

The following article, by Joe Kenwright, appeared in the November, 1995 edition of WHICH CAR? Magazine, and is reproduced with permission from the publishers, ACM Syme.

## Coolant can **kill** your engine

### *Your car's coolant can cost you thousands*

Instead of cooling and protecting, it can become **mechanical poison** capable of killing your engine before it has covered 100,000 km.

It's a huge problem which may affect up to 90 per cent of Aussie cars, with **ignorance and fast-bucks scams** adding to the confusion.

There is no law stopping someone from bottling coloured water and selling it as coolant. And because car companies use different materials and build engines with unique characteristics, **a safe coolant in one car may cause damage in another.**

There is also a growing trade in sub-standard coolants, including incentives for workshops to switch from reputable brands to unproven products.

Up to 90 per cent of cars checked at some service centres contain coolant which provides little or no protection and **will soon lead to serious engine damage.** Blown head gaskets are so common today they are an accepted part of motoring.

Which car ? first heard of the coolant drama while researching used car problems, when persistent engine troubles in most cars made it clear there was more at fault than just individual design problems.

Cars today are still described as water-cooled - apart from oddities like the air-cooled Porsche 911 - but plain tap water is the last thing you should put into a modern radiator.

Water cannot cope with the extra heat generated by anti-pollution engines or the anti-corrosion requirements of hi-tech engine materials introduced over the past 20 years.

All car companies specify strict brews of anti-freeze, anti-boil and anti-corrosion chemicals - called coolant - to protect the engine and cooling system components for more than a decade.

There is an Australian Standard for coolants - 2108-1984- but it won't stop a sharp operator filling a bottle with tap water and labeling it as "coolant" when there's no compulsory compliance.

Which car ? has also discovered flaws in the administration of the Standard.

Reputable companies may meet the AS2108-1984 Standard for coolants, but their credibility is reduced when it's too easy for unscrupulous operators to claim Standards compliance for coolant which does not comply.

Our researchers found there is no easy way for consumers to check whether the coolant complies - or whether the Standards sticker is genuine. A recent laboratory test showed more than 80 of 100 coolants sold in Australia did not meet the basic Standard.

A comprehensive check with car companies also showed coolant which only meets the Australian Standard is usually not enough. There have been many technology changes since the Standard was introduced in 1984, so it is long overdue for an overhaul.

The coolant situation has become critical today because of the latest developments in engine technology. Engines were made from thick and heavy-cast iron as late as 1985, with heavy radiators made from brass and lead, and used low-pressure, low-temperature cooling systems.

With untreated water they rusted internally but damage took much longer to show up when there was so much excess metal. And many of the problems developed slowly and did not stop the engine completely.

The unusual problems were:-

- Radiator blockage from scale.
- Rotted Welsh plugs
- Worn water pump
- Weeping head gaskets

Lower operating temperatures and slow warm-up meant engines belched out more pollution - especially through heavy use of the choke - wore out more quickly and used more fuel . Passengers also had to suffer cold cabins and misted windows before the heater warmed up.

But things are much different today, especially as modern engines have to do more work - air conditioning, power steering, big electrical systems - while using less fuel, polluting less and running better.

They have to heat up quickly to cut emissions, swallow and convert their own waste to cut pollution - which adds heat - and operate more efficiently.

Modern drivers also demand their heater-demisters start working by the end of their street on even the coldest mornings, which means thin cooling walls and minimum cooling capacity for fast heat transfer from engine to coolant, heater core to cabin.

It's all resulted in hi-tech alloy engine parts, aluminium and plastic composite radiators and heater cores, as well as lightweight engines with little excess material. Yet if their coolant loses its protective qualities, they can develop holes or cracks very quickly and have to be scrapped at big expense.

***The rate of expansion and contraction in lightweight engine parts is huge, so car companies have had to develop special gasket materials which stay flexible and still seal. But bad or incorrect coolant will cause corrosion under these gaskets which can break their seal, leading to catastrophic failure. In some cars **the wrong coolant can eat away, perish or harden the gaskets or seals with the same result.*****

Common failures today include:-

- Head gaskets and water pump seal failures.
- Holed Welsh plugs.
- Damaged cylinder liner seals.
- Cylinder head cracks and holes.
- Radiators, heater cores and other cooling system parts eaten away.

A modern engine has a finely balanced, high-pressure cooling system with less coolant so it requires minimal time to heat up. But it also must have the capacity to cool the engine on the hottest day while housed beneath the sleek and poorly ventilated bonnet of a modern car.

So the engines coolant must be chemically stable not to vaporise or self-destruct at searing temperatures which can reach more than 150 degrees Celsius in some parts of the engine - straight water does not have a chance!

The high pressures and temperatures in a modern cooling system will cause a blow-out as soon as there is any weakness.

It's all become a big problem for the car's coolant, and for coolant manufacturers.

***A coolant must perform its anti-corrosive, anti-boil and anti-freeze functions without destroying the parts its meant to protect.***

Glycol - the traditional chemical base for most coolants - on its own does not protect a cooling system from corrosion and might eventually contribute to it.

It's still a vital component, but must be combined with anti-corrosive additives. The mixture must be used in proper proportions to do its job and has limited life after which it "goes off" chemically - which means no protection (at best) or eating away the engine's insides (at worst).

Coolant can also look clean - unlike rusty radiator water - after it has "gone off" chemically and is ***destroying your engine***. The only safe way of monitoring coolant is sticking to recommended changeover times and distances.

Another problem in modern, hot engines is the presence of highly corrosive "bubbles" - corrosive vapour - which form near the engine hotspots, including the cylinder liners and spark plugs. They pound away at cooling system and engine components and can wear a hole through an unprotected cylinder head or radiator in less than 10,000km.

Electrolysis between different metals within the cooling system can have a similar effect, not like traditional rusting but far worse.

So coolant must have the right amount of anti-boiling agent to reduce "bubbles" and of corrosion inhibitors to form a protective skin throughout the cooling system. But it's only a matter of time before even the best inhibitors are worn away and this is one of the key reasons why most manufacturers prescribe short intervals for coolant changes.

***You ignore their advice at your peril.***

The Australian Standard for coolant requires at least 25 per cent ethylene glycol - some manufacturers require 30 - 50 per cent - but it's not cheap and neither are the corrosion inhibitors.

It's possible to produce coolant which looks right, but independent tests have shown a number of packaged ready - to - use coolants - even with an impressive contents list on the packaging - do not contain enough of the key components necessary for use in a modern engine.

Which Car? has also discovered a growing business in special deals and incentives to service centres to switch from reputable or factory certified coolants to substitute or "trade" products.

Solid chunks of metal can disappear within days if left submerged in a sample of some of these coolants, suggesting the incentives and savings are funded by ***short-changing on the coolant components***.

The ***greed and ignorance*** of service centres and garages who participate in this coolant substitution by specifying it - without your knowledge - can cost owners thousands of dollars in unnecessary repairs to blown head gaskets, destroyed welsh plugs, heater cores and radiators, cracked or holed cylinder heads and worse.

And, unfortunately, there is evidence some authorised factory service centres are not immune from the same incentives and profit motives.

You should also be able to trust a qualified mechanic or service agent to carry out any servicing at the required interval with a product which meets or better the standards prescribed by your car's manufacturer.

But the reputable coolant manufacturers have learned there is little point in exposing the substitute coolants because they disappear then re-appear under a different name.

Mechanics and service centres also complain about being targets of protest. They charge the correct amount for correct coolant then suffer complaints from customers who have seen large containers of much cheaper coolant in supermarkets and garages.

So. what you need to know to protect your car - and your pocket - is fairly simple.

- Most manufacturers specify a coolant when they build a car. If you do not use the correct coolant, or change it often enough, you can void the warranty and forfeit any out-of-warranty consideration.
- Coloured liquid in the radiator does not mean it is filled with reputable coolant.
- Stick to change intervals in the owner's manual and, if you are doing it yourself, check special procedures. Most cars require a coolant flush and new coolant every two years or 40,000 km.
- Do not mix different brands of formulated glycol coolant and never put drained coolant back into the car.
- Do not rush a coolant change. Stick to the correct draining, flushing and re-filling procedure; opening the radiator drain plug does not remove all the coolant and can leave air-locks in the system, causing major engine damage if your car needs special bleeding.
- Check the cause if your car needs a coolant top-up; only add pre-blended water and recommended coolant, never plain water.
- Never use hard water to make up the recommended blend of coolant for your car. Melbourne and Sydney water is alright - Adelaide, Brisbane and Perth water is not, so always use distilled or demineralised water.
- Handle coolants with care, since they can be toxic, and dispose of them in accordance with local regulations.
- Even fresh factory-standard coolant may not be good enough for extreme conditions - towing, off-road driving or prolonged use below five degrees - so check if a special coolant is needed.

Today's VN Commodore and Toyota Lexcen twins are a perfect example of a common, modern car with a special coolant requirement.

In future, coolant will become even more vital and sophisticated. European defence research into protecting vehicles which must be on standby for shipping anywhere from the equator to the North Pole will soon lead to a whole new family of long-life coolants.

General Motors will also use long-life engine coolant (five years or

160,000 km) starting with its 1996 American models and, as Holden gets its Commodore engines from the US, the changes will affect Australia very soon.

The new coolants are based on organic acid technology (OAT), which Prix Max - one of the first aftermarket coolants sold in Australia with this technology - promotes with a three-year or 100,000 km life and claims to meet a wide range of manufacturer's performance standards.

Organic acid technology coolants are predicted to reduce coolant demand by as much as 50 per cent and Prix Max says they are readily biodegradable and environmentally friendly. But some reports warn old-style coolant mixed with OAT may cause radiator blockages and extra corrosion so, when the switch occurs, it may need to be a total changeover.

But there's still a long way to go and there's an urgent need for a coolant re-education program in the vehicle service industry. Especially as garages, mechanics and authorised service centres which substitute coolants which do not meet manufacturers standards leave themselves open to potential damage claims.

Some car companies have contributed to the coolant ignorance by burying time-based service requirements in their kilometre service coupons instead of tagging them separately - in red, if necessary - in the service book. Even factory dealers are not checking later service coupons for time-based items when they service low mileage cars.

Which Car? research has shown there is not even a list of approved coolants available from Standards Australia, which hardly encourages reputable companies to have their products tested to verify they meet the Standard.

And, despite the guarantees, meeting the Standard is no guarantee a coolant is suitable for your vehicle. The current standard is 11 years old and there are strong moves to have it reviewed.

But most reputable coolant manufacturers will have a product suitable for your car. So when your car is due for a coolant service, ask the service centre - factory outlet or local garage - about the coolant they use. And ask them to guarantee it meets the manufacturers requirements for your vehicle.