Breakthroughs in CP *Vehicle Rust Prevention.*

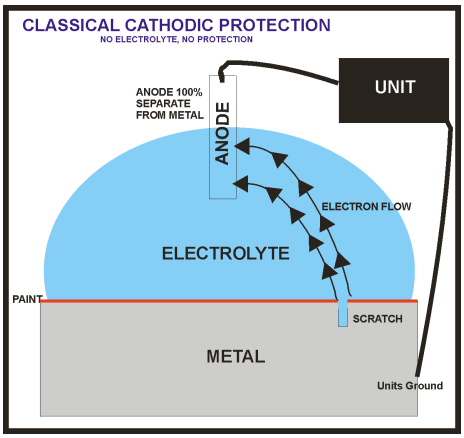
November 1994

What is CP?

A technology called Cathodic Protection (CP) has been used worldwide for decades to effectively protect multi-million dollar structures from the ravages of rust. According to the U.S. Navy, CP is the best form of electronic corrosion (rust) control. It is widely used at Naval Shore Activities for protecting buried and waterfront structures and for protecting the interiors of water storage tanks. In some cases, such as underground pipelines, their field experience has shown that CP is such an effective means of providing the required levels of safety in the operation of the systems that they require CP by regulation.

Rust is an electrochemical reaction caused by the presence of moisture, oxygen, (and possibly contaminants, e.g. fertilizer, cement, dirt, grime, etc) and the interaction of negative free electrons and positive ions in the metal. As in any electronic process, the positive side, the anode, gets eaten away while the negative side, the cathode, is protected. CP interferes with this interaction interrupting the corrosion process. There are two methods of Cathodic Protection

The first method, *Sacrificial Anode*, makes use of an anode, usually made from aluminum or zinc, which naturally has a more positive charge than the metal being protected. This potential (Voltage) difference causes a greater attraction of negative free electrons than the ions in the metal. The result is that the anodes now get sacrificed (corroded) and the corrosion process in the metal (vehicle) is interrupted and hence protected. This method relies on there being an electrolyte (current path), such as water, between the anode and the metal, and so is extremely effective in the wet but ineffective in dry conditions.



The second method, *Impressed Current*, makes use of a direct electrical current, which interferes with the corrosion process. In this system, an inert anode is used, such as graphite, and is not consumed in the process. With the presence of an electrolyte between anode and metal, the circuit is completed and the desired current flow is achieved to interrupt the rusting process. This method is effective but it is imperative that a constant electrolyte is present.

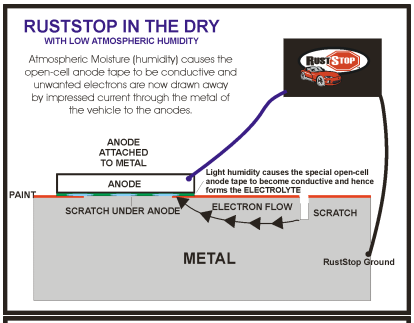
If CP needs a constant electrolyte then how is it effective on vehicles?

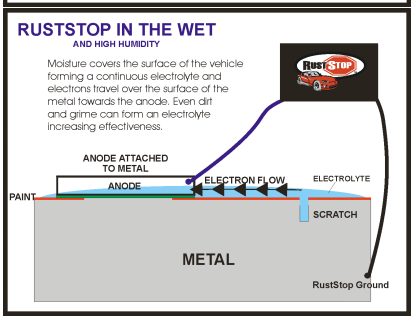
CP, used in its original form, relied upon an electrolyte to bridge the gap between the anode and metal to enable the required current to flow between the two, to interfere with the rusting process. The reason why it was not effective in atmospheric conditions, for example vehicles, was because of the lack of an electrolyte. This meant it was only effective when the vehicle was totally wet or covered in a conductive coating, i.e. electrolyte.

So many automotive CP products were ineffective hence giving electronic rust prevention a bad name.

Extensive testing and research have resulted in major advancements in the field of CP and it has resulted in an adapted version of CP, which gives rust protection in atmospheric conditions without a constant electrolyte. This technology, Directed Cathodic Protection (DCP), makes use of a clever combination of both sacrificial anode and impressed current technologies. Instead of relying on the electrolyte (water) to provide a path for electrons to flow towards the anodes, a current is impressed onto the vehicle forcing the electrons to flow through the metal and towards positively charge anodes. The anodes corrode (sacrifice) and the corrosion process is interrupted thus the vehicle is protected.

Two products using this new technology are RustStop and Rust Arrestor. This technology is now available as factory fitted on certain Toyota models. Lets discuss the product RustStop, one of the established products in vehicle CP. They have enhanced this technology in a number of ways, firstly the anodes are adhered to the vehicle using a unique, specially designed, variable resistance, conductive tape. This tape is a partial conductor and so forms a constant electrolyte between anode and vehicle. It also has varying resistance levels depending on the humidity or moisture present. This means that in dry conditions it impresses the required current but senses when there is more moisture present and hence a greater rust threat, and then impresses greater levels of current offering greater protection when needed. The unit also outputs a charge of +45 Volts onto the anodes, this high voltage causes a greater attraction of electrons and hence greater protection.





Importance of installing an advanced dual system !

In addition to DCP, these systems also use CP in its original (Classic) form under wet conditions or when there is a high atmospheric humidity or salt content. Even dirt and grime on the vehicle is conductive and so forms an electrolyte for original CP to become effective. The result is that effective protection can be achieved using Cathodic Protection for vehicles in dry or wet conditions. There are, however, a number of products using basic CP that are only effective in wet conditions so care must be taken to ensure that an advanced dual system is purchased.

Many years of physics based research and development, together with new "leading edge" technology, has created worldwide interest in these new systems, the new "24 hours a day" method to fight the unrelenting problem of rust plaguing millions of cars, 4wds, trucks, motorhomes and countless other motor vehicles. This same technology has now available as factory fitted on various Toyota models.

Cathodic Protection can be effective on vehicles if the correct methods are used.