ROADRUNNER ENGINEERING NEWSLETTER

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APRIL, 2013

Inside This Issue

What's Happening?

Motor/Engine Oil. In December 2012 I talked to many engine oil suppliers exhibiting at the Specialty Equipment Manufacturer's Association (SEMA) show and at the Performance Racing Industry (PRI) show. The purpose was to sample the current thinking on motor oil. I also attended seminars on engine oil at these shows and at the Advanced Engine Technology Conference (AETC). What I re-discovered was that engine oil is a complex subject and that there is a diversity of opinions on their formulation and application. The art and science of lubrication is constantly evolving. As an example, Mobil 1 was originally offered in one configuration, but is currently offered in 21 versions for various applications. The article in this issue is an update of what I knew and what I learned from my latest interviews and studies.

Roadrunner flathead blower kits sold out again in 2012 as reported previously. The combination of performance, appearance and price of the kits has made the Roadrunner kits the favorite of flathead fans since 1997. I am pursuing options for future production.

The books have been selling well also. ***Blown Flathead*** is sold out although used copies are available from various sources. ***335 HP Flathead Ford V-8 Performance Handbook*** is almost sold out. Get yours while you can from www.roadrunnerengineering.com or other sources listed on the website.

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Engine Oil Update - Part 1

Summary

Cooling and protecting engine components are primary functions of engine (aka "motor") oil. Doing these jobs properly enhances engine performance and life by reducing friction and improving sealing (greater engine efficiency, more net power, and better fuel economy) while minimizing wear and corrosion. All this must be accomplished under very demanding and constantly evolving conditions. Not surprisingly, a complex array of products (see figure below) has been developed to meet the needs and the end is not in sight.

In general, we should follow the auto manufacturer's engine oil recommendations for our vehicles. However, in many cases the manufacturer's recommendations are obsolete or no longer relevant. In this article we will review engine oil basics to better understand the options and to optimize our oil selection.

Some of the choices.

Base Oil Classifications

Oils are broadly classified as conventional or synthetic. Fundamentally, conventional oils are refined "down" from naturally occurring stock such as crude oil (paraffin or asphalt based), vegetable oil, or animal fat. Synthetics are built "up" from a variety of manufactured chemical stocks such as polyalphaolefins (PAO). These stocks can then be blended to produce "semi-synthetics". In general, synthetic oils have more uniform properties, smaller molecules (leak more easily), and are more temperature stable (e.g. 350F vs. 250F) than conventional oils. As you might guess, synthetics are also more expensive.

Oil Additives

The resulting "base" oils above typically receive some type of "additive package" (which may constitute over 20% of the final product) to enhance their properties for specific applications. Examples of additives and their purpose include:

- Surface modifiers (compounds of Boron, Graphite, Molybdenum, Sulfur, Teflon, Zinc, etc. that affect wear)
- Friction modifiers (Graphite, Molydisulphide, etc. that may be thought of as "ball bearings" in the oil)
- Antioxidants and corrosion inhibitors
- Detergents and dispersants (compounds of Phosphorous, Calcium, etc. that keep the system clean)
- Anti-foaming agents (Silicones, etc. to prevent oil cavitation and starvation)
- Viscosity Index improvers (generally long chain polymeric compounds to maintain more constant oil viscosity over the operating temperature range)

As you might guess, there are an unlimited number of combinations of these products. While there are many oil and lubricant product sellers, most of the base stock comes from only three suppliers (Chevron-Phillips, Exxon-Mobil, British Petroleum) and only four additive package suppliers (Lubrizol and others).

Oil Properties of Interest

One of the most important engine oil properties is the viscosity, which is a measure of flow resistance at various temperatures (like 0, 32, 210, 300F). The unit of viscosity is usually centistokes. Water has a viscosity of one at 68F. Oils meeting certain defined viscosity-temperature characteristics are assigned an SAE "weight" such as SAE 30. See Oil Specifications section below. Another important oil characteristic is the Viscosity Index (VI) which is a measure of the viscosity change over a specified temperature range (typically from 100 to 210F). Other properties of interest include the flash point, the pour point, the friction and wear characteristics, the corrosion, sludge, varnish, clogging, and sticking characteristics, and more!

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Oil Specification Sources

The properties are specified and measured by the users (e.g. auto manufacturers like Ford and GM) and the oil product manufacturers (e.g. Chevron, Pennzoil, Valvoline, etc.). Other bodies independently certify, measure, and test oils such as the ASTM (American Society for Testing Materials), the API (American Petroleum Institute), the ILSAC (International Lubricants Standardization and Approval Committee), the SAE (Society of Automotive Engineers) and many others like the ACM (Chemical Manufacturer's Association), etc.

Oil Specifications - Deciphering the "Alphabet Soup" on the Package

SAE Viscosity

Examples: SAE 20 ("straight weight"- viscosity at 210F is specified), SAE 20W ("winter" grade viscosity at 32F is specified), SAE 20W50 "multi-grade" (viscosity at 32F is the same as SAE 20W and the viscosity at 210F is the same as SAE 50).

API Service

Examples: SJ, SL, SM, etc. "S" indicates spark ignition (gasoline) engines, 2nd letter indicates specification year, A = 1900, B =1930, C = 1963, D = 1968, E = 1972, F = 1980, G = 1989, H = 1993, J = 2001, L = 2004, M = 2005, etc. Similarly, service ratings for oils suitable for diesel service start with a "C" indicating compression ignition engines, e.g. CJ-4. **Note that the API did not actually certify motor oils to the above until 1971.**

To be Continued. Part 2 will discuss specific recommendations for the flathead Ford and other collector vehicles.

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Sad Story of the Month - Soft Tappets

The tappet on the left had a much lower hardness than the supposedly identical tappet on the right, both from the same engine. The wear debris from soft tappets such as the one in the picture required a complete rebuild of the engine to remedy the damage.

Tappets Removed From a Failed Engine

The Problem

One of our fellow V-8 owners approached me recently with a tale of woe. It seems he rebuilt his 8BA using aftermarket lifters (also called tappets, basic Ford P/N 6500) and an aftermarket cam. In a very short period of time the engine became extremely noisy. Upon investigation, the owner found extreme wear on the cam and some of the lifters, and the rest of the engine had become contaminated with the resulting wear debris. This required a total rebuild to remedy. He had the lifters from the failed engine in a bag. About half the lifters exhibited extreme wear and the others appeared normal. See photo.

Finding the Cause

Since I did not have the cam and it seemed less likely that it would have been the culprit, I confined my effort to determining the difference between a sample of a “good” lifter and a “bad” lifter. A hardness check by three independent measurement devices revealed that indeed the bad lifter was much softer than the good lifter in the vicinity of the surface that mates with

the cam. The bad lifter demonstrated average hardness readings of 38 on the Rockwell "C" scale. The good lifter yielded readings averaging 56 on the same scale. While I don't have manufacturing drawings for any of the lifters I have used in the past, all satisfactory units have yielded readings of Rockwell C 55 or greater at the cam interface area. I conclude that while other factors such as the oil or clearances could have contributed to the problems in this engine, the difference in lifter hardness was the major cause of abnormal wear in the tested parts.

All of the lifters from the failed engine came in the same unmarked box according to the owner. The lifters were purchased about five years earlier from a reputable retail source. This retail source did not know or remember the brand of the lifter, nor the manufacturer, nor the country of origin. Other retailers have told me that in years past (e.g. 2005) the supply of domestic flat tappet lifter manufactures had dried up and that inferior off shore product had entered the market. **The only visible distinguishing feature of the uncertain lifters is a thin, copper colored plating or coating on the adjusting screw.** I have not observed this coloring on any satisfactory lifters from any source.

Recommendations

Domestic lifter suppliers are presently up and running again and no problems have been reported with current product. However, the problem may still exist in old stock and if in doubt I recommend checking lifter hardness or just discarding suspicious parts. Many machine shops have the capability to do hardness testing and the cost is minimal (takes less than an hour to set up and test), especially when compared to the cost of a major engine rebuild. The testing makes a very slight indent on the part that should be carefully removed prior to installation.