ENGINEERING

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To order the catalog, please contact your Timken engineer and request a copy of the Timken® Small Bore Metric Seals Catalog (order no. 10951).

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OIL SEAL NOMENCLATURE AND COMPONENTS

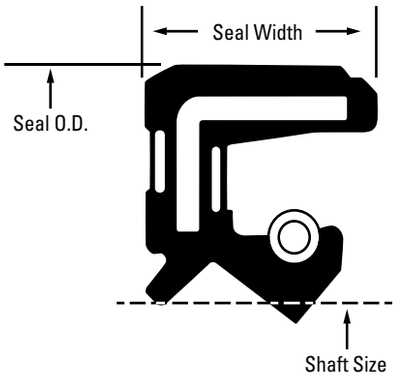

Fig. 1. Oil seal nomenclature.

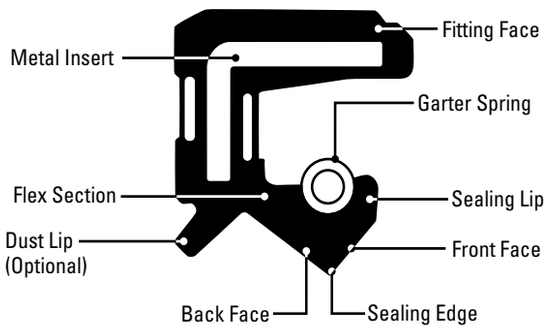

Fig. 2. Oil seal components.

OIL SEAL MODEL TYPES

TABLE 1. OIL SEAL MODEL TYPES

Model	Characteristics	Maximum Surface Speed	Maximum Pressure
 **RLS35**	This model type is a rubber outside diameter (O.D.) seal with one spring loaded sealing lip. With only one sealing lip, this seal can either retain lubricant or exclude contaminants. It cannot do both simultaneously.	12 m/s (2362 fpm)	0.3 kg/cm2 (4.267 psi)
 **R2LS32**	This model type is a rubber O.D. seal with two sealing lips. The main sealing lip is spring loaded. This is a two-way seal, which means that it can retain lubricant and exclude contaminants simultaneously.	10 m/s (1969 fpm)	0.3 kg/cm2 (4.267 psi)

ELASTOMER MATERIALS

TABLE 2. ELASTOMER MATERIALS

Material	Code	JIS Hardness	Temperature Range	Characteristics
Nitrile (NBR)	S	70	-20° C to 120° C (-4° F to 248° F)	This material has good resistance to standard oils, greases and normal fuels. This material also has good abrasion resistance.
Fluoroelastomer (FKM)	V	75	-40° C to 250° C (-40° F to 482° F)	This material has high-temperature resistance. It also is resistant to a variety of chemicals and acidic solutions.

CHEMICAL RESISTANCE GUIDE

The following guide should be treated as a general guideline for elastomer performance when exposed to common chemicals. For seal use in applications with various chemicals or other chemical compounds not listed, please contact your Timken sales engineer. See table 3 below.

TABLE 3. CHEMICAL RESISTANCE GUIDE

		Nitrile	Fluoroelastomer
Acidic Solutions	Non-Organic	2	2
	Organic	3	2
Basic Solution		1	1
Salts or Saline		1	1
Hydrocarbon		4	2
Alcohol		1	1
Grease		1	1
Phenol		4	2
Aldehyde		4	4
Ketone		4	3

Ratings:
1 = Can be used with little to no effect.
2 = Can be used but caution must be taken with respect to operating conditions.
3 = Can be used for a short period of time.
4 = Cannot be used.

SHAFT INFORMATION

SHAFT SPEED

The operating shaft speed limit is highly dependent on the oil seal material and seal lip design. If there are minimal vibrations, the surface speed of the seal can be higher. To determine the surface speed of a certain seal, consult the diagram below. This diagram should be used as a general guide to determine if a seal is considered to be used at low, medium or high speed. For high-speed applications that may fall outside of the chart limits below, please contact your Timken sales engineer. See Fig. 3 below.

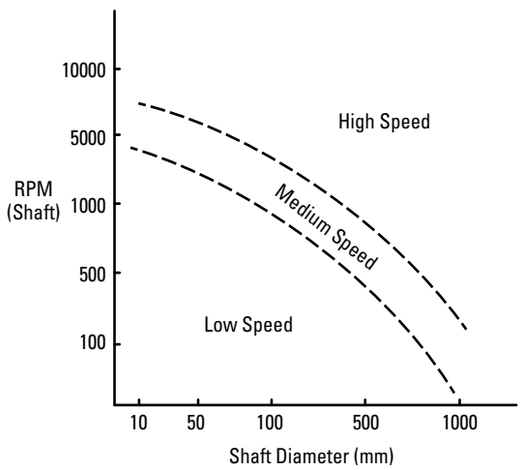

Fig. 3. Seal surface speed selection guide.

SHAFT SURFACE FINISH

The shaft surface roughness and finish play a big role in seal surface speed. Generally for low-speed applications, the shaft surface roughness must be 0.75 µm Ra (29.5 µin) or lower. For medium- to high-speed applications the surface roughness must be 0.375 µm Ra (14.75 µin) or lower. If a ground surface finish has been used with a roughness greater than 0.75 µm Ra (29.5 µin), the probability for oil (or grease) leakage greatly increases. For more detail regarding shaft finish, please see table 6 on page 9 for shaft and housing manufacturing standards.

SHAFT HARDNESS

The standard shaft hardness to be used is a minimum of 30-40 HRC. However, if the application is in a very contaminated environment, excess dirt and particles can increase shaft wear. If this is the case, a shaft with greater hardness may need to be used. Contact your Timken sales engineer for more details.

HRC = Rockwell Hardness

SHAFT MISALIGNMENT AND RUN-OUT

Shaft misalignment and run-out will affect the efficiency and durability of an oil seal. Acceptable misalignment is dependent on shaft speed, shaft diameter, oil seal material and model type. Acceptable misalignment, in regards to seal diameter and basic shaft speed, can be found in the below diagram. This diagram should be used as a general guide to determine permissible seal misalignment. If large amounts of shaft misalignment and run-out are present in your application, please contact your Timken sales engineer. See Fig. 4 below.

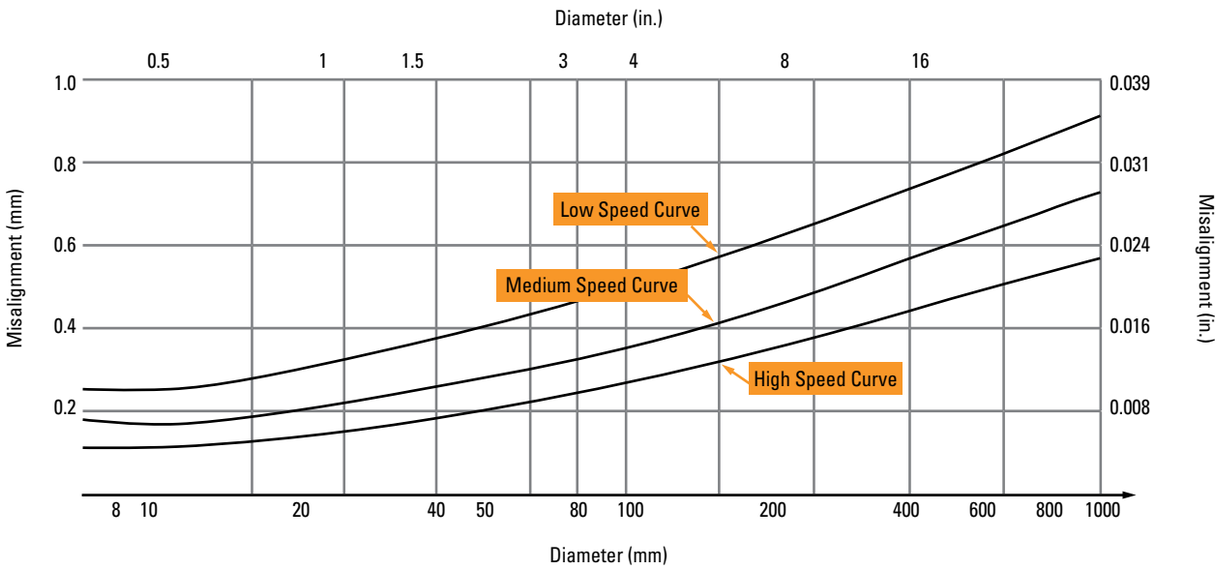

Fig. 4. Acceptable shaft misalignment.

SEAL OUTSIDE DIAMETER TOLERANCE

TABLE 4. SEAL OUTSIDE DIAMETER TOLERANCE

O.D. Range	O.D. Tolerance
mm	mm
< 30	+0.10 to +0.30
30 to 120	+0.10 to +0.35
120 to 180	+0.15 to +0.40
180 to 300	+0.15 to +0.45
300 to 550	+0.20 to +0.55

SEAL WIDTH TOLERANCE

TABLE 5. SEAL WIDTH TOLERANCE

Width Range	Width Tolerance
mm	mm
< 6	± 0.2
6 to 10	± 0.3
10 to 14	± 0.4
14 to 18	± 0.5
18 to 30	± 0.6
> 30	± 0.7

SHAFT AND HOUSING MANUFACTURING STANDARD

TABLE 6. SHAFT AND HOUSING MANUFACTURING STANDARD

Shaft Manufacturing Standard						
Size Range		Tolerance	Fitting Surface			Surface Roughness
From	To	H9	b	r	a	
mm	mm	µm	mm	mm		
3	6	-30 to 0	1.5	2	30°	For low speed use 0.75 µm Ra max.
6	10	-36 to 0				
10	18	-43 to 0				
18	30	-52 to 0				
30	50	-62 to 0	2			
50	80	-74 to 0				
80	120	-87 to 0	2.5			
120	180	-100 to 0				
180	250	-115 to 0	3	5		
250	315	-130 to 0			20°	For medium to high speed use 0.375 µm Ra max.
315	400	-100 to 0	5			
400	500	-155 to 0				
500	630	-175 to 0	7	10		
630	800	-200 to 0				
800	1000	-230 to 0	9			
1000	1250	-260 to 0				

Housing Manufacturing Standard						
Size Range		Tolerance		K	Fitting Surface	Surface Roughness
From	To	H7	H8			
mm	mm	µm	µm	mm		
3	6	0 to 12	0 to 18	3	a = 15 - 30°	1.5 µm Ra max.
6	10	0 to 15	0 to 22			
10	18	0 to 18	0 to 27			
18	30	0 to 21	0 to 33			
30	50	0 to 25	0 to 39			
50	80	0 to 30	0 to 46			
80	120	0 to 35	0 to 54			
120	180	0 to 40	0 to 63	4		
180	250	0 to 46	0 to 72			
250	315	0 to 52	0 to 81	5		
315	400	0 to 57	-			
400	500	0 to 63	-	6	c = 0.1 – 0.15W	
500	630	0 to 70	-			
630	800	0 to 80	-			
800	1000	0 to 90	-			
1000	1250	0 to 105	-			

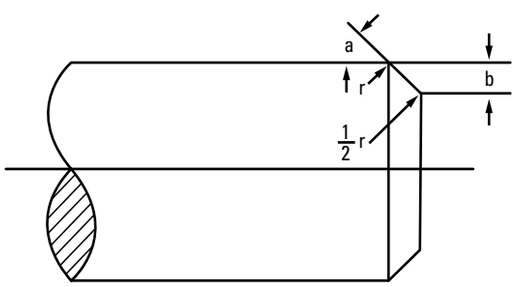

Fig. 5. Shaft parameters.

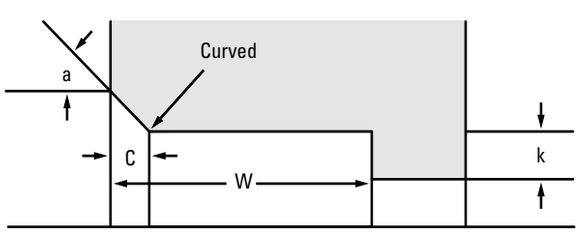

Fig. 6. Housing parameters.

OIL SEAL DESIGN CONSIDERATIONS

When designing the housing, it is important to consider ease of seal installation. The two diagrams below illustrate common housing designs. No matter how you design the housing, you must ensure that all components are referenced off of the same datum plane so that the oil seal is not installed at an angle.

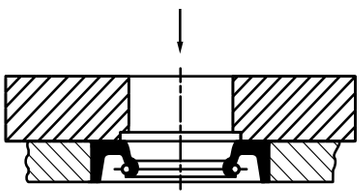

Fig. 7. Seal Installation with an end plate.

Without a datum plane, a high internal pressure or light-metal housing may cause leakage. In such a case, an end plate can be used to firmly fix the seal. See Fig. 7 above.

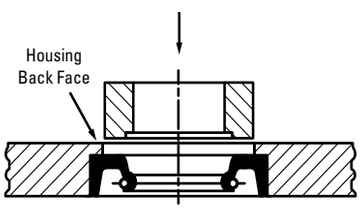

Fig. 8. Seal removal from the back face.

The inside diameter of the housing back face should not cover the entire seal. This way, the oil seal can be pushed out from the other side. See Fig. 8 above.

OTHER PRECAUTIONS

- It is very important that the seal lip contact area remain lubricated. If the seal begins to run dry, seal wear will drastically increase.
- When designing the equipment, care must be taken to ensure that the internal pressure does not continually increase.
- Applying grease to the bearing also affects the effectiveness of the seal. Therefore a grease return path may be needed between the bearing and the seal.
- Axial shaft movement should be minimized as much as possible to ensure optimal seal performance.
- Housings manufactured using a stamping press should not be used.
- Along with the oil seal lip contacting surface, the design should ensure that no other areas will leak oil/grease. This includes the housing bore and securing bolts which may have been tapped into the sealing area.

SPECIAL HOUSING DESIGNS

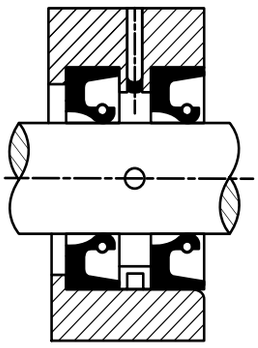

Fig. 9. Special design 1.

When two seals are oriented to provide one-way sealing, a lubricating channel can be used to lubricate the outer oil seal. See Fig. 9 above.

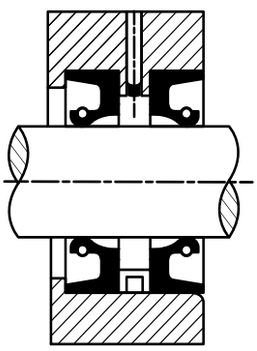

Fig. 10. Special design 2.

When two seals are oriented to provide two-way sealing between two fluids, a fluid channel can be used. This will create pressure between the seals to prevent leakage of either fluid. See Fig. 10 above.

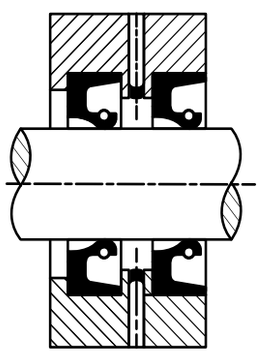

Fig. 11. Special design 3.

If the lubricating channel creates its own leakage problem in the outer seal, an additional channel can be used to drain excess oil from between the seals. See Fig. 11 above.

INSTALLATION

PRE-INSTALLATION CHECKS

1. The shaft and housing dimensions should be checked prior to installation.
2. The oil seal inside diameter (I.D.), outside diameter (O.D.), and width dimensions should also be checked prior to installation.
3. The end surfaces of the shaft and housing should be inspected for damage and proper chamfer before installation.
4. The oil seal lip must be inspected for damage or deformation. Also, ensure that the spring is located behind the main lip and that it is not rusted.
5. The fitting surface must be cleaned and free of debris.

INSTALLATION METHOD

THE SHAFT

Before the seal is fitted to the shaft, grease (or oil) should be applied to the sealing lip(s) and the contact surface of the shaft. This will make installation easier and reduce the initial seal lip wear. The amount of grease (or oil) to be applied should be about 1/3 – 1/2 of the volume between the lips.

THE HOUSING

Excessive or uneven force should not be used to fit the seal into place in the housing. A fitting tool should be used to ensure that force is evenly applied when installing the seal. See Figs. 12 and 13 below.

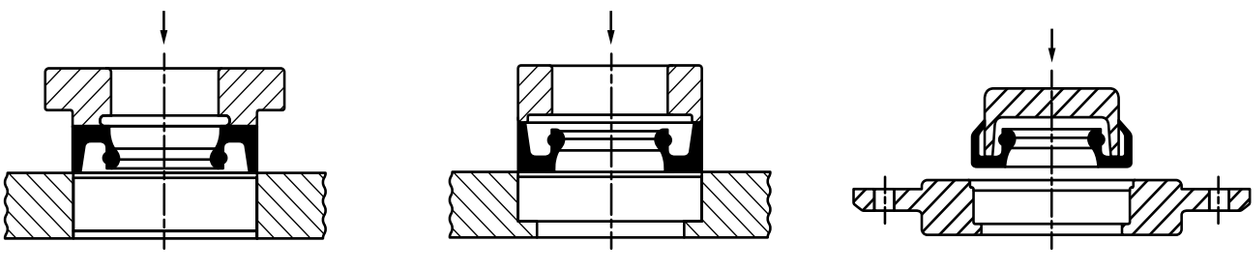

Fig. 12. Acceptable methods.

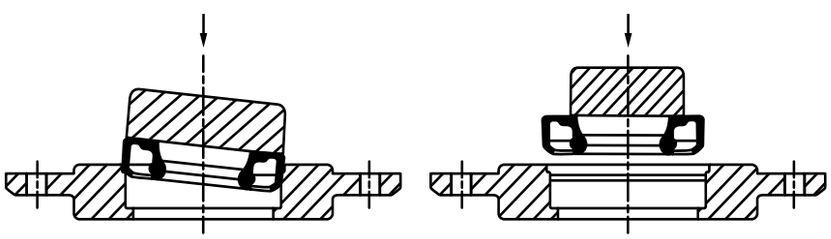

Fig. 13. Unacceptable methods.

INSTALLATION CONSIDERATIONS

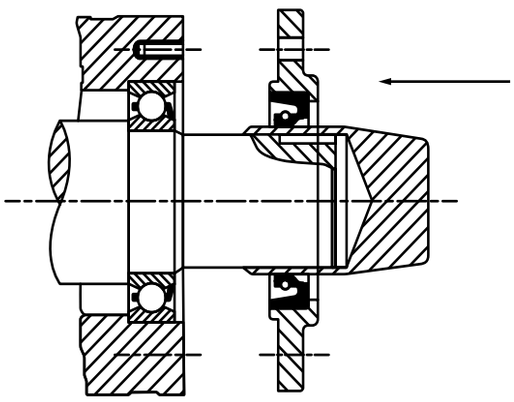

Fig. 14. Shaft with a key way.

If the shaft has a thread/keyway, the seal riding surface diameter needs to be larger than the diameter of the thread/keyway. If this is not possible, then a tool must be used to facilitate the oil seal installation. See Fig. 14 above.

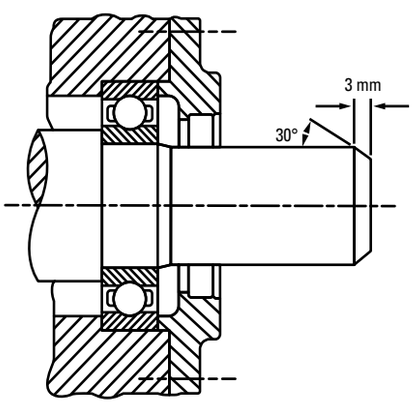

Fig. 15. Stepped shaft.

When a bearing is fitted, the shaft may be damaged. Therefore the seal riding surface diameter must be made smaller compared to the fitting surface diameter of the bearing. See Fig. 15 above.

AFTER INSTALLATION

1. Do not clean the seal.
2. If the equipment must be painted, the seal lip riding surface on the shaft must be free from paint.
3. Do not reuse removed seals. Used seals must be discarded.
4. After the seal has been installed, optimum seal performance is not achieved until the seal has been broken-in during operation.

ORDERING

For standard seals located in this catalog, please reference the example part numbers below. If there are any questions regarding part numbers or special order seals, feel free to contact your Timken sales engineer. See Figs. 16 and 17 below.

RLS35

25 x 40 x 7 RLS35 - V

Shaft Diameter (mm) | Housing Diameter (mm) | Width (mm) | Model Type | Material

Fig. 16. RLS35 ordering example.

This model type is a rubber O.D. seal with one spring loaded sealing lip. With only one sealing lip, this seal can either retain lubricant or exclude contaminants depending on orientation. It cannot do both simultaneously.

R2LS32

35 x 50 x 7 R2LS32 - S

Shaft Diameter (mm) | Housing Diameter (mm) | Width (mm) | Model Type | Material

Fig. 17. R2LS32 ordering example.

This model type is a rubber O.D. seal with two sealing lips. The main sealing lip is spring loaded. This is a two-way seal, which means that it can retain lubricant and exclude contaminants simultaneously.

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