

DETAILED PRODUCT INFORMATION

"CAT Electronic Anti-Corrosion Systems"



Introduction

Thank you for your interest in the CAT Electronic Anti-Corrosion System. The aim of this paper is to supply as much detail as possible about the CAT System, how it works, the chemistry of rust and how you can use the CAT System to save money and preserve your mobile asset. CAT provides a system, not just a gadget. We are a well established, 100% Australian company dedicated to providing quality factory backed products to the Australian and world markets. Our clients include Government Departments, Major Councils, Fleet Owners, Earth Moving Contractors, Car Dealerships and many Overseas Companies. These clients and their customers have benefited from more than 20 years of CAT's continued investment in research and development and our commitment to quality, proven products. If you have a new or relatively new vehicle then CAT is the easiest and best way to reduce corrosion. In many cases you simply have the CAT unit fitted and the vehicle has the best rust protection currently available. The CAT system is being continually developed both in the lab and through experience in the field. Our Electronic systems have been proven effective in real life and are also working hard on the farms, in the mines and all the places where corrosion is a costly problem.

CAT leads the world in this technology and has more experience than anyone. Don't think that all electronic systems are the same.

After going through this information sheet you will be in a much better position to ask questions and make decisions about Electronic Rust Prevention.

Why CAT?

Aside from the fact that a negative electrolysis system like CAT is the only method effective on 'free air structures' like motor vehicles and machinery, it is CAT's attention to detail that sets us apart. Everything associated with CAT is quality. You can be assured that when a CAT unit is protecting your asset then nothing in the world could be doing a better job. The amount of research and development that has made CAT the world leaders in electronic rust prevention is unmatched by any other similar company. Put simply, when you buy CAT you are buying the best. We leave no stone unturned so that you can be safe in the knowledge that your CAT unit will keep protecting for many years.

Things to remember

- CAT when correctly fitted can slow the spread of existing rust by up to 5 times (from test results).
- CAT can help prevent electrolysis caused by dissimilar metals.
- CAT is proven to reduce maintenance costs and prolong the life of the vehicle.
- CAT is both 12VDC and 24VDC compatible.
- CAT uses "Smart Input/Output Control" (SIOC) which increases the output power up to 4 times when the vehicle is running
- CAT Uses 20-30 milliamps when the vehicle is off – less than your dashboard clock – so will not send your battery flat. (Low voltage cutoff Protection also)
- CAT is 100% Australian owned, so your money stays in Australia
- CAT will not in any way interfere with automotive electronics
- CAT increases resale or trade-in value
- CAT can be transferred to your next vehicle (new pads are required)
- CAT protects the entire vehicle, not just areas which can be sprayed.
- CAT may also slow paint oxidation (this is not yet proven but is worth mentioning due to a wealth of anecdotal evidence)

Unit Specifications

Input Voltage	12V/24VDC
Operating Voltage	9V-32VDC
Operating Temperature	-30°C~85°C
Ground	- Negative
Current Draw	25ma +/-
Low Voltage Cut Off	11.9V/23.9V
High Voltage Cut Off	15.1V/28.1V



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of your vehicle!**

LED Status Indicators

Flashing GREEN	Normal Operation
Solid GREEN	Normal Operation - High Output
Flashing AMBER	Battery voltage or temperature too high or too low
Flashing RED	Pad/s not mounted correctly
Solid RED	Extremely low or high voltage or internal fault condition
No Light	Power not connected - Blown Fuse - internal fault

Technical

How CAT Works

The unit operates continually from the vehicle battery. The DC battery voltage is stepped up to an AC Voltage by the Cats' internal circuitry before it is transferred to the "Delivery" or "Sensor PADS". The frequency of the output voltage is critical! It is actually possible to accelerate corrosion by using the incorrect frequency so therefore tuning the output power and frequency is what makes the CAT system unique. The Delivery Pads then "impress" or "induce" a strong negative electrolysis charge into the structure of the vehicle using a form of magnetic coupling. The continual over supply of electrons causes the surface to become saturated with a layer of excess negative electrons. We will explain later why an excess of electrons is an important factor in prevention of corrosion. These electrons must now be held static by a dielectric - usually paint - otherwise they will quickly dissipate and be of no further use. This is an important principle regarding the operation of the CAT system and needs to be considered when deciding the suitability of the CAT system on structures other than motor vehicles and mobile pant. i.e. if the metal surface is unpainted then the CAT won't work! Painting the surface will however fix this. The requirement of a dielectric also explains why when a small area of metal is exposed - such as a chip or scratch - the area will develop a brown stain or ferric oxide layer. This is because the CAT system cannot protect bare metal as stated. However immediately the ferric oxide starts to develop it acts like a layer of paint and the CAT can now help protect the area again. It is true that a vehicle may develop many areas of ferric oxide staining however the rusting process will be significantly slowed.

Corrosion prevention Technology

It has been known for over 100 years that electricity plays a large part in most forms of corrosion and it is also known that electricity can be used to prevent corrosion. As previously stated the CAT System works by developing a high concentration of electrons in the metal body of a vehicle and the paintwork prevents the charge from leaking away too quickly. This is similar to the way a magnet placed on steel will

magnetise the surrounding area. Electrostatic experiments from over two hundred years ago showed that if a metal and an insulator or dielectric are in contact then the two can hold opposing charges for some time. The layer of electrons on the surface of the metal prevents corrosion by lowering the metals voltage potential. This lower voltage potential means the metal becomes less reactive and therefore less likely to corrode. Although the system relies on static electricity, the voltage stored on the paint is equal to and opposite of the voltage stored on the metal surface, so the combined voltage of the system will never discharge in a spark.

The overall effectiveness of the CAT system is dependent on the dielectric coating. In most cases this will be paint. Where metal surfaces are left bare, a surface coating of ferric oxide may form, as until this coating occurs no charge can hold on the metal surface. The ferric oxide is an insulator and therefore acts as a dielectric. As can be seen from the above paragraphs, a good quality coating is essential to maximise the protection and prevention offered by the electronic system. Most vehicles have excellent exterior paintwork and adequate interior coverage to ensure effective electronic protection.

With older vehicles, the paint becomes thin and porous as mentioned above and so the harmful layers of salt, acid and moisture are allowed through to the metal beneath. With a vehicle of this description the paint must be sealed to get the full effect of the CAT unit.

Rust repairs can be eliminated and maintenance costs halved, but it is not simply a matter of screwing on a CAT unit and expecting miracles. A System must be applied, not just a Device.

Rust Chemistry

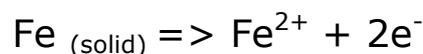
The Rust Reaction

Rust is a naturally occurring electro-chemical reaction. Put simply, the iron, steel, etc. is trying to revert to its natural state, i.e. iron ore. A good example: A hunk of iron ore, freshly mined, and an old engine block left out in a paddock for about thirty years - look similar.

In an electrochemical reaction (rusting for example), a substance is said to be oxidized if it gives up one or more electrons when combining with another element. Conversely, a substance is said to be reduced if it takes one or more electrons when combining with another element.

Rust occurs in two forms: Surface rust occurs when bare metal is left in moist air. This type of rust is a direct reaction between the oxygen and water in the air and the bare steel and in most cases will be nothing more than a harmless surface coating.

The Second form of rust that occurs involves an electrochemical process much like a battery. Ferric ions are formed at some weak point in the metal a crevice, dint or heat stressed area, etc.



This becomes the anode or negative terminal of our battery and begins to pump electrons into the car body. At a region remote to this where the water-air surface meets the metal a second reaction occurs. The electrons from the anode are



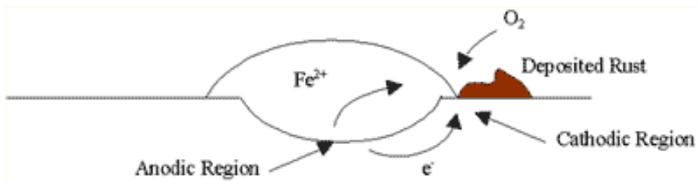
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combined with oxygen in the air and the water to produce hydroxide ions.



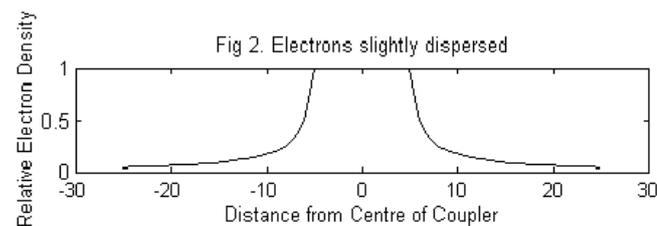
These Hydroxide ions combine with the ferric ions produced earlier and solidify as rust. Because this form of rust favours removal of metal in pits, it is very destructive. Electrochemical rusting is responsible for eating holes into panels and causes rust to bubble underneath the paint.



CAT Physics

The easiest way to describe the physics of the system is to examine the workings of a capacitor. There are three components to a charged capacitor: the positive plate, the negative plate and the insulation layer between them. The positive plate is a sheet of conductive material, e.g. copper that has had a number of electrons removed from it leaving it effectively positively charged. Likewise the negative plate will have the extra electrons that have been removed from the positive plate stored on it. The insulation between the two plates does more than stop the charges passing between the plates, because the insulation material is not exactly a perfect insulator. This means that when placed in the electric field caused by the two plates, the electrons in the material are able to gradually drift towards the positive plate effectively lowering the electric field between the plates. This allows a larger charge to be placed on the plates for a given voltage and the insulator is said to therefore increase the capacitance. Because an insulator becomes polarised in an electric field, the material is known as a dielectric.

The CAT system effectively turns the car body (or other metal structure) being protected into the negative plate of a capacitor. The delivery pads form the positive side of the capacitor allowing the unit to pump electrons out of the pads and onto the car body. Intuitively you may expect this charge to dissipate in to the surroundings, but instead the positive charge on the pads attracts and holds the electrons within the vicinity of the coupler. However the electric field generated does tend to spread at the edges, so for a pad attached to bare metal we might expect a distribution of charge somewhat like this:

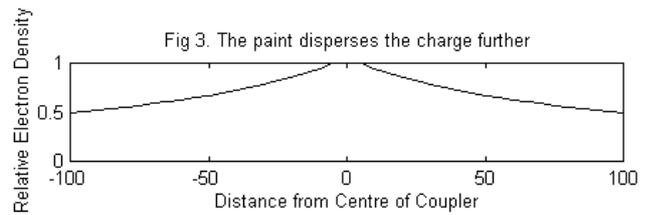


The third component of the car/capacitor is the paint that takes the role of the dielectric. When the charge on the car

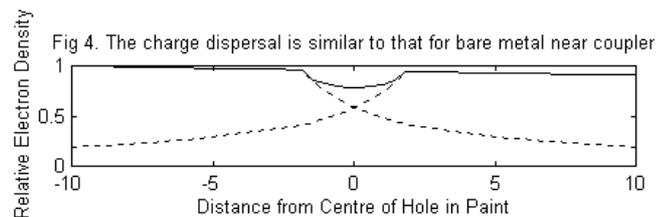
body drifts about randomly an electric field is induced in the paint causing the paint to polarise. Once the paint has polarised the negatively charged outer surface of the paint can easily lose its charge to the atmosphere.

What has now formed is the positively charged inner surface of the paint that is actually a positive plate itself. The positively charged inner surface of the paint can now induce further spreading of the negative charges.

The charge distribution which could be expected is now more likely to be like this:



Where holes occur in the paint i.e. stone chips, small dints and porous sections of paint, the distribution of charge becomes similar to that of bare metal around a positive plate. The paint acts like a positive plate from both sides of the hole and some charge is kept on the bare metal. Unlike when a charged insulator is exposed to air, the bare metal will not simply lose its charge when exposed to air as the electric field produced by the surrounding positively charged paint holds the charge stable. Because this bare metal has no positively charged dielectric cancelling its electric field, a negative field produced by these uncovered electrons will emanate from any bare metal around the car body. Fig 4 shows the charge dispersal on a section of bare metal, the dashed lines represent the field induced by the paint on either side of the bare metal and the resulting distribution of charge is shown by the solid line.



These are the basic principles of the CAT system and how it disperses and holds a negative charge around the car body. Through years of experimenting and trials the electronic rust prevention system has been finely tuned to give the best coverage as well as assisting the prevention of rust through less easily explained secondary effects.

When the unit is operated correctly, it should not induce any significant current through the bodywork and so will not affect car computer systems or produce any significant radio emissions. The charge that is stored on the car is a form of static electricity. Though unlike the charge that can be developed occasionally while driving, the charge is held steady by the pad and paintwork therefore the charge will not discharge suddenly onto a person who touches the car.



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CAT can and cannot...

What the CAT System CAN do

The CAT system has been proven to decrease the rate of corrosion that occurs due to electrochemical processes. It does this by inducing a negative charge on the metal surface that helps make the metal more electrochemically inert. The charge is spread and held by the dielectric properties of the paint. Where the metal is uncovered or poorly covered, what paint is in the vicinity helps keep the charge on the metal surface. By placing a negative charge on the surface, the positive metal ions that are produced during corrosion are less likely to form and the reaction is slowed. The system therefore helps eliminate pitting, rust bubbles and other forms of cancerous corrosion that results from electrochemical corrosion.

What the CAT System CANNOT do

It cannot return rusted components back to metal; the amount of energy that is released in a rust reaction is very large. While the system can help slow and in some cases stop the rust reaction it cannot replace the large amount of energy needed to restore the metal. This makes reversing the reaction well beyond the capability of the system.

It Cannot Protect Large Areas of Bare Metal

It is still important to keep paint on the metal, as paint is required to keep the amount of charge large enough to protect. Therefore it will not be of great assistance on bare metals, including galvanising and other metallic plating's. The CAT system will be of assistance close to paint, so 100% paint coverage that is normally needed to be 100% effective is certainly not as crucial as it is without the protection of the system.

It cannot be too strongly emphasised that Ferric Oxide (surface rust) will form on bare metal or perhaps come through thin, porous paint.

It Cannot Protect the Metal Surrounding Existing Rust

A fact of life in the electrostatics field is that it is almost impossible to hold a charge on a sharp thin edge; such as often exists in rust holes. If covered with paint everything is fine, but exposed areas with thin sharp metal edges will be unprotected. This means that any rust perforations or bubbling will need to be adequately cleaned up, edges filed square and a reasonable coat of paint applied, before the system will be properly effective in that area.

It Cannot Prevent Corrosion Completely

While the system is a unique and very effective rust preventative, its basic mechanism is to slow the electrochemical reactions involved in rust, therefore any bare metal is still likely to develop a superficial layer of surface rust, because this is a direct reaction between the chemical components of corrosion.

Most automotive paints are porous to some degree and will allow moisture to enter and react with the metal underneath, causing the rust to bubble under the paint. When protected by the CAT system, this destructive form of rust is restricted to a thin surface layer of rust. In some cases when it rains, surface rust can leech down the paint as a rusty streak. This is due to

either exposed metal or porous paint and while this rust will not develop into bubbling or pitting, the effect can be unsightly. This problem becomes more apparent as vehicles age and paints oxidise and become thinner. In cases such as this, it is advisable to either give the area a coat of paint, in the case of exposed metal, or wash the area and go over it with a good quality paint sealant in the case of porous paints. The incidence of surface rust leeching through paint is particularly evident in salty conditions and during periods of constant rain. If the CAT system is fitted when the vehicle is new, or near new, it is unlikely that such leeching would occur at all, since the electronic system also protects against oxidation of paint.

It Cannot Perform Miracles

The CAT system cannot perform miracles. Inducing a charge onto the metal surface is a proven and reliable method of reducing electrochemical corrosion, but it has its limits. We therefore suggest that if your corrosion problem is unique, by either the environment the vehicle is working in or the size and paint coverage of the vehicle that the factory is contacted for specialist advice.