Bombing down the interstate, you glance at the odometer and realize you've just reached an automotive milestone: 100,000 miles with no major repairs. Time was a car that had passed its belly over that much real estate was considered pretty much used up, but yours still runs great and looks practically new. Amazing how technology has advanced.

Then you notice the temperature gauge. Holy smokes—pegged! You put it in neutral, coast off onto the shoulder and shut her down. There's that maple-syrup-spilled-on-the-radiator odor again—you've smelled it before, but filed it under "things to think about later." Sooner would've been better—now you're walking.

Seal Deal

This is an easy one, because it's near the top. Your job would be a lot tougher if the pump were near the bottom.

The biggest change in water pump design occurred decades ago when the spring-loaded mechanical seal was adopted. However, its rubber parts may disintegrate if the engine overheats, and its polished sealing faces can wear and warp if the engine is run dry. Typically, pumps will start leaking catastrophically shortly after a boil-over.

This kind of failure can be worse than it sounds. Besides the vastly expensive internal engine damage that running without coolant may cause, a leaking seal can wash away the shaft bearing's lubricant, perhaps resulting in a snapped shaft, and a flying fan or belt pulley can destroy the radiator or even dent the hood.

So, leakage is the No. 1 failure. Noise is second, and is always indicative of a terminal condition. While service literature on water pumps often will show a picture of a badly eroded impeller that contributes to overheating, technicians say that's not as common as it once was. Another possible problem with the same consequences is an impeller that's come loose from its shaft. Erosion of the inside surfaces of the pump chamber caused by cavitation (a weak cap or a chronically low level, perhaps?) can open up the working space and reduce flow, as can corrosion from too little antifreeze in the coolant mix.

Evidence Gathering

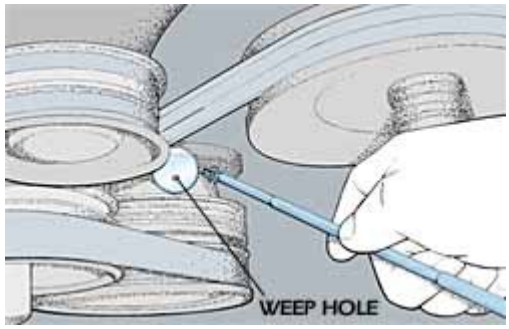
If you start to smell the distinctive odor of engine coolant, or you notice that the level in the overflow bottle is dropping rapidly, it's time for a careful exam. (If you're lucky, it may be just a leaky hose connection, but look the radiator over, too. If the smell is strong in the passenger compartment and the windshield tends to steam up, think about the heater core. In cases where none of the above is the culprit, better check out the water pump.)

With the engine warm enough to open the thermostat, but not hot enough to pressurize the system, look for vigorous flow at 3000 rpm.

First, use an inspection mirror and a good light to view the vent hole that's at the bottom of the pump casting's nose. Or, support the front of the car safely on jackstands and look up from underneath. All seals are supposed to weep slightly (a little coolant is needed to lube the faces), but drips mean you'd better go shopping for an estimate. Next, grasp the fan or water pump pulley and see if it rocks from side to side. If there's anything but slight movement, the bearing is on its way out. Also, you can remove the belt and see how the bearing feels as you rotate the pump shaft. Roughness isn't acceptable.

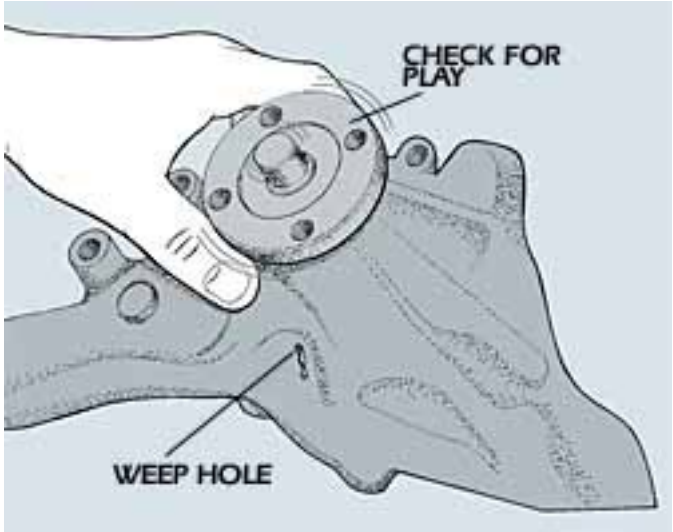
A low-flow situation that results in hot running can be hard to diagnose. Drain the level down to the top of the radiator tubes, get the engine hot, and then shut it off for 10 minutes and let it heat soak to make sure the thermostat is wide open. Now, fire it up again and run it at 3000 rpm. On cars using the radiator fill neck on the top tank, look down into it with a flashlight and you should see strong circulation. Another possibility is to squeeze the upper hose to feel for flow, but that's pretty subjective. Unfortunately, there's no good way for the do-it-yourselfer to differentiate a weak pump from a clogged radiator.

Major Undertaking?



Wet liquid seeping from the weep hole signifies the end of the service life of the seals in your pump.

On some front-wheel drives the job is a horror story. Make sure you resist the temptation to get into this repair if you're not prepared to invest the time required. Find out the flat-rate hours by asking a local garage owner or dealer service manager. Or, look it up on your PM CD-ROM. It's a job that could take several hours, depending on what you drive. The first steps in removing any water pump are to let the engine cool off completely, and then drain the cooling system by either opening the radiator petcock or disconnecting the bottom radiator hose. Next, do whatever is necessary to remove the accessory drivebelts. If the car has a longitudinally mounted engine as found in every rwd and some front-drivers, remove the air shrouds (in some cases, the radiator, too), and then the fan and its clutch, which bolt to the front of the water pump shaft.



Almost any radial play in the water pump shaft is grounds for immediate pump replacement before something fails.

Now you can start on the pump by disconnecting the hoses. Those for the heater will probably be stubborn, so you may need to split their ends with a utility knife (if they're long enough, you might be able to trim them off square and reuse them).

Extract the pump-to-engine bolts and keep them and any accessory brackets they retain in strict order or you'll regret it at assembly. There may be hidden bolts, so take a look at a diagram.

The pump should come off with a good tug. If not, make sure you didn't miss any bolts, and then tap on the inlet or outlet neck with a mallet or a block of wood and a hammer. Don't use a screwdriver to pry the seam open or you'll make a nick that the gasket may not seal.

Pumps seal against the engine or backing plate with a gasket, an O-ring or RTV silicone. Get the mating surface clean with a scraper.

If you must use silicone sealer, use one rated for automotive use. It should also be labeled low-volatility. Outgassing from the curing sealant can poison oxygen sensors—so leave the bathtub caulk with your plumbing tools.

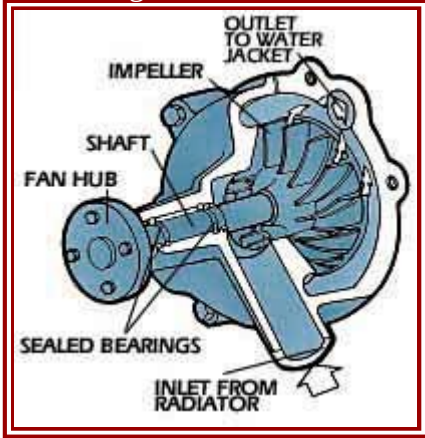
Vehicles with serpentine belts have a belt routing diagram under the hood somewhere. Read and obey.

We should mention a potential problem. Suppose you're installing a water pump on a car with a serpentine belt. Engines on many older models were equipped with a regular V-belt, but the water pump for the old model may fit physically on the new one. Can you guess the possible mistake? Think about direction: The serpentine belt might drive the impeller in the opposite direction from that of the V-belt, so you could end up installing a pump that runs backward, causing a seemingly incurable overheating situation. Make sure you get exactly the right part, and compare the impellers. Also, heed that routing diagram.

After everything is buttoned up, figure out how much coolant your system holds. This should be in your owner's manual, or in the shop manual. Using the appropriate manufacturer's coolant, add half that amount and then top off with water. This will give you a 50-50 mix. Be sure to follow the service procedure for bleeding the air bubbles out of the system.

HOW IT WORKS: Water Pump Shaft Seals

Two perfectly flat rings, one stationary and the other rotating with the pump shaft, are pressed together by means of a coil spring. The rings may be made of carbon or may be ceramic, phenolic, porous bronze, cast iron, etc., in any combination. This allows only enough seepage to keep the elements lubricated. It has a weak link, however, in the form of its rubber parts—the bellows that seals the spring and the rubber seat cup between the rotating element and the shaft. If the engine is ever run dry, the temperature of the pump is apt to rise far beyond what the rubber can survive, and a leak occurs. Another possibility is warpage of the sealing elements, also from overheating.



There's conflicting evidence on whether silicates and phosphates from antifreeze, or other hard particles such as casting core sand, can actually damage the seal faces. Engineers have told us the running clearance is way too small to admit solids of any appreciable diameter.

Since cars are lasting longer than they used to, and since we've become such a litigious society, carmakers are working harder than ever to make water pumps last. After all, when a pump goes you've got to get out and walk, which exposes you to dangers that horrify auto company lawyers.

So, there has been a push for water pump seals that will rarely, if ever, fail. One design that looks promising is from Michael Ostrowski and John Crane International, the leading supplier of conventional water pump seals. Called the Advanced Metal Diaphragm seal, it uses a flexible stainless steel diaphragm that acts as both the spring and the bellows, and incorporates an improved method of mounting the seal faces.