



Modern Fuels and Classic Cars

Prepared by: Daniel Wood, Research Engineer, Vehicle Engineering Team, RACV.

July 2010

Introduction

RACV has fielded a number of requests for information surrounding ethanol blended fuels and classic cars. This short report attempts to clarify that situation for Victorian motorists by addressing common questions and misconceptions.

Executive Summary

Perhaps the most recent change to modern fuels has been the introduction of bio-fuels. Bio-fuels have been introduced to decrease our dependence on fossil fuels, clean tailpipe emissions and lower our carbon footprint, these outcomes can be achieved when used in the right vehicle

RACV must stress that ethanol blended fuels should not be used in carburettor equipped vehicles. A list of vehicles that can use ethanol blended fuels is available on the FCAI website (<http://www.fcai.com.au>). As a general rule no vehicle built before 1986 should be run on an ethanol blended fuel, and vehicles built 1986 or after should only do so at the manufacturers recommendations.

Reasoning for this comes from multiple fronts; materials compatibility, fuel metering, durability and performance. In general both the environmental and financial benefits of E10 will not be realised in a pre 1986 vehicle.

Reports available from the Department for Environment, Water, Heritage and the Arts have been used as the foundations of this report. These are available at no charge from the department and provide detailed and valuable information if any further information is desired. For a copy of these reports visit <http://www.environment.gov.au>

Questions and Answers

Should I run my classic car on an ethanol blended fuel?

No, vehicles built before 1986 are not considered compatible with ethanol blended fuelsⁱ. Also vehicles fitted with a carburettor are not compatible with Ethanol blended fuelsⁱⁱ. Fuel injected vehicles that have not been indicated as compatible with ethanol blends should also avoid ethanol blendsⁱⁱⁱ.

What vehicles should run on ethanol blends?

In Australia two types of Ethanol petrol blend's are available, E10 and E85. Most new vehicles are suitable for operation on E10^{iv} however only a select few can run on E85. Make sure your vehicle is compatible with the mix you wish to use by checking with the manufacturer or on the FCAI website (www.fcai.com.au).

Will the government and fuel retailers stop selling neat petrol?

A report in 2007 found that 59.9% of our petrol powered fleet are suitable to operate on E10^v, until a solution is found for the remainder, supply of neat petrol can't be avoided.

NSW legislation requires all regular grade unleaded petrol to be E10 from 1 July 2011, however it also states that the act does not require ethanol to be added to all petrol sold in NSW¹. This implies that ethanol free premium grade petrol's will be available into the future.

Currently (July 2010) there is no bio-fuel mandate in Victoria, although our state government has established a target of 5% of all fuel consumption by 2010. If this target is not met they stated that they would consider mandating bio-fuels².

Will petrol disappear, leaving only ethanol blended fuels?

No, E10 contains up to 10% ethanol the rest comes from conventional sources. If we ran out of fossil fuels/crude oil we would not be able to produce our current E10 and E85 blends.

Are we running out of fossil fuels/crude oil?

It is generally accepted that our traditional fossil fuels will become too difficult to source and too expensive for transport, ethanol blended with petrol will not solve that problem. It could however prolong the life of the cheaper supplies. The finite supply of fossil fuels is a problem that will affect all of our current petrol, diesel and LPG fleet, not just classic cars.

What happens if I do put E10 in my classic car?

The results will vary, details on the effects have been studied by Orbital Engines Pty Ltd, reports are available from the Department for Environment, Water, Heritage and the Arts. In the report titled "Assessment of the Operation of Vehicles in the Australian Fleet on Ethanol Blend Fuels" the

¹ Biofuel (Ethanol Content) Act 2007, No 23, New South Wales Government, www.biofuels.nsw.gov.au

² Driving Growth, A Road Map & Action Plan for the Development of the Victorian Biofuels Industry, Victorian Government, April 2007, www.business.vic.gov.au/biofuels

following issues among others were raised, regarding vehicles considered incompatible with ethanol blends;

Performance and Driveability

- Hesitation on acceleration^{vi}
- Difficult starting^{vii}
- Stalling^{viii}

Durability

- Loss of compression^{ix}
- Higher combustion temperatures^x
- Premature engine failure due to piston and valve deposits^{xi}
- Blocked fuel filters, increased debris in fuel lines^{xii}

Material Compatibility

- Fuel hoses shrinking and swelling^{xiii}
- Failure of diaphragms and accelerator plunger seals^{xiv}
- Corrosion of carburettor^{xv}, leading to possible sticking throttle^{xvi}.

Can I convert my car to E10 or E85 compatible?

Although technically possible, it means bringing the rubbers, fuel tank, fuel system and engine up to 21st century standards, RACV is not aware of a service currently provided that can offer this, or a need to do so.

What else has changed in regards to fuels?

The Australian Standards have become more stringent, giving access to better fuels for everyone with particular benefits to the air quality in Australia, details are available online at the Department for Environment, Water, Heritage and the Arts website. www.environment.gov.au

What are Australian Standards?

Fuel quality standards are set federally by the Department for Environment, Water, Heritage and the Arts. The biggest recent changes have involved the removal of lead; the lead in fuel helped to increase the RON rating and decrease wear on engines, particularly valve seat recession. However the leaded fuel has linked to serious health issues (such as lower IQ, increase violent crime, and cause birth defects among others). Lead substitutes can still be added to unleaded fuel if desired.

Two factors have driven the further changes to the standard; air quality and our oil 'dependence'. As pollutants became a more pressing concern, our fuel standard has adapted with changes including low sulphur Diesel. They also introduced a limit on bio-fuels blends and their labelling.

Further Reading and References

Driving Growth, A Road Map & Action Plan for the Development of the Victorian Biofuels Industry, Victorian Government, April 2007, www.business.vic.gov.au/biofuels

New South Wales Government, Land and Property Management Authority, Biofuels Legislation, www.biofuels.nsw.gov.au

“Assessment of the Operation of Vehicles in the Australian Fleet on Ethanol Blend Fuels” Orbital Australia Pty Ltd, February 2007 (available from the Department of Environment, Water, Heritage and the Arts. www.environment.gov.au)

<http://www.environment.gov.au/atmosphere/fuelquality/publications/ethanol-2007/index.html>

“Can my Vehicle operate on Ethanol Blend Petrol?” FCAI website

<http://www.fcai.com.au/publications/all/all/all/3/can-my-vehicle-operate-on-ethanol-blend-petrol->

The following excerpts are taken from the report: Assessment of the Operation of Vehicles in the Australian Fleet on Ethanol Blend Fuels, Report to Department of the Environment and Water Resources, Orbital Australia Pty Ltd, February 2007.

ⁱ “It has also been generally accepted that vehicles built before 1986 are unsuitable for operation with E10 because of issues with fuel metering, materials compatibility and/or vehicle performance.” Page 12

ⁱⁱ “...it is reasonable to conclude that ethanol blended fuels are not compatible with carburettor vehicles” Page 15

ⁱⁱⁱ “The results from this study generally support advice from vehicle manufacturers and importers as published by FCAI with regard to vehicles which are not listed as suitable for use with ethanol blends, particularly E10” Page 168

^{iv} “It has been generally accepted that most new vehicles in the Australian fleet are suitable for operation on ethanol blend petrol (up to 10%).” Page 12

^v “..., it is estimated that 59.5% of the petrol fleet would be suitable for use with E10 based on the FCAI advice.” Page 168 (also see *iii*)

^{vi} “Under ambient conditions, only the Holden Commodore (GOV-09) was deemed to have unsatisfactory operation. This vehicle suffered from hesitation during launch and acceleration. This result would be a concern as hesitation under acceleration has safety implications and would leave the average driver with diminished confidence in the vehicle. A number of other vehicles tested have shown similar characteristics but only the Commodore exhibited this behaviour under ambient conditions.” Page 80

^{vii} “For the cold-start and warm-up assessment, a number of vehicles, both pre-1986 and 1986-onwards, had difficulty starting on either E5 or E10 or both. The addition of ethanol raises the temperature of evaporation for the fuel which will have a negative effect on the vapourisation of the fuel and ability to achieve combustion...” Page 81

^{viii} “...The issue of most concern would be the Hilux (GOV5-06) which, on acceleration, would either stall or have severe hesitation. This would undoubtedly leave the average driver with diminished confidence in the vehicle and possibly seeking corrective action.” Page 81

^{ix} “Probably the most dramatic increase has been in the intake valve deposits; to the point that on a number of vehicles the valves were not closing leading to a loss of cylinder compression.” Page 120

^x “All vehicles clearly indicated hotter combustion gases during operation with white deposits on the exhaust valves and a lighter colouring of the spark plugs. This is typical of a leaner combustion process occurring and is particularly relevant to the carburettor vehicles for which no adaptation of the fuel delivery would occur due to the increase in oxygen content of the fuel.” Page 121

^{xi} “...The durability data gathered is sufficient to indicate that the increases in deposits on the valves and pistons will lead to premature failure of the engine. Though this would not pose an immediate impression on the owner it clearly will lead to some economic impact in the future.” Page 122

^{xii} “...Visual inspection of the filters and examination of the deposits when the filters were removed show that a significant amount of debris is being stripped from the tank, fuel lines and other sources downstream of the filter...” Page 122

^{xiii} “On drying, many components either had dimensionally “shrunk” or had lost weight whilst still returning to their original pre-test dimensions. The latter can only mean that the density of the material has changed and that the structure and/or integrity of the material may have also changed.” Page 160-161

^{xiv} “An aspect of the thinner elastomers and polymers which is cause for concern is the hardening and distortion of the material. Typically the thinner material would be used for a diaphragm or accelerator plunger seal. A primary concern would be the failure of this material which would lead to an external fuel leak and hence a serious safety concern. The Ford Festiva (GOV5-03) regulator diaphragm is a good example; as well as distortion/stiffening of the diaphragm there is evidence of material breakdown (crumbling of the elastomer). A secondary concern would be the loss of function of the part, for example if diaphragms have a significant change in stiffness or shape; this could affect the ability of the fuel regulator to actually regulate the fuel pressure. This effect on fuel regulation, could affect the operability of the vehicle but is unlikely to lead to a serious safety concern.” Page 161

^{xv} “The carburettor components show considerable areas of corrosion both on alloy, steel and brass parts. The corrosion on the alloy parts is the most extensive and both pre-1986 and 1986-onwards carburettors have significant issues after the 2000hr test.” Page 162

^{xvi} “In particular, the Hilux (GOV5-06) carburettor body both on E5 and E10 is extensively corroded with the throttle shaft sticking in the housing after periods of immersion. The shaft can be unstuck and appears to remain free, so potentially under normal operation, where the throttle shaft would rotate, this might not be a problem. This assumes that the return springs on the throttle can overcome whatever resistance the corrosion applies. It is clear that if the throttle shaft did jam in an open position and did not return then this would be a very serious failure which could result in an uncontrolled drive-away situation. The levels of corrosion seen on this part would also give cause for concern for the functionality of the device as debris might block jets and other control functions within the carburettor body. The other carburettors tested have similar issues but not to the extent of the Hilux (GOV5-06).” Page 162