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Technical Service Bulletin

Lubrication of Older Motorcycle Engines

Oils formulated for the modern engine are basically unsuitable for the older designs. There are many technical reasons for this. To start with, there is currently a strong move towards improving fuel economy, which is obviously an environmental consideration. The best way to achieve improved fuel performance is to move to thinner oils that offer reduced viscous drag on the moving parts of the engine. 10W/40s are a common equipment manufacturer's choice with 5W/40s, 5W/30s. 0W/30s and even 0W/20s starting to appear in handbooks. Thinner oils are also chosen because engines are fitted with smaller batteries and starter motors. These thinner multigrade engine oils work well in the confines of modern engines that have close tolerances and where oil films of 1 – 2 microns (0.00007") are normal. However, in older engines we are looking at poorer machining finishes with rougher surfaces, requiring an oil film thickness in the order of 6 – 7 microns (0.0003"). This type of lubrication regime is usually satisfied by SAE 30, 40 and 50 monogrades. The use of monogrades is paramount in such cases because of the way multigrades are formulated with polymers to achieve their wide operating temperature range. These polymers are long chained molecules that curl up into small bundles to allow the oil to flow at low temperatures, but at high temperatures unravel and tangle together to help the oil maintain its thickness. In the small space between the piston ring and liner, the scraping action of the ring aligns these molecules and the multigrade oil temporarily becomes thinner (regaining its thickness when it drops back into the sump). One of the functions of a lubricant is to provide a gas seal between ring and liner to aid compression and in modern engines, where machining tolerances are very small, this temporary drop in viscosity will have no affect. However, older engines do not have such tight tolerances and the temporarily thinned oil will find its way past the rings leading to high oil consumption and compression loss.

Modern oils also contain anti-wear additives that are designed to protect the valve train and gearing components. In new or re-built engines this type of additive can prevent the

satisfactory bedding in of the rings to the bores and can lead to a condition called glazing. Glazing leads to loss of compression and high oil consumption.

Increasing the power from an engine results in an increase in it average running temperature. One of the basic functions of a lubricant is to cool and therefore in hotter running engines, the oil temperature will also be higher. At these higher temperatures oils are susceptible to oxidation which causes them to thicken and loose their cooling and lubricating ability. The addition of powerful additives called anti-oxidants can prevent this and stop the formation of lacquers and varnishes that coat critical components reducing their operating efficiency.

This situation is worse in older vintage engines as combustion gases can easily blow by the piston rings and mix with the oil, cause further deterioration, thickening and poor circulation. Overheating often occurs along with rapid expansion of the engine components, often beyond their design limits, leading to increased friction and finally seizure.

To help keep the hotter parts of the engine clean, detergents are also included in the formulation to prevent carbonaceous oxidation byproducts from coating critical components, including: pistons, rings, valve stems and guides. Further additives called dispersants are added to keep these solid contaminants in suspension so that full flow filtration systems can remove the larger particles from the oil. The same additives also ensure that when the oil is drained at the service interval that all of the smaller particles leave the engine, leaving it clean for the fresh oil. However, older engine designs of the classic and vintage variety probably have little more filtration than a gauze, tank outlet strainer and a magnetic sump plug! In these types of engine it is extremely harmful to have solid contaminants continuously circulating. The viscosity will increase, the flow rate will decrease, oil galleries will become blocked, abrasive wear will take place leading in the worst case to catastrophic failure of engine components.

Acidic compounds, formed from the processes of oxidation and combustion, may reach a level where they will start to affect engine seals, hardening, cracking or even breaking up the older types of rubber compounds that were used originally. It is much better to

use modern replacements made from acrylates or fluorocarbons which are resistant to acidic attack.

Taking all of the above points into consideration, it is quite clear why modern multigrades should be avoided in older engines and the correct high quality lubricant is still far less expensive than replacement parts and time consuming rebuilds.

Morris Lubricants offer two ranges of oil specifically designed to satisfy these older types of engines: Supreme and Elite engine oils, both ranges available in SAE 30, 40 and 50 viscosity grades. These ranges are basically very similar in make up, the former being biased towards older car engines and the latter having better anti-foam performance for use in older bike engines and gearboxes.

So far we have considered the basic four stroke engine, but there are of course two stroke units and engines involved in highly stressed competition scenarios.

High stressed competition engines are usually based on humble road going varieties, but modified for increased power output and performance. Of course this also means that a suitable lubricant will also need to be selected to cope with these increased workloads. One option here is the use of castor based lubricants that have several features beneficial to this area of application. Castor based lubricants have very high natural film strengths, useful under high shock load conditions and are also very tenacious, offering a degree of seizure protection. In its natural form castor oil is very viscous, about a SAE 50, which provides good lubrication to roller bearings and gas tight seals where there may be wide tolerances between rings and liners of early engines.

Castor based products can also be improved with the addition of certain additives. Castor oxidises more rapidly than mineral oils and so has a greater tendency to form lacquers and deposits on rings, pistons, valves and ports. Oxidation is the chemical process which combines the byproducts of combustion (water vapour, acids, sulphur and nitrogen oxides) with lubricant at high temperatures leading to its deterioration. The oxidation process thickens the castor and reduces its ability to lubricate and cool. It is worth mentioning here that castor-based lubricants, two stroke or four stroke, do not mix with mineral oils. Failure to recognise and segregate lubricant types may lead to an expensive engine rebuild. A gel-like substance is formed which can circulate round the

engine, eventually blocking oil ways and galleries, pipes, strainers, etc., leading to oil starvation and serious damage.

Another problem found with castor is its inherent ability to absorb moisture. This not only reduces its shelf life, but combined with the substantial amount of water produced during combustion can lead to severe corrosion problems.

To cope with this, Morris Lubricants incorporate an anti-oxidant and a corrosion / rust inhibitor into their castor based MLR 30, MLR 40 and MLR 50 grades.

It has been proven that moisture can improve combustion, but the excess can find its way into the sump and be absorbed by the castor oil. The additive system will reject the excess water and dump it in the form of a sludge in the sump, hence the need for regular and frequent oil changes (competition engines usually every meeting).

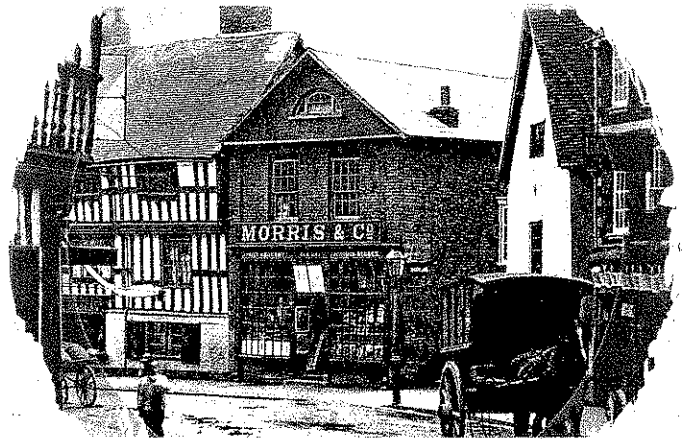
With two strokes care must also be taken when mixing castor oil with unleaded fuel, as an unbalancing of the additives can lead to sludging that can block fuel lines. Used with leaded fuel and methanol, castor mixes well, but the latter is highly flammable, so extreme care is needed when mixing and handling this fuel type. Also, as mentioned previously, water absorption limits shelf life and so it is good practice to mix only the amount required, as older mixtures can produce sludges and poor combustion.

Two strokes, by design, invariably have a higher power to weight ratio and with the oil acting as lubricant for possibly both engine and gearbox, as well as being burned off during combustion, a balance has to be struck between outright power, minimised wear, maximum reliability and environmental issues.

Taking into consideration previously mentioned factors relating to the crudity of older engines, thick monograde oils with no additive treatment were incapable of keeping engines clean, gave need for regular de-cokes and generally gave two stroke engines a bad reputation. The Morris Lubricants range of two stroke oils include pre-mixed products (fully and semi-synthetic, mineral and castor based) as well as injector system products (fully and semi-synthetic), all of which contain the necessary additives to enable maximum lubrication, even at today's incredibly lean mixtures.

As two stroke oils improved with the use of synthetic additives during the '70s and '80s, they became more viscous (thicker) allowing lean mixtures and decreases in working tolerances yet still maintained their high protection capabilities. A better understanding of heat transfer enables engines to run hotter and burn their fuel more efficiently, hence turning generated heat into energy. As exhaust emissions contain oxidised components of both fuel and oil, there is, because of environmental concerns, a trend towards lubricants that offer the least problems to the atmosphere and accordingly a tendency toward high fuel/oil ratios. If an oil has a tendency to foul plugs, block exhaust ports, cause ring sticking and leave plumes of white smoke, there is a good chance that the exhaust emissions are not particularly environmentally friendly. The two-stroke engine presently faces an uphill struggle for its survival.

Moving on from engine oils, the lubrication of transmissions is a little more straightforward. Most gearboxes in pre-1970 machines have simple gear designs not requiring high amounts of extreme pressure (EP) additives usually required for the protection of some of the latest transmission systems. If too much EP additive (i.e. API GL5 performance level) is present in a lubricant used in a syncromesh gearbox requiring an API GL4 performance level additive, it will eventually lead to notchy gear selection and increased noise. In earlier gearboxes and final drives EP performance may not be required at all (API GL1) and simple non-EP monograde gear oils will suffice. The Morris AG range of gear lubricants, AG90, AG140 and AG 250 are available to cover these applications. These 'straight' gear oils are also friendly to phosphor bronze components often employed in earlier designs.



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