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PROPER DIRECTIONS FOR CRANCKSHAFT GRINDING AND POLISHING

Crankshaft journal surfaces should be ground and polished to a surface finish of 15 micro inches roughness average Ra or better. Journals on highly loaded crankshafts such as diesel engines or high performance racing engines require & finish of 10 micro inches Ra or better.

The above is a simple straightforward specification, which can be measured with special equipment. However, there is more to generating a ground and polished surface than just meeting the roughness specification. To prevent rapid, premature wear of the crankshaft bearings and to aid in the formation of an oil film, journal surfaces must be ground opposite to engine rotation and polished in the direction of rotation. This recommendation can cause a great deal of confusion in actual execution. Understanding the reasons behind the recommendation and examination of the following illustrations will help make the recommendation more clear.

Metal removal tends to raise burrs. This is true of nearly all-metal removal processes. Different processes crease different types of burrs. Grinding and polishing produces buns that are so small that we can't see or feel them but they are there and can damage bearings if the shaft surface is not generated in the proper way. Rather than "burrs", let's call what results from grinding and polishing "microscopic fuzz". This better describes what is left by these processes. This microscopic fuzz has a gain or lay to it like the hair on a dog's back. Figure 1 is an illustration depicting the lay of this fuzz on a journal the direction in which a grinding wheel or polishing belt passes over the journal surface will determine the lay of the micro fuzz

In order to remove this fuzz from the surface, each successive operation should pass over the journal in the opposite direction so that the fuzz will be bent over backward and removed.
Polishing in the same direction as grinding would not effectively remove this fuzz because it would merely lie down and then spring up again. Polishing must, therefore, be done opposite to grinding in order to improve the surface.

In order to arrive at how a shaft should be ground and polished, we must first determine the

desired end result and then work backwards to establish how to achieve it. Figure 2 depicts a shaft turning in a bearing viewed from the front of a normal clockwise rotating engine. The desired condition is a journal with any fuzz left by the polishing operation oriented so it will lay down as the shaft passes over the bearing (Figure 2). The analogy to the shaft passing over the bearing is like petting a dog from head to tail A shift polished in the opposite direction produces abrasion to the bearing which would be like petting a dog from tail to head. To generate a surface lay like that shown in Figure 2, the polishing belt must pass over the shaft surface as shown in Figure 3. The direction of shaft rotation during polishing is not critical if a motorized belt type polisher is used because the belt runs much faster than the shaft. If a nutcracker type polisher is used, then proper shaft rotation must be observed (Figure 4). Stock removal during polishing must not exceed .0002” on the diameter.

Having determined the desired surface lay from polishing we must next establish the proper direction for grinding to produce a surface lay opposite to that resulting from polishing. Figure 5 shows the grinding wheel and shaft directions of rotation and surface lay for grinding when viewed from the front or nose end of the crankshaft This orientation will be achieved by chucking the flywheel flange at the left side of the grinder (in the headstock). Achieving the best possible surface finish during grinding will reduce the stock removal necessary during polishing.

The surface lay generated by grinding would cause abrasion to the bearing surfaces if left unpolished. By polishing in the direction shown in either Figure 3 or 4, the surface lay is reversed by the polishing operation removing fuzz created by grinding and leaving a surface lay which will not abrade the bearing surface.

Nodular cast iron shafts are particularly difficult to grind and polish because of the structure of the iron. Nodular iron gets its name from the nodular form of the graphite in this material. Grinding opens graphite nodules located at the surface of the journal leaving ragged edges, which will damage a bearing. Polishing in the proper direction will remove the rigged edges from these open nodules.

All of the above is based on normal clockwise engine rotation when viewed from the front of the engine. For crankshafts, which rotate counterclockwise such as some marine engines, the crankshaft should be chucked at its opposite end during grinding and polishing. This is the same as viewing the crank from the flanged end rather than the nose end in the accompanying figures.

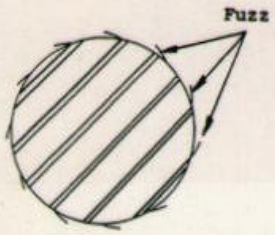

Figure 1
Journal illustrating fuzz from grinding and polishing.

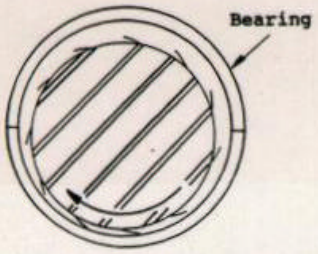

Figure 2
Journal rotating in bearing with the grain of the fuzz.

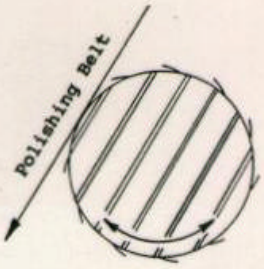

Figure 3
Direction polishing belt should pass over journal and grain of fuzz which results.

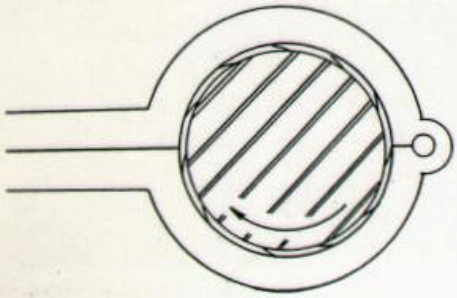

Figure 4
Direction of shaft rotation and resulting lay of fuzz generated with nut cracker type polisher.

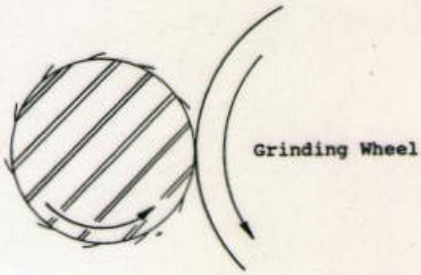

Figure 5
Directions of shaft and grinding wheel rotation and lay of fuzz which results.

All figures viewed from nose end of crankshaft