TECH

TECH INFORMATION FROM CLEVITE ENGINE PARTS

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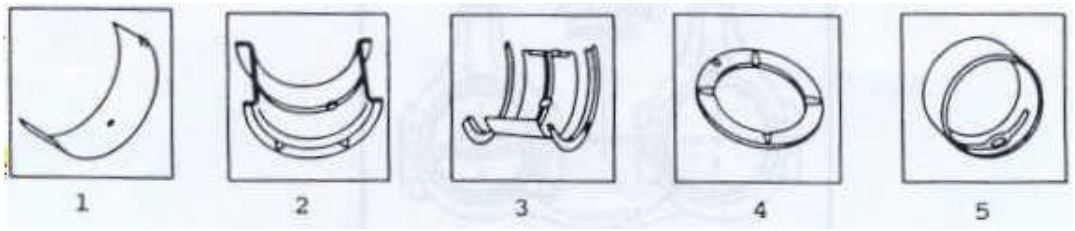
ENGINE BEARING FUNDAMENTALS PART 3 "DESIGN"

In part 2 of this series we talked about lubrication and how shaft rotation builds an oil film. Getting the lubricant to behave in a manner most beneficial to bearing performance must be taken into consideration when designing the bearing system. The term bearing system is used because bearings do not stand-alone. They are held in place by some type of housing that provides support and rigidity. The mating shaft operates very close to the bearing surface (.0001 to .0002") as we explained in part 2. And of course an adequate supply of a suitable clean lubricant is required. More on the subject of "Suitable Lubricants" and "Shaft Surfaces" in future parts of this series.

Engine bearings may come in several different configurations. Crankshaft bearings are generally what we call "Half Shells". These half shell type bearings are paired up to make a full round. Half shells come in two different configurations; "Straight Shells" (figure 1) and "Flanged" (figure 2). Flanged bearings have three bearing surfaces; one on the ID and one at each end. The end faces, or flanges, are used to support thrust or end loads on the crankshaft, while the ID supports the shaft itself. Thrust loads can also be supported by separate "Thrust Washers". Half washers are used in combination with a straight shell bearing (figure 3). Thrust washers may also be made full round (figure 4). Some bearings are made in a full circle. These are referred to as "Bushings" (figure 5) and may be made either with or without a seam. Bushings are typically used wherever assembly permits the shaft to be inserted through the bearing such as with piston pins and camshafts. Half shells are used where the size or shape of the shaft requires that the bearings be installed around the shaft as with a crankshaft.

FIGURES



Use of the proper terminology is essential in describing the functions of various characteristics or features of a bearing. Figure 6 shows a typical straight shell bearing with its various features labeled. Figure 7 shows a similarly labeled half shell flanged bearing. Terminology for bushings and washers is similar.

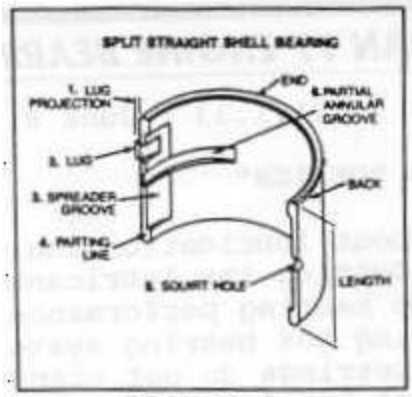


FIGURE 6

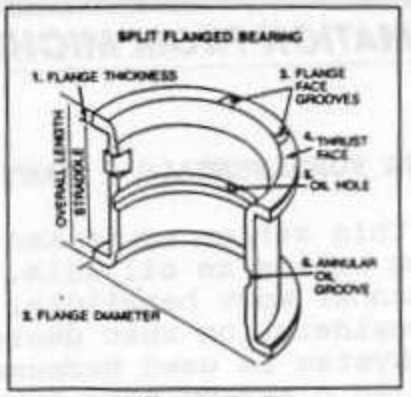


FIGURE 7

Oil is introduced into most main bearings through a hole in the upper (block) half. Upper mains generally have an annular groove to carry oil to the lower (cap) half and to provide pressurized oil to a hole in the crankshaft, which carries oil from the main to the rod journals or crankpins. Oil enters the rod bearings through a hole in the journal surface. As the crank rotates oil is spread around the inside eliminating the need for any grooving in rod bearings. Modern main bearings seldom have grooving in the highly loaded lower half because grooving tends to break up the oil film and reduces bearing surface area.

One of the most important factors in bearing design is a proper fit between the bearing and housing. Except for thrust washers, nearly all bearings are an interference fit. This means the bearing is slightly larger than the hole it fits into. In bushings we refer to this as “Press Fit”. In half shell bearings it’s called “Crush”. Figure 8 illustrates the principle of crush. On the left, the bearing ends extend slightly beyond the split line of the housing. On the right, the bearings are compressed or crushed down into the housing as the bolts are tightened. This creates a radial contact pressure that holds the bearings tight. Bushings are held by a similar radial pressure as a result of being pressed into their housing.

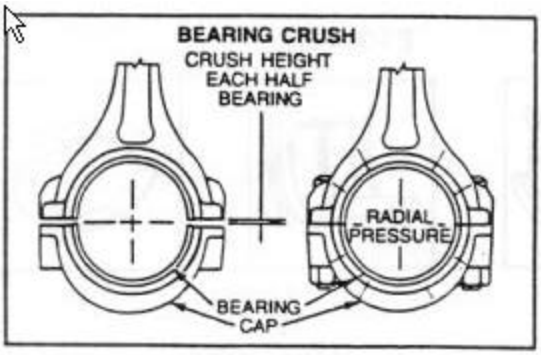


FIGURE 8

In our next installment, we will cover additional design features such as wall size, eccentricity and more.