CONTROLLING THE FLOW

...THE ENGINE IS BY FAR THE MOST AFFECTED BY POOR LUBRICATION

Staff Report

THE HUMAN BODY CAN'T LIVE WITHOUT BLOOD. Blood delivers oxygen, nutrients and other essential substances to the body and its organs. Similarly, oil serves an essential role in the performance and operation of the engine. Oil is responsible for lubricating, cooling and removing contaminants for nearly all moving parts. However, oil breaks down over time due to contamination, heat and shearing. As an oil's viscosity breaks down, it loses its ability to protect the engine. Fortunately, there are components that can improve your engine's oiling system and prolong oil life.

The oiling system of an engine (pan, pickup, pump, reservoir, etc.) transports oil through galleys to critical engine components. Most factory oiling systems perform an adequate job of lubrication on stock to mildly-tuned street-driven vehicles. However, as power levels increase and driving conditions change (road racing, drag racing, drifting), the stock oiling system can prove inadequate. The extreme g-forces associated with racing can cause the oil in the pan to lose contact with the pickup. When the pickup is sucking air and not oil, the resulting oil starvation damages the engine. A basic understanding of the major components in an engine's oiling system can help one decide which components need to be upgraded for a particular style of racing or level of performance modification.

Three of A Kind

There are three major areas in a vehicle's powertrain that require oil to function properly; the engine, transmission and differential. Of the three, the engine is by far the most affected by poor lubrication. Oil starvation in the engine can cause metal-to-metal contact between bearings, gears, chains, rings, pistons and cams resulting in premature wear and failure. The engine's oil pump is responsible for pumping oil to the galleys, bearings and journals that lubricate these important areas. If the oil pump is being starved for oil or cannot provide the proper oil pressure, severe engine damage can occur.

Dry or Wet

There are two major types of oil pump systems used in combustion engines, wet-sump and dry-sump. Nearly all production and some classes of racecars use a wet-sump system (when allowed by class rules). The wet-sump system refers to an oiling system that stores the reserve oil in an oil pan, hence the term wet sump. On a wet-sump setup, the oil pump draws oil through a pickup, pumps it through an oil filter to remove harmful debris and through the engine to the multiple points of lubrication.

Dry-sump systems found on high-performance cars combat oil starvation during hard cornering or extreme acceleration. A dry-sump system stores the oil in an external reservoir. An external oil pump (2-stage pump minimum) scavenges oil from the oil pan and pumps it into the reservoir (dry-sump tank). Besides oil storage, the dry-sump tank separates air from the oil and prevents the oil from foaming. From the tank, the second stage of the pump circulates the oil back through the engine. A dry-sump system also helps increase power production by reducing windage at the crankshaft. Engines using a dry-sump system also benefit from the vacuum effect created within the crankcase leading to higher horsepower production. Besides the benefit of reducing the chances of oil starvation, the smaller oil pan allow the engine to be mounted lower, effectively lowering the vehicle's center of gravity. The drawback of dry-sump systems is the high cost and the extra components (sump tank, lines, pump, block off plate, etc.) that are required.

Battle Ready

A high-performance dry-sump system is the ultimate oiling system for any engine, however there are opportunities to improve a wet-sump system. By upgrading to an aftermarket oil pan that uses trap doors and baffles, oil starvation becomes less likely. The trap doors and baffles prevent oil from sloshing away from the pickup during hard cornering. Most aftermarket oil pans also feature a larger sump for extra oil capacity, again reducing the chances of oil starvation. Some aftermarket pans also feature a built-in windage tray to help increase power by preventing the oil in the pan from sloshing up into the rotating assembly. To free up some additional power, aftermarket crank scrapers can be installed to remove excess oil from the counterweights of the spinning crankshaft.

WET VS DRY *Pumps and sumps*

These Honda application pans show the differeing pan capacity requirements of wet- (top) and dry-(bottom) sump systems.

WET BAFFLING SYSTEMS *Keep oil in place*

Trap doors and baffle plates help to keep oil from sloshing away from the oil pickup.

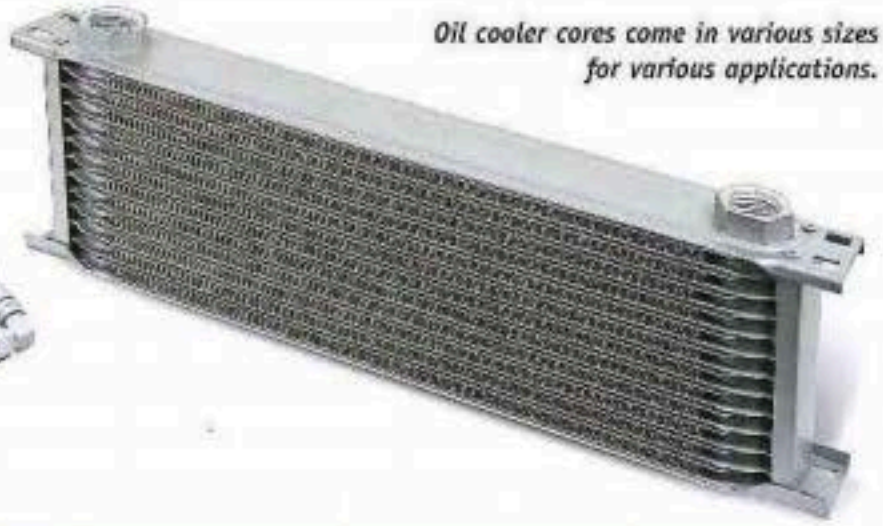
Some aftermarket oil pans increase the oil capacity to prevent oil starvation.

...AN INDICATION THAT PERMANENT ENGINE DAMAGE IS RIGHT AROUND THE CORNER

Hot, Hot, Hot

For the internal components of the engine, heat is the enemy. The more horsepower an engine makes, the more heat it creates. Thermal breakdown causes oil to lose its viscosity over time. As an oil loses its viscosity and shear strength, the chances of damaging metal-to-metal contact increase. Aftermarket oil coolers reduce oil temperatures allowing the engine oil to maintain its viscocity for optimum protection and longevity.

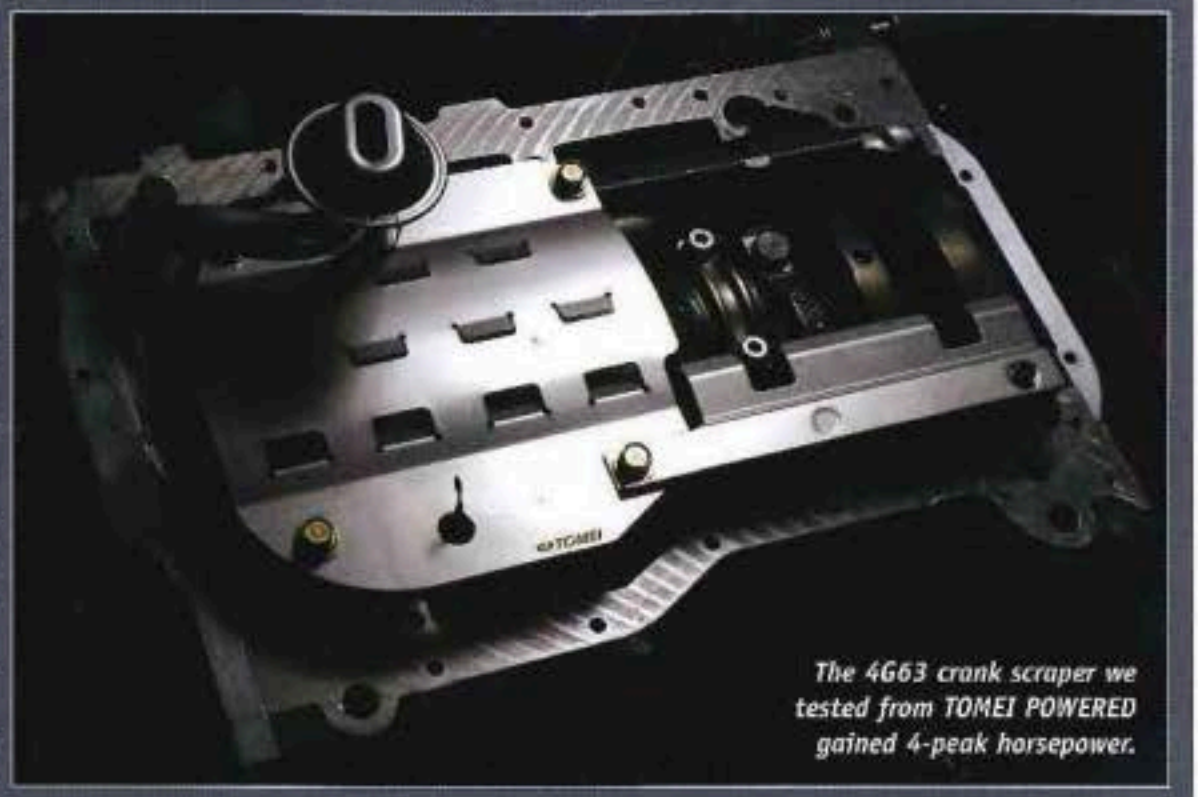
Oil cooler kits sometimes include an oil filter sandwich plate and lines to ease the installation.



Oil cooler cores come in various sizes for various applications.

Scraping By The Crank Scraper

A great deal of oil is thrown around inside an engine during normal operation. While conventional wisdom may dictate that having oil everywhere is beneficial, the truth of the matter is that it is actually detrimental to engine performance and longevity. As RPMs rise, the oil forms a cloud. When this aerated oil cloud is sucked into the oil pump it can cause random oil pressure drops inside the galleys of the engine. These pressure drops represent times when the engine is not being lubricated adequately and are an indication that permanent engine damage is just around the corner.



The 4G63 crank scraper we tested from TOMEI POWERED gained 4-peak horsepower.

A crank scraper is a piece of metal that is positioned very near the path of a spinning crankshaft. While the scraper does not come into physical contact with the rotating assembly, it is positioned incredibly close. As the rotating assembly passes by the scraper, the excess oil (that fills the gap between the rotating assembly and the scraper) is removed. Once removed, the oil is directed down into the pan towards the oil pump sump. Since the crank scraper acts as a physical barrier between the oil in the pan and the rotating assembly, it prevents the oil from being atomized into a cloud and keeps any aerated oil away from the oil pickup.

Coupled with a windage tray, the crank scraper can also cut down on the mass of oil on the rotating assembly. When oil is attached to the crank, the rotating assembly carries more mass. This translates into a loss of power. Keeping excess oil off of the crankshaft and rotating parts reduces this power loss. In addition to lowering rotating assembly mass, the oil mass reduction lowers drag and reduces windage, both of which result in even further increases in power, especially at higher RPMs. Our own independent testing with an aftermarket crank scraper kit showed an increase of four horsepower at the top end of the engine's powerband.

When available, a crank scraper is something every car owner should consider installing, especially in the middle of an engine build where access to the rotating assembly area is unhindered. Aside from simply picking up a little extra power, a crank scraper should also increase gas mileage. Free power, better fuel economy and increased reliability make for a winning combination.

by Aidan Spraic

"SHOULD I SWITCH TO A SYNTHETIC OIL?"

Synthetic Diet

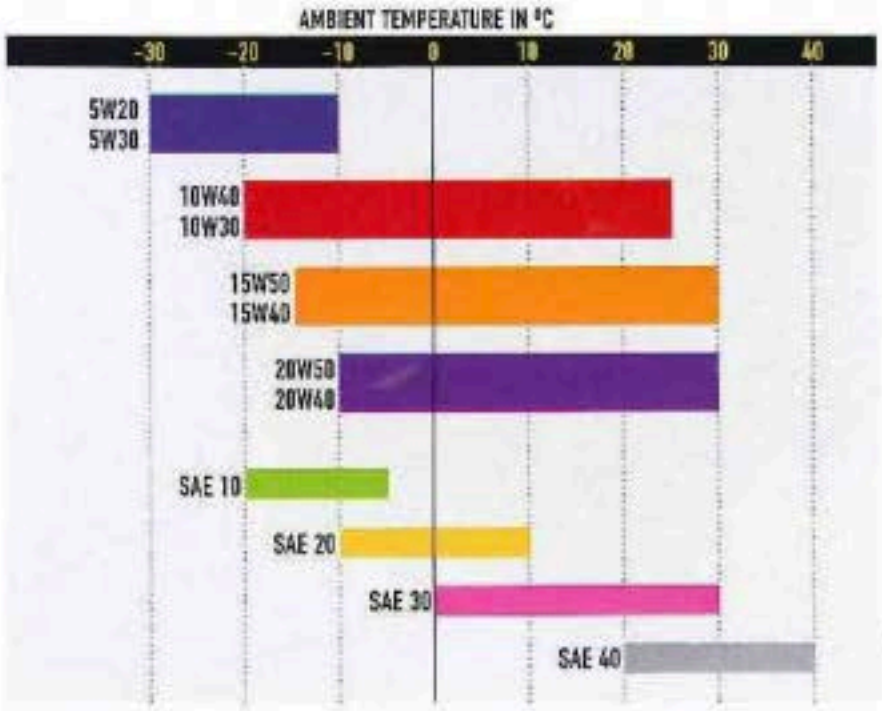
Barring any heated debates, the answer to "Should I switch to a synthetic oil?" is simply "yes." The additional cost of upgrading to a synthetic oil blend will be recovered over time with increased fuel efficiency, better component longevity and reduced oil-change frequency. Since synthetic oils are usually produced from the same grades of high-quality base stock, the quality and performance factors are found in the manufacturer's oil additive package. It's these proprietary additive packages that neutralize by-products of combustion, reduce oil foaming tendencies and increase anti-wear and anti-oxidant presence. The end result is an increase in power production while maintaining a high-level of engine component protection.

Light Makes Might

An oil's viscosity rating is an indicator of its resistance to flow. For the layman, it's easiest to think of viscosity as the "thickness" of an oil. Since the advent of multi-grade oils, there have been quite a few misconceptions as to what oil a specific application should use. A straight 30-weight oil has a particular viscosity at a standard reference operating temperature. The "W" prefix placed in front of multi-grade oil weight ratings indicates how the oil would perform under a colder ("w" for winter) initial temperature. So, the multi-grade oil allows the oil to flow like a "lighter" oil at startup to prevent wear from dry conditions, while retaining the operating temperature viscosity of a straight weight. With that in mind, it's easier to understand how viscosity inhibitors enable a 5W-30 to offer the protection of a 5-weight oil at startup and a 30-weight oil at normal operating temperatures. This is how oil manufacturers can recommend substitutions of lighter oil based on climate. If you live in a relatively temperate region that doesn't see freezing or extremely cold temperatures for extended periods, the manufacturer might recommend a multi-grade oil that has the same operating temperature weight with a lighter "W" rating; for example, you can safely run a 5W-30 oil instead of the factory recommended 10W-30 if you live in the beach area of Southern California. Consequently, you can also run a higher operating temp weight for more engine protection if you live in a warmer climate – a 10W-40 in place of the factory recommended 10W-30. When in doubt as to which oil you can run, always ask the manufacturer of the oil you want to run as they have the most information and experience with their product line.

The Bottom(end) Line

Your engine requires oil and a complex lubrication system. If you take the time to protect and enhance your engine's lubricating system, you will be rewarded with increased horsepower, better fuel economy and a longer-running engine.



TYPES OF TYPICAL ADDITIVES
Acid Neutralizers
Anti-Foaming
Anti-Oxidant
Anti-Wear
Corrosion Inhibitors
Detergents
Dispersants
Film Strength Modifiers
Friction Reducers
Viscosity Improvers

OIL PERFORMANCE CRITERIA
Low Volatility
High Film Strength
High Viscosity Index
High Lubricity
High Detergency
High Friction Reduction
High Flash Point
High Oxidation Resistance
Low Foaming