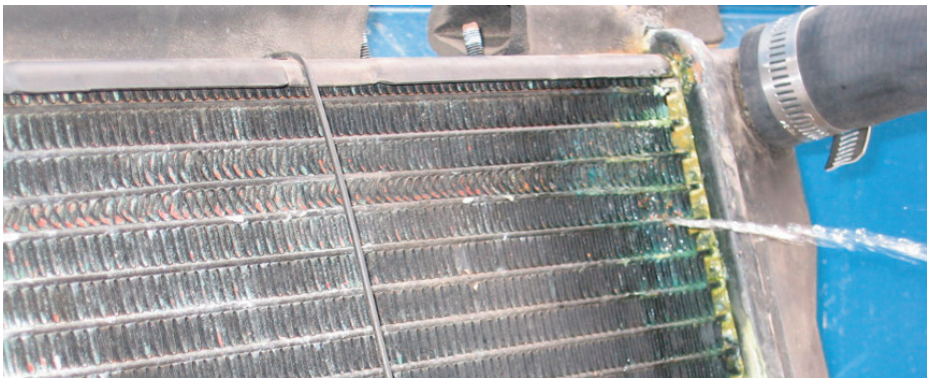
When good radiators go bad

It can happen very quickly, even in a matter of weeks or even days. A perfectly good radiator can develop pin-hole leaks that are an indicator of possible electrolysis. Harbour Radiator's Garry O'Brien, explains what to look for and how to prevent it from happening again.

Electrolysis can be very damaging to any aluminium component that comes into contact with the coolant in any vehicle. If you have a radiator, heater core, or even a thermostat housing or cylinder head that is leaking coolant from tiny holes, electrolysis is usually the cause. If you only replace the failed part, you may see the same car back again in a matter of weeks, or even days, with the same problem. Knowing when and how to look for electrolysis and how to eliminate it, will steer you clear of what can end up being an expensive and reputation ruining experience.



Electrolysis is caused by electrical current travelling through the coolant, turning the cooling/heating system into an unintended circuit. Once this stray electrical current occurs, any metal that the coolant touches can be dissolved into the coolant.
Electrolysis has a preference for different metals, and will attack zinc or magnesium before it attacks any other metal. If you are familiar with boats, you probably already know that zinc is often attached to the hull, to protect the electrical system from electrolysis. The zinc is a sacrificial anode and must be replaced when it is consumed. Aluminium is the second metal that will be consumed by electrolysis. As there is no zinc or magnesium anywhere in the cooling system of an engine, anything made from aluminium will be the first victim. The increasing amount of electronics on a modern car, also raises the potential for electrolysis, making it a problem that is more likely to occur now.

The first step in successfully curing electrolysis is recognising it when it occurs. The most obvious indication of an electrolysis problem is leaks from the radiator, heater or other aluminium component from very small pin-holes. The pin-holes are the result of aluminium being stripped away at a microscopic level, until a very small hole is created. Electrolysis can cause leaks anywhere in the cooling system, but they are more commonly found at the edges of the radiator or heater core, near seams or around an electric cooling fan mounted to the radiator. Pin holes are usually found first in the radiator or heater core, because the walls here are thinner and are the first to leak, even though aluminium throughout the entire system is being consumed. A pinhole leak anywhere in the cooling system should immediately alert you to check for electrolysis.

Chemical Electrolysis
One type of electrolysis is caused by the coolant itself. This type of electrolysis is a chemical reaction between the coolant and the aluminium, that is basically like a battery. When the coolant is "worn out", it acts like acid in a battery, allowing dissimilar metals to create voltage and a current. The cure for this type of electrolysis is simple: replace the damaged parts, flush the cooling system and refill with the proper coolant.

Stray Current Electrolysis
The second type of electrolysis is caused by stray current entering the cooling system. This is usually caused by a poor or missing ground on some electrical circuit. The most common problems used to be caused by aftermarket accessories added to the car, such as fog lights, radios, cruise controls, phone kits, etc. While it is not common to find accessories that are not factory installed, they do still exist and so it should be the first thing to check for. The most common circuits to cause stray current in modern cars, are probably electric cooling fans and starters.
No matter what the source of the stray current, it can be methodically hunted for, and you will be confident that you have cured the problem.

Testing Procedure and Repair
To determine what type of electrolysis you are facing, turn the key to the on position, attach the negative probe of a multimeter to the engine block or other proven earth, and dip the positive test probe into the coolant at the radiator or reservoir cap, being careful to make certain that this probe is not contacting anything but the coolant. If the voltage reading is less than 0.1 volts, there is not any significant electrolysis.

If there is more than 0.3 Volts, remove the positive battery cable from the battery and repeat the test. If you are still measuring the same voltage, the vehicle is suffering from chemical electrolysis caused by 'worn out' coolant. After replacing the damaged parts, flush and refill the cooling system and repeat the voltage test.

If the voltage reading drops with the battery disconnected, the electrolysis is from stray current. Methodically check all suspected circuits, including heater fan motors, air con compressors, etc. Be suspicious of recent additions or repairs made to te vehicle. A check can be done by either turning on some items, or removing fuses or power to individual parts (such as a fan motor), or by providing a temporary ground to the suspected component. When the voltage drops, you have identified a circuit that is causing stray current. Identify and repair the fault in the circuit, usually a poor or missing earth connection. Be sure to test for intermittent electrical loads, such as thermostatically controlled cooling fans or the starter. A poor ground on a starter may cause a heavy current flow through the coolant, but you have to be looking for it when the engine is cranking over. A poor earth on the starter can destroy a radiator in days.

Another problem to look for is a faulty earthing strap between the engine, chassis and battery. Visually examine these connections and test with the multimeter. Also remember that it is always possible to have multiple faults.

Once all of the faults have been repaired, replace the faulty parts, flush the cooling system and refill with new coolant. Then you can be confident that the replacement radiator or heater will have a normal service life.