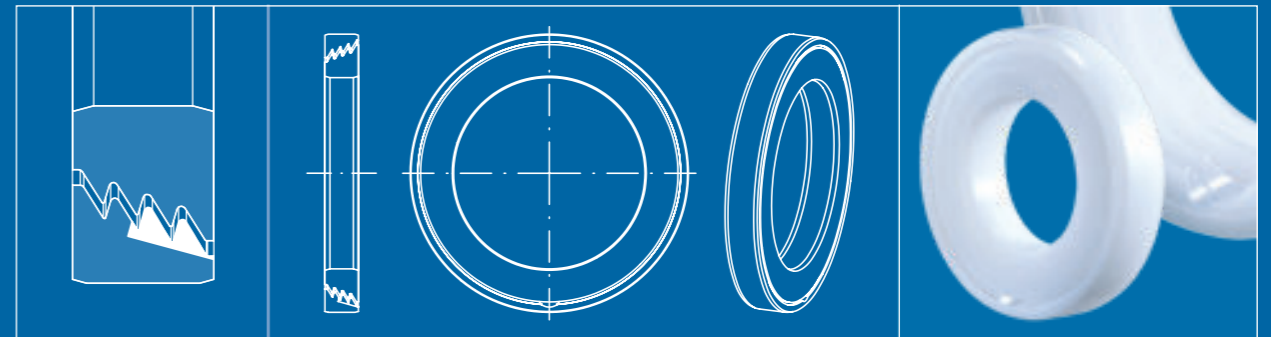
Weight [kg]



GMN Labyrinth Plastic Seals Type S and SA



Type S
Against normal splashing liquids
For rotating shafts and housings



Type SA with drain groove
Against heavy splashing liquids
For rotating shafts only (increased back transport)

Labyrinth Plastic Seals Type S and SA

Technical Data

Material

Outer- and inner ring: high quality Polyoxymethylene plastic (POM)
Temperature range: -40°–140°F (-40°–60°C)
 special design with O-ring up to 170°C (80°C)

Design

Shaft diameter: 10–160 mm
 (customized solutions available upon request)

Width: 10, 12, 15 mm (depending on size)

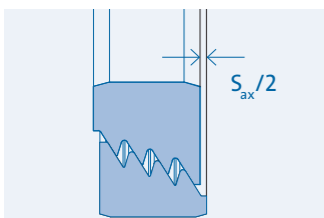
Sealing gap: Conical

Axial clearance: $S_{ax} = 0.8 \text{ mm}$
 Total axial movement of the seals inner and outer ring in relation to each other from one end position to the other.

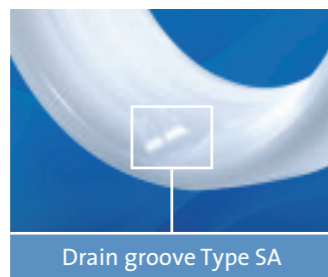
Type SA

Heavy and direct splashing liquids could be drained through an additional groove in the outer ring – for rotating shafts only.

Greased seals: Pre-greased Seals Type S – available in all sizes – provide improved protection against dust.



Axial clearance



Drain groove Type SA

The labyrinth peaks are overlapping each other. With the assembly the rings are simply clicked together.

Characteristics

Material

- **Non corrosive**
GMN Plastic Seals are made from non corrosive material and are particularly suitable against watery liquids.
- **Chemical resistant**
Polyoxymethylene (POM) guarantees high resistance against a lot of acids (i.e. lactic acid), chemicals and fungi. **GMN Non-Contact Plastic Seals are approved for the food industry.**

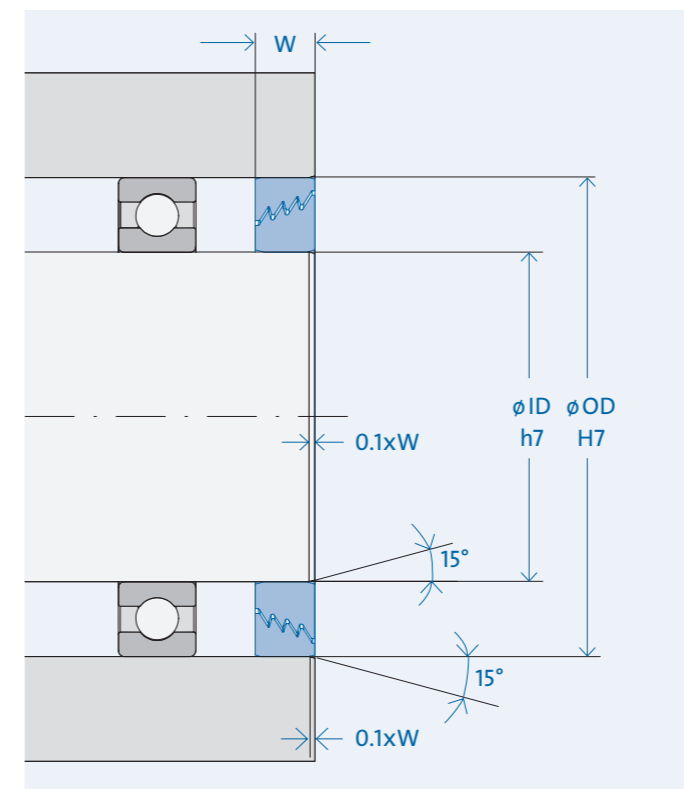
Design

- **No friction**
GMN-Seals operate without any frictional contact.
- **No wear**
GMN-Seals operate without any kind of wear, unlimited life possibilities.
- **No abrasion**
The Non-Contact design of GMN Labyrinth Seals guarantee operation without any abrasion. (GMN Plastic Non-Contact Seals are suitable for the highest demands of cleanliness.)
- **Effective**
The small distance between outer and inner ring offers high sealing efficiency and effective protection against contamination.
- **No increased temperatures**
No friction means no thermal effects to the surrounding parts and/or the lubricant.
- **Power saving performance**
The specific design of the GMN Labyrinth Seal allows operating conditions without any power loss. The result is the highest efficiency and power saving performance in high speed applications.
- **Compact design**
GMN Labyrinth Plastic Seals are offering 3 to 4 labyrinth steps within a small space.
- **Efficient**
GMN Labyrinth Seal Type S and SA take advantage of the centrifugal force to improve the sealing efficiency. Entering liquids are transported back to the bigger gap diameter with the rotation of the inner ring. Because of this effect, the bigger gap diameter (e_2) of the Labyrinth seal must always face the splashing liquids/contamination.
- **Dust-free**
The gap of pre-greased seals is filled with a specific grease type and improves protection against dust and fine particles.



Special design with O-ring for higher temperatures up to 176°F [80°C]

In applications with high temperatures, an additional O-ring at the outer ring (also available at the inner ring) saves the press fit and keeps the seal in position.



Mounting

Tolerances

Surrounding constructions (mating component)

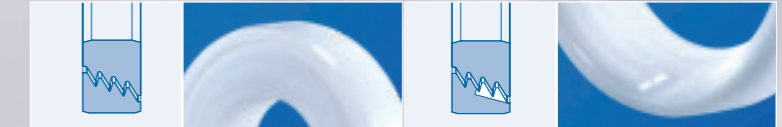
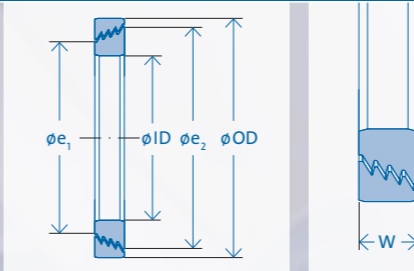
Fits

Housing: H7
 Shaft: h7
 Surface: Rz ≤ 16µm; Ra ≤ 3.2µm

Assembly

“l” Length (chamfer of housing and shaft) depending on the width “W”: l = 0.1 x W

Labyrinth Plastic Seals



| ID | OD | W | e ₁ | e ₂ | S _{ax} | Max. speed | Weight | Type S | | | Type SA (with groove) | | |
|----|----|----|----------------|----------------|-----------------|------------|--------|--------|----------|----------------|-----------------------|----------|-----------------|
| | | | | | | | | Type | Part no. | Part name | Type | Part no. | Part name |
| 10 | 30 | 10 | 14 | 24 | 0.8 | 82,000 | 0.010 | S | 301491 | S 10 X 30 X 10 | SA | 301753 | SA 10 X 30 X 10 |
| 12 | 32 | 10 | 14 | 24 | 0.8 | 75,000 | 0.010 | S | 301494 | S 12 X 32 X 10 | SA | 301756 | SA 12 X 32 X 10 |
| | 37 | 10 | 19 | 29 | 0.8 | 59,500 | 0.010 | S | 301496 | S 12 X 37 X 10 | SA | 301758 | SA 12 X 37 X 10 |
| 15 | 35 | 10 | 19 | 29 | 0.8 | 53,400 | 0.010 | S | 301498 | S 15 X 35 X 10 | SA | 301759 | SA 15 X 35 X 10 |
| | 42 | 10 | 24 | 34 | 0.8 | 44,300 | 0.010 | S | 301501 | S 15 X 42 X 10 | SA | 301762 | SA 15 X 42 X 10 |
| 17 | 35 | 10 | 19 | 29 | 0.8 | 67,900 | 0.010 | S | 301506 | S 17 X 35 X 10 | SA | 301767 | SA 17 X 35 X 10 |
| | 40 | 10 | 24 | 34 | 0.8 | 56,900 | 0.010 | S | 301509 | S 17 X 40 X 10 | SA | 301771 | SA 17 X 40 X 10 |
| | 47 | 10 | 31 | 41 | 0.8 | 45,600 | 0.020 | S | 301511 | S 17 X 47 X 10 | SA | 301773 | SA 17 X 47 X 10 |
| 20 | 40 | 10 | 24 | 34 | 0.8 | 51,300 | 0.010 | S | 301515 | S 20 X 40 X 10 | SA | 301777 | SA 20 X 40 X 10 |
| | 42 | 10 | 24 | 34 | 0.8 | 51,300 | 0.010 | S | 301516 | S 20 X 42 X 10 | SA | 301779 | SA 20 X 42 X 10 |
| | 47 | 10 | 31 | 41 | 0.8 | 45,600 | 0.020 | S | 301517 | S 20 X 47 X 10 | SA | 301781 | SA 20 X 47 X 10 |
| 22 | 42 | 10 | 24 | 34 | 0.8 | 48,500 | 0.010 | S | 301520 | S 22 X 42 X 10 | SA | 301786 | SA 22 X 42 X 10 |
| 25 | 47 | 10 | 31 | 41 | 0.8 | 40,500 | 0.010 | S | 301523 | S 25 X 47 X 10 | SA | 301789 | SA 25 X 47 X 10 |
| | 52 | 10 | 31 | 41 | 0.8 | 40,500 | 0.020 | S | 301524 | S 25 X 52 X 10 | SA | 301791 | SA 25 X 52 X 10 |
| 28 | 47 | 10 | 31 | 41 | 0.8 | 37,800 | 0.010 | S | 301533 | S 28 X 47 X 10 | SA | 301802 | SA 28 X 47 X 10 |
| | 52 | 10 | 31 | 41 | 0.8 | 37,800 | 0.020 | S | 301534 | S 28 X 52 X 10 | SA | 301803 | SA 28 X 52 X 10 |
| 30 | 62 | 10 | 46 | 56 | 0.8 | 25,900 | 0.030 | S | 301537 | S 30 X 62 X 10 | SA | 301807 | SA 30 X 62 X 10 |
| | 72 | 10 | 47 | 61 | 0.8 | 24,500 | 0.040 | S | 301541 | S 30 X 72 X 10 | SA | 301812 | SA 30 X 72 X 10 |
| 35 | 62 | 10 | 46 | 56 | 0.8 | 23,900 | 0.020 | S | 301547 | S 35 X 62 X 10 | SA | 301819 | SA 35 X 62 X 10 |
| | 72 | 10 | 47 | 61 | 0.8 | 22,600 | 0.030 | S | 301550 | S 35 X 72 X 10 | SA | 301824 | SA 35 X 72 X 10 |
| 36 | 62 | 10 | 46 | 56 | 0.8 | 23,500 | 0.020 | S | 301555 | S 36 X 62 X 10 | SA | 301829 | SA 36 X 62 X 10 |
| 40 | 62 | 10 | 46 | 56 | 0.8 | 22,000 | 0.020 | S | 301567 | S 40 X 62 X 10 | SA | 301842 | SA 40 X 62 X 10 |
| | 68 | 10 | 47 | 61 | 0.8 | 21,000 | 0.030 | S | 301570 | S 40 X 68 X 10 | SA | 301845 | SA 40 X 68 X 10 |
| | 90 | 10 | 60 | 74 | 0.8 | 17,300 | 0.060 | S | 301576 | S 40 X 90 X 10 | SA | 301851 | SA 40 X 90 X 10 |
| 42 | 65 | 10 | 46 | 56 | 0.8 | 25,300 | 0.020 | S | 301578 | S 42 X 65 X 10 | SA | 301854 | SA 42 X 65 X 10 |
| | 72 | 10 | 47 | 61 | 0.8 | 24,100 | 0.030 | S | 301580 | S 42 X 72 X 10 | SA | 301857 | SA 42 X 72 X 10 |
| 45 | 80 | 10 | 60 | 74 | 0.8 | 19,200 | 0.040 | S | 301584 | S 45 X 80 X 10 | SA | 301862 | SA 45 X 80 X 10 |
| | 85 | 10 | 60 | 74 | 0.8 | 19,200 | 0.050 | S | 301585 | S 45 X 85 X 10 | SA | 301864 | SA 45 X 85 X 10 |

| ID | OD | W | e ₁ | e ₂ | S _{ax} | Max. speed | Weight | Type S | | | Type SA (with groove) | | |
|-----|-----|----|----------------|----------------|-----------------|------------|--------|--------|----------|------------------|-----------------------|----------|-------------------|
| | | | | | | | | Type | Part no. | Part name | Type | Part no. | Part name |
| 50 | 80 | 10 | 60 | 74 | 0.8 | 17,800 | 0.030 | S | 301593 | S 50 X 80 X 10 | SA | 301873 | SA 50 X 80 X 10 |
| | 90 | 10 | 60 | 74 | 0.8 | 17,800 | 0.050 | S | 301596 | S 50 X 90 X 10 | SA | 301876 | SA 50 X 90 X 10 |
| 55 | 80 | 10 | 60 | 74 | 0.8 | 19,100 | 0.030 | S | 301606 | S 55 X 80 X 10 | SA | 301886 | SA 55 X 80 X 10 |
| | 85 | 10 | 60 | 74 | 0.8 | 19,100 | 0.040 | S | 301608 | S 55 X 85 X 10 | SA | 301888 | SA 55 X 85 X 10 |
| 60 | 95 | 12 | 72 | 87 | 0.8 | 15,400 | 0.060 | S | 301618 | S 60 X 95 X 12 | SA | 301899 | SA 60 X 95 X 12 |
| | 110 | 12 | 87 | 102 | 0.8 | 13,200 | 0.090 | S | 301622 | S 60 X 110 X 12 | SA | 301901 | SA 60 X 110 X 12 |
| 65 | 100 | 12 | 72 | 87 | 0.8 | 16,300 | 0.060 | S | 301631 | S 65 X 100 X 12 | SA | 301910 | SA 65 X 100 X 12 |
| 68 | 95 | 12 | 72 | 87 | 0.8 | 15,800 | 0.050 | S | 301639 | S 68 X 95 X 12 | SA | 301918 | SA 68 X 95 X 12 |
| 70 | 110 | 12 | 87 | 102 | 0.8 | 13,400 | 0.080 | S | 301643 | S 70 X 110 X 12 | SA | 301920 | SA 70 X 110 X 12 |
| | 125 | 15 | 96 | 112 | 0.8 | 12,300 | 0.170 | S | 301646 | S 70 X 125 X 15 | SA | 301923 | SA 70 X 125 X 15 |
| 75 | 130 | 15 | 96 | 112 | 0.8 | 12,900 | 0.160 | S | 301659 | S 75 X 130 X 15 | SA | 301936 | SA 75 X 130 X 15 |
| 80 | 110 | 12 | 87 | 102 | 0.8 | 13,300 | 0.060 | S | 301666 | S 80 X 110 X 12 | SA | 301944 | SA 80 X 110 X 12 |
| | 140 | 15 | 116 | 132 | 0.8 | 9,600 | 0.180 | S | 301671 | S 80 X 140 X 15 | SA | 301950 | SA 80 X 140 X 15 |
| 82 | 110 | 12 | 87 | 102 | 0.8 | 13,100 | 0.060 | S | 301675 | S 82 X 110 X 12 | SA | 301954 | SA 82 X 110 X 12 |
| 85 | 120 | 15 | 96 | 112 | 0.8 | 10,800 | 0.100 | S | 301678 | S 85 X 120 X 15 | SA | 301956 | SA 85 X 120 X 15 |
| 90 | 120 | 15 | 96 | 112 | 0.8 | 10,400 | 0.090 | S | 301687 | S 90 X 120 X 15 | SA | 301963 | SA 90 X 120 X 15 |
| | 145 | 15 | 116 | 132 | 0.8 | 9,800 | 0.200 | S | 301691 | S 90 X 145 X 15 | SA | 301968 | SA 90 X 145 X 15 |
| 95 | 140 | 15 | 116 | 132 | 0.8 | 9,500 | 0.150 | S | 301697 | S 95 X 140 X 15 | SA | 301973 | SA 95 X 140 X 15 |
| 100 | 140 | 15 | 116 | 132 | 0.8 | 9,100 | 0.130 | S | 301704 | S 100 X 140 X 15 | SA | 301981 | SA 100 X 140 X 15 |
| 110 | 140 | 15 | 116 | 132 | 0.8 | 7,900 | 0.100 | S | 301715 | S 110 X 140 X 15 | SA | 301992 | SA 110 X 140 X 15 |
| 120 | 150 | 15 | 126 | 142 | 0.8 | 6,200 | 0.110 | S | 301725 | S 120 X 150 X 15 | SA | 302002 | SA 120 X 150 X 15 |
| 125 | 170 | 15 | 146 | 162 | 0.8 | 5,400 | 0.210 | S | 301729 | S 125 X 170 X 15 | SA | 302008 | SA 125 X 170 X 15 |
| 130 | 170 | 15 | 146 | 162 | 0.8 | 5,200 | 0.190 | S | 301731 | S 130 X 170 X 15 | SA | 302011 | SA 130 X 170 X 15 |
| 140 | 170 | 15 | 146 | 162 | 0.8 | 5,000 | 0.140 | S | 301739 | S 140 X 170 X 15 | SA | 302019 | SA 140 X 170 X 15 |
| 150 | 190 | 15 | 166 | 182 | 0.8 | 4,300 | 0.190 | S | 301746 | S 150 X 190 X 15 | SA | 302025 | SA 150 X 190 X 15 |
| 160 | 190 | 15 | 166 | 182 | 0.8 | 4,100 | 0.140 | S | 301750 | S 160 X 190 X 15 | SA | 302029 | SA 160 X 190 X 15 |

ID = Inner diameter [mm]
OD = Outer diameter [mm]

W = Width [mm]
e₁ = Gap diameter [mm]

e₂ = Gap diameter [mm]
Max. speed [rpm]

S_{ax} = Axial clearance [mm]
Weight [kg]



Installation

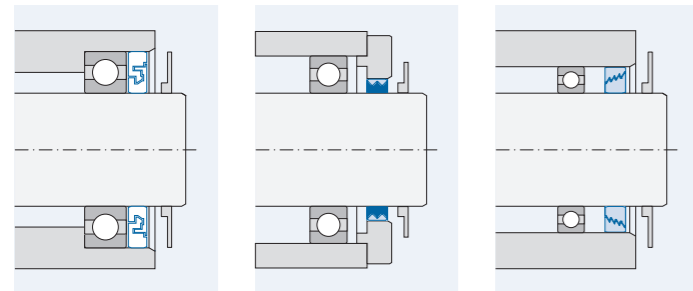
Installation

General information

When installing a GMN Non-Contact Seal, one must be certain that both the inner and outer races are axially aligned. Furthermore, the races need to be unrestricted by any shoulder, nut(s), and/or other restrictions from axial movement.

Surrounding construction

An additional disc in front of the seal protects the gap against strong and direct splashing liquids. The disc should be assembled in front of the seal with sufficient distance (capillary forces should be considered).



Non-Contact Seal (metal) Type CF...A0 with disc

Non-Contact Seal (metal) Type L with disc

Non-Contact Seal (plastic) Type S with disc

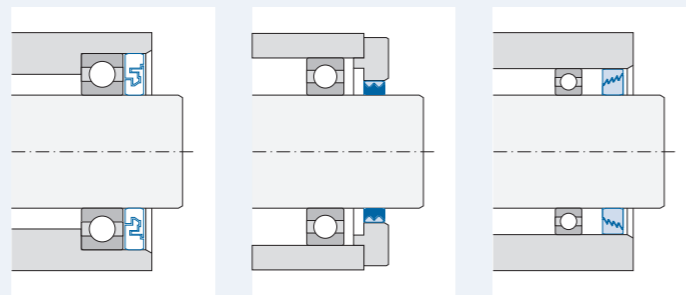
Any kind of high liquid level in front of the seal's gap needs to be avoided. (Attention: High liquid levels may cause leakage).

In a non-horizontal working application, GMN can offer specific advice to optimize your individual design in order to protect the sealing gap effectively.

When using Type SA, care should be taken that the drain groove in the stationary part is always positioned at the lowest point.

Standard assembly

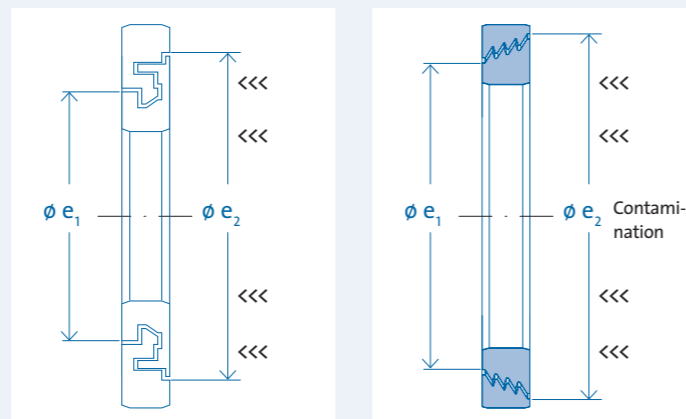
| | | |
|------------------------------------------|------------------------------------|--------------------------------------|
| Non-Contact Seal (metal) Type CF...A0 | Non-Contact Seal (metal) Type L | Non-Contact Seal (plastic) Type S |
|------------------------------------------|------------------------------------|--------------------------------------|



Non-Contact Seal (metal) Type CF...S10
The type CF...S10 is designed to be installed in direct contact to the spindle bearing. Inner ring and outer ring of the seal have to be fixed axially. The spindle bearing could be preloaded directly through the seal. The preloaded force is to apply over the inner ring only. (The retaining ring is force free.)

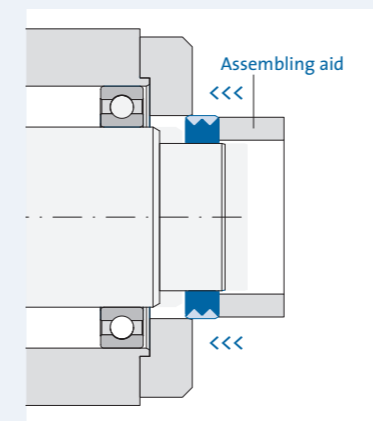
Orientation

The bigger gap diameter (e_2) of the GMN Labyrinth Plastic Seals must always face the splashing liquids/contamination.



Face-mounting with pre-assembled bearing

Both rings of the seal are pressed-in with an assembling aid (i.e. tube) together at the same time. If pressure would be applied on one ring only the labyrinth could be destroyed.



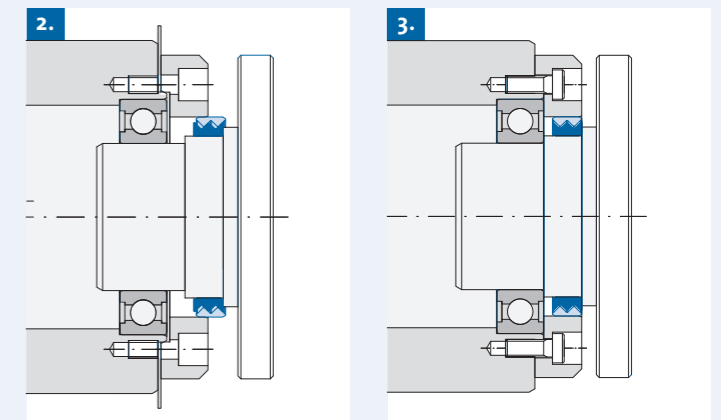
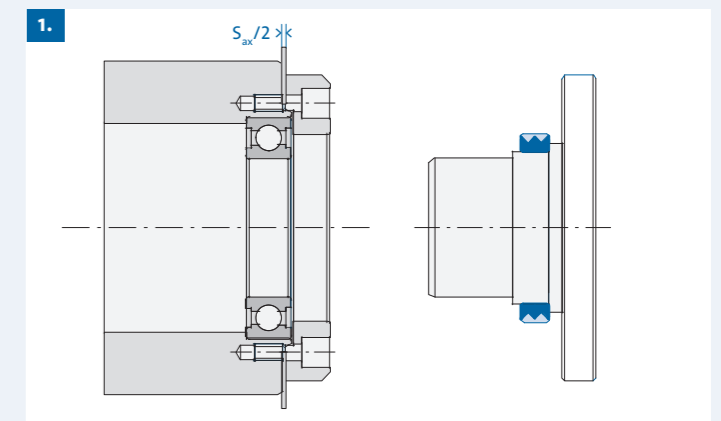
(The outer ring could be wider by maximum 0.1 mm than the inner ring.)

Shaft shoulder

A precise positioning of the seal is provided with a shaft shoulder for the inner ring. The outer ring of GMN Labyrinth Metal Seals should be positioned freely without any shoulder.

Assembly inside the unit

1. The GMN seal is pre-assembled onto the shaft. A thin metal sheet mounting aid (Thickness $S_{ax}/2$, half the amount of the seal's axial clearance) should be inserted between the housing and an additional ring.



2. Shaft (with the seal) and housing (with the bearing) are fitted into each other carefully. Now the outer ring stands in the right end position of the seal.

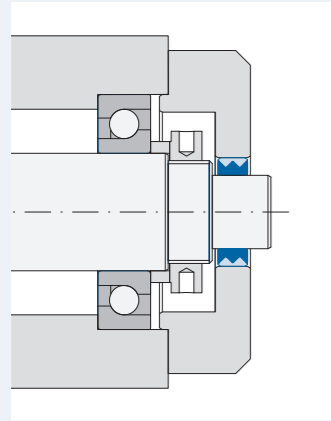
3. Finally the mounting aid is removed and the screws are tightened. With this process the seal's outer ring moves to the left by $S_{ax}/2$ and finds itself in the final, correct non-contact position.

Installation

Specific Assembly Situations

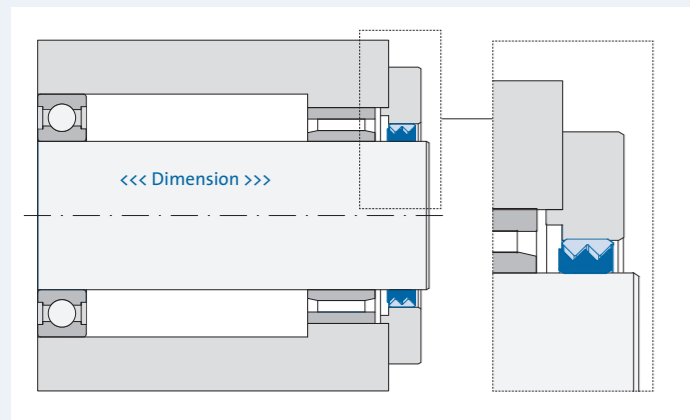
Assembly with pre-loaded spindle bearings

The seal's outer and inner ring must not be affected when the bearing is pre-loaded. The assembly into the cover keeps the seal independent from any bearing displacement.



Shaft Expansion with Temperature

To avoid any increase of the maximum axial clearance, GMN recommends a seal with an increased axial clearance or an asymmetrical seal adjustment in the extension direction. (The excess of maximum axial clearance could destroy the seal.)

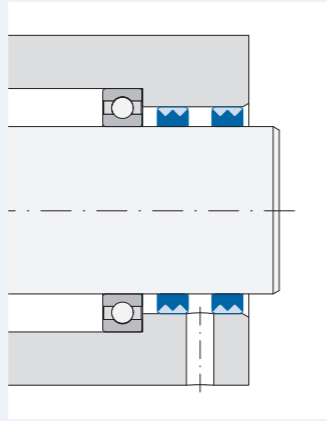


Seals with drainage

Tandem arrangement

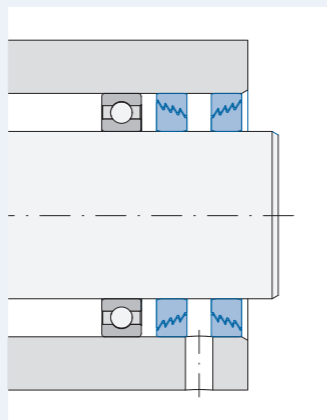
Metal Seal (Type L)

100% sealing efficiency is guaranteed with two seals in a row (minimum distance 5mm) with a drain hole in between. With this design any liquid between the seals could be drained reliably.



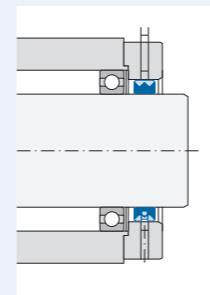
Plastic Seal (Type S)

The tandem arrangement of the plastic seals with a drain hole in between require opposite orientation with the assembly. One seal is operating specifically against possible contamination from outside while the other seal keeps the bearing's lubrication inside. The bigger gap-diameter always faces the contamination. (Space between the seals: min. 5mm)



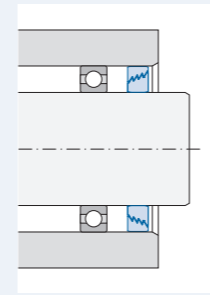
Seals with drain groove

Metal Seal (Type M)



In case of limited construction space Type M offers a compromise of the tandem arrangement in a tight package. Passing liquid is centrifugally forced through the outer ring's grooves into a drain groove inside the housing.
Width of the drain groove in housing:
 $R = c + 1\text{mm}$ (c = drain groove width)

Plastic Seal (Type SA)



When using the Type SA, care should be taken that the drain groove in the stationary part is always positioned at the lowest point.

Sealing air

Sealing air improves the efficiency of the seal, but please note the reasonable amount of air consumption. If sealing air should be applied through the grooves of the M Type the air releases in both directions of the seal; paying special attention with the bearing.

Additional aspects to consider

Correct choice of the seal as well as customized design of the mating parts is the most important aspects for a successful application, but there is more. If a milling machine is stopped suddenly within a very short time, a temporary oil level could be created in front of the sealing gap. The following questions should help to analyze your application from different points of view:

- Is the level of the sealing gap fixed?
- Would another size of the seal move the sealing gap into a more protected area?
- Could the viscosity of the cooling/oil etc. be influenced in a positive way?
- Are there any existing components (i.e. shield) which could be included into a complete design?
- Are all drain holes and drain grooves big enough?
Could any possibility of backwater be excluded?
- What is the size of any particles to be sealed? What is their speed and direction?
- Could any negative aspects be changed in a positive way with the control system?
- ...

On request, GMN would be pleased to give advice based on our decades of experience in order to optimize your individual solution.

Tolerance table

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| GMN Labyrinth Seals series CF...S10 | | | | | | | |
|-------------------------------------|----|----|-----|-----|-----|-----|--|
| CF Outer diameter outer ring D [mm] | | | | | | | |
| above | | | 30 | 50 | 80 | 120 | |
| to | | | 50 | 80 | 120 | 150 | |
| max. tolerance [µm] | | | 0 | 0 | 0 | 0 | |
| min. tolerance [µm] | | | -22 | -24 | -26 | -28 | |
| CF Bore inner ring d [mm] | | | | | | | |
| above | 18 | 30 | 50 | 80 | | | |
| to | 30 | 50 | 80 | 120 | | | |
| max. tolerance [µm] | 20 | 22 | 24 | 26 | | | |
| min. tolerance [µm] | 0 | 0 | 0 | 0 | | | |

| Tolerances | | | | | | | | |
|-----------------------------------|----------------------|-----|-----|-----|-----|-----|-----|--|
| Housing | Extract of ISO 286-2 | | | | | | | |
| Bore diameter D Nominal size [mm] | | | | | | | | |
| above | 10 | 18 | 30 | 50 | 80 | 120 | 180 | |
| to | 18 | 30 | 50 | 80 | 120 | 180 | 250 | |
| H7 | +18 | +21 | +25 | +30 | +35 | +40 | +46 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| J6 | +6 | +8 | +10 | +13 | +16 | +18 | +22 | |
| | -5 | -5 | -6 | -6 | -6 | -7 | -7 | |
| K7 | +6 | +6 | +7 | +9 | +10 | +12 | +13 | |
| | -12 | -15 | -18 | -21 | -25 | -28 | -33 | |

| Shaft | Extract of ISO 286-2 | | | | | | | |
|------------------------------------|----------------------|-----|-----|-----|-----|-----|-----|--|
| Shaft diameter d Nominal size [mm] | | | | | | | | |
| above | 10 | 18 | 30 | 50 | 80 | 120 | 180 | |
| to | 18 | 30 | 50 | 80 | 120 | 180 | 250 | |
| h6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | -11 | -13 | -16 | -19 | -22 | -25 | -29 | |
| h7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | -18 | -21 | -25 | -30 | -35 | -40 | -46 | |
| k5 | +9 | +11 | +13 | +15 | +18 | +21 | +24 | |
| | +1 | +2 | +2 | +2 | +3 | +3 | +4 | |

Tolerances [µm]

| | | | | | |
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On our website www.gmn.de we provide comprehensive product information for download.

GMN

GMN Paul Müller Industrie GmbH & Co. KG manufactures ball-bearings, machine spindles, freewheel clutches and seals for many areas of application.

On the basis of long experience in the development and production of machine components, GMN has specialized in manufacturing high quality products in the area of non-contact seals and beyond a comprehensive standard product range also offers customer-oriented special solutions.

A worldwide GMN service network provides competent customer advice as well as individual solutions.



GMN Quality management – tested and certified.

GMN guarantees maximum quality of products and services on the basis of high reliability over the long term. Highly modern development and production methods safeguard products that always correspond to the state of the art. Transparency in the structure of all GMN corporate divisions as well as comprehensible organizational procedures ensure customer-oriented services and economic safety.

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Progress means for GMN best possible customer support and performance-oriented optimization of technical products.

This aspiration is realized by GMN especially under strict observance of national and international environmental standards with regard to efficient and sustainable utilization of ecological resources.



Reference

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GMN

High Precision Ball Bearings
 Spindle Technology
 Sprag Type Freewheel Clutches
 Non Contact Seals