

ANTIFREEZE IN 2009

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by

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I originally wrote about this subject in 1997 and it appeared in RREC B222/55 May/June 1997, and is re-printed in RREC Technical Manual Number 5/163 (see the RREC Consolidated Technical Index).

Recently on the *Website for Enthusiasts of Rolls-Royce and Bentley Motor Cars* (www.rrbew.co.uk) I was very concerned to read this dire warning:

This is a **dire warning** concerning the change of formulae in various antifreeze products. Manufacturers have quietly moved to the new Organic Acid Technology (OAT) from the old Inorganic Additive Technology (IAT). That's fine for modern day cars BUT in most cases the antifreeze is totally unsuitable to our types of cars and their ages. Unless the antifreeze is specifically stated as IAT, you need to check with the manufacturer's technical department.

There was also the story behind this from Stephe Boddice. The two years were up so Stephe went and bought new Antifreeze for his PIII (which won First in Class in 2005). His usual was out of stock so he bought the new "Advanced" with no warning of danger, saying it was compliant with the BS6580 and suitable for old cars. Four weeks later he found pools of water under the car. 5 months later he had a meeting with the National Technical Manager of the "Advanced" coolant manufacturer. He was categoric in his statement that this 'technology' is inappropriate for use in any Rolls-Royce or Bentley engine other than the latest Bentley GT and Goodwood Phantom. NO 'IFS' and NO 'BUTS'!

ANTIFREEZE IN 2009

It turns out that the 'Advanced' coolant is manufactured using an Organic Acid Technology (OAT) corrosion inhibitor pack. The previous anti-freeze used an Inorganic Additive Technology (IAT). Evidence supplied to the retailer by the manufacturer admits that the OAT inhibited coolant is known to cause leak problems even in engines that do not use wet liners. The major fault with the inhibitor being that it attacks, amongst other things, silicone compounds. The most commonly used base compound for gasket sealants is silicon. It also attacks lead based products: lead bush in 20/25 Water Pump; solder in a Rolls-Royce radiator header tank.

In the USA ten years after General Motors began using Dex-Cool as an antifreeze in most of its cars and light trucks, GM car and truck owners continue to complain that the coolant corrodes and clogs radiators and radiator caps, erodes water pumps, rots radiator hoses, causes chronic overheating and engine damage while leading to leaky engine gaskets.

The conclusion:

DO NOT USE OAT INHIBITED COOLANT IN YOUR 20th CENTURY ENGINE!
DO NOT RELY ON COLOUR / COLOR

Glossary of inhibitor terminology: -

IAT = Inorganic Additive Technology is the chemical composition for the traditional antifreezes that are blue in colour in UK and green in color in the USA. An IAT can be used with either ethylene glycol (EG) or propylene glycol (PG). The normal IAT service life is two years or 30,000 miles (50,000 km). In the USA antifreeze with IAT is called “conventionally inhibited”.

OAT = Organic Acid Technology was the first long life / extended life antifreeze. OAT can be either EG or PG but is mostly EG based. It was introduced in an effort to reduce maintenance costs, downtime and environmental disposal costs and issues. With the introduction of this totally new concept, antifreeze manufacturers wanted to differentiate this new product from existing antifreezes. To accomplish this, they introduced different colored dyes for their long life / extended life products. Orange

ANTIFREEZE IN 2009

and red dyes were used first. These dye colors are still used by General Motors and Caterpillar. Now it appears there may be virtually no limit to the different dye colors: Green, pink and blue have been added to the list of available OAT antifreezes. It is recommended that OAT not be mixed with any other antifreeze technology. The normal OAT antifreeze service life is 5 years or 150,000 miles (250,000 km

HOAT = Hybrid Organic Acid Technology is a combination of IAT and OAT with nitrites added. This makes HOAT suitable for use in both light duty and heavy duty systems. Currently, two manufacturers are using HOAT for their vehicles. Daimler/Chrysler's version is dyed orange and contains 10% recycled antifreeze. Ford Motor Company's version is dyed yellow and does not contain any recycled antifreeze. Both of these HOAT antifreezes use the marketing designator of GO-5. They are compatible with each other but mixing them with IAT or OAT is not recommended. The normal HOAT antifreeze service life is 5 years or 150,000 miles (250,000 km).

NOAT - Nitrated Organic Acid Technology is an OAT with nitrates added. This makes NOAT also suitable for use in both light duty and heavy duty systems. NOAT and HOAT are very similar in performance characteristics. The normal NOAT service life is 5 years or 150,000 miles (250,000 km).

1. The colour of antifreeze is no longer an accurate indicator as to whether it is an IAT, OAT, HOAT or NOAT formulation. There are currently at least two oranges, two reds, green, dark green, yellow, blue, blue-green, clear and pink dye colors available. Further, some antifreeze manufacturers market a "universal" antifreeze they say is compatible with all OAT, HOAT and NOAT formulations. These "universal" formulas are not for use with IAT and they will not convert an IAT to a long life or extended antifreeze.
2. The officially recommended coolant for RR/B V8 engines is a 50/50 solution of

ANTIFREEZE IN 2009

water and ICI 007/400F antifreeze. The latter is still available from any Bentley Main Dealer - see <http://www.bentleymotors.com> for contact details.

3. The change of inhibitors was driven by the car manufacturers who were looking for improved coolant performance with, amongst other needs, extended product life. Engine designs were changed, including new seals, sealants and gaskets being introduced on a model by model basis. The manufacturers started selectively to introduce OAT coolants from about 1995 and virtually all engines manufactured since 2005 are now compliant with this technology.
4. The only recent mention of Antifreeze in the RREC Bulletin was in July 2008 Spares Corner B289/23. It is most unhelpful for it ignores propylene glycol and all its advantages clearly stated in Technical Manual Number 5; and states simply that: "in the UK look for an antifreeze which meets or exceeds the requirements of BS6580." This statement implies that OAT is suitable for all our cars and is incorrect. The problem for the public is that OAT versions comply with BS6580. The same applies to HOA and NOAT. Compliance with BS6580 is not enough to look for: if you need IAT – Inorganic Additive Technology and it is not stated on the product label do not use it until you have checked with the manufacturer.

In the winter of 1953, I could not afford Bluecol, so the engine was drained, and I only used the 1933 Morris Minor on days above freezing. At the same time, in accordance with R-R instructions, owners of pre-war R-R cars were draining the water if there was no antifreeze, and, also following R-R instructions, draining the antifreeze in summer.

We now know that the mixture of metals with a pre-war engine causes electrolysis, particularly attacking aluminium water pipes, and cylinder heads. Antifreeze contains inhibitors and should be used all year round to stop corrosion.

All the vehicle antifreeze I knew appeared blue (e.g. Bluecol), and contained ethylene glycol. Its characteristics:

- 1. Ethylene glycol is very toxic.**
- 2. As little as 30 ml of ethylene glycol can be fatal in adults, 4 ml kills a cat. I will not have it on my property, in case children or animals get to drink it.**
- 3. Ethylene glycol damages the paint.**

4. 1/2 to 1% of Ethylene Glycol in the oil causes rapid main bearing failure resulting in the shutdown of the engine.

The solution: **use propylene glycol**, and also be environmentally friendly.

1. propylene glycol is hazy yellow in colour, is non-toxic (will not damage paint), is bio-degradable, and can be mixed with drinking water.
2. propylene glycol has a bitter taste that makes it less attractive to curious animals.
3. propylene glycol does not persist in the environment. It is readily consumed by microorganisms. In an activated sludge treatment plant operating at 65 deg F, PG is fully degraded within 24 hours.
4. propylene glycol does not break down into corrosive elements, and can be used for many years retaining excellent aluminium protection, and prevention of lime scaling around the copper tubes in the blocks.
5. Tests have shown that aluminum corrosion was lower for PG based antifreeze than for an EG version.
6. In laboratory and engine dynamometer studies, PG antifreeze has performed better than similar products containing EG with regard to cast iron cavitation corrosion.
7. Fuel economy, heat transfer, and other key performance characteristics were the same for both PG and EG coolants.

Public pressure in France has forced the introduction of PG. Since 1998 propylene glycol based alternatives have been available highlighting the “green” aspect. However, the latest purchases from Carrefour and Auchan (both monopropylene glycol) are now 100% “Organique” and comply with AFNOR (NRF IS 601 type 3). I am not prepared to test in my cars to see if they are OK.

ANTIFREEZE IN 2009

In California, a very environmentally aware state, they have done a lot of testing on propylene glycol. Sta-Clean Antifreeze^{T M} is one recommended product, used extensively by transport fleets, and by RROC members. It is conventionally inhibited and with correct maintenance their test fleet has run 800,000 miles without changing antifreeze. They have tested (and show a film of the test) an engine running with 8% antifreeze added to the oil and are the only manufacturer to claim it will not harm bearings.

In the UK John and Melanie Els in November 2007 introduced a website

www.antifreezekills.co.uk

after losing their best friend and dearest companion Barrie, a beautiful ginger cat to antifreeze poisoning. This resulted in a petition to the Prime Minister to get manufactures to add a bittering agent: Denatonium. This failed to get Government support. They did not petition to introduce PG only stating that "Another solution is to stop using ethylene glycol and replace it with propylene glycol, although finding this alternative in stores seems to be a problem."

In 1994 (and in 2009), I also could find no product using propylene glycol marketed only for automotive use. Fernox manufactured in 1994 an automotive targeted product based as the others on ethylene glycol, but also had and still manufacture a propylene glycol product, Fernox Alphi II, which is suitable for all wet systems combining steel, cast iron, brass and aluminium. The corrosion prevention properties substantially surpass the BS 6580 which makes it suitable for automotive use.

For fifteen years in my R-R cars and my 1956 Rover 75, I have been using Fernox Alphi II. It is available from top quality plumbers merchants (£19.99 inc Vat and delivery from Supreme Plumbing for five litres as compared with £19.99 inc VAT for 5 litres of Ethylene Glycol Antifreeze from MotorWorld). The ten year cost for ethylene glycol is £100 per 5 litres. Fernox say it is good for 20 years in a domestic central heating system. As long as the ph level is above 7 I am on 20 year changing cycles at a cost of £10 per 5 litres over 10 years. So it cheaper, and with all its

ANTIFREEZE IN 2009

advantages!

I used to use a 50% mixture with ethylene glycol, and I currently do the same with propylene glycol. As we have evaporation with the old cars, I always top up with the same mix. You should note that the protection with propylene glycol does not take effect until there is a minimum 25% mixture.

A word about water. Untreated water is corrosive. Distilled water is the most corrosive. On no account should water from water softeners be used in an engine coolant as it contains harmful salts. Distilled water is expensive to make needing an evaporation process (cheap if you have a de-humidifier), so de-ionised water is what is sold instead (and is used in 50/50 manufacturer's mix). It is used to top up car batteries.

Mains tap does contain some bad things but also some good things that help stop corrosion. If the good things are missing then extra cost is involved to add inhibitors to distilled, de-ionised water, to replace the good elements taken out from tap water. You run the risk that the inhibitor in your antifreeze may not have these added inhibitors added.

However, mains tap water may have excessive solids, hardness, chlorides or sulfates, or the local water company may have added chemicals for taste and clarity reasons that are not recommended for cooling systems (fluorides, magnesium, chlorides, calcium, acids, and gases). Whether the inhibitors deal effectively with all environments in a given antifreeze is always unclear.

Given all these variables and lack of detail given on the products being sold, unless you are using Fernox Alphi II buy a 50/50 mix where you can be certain to have the best protection particularly against lime scale.

Fernox Alphi II handles the hard water south of the Bristol/Wash line, the soft water of the North with the high lead content in Scotland, and similar ranges across Europe and elsewhere.

I asked Fernox, Cookson Electronics, Forsyth Road, Sheerwater, Woking, Surrey GU21 5RZ to give me their comments, which follow:

" It is the properties of the inhibitor which produce the durable characteristics you

ANTIFREEZE IN 2009

refer to in respect of Fernox Alphi II.

As suppliers to the domestic heating market, we are obliged to use propylene glycol for the reasons of low toxicity you refer to in your article. In the past, ethylene glycol was significantly cheaper than propylene glycol and so found favour for automotive applications. However, the price differential is now much reduced and the safety benefits of propylene glycol should undoubtedly bring it into consideration for more widespread use.

Alphi 11 is used by a number of car enthusiasts as an antifreeze of choice and it is proven by the fact that it has been used for many years without any detrimental effects. It is compatibility with metal and rubbers that is important and not the specific ingredient within the inhibitor/antifreeze blend. While it is important to emphasise that the product was not specifically designed for automotive use, it does substantially surpass the requirements of BS6580 the standard for automotive antifreeze.

Whilst propylene glycol is less dangerous than ethylene glycol, contact with skin and paint should still be avoided, as should ingestion. We recommend users to refer to the manufacturers product and safety data sheets for more specific information concerning product safety and disposal."

The End.