Oil Filter Choices

by Michael Link

An important consideration for our Stags is how we choose to filter the oil. Like everything else, much has changed since the early 1970's, the filters of today are very different from the filters back then. We have choices: the original cartridge filter, conversion to a spin on, filter size, filter media, bypass valve rating, anti-drainback valves, etc. Some people believe that the filter you select is more important to an engine than the oil chosen, though I'm not convinced of that argument.

In the 1950's when American auto manufacturers worked on engineering oil filtration, they found that it was the best method to put all of the engine's oil through the filter, but that a bypass valve was needed to prevent engine oil starvation. With the relatively primitive filter media in the 1950's, it was found that only about half of the abrasive engine wear occurred with a full flow oil filtration system compared to one without.

An oil filter has one purpose, that is to filter out particles that get into the oil to prevent them having abrasive action as they circulate through the engine. Oil enters the filter through the outer ring of smaller holes into the filter 'can,' passes through the filter and returns to the engine through the larger center hole. Inside the filter, there is the filter media: the filter element that the oil passes through to remove the particles. What we have is what is called "full flow oil filtration" which means that all the engine oil is put through the filter. This does not mean, however, that all the oil flows through the filter media all of the time.

There is a bypass valve inside the filter that will allow oil to bypass the filter media element in the event that the media does not pass enough oil through—this can be caused by partial blocking of the media from too many trapped particles, cold oil that will not pass through the media at a sufficient rate, filter media that doesn't have adequate flow for the conditions, or too much oil coming from the oil pump than can pass through the media, such as at high engine RPMs. It is a myth that the bypass valve only opens when the filter becomes blocked. Bypass valves are open a lot of the time, especially at high RPMs when there is more flow through the system, as well as when the oil is cold and doesn't pass through the filter media as easily as when warm. This is with fresh clean oil too, not only dirty oil.

The bypass valve is very important, it prevents oil starvation in the engine. It also prevents the high rate oil flow at freeway speeds from blowing through the filter media which would put the pieces of the element and all the particles it has trapped back into the engine, plus potentially blocking oil passageways. If it is too high a rating, the engine will not have enough oil when cold, or potentially at idle when hot, or if the media becomes partially blocked. Bypass valves are made of different materials. Spring loaded steel valves work well and are generally regarded as the best. Some manufacturers use plastic—with some making their plastic to look like steel—the plastic valves don't always seal well allowing oil to bypass regardless of conditions.

As you have likely concluded at this point, this all means that only some of the oil actually passes through the filter media much of the time, and as the oil circulates all of it eventually passes through the filter media. The type of filter media and the amount of surface area of the media play a large role in how much of the oil goes through the bypass and how much through the media at any moment. Various types of media have different flow characteristics. Adding pleats to the filter media is a way that manufacturers can add filter media surface area without the whole filter becoming larger.

Original-style Stag oil filter *Image: Rimmer's Catalogue*

This K&N filter has the advantage of a tightening lug on the bottom
Image: K&N website

If you research this topic, you will find discussion about the relative merits of the location within the filter of the bypass valve. Some will argue for the valve location closer to the filter baseplate (the part with the holes in it) as the superior design, and others will argue that its location at the far end (can end) from the baseplate isn't a concern. The argument is, essentially, that if the valve is located at the 'can end' of the filter, the oil washes over the media element, allowing already trapped particles to be washed back into the oil system. I am not entirely convinced of this argument, because when the oil is bypassing, there is still flow through the element which will press the already trapped particles against the media and it should not likely wash back in to the oil system. However, when the oil is cold and much is bypassing, it certainly could wash some of the already trapped particles into the oil, so I leave it up to each of you to decide what you think about this.

Before moving on from the topic of bypass valves, one last aspect of them. Manufacturers make filters with different

bypass value ratings. Which is the correct rating for our Stags when selecting a spin on filter? After all, there needs to be more considered than whether it just fits and does not leak. The bypass value for a filter is not a function of the engine oil pressure. The bypass value is the pressure differential between the oil on the outside of the filter media and the oil in the center of the filter (the other side of the filter media) on its way into the engine. As such, there is a combination of oil flow through both the media and the bypass, and as the filter media allows more through, the amount bypassing will reduce.

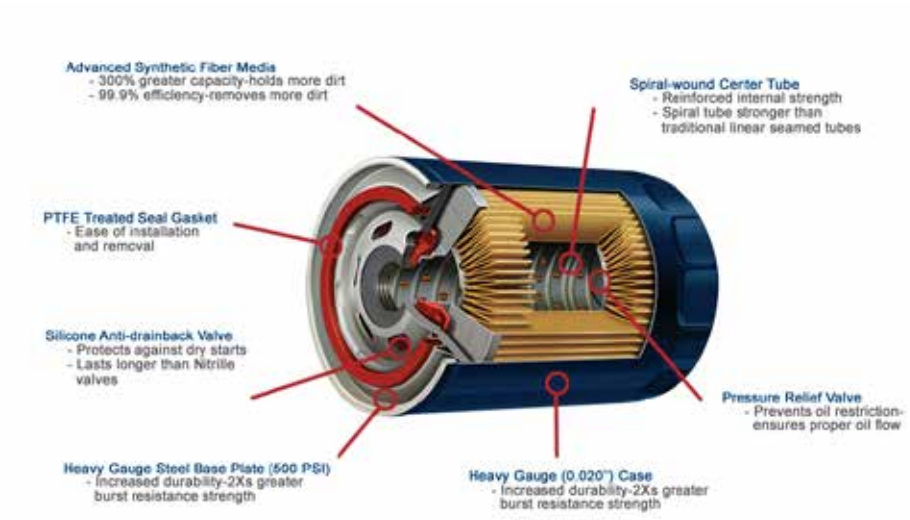
In the era of the Stag engine, oil filters used a relatively low bypass value (< 20 lbs), the oil pumps from back then were not designed to produce so much flow that a high bypass value could be used; using a high bypass value filter in a 20th century engine will likely result in an oil starved engine at least some of the time. With a modern engine high flow oil pump, a higher bypass value can be used, forcing more oil through the filter media; but these are engines from this millennium, not the last. This is one of the trends, in fact, in modern engine design: to have high flow oil pumps and high bypass value oil filters resulting in much more oil being filtered all the time and less going through a bypass. Why mention this when we are discussing Stags? There are filters that fit our Stag spin on adaptor that have a high bypass value, and should be avoided.

Remember this is what happens when you select your oil filter, those with media having better flow put less through the bypass in any given set of circumstances. When you start your engine cold, the cold oil does not flow through the media as readily as warm oil does, so much of it goes through the bypass. As the oil warms, it flows better through the media and so less of it goes through the bypass. As a driver, you could also not rev the engine above 1750 - 2000 RPM when it is cold, wait for it to warm up so you don't have a large percentage going through the bypass.

There is a trade-off between flow and filtration. If you are after the best possible flow, then the media has to be a bit more course to allow more to pass through it, or be designed to allow a good flow with lower restriction. It is argued that a high flow rate filter media is important when a heavier grade of oil is used, and in an engine where oil is pumped faster as the RPM is increased. On the other hand, some would want the best possible filtration for quick removal of as much as possible, preferring a more fine filter media, and accept the pressure drop across it and potentially the need for more to bypass. *Take care, though, with filtration that has too fine a micron size (<15), these are made for the thin modern oils.* Too fine a media will cause bypass because the back pressure across the filter media from the heavier oil we use in our Stags. This is a judgement call, both sides have merit. It is likely best to try to choose a midpoint between the two positions of flow and filtration.

The filter media is the actual part of the oil filter that does the filtering. There are a number of differing media compositions available in oil filters. There is paper—what the manufacturers call cellulose media, there is resin treated cellulose, cotton or glass fiber plus cellulose, synthetic, and synthetic blends. The amount of media surface area varies, with some manufacturers adding pleats to the media to increase its surface area allowing for a better flow, others make the entire filter larger to increase the media surface area. Some better oil filters may contain up to 50% more surface area of filter media than a cheaply made filter. In general, a filter with a larger quantity of media surface area will pass oil more easily. The media has to be able to trap small particles without restricting the flow.

The ability of filters to trap and hold contaminants is also different between filter media types. I think the upper limit of micron size should be around 35-40, given that the average human hair is 40-50 microns, and the human eye can see and differentiate down to about 40 microns. Cellulose media filters present the weakest filtration, they can trap fewer particles with their larger hole sizes (>40 microns) and flow less oil per square inch due to having fewer passages, resulting in reduced flow over other filter media options. Resin impregnated filters offer a significant improvement over cellulose media, keeping the flow relatively high while offering a fine filtration of 25-35 microns. Some manufacturers offer a synthetic media or a blended synthetic media which gives a very fine filtration down to 10 microns in some cases. The synthetic media is like a microfiber fabric, trapping particles and becoming a finer filter as contaminants become trapped—to the point until the flow becomes restricted. Synthetic media has more passages and can trap and hold more particles and has better flow per square inch.



What about the spin-on filter conversion? The first question to ask is does it matter to you if you change the car's originality? Personally I think that Triumph would have switched the engine over to spin-on if they had put money into engineering to keep it current and updated during its life cycle. From my own experience, I installed a spin-on adaptor in 1998 and have had no wear or oil issues caused by the filtration or lack thereof. But, make your own decision. I also think that there are many more options for the spin-on filter choices than there are for the original canister filter, which for me is a big reason to changeover to spin-on. If the decision is for spin-on, then the next questions need to be

bypass value, flow-filtration considerations, and cost-benefit analyses.

What about anti-drainback valves on oil filters? These is the material on the inside of the filter from the ring of holes where the oil enters the filter. There are different materials for these: metal, nitrile, and silicone are the most commonly used materials. Which is better? For those to whom this really matters a lot, silicone is the material of preference in most cases. On our Stags, the filters are mounted vertically, the oil in them does not drain out, so it does not really matter much whether we have drain back valves or not. Some argue that in the case of Stags, it is better to not have them, since their presence provides a sort of restriction to oil flow into the filter. Personally, I am indifferent to them in the Stag.

The oil pressure in a hot idling engine and in a cold engine can be affected by the filter. This is not to say that the filter can or will improve oil pressure in a worn engine, rather for those with oil pressure concerns, I would suggest trying different filters to see if they result in oil pressure readings they like better. The oil pressure is measured after the filter, so the flow characteristics and bypass values of the filter affect it. Keep track of the various filters as you try them, likely one will be found that has the characteristics to produce the oil pressure values desired.

In my opinion, an ideal filter for the Stag is one that does a good job balancing the oil flow and the fineness of the filtration, and it should have a 'better' filter media. Its housing should be constructed in a quality manner, a strong housing construction to withstand the high oil pressure when the engine is cold and not leak at the crimp where the back plate is attached to the 'can' along the seam—I have seen people driven crazy by oil leaks, when it turned out to be the filter itself leaking along the seam. It should also not be overly costly; there does come a point where there isn't enough gain to justify the additional price, especially when most of us change our oil and filter quite often.

Before continuing, by way of disclaimer, *I have no known equity or interest, directly or indirectly, in any oil filter company, any of their parent companies, or connection with any of their employees or any of their products.* Due to the various considerations stated in the article, the following conclusions are my opinions. Feel free to disagree and go your own way. This is intended as a place to start and to provide further food for thought to readers, a way to round out the discussion.

Any of these spin-on filters will do an excellent job filtering your oil - they are all well made and have excellent filtration and flow characteristics. Filters with the bypass valve at the baseplate end: K&N, Motorcraft, Wix, Napa Gold; others may, but without cutting them open, the bypass location is unknown to me.

Top rated spin on filters are, in order:

Construction: Mobil 1, K&N, Wix, Napa Gold, Purolator Pure One, Bosch Premium
Filtration-microns: Purolator Pure One-20, Bosch Premium-20, Mobil 1 Extended Performance-(proprietary info.), K&N-30
Oil Flow: Mobil 1 Extended Performance, K&N, Wix, Napa Gold, Purolator Pure One, Bosch Premium

My suggestion for the filters to use in the Stag spin-on would be:
Bosch Premium 3422, K&N HP-2009, Mobil One Extended Performance M1-209, Motocraft FL400S, Napa Gold 1516, Purolator Pure One PL20195, or Wix 51516.

I am of the opinion that the bypass value should be in the 8-18 pound range for any filter chosen and would advise caution if using a filter with a higher value than 23. From the era of our Stags, that is the common bypass value range.

I have found that with auto supply being an application based world where our Stags with spin-ons are not included, check the recommended filter for a 2008 Jaguar X-type V-6, 3.0 Litre 24 v. The threads will fit, the filter will seal, and the bypass will be in the correct range. The next part is up to you: which filter media, flow, filtration, brand and line of filter?

Decide what you want as your trade-offs between filtration, flow and construction, from these or whatever other filter you choose. If you're using a different filter from the ones I suggest here, be sure to consider all the aspects of the filter, including the bypass value. In some instances, you will not be able to find the information you seek on the manufacturer's website, in which case they have a phone and/or e-mail option to put questions to them. Even then, not all manufacturers release certain data such as micron filtration size, oil flow numbers, which end the bypass is located, etc. Each manufacturer has different data they are willing to release or not.

What about the filter cartridges available for the original filter set-up? These are much more difficult to say much about, since they are such a specific application, there isn't much that I have found in the way of data, testing, construction, or any other pertinent information. I can say that for the manufacturers where I have been able to compare, their cartridge for the Stag is from their lower lines with poorer performance than the spin-on filters I suggested above. But that is only some of them, others are unknown and the only way to determine their efficacy would be to commission an engineering study. I would expect that the Purolator, Hastings, Mann, Napa, AC Delco or Wix cartridges would be amongst the better ones available based on their spin-on filters' quality. But there isn't necessarily a relationship between the spin-on filter media and the cartridge filter media, so that is just reliance on the manufacturer's reputation.

Have you found yourself knowing more than you wanted to about oil filters, perhaps? I hope you've found some food for thought on the subject, maybe finding something new, maybe organizing a bit differently what you already knew. **SN**

Not all filters are created equal
Image: Terence McKillen

[Michael Link is retired from a career in Silicon Valley High Tech. He is an alumnus of UC Berkeley living in California's Central Coast region. When in Silicon Valley he was involved in the local Triumph club, the Triumph Travelers Sports Car Club, serving in various officer positions including President more than once. The May 1973 Sienna Stag was purchased in 1996 as a wedding anniversary present for his wife. He is active in the Paradise British Car Club locally, serving as club secretary. Other current club affiliations are the Triumph Stag Club USA, Vintage Triumph Register, and the Stag Owner's Club (UK). Other Triumphs owned (past):1977 Spitfire and 1981 TR8 FI. Michael is a regular contributor on the TSC Forum]