

REPLACING AN IN-TANK FUEL PUMP

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You're headed to the beach. Even though the radio's blaring and the kids are yelling, you've noticed your car's got a problem. And this is no momentary miss or a bump or thump that takes the trained ear of a technician to interpret. No. Your car's engine has suddenly ceased to function, while you and your family are hurtling down the freeway at more than 60 mph.

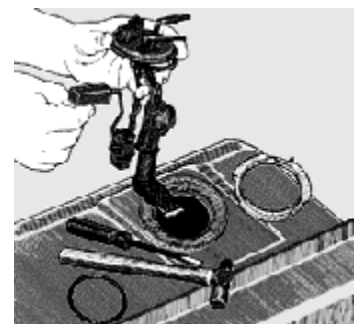
At the side of the road, you pop the hood release. After making a couple of quick checks—yes, the coil wire is still on, there's good spark—you figure the engine must have jumped a timing chain or there's a fuel problem. So you break out the cellphone and call for a tow home.

With your car back in the garage, you hook a pressure gauge to the fuel rail and turn the key on. The fact that there's no fuel pressure has you breathing a sigh of relief since it means the valvetrain will likely live to see another day. At this point you're almost certain that what you have is an in-tank fuel pump that's given up the ghost.

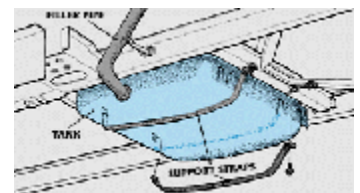
Pump up

In-tank fuel pump failure can cause a number of engine problems, depending on the nature of the failure. A bad pump check valve can cause hard starting (see "How It Works"). "Low voltage to the pump, poor connections or simply a worn-out pump can cause hard starting, acceleration flat spots, or the engine can even die at highway speeds simply because the pump can't keep up," says Jess Wagner, a technical specialist with BWD Automotive, a company that makes in-tank fuel pumps.

Before you remove the fuel tank, you'll want to be absolutely sure that the pump is bad. "Most pumps operate for only 1 to 2 seconds when the key is turned to run," says Wagner. During that short running period, the pump pressurizes and holds the system to a specified pressure. Then the pump shuts off until the engine starts and an oil pressure switch on the engine closes, which



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Undo any hoses or wires, and the filler pipe at one end or the other. The tank will drop free when the

starts the pump again. If the pressure doesn't reach specification, there's a problem, but don't yank the pump yet.

If the engine doesn't run, or there are performance problems, you'll want to check voltage where the pump wires enter the fuel tank. Have an assistant turn the key to run, then make sure the pump voltage is within 0.5 volts of battery voltage. If it isn't, the problem could be bad wiring, the fuel pump relay, the oil pressure switch or, if there's no voltage, the fuel pump fuse could be blown.

It's also a good idea to check the ground side of the circuit by using a digital volt-ohmmeter to check voltage drop between the negative wire and the pump connection at the tank. If the drop is more than 0.1 volts, there's a problem with the ground.

Don't fuel around

With very few exceptions, fuel tanks must be removed in order to get the pump out. (Some cars actually have an access panel in the floor that will let you change the pump with the tank in place.) And Murphy's law almost guarantees that you'll need to pull your car's fuel tank out a mere 10 minutes after gassing up. If that's the case, you'll have to move the car outdoors and drain the tank first.

Since few vehicles have a drain fitting on the fuel tank, you'll probably have to siphon the fuel out. Don't even think about sucking on a garden hose to do the job. Gasoline can cause cancer. And if you inhale a mouthful into your lungs, it can easily kill you.

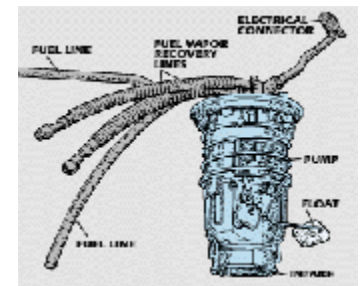
Keep in mind that fuel hoses can have residual pressure, as well as fuel that can spill out when it is removed. Eliminate pressure by cracking a fuel line loose near the engine or depressing the Schrader valve on the fuel rail.

Pump out

Gas tanks are held in place with straps. Remove the bolts at the ends so the straps come off and the tank can be lowered. First, you'll have to disconnect the battery and raise the rear of the vehicle on wheel ramps. Then remove the fasteners behind the fuel-filler door that hold the fuel-filler neck to the body. Unbolt the tank clamps, then lower the tank slowly to the ground. The combination fuel pump/sending tank unit fits in a 2- to 3-in.-dia. hole on top of the tank. Disconnect any fuel lines and electrical connectors before unfastening the pump.

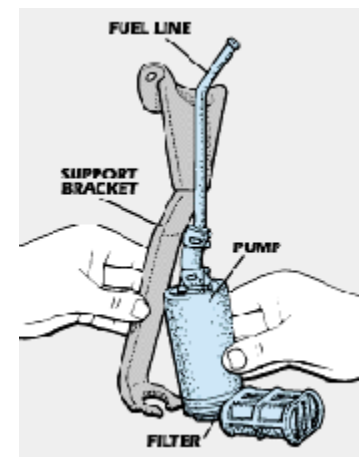
Some pumps are mounted to the tank with a locking ring that rotates with large pliers. Some are mounted to a hole in the tank with a matching round plate that has five or six screws. After loosening the ring, or removing the screws, carefully lift the pump and sender out of the tank, being careful not to allow dirt and gasket material to fall into the tank.

bolts holding the support straps are removed. No smoking!



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This all-in-one style of pump has no serviceable parts and is replaced as a unit.



Some pumps have metal brackets supporting them inside the gas tank.

Never attempt to bench test a new or old pump. In-tank pumps use fuel for cooling and lubrication. Running one while dry will quickly damage it.

Pump in

To replace the pump, remove the fuel pump socket, fuel pump and pulse damper from the sending unit bracket. Many new pumps come with a new fuel sock and pulse damper as part of a kit. If these items are not with the kit, it's a good idea to replace them anyway. You should also replace any clamps and lengths of flexible fuel hose.

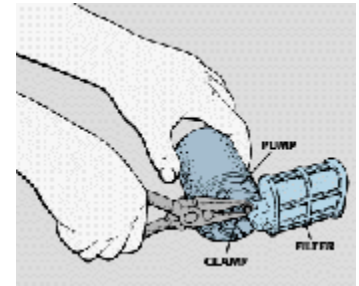
This is the perfect time to inspect the fuel tank. Begin by inspecting and cleaning the area where the pump unit attaches to the tank. Then check the area under the tank straps. Even if the tank didn't leak before, removing the straps often enough loosens corrosion, which can result in pinhole leaks. You also should check all tank seams and make sure the tank isn't dented or creased anywhere.

Before installing the new pump in the tank, attach the in-tank electrical wires. It's critical that the wires be installed in the same manner as the original pump. Often they are soldered. It might be tempting to switch to another type of connection, but Wagner warns against this. "If it was originally soldered, then resolder the new connections," he says.

Next, coat the gasket surface on the pump unit and the gas tank with a gas-proof sealer, then install a new gasket on the tank before fastening the pump unit to the tank. Install the pressure line and return hoses to the outside of the pump unit, then install the outside wires and reattach the tank with the straps and refasten the fuel-filler neck to the body.

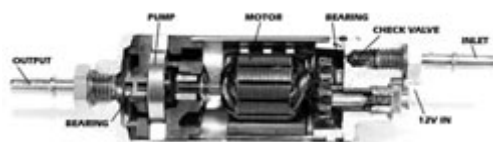
Keep in mind that when a pump fails it usually creates excessive current for a while before there are driveability problems. That extra current can cause the points to become blue and overheated in the fuel pump relay and the oil pressure switch, which in turn can raise resistance and lower voltage to the pump. For these reasons, it's a good idea to replace the fuel pump relay and the oil pump switch whenever you replace a bad pump.

Once the pump and related parts are installed and tightened up, add some fuel to the tank, start the engine, check for leaks and perform the previously mentioned fuel pressure checks to make sure the pump is performing to specs.



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You may need to squeeze the metal spring clamp to remove the old filter.



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How It Works: Submerged Fuel Pumps

You can lead an electronic fuel-injection (EFI) system to gasoline, but you can't make it drink. In fact, EFI systems won't work at all unless they're force-fed a constant supply of fuel

under fairly high pressure.

In the early days of EFI, electric pumps could be found outside the gas tank. But they faded from view because in-tank pumps held many advantages. In-tank pumps are quieter and tucked away from engine heat and weather-related corrosion. Perhaps most important, they pressurize the fuel along the entire length of the system. Because higher pressure raises the fuel's boiling point, vapor-lock is virtually nonexistent in vehicles with an in-tank pump. It's also easier for a pump to push a liquid through a line than to pull it, so in-tank pumps are smaller and lighter. Most in-tank pumps are mounted in a hanger that fits into a hole on top of the gas tank. The hanger also holds the gas gauge sending unit, the fuel pickup and a pickup screen called a fuel sock. The whole assembly sits in a cup-shaped fuel reservoir that's usually fastened to the bottom of the tank. Unused fuel spills from the return line into the cup whenever the pump is running. The filled cup assures that sufficient fuel surrounds the pump pickup during braking, cornering and acceleration, even when the tank is near empty.

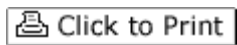
Electrical power for the pump usually comes from a pump relay. Turn the key on in a car with an in-tank pump, and the relay switches the pump on for a couple of seconds, filling the cup reservoir and pressurizing the system. After it travels up the pickup tube, it enters the inlet side of the pump, where it rushes directly through the pump motor to cool and lubricate it. From there, the fuel goes into a gerotor (sliding vane) or roller vane pump assembly, where it's pressurized. Yes, that's right, the fuel runs directly through the motor, where electricity sparks across the motor's brushes. If you think back to your high-school chemistry class, you'll recall that combustion (or, in this case, an explosion) requires three things: fuel, ignition and oxygen. Fortunately, oxygen is not present in the fuel pump, so there's no ka-boom. Before the fuel exits the pump into the fuel line, it passes through a one-way check valve. The valve keeps fuel from draining out of the line and back into the tank when the pump is off.

Once the fuel has left the pump, it travels through the fuel line to the pressure regulator mounted on the engine on many vehicles. On others it travels first through a pulse damper that's mounted directly above the pump.

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