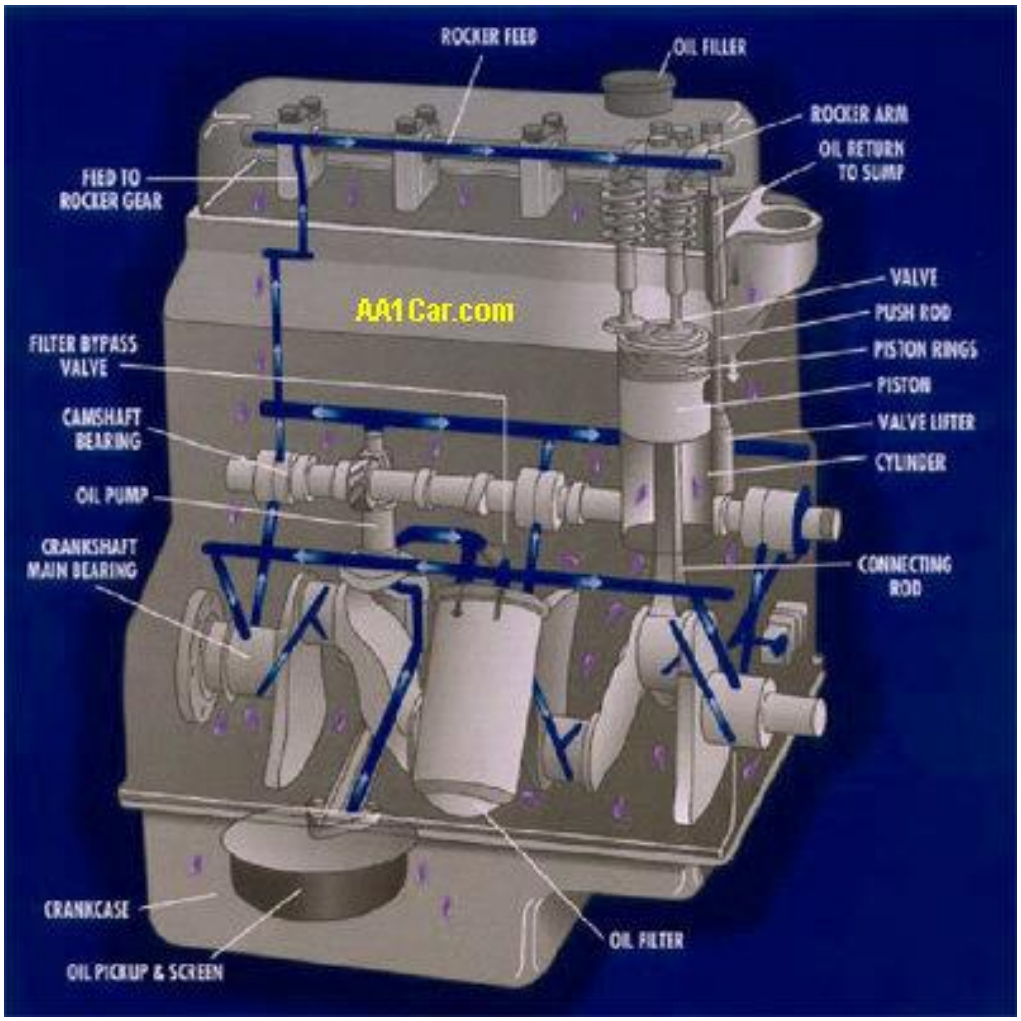
Troubleshoot Low Oil Pressure

by Larry Carley

The first indication of trouble may be a flickering **oil pressure warning light** or a **low oil pressure** reading on a dash gauge. If the warning goes unnoticed or is ignored, the next clue that something is amiss may be valve clatter as the hydraulic lifters or lash adjusters are starved for oil and ingest air. If the motorist keeps on driving in spite of the obvious warnings and audible protests from under the hood, the next sound he hears may be rapping or knocking noises from the rod bearings, which will eventually be followed by dead silence as the engine seizes and the vehicle coasts to a stop.

All engines will lose a certain amount of oil pressure over time as normal wear increases engine bearing clearances. But unusually low oil pressure in an engine regardless of mileage is often an indication that something is seriously wrong and requires immediate attention.

So anytime a vehicle has a low oil pressure condition, or the oil pressure warning light on or flickering, the oil pressure gauge is reading lower than normal, or you hear engine valve noise (ticking sounds) or bearing noise (rattling or knocking noise), don't delay investigating the problem.



Engine oil system

COMMON CAUSES OF LOW OIL PRESSURE

Worn Engine Bearings: In a high mileage engine, low oil pressure is often due to worn main and rod bearings. The oil pump itself does not create pressure. It produces flow and the resistance to that flow produces pressure. Resistance is created by the orifices in the engine block through which the oil flows, and the amount of clearance between the bearings and crankshaft journals. As the bearings wear, clearances increase allowing increased flow which reduces pressure.

Excessive bearing clearances (more than about .001 inch per inch of diameter of the crankshaft journal) can cause up to a 20 percent or greater drop in oil pressure, which may in turn have an adverse effect on lubrication elsewhere in the engine (such as the camshaft and upper valvetrain, especially in overhead cam engines). Low oil pressure can also cause problems in overhead cam engiens with Variable Valve Timing. Whether the excessive clearances are due to normal wear or "loose" assembly tolerances makes

no difference because the end result is exactly the same. Excessive bearing clearances will also increase engine noise and pounding, which over time can lead to bearing fatigue and failure.

Recommended bearing clearances vary a great deal depending on the engine application, but many engine rebuilders today aim for about .001 to .002 inch clearance in the main and rod bearings. This compares to as much as .004 inch of clearance that may be present in some new engines from the factory!

Excessive clearances elsewhere in the engine can also reduce oil pressure. This includes wear in the lifter bores, excessive clearances between the camshaft journals and cam bearings, and excessive end play in the cam. Of course, any cracks in the oil galleys, leaking galley plugs, or leakage between the oil pump and block will also reduce pressure.

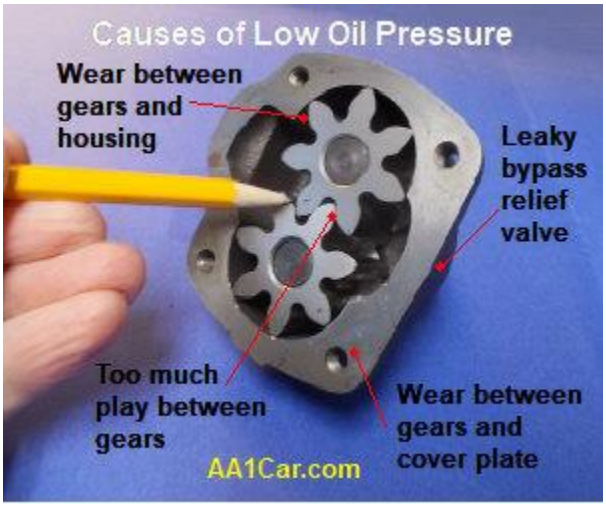
The only cure for low oil pressure due to excessive bearing clearances is to reduce the clearances by replacing the bearings or overhauling the engine. Installing a new oil pump or a higher pressure pump won't help because the bearings have too great a leakage rate to hold the required pressure. Installing a higher volume oil pump can increase flow and regain a little lost pressure. But the underlying clearance problem will still be there, which will accelerate bearing noise, wear and fatigue.

Worn Oil Pump: Another common cause of low oil pressure is wear or excessive clearances inside the oil pump. Specifications vary, but as a rule gear type oil pumps should have less than about 0.003 inches of end play between the gears and cover. The clearances between the teeth and pump housing should usually be less than about 0.005 inches. With rotor style pumps, the clearance between the outer rotor and pump housing should usually be less than 0.012 inches, with no more than about 0.010 inches between the inner and outer rotor lobes. Too much clearance inside the pump will reduce the pump's ability to pump oil efficiency, which reduces flow and pressure.

Because of the close tolerances that are required inside the oil pump, debris of any kind can cause havoc if it gets sucked into the pump. Anything larger than the minimum internal clearances can score or jam the pump. Debris such as pieces of old valve stem seals, gasket material, plastic chips from a worn timing chain gear, bearing material, casting flashing, sand, dirt, etc., may be harmful or fatal if ingested.

But how can this kind of crud get inside the pump, you ask? The screen that is on the oil pump pickup tube in the crankcase only prevents relatively big pieces of debris from being drawn into the pump, and even then it does not always do that because most pickup screens have some type of bypass valve or vent that allows oil to bypass the screen if the screen becomes plugged or the oil is too thick to pass through the screen. The holes in the screen itself measure about 0.040 inches square, which are huge openings as far as debris is concerned. But the holes are large by design so the screen

will flow an adequate amount of oil when the engine is cold and the oil in the crankcase is thick (which is why you should always follow the vehicle manufacturer recommendations on oil viscosity). All this means the oil pump is the only engine component that is continually lubed with unfiltered oil! The oil does not pass through the filter until after it leaves the pump. So any abrasive debris that finds its way into the crankcase will first pass through the pump before it is trapped by the filter. No wonder oil pumps wear out and break.



Internal pump wear and leaks can cause a loss of oil pressure.

Restrictions in the pickup tube screen can choke off the flow of oil into the pump, reducing flow and pressure. Even a relatively small amount of varnish buildup on the screen can restrict oil flow at higher engine speeds. A coating only .005 inch thick on the screen will reduce the total "open" area of each hole to .030 inches, causing a whopping 44 percent reduction in oil flow!

Weak or Leaky Oil Pressure Relief Valve: The pressure relief valve, which may be located on the pump body or elsewhere on the engine, can be yet another cause of low oil pressure if the valve sticks open or is held open by a small piece of debris. The relief valve is designed to limit oil pressure as engine speed increases. The valve opens when pressure reaches a preset value (typically 40 to 60 psi). This vents oil back into the crankcase and limits maximum oil pressure in the engine. The reason for doing so is to prevent oil pressure from reaching dangerous levels. Too much oil pressure can be just as bad as too little because excessive pressure can rupture the oil filter or even blow out pressed-in oil galley plugs in the block.

Aerated Oil: Low oil pressure may also be the result of air in the pump. If there is too little oil in the pan, air can be drawn into the pump. But this can also happen if the crankcase has been overfilled. The oil can become aerated (full of tiny bubbles) because it is making contact with the spinning crankshaft and is being churned into foam.

Dirty Oil and Engine: Sometimes the engine may become starved for oil at higher speeds because the oil is not returning quickly enough to the crankcase. The underlying cause here is usually severe varnish buildup that restricts the oil return holes in the head.

Oil System Leaks: Leakage between the oil pickup tube and pump, as well as between the pump and block can also suck air into the pump. It is not unusual to find engines where the pickup tube has fallen completely off, causing a complete loss of oil pressure.

Plugged Oil Filter: A plugged oil filter can be yet another cause of low oil pressure. When the oil leaves the pump, it passes through the filter before going on to the bearings and oil galleys. All filters create a certain amount of resistance to flow that increases with the rate of flow. But the amount is not much, typically only a couple of pounds. But as the filter becomes clogged with debris, the restriction created increases. Eventually the point may be reached where no oil will pass through the filter element. So to prevent such a blockage, a pressure relief valve located in the filter or where the filter mounts to the block is designed to open if the pressure differential across the filter exceeds a preset value (typically 5 to 40 psi). This allows the oil to bypass the filter and keep on flowing. But the engine's oil pressure will be reduced to that of the bypass valve. Replacing the plugged filter will solve the problem.

DIAGNOSING LOW OIL PRESSURE

A good place to start your diagnosis of a low oil pressure condition is at the dipstick. Check the oil level to see that it is at the proper level (not low and not overfilled). If low, the engine may be burning oil, leaking oil and/or be neglected. Adding oil may temporarily remedy the low oil pressure condition, but unless the oil level is properly maintained by your customer the problem may reoccur.

If the engine is leaking oil, recommend new gaskets or seals to fix the leak. If the engine is burning oil, the valve guides and seals are most likely worn, but the rings and cylinders might be bad, too. A wet compression test and/or leakdown test will tell you if the valve guides or rings and cylinders are worn. The least expensive fix in the case of worn guides would be to install new valve guide seals (if possible) without pulling the head. But the best fix would be to pull the heads and have the guides lined, knurled, replaced or reamed for oversized valve stems. Worn rings and cylinders would call for a complete overhaul.

Also note the condition of the oil and make sure it is the correct viscosity for the application. Heavier viscosity oils such as 20W-50, straight 30W and 40W may help maintain good oil pressure in hot weather, but are too thick for cold weather driving and may cause start-up lubrication problems especially in overhead cam engines. Light

viscosity oils, on the other hand, such as straight 10W or 5W-20 may improve cold weather starting and lubrication, but may be too thin for hot weather driving to maintain good oil pressure. That is why most OEMs today recommend 5W-30 for year-round driving in modern engines.

If the oil level is okay, the next thing to check would probably the oil pressure sending unit. Disconnect the unit and check the warning lamp or gauge reading. If the warning light remains on with the sending unit disconnected, there is probably a short to ground in the warning lamp circuit. Likewise, if there is no change in a gauge reading the problem is in the instrumentation not the engine.

Bad oil pressure sending units are quite common, so many technicians will replace the unit without checking anything else to see if that cures the problem. This approach might save you some time, but it is risky because unless you measure oil pressure directly with a gauge attached to the engine you have no way of knowing if pressure is within specifications or not. Most warning lamps won't come on until oil pressure is dangerously low (less than 4 or 5 lbs.). So don't assume the absence of a warning lamp means oil pressure is okay, especially if the engine is making any valve or bearing noise.

If a check of oil pressure reveals unusually low readings, check the filter. It is possible the filter might be plugged with gunk. Ask the customer when he last had the oil and filter changed. Or, replace the filter and see if that makes a difference.

The next step would be to drop the oil pan and check the oil pump pickup screen. If the screen is clogged with debris, you have found the problem. Also, check to see that the pickup tube is properly mounted and positioned, firmly attached to the oil pump (no leaks) and is not obstructed.

If the oil pump is mounted inside the crankcase, the next step might be to remove and inspect the pump. Open the pump cover and measure clearances. Also, check for scoring or other damage. A broken pump drive would tell you something entered and jammed the pump. If the pump is worn or damaged, replacement is the only option.

If the pump appears to be okay, the next step would be to measure the rod and main bearing clearances. Check the clearances on the main bearing closest the pump (since this has the greatest effect on pressure), and clearances on the furthest rod bearing (since this will show the greatest wear). If the bearings are worn, they need to be replaced. But before you do so, carefully inspect and measure the crankshaft journals to check for wear, scoring, out-of-round and taper. If the journals need attention, the crank will also have to be reground or replaced.

Other checks might include camshaft end play, and/or pulling a valve cover or the intake manifold to check the cam bearings and lifters. Remember, excessive clearances or leaks anywhere in the engine's oil supply system can contribute to low oil pressure.

OIL PUMP INSTALLATION TIPS

If you have found a worn or damaged oil pump that needs replacing, read all the instructions before you attempt to install the new pump. This is common sense advice but it is amazing how many people assume they know how to replace an oil pump on an engine they have never replaced a pump on before. There can be surprises, so take a few minutes to review the instructions.

Most pump manufacturers do not recommend using a sealer on the pump mounting. Use the gasket or O-ring that is provided. The risk of using sealer is that if too much is applied, some of it may end up inside the pump or block the pump passageways.

Toss the old pickup tube and screen and replace with a new one. Yes, you can attempt to clean and reuse the old screen but it is risky. The bottom cover often hides a lot of debris, and solvent can loosen "hidden" debris inside the tube that will later be sucked into the pump.

Use the correct installation tool to seat the pickup tube in the pump. Do not force it in with a hammer as doing so may deform the pump housing and/or damage the tube.

Make sure the pump is properly mounted, and that the pickup tube is properly positioned before replacing the oil pan. The pickup screen should usually be about half an inch above the bottom of the oil pan. This will reduce the risk of drawing in debris that settles to the bottom of the pan. Make sure the pickup is not too high because you do not want it sucking air either.

The pump should be primed before the engine is started. This can be done by adding some oil to the pump before it is installed (packing the pump with grease is not recommended). If the pump is driven off the distributor, the distributor can be removed so the pump can be turned with a drill to prime the system.

Another alternative for all types of pumps is to use an aftermarket aerosol priming system that feeds oil under pressure to the engine through the oil pressure sending unit fitting. This type of system was originally developed for rebuilt engines, but can be used in any application where the engine should be primed before it is cranked.

Install a new oil filter and fill it with oil (this does not work with filters that mount sideways on the engine unfortunately) to eliminate the delay in lubrication that normally occurs when the engine is first started after replacing the filter.

Finally, start the engine and make sure oil pressure is within specifications. Use a mechanical pressure gauge and do not rely on the dash gauge or the warning light to verify that the repairs you have made have eliminated the low oil pressure problem.

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