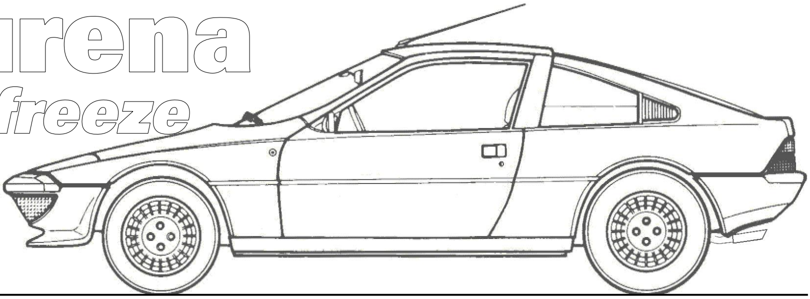
Murena anti-freeze



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A little history first

In the early days of motoring when liquid cooled engines were mostly made from cast iron, the coolant was plain water during the warmer weather and salts were added during winter to stop the water freezing. The system was drained and flushed at the changes between summer and winter coolant which kept the systems relatively clear of silt.

Radiators could be stripped to clean, whilst individual tubes could be changed for repair, replacement or cleaning anyway. Cooling systems were not pressurized and engines produced less power and heat so coolant temperatures were lower, and with lower mileages generally corrosion was less of a problem. System circulation was purely by convection.

Later, water pumps were added to improve circulation and cooling, allowing smaller radiators. These pumps had grease nipples fitted so you could regularly grease them.

Improving anti-freeze

Methyl alcohol (methanol) was added to the coolant to provide anti-freeze properties but since systems were not sealed it was continually lost by evaporation and you needed to top it up regularly. Methanol also accelerates the corrosion of metals such as aluminium.

Exclusive market

More expensive and exotic cars had engines in aluminium for lightness and maybe ease of small scale production. Since you cannot use plain water or methanol as a coolant in an aluminium engine owing to the reactions which silt the system and block the small passages particularly in the radiator, Ethylene glycol was developed to replace methanol, and an inhibitor was added to further reduce corrosion. So these cars kept their anti-freeze in all year round, taking advantage of the corrosion inhibitor it contained, during the warmer weather.

Mass market

In the sixties particularly, many cast iron engines started being fitted with aluminium cylinder heads as well as inlet manifolds with coolant passages, so the corrosion effects could have started to become a problem for these basic engines except for the systems being flushed twice a year during the changes between water and anti-freeze. Although you would use anti-freeze during the winter not all anti-freeze contained a suitable corrosion inhibitor. Also grease nipples started to disappear from water pumps, as they did from everything else! Part of the reason for this was people not greasing cars correctly at the stipulated intervals anyway, so the manufacturers, always looking to reduce costs, decided to do away with them.

Two anti-freezes

In the sixties, we had one anti-freeze for cast iron engines (BS3150) and another for aluminium engines (BS3152). Only the latter containing aluminium corrosion inhibitor. Both had a water pump lubricant added. All anti-freeze was commonly blue in the U.K. but green in N.America. It was still considered normal to run plain water in cast iron engines during the summer and flush between changes. However, for various reasons the shift towards keeping anti-freeze in all year round was gaining momentum. Since one common corrosion inhibitor, Tolytriazole, is carcinogenic, it is not exactly user friendly, and it's better to rely on the anti-freeze for this additive and not have to deal with it separately! Propylene glycol is less toxic and has an added feature that when it turns red it is saying it should be replaced.

Using the wrong anti-freeze in an all-aluminium engine was noticeably detrimental to the engine and cooling system. How many cooling problems with Imps or Reliants (both unusually at the time for the mass market in having totally aluminium engines) were caused by a lack of understanding by owners and not the design? It was obvious from public confusion that things had to change and a common anti-freeze for all engines became standard. The British Standard numbers change continually along with changes in specifications and the products made to conform to them.

Difficulty changing coolant

To cut costs further the manufacturers had started dropping the fitting of drain taps to radiators and the block plugs were often inaccessible, so continually changing back and forth, became more difficult, and time consuming, which means more cost, if you are paying someone else to do it. It was also somewhat messy because without proper drain taps all you could do was release a bottom hose and try to catch as much as possible. However, some would always miss the drain tray no matter how big it was, as it ran off parts of the underside of the car elsewhere! This leads to complaints of ground contamination. Later still, cars gained undershields which further hampered access, so it is common to leave anti-freeze in all engines all year round, and the idea of draining and flushing systems became a thing of the past...

...but still necessary

Except the corrosion inhibitor and water pump lubricant gets weaker with time, so the coolant requires changing every so often to replenish these additives. Consequently today most manufacturers recommend replacing the coolant every three to four years maximum and for many this is another garage job added to the service schedule.

Progress and development

Modern cars started using radiators with aluminium cores and plastic ends, and often plastic inlet manifolds, and plastic coolant pipes or hoses have replaced metal ones. Similarly with technological advancement all the fluids used have improved or changed and the oils and anti-freeze we use now are much different. Much of this development matches the changes in the cars and/or environmental concerns. What is very often forgotten though are all the classic cars still in use.

Three types of anti-freeze!

To prove they do not learn from past mistakes, we now have not two but three different anti-freeze types to confuse you! We still have the older Phosphate and Silicate based anti-freeze, classed as Inorganic Added Technology (IAT) but we also have two new ones - Organic Acid Technology (OAT) and Hybrid Organic Acid Technology (HOAT).

Why change?

Two reasons mainly from what I can find out. One is that the properties of the substances used are supposed to be 'greener' or more environmentally friendly! Mind you, if they still provided drain taps to radiators there would be less ground contamination anyway as you could easily catch all the coolant being drained! The second reason is that corrosion inhibitor lasts longer so the change intervals can be extended, and now the replacement can be every 5 to 6 years rather than 3 or 4.

Negative properties

As always there is a downside particularly for 'us'. This OAT anti-freeze can be detrimental to the metals used in older cars like ours. Specifically the solder in copper radiators and pipes. There have already been concerns over gaskets failing too, and the possibility of less protection against water pump cavitation.

Identification

So you should not use OAT anti-freeze in older cars with metal radiators and pipes. (modern cars use aluminium and plastic radiators and plastic pipes, bleeds screws etc.) To aid identification and help stop the incorrect anti-freeze being used they add dyes to colour it. OAT anti-freeze should be orange, but can be red or pink. As long as you stick to blue you should be fine, but the HOAT that should be yellow can be green, so you can't trust the colours completely! You should check to see if the container states IAT (Inorganic Added Technology or 'contains Phosphates' or 'Silicates') but I have found the containers are not often clearly marked.

These different types of anti-freeze are miscible, but if you add older type Inorganic Added Technology to the new Organic type then the longer life of the OAT is reduced to the same as the IAT. i.e. 3 to 4 years.

Anti-freeze strength

There is quite a lot more to a cooling system than most owners understand. Most will know that we need anti-freeze in there, but do you realise that the higher the strength the worse the cooling? Adding anti-freeze to water obviously stops it from freezing in particularly cold weather, but water is a much better fluid for taking the heat way from the engine to get rid of in the radiator, so adding too much anti-freeze means you degrade the capability unless you increase the cooling system capacity.

For the normal expected low point during our winter a third mix of anti-freeze to two thirds water is sufficient whilst maintaining good cooling; but increasing that mix to 50/50 means the system needs to be another 8% larger. Many modern cars specify a 50/50 mix but they have been designed for it. Don't use a 50/50 mix in older cars just because they now specify it in new ones.

Types of radiator cap

A radiator cap has a pressure rating and also it can be non-recovery or recovery enabled. This is another feature of the system not always fully understood. When we had radiators with the cap on the top and a simple overflow hose, these were a total loss system. i.e. any coolant that escaped past the cap was lost for good. An early form of no-loss system was for the overflow hose to be connected to a bottle which any overflow would transfer into, and as the system cooled the cap would allow the coolant in the overflow bottle to be drawn back into the radiator. This recovery enabled cap has two seals, one for overflow and one for recovery. A non-recovery cap has only one seal.

Present sealed systems

Now we have the fully-sealed systems where the overflow bottle is part of the cooling system and is pressurised the same as the main system. Usually this means the radiator has no cap at all, or only a blanking cap, and the non-recovery cap is fitted to the expansion or header tank. The cooling system is filled to a point usually about half way up the expansion tank, and the coolant can expand in there as it gets hotter. At normal operating temperature it may nearly fill the expansion tank. Once the coolant is cold after say an overnight halt, it will have returned to its normal cold maximum mark.

Since this is a no loss sealed system, you can see why if the level drops in the header tank, it is indicating that some coolant has escaped either through an external or internal leak. External leaks should leave stains as the anti-freeze leaves coloured streaks, but if no external leaks can be found then the loss indicates an internal leak usually through a head gasket failure but sometimes a crack.

Water at atmospheric pressure (one bar) will boil at 100° C as most people know. Raising the pressure in the sealed system to roughly half as much again (a cap rated at 50 kPa or roughly 7 psi) will raise that boiling point to around 112° C. Raising it to 70 kPa will add another 3° and 90 kPa will take it to 119° C. Most caps are rated for those 3 levels. However, Talbot for some reason chose 80 kPa! So now the caps we need are difficult to find as they are not the normal rating.

To use one of the nearest rating we need to understand what the effect may be. If we choose a rating lower than original specified it means the coolant could reach the boiling point and we could loose some of the water from the system. Potentially more harmful could be that vapour bubbles may form in pockets in the cylinder head and once you have a vapour pocket the transfer of heat stops and local overheating may occur even though the overall coolant level is within limits.

It is better to choose a slightly higher cap pressure setting as that will raise the boiling point and help stop these local hot spots developing. The downside is higher pressure on all the seals, gaskets, hoses, clips, or any weak spots in the system. Fortunately as we are only talking about another 1 psi, the problem is not great.

Water Wetter

Since our mid-engined compartments are more encapsulated they can get hotter and anything that can help cool the engine should be considered. There is a product called Water Wetter that I will be trying when I next change the coolant. This is a product that helps the transfer of the heat from the metal to the coolant by lowering the surface tension and making the liquid 'attach' to the metal better. The claims are that it works best with plain water, and you might get as much as a 10°F (which is approximately a 4°C) drop.

This is not a lot but could be significant particularly if one of the other claims that owing to the lower surface tension it stops vapour bubbles and local hot spots in cylinder heads, is realised. These steam vapour hot spots could be part of the cause of our heads cracking not only because of the local overheating but as the bubbles collapse they can cause metal erosion. Obviously we can't run plain water so I won't expect the benefits to be as good. However, for a trial it is not expensive so it is worth trying. I will report back later.

Waterless Coolant

A more expensive alternative to an anti-freeze change, could be waterless coolant. This replaces the water and anti-freeze mix entirely, and can protect from -40°C to 180°C, which is much hotter than any engine should ever get!

Now since we have much larger cooling systems with our mid-engine location and front radiator, this means using more of the product, so it will be more expensive than simply changing anti-freeze and/or a small amount of additive, but the advantage is they say that it has such a long life it can be considered to be the last coolant change you will ever need to make.

You do have to get rid of all the water from the system first though, because you cannot have more than 3% water maximum mixed in with the waterless coolant, and since simply draining a system does not get all the coolant out, especially from the cylinder block, you need to do much more to get rid of all the coolant first. This may mean buying another of their products which is designed to absorb any water left in small pockets within the system before you can fill with this new fluid.

Obviously if you have just built up an engine and it is dry, this is an ideal time to change to the waterless fluid. Make sure all the rest of the system is drained including the heater matrix. In fact if you haven't checked the heater matrix since the car was made, over thirty years ago, you should check it now since they don't last for ever.

As it is expensive you won't want to lose it through leakage, so you need to make sure everything else is in top condition before you change to it. However, afterwards, you should hardly ever have to touch the system again, according to the manufacturer. Always make sure all pipes and hoses are clamped properly as they should be and nothing can rub against a pipe or hose as that will eventually cause a split probably just at the most inconvenient place or time!

Heat transfer

The heat transfer coefficient for waterless coolant is not as good as water with anti-freeze, so we would need to use a lower rated thermostat I suspect, but if the heat transfer is slower, since the circulation rate will still be the same, this may not reduce the temperature that much. This is why my guess is that the engine is going to run slightly hotter; but without having tried this fluid I cannot say by how much, or even if it is therefore really suitable for our mid-engined cars. The one thing I can say is that we don't really want the engine running any hotter than it does now.

One of the manufacturers claims is that no vapour pockets should ever occur since the fluid's boiling point is much higher than that at which any normal internal combustion engine runs, and therefore the waterless fluid should never get anywhere near its boiling point to form any gas bubbles.

A second claim is that it is better at protecting against corrosion in the system, and will not require the frequent changes that even modern systems require even when using OAT anti-freeze.

Although this fluid would be costly to change to at the beginning, if it doesn't ever need to be changed afterwards, then in the long run it should work out cheaper compared to the frequent costs of changing your anti-freeze regularly. However, there is one more thing here...

Switch & 'Stat replacement

It is always a good practice and a recommendation that you should replace the thermostat and the radiator fan switch every few years as they don't last forever. Occasionally you may have to replace the gauge temperature sender too. So even if you don't need to replenish the Waterless Coolant, you would still have to disturb the cooling system and lose a little fluid maybe every six years or so.

Finally, Waterless Coolant doesn't appear to have any water pump lubricant in it, so whilst it may be suitable for modern cars with sealed water pump bearings, including the Murena or other Matra, please note it is not suitable for much older cars & engines, even without the metal incompatibility problem. Most of those systems designed pre-WWII not only had grease nipples on their water pumps for periodic maintenance but also required some lubricant in the coolant. So if you have any other classic vehicles, other than your Matra, particularly say pre-1950, this solution may not be suitable for them at all.

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