Oil Filter Advice

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In my column entitled "Changing Oil Preference" (*Machinery Lubrication*, September-October 2004), I reevaluated my long-held convictions for recommending mineral-based oil over synthetic. While writing the article, it occurred to me that I should look at oil filters more closely and with an open mind. Filters are an integral part of the oil cycle in an engine. If I were changing my mind about what lubricant to recommend, I should also reevaluate my oil filter recommendations.

Automotive oil filters fall into two categories, full-flow and bypass. Bypass oil filters take about 10 percent of the oil pumped from the sump, filter it and then return it to the sump while the remaining 90 percent is delivered to the lubricated components. Full-flow oil filters filter 100 percent of the oil pumped before it continues on to the lubricated surfaces. It might seem that the full-flow filter would be the best oil filter, though that is not necessarily true. Each has its virtues and vices.

No Oil Filter

Early car engines did not employ oil filters. The forerunner to oil filtration was mesh and screen strainers. I don't consider screen or mesh to be an effective filter. There were cars manufactured through the late 1960s that did not have oil filters at all. (Anyone have a 1960s-model Volkswagen or Fiat?) The first VW I saw with an oil filter was the water-cooled VW Rabbit in 1975. The VW Super Beetle had a full-flow filter after 1972 until production stopped in 1980. There was also a full-flow filter on the 1975 VW sedan and the 1980 VW convertible.

Bypass Oil Filters

Bypass oil filters were the first oil filters on cars. They've been installed on cars and light trucks since the early 1920s. Ernest Sweetland introduced the first modern oil filter which promised "pure oil later" … so named because it was located between the pump and the sump, and it promised to deliver the pure oil later to the bearing surfaces.[1] The filter was a heavy metal case; inside was a series of metal plates with twill weave material around each plate. A sight glass let the user know when the oil flow dwindled to a trickle. At this point the whole filter unit, case, sight glass, plates and twill material had to be replaced. This was the beginning of the Purolator oil filter company.

Mr. Sweetland's filter was improved by introducing replacement cotton fiber filtration in the late 1930s, which could be changed without replacing the whole filter unit. However, it remained a bypass oil filter, where 90 percent of the oil was sent to the engine unfiltered. As long as the oil contamination rates were low and the oil was changed frequently, the bearings had some reasonable life expectation. Most automotive oil filters were the bypass-type until the mid-1940s.

In a previous column, I wrote that 45 years ago an engine could run 100,000 miles before needing an overhaul (*Machinery Lubrication*, July-August 2001). All the engine required was care and persistent maintenance. In that age of $2,000-cars and oil costing $0.25 per quart, oil filtration methods and schedules were doing a fiscally responsible job. By 1950, most new cars were built with full-flow filters. The increased use of full-flow oil filters accompanied a decrease in bypass filter application.

Full-flow Filters

What was the reasoning for the shift to full-flow filters? It's simple - all the oil, not the 10 percent of bypass norms, was filtered before it was sent to the oil gallery. Ideally, we would like to see particles somewhat smaller than five microns trapped by the oil filter, however, there are typically price and performance trade-offs with finer filtration.

Judging a filter only by its micron-size trapping ability has its limitations. My barbeque grill will filter five microns; a few five-micron particles will catch on the grill as fluid passes over. The SAE HS806 standard uses both a single-pass test and a multipass test, assessing dirt-holding, contaminant capacity in grams, and efficiency based on weight. The efficiency of the filter is determined by weight only through gravimetric measurement of the filtered test liquid. Typical numbers for cellulose paper filter elements are 85 percent (single-pass) and 80 percent (multipass).

The SAE J1858 test provides both particle counting and gravimetric measurement to measure dirt-holding capacity and capture efficiency. Actual counts of contaminant particles by size are obtained every 10 minutes, both upstream (before the filter) and downstream (after the filter), for evaluation. From this data, a filtration ratio and capture efficiency above different contaminant particle sizes can be determined as well as dirt-holding capacity and pressure drop as a function of time. Typical numbers for paper element filters are 40 percent capture efficiency at 10 microns, 60 percent at 20 microns, 93 percent at 30 microns, and 97 percent at 40 microns.

Oil filter design is somewhat of a balancing act between particulate size, filter medium, surface area of filter medium and oil pressure. The finer the filter medium, the shorter a filter's lifespan

before it begins to show pressure drop and the oil filter bypass valve is opened. However, new synthetic filter media and pleating configurations have managed to overcome some of these drawbacks. We have the capacity to filter out particles smaller than needed (less than two microns) to protect the oil between bearing surfaces, but determining the right balance can be a real puzzle.

The original full-flow filters were housed in heavy canisters. The element was changed, the canister was cleaned, and a new sealing ring was installed. In about 1955, however, the full-flow filter as we recognize it today was introduced. Within a few years, almost all cars featured the present-day disposable, spin-on filter with a lightweight canister and its own sealing ring.

Choosing a Filter - Full-flow or Bypass

Bypass filters are not new to the automotive environment. They were the first filters installed on cars, but have since been replaced by full-flow filters on almost 100 percent of the new cars manufactured today. I am, however going to vote for both types of filters; each stands out in certain conditions. Ford Motor recently announced that it is equipping its 2005 E Series with bypass filtration.

I am a big advocate of oil coolers to help ease the burden on the lubricant. Cars last longer with oil coolers. Cars last longer with better filtration and timely oil and filter changes. Cars last longer with cleaner oil. The trucking industry is ahead of the auto industry on recognizing the importance of cleaner oil. There is, in the trucking industry, a reasonable expectation of 500,000 miles between major overhauls. Why the long interval? Truck manufacturers use both bypass and full-flow filters, oil coolers and transmission coolers. In short, they use it all and have the results to justify their expenditure. One million miles between overhauls is no longer rare in the trucking industry.

With the replacement cost of my wife's 1998 Buick Park Avenue approaching $35,000 I need to make that car last as long as I can. Any reasonably priced device that would extend its life beyond 200,000 miles (it is currently at 88,000 miles) is of interest, and is financially beneficial to me. Some of the advertisers in *ML* make or sell bypass filters for modern automobiles.

There are now oil filter units commercially available for passenger cars that employ both the bypass and full-flow filters. I've found a neat place under the hood of the Park Avenue to mount the manifold and filters. I think I will check the dimensions one last time and purchase one.

Final Note

Any dirt that gets past the air filter enters the engine, becoming the enemy of all lubricated components. This makes the oil filter's job more challenging. To combat such wear, change your air filter regularly. "PCV System - A Breath of Fresh Air" (*Machinery Lubrication*, September-October 2001) discusses maintaining the PCV system. If damaged, it can be another source of engine damage.