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**Plain bearings - Recommendations for automotive
crankshaft bearing environments**

滑动轴承 汽车曲轴轴瓦工作环境推荐参数

(ISO/TR 27507:2010, MOD)

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Plain bearings - Recommendations for automotive crankshaft bearing environments

1 Scope

This standard gives the recommended parameters for the working environment of automotive engine crankshaft bearings. It is explained that in order to meet the working environment of crankshaft bearings, with the current processing equipment, the various sizes and states related to the crankshaft bearing environment that most engine manufacturers can achieve, such environment for crankshaft bearing will not cause bearing problems.

Some of the recommended parameters in this standard cannot be fully met for certain applications. In these applications, design specifications require more precise high-quality parts.

2 Crankshaft

2.1 Surface roughness

The rougher the journal surface, the more likely it is that the rough surface contact will have a destructive effect on the lubricant film and the higher the wear rate. Excessive surface roughness will reduce the thickness of the lubricant film to the extent that overheating or even seizure occurs.

Generally, the surface roughness of the crank pin and the main journal shall not be greater than $Ra0.25\ \mu\text{m}$. The roughness of the thrust surface shall never be greater than $Ra0.4\ \mu\text{m}$. Experience and tests have shown that the load that the thrust ring can withstand is inversely proportional to the roughness of the matching surface. Therefore, it is necessary to finish the thrust surface to a state much lower than $Ra0.4\ \mu\text{m}$.

2.2 Grinding and polishing

When grinding standard cast iron shafts, nodular graphite will be exposed and fall off from the surface of the material, thus forming fiber filaments or tongue thorns in these shed pits of the iron substrate. During operation, these fiber filaments can become embedded in the bearing alloy and can quickly cause severe wear and damage. Therefore, it is common practice to polish the crankshaft after grinding to remove these raised tongue thorns. The direction of these tongue thorns on the shaft surface depends on the direction of rotation

3 Bearing seat

3.1 Overview

The shape of automotive thin-walled bearings mainly depends on the contour shape of the bearing seat hole, then affects the shape of the bearing hole, so the machining of the bearing seat hole is very important.

3.2 Surface roughness of seat hole

The close contact between the bearing and the seat hole is very important for the good heat transfer and heat dissipation of the bearing; and to prevent displacement and fretting wear in the interference state. The surface roughness of the connecting rod seat hole shall not exceed $Ra0.8\ \mu\text{m}$; the surface roughness of the crankshaft bearing seat hole shall not exceed $Ra1.6\ \mu\text{m}$; the surface roughness shall be avoided from exceeding these recommendations, because the roughness exceeding the limit will reduce the heat conduction of the bearing back to the seat, thereby causing overheating in the bearing clearance.

3.3 Tolerance of seat hole size

For main bearing seat holes, the diameter tolerance is usually specified as $25\ \mu\text{m}$; for connecting rod holes below 80 mm. The diameter tolerance shall be controlled at $12.5\ \mu\text{m}$ if possible, especially under heavy loads. For automotive bearing, it is usually desirable to be $20\ \mu\text{m} \sim 25\ \mu\text{m}$. Very large connecting rods with a diameter tolerance of $25\ \mu\text{m}$ are acceptable. If the bearing clearance needs to be strictly controlled, tighter tolerances on the seat holes are required.

3.4 Cylindricity of seat holes

See Table 3 for the cylindricity deviation limits for the large end hole of the connecting rod and the main bearing block. If the deviation from the cylindrical geometry is too large, a concentrated load will be formed on the bearing, resulting in high lubricating film pressure and low oil film thickness at the corresponding location. Cylindricity is the most critical at heavy loads. For heavy-duty short bearings, the smaller the cylindricity in the load area, the better.

Because not only the taper, but also the shape errors such as hourglass and drum shape affect the cylindricity, in order to accurately evaluate and effectively control the cylindricity, each journal shall be subject to diameter measurement in three cross-sections such as the both axial ends and middle part.

3.7 Parallelism of connecting rod holes

The parallelism and twist between the large-end hole and the small-end hole of the connecting rod are measured at the 150 mm length of connecting rod, which shall be controlled at 25 μm .

3.8 Alignment of oil hole

The oil hole on the bearing must be aligned with the oil hole on the seat hole; the deviation is not more than 750 μm .

3.9 Fitting of the positioning lip

The function of the positioning lip of the thin-walled bearing is to prevent the oil holes from being blocked by each other. Therefore, it is required that the distance from the bearing seat to the end surface of seat hole and from the positioning lip groove on the bearing cover to the end surface of the seat hole are different; secondly, the upper and lower bearings and the seat hole do not have a significant axial displacement. Therefore, the coordination of the positioning lip and the positioning groove shall be clearance fit in the three directions of length, width and height, so as to prevent mutual interference from causing the poor fit of the bearing back around the positioning lip, raising the surface of local bearing, thereby causing damage. See Table 4 for minimum fitting clearance.

Table 4 -- Fitting clearance of positioning lip and groove

Diameter of seat hole D_H / mm		Minimum fit clearance / mm		
>	$\leq$	Width	Height	Length
-	50	0.14	0.4	0.5
50	80		0.45	1.0
80	120		0.50	1.5

3.10 Positioning of bearing seat cover

The bearing seat is generally positioned by bolts, fractures, steps, toothed joint surfaces or positioning pins on the joint surface of the bearing seat by twisted holes. However, the tooth-shaped joint surface method is not recommended, because it is impossible to completely contact between the two surfaces. The positioning of the bearing cover, especially the radial positioning, is very important, because the slightest misalignment will also cause a step at the bearing joint surface, which will generate uneven loads and may even damage the lubricant film.

The positioning of the bearing cover must be reliable, and even the positioning surface must have a slight interference fit. In the case of bolt fastening, with the change of bolt torque, even if it is very well positioned, a certain misalignment may occur. The step caused by the misalignment shall not exceed 12.5 μm .

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