M SEALS
- Part of Diploma PLC

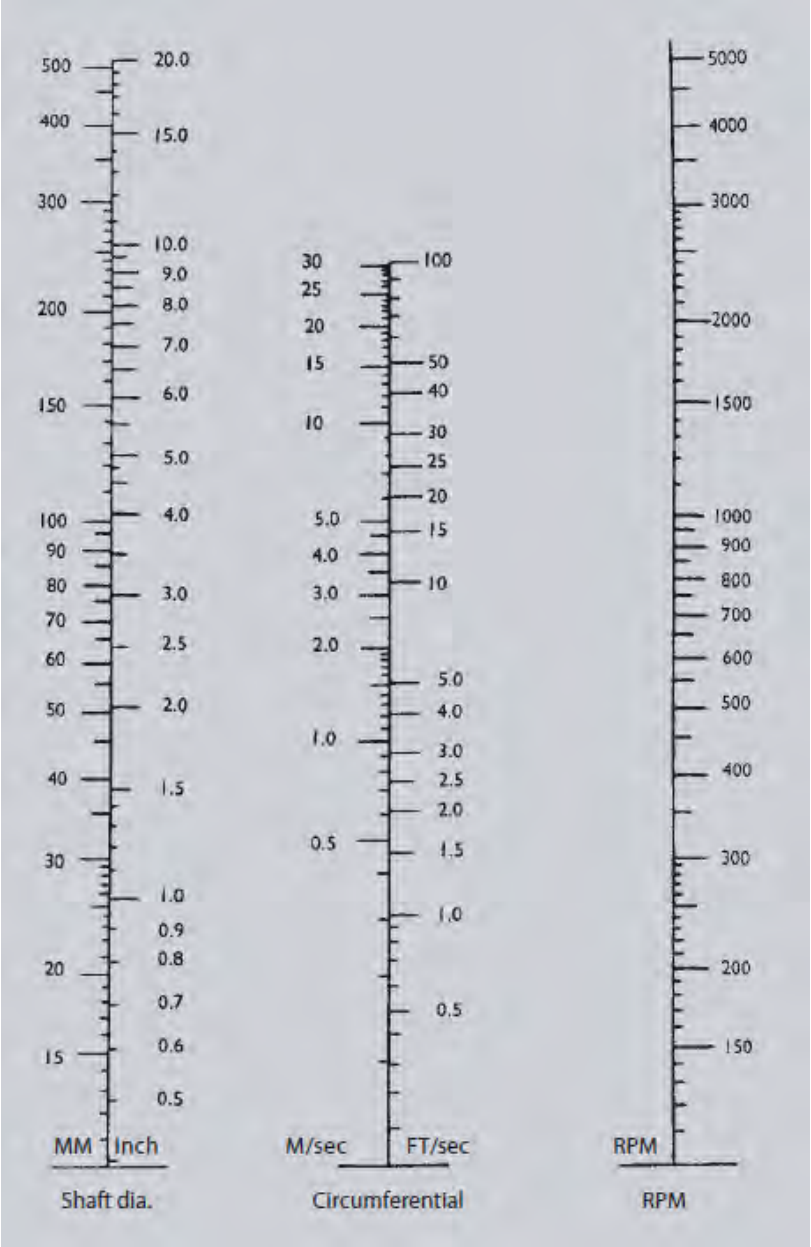
Oil Seals | V-Rings

Durable, Versatile & Reliable

Small things make **GREAT** things possible

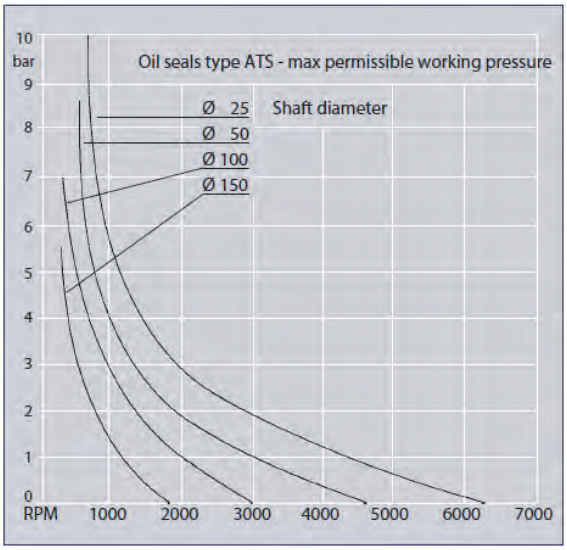
Contents

Shaft Seals/Oil Seals



To calculate circumferential speed, connect shaft diameter on left hand scale and RPM on right hand scale with a straight line and read off peripheral speed where line crosses centre scale.

MAX. PERMISSIBLE PRESS. FOR TYPE AT/ATS (REF. PAGE 10)



Oil Seals for Rotary Shafts

STANDARD OIL SEALS WITH METAL INSERT AS DIN 3760

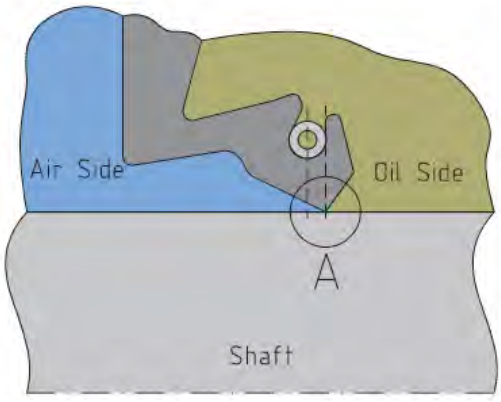
This seal has been designed to give maximum sealing efficiency and longest working life. It is equally suitable for either grease or oil. Water can be sealed if the standard garter spring, and in certain applications also the insert, is replaced with one in stainless steel.

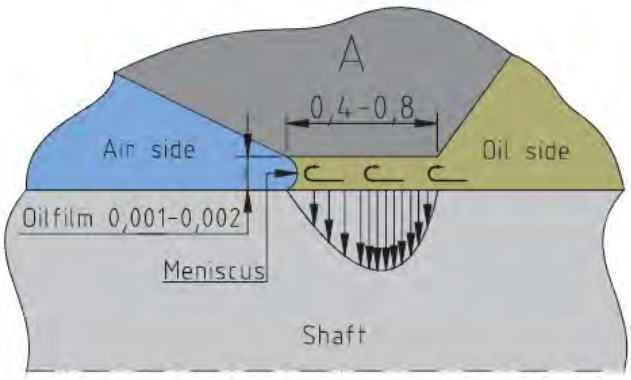
The standard oil seal is intended to be used by fluid pressures up to 0,5 bar. If pressures >0,5bar up to 10 bar are to be sealed, a special design with a shorter and stiffer lip is available - type AT/ATS. See page 10.

FUNCTIONALITY OF OIL SEALS

The sealing lip of an oil seal does not actually run on the shaft, but on an oil film which forms under the lip contact area, through capillary action, shortly after start up. The oil film thickness varies with the viscosity of the oil, shaft surface finish and seal radial load, but has to be approximately 0,001 mm (1µm) to avoid leakage. Any break in the meniscus at the interface between the oil film and the atmosphere will result in leakage. This accounts for leakage occurring when the shaft contains a longitudinal scratch across the seal path (even as small as 0,025mm).

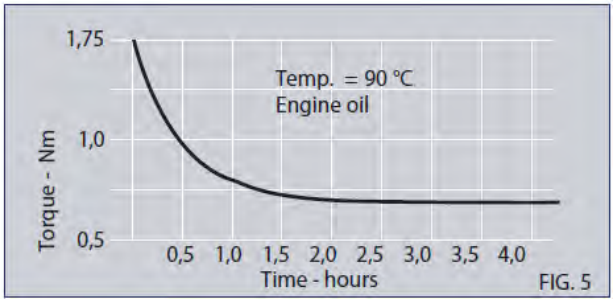
Shaft damage is responsible for a large percentage of seal leakage; therefore care must be taken when handling the shaft, which should be well protected against damage up to the time of fitting by the use of protecting sleeves.





Bedding In, Friction & Seal Life

BEDDING-IN

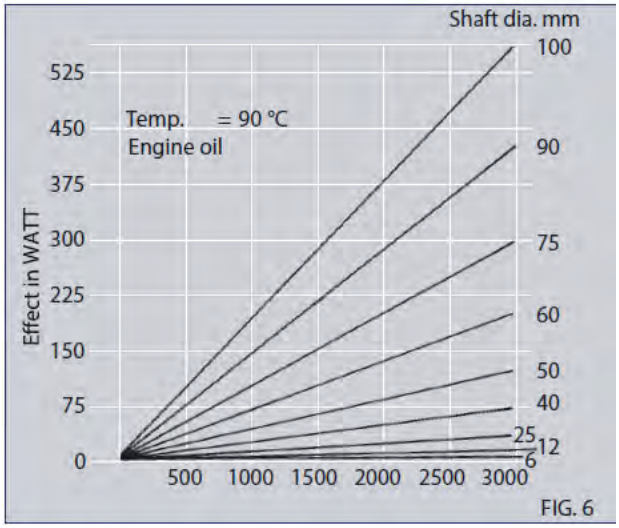


Frictional torque of standard oil seal type A in 70 sh. NBR material. Shaft 75mm and speed 1000 RPM (4 m/sec.).

The lip of the sealing ring has a slight interference to the shaft, which is calculated to ensure an even radial preload. Shortly after a seal has been put in service, the lip, which is sharp-edged from the manufacturing, will become bedded in, and a smooth contact surface is formed. Fig. 5 shows that this will normally take place within a few hours, after that, the friction will be near to constant. The temperature during the bedding-in period is higher than the normal service temperature, therefore lubrication is important. After that, the seal should be left undisturbed. Removal and refitting of an oil seal is not recommended, but a new seal should be fitted after dismantling.

FRICTION

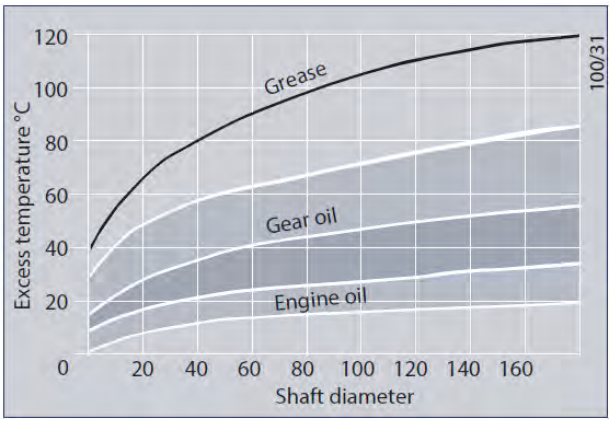
The power loss by friction is significantly increasing with the peripheral speed as shown in fig.6. Other parameters like shaft material, surface roughness, lubrication fluid and the operating temperature impact on the friction power loss.



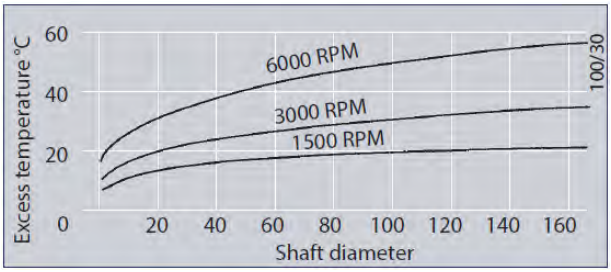
Effect of shaft RPM on Frictional Power Loss of a standard oil seal type a in NBR 70.

SEAL LIFE

The lifetime of a sealing material depends on the temperature and nature of the oil or fluid to which the seal has been exposed. The effective temperature that determines the life is the local temperature at the sealing edge.
The figure is a product of the temperature of the surrounding oil and metal, plus the heat generated by friction. The friction is related to the speed and the shaft surface. By oil lubrication, the local excess temperature is normally 10-30°C, depending on speed, shaft dia. and lubrication (see figures below).
Factors that have great influence on seal life are; shaft finish should be smooth, shaft diameter to be as small as possible, speed as low as possible, temperature as low as possible, the sealing material selected according to the application, the fluid has to be a good lubricant and has to be well circulated, the radial pressure of the lip low, and the heat dispensing properties of the shaft and housing must be good.



The type and amount of lubricant present can have a marked effect on excess temperature generated. The graph illustrates the possible variation between oil and grease and the effect of the oil level. The lower curve for each kind of oil is for a seal fully submerged and the upper for the oil level just touching the bottom of the shaft.



To keep the under-lip temperature low the surrounding Conditions should dissipate the heat quickly. This can best be achieved with good lubrication and oil circulation. The graph shows how shaft speed affects the excess underlip temperature generated by seals of varying diameters.

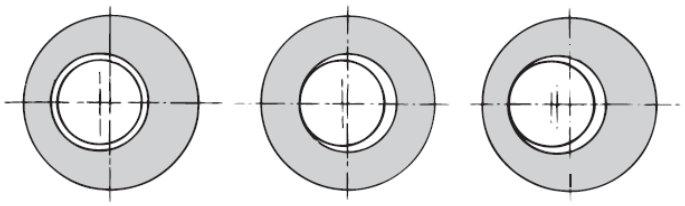
The Shaft

SHAFT MATERIAL

Shaft diameter	Tolerance h11	Shaft diameter	Tolerance h11
7-10	+0 -0,09	81-120	+0 -0,22
11-18	+0 -0,11	121-180	+0 -0,25
19-30	+0 -0,13	151-250	+0 -0,29
31-50	+0 -0,16	251-315	+0 -0,32
51-80	+0 -0,19	316-400	+0 -0,36

Mild steel is well suitable as material for the shaft. Heat treatment or nitriding should be considered if dirt or grit is present.

Castings, especially SG-iron and tempered castings, perform well as shaft material or for sleeves, but must be free from porosities wider than 0,05mm in the track for the lip. When sealing for water and water emulsions is wanted, non-ferrous metals can be used - or better stainless steel AISI 302. These materials are less resistant to wear compared to the types of stainless steel that can be hardened, like AISI 420, but are less resistant to corrosion, so a balance between the desired properties must be found. Plastic materials are in general poor heat conductors, and the use of these materials as shafts or sleeves is not recommended. Ceramic sleeves are very wear resistant, and are used in demanding applications.



Offset housing bore
- causing heavy wear on one side of the seal

Run-out
- shaft whip causes oil leakage at high speeds.

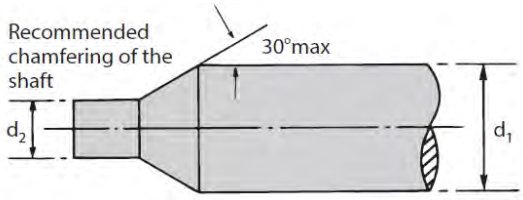
Offset house AND Run-out
- worst condition.

ECCENTRICITY

It is naturally desirable for efficient sealing that the shaft should run dead true, but in practice, a certain amount of eccentricity has to be accepted. Oil seals are designed so they can follow the movement of the shaft within certain limits by its flexible resilient lip. Offset of the housing is not so serious as run-out of the shaft (shaft whip), since the latter involves alternating displacement of the sealing lip at a frequency determined by shaft speed. Acceptable run-out of the shaft in relation to the speed can be found in fig. 8.

Recommended chamfer

Shaft diameter d1	d1-d2	Shaft diameter d1	d1-d2
10	1,5	51-70	4,0
11-20	2,0	71-95	4,5
21-30	2,5	96-130	5,5
31-40	3,0	131-240	7,0
41-50	3,5	241-400	11,0



For the section of the shaft where the sealing lip tracks, a hardness of min. 45 HRC is recommended acc. to DIN3760. By circumferential speeds >4 m/sec, the recommended hardness should be 55 HRC and >10 m/sec 60 HRC.
Machining the shaft by grinding is preferable to turning and polishing, and plunge grinding is preferable to traverse grinding, but not essential.
The surface should be as smooth as possible, taking in consideration the production limitations and cost. A surface roughness of 0,2 to 0,8 µm Ra (1,0-3,2 Rz) is satisfactory for most applications. A table of recommended tolerances for the shaft is above on the left.

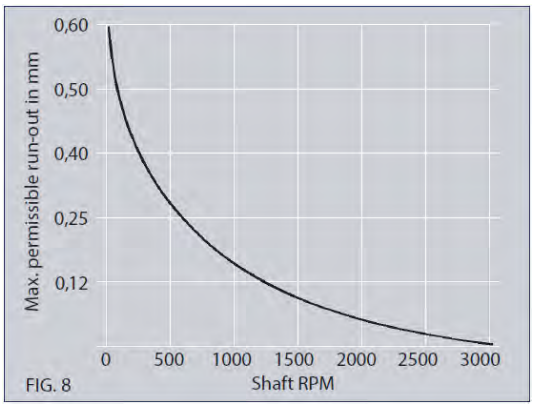


FIG. 8

Fig. 8 indicates broadly the amount of run-out or whip that can be accommodated by standard oil seals at various shaft speeds. When both shaft and housing are eccentric, the max. permissible eccentricity can be regarded as the sum of both. Oils seals with helix hydrodynamic lip are generally capable of taking higher eccentricity than with plain lip.

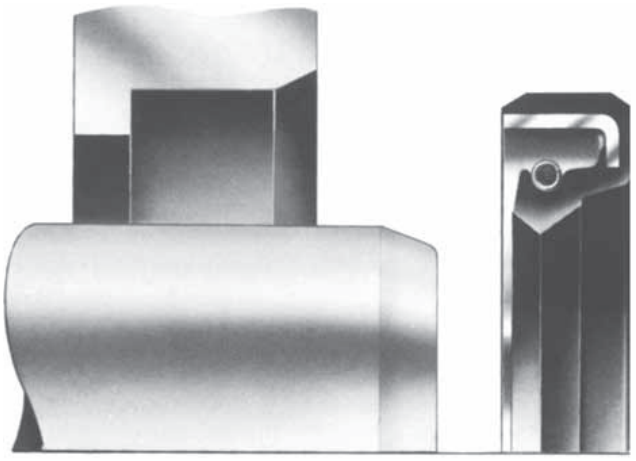
The Housing

HOUSING FOR OIL SEALS

The recess or housing, into which the oil seal is to be pressed, should be machined to the correct tolerance (see table below), and be smooth and free from longitudinal scratches that could provide a leak path for oil. For use with oil seals with outside rubber covering, it is essential that the bore is duly chamfered according to table 9.

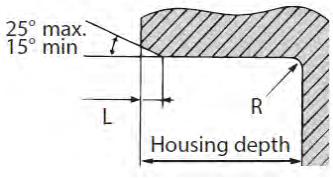
To ensure correct location of the seal, a flange or shoulder should be provided against which the seal can be pressed. If impracticable, care should be taken to press the seal flush with a machined face on the housing so it will be square to the shaft. Where the house consists of a separate part e.g. a cap, end plate or bearing cover, it should be centralised by means of a spigot and sealed so no secondary leak path is formed - see fig12.

From the factory, the rubber covered oil seal is provided with the necessary interference fit to ensure that is it secured and leakless. However, if oil temperature is high, combined with a slight pressure, the oil seal should be secured with a circlip.



Typical housing and shaft for an oil seal.

Fig.9



Metric H8				Inch	
Housing Ø	Tol.	Housing Ø	Tol.	Housing Ø	±
6-10	+0,022 -0	50-80	+0,046 -0	0"-4" (inclusive)	0,0010
10-18	+0,027 -0	80-120	+0,054 -0	4"-7" (inclusive)	0,0015
18-30	+0,033 -0	120-180	+0,063 -0		
30-50	+0,039 -0	180-250	+0,072 -0	Over 7"	0,0020

Nominal width b	Housing bore depth	Chamfer length	Max. radius
up to 10	b + 0,9	0,70 - 1,00	0,50
Over 10	b + 1,2	1,20 - 1,50	0,75

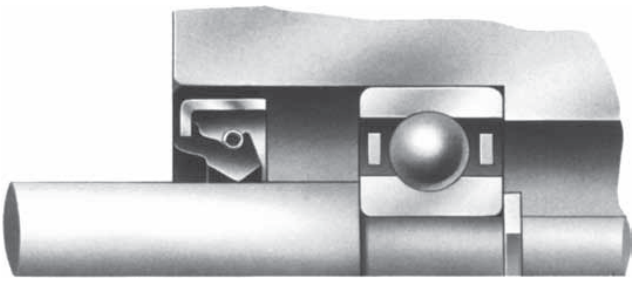


Fig.11: Seal assembled flush with machined face

SURFACE

The surface of the bore should be < 3,2 µm Ra.

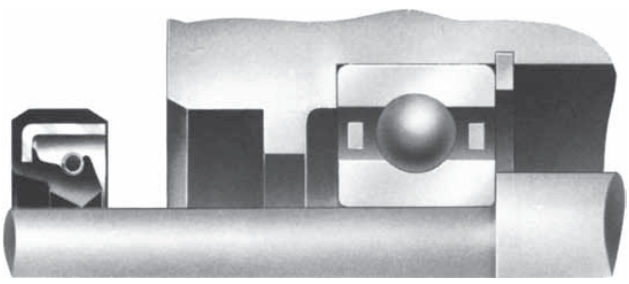


Fig.10: Housing recess with locating flange

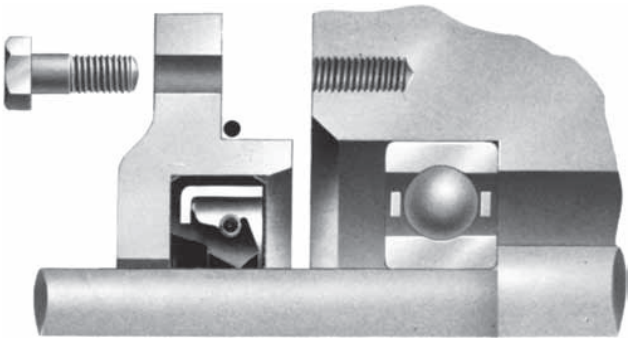


Fig.12: Separate housing with centralising spigot

Fitting & Lubrication

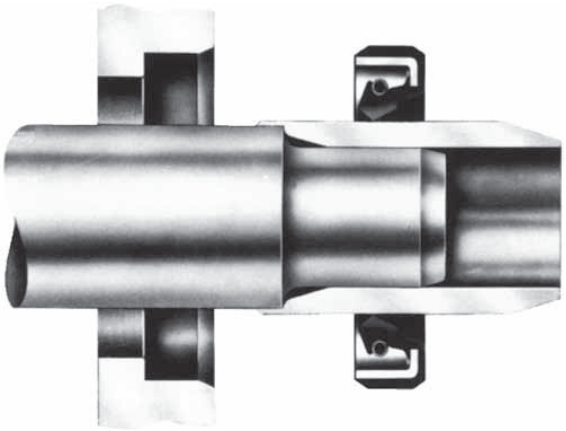
FITTING

The majority of failures and leakage of oil seals are due to improper fitting which causes damage to both seal and shaft sealing surface. Strict attention to the following rules is essential if good results are to be obtained.

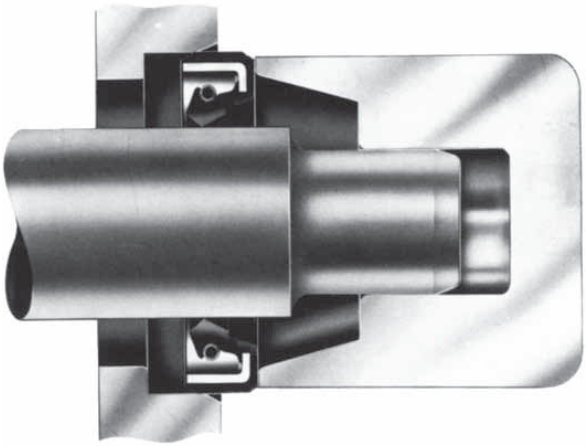
1. Before fitting, examine the seal to ensure that it is clean and undamaged.
2. Smear the sealing lip with clean grease. Seals used as dust excluders should be packed with grease and double seals should be packed between the lips.
3. If a spring is provided, see that it is correctly located.
4. Normally, the spring side of the sealing lip should face the fluid to be sealed.
5. Examine the shaft and remove all roughness, sharp edges of keyways, screw threads or shoulders over which the sealing lip is passed. Shaft edges and shoulders should be well rounded or chamfered, and where this not practicable, a fitting sleeve with a lead-on taper and a diameter slightly greater than the shaft, should be used.
6. When pressing the seal into the housing, a firm uniform pressure should be exerted e.g. by an arbor press with a suitable tool. The diameter of the tool should be slightly less than the diameter of the housing (0,1-0,4mm). The outside of the seal should be smeared with grease to ease the fitting. Care should be taken to ensure the seal does not enter the recess in a tilted position, as this will cause the rubber skin to be damaged.

LUBRICATION

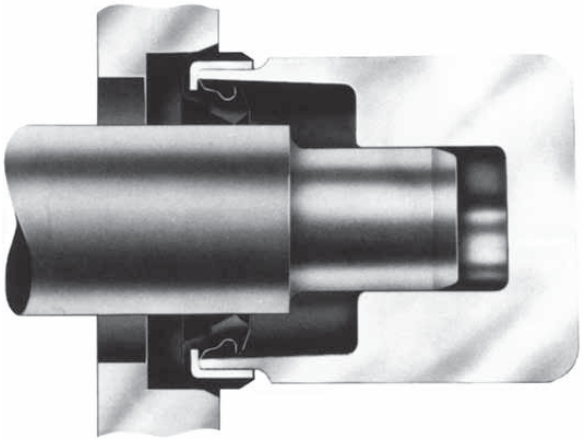
Sometimes the mechanical construction is such that it will take some considerable time after starting up for the oil supply to reach the seal. In these cases, more care than usual should be taken by the fitter to ensure that the sealing lip is properly greased on assembly. This precaution will secure lubrication of the seal for a period before the oil is in full circulation.



A fitting sleeve like this will ease the mounting and take care of the sealing lip.



Correct method of fitting oil seals into a housing recess with a special device called a “bell piece”. If the seal has to be fitted “backwards”, the spring must be removed and replaced after the seals are pressed fully in.



Material Selection Guide

The temperature ranges relate to actual operating conditions and are for general guidance only. Many factors influence the absolute upper and lower temperature limits within which a seal will function successfully.

NBR (ACRYLONITRILE-BUTADIENE)

Temp range: -20 / +100°C (-4 / +212°F).
This is the nitrile-based standard material that is recommended for the majority of conventional fluid sealing applications. Particularly recommended for sealing mineral oils and greases. Low friction.

FPM (VITON™ - FLUOROCARBON ELASTOMER)

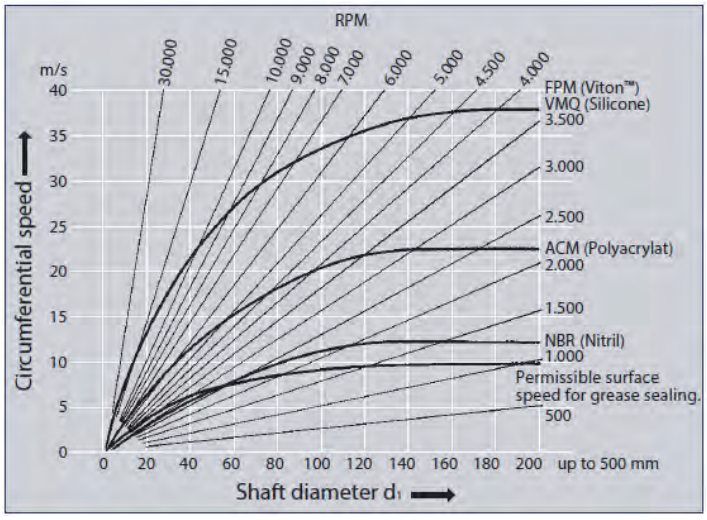
Temp range: -20 / +200°C (-4 / +392°F).
FPM is highly resistant to most oil and grease types and is recommended in sealing applications with high temperature, high speed, fuels and certain solvents. Fitted as standard with spring of stainless steel AISI 302.

HNBR (HYDROGENATED ACRYLONITRILE-BUTADIENE)

Temp range -30 / +150°C (-22 / +302°F).
HNBR has the same good oil resistance as NBR, but also good resistance to ozone, alkalis and amines. Better mechanical properties, especially abrasion resistance and enhanced high temperature properties.

PTFE (TEFLON, POLYTETRAFLUOROETHYLENE)

Temp range: -60 / +220°C (-76 / +428°F).
This material has exceptional qualities not found in elastomeric materials. Its wide temperature range, very low frictional properties and resistance to practically all known fluids makes it a good material for some difficult applications.



This graph will assist in choosing the right material to meet speed and temperature conditions in the application. Select shaft diameter from bottom index and shaft RPM from top and right index. Choose material above the point where they cross.

FOOD COMPATIBLE MATERIALS

Where the sealing material is in contact with food and drinking water, and for use in pharmaceutical applications, we can offer rubber materials which have been tested in compliance with various regulations like FDA, NSF, WRAS and USP.

SPRINGS

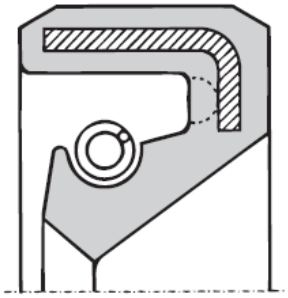
Oil seals are normally supplied with springs made of plain spring steel. By sealing water and water emulsions, it is recommended to use springs of stainless steel. M Seals carry stock of springs in AISI302, and offer an exchange on request.

INSERT/HOUSING

The insert are normally made of mild steel, but we can offer on request inserts of stainless steel.

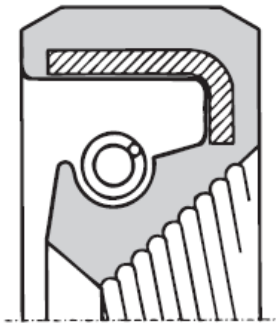
Typical Specifications		NBR	HNBR	FPM
Max/min. service temperature	± 2°C	-20° +100°	-30° +150°	-20° +200°
Max. recommended service speed	mt/sec	10-12	10-12	40-45
Hardness	± 3 Shore A	73°	70°	75°
Tensile strength (ASTM D 412 C)	kg/cm²	≥165	≥135	≥135
Elongation (ASTM D 412 C)	%	≥300	≥175	≥160
Tear strength (ASTM D 624 C)	kg/cm	≥37	≥30	≥25
Compression set (ASTM D 395)	%	70h / 100°C 10	24h / 150°C <30	70h / 200°C 17
Specific gravity	±0,002 gr/cm³	1,20	1,17	1,91

Types



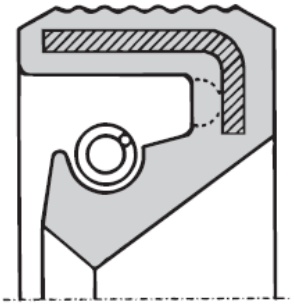
TYPE A+AI

Standard type according to DIN3760. Equipped with a rubber coating on the outside, which ensures a good seal in the housing. Can be supplied with hydrodynamic helix-ribs on the lip for back-pumping of any leaked oil. Particularly recommended for applications that suffer from high eccentricity or vibrations and can be designed for bi-directional or specific direction operation.



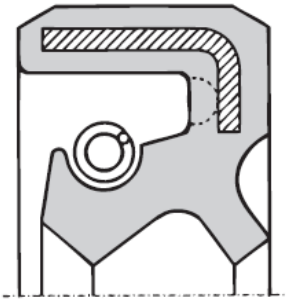
TYPE AG

Commonly used in food and pharmaceutical industries, designed to provide a high level of hygiene. Features a stainless steel casing with a lip seal made of FDA-approved elastomer material. Has a secondary dust lip to prevent contaminants from entering the housing. Type AG is typically used in applications with low to medium speeds and pressures. Note: Requires special tools.



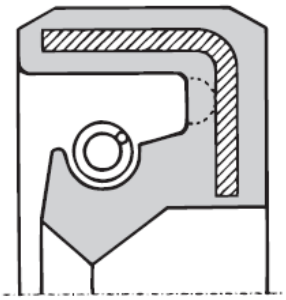
TYPE AX+AXI

Like type A/AS, but the outer circumference is corrugated. This design facilitates the installation of the seal and allows for a closer fit. This can ensure better static sealing - especially where the housing is subject to high thermal expansion.



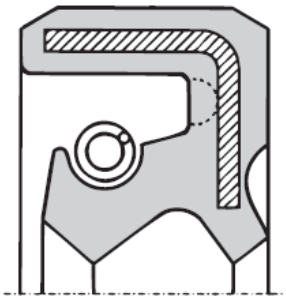
TYPE AS+ASI

Similar to type A, but with an additional dust lip. The dust lip protects the shaft and main sealing lip under certain service conditions where the oil seal is exposed to dust or dirt, e.g. high pressure cleaning. In some applications, it might accumulate dirt between the two lips, and score the shaft more rapidly than with a type A seal without the dust lip.



TYPE AT

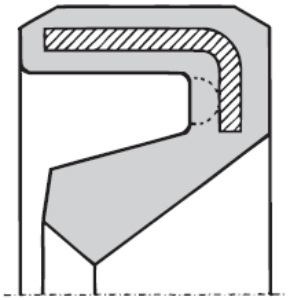
Designed to perform optimally under high pressure (0,5-10 bar) and speed conditions. Its durable elastomer lip seal, which is spring-loaded and housed within a metal casing, provides a secure and effective seal against the shaft. The self-supporting lip ensures a reliable fit, while the secondary dust lip prevents the ingress of contaminants.



TYPE ATS

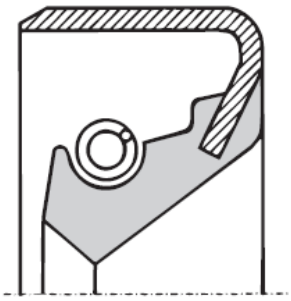
Similar to Type AT but with a secondary dust lip to prevent contaminants from entering the housing.

This type can be supplied in 110 standard sizes, or in other sizes upon request.



TYPE AUF

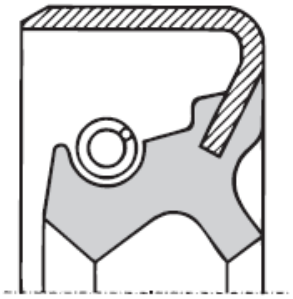
Designed without any spring loading mechanism. It is typically utilised in narrow constructions, especially in sealing needle bearings. The primary purpose of this type of seal is to prevent the entry of dust or grease into the bearings, thereby ensuring their proper functioning.



TYPE B+BI

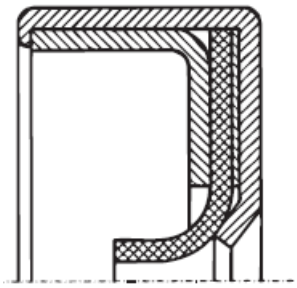
This type is without rubber covering on the outside. Used under conditions where maximum heat transfer to the housing is desired. Compared to type A, this seal demands a better finish of the housing bore in order to secure a proper secondary sealing, but on the other hand, a better fastening can be achieved, eventually by gluing.

Types



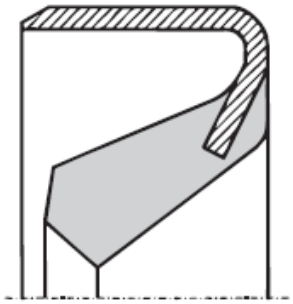
TYPE BS+BSI

Like type B, but with additional dust lip in both metric inch sizes (BSI).



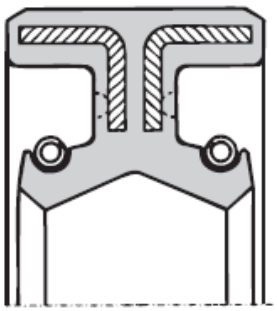
TYPE BP

Stainless steel housing with sealing lip in PTFE. Very low friction and very good resistance to high temperature and chemical attacks. Can be specified for speeds up to 30 m/sec., and for a certain degree of dry-running. Can be used at pressures up to 10 bar (20 bar in special design) considering the speed. Low breakaway force after long time of standing still. Only oil seal to work between -60 to +220°C (-76 to 428°F).



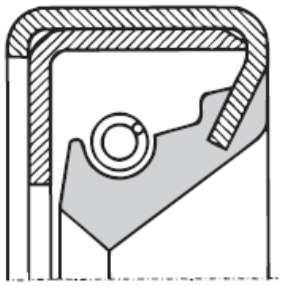
TYPE BUF

Like AUF, but without rubber covering.



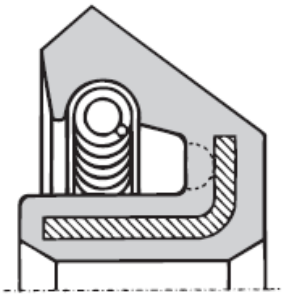
TYPE ADUO

Can be used where two fluids have to be separated. Supplied in certain sizes or as per request



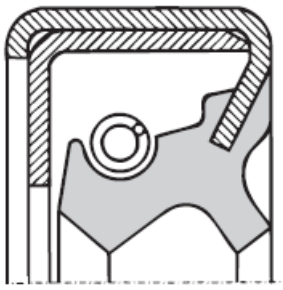
TYPE C+CI

Like type B, but with reinforced housing (double shell). Used where a higher grade of stiffness is desirable, e.g. large dimensions where there is a risk of distorting the ring during the fitting. Thinner inner housing also protects the lip from mechanical impact. Supplied in standard dimensions in metric and inch sizes (CI).



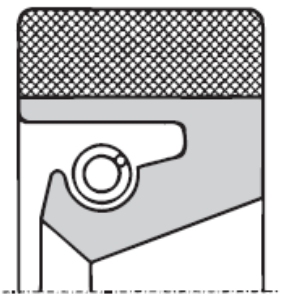
TYPE AE

For external sealing. Used where the housing rotates in relation to a non-rotating shaft, or for relative movement between shaft and housing. If a standard type is used in such applications, the sealing lip will lose its radial force against the shaft due to the centrifugal force. Supplied on request.



TYPE CS+CSI

Like type C+CI, but with additional dust lip.



TYPE DR

Oil seals with fabric reinforcement instead of steel, and with a garter or finger spring. These types are supplied also as split types which allow replacement without removal of the shaft. Need to be fixed axially.

PLEASE SEE PAGE 21-23 FOR MORE DETAILS OF THE HEAVY DUTY AND LARGE DIAMETER SEALS.

Dimensions - Metric Sizes

The sizes in below list marked with • belong to the standards DIN 3760 or SMS2290. All these sizes, and plenty of the other sizes in the list, are normally stocked by M Seals in one or more types, mainly type A and/or AS, in either NBR or FPM material.

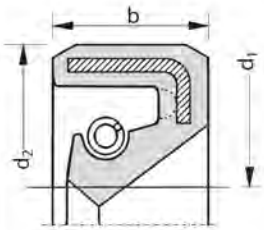
Other sizes and materials can be supplied on request depending on tooling availability. However, type C can be made in all dimensions between Ø20 up to Ø1200 on a single piece basis.

d_1	d_2	b
4	18	12
4	12	6
5	15	6
5	15	7
5	16	6
5	16	7
6	10	2
6	11	4,5
6	12	2
6	14	6
6	19	7,5
6	16	5
6	16	6
• 6	16	7
6	19	5
6	19	6
6	19	7
6	21	7,5
• 6	22	7
7	14	5
7	15	5
• 7	16	7
7	19	6
• 7	22	7
8	12	3
8	15	3
8	16	3,5
8	16	5
• 8	16	7
8	18	5
8	18	6
8	20	5
8	20	7
8	22	6
• 8	22	7
8	22	8
• 8	24	7
8	25	7
8	25	8
8	26	7
8	30	7
9	18	7
9	19	5
• 9	22	7
• 9	24	7
9	25	8
• 9	26	7
9	30	7
10	14	3
10	16	5
10	17	3
10	18	5
10	18	6
• 10	19	7
10	20	5

d_1	d_2	b
10	20	6
10	20	7
10	21	4
10	22	6
• 10	22	7
10	22	8
• 10	24	7
10	25	7
10	25	8
10	25	10
10	26	5,5
10	26	7
10	30	7
10	30	8
11	17	4
11	20	6
• 11	22	7
11	26	7
11	30	7
11	30	10
11	35	10
12	16	3
12	18	3
12	19	3
12	19	5
12	20	5
12	21	5
12	22	4
12	22	5
• 12	22	7
12	22	8
12	24	4,5
12	24	6
• 12	24	7
12	25	5
12	25	7
12	25	8
12	26	7
12	26	8
• 12	28	7
12	28	8
• 12	30	7
12	32	7
12	35	10
12	37	10
13	19	3
13	20	4
13	22	4
13	22	5
13	22	7
13	25	5
13	25	7
13	26	5
13	26	7
13	28	7

d_1	d_2	b
13	30	7
13	30	8
13	32	7
13	35	10
14	20	3
14	20	5
14	21	3
14	22	4
14	22	5
14	22	7
14	24	5
14	24	6
• 14	24	7
14	24	8
14	25	5
14	25	7
14	26	7
14	26	8
• 14	28	7
14	28	8
• 14	30	7
14	30	8
14	30	10
14	32	7
14	34	10
• 14	35	7
14	35	10
14	40	7
15	21	3
15	22	5
15	22	7
15	24	5
15	24	6
• 15	24	7
15	25	3
15	25	7
• 15	26	7
15	27	6
15	27	7
15	28	6
15	28	7
15	30	4
15	30	4,5
15	30	6
• 15	30	7
15	30	8
15	30	10
• 15	32	7
15	32	9
15	33	5,5
15	30	8
15	33	10
15	35	5
15	35	6
• 15	35	7

d_1	d_2	b
15	35	10
15	37	10
15	40	10
15	42	7
15	42	8
15	42	10
15	48	8
15	50	8
16	22	4
16	24	3
16	24	4
16	24	5
16	24	6,5
16	24	7
16	25	7
16	26	7
• 16	28	7
16	30	5
• 16	30	7
16	30	10
16	32	6
• 16	32	7
16	32	10
• 16	35	7
16	35	10
16	38	4
16	40	10
17	23	3
17	25	4
17	26	6
17	27	7
17	28	6
• 17	28	7
17	28	8
17	29	7
17	30	5
17	30	6
• 17	30	7
17	30	8
17	31	7
17	31	10
17	32	5
• 17	32	7
17	33	7
17	33	8
17	34	7
17	35	5
• 17	35	7
17	35	8
17	35	10
17	37	7
17	37	10
17	40	6
• 17	40	7
17	40	8



d_1	d_2	b
17	40	10
17	47	7
17	47	8
18	24	4
18	26	4
18	28	7
• 18	30	7
18	30	8
18	32	4,6
18	32	6
• 18	32	7
18	32	8
• 18	35	7
18	35	8
18	35	10
18	38	7
• 18	40	7
18	40	10
18	42	8
18	47	10
19	27	6
19	29	5
19	30	6
19	30	7
19	30	8
19	31	6
19	32	7
19	32	8
19	32	10
19	35	6
19	35	7
19	35	10
19	36	8
19	37	10
19	38	7
19	40	10
19	42	7
19	46	5,5
19	47	7
20	26	4
20	28	4
20	28	4,5
20	28	6
20	28	7
20	30	4

Other dimensions can be made to order, but may require tooling.
We reserve our right to make changes to the dimension list without notice.

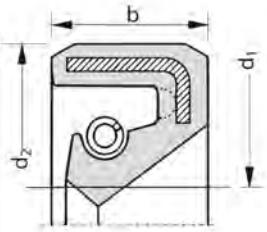
Dimensions - Metric Sizes

d_1	d_2	b
20	30	4,5
20	30	5
20	30	6
● 20	30	7
20	30	8
20	30	10
20	32	5
● 20	32	7
20	32	8,5
20	33	8
20	33	9
20	33	10
20	34	7
20	35	5
20	35	6
● 20	35	7
20	35	8
20	35	10
20	36	7
20	37	8
20	38	7
20	38	8
20	40	4
20	40	6
20	40	7
20	40	8
20	40	10
20	42	6
20	42	7
20	42	10
20	45	7
20	45	10
20	46	8
● 20	47	7
20	47	8
20	47	10
20	48	9
20	52	7
20	52	8
20	52	10
20	60	8
21	29	4
21	30	6,5
21	32	5
21	35	7
21	37	7
21	40	7
21	40	10
21	47	10
22	28	4
22	32	6
● 22	32	7
22	33	6,5
22	35	5
22	35	6
● 22	35	7
22	35	8
22	35	8,5
22	35	10
22	36	7
22	37	7
22	38	8
● 22	40	7
22	40	8

d_1	d_2	b
22	40	8,5
22	40	10
22	42	7
22	42	10
22	45	7
22	45	8
● 22	47	7
22	47	10
22	62	7
23	30	4
23	36	10
23	40	6
23	40	10
23	41	10
23	42	10
23	47	7
23	47	10
24	32	4
24	33	4,5
24	34	5,5
24	34	7
● 24	35	7
24	35	8
24	36	5
24	36	7
24	36	9
● 24	37	7
24	38	8
● 24	40	7
24	40	8
24	40	10
24	42	8
24	42	10
24	45	7
24	45	10
● 24	47	7
24	47	10
24	48	10
24	50	10
24	52	10
25	32	4
25	32	5
25	32	6
25	33	4
25	33	6
25	35	4
25	35	5
25	35	6
● 25	35	7
25	35	8,5
25	35	10
25	36	7
25	36	8
25	36	10
25	37	5
25	37	7
25	37	8
25	38	7
25	38	8
25	40	5
25	40	6
● 25	40	7
25	40	8
25	40	10

d_1	d_2	b
25	42	3
25	42	6
● 25	42	7
25	42	8
25	42	8,5
25	42	10
25	43	9
25	45	7
25	45	8
25	45	10
25	46	6
25	46	7
25	47	6
● 25	47	7
25	47	8
25	47	10
25	48	8
25	49	10
25	50	10
25	50	12
● 25	52	7
25	52	8
25	52	10
25	52	12
25	55	10
25	62	7
25	62	8
25	62	10
25	62	12
26	35	7
26	36	7
26	36	10
● 26	37	7
26	37	10
26	38	5
26	38	7
26	40	6
26	40	10
● 26	42	7
26	42	8
26	42	10
26	45	10
● 26	47	7
26	47	10
26	50	10
26	52	8
26	52	10
27	37	7
27	38	7
27	40	8
27	40	10
27	41	10
27	42	10
27	43	9
27	45	6
27	45	10
27	47	6
27	47	7
27	47	10
27	50	10
27	52	8
27	52	7
28	35	4
28	35	5

d_1	d_2	b
28	35	7
28	37	4
28	38	6
28	38	7
● 28	40	7
28	40	8
28	40	10
28	42	7
28	42	8
28	42	10
28	43	10
28	45	7
28	45	8
● 28	47	7
28	47	8
28	47	10
28	48	8
28	48	10
28	50	8
28	50	10
28	52	5
28	52	6
● 28	52	7
28	52	10
28	56	12
28	62	12
29	40	7
29	42	7
29	42	8
29	45	9,5
29	46	10
29	47	7
30	37	4
30	40	4
● 30	40	7
30	40	8
30	42	4,5
30	42	6
● 30	42	7
30	42	8
30	42	10
30	43	8
30	44	10
30	45	5
30	45	7
30	45	8
30	45	10
30	45	12
30	46	7
30	46	10
30	47	5
30	47	6
● 30	47	7
30	47	8
30	47	10
30	48	8
30	48	10
30	50	5
30	50	7
30	50	8
30	50	10
● 30	52	7
30	52	8
30	52	10



d_1	d_2	b
30	52	12
30	53	10
30	54	10
30	55	7
30	55	10
30	55	12
30	56	10
30	60	10
● 30	62	7
30	62	10
30	62	12
30	65	8
30	68	7
30	72	8
30	72	10
30	75	8
30	75	10
30	80	10
31	47	7
31	47	10
31	52	7
31	62	5
32	42	4
32	42	5
32	42	7
32	42	8
● 32	45	7
32	45	10
32	46	8
● 32	47	7
32	47	8
32	47	10
32	48	7
32	48	8
32	50	8
32	50	10
32	50	12
32	52	5
● 32	52	7
32	52	10
32	52	12
32	54	10
32	55	10
32	56	10
32	56	12
32	58	12
32	62	7
32	62	10
32	65	10
33	45	7
33	46	10
33	48	8
33	50	10
33	52	6

Other dimensions can be made to order, but may require tooling.
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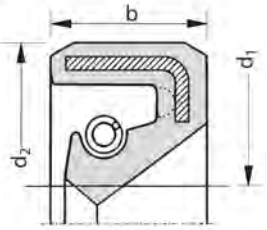
Dimensions - Metric Sizes

d_1	d_2	b
33	52	10
33	56	12
34	44	7
34	45	7
34	46	8
34	46	10
34	47	7
34	48	8
34	50	10
34	52	8
34	52	10
34	58	10
34	62	10
34	72	10
35	42	4
35	42	5
35	42	8
35	45	4
35	45	7
35	45	10
35	47	4,5
35	47	5
35	47	6
● 35	47	7
35	47	10
35	48	8
● 35	50	7
35	50	8
35	50	10
● 35	52	7
35	52	8
35	52	10
35	52	12
35	54	10
35	55	8
35	55	9
35	55	10
35	55	12
35	56	10
35	56	12
35	58	7,5
35	58	10
35	58	11,5
35	58	12
35	60	10
● 35	62	7
35	62	8
35	62	10
35	62	12
35	64	13
35	65	10
35	65	12
35	67	7
35	68	6
35	68	10
35	70	10
35	72	8
35	72	10
35	72	12
35	80	10
35	80	12
● 36	45	6
36	48	10
● 36	50	7

d_1	d_2	b
36	50	10
● 36	52	7
36	52	9
36	52	10
36	55	10
36	56	10
36	58	10
36	58	12
● 36	62	7
36	62	10
36	68	10
36	75	12
37	47	4
37	47	7
37	50	10
37	52	8
37	52	10
57	58	13
37	60	12
37	62	8
37	62	9
37	64	12
38	48	4
38	50	7
38	50	8
● 38	52	7
38	52	8
38	52	9
38	52	10
38	54	5
38	54	6,5
38	54	10
● 38	55	7
38	55	8
38	55	10
38	56	10
38	57	10
38	58	10
38	58	11
38	60	10
● 38	62	7
38	62	10
38	62	12
38	64	8
38	65	10
38	68	6
38	70	10
38	72	10
38	74	10
39	52	9
40	47	4
40	50	4
40	50	6,5
40	50	7
40	52	5
40	52	6
● 40	52	7
40	52	8
40	52	9
40	52	10
● 40	55	7
40	55	8
40	55	10
40	55	12

d_1	d_2	b
40	56	7
40	56	8
40	56	10
40	56	12
40	58	8
40	58	9
40	58	10
40	60	7
40	60	8
40	60	10
40	60	12
● 40	62	7
40	62	9
40	62	10
40	62	12
40	63	10
40	64	12
40	65	10
40	65	12
40	68	6
40	68	10
40	70	8
40	70	10
● 40	72	7
40	72	10
40	80	8
40	80	10
40	80	13
40	85	10
40	90	9
40	90	10
40	90	12
41	56	7
41	62	10
42	52	4
42	52	8
42	55	7
● 42	55	8
42	55	10
42	56	5
42	56	7
42	57	7
42	58	10
42	60	7
42	60	10
42	60	12
42	62	7
● 42	62	8
42	62	10
42	62	12
42	64	10
42	65	8
42	65	10
42	65	12
42	68	10
42	70	10
● 42	72	8
42	72	10
42	75	10
42	60	10
43	85	10
43	58	13,5
43	60	10
43	62	10

d_1	d_2	b
43	65	13
43	66	10
43	75	10
44	60	10
44	60	12
44	62	8
44	62	10
44	62	12
44	65	10
44	66	6
44	72	10
44	72	12
45	52	4
45	55	4
45	55	6
45	55	8
45	55	10
45	57	7,5
45	58	7
45	60	7
● 45	60	8
45	60	10
45	62	7
● 45	62	8
45	62	10
45	62	12
45	65	8
45	65	10
45	65	12
45	66	6
45	66	10
45	68	8
45	68	10
45	70	10
45	70	12
● 45	72	8
45	72	10
45	72	12
45	73	12
45	75	6
45	75	8
45	75	10
45	75	12
45	80	10
45	80	13
45	85	10
45	90	8
45	90	10
46	62	8
46	64	8
46	65	10
46	72	10
47	58	6
47	62	8
47	65	8
47	65	10
47	70	10
47	72	12
47	77	8
48	60	10
48	62	7
● 48	62	8
48	62	10
48	65	9



d_1	d_2	b
48	65	10
48	68	10
48	68	12
48	68	14
48	70	8
48	70	10
48	70	12
● 48	72	8
48	72	10
48	80	8
48	80	10
48	90	13
49	65	10
50	58	4
50	62	5
50	62	7
50	62	10
● 50	65	8
50	65	10
● 50	68	8
50	68	9
50	68	10
50	68	12
50	70	8
50	70	9
50	70	10
50	70	12
50	72	6
● 50	72	8
50	72	9
50	72	10
50	72	12
50	75	10
50	75	12
● 50	80	8
50	80	10
50	80	13
50	85	6
50	85	8
50	85	10
50	90	10
50	90	12
50	90	13
51	72	10
51	73	12
52	65	9
52	68	7
● 52	68	8
52	68	12
52	69	10
52	70	7
52	70	9
● 52	72	8
52	72	10

Other dimensions can be made to order, but may require tooling.
We reserve our right to make changes to the dimension list without notice.

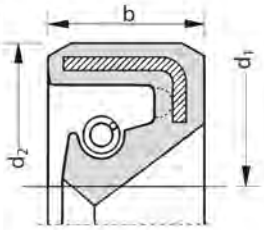
Dimensions - Metric Sizes

d_1	d_2	b
52	72	12
52	75	12
52	80	10
52	85	10
52	87	8
53	68	10
53	72	12
53	80	10
54	70	10
54	72	8
54	72	10
54	78	12
54	80	13
54	82	11
54	85	10
55	63	5
55	68	8
55	68	9
● 55	70	8
55	70	10
55	70	12
● 55	72	8
55	72	9
55	72	10
55	72	12
55	75	8
55	75	9
55	75	10
55	75	12
55	76	12
55	78	8
55	78	10
● 55	80	8
55	80	10
55	80	12
55	80	13
55	82	12
● 55	85	8
55	85	10
55	85	12
55	90	8
55	90	10
55	100	12
● 56	70	8
● 56	72	8
● 56	80	8
56	80	12
● 56	85	8
56	90	10
57	80	12
57	90	12
57	90	13
● 58	72	8
58	72	9
58	72	10
58	75	12
58	78	13
58	80	5
● 58	80	8
58	80	10
58	80	12
58	80	13
58	85	10
58	90	10

d_1	d_2	b
60	70	7
60	70	10
60	72	8
● 60	75	8
60	75	12
60	78	9
60	78	13
60	80	7
● 60	80	8
60	80	10
60	80	12
60	80	13
60	82	12
● 60	85	8
60	85	10
60	85	13
60	88	12
● 60	90	8
60	90	10
60	90	13
60	95	13
60	100	10
60	100	13
60	110	13
62	70	10
62	76	10
62	80	10
62	81	10
● 62	85	10
62	85	12
62	87	8
● 62	90	10
62	90	12
62	90	13
62	100	12
62	110	13
63	80	9
● 63	85	10
63	85	13
63	88	10
● 63	90	10
63	100	10
64	80	8
64	85	10
64	85	13
64	90	13
65	75	8
65	80	8
65	80	10
65	80	12
65	85	8
● 65	85	10
65	85	12
65	85	13
65	88	12
65	89	10
● 65	90	10
65	90	12
65	90	13
65	92	12
65	95	10
65	95	12
● 65	100	10
65	100	12

d_1	d_2	b
65	110	10
65	120	12
65	125	12
66	90	10
67	91	13
67	95	10
68	82	10
68	85	10
68	85	13
68	88	10
68	90	7
● 68	90	10
68	90	13
68	95	13
68	97	8
● 68	100	10
68	100	13
70	78	5
70	80	8
70	85	7
70	85	8
70	85	10
70	86	12
● 70	90	10
70	90	12
70	90	13
70	92	13
70	85	10
70	95	13
● 70	100	10
70	100	12
70	100	13
70	105	10
70	105	13
70	110	10
70	110	12
70	112	12
70	115	15
70	120	13
72	90	10
● 72	95	10
72	95	12
● 72	100	10
72	100	12
72	105	13
72	110	12
72	130	12
74	95	10
74	100	12
75	90	8
75	90	10
75	90	12
75	90	15
75	95	7
75	95	9
75	95	10
75	95	12
● 75	100	10
75	100	12
75	100	13
75	100	14
75	101	13
75	105	12
75	105	13

d_1	d_2	b
75	107	10
75	110	12
75	110	13
75	120	12
76	100	16
76	105	12
● 78	100	10
78	100	12
78	110	10
78	110	12
80	90	6
80	90	12
80	95	5
80	95	8
● 80	100	10
80	100	12
80	100	13
80	105	10
80	105	12
80	105	13
● 80	110	10
80	110	12
80	115	12
80	120	13
80	125	12
82	105	12
82	110	12
82	110	13
84	110	16
85	100	9
85	102	13
85	105	10
85	105	12
85	105	13
● 85	110	12
85	110	13
85	115	13
85	115	15
● 85	120	12
85	120	13
85	126	12
85	130	12
85	135	14
85	150	13
86	116	10,5
88	110	12
88	113	8
88	126	12
90	110	12
90	105	10
90	110	8
90	110	10
● 90	110	12
90	110	13
90	115	9
90	115	12
90	115	13
● 90	120	12
90	120	13
90	125	13
90	130	12
90	130	13
90	140	13
90	150	12



d_1	d_2	b
92	110	12
92	120	13
93	108	10
95	110	9
95	110	10
95	110	12
95	112	12
95	115	13
95	120	8
● 95	120	12
95	120	13
● 95	125	12
95	130	12
95	135	13
95	136	13
96	112	10
96	136	12
97	120	13
98	120	13
100	115	9
100	120	10
●100	120	12
100	120	13
●100	125	12
100	125	13
●100	130	12
100	130	13
100	130	14
100	150	13
100	185	13
102	135	14
105	125	13
●105	130	12
105	130	13
105	130	15
105	135	15
●105	140	12
105	140	13
105	145	16
105	150	15
110	128	9
110	130	8
●110	130	12
110	130	13
110	130	14,5
110	135	12
110	135	13
110	140	10
●110	140	12
110	140	13
110	140	14
110	150	13
110	150	15
110	155	15

Other dimensions can be made to order, but may require tooling.
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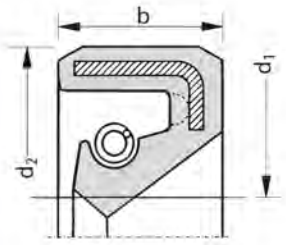
Dimensions - Metric Sizes

	d_1		d_2		b
	112	x	140	x	9
	112	x	140	x	13
	115	x	130	x	12
	115	x	135	x	10
	115	x	140	x	10
●	115	x	140	x	12
	115	x	140	x	13
●	115	x	150	x	12
	115	x	150	x	15
	118	x	140	x	13
	120	x	140	x	10
	120	x	140	x	13
	120	x	145	x	15
	120	x	150	x	10
●	120	x	150	x	12
	120	x	150	x	13
	120	x	150	x	14
	120	x	150	x	15
	120	x	155	x	12
●	120	x	160	x	12
	120	x	160	x	13
	120	x	160	x	15
	120	x	200	x	15
	122	x	150	x	12
	122	x	150	x	15
	125	x	140	x	10
●	125	x	150	x	12
	125	x	155	x	12
●	125	x	160	x	12
	125	x	160	x	13
	125	x	160	x	15
	128	x	150	x	13
	130	x	150	x	10
	130	x	150	x	12
●	130	x	160	x	12
	130	x	160	x	13
	130	x	160	x	14
	130	x	160	x	15
●	130	x	170	x	12
	130	x	170	x	13
	130	x	182	x	16
	135	x	160	x	12
	135	x	165	x	12
●	135	x	170	x	12
	135	x	180	x	15
	138	x	160	x	15
	140	x	160	x	13
	140	x	165	x	12

	d_1		d_2		b
	140	x	165	x	9
	140	x	170	x	8
	140	x	170	x	12
●	140	x	170	x	15
	140	x	180	x	12
	140	x	180	x	13
	140	x	180	x	15
	144	x	160	x	12
	145	x	170	x	15
●	145	x	175	x	15
	145	x	180	x	12
	145	x	180	x	13
	145	x	180	x	14
	145	x	180	x	15
	148	x	170	x	15
	150	x	168	x	12
	150	x	170	x	12
	150	x	170	x	15
	150	x	180	x	12
	150	x	180	x	13
●	150	x	180	x	15
	152	x	176	x	15
	155	x	180	x	15
	155	x	190	x	15
	158	x	180	x	13
	158	x	180	x	15
	160	x	180	x	12
	160	x	180	x	15
	160	x	185	x	10
	160	x	185	x	13
●	160	x	190	x	15
	160	x	200	x	12
	160	x	200	x	15
	162	x	190	x	13
	165	x	190	x	13
	165	x	190	x	15
	165	x	200	x	15
	168	x	200	x	15
	170	x	190	x	15
	170	x	200	x	12
●	170	x	200	x	15
	170	x	205	x	15
	175	x	200	x	15
	175	x	210	x	14
	175	x	310	x	16
	180	x	200	x	13
●	180	x	200	x	15
	180	x	210	x	15

	d_1		d_2		b
	180	x	215	x	16
	180	x	215	x	18
	180	x	220	x	15
	185	x	210	x	13
	185	x	215	x	15
	185	x	220	x	15
	190	x	215	x	16
●	190	x	220	x	15
	190	x	225	x	16
	190	x	230	x	15
	200	x	220	x	15
	200	x	230	x	13
●	200	x	230	x	15
	200	x	235	x	15
	200	x	240	x	15
	200	x	240	x	16
	205	x	230	x	16
	205	x	240	x	15
	205	x	250	x	16
●	210	x	240	x	15
	210	x	250	x	15
	210	x	260	x	15
	215	x	240	x	12
	217	x	250	x	16
●	220	x	250	x	15
	220	x	260	x	15
	230	x	255	x	15
●	230	x	260	x	15
	230	x	270	x	15
	230	x	270	x	16
	230	x	280	x	15
	230	x	280	x	16
●	240	x	270	x	15
	240	x	280	x	15
	245	x	270	x	15
●	250	x	280	x	15
	258	x	290	x	16
	260	x	290	x	16
	260	x	300	x	15
	260	x	300	x	16
●	260	x	300	x	20
	265	x	290	x	16
	270	x	300	x	15
	270	x	310	x	16
	280	x	310	x	15
	280	x	310	x	16
	280	x	320	x	15
●	280	x	320	x	20



	d_1		d_2		b
	285	x	320	x	20
	290	x	320	x	15
	290	x	330	x	18
	300	x	332	x	16
	300	x	340	x	16
	300	x	340	x	18
●	300	x	340	x	20
	320	x	350	x	15
	320	x	360	x	18
●	320	x	360	x	20
	330	x	370	x	18
	340	x	370	x	20
	340	x	380	x	18
●	340	x	380	x	20
	350	x	390	x	18
	360	x	390	x	18
●	360	x	400	x	20
	370	x	410	x	15
	380	x	420	x	18
●	380	x	420	x	20
	385	x	430	x	25
	394	x	420	x	16
	394	x	430	x	18
●	400	x	440	x	20
●	420	x	460	x	20
	420	x	470	x	20
	430	x	474	x	20
●	440	x	480	x	20
	450	x	500	x	20
●	460	x	500	x	20
●	480	x	500	x	20
●	480	x	520	x	20
	480	x	530	x	25
●	500	x	540	x	20
	500	x	550	x	22
	560	x	610	x	20
	600	x	640	x	20
	670	x	730	x	25

Other dimensions can be made to order, but may require tooling.
We reserve our right to make changes to the dimension list without notice.

Dimensions - Inch Sizes

The list below shows a part of the dimension in inch sizes that M Seals are able to supply. Some of them are stocked in one or more types/materials. Other dimensions can be supplied per request, but may require tooling. However, type C can be made in all dimensions between Ø20 up to Ø1200 on a single piece basis.

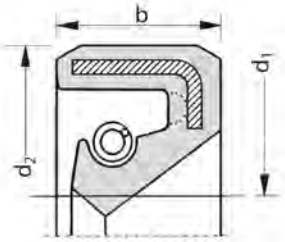
The dimensions are shown in decimal inches.

Example:

2 1/4" x 3 3/8" x 1/2" = 2.25 x 3.37 x 0.50.

A conversion table between fraction/decimal/millimetres is found on page 31.

d_1	d_2	b
0.25	0.62	0.18
0.25	0.75	0.25
0.25	1.00	0.18
0.31	0.75	0.25
0.31	0.78	0.25
0.31	0.87	0.25
0.34	0.75	0.25
0.37	0.75	0.18
0.37	0.87	0.25
0.37	1.00	0.37
0.37	1.12	0.37
0.37	1.25	0.29
0.40	1.00	0.18
0.43	0.87	0.25
0.43	1.00	0.25
0.43	1.12	0.37
0.46	0.87	0.18
0.50	0.87	0.25
0.50	1.00	0.25
0.50	1.12	0.37
0.50	1.12	0.25
0.50	1.18	0.25
0.50	1.25	0.25
0.56	1.00	0.25
0.56	1.12	0.25
0.56	1.25	0.25
0.57	1.50	0.25
0.59	1.12	0.25
0.59	1.37	0.25
0.62	0.75	0.25
0.62	0.93	0.18
0.62	1.00	0.18
0.62	1.00	0.25
0.62	1.06	0.18
0.62	1.06	0.25
0.62	1.12	0.25
0.62	1.12	0.37
0.62	1.12	0.31
0.62	1.25	0.25
0.67	1.25	0.31
0.62	1.37	0.25
0.62	1.37	0.31
0.65	1.50	0.25
0.68	1.06	0.25
0.68	1.12	0.25
0.68	1.12	0.37
0.68	1.18	0.18
0.75	1.75	0.31
0.75	1.82	0.43
0.75	1.87	0.31
0.78	1.25	0.25
0.78	1.50	0.37
0.78	1.62	0.18
0.81	1.18	1.12
0.81	1.31	0.37
0.81	1.37	0.25
0.81	1.37	0.37
0.81	1.50	0.25
0.81	1.62	0.37
0.86	1.37	0.25
0.87	1.12	0.12
0.87	1.25	0.18
0.87	1.31	0.25
0.87	1.37	0.25
0.87	1.37	0.31
0.87	1.50	0.25
0.87	1.50	0.37
0.87	1.57	0.31
0.87	1.62	0.25
0.87	1.62	0.37
0.87	1.78	0.31
0.87	1.87	0.25
0.90	1.62	0.25
0.93	1.37	0.25
0.93	1.50	0.31
0.93	1.50	0.37
0.93	1.62	0.25
0.93	1.62	0.31
0.93	1.75	0.37
0.96	1.49	0.31
0.96	1.75	0.25
0.98	1.82	0.31
1.00	1.25	0.12
1.00	1.31	0.12
1.00	1.37	0.25
1.00	1.43	0.25
1.00	1.50	0.18
1.00	1.50	0.25
1.00	1.50	0.31
1.00	1.50	0.37
1.00	1.62	0.25
1.00	1.62	0.37
1.00	1.75	0.25
1.00	1.75	0.31
1.00	1.75	0.37
1.00	1.75	0.43
1.00	1.82	0.43
1.00	1.87	0.25
1.00	1.87	0.37
1.00	2.00	0.25
1.00	2.00	0.37
1.12	2.00	0.25
1.12	2.00	0.37
1.12	2.00	0.50
1.12	2.06	0.31
1.12	2.12	0.31
1.12	2.25	0.25
1.12	2.25	0.37
1.12	2.25	0.50
1.12	2.28	0.25
1.12	2.50	0.50
1.15	2.12	0.37
1.15	2.37	0.37
1.18	1.75	0.18
1.18	1.75	0.25
1.18	1.87	0.37
1.18	2.00	0.25
1.18	2.00	0.37
1.18	2.06	0.25
1.18	2.06	0.43
1.21	2.12	0.43
1.21	2.18	0.43
1.25	1.62	0.25
1.25	1.68	0.31
1.25	1.68	0.25
1.25	1.75	0.25
1.25	1.87	0.31
1.25	1.87	0.31
1.25	1.87	0.43
1.25	1.93	0.43
1.25	2.00	0.25
1.25	2.00	0.37
1.25	2.00	0.50
1.25	2.06	0.37
1.25	2.06	0.43
1.25	2.06	0.50
1.25	2.12	0.31
1.25	2.18	0.43
1.25	2.25	0.25
1.25	2.25	0.37
1.25	2.25	0.50
1.25	2.50	0.31
1.25	2.62	0.37
1.28	2.00	0.43
1.31	1.87	0.25
1.31	1.87	0.31
1.31	2.00	0.31
1.31	2.12	0.31
1.31	2.12	0.37
1.31	2.28	0.50



d_1	d_2	b
1.31	2.50	0.50
1.37	1.87	0.25
1.37	1.87	0.28
1.37	1.87	0.31
1.37	1.87	0.61
1.37	2.00	0.31
1.43	2.43	0.46
1.43	2.50	0.50
1.50	1.87	0.18
1.50	2.00	0.25
1.50	2.00	0.31
1.50	2.00	0.37
1.50	2.06	0.31
1.50	1.68	0.25
1.50	2.18	0.31
1.50	2.18	0.43
1.50	2.25	0.25
1.50	2.25	0.31
1.50	2.25	0.37
1.50	2.37	0.37
1.50	2.43	0.37
1.50	2.50	0.37
1.50	2.50	0.50
1.50	2.50	0.31
1.50	2.56	0.50
1.50	2.62	0.25
1.50	2.62	0.50
1.50	2.75	0.37
1.50	3.00	0.50
1.56	2.00	0.25
1.56	2.06	0.18
1.56	2.12	0.43
1.56	2.25	0.31
1.56	2.37	0.37
1.56	2.43	0.37
1.56	2.50	0.31
1.56	2.62	0.37
1.56	2.68	0.37
1.57	2.00	0.15

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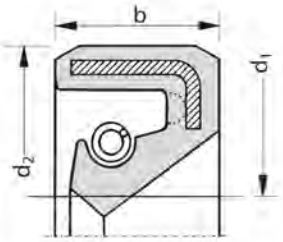
Dimensions - Inch Sizes

d_1	d_2	b
1.62	2.12	0.25
1.62	2.25	0.31
1.62	2.25	0.37
1.62	2.37	0.31
1.62	2.37	0.37
1.62	2.37	0.50
1.62	2.43	0.50
1.62	2.50	0.31
1.62	2.50	0.50
1.62	2.62	0.31
1.62	2.62	0.37
1.62	2.62	0.50
1.62	2.68	0.50
1.62	2.75	0.25
1.62	2.75	0.37
1.62	2.75	0.43
1.62	2.87	0.50
1.68	2.32	0.50
1.68	2.33	0.50
1.68	2.43	0.46
1.68	2.50	0.37
1.75	2.87	0.37
1.75	2.87	0.50
1.75	3.18	0.50
1.75	3.37	0.37
1.76	2.31	0.25
1.81	2.37	0.37
1.81	2.50	0.25
1.81	2.50	0.50
1.81	2.62	0.37
1.81	2.75	0.37
1.87	2.50	0.31
1.87	2.50	0.50
1.87	2.56	0.25
1.87	2.62	0.31
1.87	2.75	0.31
1.87	2.75	0.50
1.87	2.75	0.37
1.87	2.87	0.37
1.87	2.87	0.50
1.87	3.00	0.50
1.87	3.12	0.37
1.87	3.18	0.50
1.93	2.50	0.31
1.93	2.50	0.37
1.93	2.68	0.31
1.93	2.75	0.31
1.93	2.75	0.37
1.93	2.87	0.31
1.93	3.00	0.50
1.93	3.12	0.50
1.93	3.18	0.31
2.00	2.50	0.25
2.00	2.56	0.25
2.00	2.68	0.37
2.00	2.75	0.25
2.00	2.75	0.37
2.00	2.75	0.50
2.00	2.87	0.50
2.00	3.00	0.37
2.00	3.00	0.50
2.00	3.18	0.46
2.00	3.37	0.43
2.00	3.50	0.50

d_1	d_2	b
2.00	3.62	0.50
2.00	4.00	0.50
2.06	2.87	0.37
2.06	3.00	0.37
2.06	3.18	0.50
2.12	2.75	0.31
2.12	2.87	0.37
2.12	2.87	0.50
2.12	3.00	0.25
2.12	3.00	0.37
2.12	3.00	0.50
2.12	3.12	0.37
2.12	3.18	0.37
2.12	3.18	0.50
2.12	3.50	0.50
2.18	3.00	0.37
2.25	2.62	0.18
2.25	3.00	0.37
2.25	3.12	0.37
2.25	3.18	0.43
2.25	3.18	0.50
2.25	3.25	0.37
2.25	3.25	0.43
2.25	3.25	0.50
2.25	3.37	0.43
2.25	3.37	0.50
2.25	3.50	0.43
2.25	3.50	0.50
2.25	3.62	0.43
2.25	3.75	0.50
2.31	3.00	0.50
2.31	3.12	0.37
2.31	3.18	0.50
2.31	3.25	0.50
2.31	3.35	0.31
2.31	3.37	0.46
2.31	3.54	0.37
2.31	3.75	0.50
2.37	2.87	0.31
2.37	2.87	0.37
2.37	3.00	0.37
2.37	3.06	0.50
2.37	3.12	0.37
2.37	3.18	0.43
2.37	3.25	0.50
2.37	3.37	0.37
2.37	3.37	0.50
2.37	3.75	0.50
2.43	3.18	0.37
2.43	3.25	0.37
2.43	3.37	0.50
2.43	3.75	0.43
2.50	3.18	0.37
2.50	3.25	0.37
2.50	3.37	0.50
2.50	3.50	0.25
2.50	3.50	0.37
2.50	3.50	0.50
2.50	3.62	0.50
2.50	3.75	0.50
2.50	3.87	0.25
2.50	4.00	0.37
2.56	3.37	0.37
2.56	3.62	0.43

d_1	d_2	b
2.56	4.00	0.50
2.62	3.37	0.37
2.62	3.50	0.43
2.62	3.50	0.50
2.62	3.62	0.50
2.62	3.75	0.37
2.62	3.75	0.50
2.62	4.00	0.50
2.68	3.50	0.37
2.68	3.50	0.50
2.68	3.62	0.37
2.68	3.75	0.43
2.68	3.87	0.43
2.68	3.87	0.50
2.69	3.75	0.50
2.75	3.37	0.50
2.75	3.50	0.37
2.75	3.54	0.50
2.75	3.62	0.43
2.75	3.62	0.50
2.75	3.75	0.50
2.75	3.87	0.50
2.75	4.00	0.43
2.75	4.00	0.50
2.75	4.06	0.50
2.81	3.62	0.37
2.81	3.75	0.37
2.87	3.62	0.37
2.87	3.75	0.43
2.87	3.75	0.46
2.87	3.87	0.50
2.87	4.00	0.50
2.87	4.50	0.50
2.93	3.75	0.37
2.93	3.93	0.50
3.00	3.75	0.35
3.00	3.75	0.37
3.00	3.87	0.37
3.00	4.00	0.25
3.00	4.00	0.37
3.00	4.00	0.50
3.00	4.12	0.43
3.00	4.37	0.43
3.00	4.50	0.43
3.06	3.75	0.37
3.06	4.12	0.50
3.06	4.25	0.50
3.12	3.87	0.50
3.12	4.00	0.50
3.12	4.12	0.50
3.12	4.25	0.50
3.12	4.37	0.50
3.12	4.50	0.50
3.12	4.62	0.43
3.18	4.25	0.50
3.18	4.50	0.43
3.25	4.00	0.37
3.25	4.00	0.50
3.25	4.25	0.31
3.25	4.25	0.37
3.25	4.25	0.50
3.25	4.37	0.50
3.25	4.50	0.50
3.25	4.75	0.50



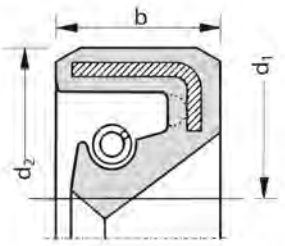
d_1	d_2	b
3.31	4.37	0.50
3.37	4.00	0.50
3.37	4.37	0.50
3.37	4.62	0.43
3.40	4.50	0.50
3.43	4.06	0.50
3.43	4.50	0.43
3.43	4.50	0.50
3.50	4.12	0.25
3.50	4.37	0.50
3.50	4.43	0.25
3.50	4.50	0.25
3.50	4.50	0.50
3.50	4.75	0.62
3.50	4.87	0.50
3.50	5.12	0.50
3.50	5.37	0.50
3.56	4.62	0.50
3.62	4.50	0.50
3.62	4.62	0.43
3.62	4.62	0.50
3.62	4.75	0.50
3.62	5.25	0.62
3.68	4.43	0.37
3.68	4.75	0.43
3.68	5.62	0.50
3.75	4.50	0.50
3.75	4.62	0.50
3.75	4.75	0.43
3.75	4.75	0.50
3.75	4.87	0.43
3.75	4.92	0.50
3.75	5.00	0.50
3.75	5.37	0.43
3.81	4.87	0.50
3.87	4.87	0.50
3.87	5.37	0.43
3.93	5.00	0.43
3.93	5.00	0.50
3.93	5.25	0.43
4.00	5.00	0.31
4.00	5.00	0.50
4.00	5.12	0.51
4.00	5.25	0.43
4.00	5.25	0.50
4.00	5.37	0.43
4.00	5.50	0.43
4.00	5.50	0.50
4.06	5.12	0.50
4.12	5.00	0.43
4.12	5.12	0.50
4.18	5.25	0.50
4.18	5.75	0.43

Dimensions - Inch Sizes

d_1	d_2	b
4.25	5.00	0.50
4.25	5.25	0.43
4.25	5.25	0.50
4.25	5.62	0.43
4.25	5.75	0.43
4.25	6.00	0.56
4.31	5.37	0.50
4.31	5.50	0.56
4.37	5.25	0.50
4.43	5.50	0.50
4.50	5.25	0.37
4.50	5.25	0.43
4.50	5.37	0.43
4.50	5.50	0.43
4.50	5.50	0.50
4.50	5.62	0.50
4.50	5.75	0.50
4.50	6.00	0.56
4.50	6.12	0.56
4.50	6.25	0.56
4.56	5.62	0.50
4.62	5.62	0.50
4.68	5.75	0.50
4.68	6.00	0.25
4.75	5.75	0.37
4.75	5.75	0.50
4.75	6.00	0.50

d_1	d_2	b
4.81	5.87	0.50
4.81	6.00	0.25
4.81	6.00	0.62
4.87	5.87	0.50
4.87	6.00	0.50
4.93	6.00	0.50
5.00	6.00	0.37
5.00	6.00	0.50
5.00	6.25	0.50
5.00	7.00	0.50
5.06	6.12	0.50
5.12	6.12	0.50
5.12	6.12	0.56
5.18	6.25	0.50
5.25	6.25	0.50
5.25	6.50	0.50
5.25	6.50	0.62
5.29	6.12	0.37
5.31	6.37	0.50
5.37	6.37	0.50
5.43	6.50	0.50
5.50	6.50	0.50
5.50	6.75	0.50
5.50	6.87	0.56
5.56	6.62	0.50
5.62	6.62	0.50
5.62	6.62	0.56

d_1	d_2	b
5.62	6.75	0.50
5.62	6.87	0.50
5.68	6.75	0.50
5.75	6.62	0.50
5.75	6.75	0.50
5.81	6.87	0.50
5.87	6.87	0.50
5.93	7.00	0.50
6.00	7.00	0.50
6.00	7.50	0.62
6.00	7.62	0.50
6.06	7.12	0.50
6.12	7.12	0.50
6.12	7.12	0.62
6.18	7.25	0.50
6.25	7.25	0.50
6.25	7.87	0.62
6.43	7.50	0.50
6.50	7.50	0.50
6.62	7.50	0.56
6.62	7.62	0.50
6.68	7.75	0.50
6.75	7.75	0.50
6.93	8.00	0.50
7.00	8.00	0.50
7.00	8.50	0.62
7.12	8.62	0.56



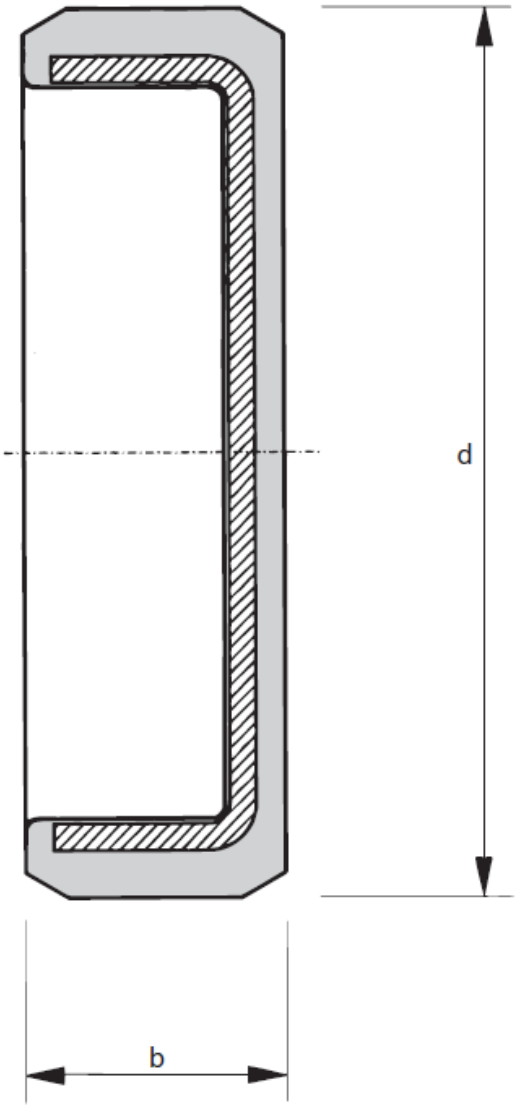
d_1	d_2	b
7.50	8.50	0.62
7.50	9.00	0.56
7.62	9.12	0.56
7.75	9.25	0.56
8.00	9.50	0.56
8.25	9.75	0.56
8.37	9.87	0.56
8.50	9.62	0.56
8.50	9.75	0.62
8.50	x10.00	0.56
8.75	x10.25	0.56
8.75	x10.75	0.62
9.00	x10.50	0.56
9.25	x10.75	0.68
10.00	x11.50	0.56

Other dimensions can be made to order, but may require tooling.
We reserve our right to make changes to the dimension list without notice.

VK Seals / End Cover / Sealing Cap, type BD

The end cover is a cost-effective solution where you need to close a bore as substitute for a sealing cover e.g. in the manufacture of gearboxes. Supplied in a number of common bearing sizes.

d	b	d	b
13	4,5	52	7
14	3	52	10
14	4	55	7
16	4	55	10
19	7	62	7
20	4	62	8
20	5	62	10
20,2	4	65	10
21	4	68	8
22	5	70	10
22	7	72	8
24	7	72	9
26	5	72	10
26	6,5	75	8
28	4	75	12
28	7	80	8
30	7	80	10
32	7	80	12
34	7	90	8
35	7	90	10
35	8	90	12
37	5	100	10
37	7	106	15
40	6	110	10
40	7	120	12
42	7	120	13
42	9,5	130	12
45	7	130	13
47	4	150	12
47	7	150	13
47	10	170	12
48	4	190	15
52	6,5		



Material

Insert: Mild steel
Covering: NBR or FPM

Housing Bore

Tolerance: ≤ H8
Surface : ≤ 3,2 µm Ra

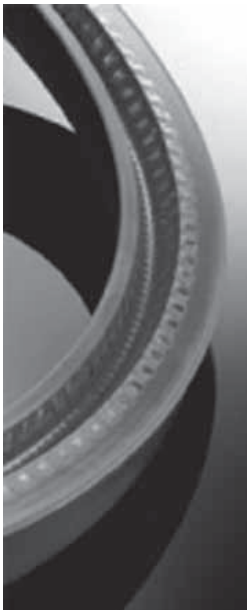
Heavy Duty Shaft Seals

Our heavy duty shaft seals are especially suited for large diameters and/or rough applications like rolling mills, wind turbines, pulp and paper industry, gearboxes and other demanding applications where high speeds and great misalignment are present.

DR10

The DR10 range is constructed with a flexible textile reinforced rubber structure that allow an easy fitting, and with a garter spring. Also available in a split form for re-fitting in place, without removing the shaft.

This type normally requires a retaining cover. Can be supplied also with additional dust lip and different types of lubricating grooves (where the seals are used back to back or in tandem).



DR20

The DR20 is a rubber seal with finger spring. In split form, this seal type is very suited for difficult fitting conditions, and in endless form it is also suited as wiper ring in hydraulic applications.

A10

The A10 is a rubber seal with garter spring, with a stiffening steel reinforcement. Good flexibility for easy installation, which in some cases allow use without a retaining cover.

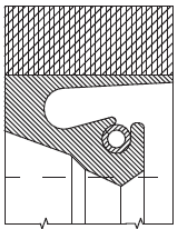
The steel reinforcement can then prevent the seal from tilting in the groove, and the spring is the finger type for secure installation and even radial force.

C10

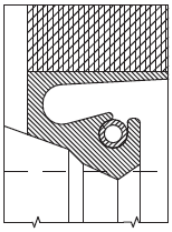
The C10 range is built with a strong steel casing and with a finger leaf+garter spring, making this type of seal especially suited for large misalignments (shaft deflection, large bearing clearances etc.).

This type is also capable of shaft speeds up to 35m/sec. widely used in rolling and paper mills.

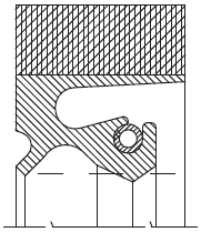
Heavy Duty Shaft Seals



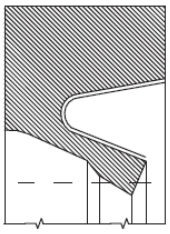
DR10



DR11



DR10S



DR20

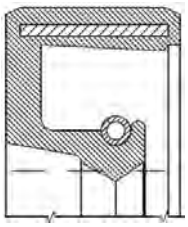
	DR10 Range	DR20 Range
Retaining cover required	Yes	Yes
Available in split form	Yes	Yes
Available with dust lip	Yes, DR10S	Yes DR20S
Dimensions (see list at www.m-seals.com)	75-2200mm in one piece >2200 mm in more than one piece	75-2200mm in one piece >2200mm in more than one piece
Available with lubrication grooves for use back to back and in tandem	Yes, DR11 / 12	No
Pressure (standard version)	Max 0,5 bar as standard	Max 0,5 bar as standard
Available in version for higher pressure	Yes, DR10T and D12T up to 4 bar	No
Max permissible speed	15 m/sec	15 m/sec
Permissible shaft misalignment	Up to 1,5mm depending on speed	Up to 1,5mm depending on speed
Shaft tolerance	h11	h11
Housing tolerance	H8	H8
Width tolerance	+/-0,1mm	+/-0,1mm
Shaft surface finish	0,2-0,8 µm Ra (1,0-3,2 µm Rz)	0,2-0,8 µm Ra (1,0-3,2 µm Rz)
Shaft hardness	40-50 HRC	40-50 HRC
Spring material	Stainless steel	Stainless steel

Mounting instructions - type DR10 and DR20 range:

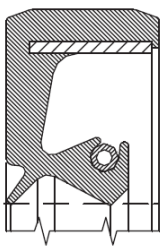
- Must always be used with a retaining cover/ clamping plate of sufficient dimension to avoid distortion. The axial preload secures the stability of the seal.
- Make sure the housing has a chamfering.
- Add oil to the housing bore, press in the seal gently, and check the location of the lip before tightening the cover evenly.

Split types:

- Remove spring from the seal and open it at the joint. Place the spring around the shaft and screw/hook together.
- Then pass the seal over the shaft, and re-mount the spring in the seal.
- Place the split joint at 12 o'clock . Only in special applications should the ends be glued together, and if done, extreme care should be taken to make the lip ends line up accurately.
- Enter the seal with the joint first, and work the seal in, from the top and down each side, pressing in the bottom part at last.



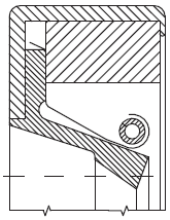
A10



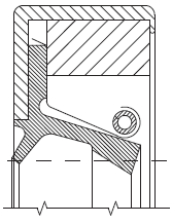
A10S

	A10 Range
Retaining cover required	No, can be self-retaining in many applications
Available in split form	Possible with special design - please enquire
Available with dust lip	Yes, A10S
Dimensions (see list at www.m-seals.com)	75-2200mm
Available with lubrication grooves for use back to back and in tandem	Yes, A11
Pressure (standard version)	None, if used without cover
Available in version for higher pressure	No
Max permissible speed	15 m/sec
Permissible shaft misalignment	Up to 1,5mm depending on speed
Shaft tolerance	h11
Housing tolerance	H8
Width tolerance	+/-0,1mm
Shaft surface finish	0,2-0,8 µm Ra (1,0-3,2 µm Rz)
Shaft hardness	40-50 HRC
Spring material	Stainless steel

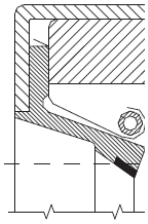
Heavy Duty Shaft Seals



C10



C10S



C14

	C10 Range
Retaining cover required	No
Available in split form	No
Available with dust lip	Yes, C10S
Dimensions (see list at www.m-seals.com)	150-1450mm
Available with lubrication grooves for use back to back and in tandem	N/R
Pressure (standard version)	0,4 bar as standard
Available in version for higher pressure	C10T up to 1 bar
Max permissible speed	C10 max 20 m/sec - type C14 with PTFE wear piece on the lip, up to 36 m/sec
Permissible shaft misalignment	Max 2,5mm
Shaft tolerance	h11
Housing tolerance	See table below for housing tolerance and chamfer
Shaft surface finish	0,2 - 0,6 µm Ra depending on service speed
Shaft hardness	30-50 HRC depending on expected service speed
Spring material	Stainless steel

HOUSING TOLERANCES FOR C10-RANGE SEALS

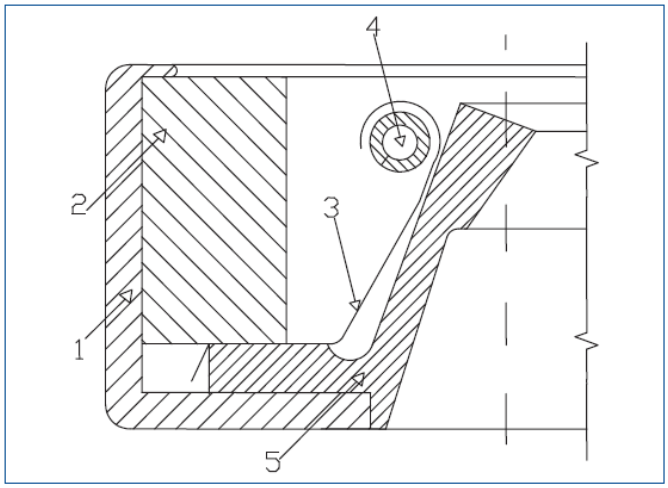
Housing bore:	
<= 76 ± 0.025	256 - 510 + 0.05/-0.10
77 - 150 ± 0.040	511 - 1015 + 0.05/-0.15
151 - 255 ± 0.050	> 1015 + 0.05/-0.25

CHAMFER

Shaft Ø mm	Fitting chamfer 20°
<= 250	x 7.00 mm
> 250	x 12.00 mm

SEAL CONSTRUCTION

The illustration below shows the construction of the C10 seal range and its components.



1. Steel outer ring in Fe-PO3 with a finish surface according to the relevant DIN standard for outer diameters.
2. Steel filler ring in Fe37 steel providing the rigidity required ensuring an accurate assembly of the seal in the grove.
3. Stainless steel spring carrier of AISI 301 is designed:
   a) to ensure the spring retention during the assembly.
   b) if necessary to permit the removal and refitting of garter spring in AISI 316, to provide a predetermined sealing lip preload which will permit the sealing element to follow shaft deflections.
4. Garter spring in AISI 316 to provide a regulated loading on the sealing lip and enable the sealing element to follow shaft deflections.
5. Sealing element is available in NBR, FPM or HNBR, and is bonded to the steel outer ring.

For selection, see page 9.

V-Rings

V-RINGS

The V-ring is a one-piece moulded sealing ring in synthetic rubber. It holds on the shaft by its own radial elastic force, and seals axially against a face. The V-ring is constructed of two parts; the body (a) and the flexible, self-tensioning sealing lip (b).

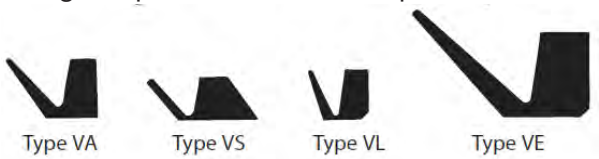
MATERIALS

NBR -40 to +100°C (-40 to +212 °F).
The standard material with very good resistance to oil, grease, weak acids, alkalis and many other fluids.

FPM (Viton ™) -30 to + 200°C (-22 to +392°F).
Preferred for high temperature applications, and with more aggressive fluids.

CR, EPDM and HNBR are also available for special applications e.g. enhanced weather resistance. The materials are supplied per request.

V-rings are produced in four main profiles

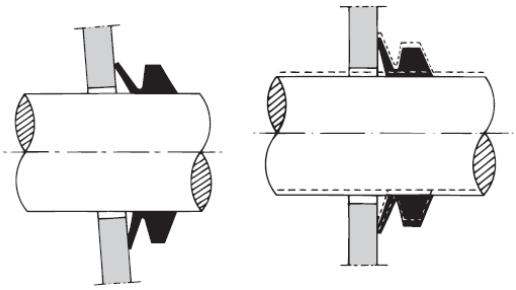


Type VA is the most common profile and is available from Ø2,7 mm shaft up to almost unlimited sizes.

Type VS offers a stronger radial hold on the shaft but takes more space. It is available for Ø4,5 mm to Ø210 mm shafts.

Type VL can be used where space is restricted. From Ø135 mm to Ø630 mm shafts.

Type VE is our heavy-duty large diameter seal for use as a dirt/water excluder in for example paper mills; rolling mills etc. where large axial movement is present. Can be supplied with an additional radial clamping band for better fixation. From Ø450 mm to Ø2000 mm shafts.



The V-ring can accommodate significant eccentricities and can function effectively even with a non-square counterface.

SIMPLE CONSTRUCTION

Normally, no separate housing are needed. Grinding of the shaft is not necessary. Coarse tolerances can be accepted.

DUO-FUNCTION

The V-ring acts as a seal as well as a deflector ring.

LOW FRICTION

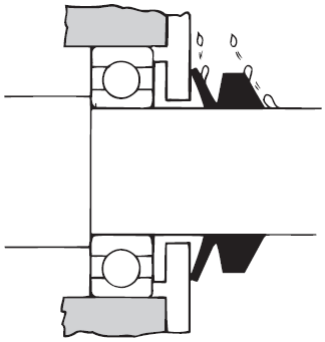
Low power loss. The power loss, due to friction, is much less for a V-ring compared to a spring loaded shaft seal. At about 10 m/sec, the friction drops rapidly due to the centrifugal force on the lip.

LARGE DIMENSIONALLY SPAN

One size covers a range of dimensions. 85 sizes cover the range from Ø3 mm to Ø2000 mm (above Ø2000 mm, any size can be made by jointed rings).

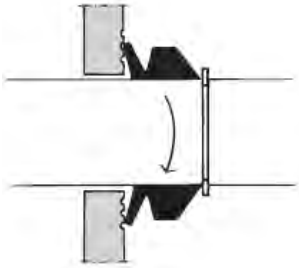
SIMPLY FITTED

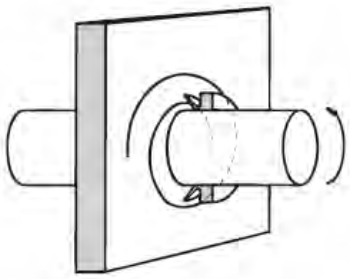
The fitting of the V-ring is simple and fast. The ring is stretched and pushed over shaft, taking care that it is not damaged by any sharp edges. Using a simple tool, the seal is aligned and set to the working distance H1, found in the dimension table. If done carefully, it is possible to cut and glue in place, especially with larger dimensions. Special care has to be taken to ensure that the ends of the sealing lip align properly.

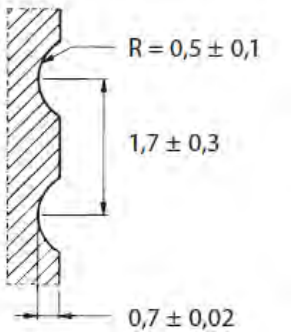


The body of the V-ring secures itself by the radial preload of the elastomer, and rotates with the shaft. The dynamic sealing area is where the sealing lip is in contact with the counterface, which can be e.g. the external part of a bearing housing, a flange. The counterface does not necessarily need to be machined, but can be a pressed part. Due to the centrifugal force, the V-ring acts as a deflector ring as well as a dynamic seal.

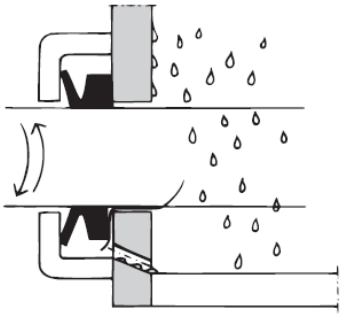
V-Rings



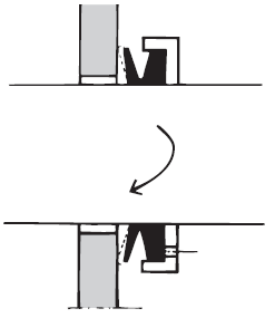




If the shaft is only turning in one direction, and the V-ring is mounted on the oil side, a certain pumping effect can be achieved by combining with a spiral groove as shown. This may help to return oil from the sealing area.



In this application, the back of the V-ring is the primary seal, acting as a deflector, and the lip is the secondary seal.



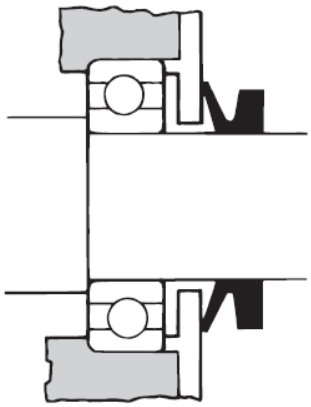
At circumferential speeds > 8 m/sec, it is advisable to secure the seal axially on shaft, and at speeds > 12 m/sec, a radial support is needed, either in form of a collar as shown on the sketch, or as a groove cut in a machine member next to the seal.

At speeds > app. 15 m/sec, the centrifugal force will tend to lift the lip away from the face. The V-ring now functions as a deflector seal.

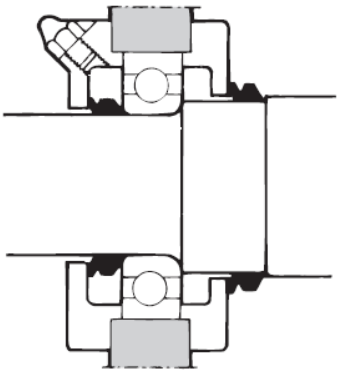
SURFACE ROUGHNESS

For most applications, the following guidelines can be followed:

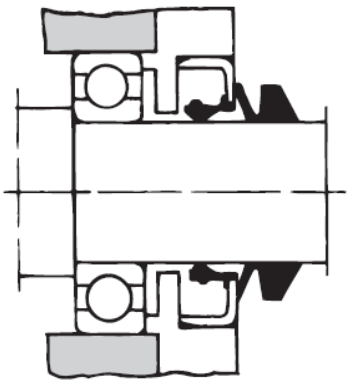
- >10 m/sec 0,4-0,8 Ra (16/32 CLA) by fluid sealing
- 5-10 m/sec 0,8-1,6 Ra (32-64 CLA) by fluid and grease sealing
- <1 m/sec 2,0 Ra (80 CLA) by grease and dust sealing.



V-ring is mounted on the outside of a bearing housing, sealing against incoming dust, and against grease from the bearing to some extent.

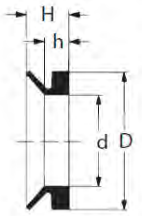


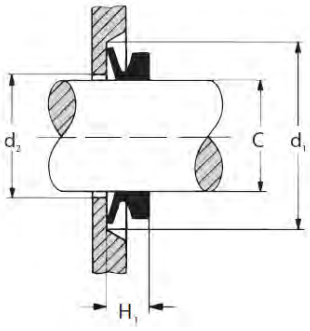
Two V-rings used to form a “grease valve”. If shaft speeds exceed 8 m/sec, it is advisable to secure the seal axially.



A V-ring can also be used as an additional dust seal in combination with an oil seal (metal cased).

V-Rings Type VA

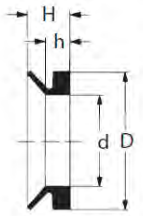


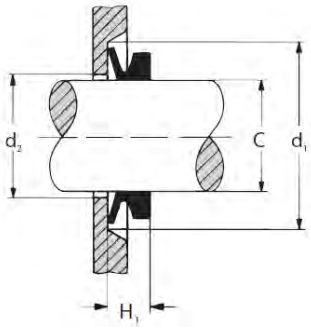


Ref.	Shaft Ø C	Dimensions in millimetres						
		d	D	h	H	d_2	d_1	H_1
VA 3	2,7 - 3,5	2,5	5,5	2,1	3	C + 1	C + 4	2,5 ± 0,3
VA 4	3,5 - 4,5	3,2	7,2	2,4	3,7	C + 1	C + 6	3 ± 0,4
VA 5	4,5 - 5,5	4	8	2,4	3,7	C + 1	C + 6	3 ± 0,4
VA 6	5,5 - 6,5	5	9	2,4	3,7	C + 1	C + 6	3 ± 0,4
VA 7	6,5 - 8	6	10	2,4	3,7	C + 1	C + 6	3 ± 0,4
VA 8	8 - 9,5	7	11	2,4	3,7	C + 2	C + 6	3 ± 0,4
VA 10	9,5 - 11,5	9	15	3,4	5,5	C + 2	C + 9	4,5 ± 0,6
VA 12	11,5 - 13,5	10,5	16,5	3,4	5,5	C + 2	C + 9	4,5 ± 0,6
VA 14	13,5 - 15,5	12,5	18,5	3,4	5,5	C + 2	C + 9	4,5 ± 0,6
VA 16	15,5 - 17,5	14	20	3,4	5,5	C + 2	C + 9	4,5 ± 0,6
VA 18	17,5 - 19	16	22	3,4	5,5	C + 2	C + 9	4,5 ± 0,6
VA 20	19 - 21	18	26	4,7	7,5	C + 2	C + 12	6 ± 0,8
VA 22	21 - 24	20	28	4,7	7,5	C + 2	C + 12	6 ± 0,8
VA 25	24 - 27	22	30	4,7	7,5	C + 2	C + 12	6 ± 0,8
VA 28	27 - 29	25	33	4,7	7,5	C + 3	C + 12	6 ± 0,8
VA 30	29 - 31	27	35	4,7	7,5	C + 3	C + 12	6 ± 0,8
VA 32	31 - 33	29	37	4,7	7,5	C + 3	C + 12	6 ± 0,8
VA 35	33 - 36	31	39	4,7	7,5	C + 3	C + 12	6 ± 0,8
VA 38	36 - 38	34	42	4,7	7,5	C + 3	C + 12	6 ± 0,8
VA 40	38 - 43	36	46	5,5	9	C + 3	C + 15	7 ± 1
VA 45	43 - 48	40	50	5,5	9	C + 3	C + 15	7 ± 1
VA 50	48 - 53	45	55	5,5	9	C + 3	C + 15	7 ± 1
VA 55	53 - 58	49	59	5,5	9	C + 3	C + 15	7 ± 1
VA 60	58 - 63	54	64	5,5	9	C + 3	C + 15	7 ± 1
VA 65	63 - 68	58	68	5,5	9	C + 3	C + 15	7 ± 1
VA 70	68 - 73	63	75	6,8	11	C + 4	C + 18	9 ± 1,2
VA 75	73 - 78	67	79	6,8	11	C + 4	C + 18	9 ± 1,2
VA 80	78 - 83	72	84	6,8	11	C + 4	C + 18	9 ± 1,2
VA 85	83 - 88	76	88	6,8	11	C + 4	C + 18	9 ± 1,2
VA 90	88 - 93	81	93	6,8	11	C + 4	C + 18	9 ± 1,2
VA 95	93 - 98	85	97	6,8	11	C + 4	C + 18	9 ± 1,2
VA 100	98 - 105	90	102	6,8	11	C + 4	C + 18	9 ± 1,2
VA 110	105 - 115	99	113	7,9	12,8	C + 4	C + 21	10,5 ± 1,5
VA 120	115 - 125	108	122	7,9	12,8	C + 4	C + 21	10,5 ± 1,5
VA 130	125 - 135	117	131	7,9	12,8	C + 4	C + 21	10,5 ± 1,5
VA 140	135 - 145	126	140	7,9	12,8	C + 4	C + 21	10,5 ± 1,5
VA 150	145 - 155	135	149	7,9	12,8	C + 4	C + 21	10,5 ± 1,5
VA 160	155 - 165	144	160	9	14,5	C + 5	C + 24	12 ± 1,8
VA 170	165 - 175	153	169	9	14,5	C + 5	C + 24	12 ± 1,8
VA 180	175 - 185	162	178	9	14,5	C + 5	C + 24	12 ± 1,8
VA 190	185 - 195	171	187	9	14,5	C + 5	C + 24	12 ± 1,8
VA 199	195 - 210	180	196	9	14,5	C + 5	C + 24	12 ± 1,8

Changes may be made to the dimensions list without notice

V-Rings Type VA

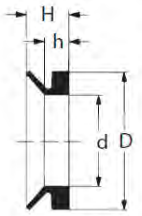


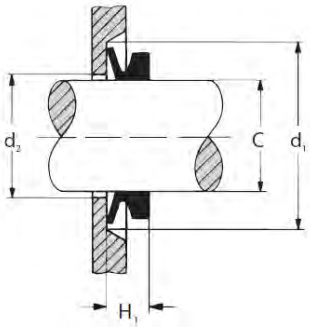


Ref.	Shaft Ø C	Dimensions in millimetres						
		d	D	h	H	d_2	d_1	H_1
VA 200	190 - 210	180	210	14,3	25	C + 10	C + 45	20 ± 4
VA 220	210 - 235	198	228	14,3	25	C + 10	C + 45	20 ± 4
VA 250	235 - 265	225	255	14,3	25	C + 10	C + 45	20 ± 4
VA 275	265 - 290	247	277	14,3	25	C + 10	C + 45	20 ± 4
VA 300	290 - 310	270	300	14,3	25	C + 10	C + 45	20 ± 4
VA 325	310 - 335	292	322	14,3	25	C + 10	C + 45	20 ± 4
VA 350	335 - 365	315	345	14,3	25	C + 10	C + 45	20 ± 4
VA 375	365 - 390	337	367	14,3	25	C + 10	C + 45	20 ± 4
VA 400	390 - 430	360	390	14,3	25	C + 10	C + 45	20 ± 4
VA 450	430 - 480	405	435	14,3	25	C + 10	C + 45	20 ± 4
VA 500	480 - 530	450	480	14,3	25	C + 10	C + 45	20 ± 4
VA 550	530 - 580	495	525	14,3	25	C + 10	C + 45	20 ± 4
VA 600	580 - 630	540	570	14,3	25	C + 10	C + 45	20 ± 4
VA 650	630 - 665	600	630	14,3	25	C + 10	C + 45	20 ± 4
VA 700	665 - 705	630	660	14,3	25	C + 10	C + 45	20 ± 4
VA 725	705 - 745	670	700	14,3	25	C + 10	C + 45	20 ± 4
VA 750	745 - 785	705	735	14,3	25	C + 10	C + 45	20 ± 4
VA 800	785 - 830	745	775	14,3	25	C + 10	C + 45	20 ± 4
VA 850	830 - 875	785	815	14,3	25	C + 10	C + 45	20 ± 4
VA 900	875 - 920	825	855	14,3	25	C + 10	C + 45	20 ± 4
VA 950	920 - 965	865	895	14,3	25	C + 10	C + 45	20 ± 4
* VA 1000	965 - 1015	910	940	14,3	25	C + 10	C + 45	20 ± 4
* VA 1050	1015 - 1065	955	985	14,3	25	C + 10	C + 45	20 ± 4
* VA 1100	1065 - 1115	1000	1030	14,3	25	C + 10	C + 45	20 ± 4
* VA 1150	1115 - 1165	1045	1075	14,3	25	C + 10	C + 45	20 ± 4
* VA 1200	1165 - 1215	1090	1120	14,3	25	C + 10	C + 45	20 ± 4
* VA 1250	1215 - 1270	1135	1165	14,3	25	C + 10	C + 45	20 ± 4
* VA 1300	1270 - 1320	1180	1210	14,3	25	C + 10	C + 45	20 ± 4
* VA 1350	1320 - 1370	1225	1255	14,3	25	C + 10	C + 45	20 ± 4
* VA 1400	1370 - 1420	1270	1300	14,3	25	C + 10	C + 45	20 ± 4
* VA 1450	1420 - 1470	1315	1345	14,3	25	C + 10	C + 45	20 ± 4
* VA 1500	1470 - 1520	1360	1390	14,3	25	C + 10	C + 45	20 ± 4
* VA 1550	1520 - 1570	1405	1435	14,3	25	C + 10	C + 45	20 ± 4
* VA 1600	1570 - 1620	1450	1480	14,3	25	C + 10	C + 45	20 ± 4
* VA 1650	1620 - 1670	1495	1525	14,3	25	C + 10	C + 45	20 ± 4
* VA 1700	1670 - 1720	1540	1570	14,3	25	C + 10	C + 45	20 ± 4
* VA 1750	1720 - 1770	1585	1615	14,3	25	C + 10	C + 45	20 ± 4
* VA 1800	1770 - 1820	1630	1660	14,3	25	C + 10	C + 45	20 ± 4
* VA 1850	1820 - 1870	1675	1705	14,3	25	C + 10	C + 45	20 ± 4
* VA 1900	1870 - 1920	1720	1750	14,3	25	C + 10	C + 45	20 ± 4
* VA 1950	1920 - 1970	1765	1795	14,3	25	C + 10	C + 45	20 ± 4
* VA 2000	1970 - 2020	1810	1840	14,3	25	C + 10	C + 45	20 ± 4

** Vulcanised*

V-Rings Type VS



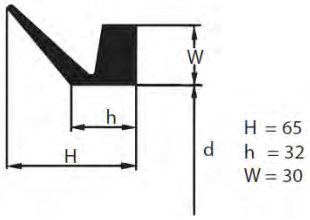


Ref.	Shaft Ø C	Dimensions in millimetres						
		d	D	h	H	d_2	d_1	H_1
VS 5	4,5 - 5,5	4	8	3,9	5,2	C+ 1	C+ 6	4,5 ± 0,4
VS 6	5,5 - 6,5	5	9	3,9	5,2	C+ 1	C+ 6	4,5 ± 0,4
VS 7	6,5 - 8	6	10	3,9	5,2	C+ 1	C+ 6	4,5 ± 0,4
VS 8	8 -9,5	7	11	3,9	5,2	C+ 1	C+ 6	4,5 ± 0,4
VS 10	9,5 - 11,5	9	15	5,6	7,7	C+ 2	C+ 9	6,7 ± 0,6
VS 12	11,5 - 13,5	10,5	16,5	5,6	7,7	C+ 2	C+ 9	6,7 ± 0,6
VS 14	13,5 - 15,5	12,5	18,5	5,6	7,7	C+ 2	C+ 9	6,7 ± 0,6
VS 16	15,5 - 17,5	14	20	5,6	7,7	C+ 2	C+ 9	6,7 ± 0,6
VS 18	17,5 - 19	16	22	5,6	7,7	C+ 2	C+ 9	6,7 ± 0,6
VS 20	19 - 21	18	26	7,9	10,5	C+ 2	C + 12	9 ± 0,8
VS 22	21 - 24	20	28	7,9	10,5	C+ 2	C + 12	9 ± 0,8
VS 25	24 - 27	22	30	7,9	10,5	C+ 2	C + 12	9 ± 0,8
VS 28	27 - 29	25	33	7,9	10,5	C+ 3	C + 12	9 ± 0,8
VS 30	29 - 31	27	35	7,9	10,5	C+ 3	C + 12	9 ± 0,8
VS 32	31 - 33	29	37	7,9	10,5	C+ 3	C + 12	9 ± 0,8
VS 35	33 - 36	31	39	7,9	10,5	C+ 3	C + 12	9 ± 0,8
VS 38	36 - 38	34	42	7,9	10,5	C+ 3	C + 12	9 ± 0,8
VS 40	38 - 43	36	46	9,5	13	C+ 3	C + 15	11 ± 1
VS 45	43 - 48	40	50	9,5	13	C+ 3	C + 15	11 ± 1
VS 50	48 - 53	45	55	9,5	13	C+ 3	C + 15	11 ± 1
VS 55	53 - 58	49	59	9,5	13	C+ 3	C + 15	11 ± 1
VS 60	58 - 63	54	64	9,5	13	C+ 3	C + 15	11 ± 1
VS 65	63 - 68	58	68	9,5	13	C+ 3	C + 15	11 ± 1
VS 70	68 - 73	63	75	11,3	15,5	C+ 4	C + 18	13,5 ± 1,2
VS 75	73 - 78	67	79	11,3	15,5	C+ 4	C + 18	13,5 ± 1,2
VS 80	78 - 83	72	84	11,3	15,5	C+ 4	C + 18	13,5 ± 1,2
VS 85	83 - 88	76	88	11,3	15,5	C+ 4	C + 18	13,5 ± 1,2
VS 90	88 - 93	81	93	11,3	15,5	C+ 4	C + 18	13,5 ± 1,2
VS 95	93 - 98	85	97	11,3	15,5	C+ 4	C + 18	13,5 ± 1,2
VS 100	98 - 105	90	102	11,3	15,5	C+ 4	C + 18	13,5 ± 1,2
VS 110	105 - 115	99	113	13,1	18	C+ 4	C + 21	15,5 ± 1,5
VS 120	115 - 125	108	122	13,1	18	C+ 4	C + 21	15,5 ± 1,5
VS 130	125 - 135	117	131	13,1	18	C+ 4	C + 21	15,5 ± 1,5
VS 140	135 - 145	126	140	13,1	18	C+ 4	C + 21	15,5 ± 1,5
VS 150	145 - 155	135	149	13,1	18	C+ 4	C + 21	15,5 ± 1,5
VS 160	155 - 165	144	160	15	20,5	C+ 5	C + 24	18 ± 1,8
VS 170	165 - 175	153	169	15	20,5	C+ 5	C + 24	18 ± 1,8
VS 180	175 - 185	162	178	15	20,5	C+ 5	C + 24	18 ± 1,8
VS 190	185 - 195	171	187	15	20,5	C+ 5	C + 24	18 ± 1,8
VS 199	195 - 210	180	196	15	20,5	C+ 5	C + 24	18 ± 1,8

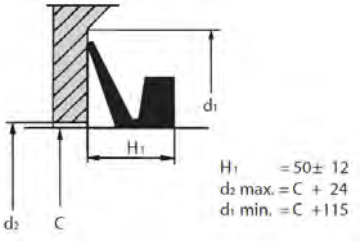
Changes may be made to the dimensions list without notice

V-Rings Type VE

DIMENSIONS IN FREE STATE



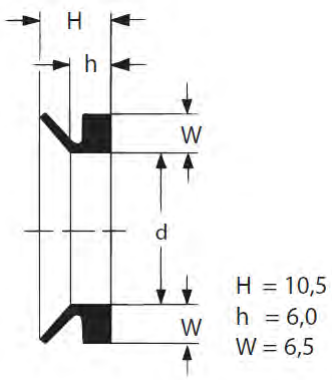
DIMENSIONS, FITTED



Dimensions in millimetres								
Ref.	Shaft Ø C	d	Ref.	Shaft Ø C	d	Ref.	Shaft Ø C	d
VE 450	450 - 455	439	VE 660	660 - 670	640	VE 1040	1025 - 1045	990
VE 455	455 - 460	444	VE 670	670 - 680	650	VE 1060	1045 - 1065	1008
VE 460	460 - 465	448	VE 680	680 - 690	660	VE 1080	1065 - 1085	1027
VE 465	465 - 470	453	VE 690	690 - 700	670	VE 1100	1085 - 1105	1045
VE 470	470 - 475	458	VE 700	700 - 710	680	VE 1120	1105 - 1125	1065
VE 475	475 - 480	463	VE 710	710 - 720	689	VE 1140	1125 - 1145	1084
VE 480	480 - 485	468	VE 720	720 - 730	699	VE 1160	1145 - 1165	1103
VE 485	485 - 490	473	VE 730	730 - 740	709	VE 1180	1165 - 1185	1121
VE 490	490 - 495	478	VE 740	740 - 750	718	VE 1200	1185 - 1205	1139
VE 495	495 - 500	483	VE 750	750 - 758	728	VE 1220	1205 - 1225	1157
VE 500	500 - 505	488	VE 760	758 - 766	735	VE 1240	1225 - 1245	1176
VE 505	505 - 510	493	VE 770	766 - 774	743	VE 1260	1245 - 1270	1195
VE 510	510 - 515	497	VE 780	774 - 783	751	VE 1280	1270 - 1295	1218
VE 515	515 - 520	502	VE 790	783 - 792	759	VE 1300	1296 - 1315	1240
VE 520	520 - 525	507	VE 800	792 - 801	768	VE 1325	1315 - 1340	1259
VE 525	525 - 530	512	VE 810	801 - 810	777	VE 1350	1340 - 1365	1281
VE 530	530 - 535	517	VE 820	810 - 821	786	VE 1375	1365 - 1390	1305
VE 535	535 - 540	521	VE 830	821 - 831	796	VE 1400	1390 - 1415	1328
VE 540	540 - 545	526	VE 840	831 - 841	805	VE 1425	1415 - 1440	1350
VE 545	545 - 550	531	VE 850	841 - 851	814	VE 1450	1440 - 1465	1374
VE 550	550 - 555	536	VE 860	851 - 861	824	VE 1475	1465 - 1490	1397
VE 555	555 - 560	541	VE 870	861 - 871	833	VE 1500	1490 - 1515	1419
VE 560	560 - 565	546	VE 880	871 - 882	843	VE 1525	1515 - 1540	1443
VE 565	565 - 570	550	VE 890	882 - 892	853	VE 1550	1540 - 1570	1467
VE 570	570 - 575	555	VE 900	892 - 912	871	VE 1575	1570 - 1600	1495
VE 575	575 - 580	560	VE 920	912 - 922	880	VE 1600	1600 - 1640	1524
VE 580	580 - 585	565	VE 930	922 - 933	890	VE 1650	1640 - 1680	1559
VE 585	585 - 590	570	VE 940	933 - 944	900	VE 1700	1680 - 1720	1596
VE 590	590 - 600	575	VE 950	944 - 955	911	VE 1750	1720 - 1765	1632
VE 600	600 - 610	582	VE 960	955 - 966	921	VE 1800	1765 - 1810	1671
VE 610	610 - 620	592	VE 970	966 - 977	932	VE 1850	1810 - 1855	1714
VE 620	620 - 630	602	VE 980	977 - 988	942	VE 1900	1855 - 1905	1753
VE 630	630 - 640	612	VE 990	988 - 999	953	VE 1950	1905 - 1955	1794
VE 640	640 - 650	621	VE 1000	999 -1010	963	VE 2000	1955 - 2010	1844
VE 650	650 - 660	631	VE 1020	1010 -1025	973			

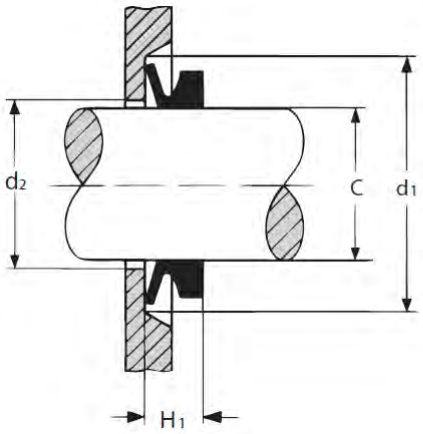
V-Rings Type VL

DIMENSIONS IN FREE STATE



H = 10,5
h = 6,0
W = 6,5

DIMENSIONS, FITTED



H1 = 8 ± 1,5
d2 max. = C + 5
d1 min. = C + 20

Dimensions in millimetres		
Ref.	Shaft Ø C	d
VL 140 VL 150 VL 160 VL 170 VL 180	135 - 145 145 - 155 155 - 165 165 - 175 175 - 185	126 135 144 153 162
VL 190 VL 200 VL 220 VL 250 VL 275	185 - 195 195 - 210 210 - 233 233 - 260 260 - 285	171 182 198 225 247
VL 300 VL 325 VL 350 VL 375 VL 400	285 - 310 310 - 325 325 - 365 365 - 385 385 - 410	270 292 315 337 360
VL 425 VL 450	410 - 440 440 - 475	382 405

Changes may be made to the dimensions list without notice

Conversion Table - Imperial/Metric

(British/US inches)

Fraction”	Decimal”		1”	2”	3”	4”	5”	6”	7”	8”	9”	10”	11”
-	-	-	25,40	50,80	76,20	101,6	127,0	152,4	177,8	203,2	228,6	254,0	279,4
1/64	0,016	0,397	25,80	51,20	76,60	102,0	127,4	152,8	178,2	203,6	229,0	254,4	279,8
1/32	0,031	0,794	26,19	51,59	76,99	102,4	127,8	153,2	178,6	204,0	229,4	254,8	280,2
3/64	0,047	1,191	26,59	51,99	77,39	102,8	128,2	153,6	179,0	204,4	229,8	255,2	280,6
1/16	0,062	1,588	26,99	52,39	77,79	103,2	128,6	154,0	179,4	204,8	230,2	255,6	281,0
5/64	0,078	1,984	27,38	52,78	78,18	103,6	129,0	154,4	179,8	205,2	230,6	256,0	281,4
3/32	0,094	2,381	27,78	53,18	78,58	104,0	129,4	154,8	180,2	205,6	231,0	256,4	281,8
7/64	0,109	2,778	28,18	53,58	78,98	104,4	129,8	155,2	180,6	206,0	231,4	256,8	282,2
1/8	0,125	3,175	28,58	53,98	79,38	104,8	130,2	155,6	181,0	206,4	231,8	257,2	282,6
9/64	0,141	3,572	28,97	54,37	79,77	105,2	130,6	156,0	181,4	206,8	232,2	257,6	283,0
5/32	0,156	3,969	29,37	54,77	80,17	105,6	131,0	156,4	181,8	207,2	232,6	258,0	283,4
11/64	0,172	4,366	29,77	55,17	80,57	106,0	131,4	156,8	182,2	207,6	233,0	258,4	283,8
3/16	0,187	4,763	30,16	55,56	80,96	106,4	131,8	157,2	182,6	208,0	233,4	258,8	284,2
13/64	0,203	5,159	30,56	55,96	81,36	106,8	132,2	157,6	183,0	208,4	233,8	259,2	284,6
7/32	0,219	5,556	30,96	56,36	81,76	107,2	132,6	158,0	183,4	208,8	234,2	259,6	285,0
15/64	0,234	5,953	31,35	56,75	82,15	107,6	133,0	158,4	183,8	209,2	234,6	260,0	285,4
1/4	0,250	6,350	31,75	57,15	82,55	108,0	133,4	158,8	184,2	209,6	235,0	260,4	285,8
17/64	0,266	6,747	32,15	57,55	82,95	108,3	133,7	159,1	184,5	209,9	235,3	260,7	286,1
9/32	0,281	7,144	32,54	57,94	83,34	108,7	134,1	159,5	184,9	210,3	235,7	261,1	286,5
19/64	0,297	7,541	32,94	58,34	83,74	109,1	134,5	159,9	185,3	210,7	236,1	261,5	286,9
5/16	0,312	7,938	33,34	58,74	84,14	109,5	134,9	160,3	185,7	211,1	236,5	261,9	287,3
21/64	0,328	8,334	33,73	59,13	84,53	109,9	135,3	160,7	186,1	211,5	236,9	262,3	287,7
11/32	0,344	8,731	34,13	59,53	84,93	110,3	135,7	161,1	186,5	211,9	237,3	262,7	288,1
23/64	0,359	9,128	34,53	59,93	85,33	110,7	136,1	161,5	186,9	212,3	237,7	263,1	288,5
3/8	0,375	9,525	34,93	60,33	85,73	111,1	136,5	161,9	187,3	212,7	238,1	263,5	288,9
25/64	0,391	9,922	35,32	60,72	86,12	111,5	136,9	162,7	187,7	213,1	238,5	263,9	289,3
13/32	0,406	10,319	35,72	61,12	86,52	111,9	137,3	162,7	188,1	213,5	238,9	264,3	289,7
27/64	0,422	10,716	36,12	61,52	86,92	112,3	137,7	163,1	188,5	213,9	239,3	264,7	290,1
7/16	0,437	11,113	36,51	61,91	87,31	112,7	138,1	163,5	188,9	214,3	239,7	265,1	290,5
29/64	0,453	11,509	36,91	62,31	87,71	113,1	138,5	163,9	189,3	214,7	240,1	265,5	290,9
15/32	0,469	11,906	37,31	62,71	88,11	113,5	138,9	164,3	189,7	215,1	240,5	265,9	291,3
31/64	0,484	12,303	37,70	63,10	88,50	113,9	139,3	164,7	190,1	215,5	240,9	266,3	291,7
1/2	0,500	12,700	38,10	63,50	88,90	114,3	139,7	165,1	190,5	215,9	241,3	266,7	292,1
33/64	0,516	13,097	38,50	63,90	89,30	114,7	140,1	165,5	190,9	216,3	241,7	267,1	292,5
17/32	0,531	13,494	38,89	64,29	89,69	115,1	140,5	165,9	191,3	216,7	242,1	267,5	292,9
35/64	0,547	13,891	39,29	64,69	90,09	115,5	140,9	166,3	191,7	217,1	242,5	267,9	293,3
9/16	0,563	14,288	39,69	65,09	90,49	115,9	141,3	166,7	192,1	217,5	242,9	268,3	293,7
37/64	0,578	14,684	40,08	65,48	90,88	116,3	141,7	167,1	192,5	217,9	243,3	268,7	294,1
19/32	0,594	15,081	40,48	65,88	91,28	116,7	142,1	167,5	192,9	218,3	243,7	269,1	294,5
39/64	0,609	15,478	40,88	66,28	91,68	117,1	142,5	167,9	193,3	218,7	244,1	269,5	294,9
5/8	0,625	15,875	41,28	66,68	92,08	117,5	142,9	168,3	193,7	219,1	244,5	269,9	295,3
41/64	0,641	16,272	41,67	67,07	92,47	117,9	143,3	168,7	194,1	219,5	244,9	270,3	295,7
21/32	0,656	16,669	42,07	67,47	92,87	118,3	143,7	169,1	194,5	219,9	245,3	270,7	296,1
43/64	0,672	17,066	42,47	67,87	93,27	118,7	144,1	169,5	194,9	220,3	245,7	271,1	296,5
11/16	0,687	17,463	42,86	68,26	93,66	119,1	144,5	169,9	195,3	220,7	246,1	271,5	296,9
45/64	0,703	17,859	43,26	68,66	94,06	119,5	144,9	170,3	195,7	221,1	246,5	271,9	297,3
23/32	0,719	18,256	43,66	69,06	94,46	119,9	145,3	170,7	196,1	221,5	246,9	272,3	297,7
47/64	0,734	18,653	44,05	69,45	94,85	120,3	145,7	171,1	196,5	221,9	247,3	272,7	298,1
3/4	0,750	19,050	44,45	69,85	95,25	120,7	146,1	171,5	196,9	222,3	247,7	273,1	298,5
49/64	0,766	19,447	44,85	70,25	95,65	121,0	146,4	171,8	197,2	222,6	248,0	273,4	298,8
25/32	0,781	19,844	45,24	70,64	96,04	121,4	146,8	172,2	197,6	223,0	248,4	273,8	299,2
51/64	0,797	20,241	45,64	71,04	96,44	121,8	147,2	172,6	198,0	223,4	248,8	274,2	299,6
3/16	0,812	20,638	46,06	71,44	96,84	122,2	147,6	173,0	198,4	223,8	249,2	274,6	300,0
53/64	0,828	21,034	46,43	71,83	97,23	122,6	148,0	173,4	198,8	224,2	249,6	275,0	300,4
27/32	0,844	21,431	46,83	72,23	97,63	123,0	148,4	173,8	199,2	224,6	250,0	275,4	300,8
55/64	0,859	21,828	47,23	72,63	98,03	123,4	148,8	174,2	199,6	225,0	250,4	275,8	301,2
7/8	0,875	22,225	47,63	73,03	98,43	123,8	149,2	174,6	200,0	225,4	250,8	276,2	301,6
57/64	0,891	22,622	48,02	73,42	98,82	124,2	149,6	175,0	200,4	225,8	251,2	276,6	302,0
29/32	0,906	23,019	48,42	73,82	99,22	124,6	150,0	175,4	200,8	226,2	251,6	277,0	302,4
59/64	0,922	23,416	48,82	74,22	99,62	125,0	150,4	175,8	201,2	226,6	252,0	277,4	302,8
15/16	0,937	23,813	49,21	74,61	100,0	125,4	150,8	176,2	201,6	227,0	252,4	277,8	303,2
61/64	0,953	24,209	49,61	75,01	100,4	125,8	151,2	176,6	202,0	227,4	252,8	278,2	303,6
31/32	0,969	24,606	50,01	75,41	100,8	126,2	151,6	177,0	202,4	227,8	253,2	278,6	304,0
63/64	0,984	25,003	50,40	75,80	101,2	126,6	152,0	177,4	202,8	228,2	253,6	279,0	304,4

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- Part of Diploma PLC

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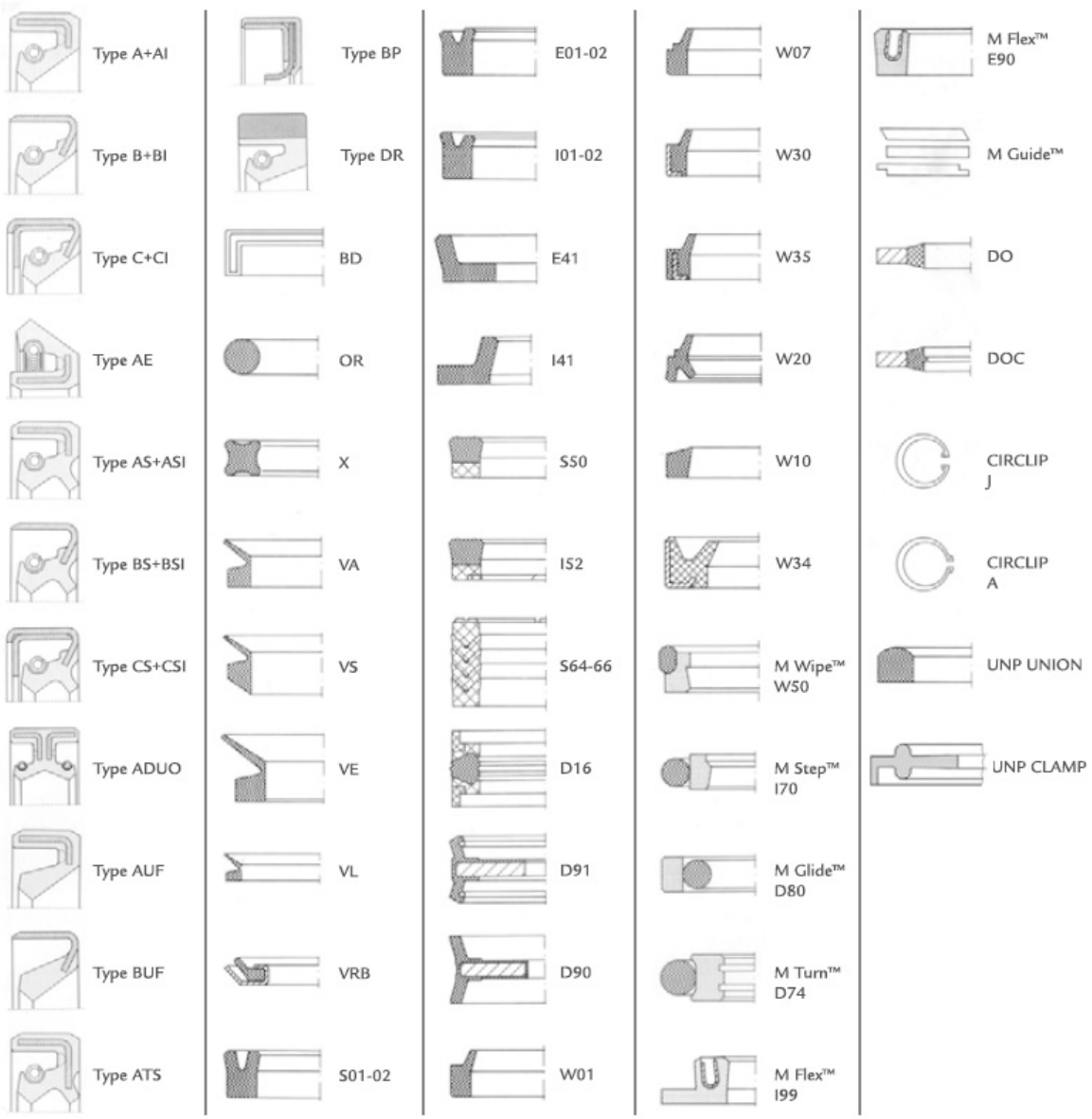

Small things make **GREAT** things possible

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