# PRESSURE vs. FLOW

The subject of pressure versus flow can be confusing because it's hidden inside the engine. So let's consider this principle in something we all use daily - the water system in a house. The maximum amount of flow is determined by the size of the line into your house if you have city water, or by the size of your pump if you have a well. The upper and lower limits of pressure are regulated by the city or by two electronic pressure switches on your pump. Everything works fine, and you have water when you need it.

But have you ever opened every faucet, including those outside? If you did, the pressure drops considerably. The maximum flow available has not changed. With all the faucets open the resistance is very small, but the flow is maximum and the pressure is slim to nil.

Pressure, relative to your house, is created by the resistance to flow, i.e., the faucets being closed. When you have total resistance, all faucets are closed, the upper pressure is limited by the city or the electronic switch and the flow is zero.

Now let's consider pressure vs. flow inside an engine. The size of any oil pump is designed to supply the correct amount of oil to meet the engine requirements. It produces a specific amount of flow at a given rpm. The resistance to that flow produces the pressure. There is never a time that duplicates all the faucets closed (maximum pressure/zero flow). The resistance to the oil flow is from the bearing and lifter bore clearances.

When an engine is new, the clearances are tight and the pressure is good, just like a faucet that is cracked open enough to produce a small stream of water. As the bearings and lifter bores wear, clearances increase, resistance to flow decreases and oil pressure starts to drop.

When the pressure drops, we get our first signal that something is wrong in the engine. With the increased clearances/decreased resistance, the flow from the oil pump is at its maxi- mum. This is like opening all the faucets in your house. Pressure is down, but flow is at a maximum. If we used a flow meter instead of a pressure gauge, we would see a gradual increase in flow as the bearing clearances increase with wear. But flow meters are more expensive and more bulky than oil pressure switches, making this method impractical.

A few comments about the relief valve in an oil pump. The spring pressure behind the valve determines when it will open. If it is designed to open at 60-psi, it does not have an effect on anything below 60-psi, unless it sticks open. If it does stick open, the pressure is low at idle, but builds up to 60-psi at the point the valve opens.

If an engine has excessive clearances in anything but rod bearings, the oil pressure will be uniformly low throughout the rpm range. If the rod bearings have excessive clearances, the oil pressure will be low at idle and will get worse as the rpm increases. Rod bearings turn in a circle rather than on an axis, so they are subject to centrifugal force trying to pull the oil out of the bearing. The amount of loss will vary depending on the actual clearances in every bearing and lifter bore.

This gives you an idea of how much flow increases with a small increase in clearances, and how pressure can drop when we exceed the flow available from the pump.