The Engine Oil Bible

DISCLAIMER: I am in no way affiliated with any branch of the motor industry. I'm just a pro-car, pro-motorbike petrolhead :-) The information on these pages is the result of a lot of information-gathering and research. It also answers a lot of FAQs from posters on the transport-related usenet groups. However, by reading these pages, you agree to indemnify, defend and hold harmless me (Christopher J Longhurst), any sponsors and/or site providers against any and all claims, damages, costs or other expenses that arise directly or indirectly from you fiddling with your car or motorbike as a result of what you read here.

In short : the advice here is worth as much as you're paying for it

One more thing : the Google ads are only at the top of the page here - I need to pay for my site space and bandwidth somehow. The rest of the page is ad-free for your reading pleasure.

What price do you put on the oil in your car's sump? After all, it is the lifeblood of your car's engine. In the mid-80's to mid-90's there was a mini revolution in car engine oil. All oils are no longer the same. Thanks to the increased popularity of sporty GTi's, 16 valve engines, turbos and the *black death*, the days of one oil catering for everyone are over. Take Castrol for example. They led the field for years with GTX. This was surpassed a few years back by semi-synthetic and fully synthetic oils, including GTX2 and GTX3 Lightec. Now, that's been surpassed by Formula SLX which will cost upwards of £50 ($75) for 5 litres. And most recently, Castrol GTX Magnatec which is muscling in on the hitherto separate world of friction reducers (and we'll deal with them later, on the additives page.).

What does my oil actually do?

An engine oil's job is primarily to stop all the metal surfaces in your engine from grinding together and tearing themselves apart (and that's the last thing we'd want!). But it also has to dissipate the heat generated from this friction too. It also transfers heat away from the combustion cycle. Another function is that a good engine oil must be able to hold in suspension the nasty by-products of fuel combustion, such as silica (silicon oxide) and acids, whilst also cleaning the engine of such nasties. And it must do all of these things under tremendous heat and pressure without succombing to fatigue or *black death*, the ultimate engine destroyer.

What the heck was Black Death?

Black death first appeared in the early 80's when a horrible sticky black substance was found to be the cause of many engine seizures in Europe. Many engines were affected but Ford and Vauxhall (GM) suffered the most. Faster roads, higher under-hood temperatures, tighter engineering tolerances and overworked engine oils turned out to be contributors to the problem. The oils just couldn't handle it and changed their chemical makeup under pressure into a sort of tar-like glue. This blocked all the oil channels in the engines, starved them of lubrication and caused them to seize. This could all happen in a matter of minutes. I don't recommend this but you can reproduce the effect with a frying pan, cooking oil and a blowtorch. The cooking oil will heat up far quicker than it's designed to and will turn to a sticky black tar in your pan. Either that or it will set fire to your kitchen, which is why I said "don't do this". Anyway, buring kitchens aside, Black Death was the catalyst for the production of newer higher quality oils, many of them man-made rather than mineral-based.

Mineral or synthetic?

Mineral oils are based on oil that comes from dear old Mother Earth which has been refined. **Synthetic** oils are entirely concocted by chemists wearing white lab coats in oil company laboratories. For more info, see the section on synthetics further down the page. The only other type is **semi-synthetic**, sometimes called premium, which is a blend of the two. It is safe to mix the different types, but it's wiser to switch completely to a new type rather than mixing.

A couple of words of warning:

- If you've been driving around with mineral oil in your engine for years, don't switch to synthetic oil without preparation. Synthetic oils have been known to dislodge the baked-on deposits from mineral oils and leave them floating around your engine - not good. I learned this lesson the hard way! It's wise to use a flushing oil first.
- If you do decide to change, only go up the scale. If you've been running around on synthetic, don't change down to a mineral-based oil - your engine might not be able to cope with the degradation in lubrication. Consequently, if you've been using mineral oil, try a semi or a full synthetic oil. By degradation, I'm speaking of the wear tolerances that an engine develops based on the oil that it's using. Thicker mineral oils mean thicker layers of oil coating the moving parts (by microns though). Switching to a thinner synthetic oil can cause piston rings to leak and in some very rare cases, piston slap or crank vibration.
- Gaskets and seals! With the makeup of sythetic oils being different from mineral oils, mineral-oil-soaked gaskets and seals have been known to leak when exposed to synthetic oils. Perhaps not that common an occurance, but worth bearing in mind nevertheless.

Synthetics

Despite their name, most synthetic derived motor oils (ie Mobil 1, Castrol Formula RS etc) are actually derived from mineral oils - they are mostly Polyalphaolifins and these come from the purest part of the mineral oil refraction process, the gas. PAO oils will mix with normal mineral oils which means Joe public can add synthetic to his mineral, or mineral to his synthetic without his car engine seizing up. The most stable bases are polyol-ester (not polyester, you fool). When I say 'stable' I mean 'less likely to react adversely with other compounds.' Synthetic oil bases tend not to contain reactive carbon atoms for this reason. Reactive carbon has a tendancy to combine with oxygen creating an acid. As you can imagine, in an oil, this would be A Bad Thing. So think of synthetic oils as custom-built oils. They're designed to do the job efficiently but without any of the excess baggage that can accompany mineral based oils.

Pure synthetics

Pure synthetic oils (polyalkyleneglycol) are the types used almost exclusively within the industrial sector in polyglycol gearbox oils for heavily loaded gearboxes. These are typically concocted by intelligent blokes in white lab coats. These chaps break apart the molecules that make up a variety of substances, like vegetable and animal oils, and then recombine the individual atoms that make up those molecules to build new, synthetic molecules. This process allows the chemists to actually "fine tune" the molecules as they build them. Clever stuff. But Polyglycols don't mix with normal mineral oils.

While we're on synthetic oils, I should mention Amsoil. I originally had them down as an additive. I was wrong. I've got to say I've had no experience of the product myself so I can't vent my spleen about it. However, there is a particularly good page with a ton of info about it here. I recommend you pop over and read this and see what you think.
I've been contacted by Amsoil themselves and asked to point out the following:
Amsoil do NOT produce or market oil additives and do not wish to be associated with oil additives. They are a formulator of synthetic lubricants for automotive and industrial applications and have been in business for 30+ years. They are not a half-hour infomercial or fly-by-night product, nor have they ever been involved in a legal suit regarding their product claims in that 30+ year span. Many Amsoil products are API certified, and ALL of our products meet and in most cases exceed the specifications of ILSAC, AGMA etc..... Their lubricants also exceed manufacturers specifications and Amsoil are on many manufacturers approval lists. They base their claims on ASTM certified tests and are very open to anyone, with nothing to hide.

It turns out that Amsoil actually have the stance that they recommend engine oil additives are NOT to be used with their products. This will become relevant later on this page, and in the additives section. They have a pretty good FAQ on the Amsoil website, which you can find here.

Flushing oils

These are special compound oils that are very, *very* thin. They almost have the consistency of tap water when cold as well as hot. Typically they are 0W/20 oils. Don't ever drive with these oils in the engine - it won't last. Their purpose is for cleaning out all the gunk which builds up inside an engine. Note that Mobil1 0W40 is okay, because the '40' denotes that it's actually thick enough at temperature to work. 0W20 just doesn't get that viscous! To use them, drain your engine of all it's oil, but leave the old oil filter in place. Next fill it up with flushing oil and run it at a fast idle for about 20 minutes. Finally, drain all this off (and marvel at the crap that comes out with it), replace the oil filter, refill with a good synthetic oil and voila! Clean engine.
Of course, like most things nowadays, there's a condition attached when using flushing oils. In an old engine you really don't want to remove all the deposits. Some of these deposits help seal rings, lifters and even some of the flanges between the heads, covers, pan and the block, where the gaskets are thin. I have heard of engines with over 280,000km that worked fine, but when flushed it failed in a month because the blow-by past the scraper ring(now really clean)contaminated the oil and screwed the rod bearings.

So what should I buy?

Quality Counts! It doesn't matter what sort of fancy marketing goes into an engine oil, how many naked babes smear it all over their bodies, how bright and colourful the packaging is, it's what's *written* on the packaging which counts. Specifications and approvals are everything. There are two established testing bodies. The **API** (American Petroleum Institute), and the European counterpart, the **ACEA** (Association des Constructeurs Europeens d'Automobiles - which was the CCMC). You've probably never heard of either of them, but their stamp of approval will be seen on the side of every reputable can of engine oil.

The API

The API classifications are different for petrol and diesel engines:

- For petrol, listings start with 'S' (meaning **S**ervice category, but you can also think of it as **S**park-plug ignition), followed by another code to denote standard. 'SJ' is the current top grade, which recently replaced 'SH'. 'SH' will be found on most expensive oils, and almost all the new synthetics. It's basically an upgraded 'SG' oil which has been tested more sternly.

- For diesel oils, the first letter is 'C' (meaning **C**ommercial category, but you can also think of it as **C**ompression ignition). 'CH' is the highest grade at the moment, (technically CH-4 for heavy-duty) but 'CF' is the most popular and is well adequate for passenger vehicle applications.

Note about Castrol oils: Castrol have recently upgraded all their oils and for some reason, castrol diesels now use the 'S' rating, thus completely negating my little aid-memoire above. So the older CC,CD,CE and CF ratings no longer exist, but have been replaced by an 'SH' grade diesel oil. This link is a service bulletin from Castrol themselves, explaining the situation.

The CCMC / ACEA

The ACEA standards are prefixed with a 'G' for petrol engines and a 'D' or 'PD' for diesel. Coupled with this are numerous approvals by car manufacturers which many oil containers sport with pride. ACEA replaced CCMC in 1996 primarily to allow for greater read-across in test programs (eg for viscosity, viscosity modifiers and base oil). The CCMC specifications were G (1 to 5) for gasoline, D (1 to 5) or heavy duty diesel and PD1 and PD2 for passenger car diesel. ACEA though have a slightly different nomenclature they can be summarised as A for petrol, B for passenger car diesel and E for heavy duty diesel. The ACEA grades may also be followed by the year of issue which will be either '96, '98 (current) but coming soon is 2000.
Full ACEA specs are:

- A1 Fuel Economy Petrol
- A2 Standard performance level
- A3 High performance and / or extended drain
- B1 Fuel Economy diesel
- B2 Standard performance level
- B3 High performance and / or extended drain
- B4 For direct injection passenger car diesel engines
- E1 Non-turbo charged light duty diesel
- E2 Standard performance level
- E3 High performance extended drain
- E4 Higher performance and longer extended drain
- E5 (1999) High performance / long drain plus American/API performances. - This is ACEAs first attempt at a global spec.

Typically, these markings will be found in a statement similar to: *Meets the requirements of API SH/CD* along the label somewhere. Also, you ought to be able to see the API Service Symbol somewhere on the packaging:

The API service symbol

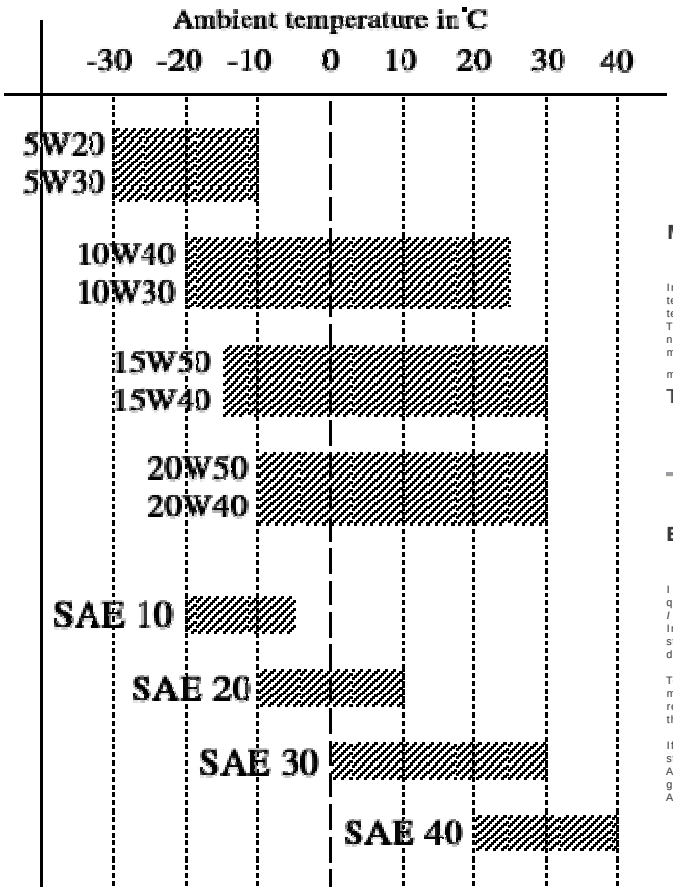
If this is all confusing you, then rest assured that all top oils safely conform to the current standards. **What you should treat with caution** are the real cheapies and those with nothing but a maker's name on the pack. Anything below about £12 ($18) for 5 litres just isn't going to be worth it.

A Brief History of ~~Time~~ API ratings
Some people have asked about the old standards, and although they're not especially relevant, some rampant plagiarism from an API service bulletin means I can bring you all the API ratings right back from when the earth was cooling.

Petrol Engines			Diesel Engines		
Category	**Status**	**Service**	**Category**	**Status**	**Service**
SL	**Current**	For all automotive engines presently in use. Introduced in the API service symbol in 1998	**CH-4**	**Current**	Introduced in 1998 for high-speed four-stroke engines. CH-4 oils are specifically designed for use with diesel fuels ranging in sulphur content up to 0.5% weight. Can be used in place of CD, CE, CF-4 and CG-4.
SJ	Obsolete	For all automotive engines presently in use. Introduced in the API service symbol in 1996	**CG-4**	**Current**	Introduced in 1995 for high-speed four-stroke engines. CG-4 oils are specifically designed for use with diesel fuels ranging in sulphur content less than 0.5% weight. CG-4 oil needs to be used for engines meeting 1994 emission standards. Can be used in place of CD, CE and CF-4.
SH	Obsolete	For model year 1996 and older engines.	**CF-4**	**Current**	Introduced in 1990 for high-speed four-stroke naturally aspirated and turbo engines. Can be used in place of CD and CE.
SG	Obsolete	For model year 1993 and older engines.	**CF-2**	**Current**	Introduced in 1994 for severe duty, two stroke motorcycle engines. Can be used in place of CD-II.
SF	Obsolete	For model year 1988 and older engines.	**CF**	**Current**	Introduced in 1994 for off-road, indirect-injected and other diesel engines including those using fuel over0.5% weight sulphur. Can be used in place of CD.
SE	Obsolete	For model year 1979 and older engines.	**CE**	Obsolete	Introduced in 1987 for high-speed four-stroke naturally aspirated and turbo engines. Can be used in place of CC and CD.
SD	Obsolete	For model year 1971 and older engines.	**CD-II**	Obsolete	Introduced in 1987 for two-stroke motorcycle engines.
SC	Obsolete	For model year 1967 and older engines.	**CD**	Obsolete	Introduced in 1955 for certain naturally aspirated and turbo engines.
SB	Obsolete	For older engines. Use this only when specifically recommended by the manufacturer.	**CC**	Obsolete	Introduced in 1961 for all diesels.
SA	Obsolete	For much older engines with no performance requirement. Use this only when specifically recommended by the manufacturer.	**CB**	Obsolete	Introduced in 1949 for moderate-duty engines.
			CA	Obsolete	Introduced in 1940 for light-duty engines.

Grade counts too!The API/ACEA ratings only refer to an oil's quality. For grade, you need to look at the **SAE** (Society of Automotive Engineers) ratings. These describe the oil's function and viscosity standard. Viscosity means the substance and clinging properties of the lubricant. When cold, oil can become like treacle so it is important that any lube is kept as thin as possible. It's cold performance is denoted by the letter 'W', meaning 'winter'. At the other end of the scale, a scorching hot oil can be as thin as water and about as useful too. So it needs to be as thick as possible when warm. Thin when cold but thick when warm? That's where *MultiGrade* oil comes in. For ages, good old 20W/50 was *the* oil to have. But as engines progressed and tolerances decreased, a lighter, thinner oil was required, especially when cold. Thus 15W/50, 15W/40 and even 15W/30 oils are now commonplace. Synthetics can go down as far as 5W which seemed unbeatable until Castrol came up with SLX - a 0W30 formulation! 'Free flowing' just doesn't describe it! It's predominantly a workshop oil retailing at around £10 ($15) a litre, but recommended for use in places like Canada in the winter. The latest offering to this 0W30 engineering miracle comes from AMSOIL.

So again: what should I buy? That all depends on your car, your pocket and how you intend to drive and service the car. All brands claim theirs offers the best protection available - until they launch a superior alternative. It's like washing powders - whiter than white until new Super-Nukem-Dazzo comes out. For most motorists and most cars, a quality mainline oil is the best. Ones which are known to be good at their job. Stuff like Castrol GTX. They're not too dear either. Don't believe the sales hype - they all perform to the same standards once they're out of the can and into your engine. Moving up a step, you could look at Duckhams QXR and Castrol Protection Plus and GTX3 Lightec. The latter two of these are designed specifically for engines with catalytic converters. They're also a good choice for GTi's and turbo'd engines. Go up a step again and you're looking at synthetic oils aimed squarely at the performance market. To get more money out of you, the manufacturers sell this stuff in smaller amounts which makes an oil change more expensive.



Marine Diesels and other special considerations.

Inland Marine Diesels (and certain road vehicles under special conditions) can, and do, glaze their bores due the low cylinder wall temperature causing the oil (and more importantly the additive pack) to undergo a chemical change to a varnish-like substance. The low temperature is caused by operating under light load for long periods.
This is related to engine design, some engines being nearly immune to it and others susceptable. The old Sherpa van diesel engines were notorious for this problem. The "cure" such as it is, is to use a low API specification oil, such as CC. Certain engine manufacturers/marinisers are now marketing the API CC oil for this purpose under their own name (and at a premium). You'll find some modern engines where its' industrial/vehicle manual states API CF and the marinised manual states API CC/CD. {Thanks to Tony Brooks for this information.}

Engine Oil Shelf Life.

I couldn't decide whether to put this in the FAQ or the main page, so it's in both, because I get asked this question a lot. Typically, the question is along the lines of *"GenericAutoSuperStore are having a sale on WickedlySlippy Brand synthetic oil. If I buy it now, how long can I keep it before I use it?"*
In general, liquid lubricants (ie. oils, not greases) will remain intact for a number of years. The main factor affecting the life of the oil is the storage condition for the products. Exposure to extreme temperature changes, and moisture will reduce the shelf life of the lubricants. ie. don't leave in the sun with the lid off. Best to keep them sealed and unopened.

Technically, engine oils have shelf lives of four to five years. However, as years pass, unused engine oils can become obsolete and fail to meet the technical requirements of current engines. The specs get updated regularly based on new scientific testing procedures and engine requirements. But this is only really a concern if you've bought a brand new car but have engine oil you bought for the previous car. An oil that is a number of years old might not be formulated to meet the requirements set for your newer engine.

If your unopened containers of engine oil are more than three years old, read the labels to make sure they meet the latest industry standards. If they do meet the current standards, you might want to take the extra precaution of obtaining oil analysis before using them. An oil analysis will check for key properties of the oil and ensure that it still meets the *original* manufacturing specs. Of course the cost of getting an analysis done on old oil is probably going to outweigh going and buying fresh stuff. So it's a double-edged sword. As a general rule, the simpler the oil formulation, the longer the shelf life. The following is a guideline under protected conditions:

Product	Shelf Life
Base Oils, Process Oils	3 years
Hydraulic Oils, Compressor Oils, General Purpose Lubricating Oils	2 years
Engine Oils and Transmission Oils	3 years
Industrial and Automotive Gear Oils	2 years
Metal Working and Cutting Oils	1 year

The following are signs of storage instability in a lubricant:

- Settling out of the additives as a gel or sticky liquid
- Floc or haze
- Precipitates/solid material
- Color change or haziness

Water contamination in a lubricant can be detected by a "milky" appearance of the product.

"High mileage" oils.

More and more oil companies are coming out with "high mileage" oils now, some recommended for engines with as few as 75,000 miles on them. So what is a "high mileage" oil you ask? Well very generally speaking, these oils have two additives in them which are more suited to older engines. The first is normally a burnoff-inhibitor which helps prevent the oil from burning off if it gets past an engine seal into the combustion chamber. The second is a "seal conditioner", the exact makeup of which I'm not sure of, but it's designed to soak into seals such as head- and rocker-cover gaskets and force them to expand. Thus if one of the seals is a bit leaky, the seal conditioner will attempt to minimise the leak.
I've not had experience of high mileage oils myself, but a few people who've emailed me have passed on various tales from it being the miracle cure to it making no difference at all. I think the general rule-of-thumb though should be "if it 'aint broke, don't fix it." Just because your engine has over 75,000 miles on it, doesn't automatically mean you need high mileage oil. Is the exhaust sooty or smokey? Are you noticing oil leaks? Is the engine consuming oil? If your engine is working fine, the exhaust is clean and you're not noticing any problems, my guess is that it doesn't need high-mileage oil.

Viscosity and Viscosity Index (VI).

The proper viscosity is the single most important criteria of a lubricating oil. The basic performance of machinery is based on the viscosity of the lubricant. Viscosity is, if you like, the resistance to the flowability of the oil. The thicker an oil, the higher its viscosity. The chart on the right shows a ***rough*** guide to ambient temperatures vs oil viscosity performance in both multigrade (top half) and single grade (lower half) oils. Multigrade oils work by having a polymer added to a light base oil which prevents the oil from thinning too much as it warms up. At low temperatures, the polymers are coiled up and allow the oil to flow as it's low number (W number) indicates. As the oil heats up, the polymers unwind into long chains which prevent the oil from thinning as much as it normally would. The result is that at 100°C, the oil has thinned only as much as it's higher rating. Think of it like this: a 10W30 oil is a 10-weight oil that will not thin more than a 30-weight oil when it gets hot.
The viscosity index of a lubricant is an empirical formula that allows the change in viscosity in the presence of heat to be calculated. This tells the user how much the oil will thin when it is subjected to heat. The higher the viscosity index, the less an oil will thin at a specified temperature. Multi-viscosity motor oils will have a viscosity index well over 100, while single viscosity motor oils and most industrial oils will have a VI of about 100 or less.

Viscosity and oil weight numbers is quite a nauseatingly detailed topic. So if you're curious about why a 15W50 oil is so-called, then put on the geek shield and pop over to the Viscosity Page.....

What about own-brands?

If you can't afford the big-name players, you could look at own-brand oils. These are usually badged oils from one of the larger companies but sold without the name, they are cheaper. **Check the standards and grade ratings on the pack first!!!** And just make sure it isn't a 20W/50 oil (which a lot are because it's cheap) unless your car is old enough to warrant it.

Servicing and checking

For God's sake don't skimp on either of these. You can *never* check your engine oil too often. Use the dipstick - that's what it's there for - and don't run below the 'min' mark. Below that, there isn't enough oil for the pump to be able to supply the top of the engine whilst keeping a reserve in the sump. All oils, no matter what their type, are made of long-chained molecules which get sheared into shorter chains in a running engine. This in turn means that the oil begins to lose it's viscosity over time, and it uses up the additives in it that prevent scuffing between cams and followers, rings and cylinder walls etc etc. When this happens, fresh oil is the key. And don't worry about the engine oil turning black. It will lose it's golden-brown colour within a few hundred miles of being put in to the engine. That doesn't mean it's not working. Quite the contrary - it means it **is** working well. It changes colour as it traps oxidised oil, clots and the flakes of metal that pop off heavily loaded engine parts. Just don't leave it too long between oil changes.

So how often should I change my oil?

You can *never* change your engine oil too frequently. The more you do it, the longer the engine will last. The whole debate about exactly when you change your oil is somewhat of a grey area. Manufacturers tell you every 10,000 miles or so. Your mate with a classic car tells you every 3,000 miles. Ole' Bob with the bad breath who drives a truck tells you he's never once changed the oil in his car. Fact is, large quantities of water are produced by the normal combustion process and, depending on engine wear, some of it gets into the crank case. If you have a good crank case breathing system it gets removed from there PDQ, but even so, in cold weather a lot of condensation will take place. This is bad enough in itself, since water is not noted for its lubrication qualities in an engine, but even worse, that water disolves any nitrates formed during the combustion process. If my memory of chemistry serves me right, that leaves you with a mixture of Nitric (HNO_3) and Nitrous (HNO_2) acid circulating round your engine! So not only do you suffer a high rate of wear at start-up and when the engine is cold, you suffer a high rate of subsequent corrosion during normal running or even when stationary.
The point I'm trying to make is that the optimum time for changing oil ought to be related to a number of factors, of which distance travelled is probably one of the least important in most cases. Here is my selection in rough order of importance:

1. Number of cold starts (more condensation in a cold engine)
2. Ambient temperature (how long before warm enough to stop serious condensation)
3. Effectiveness of crank case scavenging (more of that anon)
4. State of wear of the engine (piston blow-by multiplies the problem)
5. Accuracy of carburation during warm-up period (extra gook produced)
6. Distance travelled (well, lets get that one out of the way)

If you were clever (or anal) enough, you could probably come up with a really clever formula incorporating all those factors. However, I would give 1, 2, and 3 equal top weighting. Items 1 to 3 have to be taken together since a given number of "cold" starts in the Dakar in summer is not the same as an equal number conducted in Fargo in January. The effect in either case will be modifed by how much gas gets past the pistons. What we are really after is the severity and duration of the initial condensation period. All other things being equal, that will give you how much condensate will be produced and I would suggest that more than anything else determines when the oil should be dumped.

Dammit Chris, get to the point already!

Hang on a tic - if you really want the answer, there's a couple more factors you need to take account of: Crank-case scavenging (that's the clever term for sucking the nasty fumes back out of the crank-case) - or lack of it - is a crucial multiplying factor affecting all the other items listed above. As an example, the worst I've heard of was a Ford Fiesta of the mid 70s or so. It's crank-case fume extraction was via a tiny orifice directly into the inlet manifold which obviously could not handle any significant volume of crank-case fumes without upsetting the carburation. The car in question had been used almost exclusively for 5 mile journeys to/from work, shopping etc, and it had always been serviced "by the book". Despite (or because of) this, the engine was totally buggered at 40,000 miles. Alternatively you might get a car that by virtue of excellent crank case fume scavenging could tolerate many more cold starts than one without.

Taking all these into consideration, my philosophy would be to totally ignore the distance and change the oil three times a year - about November, February and May. Move these dates a bit according to the severity of the winter. An average family car will do around 14,000 miles per year and about 2/3 of that will fall in the May - November period. At the end of that period, the car will have just about touched on the recommended oil change distance - but all done at reasonable temperatures and including long distance runs during vacations and good weather. During the Nov - Feb. period it may acumulate only 2 or 3 thousand miles, all low temperature starts and mostly short runs. The Feb. to May period is likely to be about the same.
About 10 or 15 years ago, an article in the ANWB journal (ANWB is the Dutch equivalent of the AA - or the AAA in the American case) reached more or less the same conclusion that distance was not very important. In their case they applied this to their road service fleet, which typically once started in the morning never got cold. In effect, they hardly ever changed the oil! I seem to remember 30,000 miles between oil changes being quoted. I also seem to remember that they had some kind of water or acid indicator attached to the end of the dipstick and went by that rather than distance.

That's a politician's answer - you've dodged the entire issue!

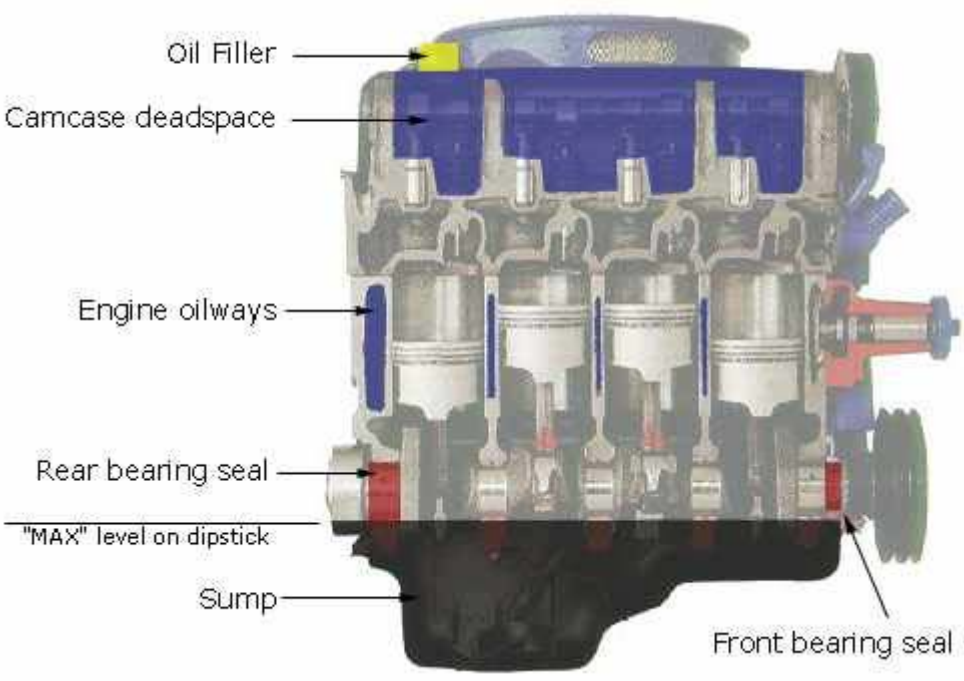
Have I? I don't know how far you drive in a year, where you live, the style of your driving or anything else so I can't tell you what's right for your car. Personally, I changed the oil and filter in my 1985 Audi Coupe every 5,000 miles. It had done over 150,000 miles when I sold it, wasn't leaking and didn't consume any oil. If you must have a figure from me, then 5,000 is it.

What else happens when I change the oil then?

Engines pump about 10,000 litres of air for every litre of fuel consumed, and along with all that air, they suck in plenty of dirt and grit. A good air filter will stop everything bigger than a micron in diameter - everything smaller mostly just floats around harmlessly in the 0.001inch minimum thickness oil films that separate all the moving parts. Despite all of this, there will always be submicron particles that get in and there will be places in the engines oilways where they will gather. Every time you empty the oil from your sump, you're also draining this fine grit with it.

Checking the oil in your engine, and topping up.

To a lot of people, this little section could be categorised by the rearranging the words "granny eggs teaching suck your to". But you'd be surprised by the number of people that don't know how to do even this basic task. When checking the level of oil in the engine, the car should be on a level plane, and should be relatively cold. I've run into several people lately who insist in keeping the crankcase topped off completely, and they invariably check the dipstick just after shutting down the engine. Now look at this image, and then read on.



Reading the oil in this way results in an erroneous reading because a quantity of oil (usually about half a litre) is still confined in the oilways and passages (galleries) of the engine, and takes some time to drain back into the crankcase. On the image, the blue areas are where oil is likely to still be running back down to the sump. But on seeing what appears to be an abnormally low level on the dipstick, these buffoons then add more oil to the crankcase. The oilways and passages all empty, and suddenly the engine becomes over-filled with oil, going way above the 'MAX' mark on the dipstick. The problem with this is that the next time the engine is run, the windage in the crankcase and other pressures generated by the oil pump, etc. place a great strain on the seal on the rear main bearing. Eventually, often much sooner than the ordinary man in the street might expect, the rear main bearing seal ruptures, and the engine becomes a 'leaker'. If you've got a manual gearbox, this means one thing: this oil goes right onto the flywheel and the face of the clutch disc. A lubricated clutch is A Bad Thing. If this still goes unnoticed, the front seal is the next to go, and the engine then becomes a 'gusher'. As well as smothering the clutch with oil from the rear, the oil now coming from the front leak will be neatly distributed about the engine bay as it hits the front pulley - often propelling it out as far as the brake discs. It's sort of like a Hollywood disaster movie in the making, yet people don't consider this.

Can I use car engine oil in my motorbike then?

No you can't. Well, actually you can, but all sorts of nasty things happen if you do. Oils formulated for car engines have friction-modifiers in them. If you top up your bike with car oil, this causes a problem because most motorbikes have a wet clutch - ie. a clutch that sits partially immersed in the sump oil. When the engine oil gets into the clutch, the friction-modifiers get to work and you'll end up with a clutch that won't bite. Bike oils don't have friction-modifiers, so they don't have this problem. If you're not sure, check for a JASO MA spec on the bottle. If you see that on the label, then it means the oil has been tested and confirmed to work with a wet clutch.

And so to engine additives

Think what you will of these. Whatever you call them, they are an addition to the engine which it was not designed to take. Engines are designed to use engine oil, not Teflon®. Make up your own mind - read this report and see what you think. In my opinion (and that doesn't mean I'm right) the majority of these are primarily a placebo to put uneducated minds at rest whilst making a nice profit for the additive manufacturer. The additive part of this site started quite small, but as more and more of the companies got into lawsuits and legal actions, and lost, this page became far too long to read all in one go. So if you're considering Duralube, ProLong, Slick50 or any of the other brand-name placebos, you'll be wanting to hot-step it over to my **additives page** pretty darned quickly.....

An alternative to engine additives: pre-pressurisation

What the additive manufacturers tell you *is* true - when you start your engine, there really is very little oil in the right place - most of it is in the sump. There is another alternative. I found a site called AutoEngineLube.com and they seem to be offering an interesting alternative. They have a system which uses a cylinder of pressurised oil and a solenoid valve, all connected to the regular oil system. It works with only one moving part, (the solenoid valve - duh!). When the key is turned on it opens the valve and the oil that was trapped in the tank the previous time it was running goes back into the oil gallery in 1 or 2 seconds and the low oil pressure light will flash off. There's likely to still be a little lag before full-on lubrication gets to the main bearings, but from what I can tell, this system will massively reduce that lag compared to starting from cold - it pressurises the system before the starter engages. Of course an engine that has set up for a few months and is completely dry will take a few more seconds. When the engine is turned off the solenoid valve shuts off in 30 milliseconds so you end up with pressure on the tank equal to the pressure the last time it was running. The tank will hold more than enough oil to accomplish this. Its completely over engineered as the tank is rated for over a thousand pounds and the hose is good for 300lb. Because the valve is designed for an industrial application with an expected duty life of several million cycles, AutoEngineLube give it a lifetime warranty. It only uses *previously filtered* oil from the gallery so no damage can be done by it in any way. Their system comes as a kit and requires some menial installation - most savvy home mechanics should be able to do it. I'm not sure how it would affect the warranty on a car engine. In theory, if it works, it ought to make no difference but you know what manufacturers are like - if you even sneeze on your engine, it's likely to void the warranty.
Pop over and check them out if you're interested. If you end up buying one of these, I'd like to know what sort of results you get so I can add an objective review to my site. AutoEngineLube.com can be found here.

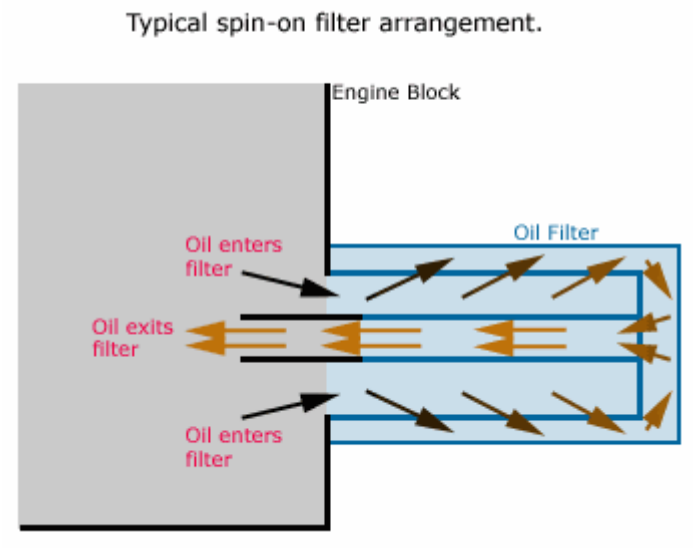
It's worth pointing out that pre-lubers have been around for quite a while; the original systems featured an electric pump that circulated the oil from the sump before the starter turned. The pump would bring the oil up to full operating pressure before you attempted to start the engine. A reader of this site emailed me about this. He had one on an old MG-TD, because the car got very infrequent use; it worked rather well and he never had any major engine problems with it installed. Enginelube.com still do the "old style" pre-lubers. Enginelube.com can be found here.

Oil filters and filtration.

Thanks to one reader who noted that in all of this page, until mid-2001 I had not given much, if any space, to the topic of filters and filtration. So here we go.

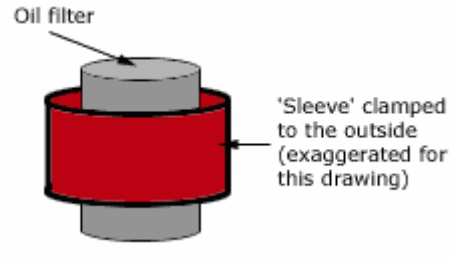
It's all very well changing your oil often, but it's not just the oil that helps prevent engine wear. The oil filter does its part too. Dirt is the prime cause of engine wear. Not big dirt, like you'd see in a yard, but minute particles of dirt. It's dirt nevertheless, and it's abrasive. These contaminants vary from road dust (which are razor-like flakes from an engine's perspective) that doesn't get filtered out by the air filter, up to actual metal particles - the byproducts of the casting scarf from the original engine manufacture, and basic engine wear. All this nastiness is carried around by the oil into the minute parts of your engine, being rammed into the precision clearances between bearings and other moving parts. Once in, they don't come out easy, but tend to stay there, wearing grooves, grinding and generally messing up your engine. Other debris that causes problems are a by-product of the mere way an engine works - sooty particles from the combustion process can be forced past the piston rings and transported around in the oil too. This is definitely A Bad Thing - the soot acts like a sponge and soaks up other oil additives reducing the oil's anti-wear properties, and messing up it's viscosity. All this dirt is why oil goes black when it's used. That lovely syrup-like yellow that it is when you put it in is pure oil. The black stuff that comes out at an oil change is the same oil full of contaminants and by-products from wear and tear.

That's where the oil filter comes in. It's job is to catch all this crap floating around in the oil, and to stop it from recirculating. Most oil filters that you or I will ever see are the spin-on type. They're shaped like an alumnium can and spin on to a threaded oil feeder poking out of the side of the engine somewhere. They're called 'full-flow' oil filters because they sit in the normal flow of the oil through the engine. Sort of like an electrical component in series with all the other electrical component. Because it sits in-line, it has to be designed not to restrict the flow of oil around the circuit, and thus can only really be effective at stopping the larger particles. Large, in this case, is around the 20micron size. So here's the catch. The smallest contaminants are in the 10-20micron size range. Not only is that "extremely small", but it means that they pass right through the oil filter and back out into circulation. This is why regular oil changes are a necessity, because these tiny little things can be the most damaging.



There is another alternative, but it's only really used in heavy applications or for racing. That alternative is to fit a secondary bypass oil filter. This is sort of like a filter in parallel with the primary one. It doesn't restrict the flow of oil in the main circuit, but the oil that passes through it is filtered down to the 5 micron range, thus removing even the smallest contaminants. The newest filters claim to work down to 1 micron, though I can't confirm nor deny those claims. The upside is that by cleaning the oil so completely, bypass oil filters increase not only engine life, but also the life of the oil itself. This means longer service intervals.

Recently, magnetic filter additions have started to surface. I was sent one last year to try out and it really did seem to work. The product in question was called the Bear Trap BT500. Their website can be found here. It's basically a sleeve made of foam rubber and plastic with some magnets in it. It bends to clamp around the outside of your regular spin-on oil filter.



The idea is that the magnets will attract any metal debris in your oil and stick them to the inside of the oil filter wall, thus preventing them from going back into the oil circulation. Being of a curious nature (or stupid, depending on how you look at it) I decided to dismantle my oil filter after using the Bear Trap for 5000 miles. I learned a couple of things.

1. You shouldn't try to do this yourself.
2. It's bloody messy.
3. But most importantly, after a brief period in accident and emergency to stitch up the gash in my hand, I discovered that sure enough, there were tiny arrangements of metal filings clustered around the inside of the oil filter wall where the magnets from the beartrap had been. You'll excuse the lack of photos to prove the point, but I had other things to worry about.

So can I recommend their product? **Yes**.

An alternative to custom magnetised oil traps.

Thanks to John Nightingale who read my pages and then felt he should contribute something. For those of you who do more than just change your filter - ie. take off the oil pan completely, John writes: *" Next time you are in the mall or high street, drop into the Radio Shack or a hardware store and purchase a package of modern, powerful ceramic magnets. These are available in various shapes and they are cheap. Radio Shack sells a package of two wafer shaped magnets, for instance. Stroll out to your car at the end of your shopping trip, bend down and stick these magnets onto convenient flat surfaces the bottom of your oil pan either side of the drain hole or as convenient. Now the magnets will magnetize the steel of the oil pan in their area. On the inside, particles coming through the field established by a magnet will be sequestered by being stuck to the bottom of the oil pan. Next time you take off the oil pan, clean it out in the usual way, pull off the magnets from the outside, clean them up and then stick them onto the inside of the oil pan at the bottom but clear of the drain hole. This will give an even better result since now the oil is exposed to the naked magnets themselves. The bottom of the oil pan in the area of each of the magnets is also magnetized, of course, and contributing to the effect. Resist the temptation to stand the magnets on edge to expose more of their surface to the oil. Placing the magnets flat on the oil pan uses the oil pan's steel as a keeper for the magnets and will ensure that they stay powerful. Placing the magnets flat will increase the area of the oil pan that is part of the magnetic circuit so you will loose no particle pick up area by having the magnets lying flat. "*

Larger filters on standard cars?

There's a school of thought which says that enlarging the oil filter on your car is A Good Thing. Why is this? The small oil filters fitted to engines these days run with quite a high back pressure, and the bypass valve trips at about 3500rpm. That means that your oil is not being filtered when the engine is spinning faster than 3500rpm. As the oil filter does its job and starts to clog up, that rpm value can be lower. If you increase the size of the filter, this will raise the rpm at which the bypass valve will switch. With a bigger filter and lower back pressure, for the same rpm (prior to bypass valve operation) less engine power will be lost in the filter. Bigger filter means better filtering and more power at low to mid revs. Clever eh? But there's some things you need to be aware of if you're going to try this approach, all of which are relevant, and none of which I can confirm or deny

- Bigger filter = more "dead" space = more oil. Remember you'd need to add more oil to the engine to keep the oil level at the correct mark on the dipstick.
- Higher rpm opening value could underpressure the oil system. If your engine is designed to bypass the oil filter at 3500rpm, and you add a new filter which forces that limit up to 4500rpm, then the engine might experience lower-than-expected oil pressure above 3500rpm. Low pressure could lead to oil starvation at higher rpms which could lead to engine seizure.
- Oil may take a little longer to circulate around the engine after startup, as the pump may have to fill up the larger capacity oil filter.
- Availability of filters and fouling. If you put a larger filter on it might foul something else in the engine bay. That is if you can find a larger filter to start with. The rule of thumb is to go to a motor factors shop, and find the oil filter that was designed for your engine .Then look through the myriad of larger oil filter boxes for a bigger filter that has the same screw thread and sealing ring diameter. Chances of success = slim.

This is all great. Now how do I actually change my oil?

A good number of readers will get to this point in the page and think "this is easy - I could do this!", and for the most part, you can. Below is a generic, idiots-guide to changing the oil in your engine. It's not specific to any particular car but ought to cover most engines.

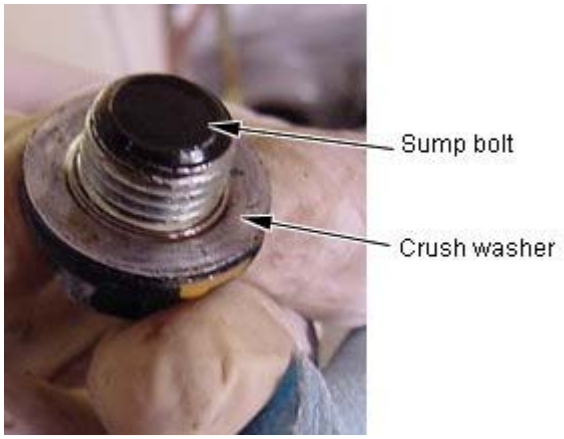
Before you start, you'll need the following :

- new oil (duh!)
- a drain pan
- an oil funnel
- rags
- a socket wrench set and / or hex wrench set (allen wrenches)
- an oil filter remover
- a new crush washer
- rubber gloves
- engineer / shop manual, if one is available

1. Start your engine and run it for a couple of minutes to get some heat into the oil
2. Leave the engine to stand for 5 or 10 minutes. When you started it, it heated the oil but it also filled the oilways. You want the oil to drain back to the sump.
3. Take the dipstick out or loosen it off and break the seal where it plugs into the engine dipstick tube. This prevents a vacuum building up behind the oil when you start to drain it.
4. Get your drain pan / oil container and stuff it under the sump. Make sure it's sitting under the sump drain plug. I Really like the combined drainer / container types. They look like regular oil containers but if you lay them on their side, there's a pop-out plug. When you drain the oil, it runs into the side of the container, then you can put the plug back in and use the same container to take the oil away.

5. Put your rubber gloves on. Try to use the disposable type. Your mum / wife will never forgive you if you use the washing-up gloves. Remember - used oil is toxic and carcinogenic. If you get it on your skin, it could cause problems. Use your socket wrench or allen wrench to loosen the sump plug just slightly. Once it's loose, remove it by hand.

6. Be amazed as the black syrup runs out of the engine and into your container. Be more amazed how, if it's windy, those last dregs just won't hit the container no matter where you put it. They will however go all over the road/garage floor/cat.
7. Remove the old crush washer from the sump plug and throw it away. Replace it with a new one. Use some of the oil from the drain container on the end of a rag to wipe around the drain hole in the sump. This will help clean any mess away and leave you with a smooth surface. Screw the sump plug back in by hand until it's finger tight and then use your wrench to crush the washer. This can vary from a quarter turn to a half turn. Don't overdo it or you'll strip the threads. Similarly, don't leave it too loose or it will fall out. If in doubt, use a torque wrench set to the value indicated in your shop manual.



8. Now get your oil filter remover out. Push the oil drain container under the oil filter - when you spin it off, there will be *a lot* of oil comes out. Use the filter remover to grip the oil filter and spin it off anticlockwise. 99.9% of oil filters take some muscle to get going. This is why a filter remover is a must-have. Stabbing the filter with a screwdriver and using brute force may work, but you'll be finding oil all over yourself for weeks to come if you use that method. Once the filter is finger-loose, spin it off by hand. (these things below are filter removers)

9. Clean off the face of the oil filter mount on the side of the engine block using a rag. Use a little oil on a rag to wipe around the seal of the new filter and spin it on by hand. Once it's locked against the side of the engine block, another quarter-turn by hand is normally enough to secure it in place.
10. Pull the drain container out from under the car and use a rag to wipe down any excess oil that has spilled down the side of the engine block. Pay attention around the sump plug and the filter. These are places you'll be checking later for leaks so the cleaner they are now, the better.
11. Use a little WD40 on the oil container and an old rag to clean the remaining oil down into the container. Put the plug back in and make sure it fits snug. That's your waste oil. Don't drink it.
12. Up to the top of the again engine now. Put the dipstick back in. Find the oil filler cap and take it off. It might say "OIL" or it might say "710". It is not a "710 cap" as one person once asked for. "710" is "OIL" upside-down. Some people need to be told....
13. Look in your shop manual for the system capacity with filter change. This will be more than the capacity *without* a filter change. A lot of oil containers now come with capacity marks on the side of them. Put your oil funnel into the oil filler hole and pour in the right amount of oil. Do it slowly. If you do it quick, you'll get airlocks and the funnel will burp oil in your face.
14. Once you're happy you've got enough oil in there (check it with the dipstick if you're not sure), remove the funnel, replace the oil cap and replace the dipstick.
15. Pull the main high tension wire from the distributor cap or in some way disable the engine so that you can crank it over but it WILL NOT start. (Note : you might want to pull out the fuel pump fuse too - if you crank the engine without it starting, it will still be pumping fuel - that could cause a backfire or damage the catalyst). Crank it over until the low pressure light goes off, and another 15-20 seconds for good measure. You are pumping new oil into the empty filter and then expelling all the air from the oil lines and cavities.
16. Replace the high tension lead (and fuel pump fuse) and start the engine and let it idle for a minute or so. Stop the engine. I don't want you crawling under a car to look for leaks when the engine is running. There's so many things that can go wrong with spinning fanblades, belts, human hair, clothes, fingers and the odd dodgy auto-gearbox that will slip into "D" and run you over.
17. *With the engine off* have a look at the side of the engine block around the oil filter. Check the area around the sump drain too. Both should be as clean as you left them with no sign of leaks. If there's a leak, a little tightening of the drain plug or filter should cure it.

Job well done. Now you should have hands that smell of talcum powder and rubber (from the gloves), a couple of greasy, slippery tools and a container full of old oil. Oh, and a crush washer and filter. If you've got more than this, you took something off that I didn't tell you to. If you turned the engine off before checking for leaks, you should also have a full complement of fingers, hair (if you had it to start with) and you should still be fully clothed. Congratulations. You've changed your engine oil.

Finally, and just as importantly: Disposing of used engine oil.

Think about it for a minute. What **did** you do with that last oil change? Pour it away down a drain? Seal it and bin it? The annual average for oil which is just *washed away* is 720Million gallons! About 120Million of that is from tanker spills which leaves another 600Million from domestic and business disposal. This all ends up polluting the groundwater. **So what can you do?** Well, you can dispose of your used oil properly. Firstly, it's worth noting that engine oils which have been used are mildly carcinogenic. This means cancer, specifically skin cancer. To be safe, wash any off quickly with a degreaser like GUNK. For heavens sake, don't use petrol (gasoline) - most fuels contain long chain hydrocarbons, which when exposed to skin pass right through to the blood stream. (This can mean liver damage, and possibly failure) Better still, wear protective gloves. Once the oil is drained into a suitable container, try your local garage. All garage workshops must have disposal barrels and many will allow you to dump your oil into their barrels. In the UK, many DIY superstores now have oil disposal banks where you can empty your used oil, and it's collected every couple of days by a tanker. So next time, just think about first. If only for the fact that in most civilised countries, it's actually an arrestable offence to dispose of oil in the public sewerage system. If you live in the UK, phone **0800 663366** to find the location of your nearest oil bank. Alternatively, you can use the postcode search on the oilbank website.