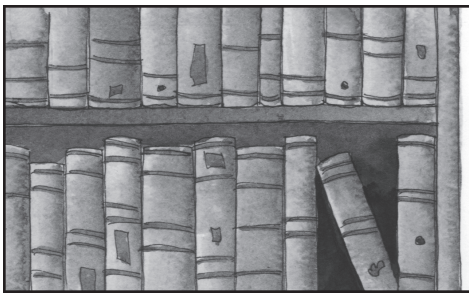


TDResource

"TDResource" is a listing of resource materials for Turbo Diesel owners

LUBE OIL FILTRATION UPDATE

by John Martin

Background

Robert Patton asked if I would update Arden Kysely's TDR "Oil Filter Buyer's Guide" published in TDR Issue 32 (summer 2001). First, let me say that Arden did an excellent job of comparing 13 oil filters for the 12-valve engines. This article has been posted at the TDR and Geno's Garage websites. If you are not familiar with the basics (i.e. paper/cellulose design versus synthetic filter media) you'll want to read (reread) Arden's entire article. The basics have not changed. However, we all know that the more things change… well, do they stay the same? Yes, indeed, it is time for an update.

Before starting, let me give you a little of my background qualifications to write an article on lube oil filtration. I'm a physicist by training (M.S., Engineering Physics), so I need to understand how things work. I worked over thirty-three years as a fuels and lubes scientist, and I have ten patents in my name. Three of them are for lube oil filtration developments. I authored a series of articles for Fleet Equipment Magazine (December 2008, January 2009, February 2009) on lube oil filtration.

Prior to retiring from the Lubrizol Corporation, I was selected to be a member of a small team charged with evaluating a filtration company for possible purchase by Lubrizol. One of our business development people had identified a filtration company they wanted to purchase, so the Senior VP of Research and Development asked our team to evaluate and make recommendations.

A core group of three of us traveled to various filter suppliers so we could compare their facilities. What we learned was truly amazing! First, like lube oils, passenger car filtration has become a commodity industry due to competitive pressures. For example, large purchasers such as Wally World (that's slang for Walmart) more or less tell oil filter manufacturers that the amount of shelf space they will obtain is indirectly proportional to the cost of their filters. That's why you see a lot of Fram filters at Wally World. Heavy duty filtration science was better.

Oil Filter R&D

Again, as part of our team's research we traveled to virtually all of the major players' R&D facilities. I have better R&D in my shop than a few of the manufacturers. In fact, the VP of Research for one well-known truck filter manufacturer told me his research philosophy. He said, "I look at what Fleetguard has recently patented, and I try to figure out a way around the patent." Research expenditures at most filtration manufacturers are less than 1% of sales. Many simply purchase media from a media supplier and produce filters without conducting anything more than basic confirmation testing.

Before you draw the conclusion that all filter manufacturers are a bunch of hacks (One of my oil filter manufacturer buddies calls them filter whores.), let me give you some more encouraging information. Manufacturers of higher end filters (such as industrial and medical) spend much more on basic filtration research.

Companies such as Donaldson, Fleetguard, and Pall have extensive research facilities. In their defense, I was unable to visit Wix's facilities, but I've heard from others that they are also a cut above the rest. In fact, NAPA makes no secret of the fact that Wix has supplied their filters for years. This is not uncommon. If a marketer wants to supply an oil filtration product, he will often contract with a filter manufacturer to simply rebrand their product. Filter manufacturers also make filters for each other when this is necessary to help control availability and/or cost. Filters are much too heavy to be shipped all over the world.

Here is the line-up of filters to evaluate.

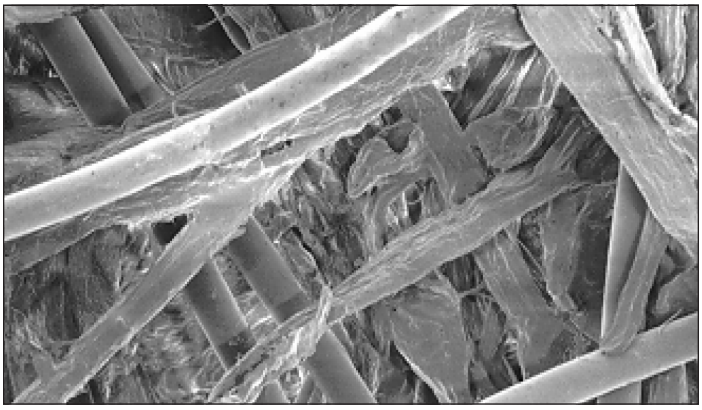
Oil Filtration Fundamentals

As I said before, Arden did an excellent job with his oil filter comparison in TDR Issue 32. I really enjoyed his comparison of the paper/cellulose and synthetic filter media. Three main things to remember here are: (1) Synthetic media can be engineered to remove finer particles while still maintaining good oil flow, (2) Synthetic media has the capacity to hold more dirt than paper/cellulose media due to the smaller cross-sectional area of the media fibers, and (3) Synthetic media costs approximately three times as much as paper/cellulose media.

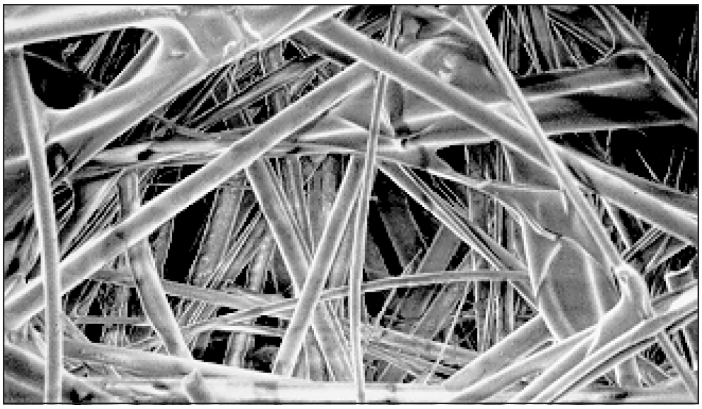
Now, I know that twice I've made reference to Arden's Issue 32 article. I also know the editor sent several copies to me, so it was easy to read about paper/cellulose versus synthetic filter media.

Finally, I know you'd rather I give you the "Cliff Notes" version of the article 'cause it is quite the interruption to get out of the EZ chair and fire up the internet. So, here goes:

Logically you think that in order to remove finer particles that there would be restriction to oil flow. As mentioned, that is not the case with the synthetic media. To understand this, the Fleetguard tech service guy told me to draw a bunch of random, intersecting lines on a paper. Do so and you'll see small gaps here and large gaps there. That is what the paper/cellulose media looks like under magnification. Now, to visualize the synthetic media, draw uniform vertical and horizontal lines on the paper. With the uniform pattern you can visualize how the synthetic media gives better filtration and better flow. Got it?



Cellulose filtration media.



Stratapore synthetic filtration media.

Now let's discuss a few more oil filtration fundamentals. First, the Glacier Metals Corporation did a landmark study of foreign particle size versus engine wear in the '70s. They concluded that the majority of engine wear was caused by particles in the 5 to 15 micron* size range. Larger particles were easily filtered out, and smaller particles traveled through the lubrication system without causing significant wear. I suspect the closer engine clearances of today might serve to tighten up this average particle size range to 3 to 12 microns*.

Secondly, oil filters for today's diesels have to handle significantly higher soot levels in the oil. Soot loading of the oil in EGR-equipped engines is 4-5 times as much as it was in the '70s. Lube oil formulators have doubled the concentration of ashless dispersants in diesel engine oils to keep the soot particles small so they will remain in suspension. Most soot particles with modern oils in modern engines are less than 1 micron in diameter, making it difficult to filter significant soot particles out of the oil.

A full-flow oil filter is, by design, constructed to filter 100% of the oil coming out of the oil pump. In order to accomplish this, filter manufacturers have to compromise on the porosity of their filtration media so the filter will not plug before the end of the oil change interval. Most modern full-flow oil filters are best at removing particles in the 20 to 40 micron size range.

So, what does all this mean? Modern diesel engines will run for many miles before abrasive engine wear becomes a problem. But, if you want the ultimate in oil filtration, you might want to consider "bypass filtration." Bypass is actually a misnomer, because it is often confused with an oil filter being bypassed because it is plugged. Bypass or secondary oil filtration actually takes about 10% of the oil stream and diverts it through a much finer filter which won't interrupt engine oil supply if it should plug.

Bypass filters can effectively filter particles as small as 1-2 microns, but they are very expensive and take additional labor to install. By the way, bypass filters don't filter fine enough to remove engine oil additives from the oil, because these particles are usually less than 1 micron in diameter. Most truckers don't use bypass filtration because they don't feel the benefits outweigh the added cost and complexity. I agree with their assessment in most instances.

If you want to read about a bypass filter for your engine, pull out TDR Issue 65, page 100. And, for grins, note that the editor and I agree about the assessment of total cost. Likewise, you can read this sidebar that Robert wrote on page 69 about the "Ideal John Martin Filter." Agreement with the editor: gotta keep these part-time writing assignments coming in, ya' know.

*** Keep these micron numbers "5 to 15" fresh in your mind while you read the sidebar "What is a Micron" on page 68.**

Oil Filter Specifications

When a filter manufacturer develops a filter to rebrand for an OEM (such as Cummins, Mopar, Motorcraft, AC/Delco, etc.), the OEM usually has a very specific battery of demanding tests they want the candidate filter to pass before they will allow their brand name/corporate logo on the box. Sometimes these tests are exhaustive. Caterpillar, for example, used to require a fuel filter which could remove much finer particles than all the other diesel engine manufacturers' fuel filters because they utilized tighter clearances in their fuel system and deemed that finer filtration was necessary.

I asked a Donaldson engineer to supply me with a list of tests which are used to validate oil filter performance. There are at least ten tests that filter manufacturers use to ensure that their products offer sufficient performance, durability, fluid compatibility, and media integrity. I thought it was particularly interesting that synthetic filtration media have a distinct advantage on two of the tests (Multipass ISO 4548-12 and Pressure Drop SAE J1985) due to their smaller fiber cross-sectional areas.

However, filters which go into the aftermarket often meet only basic minimum test standards. Some filter manufacturers conduct only those tests which they feel will ensure a consistent, safe product for them to market. Then that filter manufacturer relies on exaggerated marketing claims on the box which are often meaningless. For example, the STP S3976 filter, which is manufactured by Champion Laboratories, is a good example. This filter is undoubtedly the lowest-quality oil filter in our study, yet the box claims it has 20% more filtration capacity than the leading brand. Horse hockey! This filter has the least amount of media (in terms of both the length of the filter element and the number of pleats in the media) of all the filters we evaluated. NAPA's oil filter and O'Reilly's house brand Microguard filter (MGL 3976A), which both retail in the same price range ($5-$6), have over 20% more media surface area.

But, I'm getting ahead of myself. A little more background: The editor sent me an oil filter cutter and a bunch of oil filters to cut up and told me to quit taking naps (That semi-retirement thing, ya' know?) and get to work. Now I'll be the first to admit that cutting an oil filter apart can't tell you everything you need to know about that filter, but it can certainly give you an indication of the construction ethics and habits of those who built the filter. I bought some additional filters, lined them up on one of the ramps of my hoist, and cut filters like an ax murderer on steroids. Table 1 contains the data I collected on the ten cellulose filters I examined, while Table 2 contains the data I obtained on three partial synthetic filters. Table 3 is my full synthetic filter comparison data. Table 4 shows you where I obtained my selling price information.

Spend as much or as little time on the tables as you see fit. I think you'll enjoy my observations that follow the tables.

TABLE 1: OIL FILTER COMPARISON (CELLULOSE MEDIA)

BRAND	Mopar	Fleetguard	Donaldson	NAPA	Fram	Microguard	K&N	Super Tech.	STP	Purolator
Part #	M-285	LF3972	P558615	7620	3976A	MGL3976A	HP4003	ST3976A	S3976	L45335
Where Produced	Mexico USA	Mexico	USA	USA	China Mexico	USA	USA	USA	USA	USA
Price, Vendor*	13.09 AA	7.95 GG	7.50 NH	11.29 NA	5.99 AZ 5.99 OR	4.99 OR	13.99 AA 13.99 AZ 13.99 OR	WM	4.99 AZ	5.49 AA
Element:										
Length, in.	5-5/8"	5-5/8"	5-11/16"	5-11/16"	5-11/16"	5-3/4"	5-5/8"	5-11/16"	5-7/16"	5-7/8"
Dia., in.	3-3/8"	3-3/8"	3-5/16"	3-7/16"	3-3/8"	3-3/8"	3-5/16"	3-3/8"	3-3/8"	3-3/8"
# of Pleats	64	67	57	49	57	55	57	57	41	64
Can:										
Length, in.	>6	>6	>6	>6	>6	>6	>6	>6	<6	>6
Wt., oz.	8	8	6	7	6	5.5	7	7	7	7
Flutes	yes	yes	no	yes	no	no	nut	no	yes	yes
Base Plate:										
Wt., oz.	8	8	7	7.5	7.5	7.5	8	8	7	8
Holes	8-3/8"	8-3/8"	8-5/16"	6-5/16"	6-3/8"	6-3/8"	7-1/4" 1-5/16"	7-1/4" 1-5/16"	5-1/4" 1-5/16"	8-1/4"
Sealed by:										
Spring	coil	coil	coil	coil	coil	stamped	stamped	stamped	stamped	stamped
Gasket	rubber	rubber	molded rubber	plastic	plastic	rubber	none	none	none	none

*Vendor Code: AA Advance Auto; AM Amazon.com; AZ Auto Zone; GG Geno's Garage; NH New Haven (Local Parts House); NA NAPA Auto Parts; OR O'Reilly's Auto Parts; WM WalMart

The Analysis

I've grouped several filters together: the Mopar and Fleetguard; the Fram and Microguard; the K&N, Super Tech and STP. (Heavy vertical lines in the comparison chart group these together.) Casual observation shows that these are the same filter with different exterior paint and logos.

Such, too, was the conclusion for many of the filters back in Issue 32. Again, saving you from the task of research, Arden noted the following observations of the same filter/different logo:

Mopar, Fleetguard and Motorcraft (coil spring)
Wix, NAPA and Penske (coil spring)
Hastings and Purolator (coil spring)
Deutsch, K&N, Mobil 1 (stamped spring)
Fram (stamped spring)

In my evaluation, the cast of characters has changed somewhat, but as a quick and easy (and, yes, unscientific) judge of quality you can bet I'll not be using a filter with a stamped-type spring. In terms of then and now, it looks like the Purolator folks have changed their supplier as they are now in the stamped spring category. Further commentary on cellulose filters follows. I wonder if Purolator would still be on the recommended TSB list (TSB 09-004-01) if it were rewritten today? (For an explanation of the TSB skip to page 64.)

The STP Oil Filter

As previously mentioned, the STP filter is made by Champion Laboratories. The STP oil filter has a base plate which has only five 1/4" diameter holes and one 5/16" diameter hole for the inbound oil to flow through (as Arden said, "In around the outside, out through the inside"). Taking wall effects into account, this means the STP filter will flow no more oil than a 1/2" diameter hole. Slowing oil flow is a method used to allow the media more time to filter the incoming oil, and it is often used in bypass filtration. But, are you certain your engine is getting sufficient oil flow to protect all of its components? In addition, the STP filter uses an inexpensive, stamped steel spring and no gasket to load and seal the filter element (or cartridge) against the base threaded plate. I previously mentioned the marketing claims, and STP has a clearly established brand name. (I struggle to understand what the STP brand represents.) In my opinion the STP filter is clearly the lowest quality of all the filters I evaluated.

Inspection of the STP filter shows the limited number of holes in the base plate, the stamped metal spring to preload the cartridge, and the minimal number of pleats in the filtration media.

The K&N Oil Filter

Since I've gone on such a rant about Champion Laboratories' products, let's continue with a discussion of the K&N oil filter (HP-4003). It uses the same base plate, but with seven 1/4" diameter holes and one 5/16" diameter hole to improve oil flow into the filter element. Since some racers use higher viscosity lube oils, this makes perfect sense. It also uses the stamped steel spring to seal the filter cartridge against the base plate, again without a gasket. I had two of these filters, and one of them rattled because the filter element wasn't tight against the base plate. This means that particular filter would not be filtering 100% of the oil going into the housing. I've always had a high opinion of K&N's air filtration products. However, I'm going to pass on their oil filter ($13.99 at Advance Auto, Auto Zone, and O'Reilly's), because it is overpriced, and their quality control is lacking. It does have a nut on the can if you should require an oil filter which can be safety wired to prevent loosening. (Some racing organizations require this.)

The very expensive K&N oil filter is made by the same people who made the Mobil and STP oil filters.

The Fram Oil Filters

I usually expect Fram filters to be at the bottom of the barrel, quality wise, because they have been living off their brand name for some time now. And the Fram Tough Guard partial synthetic (TG 3976A) filter ($6.99 at Auto Zone and $8.98 at Walmart) didn't let me down. It uses the stamped steel washer to seal the filter element to the base plate (this time with a gasket) and a very light, non-fluted can. It had only three more pleats than the Mobil partial synthetic filter, yet it claims six times more engine protection than the leading economy brand. Again, what does partial synthetic mean?

However, I was truly surprised by the two baseline Fram filters (PH3976A). These are Fram entry level filters which sell for $5 to $6 at various locations. When I cut them apart, I observed a higher-quality filter with a coil spring to load the filter cartridge against the base plate and a gasket to make sure the parts are sealed. Although one filter was made in China and the other in Mexico, these filters were mid-range or above in their construction quality. I immediately called Robert to see what he might know about these Fram filters.

It seems that numerous Cummins B series engines equipped with entry level Fram filters suffered piston failures some time back (years 1999, 2000). Upon investigation it was found that the piston undercrown oiling tubes (official term: piston cooling nozzles) were plugged, which caused the pistons to overheat and scuff against the cylinder walls. Cummins found that these oilers were plugged by some of the glue or resins used in the Fram filters, so they sent Fram a bill for those engines. You don't want to screw with diesel engine manufacturers' products, because their reputations are very important to them. Fram immediately upgraded the quality of this filter for use on the Cummins B series engine. Kudos to Fram for this one filter. ***Editor's note: Documentation of Fram's filter follies (follies: as nice a term as I could find) is found in TDR Issue 34, page 105. As a result of their follies, Dodge issued a technical service bulletin (TSB 09-004-01 dated 5/18/01) which informed the service network of the recommended oil filters for the Turbo Diesel engine. The approved manufacturers were (again the date of the TSB is May 2001):***

Mopar
Fleetguard
Motorcraft
A/C Delco
Purolator

The Remaining Cellulose Oil Filters

Now let's discuss the remaining entry-level cellulose filters. First, I wouldn't use a cellulose filter if I were contemplating extending oil change intervals, because water in the oil can cause the cellulose media to sag and eventually rupture over long periods of exposure. They are fine if you don't overextend them. This is an even more serious problem if you burn ethanol fuels because alcohol in the oil sucks up and entrains significant water. You must use synthetic media in these situations, because synthetic media is impervious to water damage.

Secondly, I wouldn't use a filter which depended on a stamped steel (Belleville) washer to load the filter element against the base plate in a heavy duty application. Oil pressure in an engine can be very high at startup, and it often fluctuates wildly as the engine is operated because some oil pumps have lobes which cause pressure fluctuations as engine oil is pumped through the system and the oil pump pressure relief valves are rapidly opened and closed. If you consider a stamped steel spring and a coil spring as if they were stretched out lengthwise side by side, it's easy to visualize that the stamped steel spring only has one or two inches over which it can absorb a given pressure fluctuation without exceeding its elastic limit. The coil spring, on the other hand, has several inches of steel over which it can absorb those same pressure fluctuations. Stamped steel springs will exceed their elastic limit much more easily than coil springs, and all preload against the base plate will be lost. Then your oil won't be totally filtered. Since the Microguard (I'm sure it's made by Fram); Purolator (L45335); STP; and Super Tech ST 3976A and K&N (I'm sure they are made by Champion Labs) filters contain stamped steel springs, I wouldn't recommend their use.

My Cellulose Oil Filter Picks

This leaves us with the Donaldson P558615 ($7.50 at New Haven filters), the Fleetguard LF 3972 ($7.95 at Geno's Garage), the Mopar MO-285 ($10.47 at Walmart and $13.09 at Advance Auto), and the NAPA 7620 ($11.29 at NAPA). The Donaldson filter was unique in that it used a formed rubber gasket and heavy coil spring to seal the element against the base plate and a well designed, threaded base plate with eight oblong 1/4" wide holes. I think the resultant flow rate would be equivalent to at least eight 5/16" diameter holes. It was also the only filter I received sealed in a plastic wrapper. Both the Fleetguard and the Mopar filters use heavy threaded base plates with 8, 3/8" diameter holes, fluted cans, rubber gaskets, and heavy coil springs to seal the element against the base plate. ***Editor's note: In the case of oil and fuel filters, for all model year trucks, it is a fact that Fleetguard makes the filters for Mopar.*** These are my three favorites, and I would pick the Donaldson or Fleetguard filters basically because of the price. Some times it's hard to find Donaldson filters, because they mainly cater to the heavy duty market (look for a truck parts or filtration distributor).

The NAPA 7620 ($11.29 NAPA) is also a well built filter with a plastic gasket (not quite as good as a rubber gasket) and fewer holes in the base plate. It also has less filtration capacity because it has approximately 20% fewer pleats in the media. It's probably still a perfectly good filter. As a point of interest, the NAPA 1607 filter uses the same components in a non-fluted can for about $0.60 less. I just prefer one of the first three I mentioned because they appear to be better constructed filters.

My cellulose filter picks – the Donaldson, Fleetguard, Mopar, and NAPA Filters.

A LOOK AT PARTIAL SYNTHETIC FILTERS

The term "partial synthetic oil filter media" reminds me of partial synthetic lube oils. In the case of engine oils, mineral oils have a distinct definition, and fully-synthetic oils have an industry accepted definition. But stating that an oil is a partial synthetic could mean anything. There is no industry accepted definition of a partial synthetic motor oil. My oil filter engineer contacts say the same is true of oil filters. There is no accepted definition of a partial synthetic oil filter. Do these oil filters contain 5% or 75% synthetic fibers?

Besides the STP oil filter, the only other filter in our study with so little flow through the base plate was the Mobil M1-403 partial synthetic oil filter, which sells for between $10.99 at Advance Auto and $12.99 at O'Reilly. This filter, which is also produced by Champion Laboratories, also utilizes a stamped steel spring to load the filter cartridge against the base plate, again with no gasket to seal the cartridge to the base plate. As with the STP filter, the filter element is smaller than the competitive offerings, and the number of pleats in the media is at least 5% less than any of its competitors. The Mobil filter claims it removes more contaminants and has two times the filtration capacity of the leading brand because the filter media is a partial synthetic. Don't believe everything you read! I wouldn't trust this filter for use on my Cummins engine.

Before I would pay that kind of a price for an oil filter, I would purchase a fully-synthetic Wix ($10.49 at O'Reilly) or Fleetguard ($13.13 at Amazon.com or $12.95 at Geno's Garage). I suspect that Donaldson also makes one of their Endurance synthetic oil filters for this application, but I don't know.

I'm not going to recommend any of the partial synthetic filters for several reasons. As I said before, the Mobil filter is a cheaply constructed, over-priced filter that isn't worth the money they ask for it. The Fram Tough Guard might be a cut above the Mobil filter, but it still uses a stamped steel washer to preload and seal the filter element against the base plate. The Purolator Pure Oil filter is probably the best of the three, but the only price I could find was $17.99 at Advance Auto. That's a hell of a price to pay for a metallic blue painted can! I recommend you also steer clear of partial synthetic oil filters until more exacting specifications are developed to identify the synthetic fiber content and categorize the performance of these new generation filter designs.

Note the small 1/4" holes in the Mobil and STP base plates.

TABLE 2: OIL FILTER COMPARISON (PARTIAL SYNTHETIC)

BRAND	Fram Tough Guard	Mobil M1	Purolator Pure One
Part Number	TG3976A	M1-403	PL45335
Where Produced	USA	USA	USA
Price, Vendor*	6.99 AZ 8.98 WM	10.99 AA 11.99 AZ 12.99 OR	17.99 AA
Filter Element:			
Length, inches	5-11/16"	5-1/2"	5-7/8"
Diameter, inches	3-3/8"	3-5/16"	3-3/8"
Number of Pleats	57	54	64
Can:			
Length, inches	>6	6	>6
Weight, ounces	5.5	7	7
Flutes, Yes or No	no	yes	yes
Base Plate:			
Weight, Ounces	7.5	7.5	8
Holes	6-3/8"	5-1/4", 1-5/16"	8-1/4"
Can Sealed By:			
Type of Spring	stamped	stamped	stamped
Type of Gasket	rubber	none	none
Claims	6 x more engine protection	2 x more capacity	

***Vendor Code**

AA	Advance Auto
AM	Amazon.com
AZ	Auto Zone
GG	Geno's Garage
NH	New Haven (*Local Parts House*)
NA	NAPA Auto Parts
OR	O'Reilly's Auto Parts
WM	Walmart

SYNTHETIC OIL FILTERS

So, after cutting up 15 filters (10 cellulose, 3 partial synthetic, 2 full synthetic), it is time to evaluate the two synthetic filters that were easy to find and purchase. This should come as no surprise to you, my favorites from this entire test are both the Fleetguard LF16035 ($12.95 at Geno's Garage) and the Wix 557620XE ($10.49 at O'Reilly's). I don't see how you could go wrong with either of these filters, and the extra $5 you would pay for the synthetic filter is cheap insurance. I'm sure Donaldson also produces a synthetic filter for this application, but I just didn't have one to evaluate. I only wish I could purchase this quality of oil filter for my passenger cars.

This should come as no surprise to you, my favorites from this entire test are both the Fleetguard LF16035 and the Wix 557620XE. I don't see how you could go wrong with either of these filters, and the extra $5 you would pay for the synthetic filter is cheap insurance.

My synthetic filter picks – the Fleetguard and Wix filters.

After completing this study, I'm anxious to cut apart some passenger car automotive oil filters. I usually don't give it a lot of thought when I purchase oil filters for my cars, but I think I'm going to now.

John Martin
TDR Writer

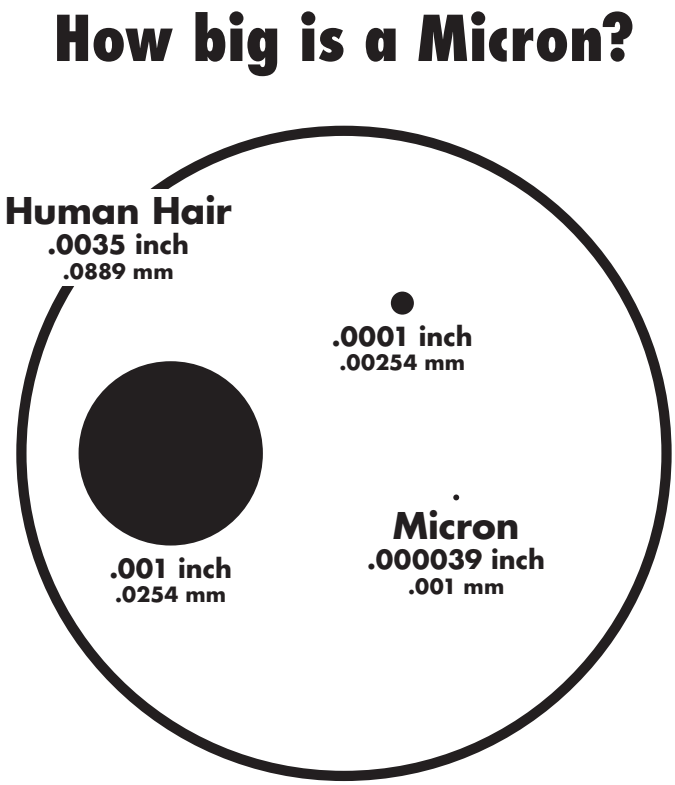
TABLE 3: OIL FILTER COMPARISON (FULL SYNTHETIC)

BRAND	Fleetguard	Wix
Part Number	LF16035	557620XE
Where Produced	USA	USA
Price, Vendor*	12.95 GG 13.13 AM	10.49 OR
Filter Element:		
Length, inches	5 5/8	5 5/8
Diameter, inches	3 3/8	3 3/8
Number of Pleats	47	47
Can:		
Length, inches	>6	>6
Weight, ounces	6.5	7
Flutes, Yes or No	yes	yes
Base Plate:		
Weight, Ounces	8	8
Holes	8-3/8"	8-3/8"
Can Sealed By:		
Type of Spring	coil	coil
Type of Gasket	rubber	rubber

WHAT IS A MICRON

by John Martin

Good question. For the answer I went to Fleetguard's web site (www.fleetguard.com) for the definition. ***(Editor's note: an understanding of this term is easy to comprehend; an understanding of its value in evaluation filter performance is convoluted by marketing hype and nonsense.)*** So, the answer is, "A micron is a thousandth of a millimeter or a millionth of a meter or.000039 of an inch. Micron is the unit of measure used to determine the size of particles in a fluid which are filtered out by the filter."



Now, to address the hype and nonsense that the editor referred to: the question often comes up, "What is the difference between Absolute and Nominal micron rating? The micron rating is the size of particles which are filtered out by filters at a certain efficiency. When this efficiency is at least 98.6%, we speak about absolute micron rating/filtration. Nominal micron rating is just a commercial trick for all efficiencies lower than 98.6%, meaning that for the same micron rating (for example 10 micron) in the case of nominal rating, not all particles will be captured in the filter as in the case of absolute micron rating."

So, when a product (most often it is in a fuel filter discussion) has a claim of "3 micron filtration," you have to stop and ask, "3 micron, what, Absolute or Nominal?" If the answer is nominal, the answer is meaningless.

To further complicate matters, Fleetguard and other manufacturers don't publish micron ratings for all products. But, in a backdoor kind of way I can tell you from research at Fleetguard's Frequently Asked Questions(FAQs) for lube oil filters that, "in full-flow lube oil filters, Cummins Filtration uses cellulose media (40 micron absolute) or upgrade media, such as StrataPore (25 micron absolute)." How does this compare with all the other oil filters? I wish I could tell you, but, as I mentioned a few sentences ago, manufacturers don't actively publish ratings for all of their products.

The 25 to 5 Range of Particles

Now, here is a concern that I have. If the Fleetguard cellulose (good at 40 micron) and Fleeguard Stratapore (best you can purchase in the industry at 25 micron) get us only to 25 micron absolute, and my research and conclusion earlier that "the majority of wear is particles in the 5 to 15 range," how do I get protection between the 25 to 5 range? Better yet, there are thousands of cars and trucks with 100,000 milestones on engines, is the 25 to 5 range protection needed? I was asked to do some more research. The following is what I found.

First, let's examine how particles are filtered out of a liquid. Most of us immediately think of a strainer and then postulate that a strainer can only filter out those particles which are too large to go through the openings in the media. Well, that's one filtration mechanism (surface filtration); but one must realize that if two particles having diameters larger than half the diameter of the opening arrive at the opening at precisely the same time, they will also be filtered out because they can't get through the opening.

A second and equally important filtration mechanism is often referred to as the torturous path mechanism (depth filtration). Remember the old oil bath air filters on '30s and '40s cars? Particles cannot (due to their higher density) be expected to turn a corner as tightly as the air or liquid they are in. The particles hit the walls of the filter and are captured. The deeper the filtration media, the more effective it is.

Of course, the more particles filtered, the more efficient the filter becomes until it eventually plugs completely. So, effectively, a dirty filter is better than a clean filter. I know, counterintuitive, but it is a fact. This causes a constant balancing act for filter designers, particularly those for diesel engines. Modern diesels generate a tremendous quantity of soot particles. If filter designers try to remove too many of these particles, the filter will plug completely before the end of the oil change interval.

Now, back to my 25 to 5 range concern. I called my engineer buddies at Donaldson and asked them if they could shed any light on the Fleetguard ratings for their cellulose media (supposedly only filtered as fine as 40 microns) and the synthetic media (supposedly filtered only as fine as 25 microns).

He said this is the problem with using micron ratings to rate filter performance. The accepted industry definition is that 98.6% of the particles of that particular size must be removed to say the filter can filter particles that small (the definition of the absolute micron

rating). However, smaller particles are removed as well. A filter which removes 98.6% of the 40 micron particles passing through it also removes progressively lower percentages of 30, 20, and even 10 micron particles (the smaller the particle, the lower the percentage). So, the 25 to 5 range of particles is being filtered; we just can't quantify the number.

This is another advantage for synthetic filtration media. Cellulose media tends to function more like a strainer (surface filtration) while synthetic media can be designed to filter particles both at the surface and down into the media (depth filtration). As a result, Fleetguard's 25 micron synthetic media (brand name Stratapore) filter probably removes more than twice as many particles in the 10-15 micron size rating as their 40 micron rated cellulose media filter. Yet another reason to purchase synthetic oil filters—not partial synthetic!

One last word about microns and ratings: Just as the public frequently uses a terminology (micron rating), the industry goes and reinvents itself with new and better tests. In vogue now are the "Beta Ratio and the ISO Code" test procedures. But, since I've already added confusion enough for one sitting with the TDR magazine, I'll refrain from further discussion on these tests. Let's save Betas and ISOs for the future.

John Martin
TDR Writer

FLEETGUARD'S VENTURI OIL FILTER
or
THE $45 OIL FILTER
or
THE IDEAL JOHN MARTIN OIL FILTER

by Robert Patton

Recently a TDR member called to ask if I knew about Fleetguard's Venturi Combo Oil Filter. My response, "Venturi, has that got anything to do with the Hollywood movie, 'Ace Ventura' or with politico Jessie Ventura?" Obviously, I needed to do some research.

The facts: Fleetguard offers a Venturi oil filter that was designed for B-series engine applications in Kubota equipment. Fleetguard also offers about 25 other part numbers for their Venturi product to fit other diesel engine applications (Caterpillar, Detroit Diesel, Cummins, Lomatsu, Hitachi, Ford Powerstroke, etc.). The part number for our application is LF9028 and the retail price is about $45. So, at $45 this oil filter had better be something special, right? And, special it is. The Venturi Combination Oil filter has a unique internal flow that is achieved with a Venturi nozzle that directs a portion of the oil to a stacked bypass media to capture soot and sludge. The balance of the lube oil flows through the full flow section that uses Stratapore material to filter the contaminants. The Venturi combo filter was designed to help fleets extend their oil drain intervals and the testing done by Fleetguard shows oil drain intervals; on severe duty Australian Road Trains were up to two times longer, extending out to 75,000 miles. This sounds like the ideal "John Martin oil filter," at least until you factor in the cost of the filter and the manufacturer's recommended oil change intervals for your engine.

First "bottom line:" Dodge is the authorized warranty agent and their recommended oil and filter products require maintenance at the intervals set forth in your Owner's Manual. In your selection of oil and filters, can you use better products? Without a doubt, but unless you want the responsibility of acting as the warranty agent you cannot ignore Dodge's maintenance intervals.

Second "bottom line:" See first bottom line and bypass products and filters like the Venturi became cost prohibitive. As John said, you have to do extended oil drain intervals to make the dollars invested worthwhile.

Third "bottom line:" See first bottom line and know that without a doubt you can use better products for your engine than those that are set forth and recommended in the Owner's Manual. Consider the second bottom line, and making the dollars invested in the maintenance of your truck worthwhile. Now, ask yourself this question "Using the recommended products and service intervals are owner's experiencing problems with engine wear-out? If I invest in better products will I be the benefactor of the extended life? Or, will my efforts to extend engine life be negated when the truck is traded/sold to someone and subsequently over-heated, over-fueled or wrecked?

Conclusion: The answers to these "bottom line" series of questions are as unique as each individual truck owner. I think I'll play it safe by sticking to the recommended service intervals and use the good quality Stratapore oil filter (yes, I can justify $5 additional cost). For oil... well, the generic works for me. Do John Martin's series on lube oils in Issues 54-58 warrant your reread?

Robert Patton
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