Mighty AUTO PARTS Tech Tip

LUBRICATION 192

# CHANGES IN ENGINE LUBRICATION

## Prompts Changes in Filtration Technology

Today's automotive engines have different filtration and lubrication requirements compared to engines produced in the past. Bearing clearances and the composition of the metal used in the bearings, plus changes in engine technology require different lubrication and filtration characteristics. Some assume that any viscosity oil will do and filtration efficiency is determined by the physical characteristics/dimensions of the filter alone. Filters of equal size often share different efficiency and capacity ratings. Efficiency is a measure of the precentage 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 bypass 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. How well the filter will perform can only be determined in a lab environment under specialized testing. And oil viscosity is really critical.

Design changes in engine and lubrication technology have resulted in an increase in the oil flow rate, resulting in a higher engine pressure differential across the filter media. These factors prompt an increase in the filter by-pass valve settings to prevent unfiltered oil from flowing to and through the vital engine components, resulting in accelerated bearing wear and component failure. Efficiency, capacity and filter by-pass settings are critical and this has been a major concern for the vehicle manufacturers, prompting notices that engine warranty claims will not be covered when the incorrect filter has been installed. Does your filter supplier comply with the original equipment specifications? Always check the application data for the proper filter for the vehicle, as many filters look alike but are not compatible for the application. Many vehicles are operating at extended drain intervals with a filter that is allowing by-pass. It's the same as not having a filter on the engine.

## FIXED AND VARIABLE DISPLACEMENT PUMPS

The oil pump is the heart of the engine charged with supplying lubricant to the engine components. Much has changed in the way lubricant is supplied throughout the engine in terms of volume and pressure, all of which are said to improve lubrication and fuel economy. To achieve this, some oil pumps are now computer controlled.

### *Fixed Displacement Pumps*

Driven by the camshaft at half the engine speed or the crankshaft at engine speed, these pumps have a long history of delivering the oil in automotive engines. The supply of lubricant has almost been an overkill during idle and slow RPM operation just to insure the engine has adequate lubrication during higher RPM ranges. Excessive pressure from the oil pump is controlled by a pressure regulating valve internally in the oil pump, or in some applications, mounted in the engine block. Most of these pumps produce more volume and pressure than required by the engine for a given RPM.

### *Variable Displacement/Two Stage Pumps*

To improve fuel efficiency and lower emission output, the oil pump is one component the engineers have recognized 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 and engine RPMs. 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 insure the engine has sufficient lubricant at higher RPMs.

A solenoid in the oil pump, controlled by the powertrain control module (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 oil pump technology.

When diagnosing engine oil pressure, consult the factory specs for the required oil pressure at a given RPM. Some oil pressure specs are 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, worn bearings, etc. With this technology, be advised that an oil pressure condition may involve more than just the oil pump, requiring a thorough diagnosis before making a recommendation.

Consider the following oil pressure specs for a 2016 Jeep with a 3.6L V6 engine:

| | | |
|---|---|---|
| Pressure @ Curb Idle | 5 PSI Min. | |
| Pressure @ 600-1200 RPM | 5 PSI (warm) | 139 PSI (cold) |
| Pressure @ 1201-3500 RPM | 30 PSI (warm) | 139 PSI (cold) |
| Pressure @ 3501-6400 RPM | 62 PSI (warm) | 139 PSI (cold) |

***Caution: If oil pressure is zero at idle…DO NOT run the engine.***

## THEORY OF OPERATION

According to Chrysler, the engine oil pump features seven vanes and a moving element that continuously makes adjustments to maintain a regulated oil pressure supply by varying the displacement of the pump. The pump has two regulated pressure stages of operation controlled by an on/off solenoid. The low pressure mode regulation (solenoid on) is approximately 20 psi and the high pressure mode regulation (solenoid off) is approximately 65 psi. The pump is controlled by the Powertrain Control Module (PCM), which switches the pump between stages based on engine operating conditions, oil and coolant temperature, speed and load. Under most conditions, the pump will run in low mode from idle up to around 3000 RPM and then switch to high mode between 3000 and 4000 RPM. The maximum oil pressure is limited to 145 psi by a relief valve.

Check the vehicle manufacturer's oil pressure specifications prior to diagnosing oil pressure related concerns. Many of the pressure readings that we are familiar with from past experience no longer apply with the new technology.

***Power Loss…*** Low oil pressure conditions may result in the PCM putting the engine in a Power Loss mode, limiting drivability. When diagnosing oil pressure concerns, run the diagnostics for any stored trouble codes and eliminate those faults first. Following are some basic checks that could result in the same default action:

1) Engine oil level low
2) Deteriorated/dirty oil
3) Contaminated oil
4) Non-compliant filter
5) Incorrect oil viscosity

## VEHICLE MANUFACTURER PRECAUTIONS

Vehicle manufacturers have published documents/ Tech Bulletins reflecting that only original equipment oil filters should be used when servicing their vehicles. Part of this is due to the fact that the vehicle manufacturer cannot qualify every filter in the marketplace as being compatible with their engines; therefore they recommend an OE filter. We understand the concern, as much of this stems from non-compatible filters causing major engine damage. We have seen filters whereby the anti-drain back valve would totally disintegrate, resulting in oil passages plugged with silicone-like material or filter media disintegrating, promoting the same restrictions. Obviously, the vehicle manufacturer will not and should not cover those damages under warranty.

Efficiency, capacity and filter by-pass settings are critical and this has been a major concern for the vehicle manufacturers, prompting the claims that engine warranties will not be covered when the incorrect filter has been installed. With the tight tolerances in today's engines and the high flow/ pressure requirements, the proper filter with the correct by-pass setting is critical in preventing unfiltered oil from flowing through the engine.

Some filters may look alike but there is a substantial difference in oil filter specifications. Installing the incorrect filter for the application can result in major engine damage. Know your filter supplier. Purchase from a reputable supplier that complies with the original equipment specifications and will back that claim with a warranty. Always check the application data for the proper filter for the application, as many filters share a like appearance but are not compatible.

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