# Oils and Oil Changes
## Part 1

This article was prompted by a recent question on the forum and as it is not a short story, it will be told in three parts. The question basically asked that if the oil looks good, do I really need to change it every year? First, what makes me the authority on oil change practices? Well, I do not claim to be an authority, but my past work experience has given me a reasonable insight into this subject albeit on aero and diesel engines. The principles are basically the same and I still have a number of contacts that I trust to tell the true story.

The real question is, how long does the oil stay in a fit condition to do its job satisfactorily. If we know that, then we can determine when it should be changed. Basically, the factors affecting oil life are, quality of the oil, quality and quantity of the additive package, oil quantity (including consumption), driving conditions and primarily the amount of fuel used.

If we understand the function of the engine oil then we can better understand the issue. The main functions are, lubrication, sealing, cleaning, cooling, anti corrosion, and (on more modern engines and our overdrives) hydraulics. A pure mineral oil will perform all these functions but not well enough to give acceptable engine performance and life, even in the TR.

That brings us to the 35% or so of additives we find in modern mineral oils. The engine manufacturers tend to drive the development of engine oils. If they want to introduce a particular feature that current oils cannot handle, the introduction is delayed until an additive company develops a suitable additive the oil companies can use in their products. Today with the quest for low emissions and fuel consumption, and lower maintenance costs, the oil companies have had to go to fully synthetic oils. Natural mineral oils simply will not cut it and all oils are synthetic to an extent if you include the additives.

Back to the oils functions:
**Lubrication**. This is the most obvious of all. There are two main types of lubrications, fluid film ( eg. main and rod bearings), and boundary layer (eg. Piston, rockers, cam ). Fluid film relies on oil being pumped in to the bearing to keep the two components apart. Boundary layer can be achieved by spray, splash and mist. There is contact between the components with this type of lubrication and some wear will occur.

**Sealing.** Oil sprayed up the cylinder walls provides sealing of the piston rings, also helps seal the engine in conjunction with the various oil seals.
**Cleaning.** As a normal function of the engine, parts wear. These wear particles are washed away by the oil. Also the oil burns around the top of the piston and this carbon needs to be cleaned away to stop the rings from sticking. There is also dust that enters the engine through the oil filler and breather.
**Cooling.** While the coolant cools the cylinder walls and head, it is the oil that cools the internals (pistons, crank, cam, rockers etc) This heat is carried away by the oil and normally cooled by air flow over the sump.
**Anti corrosion**. The oil maintains a film over the internal parts (and the under body on most TRs) to prevent corrosion. There is also the combustion by-products collected in the oil that can form acids that will cause corrosion on the various bearings and components. Chemicals in the additive help neutralise these acids.
**Hydraulics.** Not an issue with the TR engine but your every day car will probably have variable valve timing and/or hydraulic tappets. If you use engine oil in the gearbox, then it is used to operate the overdrive.

To be continued.

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As mentioned before, a straight mineral oil can not perform these functions satisfactorily so the oil is modified to achieve the desired characteristics. In general it is not the oil companies that develop the additive packages, it is companies that specialise in this technology. The oil companies select the additive package that will give the desired performance with their base stock oil at the price they are prepared to pay, and there is the rub.

To provide a standard for consumers, oils are given a rating by various standards organisation such as the API (American Petroleum Institute). This is one of the ratings you see on the oil containers such as CD, SF, etc. Engine manufacturers will then specify a standard of oil that is recommended for their products. As engine technology develops, new ratings are introduced that may or may not also meet older ratings. This also applies to transmission and hydraulic oils.

Now we come to one of the contentious issues. Do all oils with the same rating, perform the same? As the layman you would expect so but that is not the case. All it means is that the oil is blended with an additive package that meets the minimum standard for that rating. It says nothing about the quality of the base oil, and that varies widely, the quality and quantity of additive used, or by how much the additive package met the standards.

In general, oils are not tested to determine how well or even if they do meet a certain standard. Basically, if the additive package meets it then that claim is extended to the oil that uses it. I know that if the particular oil I use is to be changed/upgraded, it is tested by a number of race teams before being released on to the market. This is not testing to meet a standard but real life testing.

So we get oils that only just meet the standards and ones that not only meet but greatly exceed the standard. The additive package cost far more than the oil itself so you can see where I am heading here. Get some low grade oil, drop a little low cost additive and presto, you have an oil you can sell that meets the standard. Alternatively you get a good base oil, add a big dollop of a good additive package and it is still rated under the same standard. Which one would you think is best for your engine?

We have all heard that oils do not wear out and that is basically correct but the additives do. Take the long chain molecules that improves viscosity performance. They get sheared and destroyed in service and as there is only a finite number, eventually get used up so we need to add some more. Then there are the dispersants that keep the contaminants (wear particles, carbon, etc) in suspension. Eventually the oil will become saturated and the contaminants will drop out and we get the sludge build up we used to see with the old oils. All the additives will deplete or change form as they do their job so we need to replace them.

We could just add some more additives but we still need to get rid of the used package and all the contaminants held in the oil so the manufacturer sets a recommended oil change period. The filter only takes out the larger contaminants and the smaller ones are kept in suspension until the oil is drained. This is normally based on average driving conditions, for the TR back in the 50's this was 6000miles.

Now that we have discussed why we need to change the oil, we need to talk about when. If we accept that the additive package depletes in use, we need to work out how fast this happens. Basically the degradation of the package is directly related to the amount of fuel used. For every litre of fuel burned, a set amount of contaminants are produced and additives are destroyed doing their job.

Therefore the more additives we have, the longer the oil will last. In this regard the TR is well provided with a 6.25ltr sump. Engines today generally have smaller sumps but use synthetic oils that can still provide extended oil change periods. If we think back to when the TR was built, oils were not in the same league as today's oils and the engines were not designed to take advantage of all the benefits of modern oils.

To be continued.

# Oils and oil Changes
# Part 3

We should now compare driving back in the 50's with today's driving. Regardless of our memories of 100mph adventures, the average speed was much lower given the roads then and now. Now we tend to use fuel faster, and remember, fuel use relates to oil life.

Next is the type of driving we do. Typically we do short trips with the oil rarely getting up to what would be regarded as normal temperature. The problem with this is that the moisture and fuel that collects in the sump as part of the engines normal operation, will not boil off. This is the reason why cars that are not driven on long trips for some time, suddenly appear to use excessive oil when taken on a trip. Its not that it suddenly uses oil, it uses oil all the time but the water and fuel is not being boiled off and builds up over a period of time Remember, the engine temp gauge does not indicate the oil temp. Also, these fluids in the sump use up the additives designed to provide corrosion protection. This is why a lot of manufactures will give a shorter change period for stop start driving.

Both average speed and type of driving can reduce the oil's life. Remember, the faster you use fuel, the faster the oil reaches its use by date. The other factor that reduces the change period is operating in dusty environments. Remember the oil has to keep this dust in suspension till the oil change. I would suggest to you that Australia is a little dustier than England and our TRs are certainly not well sealed, either to keep dust out or the oil in.

If we go back to the question raised at the start, the oil looks good, why change it? You can see there are a number of factors to take into consideration. If oil is doing its job then it will get dirty as it gets older. You cannot see the degradation to the additives. The type of driving and the environment will affect the oil's condition. The quality of the oil is important also. It can also be said that oil is probably the cheapest thing you will ever put in your TR.

My recommendations, and remember they are my personal recommendations, are. First, buy a good quality mineral based oil in the range of 25w50. Don't wast your money on synthetic oil, you cannot extend the change period sufficiently to make it worthwhile. I have pulled engines down that I know have been serviced regularly and used a specialist "classic" engine oil that had sludge in the sump and rockers, and carbon build up on the pistons. This indicates to me that at the very

least, the dispersion additive and/or  viscosity improver was not up to the job. Don’t always believe the hype.

If the car is in regular use then I would change the oil about every 6000km. For irregular usage I would shorten that to 5000km. My car is driven hard and I change around 4000km. I would not leave the oil in the engine longer than 1 year without a good long run every month or so. Annual services can be recommended by manufacturers as a means of ensuring other components are serviced on a regular basis (eg. oil and air filters).

For the owners of TR2s there is another factor to consider and that is the oil filter arrangement on the early TR engines. These engines were only fitted with a bypass oil filter whereas the latter engines have a full flow filter. The bypass filter only filters oil that is dumped from the relief valve as opposed to a full flow which filters 100% of the oil pump output.

This means that the oil in the early engines needs to carry more of the smaller particles until oil change. This takes away some of the safety leeway that we build into our service recommendations.

Lastly, there has been a lot of chat about phosphorous and cam follower wear. For info on this, refer to the article on the subject in the TR Register Australia website Forum. The author is Neil McTavish of Castrol and submitted by Tr2 on April 22 2010.

I hope this helps explain the oil change storey and not simply confused you. Remember, if ever in doubt, follow the manufactures recommendation.