Lead - It's Unknown Properties

Unleaded Fuel

Unleaded fuel has to be used when a catalytic converter is fitted in order to prevent premature failure through poisoning. 'Cats' are also poisoned by phosphorus, which is present in all engine oils which use zinc dithiophosphate as the anti-wear additive. Engines with high oil consumption or oils with high evaporation rates (high noack values) will poison 'cats' faster.

The fuel producers market petrol which will conform to British Standard (BS 7070 or EN 228:1999) for Premium 95 Unleaded but fuel to these specifications will contain various components which would not have been in use when the Ford cross-flow engine was produced. Higher octane unleaded fuels often contain higher concentrations of these newer components.

Lead

Lead in the form of Tera Ethyl Lead (TEL) was initially developed for use in aircraft engines as a means of gaining large increases in power output without destroying the engines through detonation. This enabled the American Navy to start what we today know as aircraft carriers.

TEL was produced by a joint venture company owned by General Motors & Standard Oil (today Esso in UK). The leaded fuel was made available for road use and soon it was found that vehicles using Ethyl petrol did not need their valve clearances adjusting as those running on normal petrol did. Today the majority of people think leads only use in petrol was valve seat lubrication and hence putting hardened seats in means you can run unleaded petrol.

Lead actually provides three properties:

1. Flame front/detonation control
2. Valve seat lubrication
3. Octane

Replacing Lead

While unleaded petrol can always be used successfully in older engine designs consideration should always be given to its effect on various components. Modern engines which use knock sensors and ECU's can tolerate modern fuels but the older designs with ignition advance relying on springs and 'bob-weights' have no means of detecting high speed detonation and it is this which will destroy your Kenr engine pistons. The photographs show a Ford cross-flow piston from an Escort and Triumph Dolomite Sprint piston which suffered detonation.

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The formation of Peroxides in the mixture causes detonation and lead prevented this formation, as does Methylcyclopentadienyl Manganese Tricarbonyl (MMT).

Octane increases up to about 6 numbers (60 points) have been possible with lead levels significantly higher than the 150 mg/ltr specified by BS 4040 for the old 4 star leaded petrol. Without the 'cheap' octane route the oil companies have had to use other chemicals to obtain 95 octane premium and even more undesirable chemicals for higher octane unleaded fuels.

Without modern engine management systems the 'classic' engine needs octane otherwise retarded ignition timing and/or reduced compression ratios need to be employed. There are a number of products available, which have octane enhancing claims; some such compounds are also oxygenates which means that the use of these will result in a 'weak mixture' and this will exasperate the tendency for detonation.

No chemical has been developed which is as cost effective as lead but MMT is the best alternative, providing the three benefits of lead. Depending upon the fuel composition, MMT will provide an octane increase of about 3 numbers (30 points).

Conclusion

Running 'classic' engines on unleaded petrol is possible. The expense of fitting hardened valve seats does not mean you have an unleaded engine. There is still an expensive danger to high performance and hard driven engines from piston detonation damage. The highest octane unleaded petrol available at the pump is 98 in the form of Optimax*. Other super plus fuels are often 97 octane.

Valve seat protection, detonation control and octane increase to 100 octane are possible today by employing MMT in the petrol, such a product having been available since the demise of leaded petrol in this country through Millers VSP Plus and CVL.

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