

GMN

Non-Contact Seals



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QUALITY MANAGEMENT

GMN Paul Müller Industrie GmbH & Co. KG's approach to quality is based on the principle of offering our customers the best possible solutions to their problems thus providing satisfaction and gaining and keeping their trust.

The care we take all related processes and services reflects our aim to provide our customers with a perfect product.

Our company prides itself on offering its customers state-of-the-art technology in its products, processes and services.



All divisions of **GMN Paul Müller Industrie GmbH & Co. KG** (driving technology, high precision ball bearings, spindle technology) are certified in accordance with DIN EN ISO 9001:2000.



GMN GMN

GMN Paul Müller Industrie GmbH & Co. KG with its over **95 years of experience** manufactures **high precision ball bearings, machining spindles, free-wheel clutches, non-contact seals and air bearings** for a wide variety of applications at its production facilities in Nuremberg.

A large part of the products are manufactured for special applications, tailor-made to customer specification.

A world-wide network of customer service centres provides our customers with advice on the quality, performance and service life of our products.

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GMN Paul Müller Industrie GmbH & Co. KG

Catalog Non Contact Seals



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The GMN Labyrinth Seal

This seal is manufactured from steel and aluminium. The high accuracy of inner and outer rings labyrinth profile is achieved by a special production process. By this process, the non-separable connection of the steel inner ring and the aluminum outer ring is achieved.



The GMN Gap Seal

It is produced of high quality plastic material, which provides remarkable resistance to a wide variety of chemicals. The material is bacteriostatic and fungistatic and therefore utilized frequently in the Food Processing Industry.

General Information

Modern design, with respect to minimum loss of energy, requires long life and lowest power loss due to friction of all components. One of GMN's answers to this challenge is a wide range of high quality and high precision ball bearings. Another answer is producing non-contact seals of two different types.

GMN have designed complete units ready for mounting. They give economic solutions for many sealing problems, which allow non-contact sealing of rotating machine parts.

GMN Labyrinth Seals are produced from metallic material, inner ring – steel; outer ring – aluminium, by a special and patented production process, which guarantees the total identity of inner rings and outer rings labyrinth profile. Thus a highly efficient seal against splashing liquids and/or coarse and fine granular contaminants is achieved. GMN Seals can be used for many applications under extreme conditions, high speed and high temperatures. The standard model can be used up to temperatures of 170°C (340°F) at the aluminium outer ring. Temperature of the shaft and seal's inner ring may be higher. If a non-contact seal is needed for higher temperatures please contact our technical staff.

The GMN Gap Seal

For the standard model a high quality plastic material is used which provides remarkable resistance to a wide variety of chemicals. This material enables the seal to be used in a broad range of applications. It is often used in the Food Processing Industries. The plastic material which is of a high strength can be used for temperatures of –40 °C to 60 °C (–40 °F to 140 °F).

A very high accuracy of the labyrinth gap is achieved by turning the molded inner and outer ring of the seal with the same tool. The very smooth surface achieved by this turning process is a prerequisite for the high efficiency the GMN Gap Seal.

Main benefits

Compact design

Dimension equal or similar to those of antifriction bearings or contact seals.

No contact

No wear and no heat caused by the seal.
No friction power loss.

Almost unlimited life

No costs for maintenance and replacement.

Low cost for mating parts and mounting fits

Large tolerances allowed for shaft and housing. Hardening and grinding is not necessary for customers parts.

Metallic material

Almost no speed limit – applicable at temperatures up to 170 °C (340 °F)

Plastic material up to 200 mm outer diameter of the seal

Resistance against many types of chemicals, bacteria and fungi. Therefore GMN Gap Seals are ideal for the Food Processing Industry at temperatures up to 60 °C (140 °F).

Independent from sense of rotation

Not influenced by reversal of rotation.

High standard sealing efficiency at reasonable cost

Design of labyrinth gap and the above mentioned benefits allow the use of GMN Non-Contact Seals even for applications which have been solved with contact seals or with home designed, expensive, labyrinth profiles.

GMN Non-Contact Seals can be used for inner ring and/or outer ring rotation.

Applications

GMN Non-Contact Seals are supplied to the manufacturers of the following types of machines and equipment:

- Machine Tool Industry
- Testing Equipment
- Packaging Machines
- Textile Machines
- Food Processing Machines
- Driving Units
- Mechanical Conveying Equipment

Due to technical progress nowadays it is necessary to find the best solution for every component used on newly designed machinery to save costs on energy and maintenance. An important machine element is the sealing system which has to fulfil a huge variety of requirements.

Non-Contact Seals could be used for a large number of applications. Quite often a special labyrinth seal is too expensive: It is necessary to manufacture 14 fits to get a seal with only 3 labyrinth steps and very often the mounting space of custom made labyrinth seals is very large.

The GMN Non-Contact Seal has become famous for its compact design. Please see the comparison with standard contact seals in the table below. The main benefits of GMN Non-Contact Seals are:

- Low cost
- Small mounting space
- Ease of mounting
- Reliable sealing against splashing liquids and granular contaminants.

Sometimes a combination of contact seal and non-contact seal may solve very difficult sealing problems. For example if a gear box is lubricated with large amounts of oil – oil level higher than the sealing diameter – and bearings have to be protected against very coarse contamination. For this type of application a GMN Non-Contact Seal could be used to protect the contact seal and increase the lifetime of the whole system.

Comparison of contact seals and Non-Contact Seals

Topic	Contact Seal-Lip Seal	Non-Contact Seal
Wear	sliding friction	no wear
Power loss	friction loss	no power loss – savings of energy, smaller driving units
Temperature	see diagram below	see diagram below
Speed limit	depending on material	High speed limit – see diagrams pages 7/8
Lifetime	depending on wear	no limit for the life
Lubrication	at sealing location	no lubricant necessary
Mating parts	hardening and grinding necessary for shafts due to wear	no hardening and grinding necessary for the mating parts
Temperature limit	low – caused by material used: rubber or plastic	Labyrinth Seal: 170°C (340°F) Gap Seal: 60°C (140°F)
Space requirements	small	previously: large (custom made labyrinths) today: small (GMN Non-Contact Seal)
To be applied with	grease lubrication	grease lubrication
	oil lubrication	oil lubrication (oil level has to be under sealing diameter)
	water may cause problems because water lubrication at the sealing location will increase wear fine or coarse granular contaminants will increase wear.	Water – if corrosion proof material is used and water level is under the sealing diameter – will cause no problems fine or coarse granular contaminants can be sealed reliably.

Labyrinth Seals



Design

GMN Labyrinth Seals are complete units of two rings with built in labyrinth: The inner ring is made of steel the outer ring is made of aluminium. They are ready for mounting but inseparable. The profile shows at least three labyrinth peaks. Standard models are supplied with widths of 10, 15 and 20 mm depending on seal diameter. For a wide range of applications GMN offers two different designs:

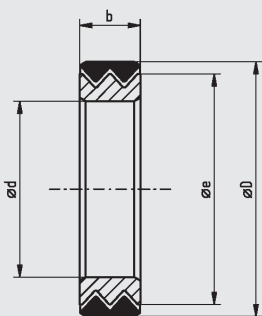


Figure 1

The basic "L" Type against coarse and fine granular contamination and light splashing liquids.

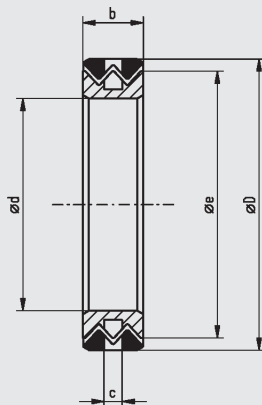


Figure 2

The "M"-Type against coarse and fine granular contamination and heavy splashing liquids.

The "M" Type seal is designed with peripheral grooves which allow liquids splashed into the first labyrinth gap to be centrifuged into a circular groove of customers mating part. The liquid may flow back via a drain hole to the reservoir or to the outside. The correct dimensioning of the circular groove and the drain hole is a necessary requirement for high sealing efficiency.

The maximum efficiency of non-contact seals is achieved during rotation. When heavy splashing liquids are expected while machine parts are stationary care should be taken that splashing directly onto the seal does not occur. This could be achieved easily by a disc or a shield which should be mounted on the shaft. Please see also pages 14 to 17 for more details and examples.

Labyrinth Gap

The precision of the rings and accuracy of the gap are essential for the efficiency of the seal which could be guaranteed for every single GMN Labyrinth Seal with a special production process.

The catalog information on axial end play "Sa" in the tables refers to the total axial movement of the seal's inner and outer ring in relation to each other; from one end position to the other. Normally the seal should be installed in flush position - thus the axial allowance would be half the value in either direction. Axial and radial clearance are almost of the same size, and do interfere each other.

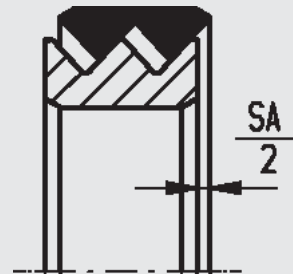


Figure 3

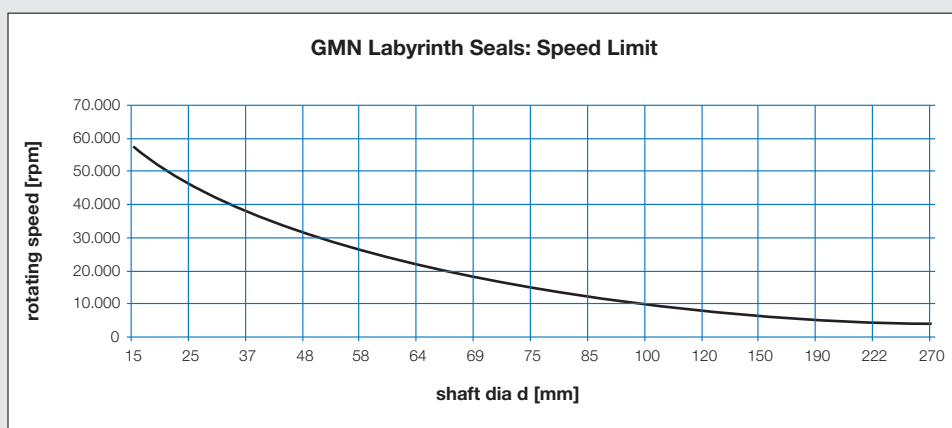
Axial end play

Special Designs

An additional solution for high requirements of axial clearance can be offered by special produced seals with increased end play by factor 1.5. If aggressive or corrosive mediums have to be sealed GMN labyrinth seals could be made from different materials. Please contact our technical staff at the earliest stage of your design to discuss solutions.

Speed Limit

GMN Labyrinth seals are pressed onto the shaft with a certain press fit. Due to centrifugal forces the inner ring could lift off of the shaft. The diagram below shows the speed limit depending on the size.



Gap Seals



Design

The GMN Gap Seal is mounted from two plastic parts, which create a zig zag shaped gap based on a conic envelope, thus the diameter of the sealing gaps are increased step by step from e1 on the dry side to e2 on the side facing the contaminant. Peaks and valleys of the inner and outer rings profiles (turned by the same tool) merge with each other so that they may be snapped together during the mounting process at GMN but are shipped as an inseparable unit.

Chemical Resistance

The acetalresin our seals are made of is resistant against a large variety of chemicals as: the most of the common organic solvents, alcohols, esters, ketones, aliphatic and aromatic hydrocarbonates, greases and oils. Alkaloid water and base even at higher temperature do not harm the material.

On the other hand this material may not be used to seal against oxidators and organic and anorganic acids (pH < 4). Another advantage of this material is the very low value of water pickup (max. 0.8%). Detailed information about the resistance against certain chemicals could be found in the internet in the section seals/gap seals/technology: www.gmn.de

Sealing principle

The basic principle of a labyrinth seal is based on the geometric shape of the labyrinth which causes some turns of the contaminant on its way to penetrate the seal. With the GMN Gap Seal the efficiency of the centrifugal force to accelerate the contaminant radially to throw it away from the sealing gap is increased by the conic envelope of the labyrinth. To penetrate the seal the contaminant has to overcome the centrifugal force by creeping from the larger labyrinth diameter facing the contaminant to the smaller diameter on the "dry" side of the seal. Particles penetrating the first steps of the conic labyrinth are expelled by the centrifugal force and led back to the side of the seal facing the contaminant.

There is no chance for a Gap Seal to protect against higher liquid levels and a pressure gradient between inside and outside of a Non-Contact Seal. Pressure gradients may be reduced or throttled but not sealed.

The correct mounting direction:

Care should be taken to install the Gap Seal the right way – the larger labyrinth diameter has to point to the contaminant.

Axial and radial clearance

The axial end play refers to the total axial movement of the seal's inner and outer ring in relation to each other; from one end position to the other. Axial and radial clearance of the seal are almost the same – approximately 0.5 mm. Both interfere each other. Normally the seal should be installed in flush position – thus the axial allowance would be half the value in either direction.

Protection against dust

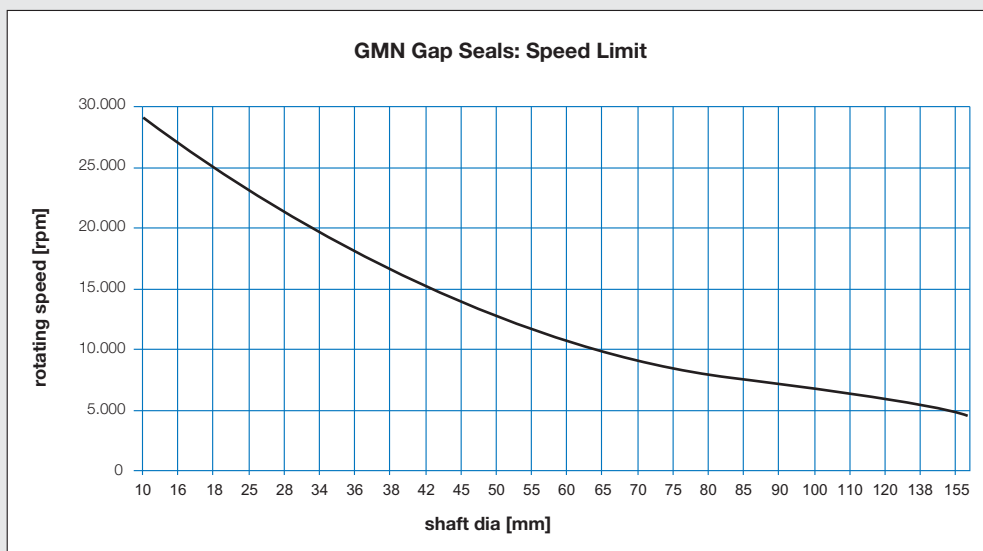
For this type of requirement the Gap Seal may be filled with grease before the mounting to increase the sealing efficiency against dusty environment. Please mark your order "pre-greased". A certain amount of the grease may be moved out

Heavy splashing liquids

There should be enough free space in front of the seal to allow free dropping or flowing of the splashing liquid. – In addition the "Sa Type" for rotating shafts or the "Si Type" for rotating housings could be used.

Speed Limit

GMN Labyrinth seals are pressed onto the shaft with a certain press fit. Due to centrifugal forces the inner ring could lift off of the shaft. The diagram below shows the speed limit depending on the size.



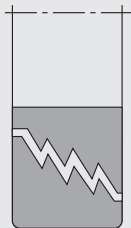


Figure 4

Type (S)

This is the basic design which can be used against light splashing of liquids and/or fine or coarse granular contamination. For either inner ring rotation or outer ring rotation.

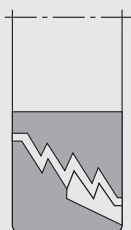


Figure 5

Type (Sa)

This design with a drain at the outer ring can be used against heavy splashing of liquids and/or fine or coarse granular contaminants.

For inner ring rotation only!



Figure 6

Type (Si)

This design with a drain at the inner ring can be used against heavy splashing of liquids and/or fine or coarse granular contaminants.

For outer ring rotation only!

The three drawings shown above are guides for the best choice of GMN Gap Seals. The most efficient design depends on whether the shaft of the housing rotates.

Mounting instructions

One of the prerequisites for the best performance of the seal is the correct mounting of the seal. Below we list some guidelines.

Mounting Position

It is very important that the GMN Gap Seal is mounted correctly. The bigger labyrinth diameter must be pointing to the contaminant. If the seal is used for two sealing functions to prevent infiltration of contaminants into a unit and to retain the lubricant inside the unit, two GMN Gap Seals should be used in opposite directions. A drain hole and a spacing ring between the two inner rings would be necessary. Minimum width of spacing ring is 5 mm. See page 20, figure 21.

With the (Sa) Type and the (Si) Type care should be taken that the built in drain is at the lowest point of the stationary part of the GMN Gap Seal.

Radial Clearance

Loose radial clearance must be avoided by accurate bearing support. Out of roundness of shafts and housings have a large influence on the sealing function – they must be kept to a minimum.

Axial Clearance

GMN Gap Seals allow an axial clearance of .5 mm (.020 inch) in total that means .25 mm (.010 inch) in each direction from the flush position of the inner and outer rings of the seal.

Axial Wobbling

To prevent axial wobbling of the rotating ring it should be mounted against a shoulder. The shoulder should be square to the shaft and be within a close tolerance.

Material

The high quality plastic material used for the standard model of GMN Gap Seals is well known for its stability and chemical resistance in a large number of applications in the capital goods and consumer goods industries. Due to its resistance to bacteria and fungi this material can be used in Food Processing and Food Conveying Industries.

The temperature range for using this material covers -40°C (-40°F) and $+60^{\circ}\text{C}$ (140°F).

Material: Polyacetal resin TK – AD; Delrin 100

Temperature limits:

-40°C to 60°C

-40°F to 140°F .

Special – customer oriented seals

On request we will be pleased to suggest and produce special seals for special applications, e.g. special dimensions. For slightly higher temperatures than the limit of 60°C up to 80°C ($140^{\circ}\text{F}/174^{\circ}\text{F}$) we offer a special design with "O"-rings at the inner and/or outer ring to increase the reliability of the press fit. Please contact our technical staff at no obligation.



Figure 7

For some applications the efficiency of GMN Gap Seal (S) Type is increased when filled with grease. This greasing can be done at the GMN plant. Please mark your order "pregreased".

Also state the brand name if a special grease is needed depending on your contaminant.

Pregreasing is possible for GMN Gap Seal (S) Type only.

Mating Parts

The dimensions of GMN Non-Contact Seals are close to antifriction bearing or contact seal standards. On request we will produce seals with special dimensions. If in doubt please contact our technical staff.

Contact seals, especially at higher speeds require hardening of the shaft as well as a high surface finish at the sealing location. With the use of GMN Non-Contact Seals, hardening and grinding of the mating parts is not necessary. Tolerances of the seal have been designed so that mounting fits usual for antifriction bearings can be accepted.

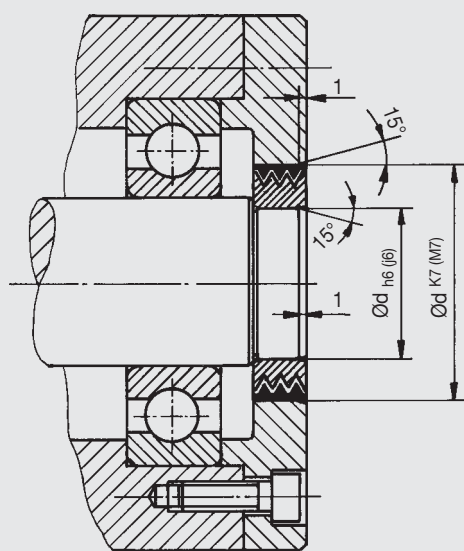


Fig. 8

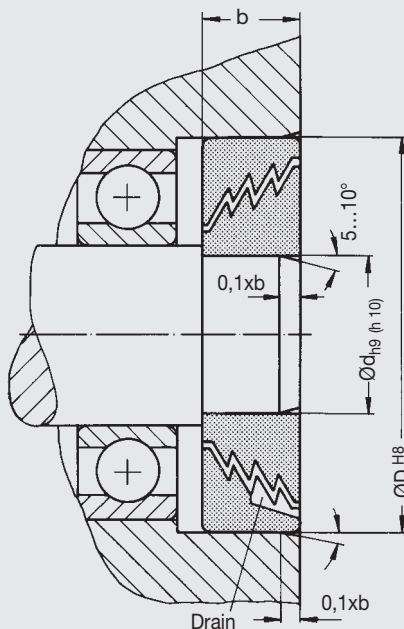


Fig. 9

Mounting fits

For GMN Labyrinth Seals:

Housing	K7
Shaft	h6

In any event the necessary press fit will be obtained. Additional bonding elements normally will not be necessary.

If it's necessary to decrease the press fit due to the design of the whole assembly, fits H7, G7 respectively g6 and f7 can be used. With these fits industrial glues for additional bonding of the GMN Labyrinth Seal onto the shaft and into the housing should be used. Surface finish $R_z \leq 6,3 \mu\text{m}$. The outer ring might be 0,1 mm wider than the inner ring.

For GMN Gap Seals the following mounting fits are required:

Housing	H7
Shaft	h7
Surface finish	$R_z \leq 6.3 \mu\text{m}$

The length "l" of the chamfered edge of shaft or housing depends on the width "b" of the seal. $L = 0,1 \times b$.

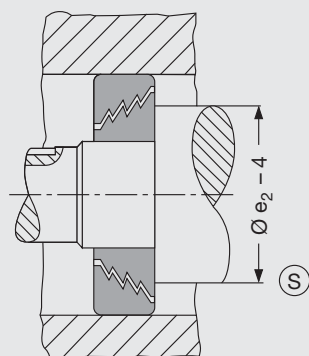


Fig. 10a

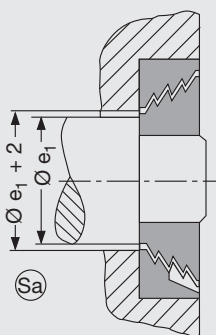


Fig. 10b

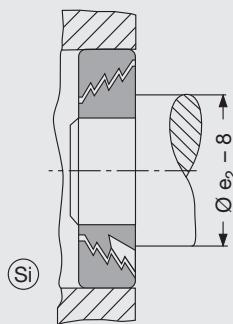


Fig. 10c

Mounting Dimensions

The drawings left are a guide for the design of mating parts. To achieve the best function of GMN Gap Seals the connecting diameters should not exceed minimum or maximum sizes.

Mounting Instructions

One of the most important requirements for the mounting of GMN Labyrinth Seals is to guarantee wobble free running of the inner ring. Therefore we recommend that the inner ring should be pressed against a solid shoulder of the shaft as shown in the section "Typical Applications" see page 18, figure 14. The shoulder and the shaft must be square and within a close tolerance. Three different methods which are commonly used for mounting are shown below.

Method I

(Face mounting position)

For these applications we recommend mounting by a mounting bushing, which covers the inner and outer ring, see figure 4. Due to the fact that both rings are almost of the same width they will be located in the working position after mounting. The difference of width, 0.1 mm in total, does not matter for normal applications. The outer ring will be, at maximum, 0.1 mm wider than the inner ring.

For high precision units or when axial clearance has to be used totally a recess could be machined on the mounting bushing and thus put the two rings into the position required.

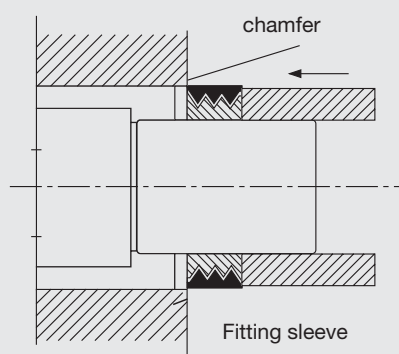


Fig. 11

With the GMN Gap-Seals basically the same mounting instructions are applicable. The only difference would be the fact that both – inner and outer ring – are of the same width.

Method II

(Mounting position inside the unit)

For assemblies where face mounting is not possible due to the design, GMN- Labyrinth Seals may be installed the following way, see figures 12a, 12b, 12c.

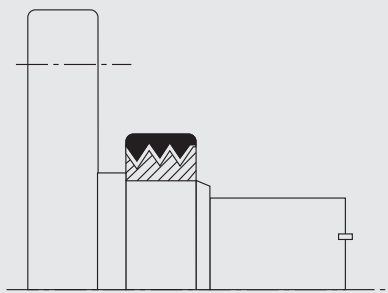


Fig. 12a

GMN Labyrinth Seal preassembled on the shaft.

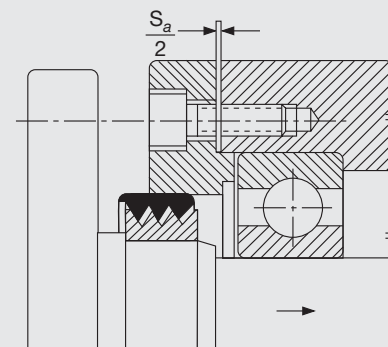


Fig. 12b

The shaft is slowly pushed into the bearing housing. The bearing flange is held in the correct position by a split shim of width $S_a/2$.

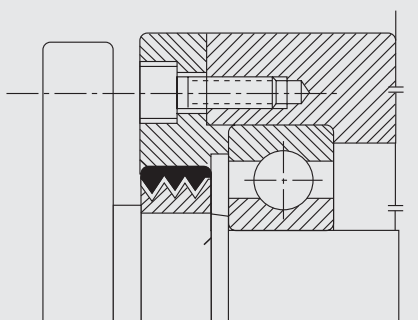


Fig. 12c

The shim is removed and the flange is fixed by screws. Now the labyrinth ring is installed in the correct position for operation.

Method III

This method can be used when neither face mounting nor preassembly on the shaft is possible, see figures 13a and 13b.

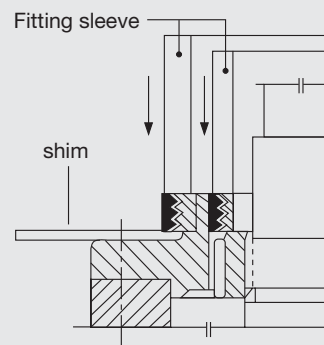


Fig. 13a

GMN Labyrinth Seal preassembled inside the housing flange.

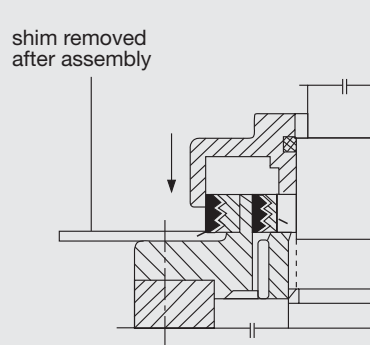
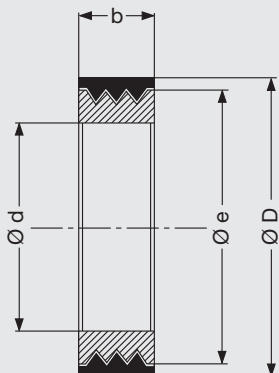


Fig. 13b

The shaft is slowly pushed into the bearing's housing while the outer ring of the labyrinth seal is held in the right position by a split shim of high accuracy.

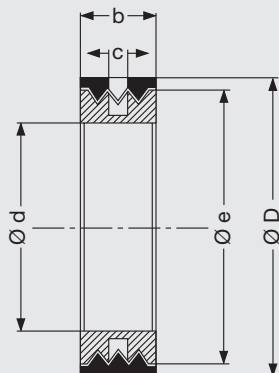
After mounting the shim is removed and both rings of the seal are in the correct position.

Type »L«



For sealing against coarse or fine granular contaminants and light splashing liquids.

Type »M«



For sealing against coarse or fine granular contaminants and heavy splashing liquids.

Simply specify seal type and dimensions.

Special dimensions on request.

S_a = end play in mounted position (total axial movement of both rings from one end position to the other)

Type »L« »M«	d mm	D mm	b mm	c mm	e mm	S_a mm
15 x 26 x 8	15	26	8	2,5	24	0,35
18 x 28 x 10	18	28	10	3	26	0,38
20 x 28 x 10	20	28	10	3	26	0,38
20 x 30 x 10	20	30	10	3	28	0,38
22 x 30 x 10	22	30	10	3	28	0,38
25 x 37 x 10	25	37	10	3	34	0,38
28 x 39 x 10	28	39	10	3	36	0,38
30 x 42 x 10	30	42	10	3	39	0,38
32 x 45 x 10	32	45	10	3	42	0,4
35 x 47 x 10	35	47	10	3	44	0,4
40 x 52 x 10	40	52	10	3	49	0,4
42 x 55 x 10	42	55	10	3	52	0,4
45 x 55 x 10	45	55	10	3	52	0,4
45 x 62 x 10	45	62	10	3	59	0,4
48 x 62 x 10	48	62	10	3	59	0,4
50 x 62 x 10	50	62	10	3	59	0,4
52 x 68 x 10	52	68	10	3	65	0,4
55 x 68 x 10	55	68	10	3	65	0,4
58 x 72 x 10	58	72	10	3	68,5	0,4
60 x 72 x 10	60	72	10	3	68,5	0,4
60 x 80 x 10	60	80	10	3	76	0,4
63 x 80 x 10	63	80	10	3	76	0,4
65 x 80 x 10	65	80	10	3	76	0,4
65 x 85 x 10	65	85	10	3	81	0,42
68 x 85 x 10	68	85	10	3	81	0,42
70 x 85 x 10	70	85	10	3	81	0,42
70 x 90 x 10	70	90	10	3	86	0,42
72 x 90 x 10	72	90	10	3	86	0,42
75 x 90 x 10	75	90	10	3	86	0,42
80 x 100 x 10	80	100	10	3	95	0,42
90 x 110 x 10	90	110	10	3	105	0,42
100 x 120 x 10	100	120	10	3	115	0,42

Type »L« »M«	d mm	D mm	b mm	c mm	e mm	S_a mm
100 x 120 x 14	100	120	14	4	115	0,7
110 x 130 x 15	110	130	15	5	125	0,7
120 x 140 x 15	120	140	15	5	135	0,7
130 x 150 x 15	130	150	15	5	145	0,7
140 x 170 x 15	140	170	15	5	165	0,7
150 x 180 x 15	150	180	15	5	175	0,7
160 x 190 x 20	160	190	20	5	184,5	0,8
170 x 210 x 20	170	210	20	5	204,5	0,8
180 x 210 x 20	180	210	20	5	204,5	0,8
190 x 230 x 20	190	230	20	5	224,5	0,8
200 x 230 x 20	200	230	20	5	224,5	0,8
210 x 250 x 22	210	250	22	5	244,5	1,0
Special sizes for spindle noses						
69,83 x 85 x 10	69,83	85	10	3	81	0,42
88,88 x 108 x 10	88,88	108	10	3	103	0,42
101,60 x 120 x 10	101,60	120	10	3	115	0,42

Mounting fits:

Housing K7

Shaft h6

See tolerance table page 22.

Remark: Mounting fits H7; G7 respectively g6, f7, can be used, but then the GMN Labyrinth Seal should be fixed with special industrial glue (e.g. Loctite) into the housing and onto the shaft.

Design and dimensions are subject to changes.

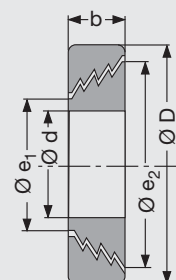
Simply specify seal type and dimensions.

Special dimensions on request.

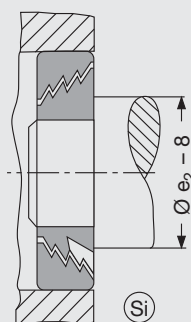
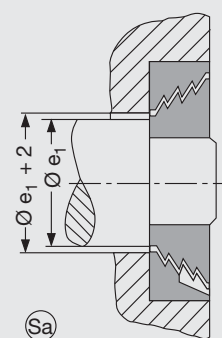
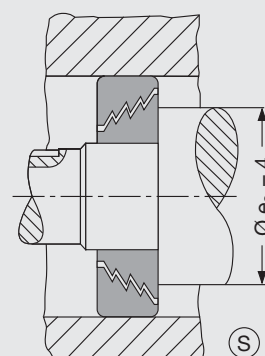
S_a = end play in mounted position (total axial movement of both rings from one end position to the other)

$S_a = 0.5 \text{ mm (0.02")}$ for all sizes

Dimensions



Mounting Dimensions



Type S - Sa - Si	d mm	D mm	b mm	e ₁ mm	e ₂ mm
10 x 30 x 10	10	30	10	14	25
10 x 32 x 10	10	32	10	14	25
12 x 30 x 10	12	30	10	14	25
12 x 32 x 10	12	32	10	14	25
12 x 35 x 10	12	35	10	19	30
12 x 37 x 10	12	37	10	19	30
15 x 35 x 10	15	35	10	19	30
15 x 37 x 10	15	37	10	19	30
15 x 40 x 10	15	40	10	24	35
15 x 42 x 10	15	42	10	24	35
16 x 35 x 10	16	35	10	19	30
16 x 37 x 10	16	37	10	19	30
16 x 40 x 10	16	40	10	24	35
16 x 42 x 10	16	42	10	24	35
17 x 35 x 10	17	35	10	19	30
17 x 37 x 10	17	37	10	19	30
17 x 40 x 10	17	40	10	24	35
17 x 42 x 10	17	42	10	24	35
17 x 47 x 10	17	47	10	31	42
17 x 52 x 10	17	52	10	31	42
18 x 40 x 10	18	40	10	24	35
18 x 42 x 10	18	42	10	24	35
20 x 40 x 10	20	40	10	24	35
20 x 42 x 10	20	42	10	24	35
20 x 47 x 10	20	47	10	31	42
20 x 52 x 10	20	52	10	31	42
22 x 40 x 10	22	40	10	24	35
22 x 42 x 10	22	42	10	24	35
22 x 47 x 10	22	47	10	31	42
22 x 52 x 10	22	52	10	31	42
25 x 47 x 10	25	47	10	31	42
25 x 52 x 10	25	52	10	31	42
25 x 62 x 10	25	62	10	46	57
25 x 65 x 10	25	65	10	46	57
26 x 47 x 10	26	47	10	31	42
26 x 52 x 10	26	52	10	31	42
27 x 47 x 10	27	47	10	31	42
27 x 52 x 10	27	52	10	31	42
28 x 47 x 10	28	47	10	31	42
28 x 52 x 10	28	52	10	31	42

Type S - Sa - Si	d mm	D mm	b mm	e ₁ mm	e ₂ mm
28 x 62 x 10	28	62	10	46	57
28 x 65 x 10	28	65	10	46	57
30 x 62 x 10	30	62	10	46	57
30 x 65 x 10	30	65	10	46	57
30 x 68 x 10	30	68	10	47	62
30 x 72 x 10	30	72	10	47	62
30 x 75 x 10	30	75	10	47	62
32 x 62 x 10	32	62	10	46	57
32 x 65 x 10	32	65	10	46	57
34 x 62 x 10	34	62	10	46	57
34 x 65 x 10	34	65	10	46	57
35 x 62 x 10	35	62	10	46	57
35 x 65 x 10	35	65	10	46	57
35 x 68 x 10	35	68	10	47	62
35 x 72 x 10	35	72	10	47	62
35 x 75 x 10	35	75	10	47	62
35 x 80 x 10	35	80	10	60	74
35 x 85 x 10	35	85	10	60	74
35 x 90 x 10	35	90	10	60	74
36 x 62 x 10	36	62	10	46	57
36 x 65 x 10	36	65	10	46	57
36 x 68 x 10	36	68	10	47	62
36 x 72 x 10	36	72	10	47	62
36 x 75 x 10	36	75	10	47	62
37 x 62 x 10	37	62	10	46	57
37 x 65 x 10	37	65	10	46	57
38 x 62 x 10	38	62	10	46	57
38 x 65 x 10	38	65	10	46	57
38 x 68 x 10	38	68	10	47	62
38 x 72 x 10	38	72	10	47	62
38 x 75 x 10	38	75	10	47	62
40 x 62 x 10	40	62	10	46	57
40 x 65 x 10	40	65	10	46	57
40 x 68 x 10	40	68	10	47	62
40 x 72 x 10	40	72	10	47	62
40 x 75 x 10	40	75	10	47	62
40 x 80 x 10	40	80	10	60	74
40 x 85 x 10	40	85	10	60	74
40 x 90 x 10	40	90	10	60	74

Mounting fits see page 12 – Tolerance Table page 22.

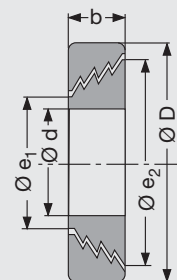
Simply specify seal type and dimensions.

Special dimensions on request.

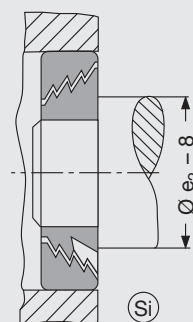
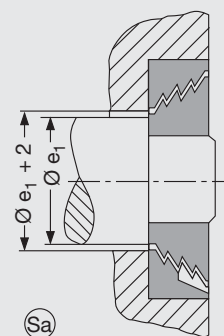
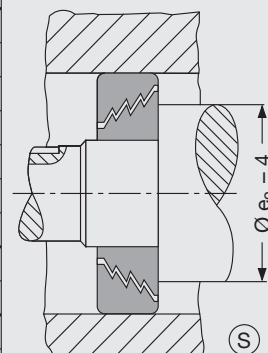
S_a = end play in mounted position (total axial movement of both rings from one end position to the other)

$S_a = 0.5 \text{ mm (0.02")}$ for all sizes

Dimensions



Mounting Dimensions



Type (S) - (Sa) - (Si)	d mm	D mm	b mm	e ₁ mm	e ₂ mm
42 x 62 x 10	42	62	10	46	57
42 x 65 x 10	42	65	10	46	57
42 x 68 x 10	42	68	10	47	62
42 x 72 x 10	42	72	10	47	62
42 x 75 x 10	42	75	10	47	62
44 x 62 x 10	44	62	10	46	57
44 x 65 x 10	44	65	10	46	57
45 x 80 x 10	45	80	10	60	74
45 x 85 x 10	45	85	10	60	74
45 x 90 x 10	45	90	10	60	74
45 x 95 x 12	45	95	12	72	89
45 x 100 x 12	45	100	12	72	89
48 x 80 x 10	48	80	10	60	74
48 x 85 x 10	48	85	10	60	74
48 x 90 x 10	48	90	10	60	74
50 x 80 x 10	50	80	10	60	74
50 x 85 x 10	50	85	10	60	74
50 x 90 x 10	50	90	10	60	74
50 x 95 x 12	50	95	12	72	89
50 x 100 x 12	50	100	12	72	89
50 x 110 x 12	50	110	12	87	104
50 x 115 x 12	50	115	12	87	104
52 x 80 x 10	52	80	10	60	74
52 x 85 x 10	52	85	10	60	74
52 x 90 x 10	52	90	10	60	74
55 x 80 x 10	55	80	10	60	74
55 x 85 x 10	55	85	10	60	74
55 x 90 x 10	55	90	10	60	74
55 x 95 x 12	55	95	12	72	89
55 x 100 x 12	55	100	12	72	89
55 x 120 x 15	55	120	15	96	114
55 x 125 x 15	55	125	15	96	114
55 x 130 x 15	55	130	15	96	114
56 x 80 x 10	56	80	10	60	74
56 x 85 x 10	56	85	10	60	74
56 x 90 x 10	56	90	10	60	74
60 x 95 x 12	60	95	12	72	89
60 x 100 x 12	60	100	12	72	89
60 x 110 x 12	60	110	12	87	104
60 x 115 x 12	60	115	12	87	104

Type (S) - (Sa) - (Si)	d mm	D mm	b mm	e ₁ mm	e ₂ mm
60 x 120 x 15	60	120	15	96	114
60 x 125 x 15	60	125	15	96	114
60 x 130 x 15	60	130	15	96	114
62 x 95 x 12	62	95	12	72	89
62 x 100 x 12	62	100	12	72	89
65 x 95 x 12	65	95	12	72	89
65 x 100 x 12	65	100	12	72	89
65 x 120 x 15	65	120	15	96	114
65 x 125 x 15	65	125	15	96	114
65 x 130 x 15	65	130	15	96	114
65 x 140 x 15	65	140	15	116	134
65 x 145 x 15	65	145	15	116	134
67 x 110 x 12	67	110	12	87	104
67 x 115 x 12	67	115	12	87	104
68 x 95 x 12	68	95	12	72	89
68 x 100 x 12	68	100	12	72	89
70 x 110 x 12	70	110	12	87	104
70 x 115 x 12	70	115	12	87	104
70 x 120 x 15	70	120	15	96	114
70 x 125 x 15	70	125	15	96	114
70 x 130 x 15	70	130	15	96	114
70 x 150 x 15	70	150	15	126	144
70 x 160 x 15	70	160	15	126	144
72 x 110 x 12	72	110	12	87	104
72 x 115 x 12	72	115	12	87	104
75 x 110 x 12	75	110	12	87	104
75 x 115 x 12	75	115	12	87	104
75 x 120 x 15	75	120	15	96	114
75 x 125 x 15	75	125	15	96	114
75 x 130 x 15	75	130	15	96	114
75 x 150 x 15	75	150	15	126	144
75 x 160 x 15	75	160	15	126	144
76 x 110 x 12	76	110	12	87	104
76 x 115 x 12	76	115	12	87	104
78 x 110 x 12	78	110	12	87	104
78 x 115 x 12	78	115	12	87	104
80 x 110 x 12	80	110	12	87	104
80 x 115 x 12	80	115	12	87	104
80 x 120 x 15	80	120	15	96	114
80 x 125 x 15	80	125	15	96	114

Mounting fits see page 12 - Tolerance Table page 22.

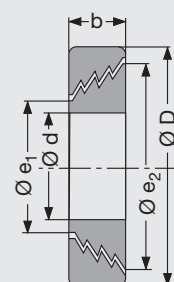
Simply specify seal type and dimensions.

Special dimensions on request.

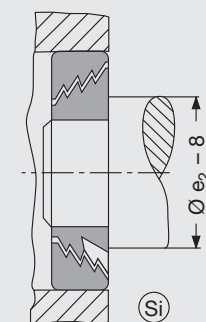
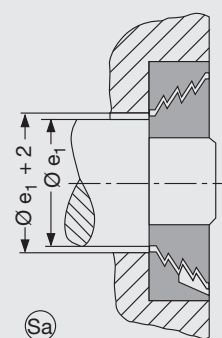
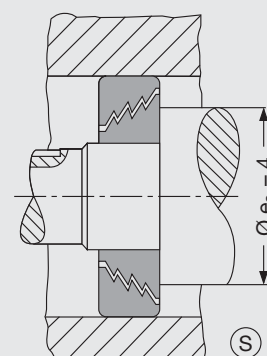
S_a = end play in mounted position (total axial movement of both rings from one end position to the other)

$S_a = 0.5 \text{ mm (0.02")}$ for all sizes

Dimensions



Mounting Dimensions



Type ⑤ - ⑤a - ⑤i	d mm	D mm	b mm	e ₁ mm	e ₂ mm
80 x 130 x 15	80	130	15	96	114
80 x 140 x 15	80	140	15	116	134
80 x 145 x 15	80	145	15	116	134
80 x 170 x 15	80	170	15	146	164
80 x 180 x 15	80	180	15	146	164
82 x 110 x 12	82	110	12	87	104
82 x 115 x 12	82	115	12	87	104
85 x 120 x 15	85	120	15	96	114
85 x 125 x 15	85	125	15	96	114
85 x 130 x 15	85	130	15	96	114
85 x 150 x 15	85	150	15	126	144
85 x 160 x 15	85	160	15	126	144
85 x 170 x 15	85	170	15	146	164
85 x 180 x 15	85	180	15	146	164
90 x 120 x 15	90	120	15	96	114
90 x 125 x 15	90	125	15	96	114
90 x 130 x 15	90	130	15	96	114
90 x 140 x 15	90	140	15	116	134
90 x 145 x 15	90	145	15	116	134
90 x 150 x 15	90	150	15	126	144
90 x 160 x 15	90	160	15	126	144
90 x 190 x 15	90	190	15	166	184
90 x 200 x 15	90	200	15	166	184
95 x 140 x 15	95	140	15	116	134
95 x 145 x 15	95	145	15	116	134
95 x 170 x 15	95	170	15	146	164
95 x 180 x 15	95	180	15	146	164
95 x 190 x 15	95	190	15	166	184
95 x 200 x 15	95	200	15	166	184
100 x 140 x 15	100	140	15	116	134
100 x 145 x 15	100	145	15	116	134
100 x 150 x 15	100	150	15	126	144
100 x 160 x 15	100	160	15	126	144
100 x 190 x 15	100	190	15	166	184
100 x 200 x 15	100	200	15	166	184
105 x 140 x 15	105	140	15	116	134
105 x 145 x 15	105	145	15	116	134
105 x 150 x 15	105	150	15	126	144
105 x 160 x 15	105	160	15	126	144
110 x 140 x 15	110	140	15	116	134

Type ⑤ - ⑤a - ⑤i	d mm	D mm	b mm	e ₁ mm	e ₂ mm
110 x 145 x 15	110	145	15	116	134
110 x 150 x 15	110	150	15	126	144
110 x 160 x 15	110	160	15	126	144
110 x 170 x 15	110	170	15	146	164
110 x 180 x 15	110	180	15	146	164
110 x 190 x 15	110	190	15	166	184
110 x 200 x 15	110	200	15	166	184
115 x 150 x 15	115	150	15	126	144
115 x 160 x 15	115	160	15	126	144
120 x 150 x 15	120	150	15	126	144
120 x 160 x 15	120	160	15	126	144
120 x 170 x 15	120	170	15	146	164
120 x 180 x 15	120	180	15	146	164
125 x 170 x 15	125	170	15	146	164
125 x 180 x 15	125	180	15	146	164
130 x 170 x 15	130	170	15	146	164
130 x 180 x 15	130	180	15	146	164
130 x 190 x 15	130	190	15	166	184
130 x 200 x 15	130	200	15	166	184
135 x 170 x 15	135	170	15	146	164
135 x 180 x 15	135	180	15	146	164
138 x 170 x 15	138	170	15	146	164
138 x 180 x 15	138	180	15	146	164
140 x 170 x 15	140	170	15	146	164
140 x 180 x 15	140	180	15	146	164
140 x 190 x 15	140	190	15	166	184
140 x 200 x 15	140	200	15	166	184
148 x 190 x 15	148	190	15	166	184
148 x 200 x 15	148	200	15	166	184
150 x 190 x 15	150	190	15	166	184
150 x 200 x 15	150	200	15	166	184
155 x 190 x 15	155	190	15	166	184
155 x 200 x 15	155	200	15	166	184
160 x 190 x 15	160	190	15	166	184
160 x 200 x 15	160	200	15	166	184

Design and dimensions are subject to changes

Mounting fits see page 12 – Tolerance Table page 22.

Examples how to optimize the sealing efficiency:

Problem: Liquid splash directly on to the sealing gap

Solution: You should place a disc in front of the seal rotating with the shaft. Care should be taken that there is enough distance between the seal and the disc to allow for free flow back of infiltrating liquid without backup in front of the seal.

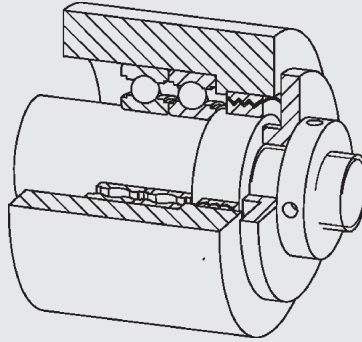
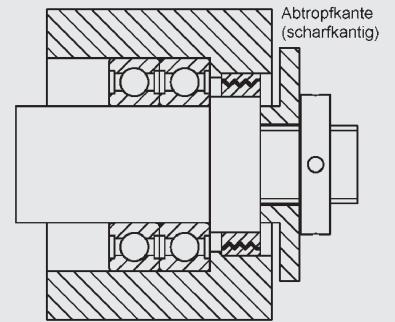


Figure 14



Problem: Large quantities of liquids facing the seal

Solution:

- Please prepare drain areas or drain holes in front of the seal to avoid liquid backup.
- Use of the "M"-Type seal with sufficiently dimensioned drain groove and drain hole
- The grooves of the "M"-Type seal may be used to improve the seal efficiency by using an air porch system to blow penetrating liquid out of the system.

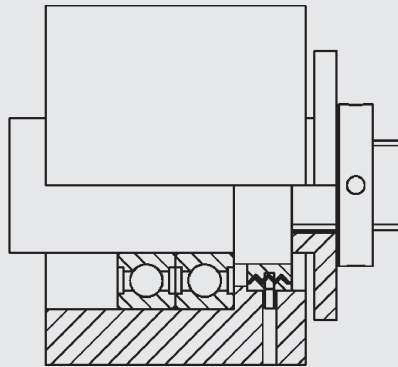
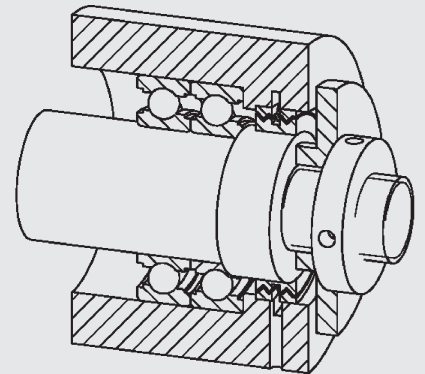


Figure 15



Problem: Very large amount of liquids – pressure gradient

Solution: You should try to prepare enough space for the sealing assembly, to allow using two labyrinth seals side by side with a parallel spacer of at least 5 mm width in between. Thus penetrating liquids may calm down and may be drained back by an annular groove and an a drain hole placed in between the two seals.

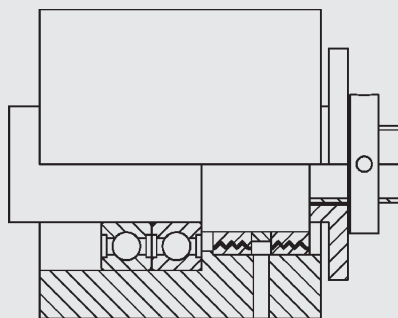
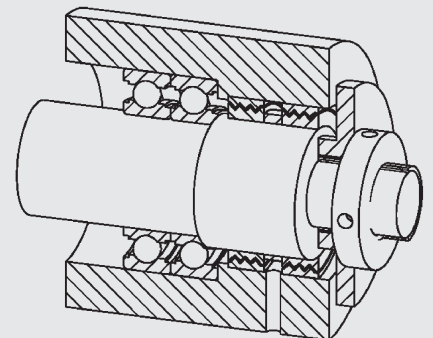


Figure 16

Abflussbohrung



Sealing a high frequency grinding spindle

The GMN Labyrinth Seal "L" Type has to protect the high precision bearings against grinding chips and lightly splashing liquids.

The excess pressure caused by the oil mist lubrication increases the sealing efficiency. To protect the seal against splashing liquids when the spindle is stationary an additional front plate should be used.

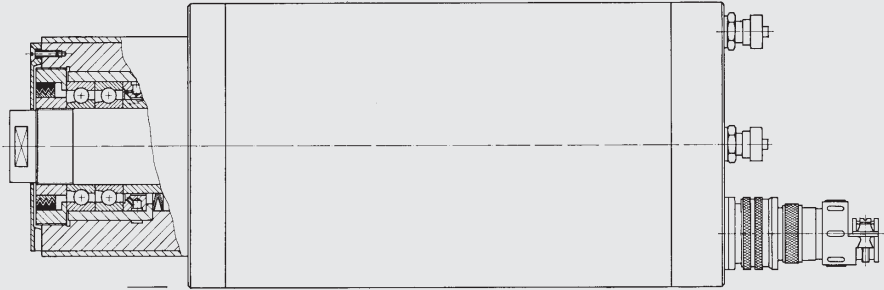


Figure 17

Sealing a drilling sleeve

The grease lubricated bearings have to be protected against cutting oil and chips. Due to the vertical mounting position the flange must be designed correctly because it is not possible to protect the inside against vertical splashing liquids by an uncovered non-contact seal.

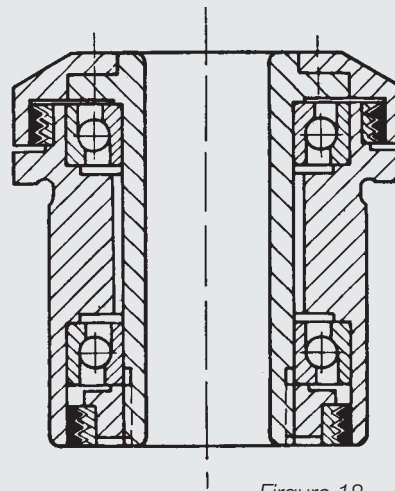


Figure 18

Sealing a conveyer roller

The grease lubricated ball bearing of the roller has to be protected against dust and coarse granular contamination from the outside.

Mounting

For mounting a bushing is used to push the seal onto the shaft and into the housing in one operation. To reach wobblefree running make sure that the inner ring is square against the shoulder of the shaft.

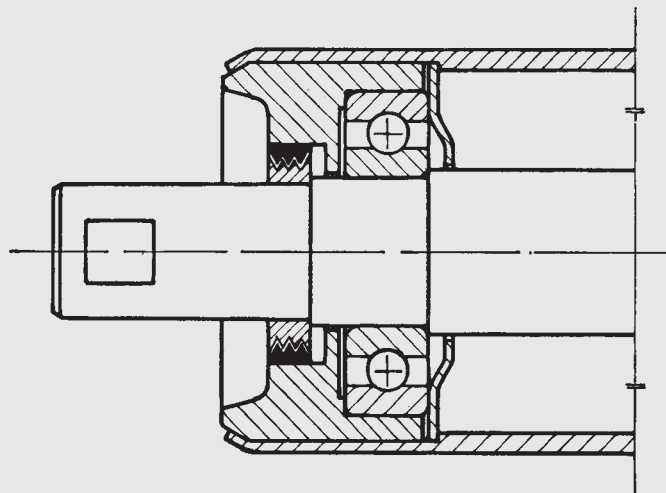


Figure 19

Sealing a gearbox with oil-level up to the middle of the shaft

With this application it is absolutely necessary to use a contact seal to keep the lubricant inside the gearbox. It is impossible to use a non-contact seal if the level of the lubricant is higher than the sealing diameter.

A GMN Gap Seal is used to protect the lip seal against rough contamination and to increase the life of the whole sealing system.

Mounting:

There is no axial limitation for the mounting depth of the GMN Gap Seal. Therefore it is necessary to true the face of the seal to the face of the housing. The face of the housing has to be square to the housing bore.

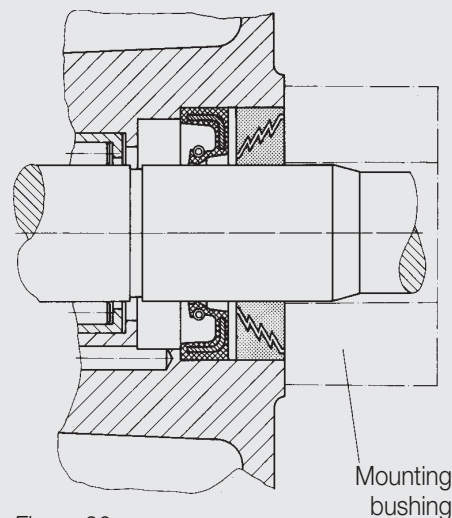


Figure 20

Sealing a spindle bearing (machine tool)

This figure shows an application, where two GMN Gap Seals are used with opposite sealing directions. One is protecting the bearing against penetration of coolant and dust. The other one is used

to keep the grease inside the spindle. To obtain the best sealing function a spacing ring on the shaft with at least 2 mm width should be used.

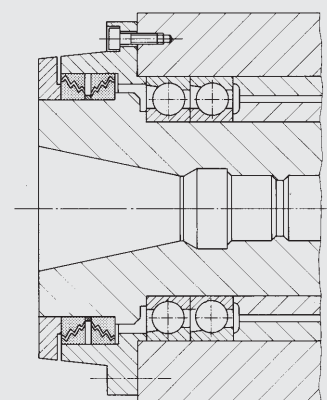


Figure 21

Sealing a grease lubricated antifriction bearing

To keep the grease inside the unit and to prevent penetration of dust, coarse granular contamination and light splashing liquids, two GMN Gap Seals in opposite sealing

directions can be used. One facing the lubricant, the other facing the contaminant. To get the best sealing function a spacing ring is placed between the two inner rings.

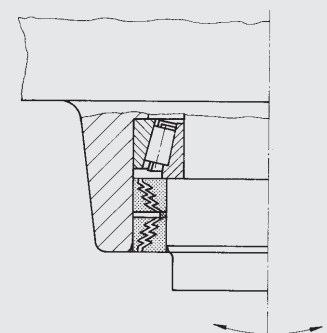


Figure 22

Sealing a conveyer roller

Conveyer rollers have to fulfill the same requirements as transport cylinders. Figure 24 shows a specially designed GMN

Gap Seal (S) Type protecting grease lubricated antifriction bearings against splashing fluids, dirt or dust.

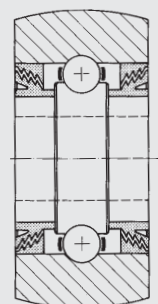


Figure 23

Sealing a spindle bearing (machine tool)

Against heavy splashing coolant the spindle bearing of a machine tool is protected by a GMN Gap Seal (Sa) Type with drain. To protect the seal against splashing coolant

while the spindle is stationary a cover plate can be placed in front of the seal. Please allow for a drain hole in the housing.

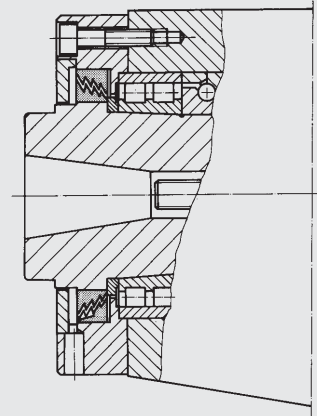


Figure 24

Sealing an automotive wheel bearing

For this application we recommend a GMN Gap Seal (S) Type filled with grease as additional sealing to prevent the penetration

by splashing liquids, dirt and dust. Ease of mounting for car repair purposes is achieved by this design.

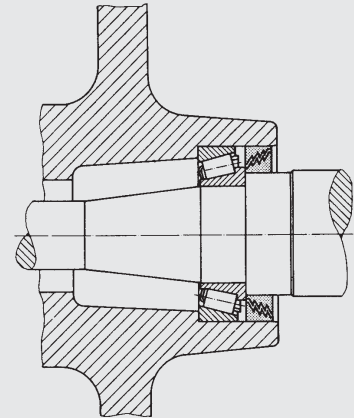


Figure 25

Sealing a work spindle

(two different working positions)

A work spindle should be used for two applications with minimum change of parts. Only the cover plate and the seal housing are to change.

Figure 27a shows an application with the sealing location on the bottom. The cover plate is designed with drain holes for centrifuging out penetrating liquids.

Figure 27b shows the design of the cover plate without drain holes if heavy splashing liquids are applied to a seal on top of the assembly.

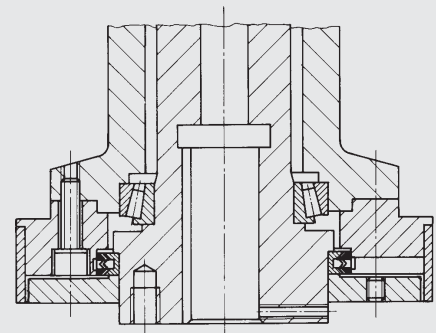


Figure 26a

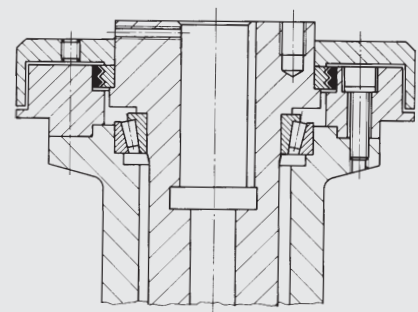


Figure 26b

Housing

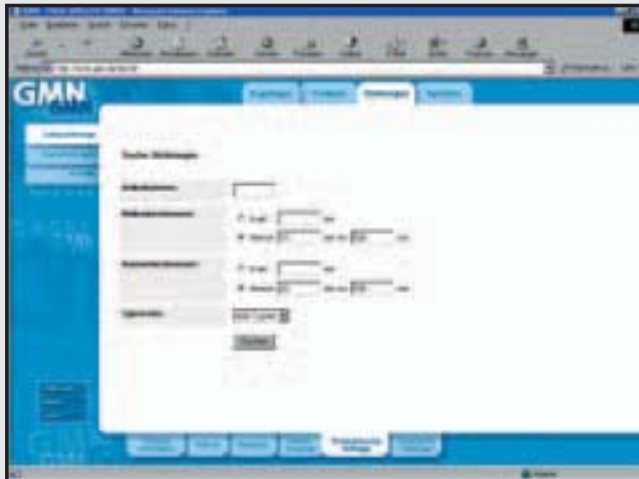
Housing	Extract of DIN ISO 286-2						
Normal size in mm above to	Housing tolerance in 0.0001 inches (0.001 mm)						
	10 18	18 30	30 50	50 80	80 120	120 180	180 250
K7	+ 2 (6) - 5 (12)	+ 2 (6) - 6 (15)	+ 3 (7) - 7 (18)	+ 4 (9) - 8 (21)	+ 4 (10) - 10 (25)	+ 5 (12) - 11 (28)	+ 5 (13) - 13 (33)
M7	0 - 7 (18)	0 - 8 (21)	0 - 10 (25)	0 - 12 (30)	0 - 14 (35)	0 - 16 (40)	0 - 18 (46)
N7	- 2 (5) - 9 (23)	- 3 (7) - 11 (28)	- 3 (8) - 11 (33)	- 3 (9) - 13 (39)	- 4 (10) - 15 (45)	- 5 (12) - 20 (52)	- 6 (14) - 24 (60)
H7 additional glueing of the aluminium outer ring necessary	+ 7 (18) 0	+ 8 (21) 0	+ 10 (25) 0	+ 12 (30) 0	+ 14 (35) 0	+ 16 (40) 0	+ 18 (46) 0
G7 additional glueing of the aluminium outer ring necessary	+ 9 (24) + 2 (6)	+ 11 (28) + 3 (7)	+ 13 (34) + 4 (9)	+ 16 (40) + 4 (10)	+ 18 (47) + 5 (12)	+ 21 (54) + 6 (14)	+ 24 (61) + 6 (15)

Shaft

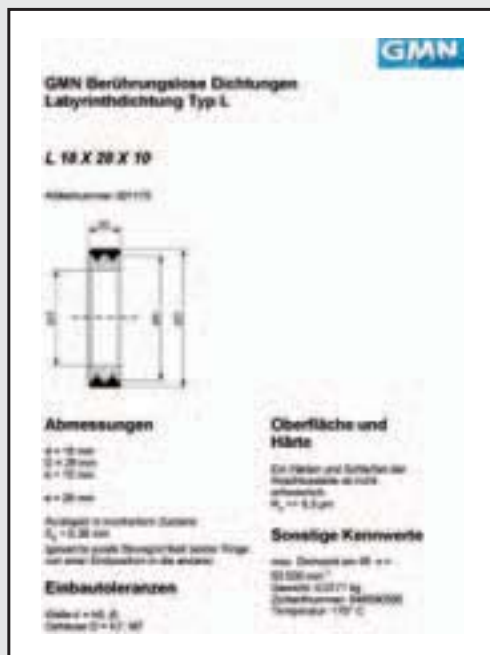
Shaft	Extract of DIN ISO 286-2						
Normal size in mm above to	Shaft tolerance in 0.0001 inches (0.001 mm)						
	10 18	18 30	30 50	50 80	80 120	120 180	180 250
h6	0 - 4 (11)	0 - 5 (13)	0 - 6 (16)	0 - 7 (19)	0 - 9 (22)	0 - 10 (25)	0 - 11 (29)
h7	0 - 7 (18)	0 - 8 (21)	0 - 9 (25)	0 - 11 (30)	0 - 13 (35)	0 - 15 (40)	0 - 18 (46)
k6	+ 5 (12) + 0 (1)	+ 6 (15) + 1 (2)	+ 7 (18) + 1 (2)	+ 8 (21) + 1 (2)	+ 10 (25) + 1 (3)	+ 11 (28) + 1 (3)	+ 13 (33) + 2 (4)
g6 additional glueing of the steel inner ring necessary	- 2 (6) - 7 (17)	- 3 (7) - 8 (20)	- 4 (9) - 10 (25)	- 4 (10) - 11 (29)	- 5 (12) - 13 (34)	- 6 (14) - 15 (39)	- 5 (15) - 17 (44)
f7 additional glueing of the steel inner ring necessary	- 6 (16) - 13 (34)	- 8 (20) - 16 (41)	- 10 (25) - 20 (50)	- 12 (30) - 24 (60)	- 14 (36) - 28 (71)	- 17 (43) - 33 (83)	- 20 (50) - 38 (96)

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