Data Sheet No. 15

Subject: Oils

**LUBRICATION CRITERIA FOR
CLASSIC, VINTAGE AND VETERAN ENGINES**

The selection of a suitable lubricant for the "older" design internal combustion engine can be problematical. Not only do we have the design parameters of the engines which will influence our choice but also a lot of myth and anecdotal evidence which will cloud the issues.

There is no doubt that modern engine lubricants are a marvel of the formulating chemist's technology, however to cater for the modern engine with all the environmental constraints, in the widest possible context, placed upon it, they have attributes that can only be regarded as detrimental to the engines we are considering.

If we look step by step into the requirements of an engine oil we will be able to see where the divergencies in requirements are.

In a modern engine in these times of high fuel prices and an emphasis on fossil fuel conservation, low fuel consumption is high on the desirable criteria lists. One of the many contributions that can be made to this is to decrease the power required to pump the oil around the engine, therefore lower viscosities, especially at start-up, are the order of the day. Normal viscosities of SAE classification 10W/40, and even 1OW/30, are now used which fulfil this need very well.

These work very well in modern engines where modern metallurgy, machining techniques and design give us clearances and surface finishes that can be lubricated with oil films as low as 1-2 micro-meters in thickness. Not so in the older engine - because of the relative roughness of their surface finish they require oils whose viscosity ratings are at least an SAE 30 or 40 and at times a 50 classification to give film thicknesses of a minimum of 6-7 micro-meters. They also need to be monogrades because the multigrades get their viscosity characteristics (or more correctly, their lower rate of thinning as the temperature increases) from the addition of polymers. Polymers are long chain molecules which will shear as they are worked in an engine, this shearing adversely affects their effectiveness and allows the viscosity of the oil to decrease by up to 15% at any given temperature. This further decrease in viscosity of a lubricant whilst in use would not be a desirable feature in older engines, for the reasons we have already stated, and additionally the sealing of the piston rings to the bore also relies on an oil film, and the more rudimentary the bore machining techniques, the thicker the film needed for satisfactory sealing.

Modern oils now contain an ever-increasing quantity of antiwear additives, mainly due to increased loading in all areas of the engine, especially concerning camshaft and valve train lubrication. Whilst a certain antiwear capability is not a bad thing, too much can, and often does, stop the piston rings bedding in to the cylinder walls causing loss of compression and high oil consumption.

To obtain more power from engines whilst keeping their physical dimensions small, often means relatively large increases in engine temperatures. These higher temperatures are transmitted to the oil and unless an oil is adequately treated with additives to resist the chemical changes which occur, lacquers, varnishes and acidic compounds are formed at an exponential rate commensurate with temperature rise. Even with these additives the situation is even more exacerbated by foul breathing engines where crankchamber gases are circulated within the engine and picked up by the oil.

To mitigate their effects on the engine, detergents are included in the oil to stop these compounds attaching themselves to metallic surfaces and then baking on them and forming carbonaceous particles. Dispersancy compounds included in the oil will then keep all of this material, plus that which has ingressed from the outside environment, suspended so that the full flow filtration system can extract it from the body of the oil and thus stop component damage. This is fine if the engine is fitted with a modern full-flow filtration system, but if it isn't and only has a wire gauze pump inlet strainer, this material keeps circulating with the oil and will not only increase the oil's viscosity thus cutting down flow, but will also block oil galleries and allow hot spots to develop thus increasing wear and the chance of terminal damage on vulnerable and vital components.

Additives of all types also have an effect on the elastomeric material used in dynamic oil seals by causing hardening and cracking leading to premature failure. Seals are now constructed from special materials such as acrylates and fluorocarbons which resist chemical attack. The older type nitrile and butadiene rubbers are not so good at resisting chemical reactions.

If we now analyse our requirements for an oil to use in the more mature engine, they will be these. Firstly, monograde oils are the most suitable, starting at a minimum SAE viscosity classification of 30 and may be going as high as 50. Little or no antiwear compounds need to be included because the stress level used in the design of these engines does not warrant it. Perhaps a little detergent in the oil to extend the periods between decarbonisation is desirable but certainly no dispersency additives present or we could ultimately end up with an oil resembling a grinding paste. The avoidance of all additives which affect seals is of primary importance but the inclusion of additives which resist oil oxidation and will stop surface corrosion are essential. This is quite a tall order for lubricants whose offtake in the global scheme of things is relatively small. However, one company in the United Kingdom is prepared to develop and market lubricants specifically for the people who own and run the mature, vintage or veteran vehicle. They are Morris Lubricants of Shrewsbury, who offer at least two ranges of oil to satisfy, in all respects, this market with their Supreme 30, 40 and 50 and the Elite 30, 40 and 50.

Further to this range of traditional mineral oil formulations Morris Lubricants also produce castor oil based products. Castor oils have many desirable properties such as exceptionally high film strength, the maintenance of such films being essential for the engines we are considering, and excellent lubricity. The film strength and oiliness (the ability of the oil to stay chemically attached to a metallic surface) helps to prevent the seizure of moving parts under conditions of high loads and relative velocities.
In order to understand the advantages and disadvantages of using castor based oils in engines it is necessary to appreciate some of the many design changes that have taken place over the developing years of the internal combustion engine, and how these changes have affected lubrication and lubricants over the past 60-70 years.

In its natural form castor oil is normally very viscous - about SAE 50. This inherent thickness provided good lubrication to big end and crank roller bearings and formed a good gas seal between the wider clearances of the pistons and barrels of early engines.

Early design surface seals between engine components also benefited from this viscosity as oil losses through leaks were minimised.

Today there is a need to provide the increasing number of classic and vintage racing vehicle owners with oils that are appropriate to their needs.

Additive systems are now available to reduce lacquer and deposit build-up on rings, pistons and valves due to the relatively rapid oxidation of castor during the combustion process, although the operational life of this type of lubricant can be significantly lower than mineral oil based products.

Because of the problem of water contamination which is formed during the combustion process, anti-corrosion additives need to be introduced to reduce deposit formation and protect the softer metals from corrosive attack.

Many modern castors also contain blends of synthetic esters, again these help to improve stability, low temperature properties and oxidation resistance.

Castor/ester blends are also available in a variety of viscosities, usually SAE 30, 40 and 50. The esters can also act as a solubilising agent for some of the additives such as rust inhibitors and anti-oxidants.

However, care must always be taken when mixing with unleaded petrols as castor can unbalance the additive system used in modern gasoline, causing precipitation and sludging which can block fuel lines.

Where methanol fuels are used for two-stroke application, castor mixes extremely well but there are a few handling problems.

Firstly, methanol is flammable, so extreme care is required when mixing. Water absorption limits shelf life of mixed solutions so it is better to mix sufficient only for immediate needs.

Using older mixture can also lead to sludging in the fuel lines with poor combustion resulting from the excess water content of the fuel mixture.

During combustion large amounts of water are produced which may lead to corroson and rusting. Ring sticking, rapid piston and cylinder wear will result unless these cautions are heeded.

Castor and leaded fuels present few problems when mixed together although this practice will gradually become obsolete as production gears more towards unleaded fuels.