FILTRATION AND LUBRICATION CONCERNS

When Pressurization Symptoms Occur the Oil Filter Is Often Blamed

When filters bulge, gaskets blow, or filters dislodge from their mounted position on the engine, the oil filter is almost always blamed. Some install the second or third filter still convinced the filter is the cause. The filter is the victim, as over pressurization is the reason for the event and these issues have plagued the internal combustion engine since its introduction and will likely continue.

The oil pump is considered the heart of the engine and the lubricant is the life's blood of the engine. The type of oil and viscosity is critical. Deviating from the vehicle manufacturer's recommendation and lubricant specification can result in a catastrophic event for the engine. While blood pressure and type are critical for a human, oil pressure and oil viscosity share similar concerns for the health of the engine. Too high or too low oil pressure or the incorrect oil viscosity can result in costly engine damage.

CONTROLLING OIL PRESSURE

While the oil filter is usually blamed for the mentioned symptoms the actual cause of the over or under pressurization symptoms is due to a malfunction within the oil pump. Most vehicles contain a pressure regulating valve located internally in the oil pump whose purpose is to maintain the oil pressure within a given pressure range determined by the vehicle manufacturer. The conventional system incorporates a valve consisting of a plunger/ball and a calibrated spring. Some applications may have the valve positioned in the engine block. When the oil pressure reaches a determined pressure the plunger will move from its seat against the calibrated spring tension, diverting some of the oil back into the oil pan or the suction side of the oil pump, thereby maintaining/regulating the desired oil pressure. Pressurization issues occur when the plunger sticks in its bore. Stuck closed, an over-pressurization condition will occur. Stuck open, a loss of oil pressure will occur that can result in engine damage. Often the plunger sticks intermittently and then resumes its normal travel. This explains why a loss of oil pressure may occur during an oil and filter change and seemingly a competitor's brand oil filter solved the loss of oil pressure concern. The oil pressure is controlled by bearing tolerances within the engine and the pressure regulating valve in the oil pump. With today's engine technology we must consider electrical issues in our diagnosis. Newer applications may be equipped with an electronic solenoid controlled by the powertrain control module (PCM), which regulates oil pressure. This will be addressed later in the article under variable displacement pumps.

Another cause of loss of oil pressure during a lube service occurs when air becomes trapped on the suction side of the oil pump, promoting cavitation and a loss of oil pressure. The oil filter is often blamed for this encounter when the condition was actually the introduction of air into the system. Installing a second filter often gets credit for restoring the oil pressure when the actual solution was the release of the trapped air.

SCHEDULED MAINTENANCE

Lack of scheduled maintenance is a major contributor to under/over pressurization concerns. The oil pump is operating on unfiltered oil; therefore any contaminant such as sludge/debris can restrict the movement of the pressure regulating valve in the oil pump, causing it to stick open or closed. Timely preventive maintenance can help prevent the accumulation of these deposits, preventing costly engine repairs. Any debris that can restrict plunger travel can promote the same: For example, metal fragments from machining or bearing wear, removing gaskets with an abrasive disc contaminating the system with grit, a damaged or improperly sealed air filter promoting bearing damage, resulting in metal fragments sticking the pressure regulating valve.

The installation of an extended life oil filter is mandatory for those vehicles driven for extended service intervals. Conventional filters will not provide sufficient filtration for extended service intervals, allowing filter by-pass to occur, flooding the system with contaminated oil. Newer engines with higher flow rates result in a higher-pressure differential across the filter media, requiring a higher by-pass valve setting.

APPLICATION SPECIFIC FILTERS

Make certain the correct filter for the application is selected, as engine damage resulting from an incorrect or improperly installed oil filter is not warrantable. Follow the supplier's

application guide and do not rely on part number conversions from another manufacturer when selecting the oil filter for a given application. The installation of an oil filter not designed for the application can result in some costly engine damage. Filters that appear to be the same dimensionally may not contain the same filtration media. The efficiency of the media can only be determined under lab conditions utilizing specialized test procedures. Filters of equal size often share different efficiency and capacity ratings. Efficiency is a measure of the percentage of particles of a determined size that the filter can capture. The capacity is the amount of debris the oil filter can hold before a differential pressure results in the by-pass valve opening, allowing unfiltered oil to flow through the engine. The selection of a filter for a given application varies depending on the media, porosity of the media, surface area and its total capacity, plus the by-pass valve setting.

New lubrication technologies with increased flow rates result in higher pressure differentials across the filter media, requiring different by-pass rates. Installing a filter with a 15 psi by-pass rate on an application that requires a 22-25 psi by-pass valve will result in unfiltered oil flowing through the engine bearings, promoting accelerated wear. In addition, the regulating valve in the oil pump can stick from the debris, promoting an under/over pressurization event.

GM cautions the service technicians with the following: Today's engines have very tight tolerances, two stage oil pumps and high flow lubrication system requirements. The proper match of oil filter to engine application is more important than it has ever been in the past. The oil pressure was increased to accommodate these tighter tolerances. The oil filter specifications of the production oil filter and the service oil filter were improved to meet the new engine requirements. Beginning in 2012, the oil pumps began to regulate main gallery feedback instead of pump out pressure. This means that the oil pump now does not begin to regulate until pressure is built up to the main gallery. This change reduces the amount of time it takes to provide oil to the engine bearings and lifters during extreme cold start conditions. These applications require a filter with a higher by-pass rating to prevent dirty oil from circulating through the engine during these operating conditions.

FIXED AND VARIABLE DISPLACEMENT OIL PUMPS

Many changes have transpired in the way lubricant is supplied to the engine components in terms of volume and pressure, all of which requires application specific filtration. While some engines are fitted with fixed displacement oil pumps, others utilize variable displacement/two stage pumps. Let's consider the following:

Fixed Displacement Pumps

Fixed displacement pumps can be driven by the camshaft at half the engine speed or the crankshaft at engine speed. While these pumps have a long history of delivering oil in automotive engines, the supply of lubricant has almost been an overkill during idle and slow RPM operation just to ensure the engine has adequate lubrication during higher RPM ranges. Pressure from the pump is controlled by the internal pressure regulating valve. Most of these pumps produce more volume and pressure than required by the engine for a given RPM.

Variable Displacement/Two Stage Pumps

The oil pump is one component the engineers have acknowledged as a consumer of energy, especially during high flow conditions. Variable displacement pumps can reduce the parasitic load on the engine by providing the proper oil pressure and volume based on a series of factors such as oil and coolant temperature, engine speed and load. The engineers claim a 3-6 percent improvement in fuel economy by reducing this parasitic power loss. This technology reduces the load on the engine by providing the proper oil pressure and volume for the varying engine demands, unlike a fixed displacement pump that may require an oversupply of lubricant at low RPMs to ensure the engine has sufficient lubricant at higher RPMs.

A solenoid in the oil pump, controlled by the PCM, regulates the output of the oil pump based on a series of conditions and demands. On some applications, the PCM has the capacity to put the system in a Power Loss or Reduced Power mode of operation when certain conditions occur, such as the incorrect oil viscosity installed. Most vehicle manufacturers have an engine group that utilizes variable displacement technology. The solenoid can be commanded on/off with a scan tool to isolate either a stuck on or off solenoid position. The engine oil pressure is higher when the PCM commands the solenoid to the off position and lower when the solenoid is commanded to the on position. A scan tool with a line graph function will make it easier to observe changes in engine oil pressure. Damaged or broken solenoids are not uncommon. A solenoid failure will usually result in a diagnostic code P06DD stored in memory.

Consult the factory specs for the required oil pressure at a given RPM when diagnosing engine oil pressure concerns. Some oil pressure specs may be as low as 5 psi (after warm-up) at 600-1200 RPM, and this should be considered normal oil pressure. Most would condemn oil pressure readings in this range, certain that engine components were at fault.

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