



WATER PUMP BEARINGS

As the automobile's core ,the engine is improving with high efficiency, so to the water pump bearing, we need more high requirements, for example, more load, and more high anti-heat, and better seal.

RTL-water pump bearing is that new style of bearing fitting for these requirements. In the fact, it is a kind of simple double-load bearing. The double-load bearing has no inner ring, the race-way of roller is on the shaft directly. The two load bearing forms a whole , both side of the outer ring sealed with seal . At the same load condition, the size of radial load is smaller than other bearings. And the same axial load condition, the ability of load is high than other bearings . Because of good-hard, high accuracy of rotate, simple structure, and easy dismounting, many countries, like AMERICA, JAPAN, and GERMAN all use this kind of structure. RTL develops all kinds of water pump bearing and they are used in automobiles that made in our China.

Water pump is formed by outer ring, water pump bearing, anti-water seal, impeller, fan and rollers. water pump bearing is the most important part of the water pump. Because the high speed of revolution, usually it reaches 9000r/min, it requires the high-load ability of water pump bearing. And only this can guarantee the life of bearing under the high speed revolution. Because of the limited space, bad operation condition, the water pump bearing should assure the normal revolution requirement, and the same time can decrease the bearing's ability of load. It is difficult for the seal of bearings, because the reliability and the wear ability of the bearing will effect the usage of the bearing. Totally, loading ability, operating seal and operating clearance, are the important factors affecting the capability of the bearing.

The range of products

■ WB	double-row ball water pump spindle bearing
■ WR	simple-row ball and simple roller water pump spindle bearing



■ WB...C	double-row ball water pump spindle (angular contact)
■ WR...C	simple-row ball and simple roller water pump spindle bearing (Four-point angular contact)
Usually, WR and WB can satisfy the most of loading requirements. Only under some special condition, the inner structure will be designed as the high-hardness, like WB...C and W...C series water pump bearing.	

Material and heating treatment

The ball and the roller of RTL are all made by high chrome steel, and shaft, outer ring uses carbon steel or chrome steel. Usually, if the shaft material is high-carbon, the hardness reaches 60-64HRC. And if the shaft material is high-chrome, the hardness reaches 58-62HRC. The hardness of ball and roller reaches 61-65HRC. And the hardness of outer ring is 60-64HRC.

Lubrication and Seal

RTL water pump bearing use once-time lubrication and also it is a kind of lifetime lubrication. It is normal for a small quantity of grease to come out of the seal lip. This quantity should be 1/4 or 1/2 part of the space. In usual condition, NO 2# or NO 3# grease can satisfy the requirement of lubrication, but when the temperature is higher than 120°C. We should use high-level grease.

The function of the water pump bearing seals is to exclude contaminants, such as dust or coolant vapour, while retaining the lubricant. It is normal for a small quantity of grease to come out of the seal lip, as part of the lubrication of the seal lip interface. This quantity should not exceed 0.2g. The seal performance is determined by the material properties and the lip design, as detailed below.

Conventional single lip snap type design

1. For normal automotive applications
2. Vulcanized elastomer sealing element
3. Ease of assembly
4. Economical



Triple lip interlocking design

1. For severe applications
2. Inward facing seal lip for improved grease retention
3. Upgraded rubber material for better sealing against coolant
4. Positive lock in outer ring, reduces possibility of seal spinning



Standard double lip interlocking design

1. For demanding applications
2. Inward facing seal lip for



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- 3. Upgraded rubber material for better sealing against coolant
- 4. Positive lock in outer ring, reduces possibility of seal spinning
- 5. Optimized lip cross-section for torque and sealing performance



- 5. Optimized lip cross-section for torque and sealing performance
- 6. Additional stainless steel slinger and third lip for increased sealing protection

Clearance

The internal bearing clearance in rolling bearings in operation greatly influences bearing performance in terms of fatigue life, vibration, noise, heat-generation, etc. Consequently, the selection of a proper internal clearance is one of the most important tasks.

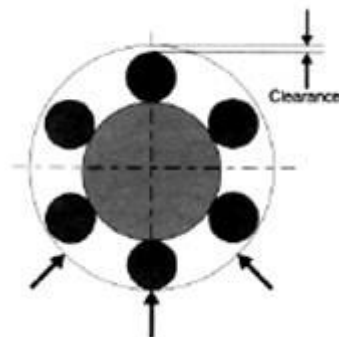
Theoretically, the longest bearing life can be expected when the clearance is slightly negative. However, it is difficult to achieve such an ideal condition, and an excessive negative clearance will greatly shorten the bearing life. Therefore a clearance of zero or a slight positive amount, instead of a negative one, should be selected in general.

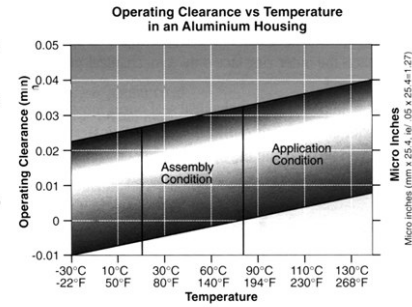
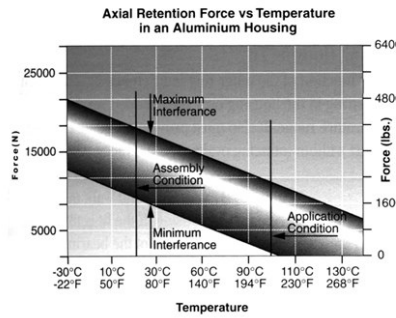
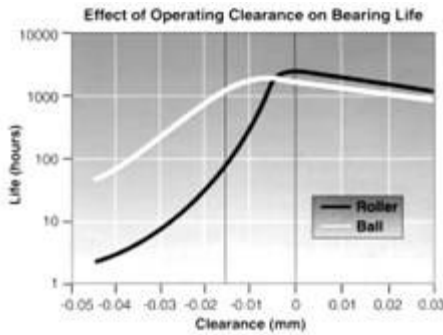
When choosing the clearance, we should not only consider the decrease of the clearance, because of the interference fit between the outer ring and bearing seating, but also should consider the decrease of the clearance, because of the increasing of the temperature. The shell of the water pump bearing has two kinds of shell, one is iron and another is aluminum. The fit of the water pump bearing and shell is interference fit (For list one).

RTL bearing has no special requirements. The radial clearance is 15-35 μ m. NSK water pump bearing's radial clearance is 10-40 μ m.

FAG is 10-36 μ m.

轴承外径D	泵壳内径偏差 (μ m)	
	iron	aluminum
--24	-27-- -48	-46-- -67
24--30	-33-- -53	-56-- -77
30--52	-34-- -59	-71-- -96





Accuracy

The tolerance of water pump bearing needs to satisfy with LIST TWO.
 The coarseness of water pump bearing needs to satisfy with LIST THREE.
 The accuracy of revolution is not more than 0.025mm.

表2 轴连轴承的尺寸公差(μm)。

D (mm)		Δ Dmp		V _{DP}	V _{Dmp}	Δ C _s		V _{C_s}
超过	到	上偏	下偏	最大	最大	上偏	下偏	最大
		差	差			差	差	
18	30	0	-11	12	8	0	-250	20
30	50	0	-13	16	10	0	-250	20
50	80	0	-15	20	11	0	-250	20

轴	D (mm)		Δ Dmp		V _{DP}	V _{Dmp}	Δ C _s	
	超过	到	上偏	下偏	最大	最大	上偏	下偏
			差	差			差	差
	10	18	0	-11	8	8	0	-500
	18	30	0	-11	9	9	0	-500

表3 轴连轴承配合表面、端面粗糙度(μm)

部位	外径	端面	圆角
	Ra不大于		
外套圈	0.63	6.3	5
轴	0.63	6.3	5

Bearing life



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This load causes a total permanent deformation of the rolling element diameter at the most heavily loaded raceway contact. Even if the operation is normal, the raceway and rolling elements also appear deformation. This total revolution calls 接触疲劳? Under the same revolving condition, even if the structure, size, material, the way of manufacture, the 接触疲劳 life? will be different. So the L10 is the lifetime expressed in millions of revolutions. It is reached or exceeded by at least 90% of a large group of identical bearings. The relationship of basic dynamic load rating, equivalent dynamic load and basic life is expressed by following formula (1). Using time expresses the life of bearing (2).

$$L_{10} = (C/P)^P \dots\dots\dots (1)$$

$$L_{10h} = (10^6/60n) * (C/P)^P \dots\dots\dots (2)$$

$$L_{10S} = \pi D L_{10} \dots\dots\dots (3)$$

L₁₀: 基本额定寿命, 10⁶转

L_{10h}: 基本额定寿命, h

L_{10S}: 基本额定寿命, Km

P: 当量动负荷, N(Kgf)

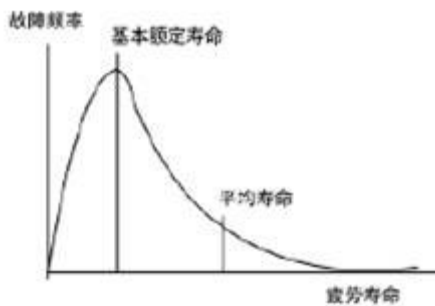
C: 基本额定动负荷, N(Kgf)

n: 转速rpm

P: 寿命指数, 水泵轴承球端 P=3

水泵轴承滚子端 P=10/3

D: 车轮或轮胎直径, mm



Basic dynamic load rating

P is the life of exponent. For a ball bearing it is 3, and for a roller bearing, 10/3. For a constant speed, the life in hours calculated:

$$L_{10} = (C/P)^P (1)$$

$$L_{10h} = (10^6/60n) * (C/P)^P (2)$$

Maintenance and mounting

Comparing with the normal part of machine, the water pump bearing is a precise part. So we should be careful when we keep.

RTL water pump bearing all use the package of anti-rust and the anti-rust oil. Only the package is not destroyed, the quality will be assured. The best maintenance condition is that the temperature is 20°C or so, the moistness is 65%, and should keep the shelf about 30cm above the ground, and should keep away the sunshine and the cold wall.

When mounting the bearing into the housing, care must be taken to prevent the transmitting of forces through the ball complement. In order to avert this, a sleeve should be used that contacts the outer ring face only. A mechanical press should be used. The hub, impeller and mechanical seal bores must be aligned with the shaft axis during their mounting. Again a press should be used and the opposite shaft end must be supported to prevent transmission of forces through the ball complement.

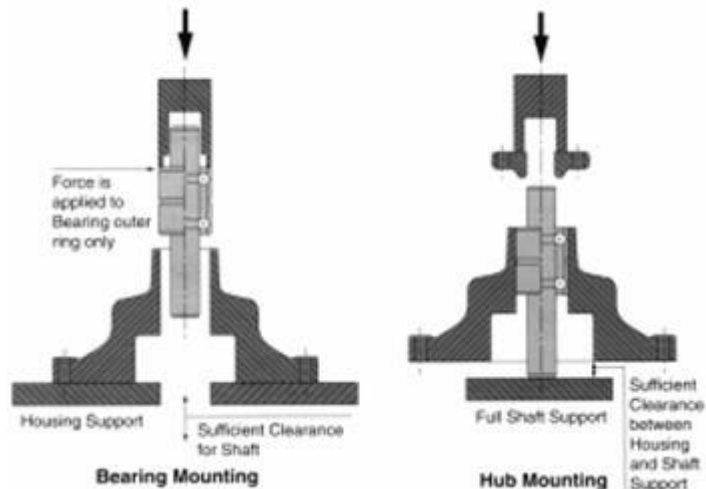
The function of the outer ring interference fit is to retain the bearing in the housing over the intended service temperature range. It also must provide adequate bearing support without inducing ovality into the raceways. If the interference fit is too light, the bearing could walk out of the housing. If the fit is too heavy, pre-load of the bearing may occur.

Housing requirements

Bore circularity < 0.010mm. Bore taper < 0.007mm per 25mm bore length.

Smoothing

During press in, material from the housing bore is removed resulting in less holding force. In cold conditions, material removal increases. This depends on the housing material and the housing bore surface finish.



Lack of attention to proper installation of pulleys, fans, fan spacers or viscous clutches will cause increased bearing loading during operation.

Typically the water pump belt forces and weights of rotating components on the bearing shafts will load the outer ring raceways over only one-half of its circumference. This is called a point loaded condition.

Because of rotation with respect to the loads, the shaft raceways are loaded over their full circumference or circumferentially loaded. If the assembly procedure or mounted components contain or induce eccentricities at the mating surfaces, imbalance loads will be generated. If angularity occurs, gyroscopic moments are created due to the tilted, wobbling motion of the misaligned components during rotation. Angularity may also contribute to the eccentric imbalance loads. All eccentric and gyroscopic load components are non-stationary in direction and rotate with the shaft. This situation, if severe, will reverse the raceway loading



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patterns to that of point loaded shaft raceways and 360 degree circumferentially loaded outer ring raceways. The magnitudes of these loads increase with the square of the rotational speed. Other conditions generated under these circumstances are roller edge stressing and misaligned ball row tracking. This acts to elevate cage and lubricant stressing and increase bearing operating temperatures. As well, the L10 bearing fatigue life becomes shorter due to the increased equivalent load on each row.

Taken to extremes, imbalance and gyroscopic loads may become so high reaching the strength limitations of the shaft material. The dynamic stress reversals may initiate tiny micro-cracks in the hardened case layer. If operation such as this continues, the cracks will propagate across the entire shaft cross section and cause the shaft to fracture, often with catastrophic results.

Size

The size of the water pump bearing has never a standard. To satisfy with different requirements.
