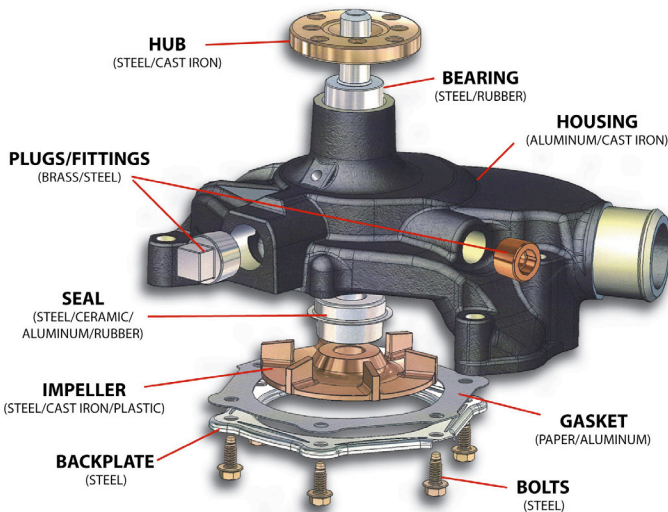


Water Pump Components



Most water pumps have five basic components:

- The housing is the outer shell that encases the pump. It is typically made of cast iron or aluminum materials, although a number of modern engines use stamped-steel housings;
- The impeller spins and distributes coolant throughout the cooling system;
- The bearing assembly is the mechanical support that allows continuous rotation of the impeller;
- Attached to the bearing assembly is the hub, which is the connecting source of power for impeller rotation.
- Finally, the seal protects the bearing assembly from coolant and contaminants.



The Water Pump Seal

As the water pump is the heart of the cooling system, the seal can be considered the heart of the water pump. The water pump seal protects the bearing assembly from being exposed to coolant and abrasive contaminants. Once coolant and contaminants enter the bearing assembly, the bearing's lubricant is washed away. If this seal failure is not detected and the pump is not replaced, the bearing will eventually fail and possibly lead to a crisis such as a snapped bearing shaft. Broken shafts may cause significant damage to the vehicle.

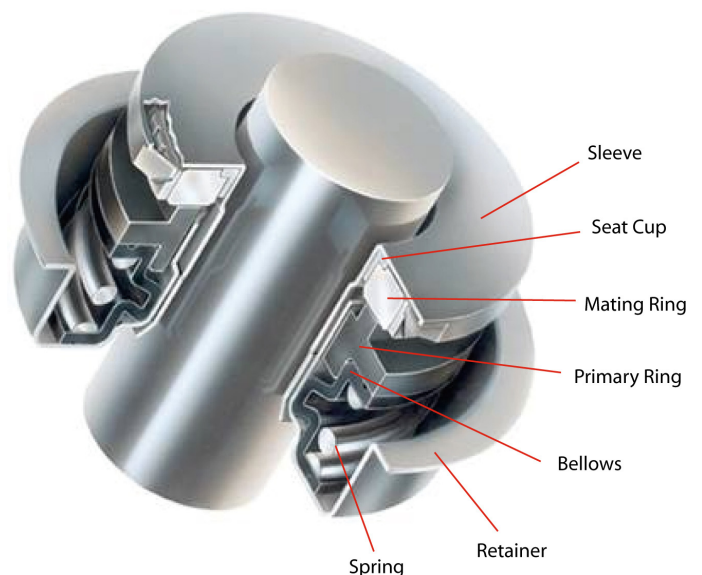
Without proper seal alignment and material composition, the seal can cause premature pump failure in a relatively short period of time.

Today's modern seal designs are made of silicone and carbide composite materials versus the two-piece ceramic of yesteryears. Modern seals are unitized, spring-loaded designs that apply exact pressure on the seal. The working height of the seal is not affected by machining tolerances.

There are three main conditions that affect a seal's life and can lead to premature pump failure. First, seal leakage and failure can occur from high temperature operation of the engine. An overheated engine operated with low levels of coolant can cause:

- Heat aging of the elastomeric components
- Potential boiling of the fluid film between the seal faces
- Potential distortion of seal face flatness

Typical Seal Configuration



The Water Pump Seal (continued)

Secondly, seal failure can be caused by abrasive contamination or deposits between the seal surfaces. Although today's running clearances greatly minimize the admission of any appreciable-sized solids, the term "filming" is still known to result in a leak path within the seal. Contaminating factors can be debris such as rust, core sand, casting binders, abrasives due to machining and assembly, or solvents from the system components. Even adhesive transfer from one seal face to a mating seal face has been known to cause a leak path.

Finally, the third reason is due to mechanical conditions. These conditions can include:

- Incorrect shaft or bore concentricity
- Bearing radial or axial play
- Incorrect seal installation
- Excessive vibration due to misalignment of belts, pulleys or a defective fan clutch.

To avoid premature pump failures caused by the seal, manufacturers of premium quality water pumps use seals with the following design features:

1. Face materials are selected that are appropriate for operating parameters, system concerns, and extended pump life.
2. The mating ring of the seal is exposed to the coolant flow to improve the removal of heat generated by seal faces during operation.
3. Since most high-mileage seal failures are caused by time-temperature effects on rubber parts, only upgraded elastomeric materials of the bellows design are used. This helps eliminate any undesirable mechanical conditions in the pump and reduces the effects of heat aging.
4. Seals with Teflon-coated retainers simplify installation and minimize bore/retainer press fit leakage. This is especially critical in machined aluminum pumps.

When diagnosing premature seal failures, be careful not to misinterpret minor weep hole stains as indications of seal failure. All seals are supposed to weep slightly as a little coolant is needed to lubricate the seal faces. However, major drips indicate that it is time to replace the water pump.

The Bearing

The integral shaft bearing assembly is permanently lubricated and combines a double row of rollers, a precision ground shaft, an outer race, and two double-lipped grease seals. The rollers consist of either ball/ball or ball/roller-type bearings along with lubricant that keeps the mechanical operation smooth and intact. The bearing is integral to the impeller rotation that moves coolant throughout the cooling system.

Often water pump failures are incorrectly attributed to bearing failure when, in fact, the bearing failure was caused by a leaky water pump seal.

It is important to note the distinct difference between the water pump seal and the bearing grease seals. As previously discussed, the water pump seal protects fluid and abrasive contaminants from entering the bearing assembly. The function of the two bearing seals is to hold grease inside the bearing assembly.

Therefore, in diagnosing water pump failure when leakage and contaminants are found in the bearing assembly, keep in mind, that bearing assembly failure is most often caused by the premature failure of the water pump seal. In this case, the water pump seal did not do its job in keeping fluids and contaminants from penetrating the bearing assembly.

