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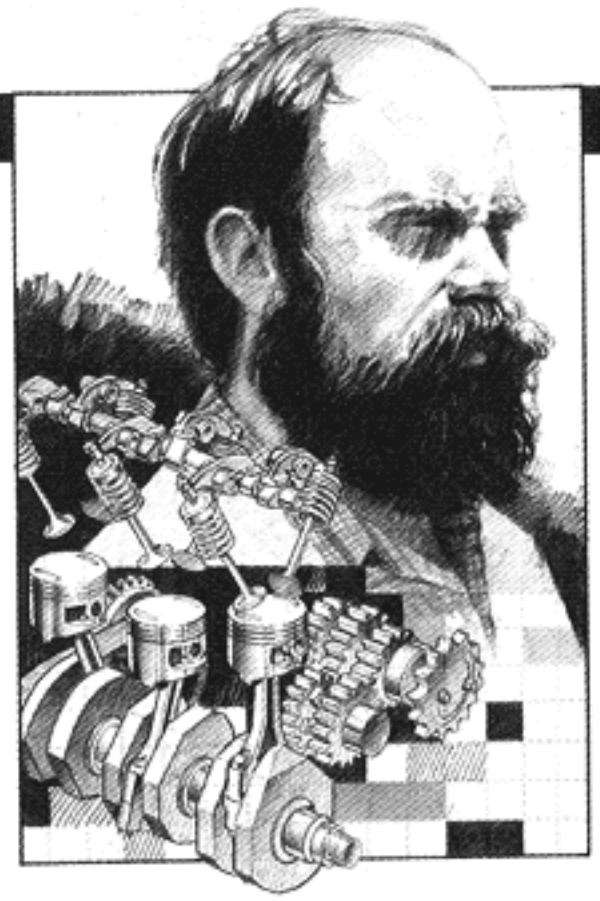
Seal Of Approval



☐ Seals and O-rings have the essential function of keeping fluids where they belong, and of excluding them from areas they do not. With time, both either wear out or otherwise deteriorate and need replacement.

A common shaft oil seal like those found on crankshaft ends consists of a steel base in the form of a ring, with rubber vulcanized onto it. One or more flexible rubber lips project from the inner edge of this steel base ring and make contact with the rotating shaft or a collar fitted on the shaft as a seal runner. Since no shaft runs perfectly true, crankshafts move around a great deal as they run, and the lip of the seal must be flexible enough to remain in contact with the shaft as it jumps. To make this contact more certain, a tiny steel coil spring may back one or both lips of the seal. This garter spring keeps the seal's lip tight against the spinning, vibrating shaft, just as garters keep stockings tight around a wearer's legs.

The actual region of contact with the shaft is narrow—typically less than a millimeter wide—so the pressure on the rubber and the shaft is high. Without lubrication, shaft friction will overheat the rubber lip and soon cause it to harden into a brittle, glass-like condition, inviting cracks and leaks. How to test for this kind of deterioration? Run your fingernail around the inside of the seal lip. If it feels soft and pliant, indenting easily under your nail, it is fine. Examine the entire circumference under strong light. If nicks or cracks appear in the lip, replace the seal. Look at the shaft or runner where the seal contacts. Are there imperfections that could cut the seal? If there are, polish them out.

The thinner a seal, the less flexibility can be built into its lips, and extremely thin seals tend to have very strong garter springs to make up for this. As a result, they rub the shaft hard and soon become glassy and brittle. Disturbing such a thin seal (as when a crank is removed for inspection) and then reusing it invites leakage—it's a better idea to replace such thin seals.

Some seals have a pattern of swirly lines molded into the lip next to the contact area. When the seal is correctly installed (such seals have arrows molded into them to show correct shaft rotation) the motion of the shaft will sweep oil along the swirly lines *toward* the oil cavity.

Sometimes careless installation will tear the rubber away from the steel base ring. To prevent this, make sure the seal enters its seat straight, and that it does not have to climb over any sharp edges to reach its final position. Cocking a press-fit seal while driving it into its seat often leads to leaks in another way. If the seal is going in crooked and binds, people often try to beat it into position, pry it out or punch it out from the pressure side. Each one of these procedures leads to a damaged or deformed seal.

Some seals designed for use only in horizontally split crankcases have a molded-on rubber lip on the outside circumference which keys into a matching groove in the case. This positively prevents the seal from blowing out in service, but also prevents use of such seals in any press-in applications.

More often than not, seals have two lips. When only one of the two has a garter spring, that lip generally faces the pressure, while the other functions as a dust shield, also forming a reservoir for lubricating grease.

Seals for high-speed use often have lips coated with the durable and self-lubricating plastic *Rulon,* giving them a dark reddish color. The entire seal isn't made from Rulon because it's both expensive and lacks flexibility.

All seals should receive some lubrication before use. A single-lip seal should be wiped with oil, while twin-lip designs should have a daub of grease smeared around the ID (inner diameter), between the two lips.

Most seals bear identifying numbers, giving the OD, the ID, and the thickness in millimeters. When you need a seal and the dealer doesn't have it, you can sometimes find substitutes "by the numbers," either by walking the parts-department aisles or by using a seal interchange book. Not all seal materials are compatible with all fluids, although most automotive seals made of nitrile or Buna-N rubber will live in common automotive-use oils.

Great confusion arises with O-rings because they don't carry numbers. O-rings used in brake systems may be ethylene-propylene—a rubber which swells horribly in gas or oil. Toss a set of brake calipers into the parts-washer and then try to get those pistons out!

Seal and O-ring materials aren't graded fair-good-better-best. From the cheapest to the most expensive, a seal of a given size may cost from a few cents up to several dollars, but the price has little to do with function. Exposed to kerosene, a very expensive Viton fluorocarbon seal (such as used to seal cylinder heads on two-stroke racers) would become useless in an hour, but at high temperature it continues to work while Buna-N or neoprene would char. A material that lasts for years in mineral oil may shrivel away to a potato chip in turbine oil. Whenever you must order O-rings from a catalog, use a seal materials booklet, published by one of the makers, to be sure of the material compatibility.

Both seals and O-rings are complete in themselves; they don't need to be slathered with miraculous patent sealants. Adding such extras makes replacement much more difficult, and actually may *promote* leaks. People get the impression O-rings need help when they notice how little they are compressed once installed. Because an O-ring is a pressure-activated seal, the pressure of the oil forces the ring to deform further, tightly sealing against leakage. An O-ring is not to be confused with a gasket. Gaskets seal when they're tightly clamped, but O-rings don't work that way. O-rings need only a light oiling before use.

Many people imagine gasket sealant will keep oil seals in place. I have known more than one person who crashed in his own oil because he installed gearbox shaft seals with gasket compound on their ODs. Under pressure, the long molecules of the rubbery sealant act like heavy grease. Cylinder base gaskets, covered with such sealants, also come out frequently—squeezed out, gliding along on a film of sealant. Don't slather up oil seals before installation. Instead, like O-rings, oil them lightly. The rubber can then move enough to key into the surface of the casting and the seal will hold itself in. For extra security, as in racing, seals may be held in with small screws or be bonded to adjacent metal with silicone sealer *after installation.*

Let the seal or O-ring do its job without trying to second-guess it. If the design is right, it will work as planned. ■