ECS TUNING

Installation Procedures

VW Audi
Cooling System
Care and Maintenance

This tutorial is provided as a courtesy by ECS Tuning.

Proper service and repair procedures are vital to the safe, reliable operation of all motor vehicles as well as the personal safety of those performing the repairs. Standard safety procedures and precautions (including use of safety goggles and proper tools and equipment) should be followed at all times to eliminate the possibility of personal injury or improper service which could damage the vehicle or compromise its safety.

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Cooling System Chaos

Charting a course through the current chaos of modern coolant chemistry is daunting. Web searches can turn up vague and often contradictory information. (OEMs keep it simple by warning us to use only approved original equipment products dispensed at huge cost through the ordained dealer network.)

To make matters worse, the proliferation of engine coolants has added mightily to the confusion. New antifreeze colors are being added at a dizzying rate, and we already have dozens of antifreeze products in designer colors that run the gamut from Outrageous Orange to Striking Strawberry. Describing coolants by color alone is an imprecise science, and those seeking hard facts commonly end up frustrated after reading marathon forum posts asking whether a coolant is better described as lilac or purple, red or pink.

Let's start with a quick question: What is antifreeze?

Antifreeze

"Water-cooled" engines circulate liquid through a cooling jacket in the engine that collects and removes heat energy unused for propulsion. Coolant then carries that energy to the radiator for transfer to the atmosphere.

Good old USA green antifreeze does a decent job of protecting cooling systems. Did so for years. Okay, so it's toxic and is highly lethal when ingested by carbon-based life forms. Health concerns aside, however, its ethylene glycol base is highly effective at preventing coolant freezing and engine boilover, and its additive package contains chemicals like silicates and phosphates to prevent chemical attacks that erode metals and eat gaskets.

The problem with conventional green antifreeze is simple: too many motorists ignore its recommended three year/36,000 mile flush and fill-with-fresh service interval. The protective chemicals in the original additive package deplete over time. Once they are gone, there is nothing to arrest corrosion, and cooling systems, including engines and related components like heater cores and radiators, are damaged quickly.

Conventional antifreeze commonly contains several corrosion inhibitors, including silicates and phosphates. Conventional European antifreeze favored silicates, but shunned phosphates. Asian carmakers? They avoided silicates, opting for phosphates. Silicates do much better with hard water than phosphates, but phosphates provide much more consistent protection in a vehicle coolant system. Europeans use silicates, which provide good protection and cope with the hard water prevalent in Europe much better than phosphates. Asian OEMs use phosphates because they do not have the hard water issues found in Europe.

Geographic preferences aside, all ***conventional*** antifreezes containing these inorganic additives have one thing in common: they need to be mixed with clean water initially and then flushed and refilled on a regular basis to renew chemical protection. The coolant experts at CRP suggested we make that "distilled" water, and we agree.

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VW/Audi Cooling System Care and Maintenance

Extended Life Coolants

Realizing that far too many cooling systems never receive preventive service, auto makers looked for a longer lasting antifreeze chemistry. So-called “extended life” coolants are the result, and they have now replaced conventional antifreeze on auto assembly lines all over the world.

GM DexCool may be the most famous name in long-life antifreeze, although there are those who still describe it as *infamous*. The war over its merits/problems continues. Whatever. Of importance here is that Dex-Cool dispensed with traditional inorganic chemistry, opting for something called Organic Acid Technology, or OAT, a solution originally intended to last for five years and 150,000 miles.

Other OEMs, including VW/Audi, have adopted OAT for the same reasons, although the exact chemicals used vary and are less published than the recipe for a Kentucky colonel’s famous fried chicken. VW G12 is OAT-protected antifreeze.

More recently, OEMs, including VW/Audi, have made adjustments to improve protection. Hybrid Organic Acid Technology (HOAT) antifreeze like G12++ even adds a small dose of silicate. A faster acting anti-corrosive, silicate in small amounts protects more quickly than OAT alone, and can “heal” minor metal damage faster. OAT additives then continue to protect the system over the long haul. It’s important to realize that it can take several thousand miles of driving before OAT protection kicks in.

An extended life antifreeze like Pentosin G12++ protects against freeze and boilover, and provides lasting chemical protection for years and many thousands of miles.

Now back to you, the motorist. As the owner of one of these cars, you’ll eventually need to make a decision about which antifreeze to use for topping off your cooling system, and whether or not you need to perform a periodic cooling system service.

The Roots of Most Cooling System Problems

We believe that most cooling system problems are the result of:

• **Cooling system neglect.** There are many things that wear out in a cooling system, including radiator caps, coolant recovery bottles, hoses, clamps, and pipes. Metal sloughs off, and legacy pollutants from the manufacturing process remain.

Small problems add up, reducing cooling efficiency. If a system low on coolant is not topped off, it suffers from air pockets, overheating, and accelerated corrosion at exposed metal surfaces. (Hot air is never a suitable substitute for hot coolant.)

While topping off with the wrong coolant can cause problems, a low coolant level is worse.

Cooling System Problems

• **Improper mix ratio.** Too much water or too little antifreeze in the mix will cause big problems. If you are a resident of a temperate climate, a 50/50 mix of antifreeze and clean water should suffice, providing freeze protection to -34F. A 60/40 antifreeze/water mix may be used in colder climates, although ratios above 70/30 are to be avoided. Conversely, too little antifreeze in the mix means too little freeze protection and a weak additive mix.

• **Improper Flushing.** System flushing can also cause mix ratio problems when too much flush water remains in the system after draining the coolant at the radiator. Adding a 50/50 pre-mix to a system still holding several quarts of water results in a weak mixture, maybe as low as 30/70 (antifreeze/water). This is a growing problem with so many coolants now coming pre-mixed at a 50:50 ratio of antifreeze to demineralized water.

To avoid this problem, measure the volume of flush water drained and compare it to total system capacity. Add pure antifreeze initially in a volume equal to the water remaining in the system, topping off with a 50/50 mix.

There are many cheap testers on the market, some costing less than cheesburger. We prefer a refractometer for accurate measurements. This precision measurement device will last a lifetime with careful use. It measures freeze protection of ethylene and propylene glycol coolants, and the specific gravity of battery acid, as an added bonus.

• **Improper topping off.** If you have a low coolant level, the first thing to do is add coolant; the second is find out where the coolant is going. Finding and fixing leaks is critical.

When topping off, be consistent. Mix and mark a jug containing a 50/50 mix of compatible antifreeze and distilled or demineralized water. Then use that container for all top-offs.

Too many systems get topped off with whatever is handy, commonly pure antifreeze, plain tap water, or...whatever is handy. Even tap water can have high levels of minerals that will settle out and form hard scale.

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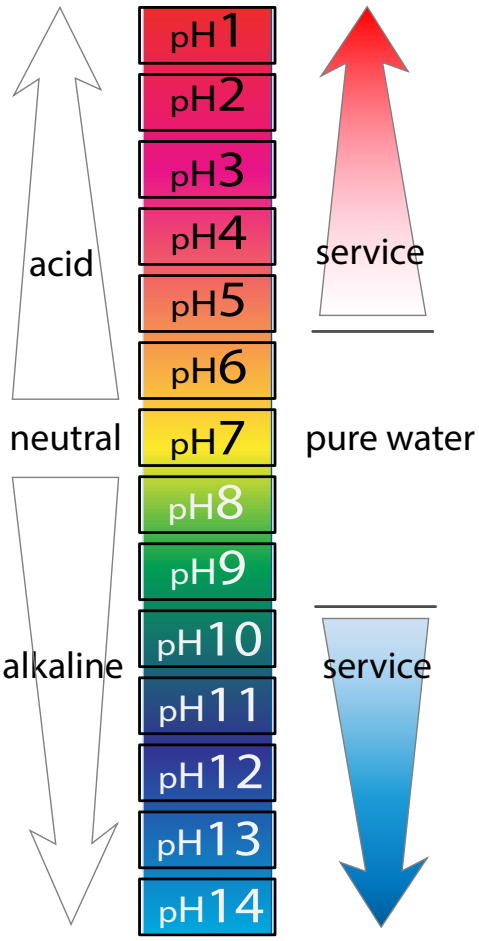
Cooling System Problems

• **Weak Chemical Package:** Test coolant chemistry as well as its antifreeze concentration. Many long-life coolants look great at 100,000 miles, but this can be misleading. In addition to suspended abrasives (dirt and sand, some of it left over from the manufacturing process) there may also be trace contamination from deteriorating hoses, combustion blow-by at weak head gaskets or leaking EGR coolers, and metal erosion.

Don't assume that just because the coolant ***looks*** clear that it is protecting your system. Cooling system test strips are available from many parts suppliers. They are affordable and easy to use: just dip them in the coolant; wait for them to change color, and compare them to the color bar legend printed on the label.

Good test strips don't just measure freeze protection, they also indicate actual system pH and a critical thing called ***reserve alkalinity***.

The pH scale measures the acidity or alkalinity of a solution. A pH of 7 is neutral; numbers lower than 7 are acidic; higher than 7 are alkaline. It is importrant to have a small reserve of alkalinity to neutralize acids, because other corrosion protectors in the system may be useless against acids. If you have combined low pH and low reserve alkalinity test strip readings, the additives in the coolant are depleted, allowing corrosive acids to build in the system. At the other end, highly alkaline solutions are hard on aluminum.



Regardless of promises about long life, a cooling system with pH of 5 or less, or 10 or more, should be flushed and refilled with a fresh coolant mix, regardless of actual mileage.

• **Adding the wrong antifreeze.** Ideally, cooling systems should be topped off with a coolant mixed with the same antifreeze in the system. Since most factory antifreeze is still ethylene glycol based, the differences lie in the additive packages. DexCool and most US green traditional antifreeze are both ethylene glycol based, but their additives are worlds apart. (Propylene glycol is used, although not as common. Glycerine-based antifreeze is already here, and market penetration may increase quickly for energy and environmental considerations.)

If you have no choice in an emergency, using the wrong coolant is preferable to driving with a low coolant level. Adding a lot of conventional antifreeze to a system previously filled with OAT produces a weird color and reduces the service interval to that of the conventional antifreeze. Prudence suggests that once the cause of the emergency leak is repaired, the system should be flushed and refilled using a coolant mix made from an antifreeze recommended for the vehicle.

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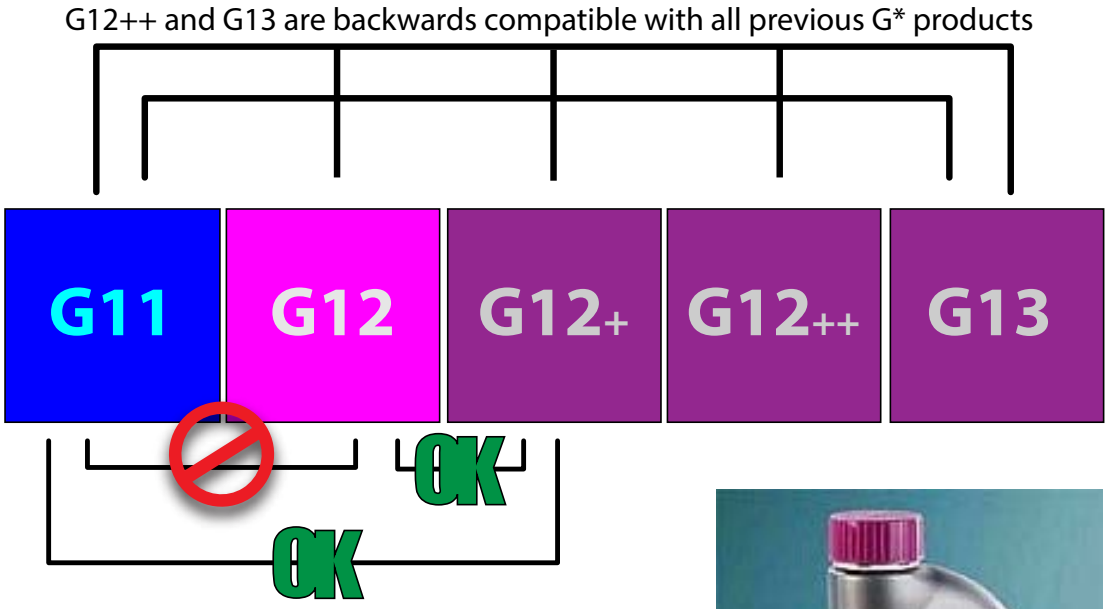
Cooling System Problems

Coolant Compatibility Issues

We contacted CRP Automotive, who is the NAFTA importer of Pentosin technical fluids and asked about compatibility among various "G" antifreezes. The chart below summarizes their response, and takes the guesswork out of picking an antifreeze you can use to safely top off or refill your system.

G13 is now being used as a factory fill in VW/Audi vehicles. ECS Tuning stocks this most recent coolant version. Owners of older cars may want to consider using it, especially for a total system flush and refill. G13 is backwards compatible with previous antifreeze mixtures. It combines OAT with a measure of silicate, for fast-healing in systems that need an extra corrosion fighter. As always, it is phosphate-free.



Environmental and energy conservation are leading to innovative uses of glycerin, a byproduct of biofuel production.

G13 contains 20% glycerin, compared to G12++, an all EG based coolant. As of 2010, G13 is used in VW Group vehicles worldwide, and VW estimates that its use will reduce CO2 emissions by 30,000 tons annually, with added savings in coming years.

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Cooling System Checklist

- Inspect the system at each oil change service and repair all coolant leaks. Top off the system, if necessary.
- Top off the system only with a 50/50 mixture of approved coolant and demineralized water. Do not use tap water to mix coolant.
- Test antifreeze chemistry and concentration annually. Flush a system with low pH and insufficient reserve alkalinity.
- Flush and refill a system following replacement of a major cooling system component: radiator, heater core, or water pump.
- Pressure test the system pressure cap annually. Replace any cap that does not hold pressure and vent at its rated limit.
- Clean away leaves and accumulations of debris that are lodged in the condenser or radiator. Check and repair air dams and radiator/condenser seals to ensure adequate air flow through the radiator under all conditions.
- Check belt tension and condition on cars with belt-driven water pumps.

Our thanks to CRP Automotive, supplier of Pentosin fluids for their technical assistance in the preparation of this article.

ECS Tuning sells the products you need to properly maintain your VW/Audi cooling system for peak performance and reliability.

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