T E C H N I C A L I N F O R M A T I O N

Charging System On the 1986-1987 Turbo Buick 3.8L

It's probably one of the most common problems found on these 25+ year-old cars. but not easily understood. Here is some valuable information that can prevent the dreaded "dead battery" condition, and help keep your charging system functional.

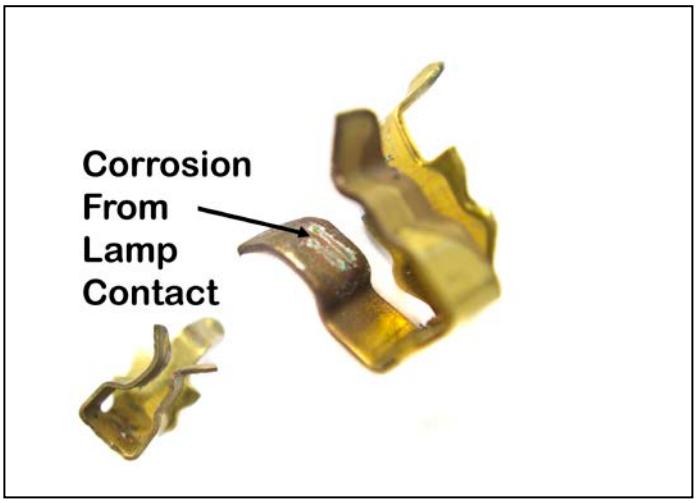
First of all, some of the basics. The alternators are commonly referred to as the CS-130 style, used extensively across the GM line. The turbo cars, however, were fitted with 120 amp capability, which provided extra current capacity over the standard 105 amp models. Generally speaking, the 120 amp alternator is more than adequate, and allows room for a great deal of expansion, i.e. modifying your turbo car with low impedance injectors, higher output ignition, larger capacity fuel pump, etc.

In order for the alternator to produce electricity, it requires a small current to be introduced to the field windings. To do this, a dash lamp "VOLTS" is wired into the alternator "L" terminal of the regulator circuit. One of the two terminals on the lamp is wired to key-switched positive. In addition, the regulator circuit doubles as a charge indicator; when the alternator is not spinning, the "L" terminal is switched to battery negative, causing the VOLTS lamp to illuminate. This is a pre-test indication that tells the driver of the car that the alternator is functioning properly. **Note that the light must be illuminated when the key is on and the engine is <u>not running.</u>** Once the alternator starts to spin (engine running), the VOLTS light goes off and the alternator produces current. If for some reason the alternator fails, the VOLTS light will illuminate, indicating a fault. Sounds simple, right? When the system works, it works well. However, when the connection to the alternator field gets interrupted, everything stops working. And it happens most of the time due to poorly designed electrical components leading to the alternator. Let's look at why this happens.

To start with, the VOLTS lamp is a wedge-style bulb, white bead type 194. It's inserted into a twist-lock socket, then installed into the dash cluster. The contacts of the socket are un-plated brass, but the contacts of the bulb are stainless steel, 4xx material that's magnetic. And herein lies the very reason that the system fails.

It's called "galvanic corrosion", which occurs when there are two dissimilar metals in contact with one another, and an electro-chemical process causes one of the metals to corrode. In this instance, the "electrolyte" is simply moisture in the air, which contains salt and other oxidizers. Since the bulb socket contacts are unsealed, moisture gets in, and when electricity flows across the contact area, corrosion is inevitable. As you can see in the image below, the greenish corrosion is copper sulfate, which does not conduct electricity, and as a result, prevents the connection from conducting.

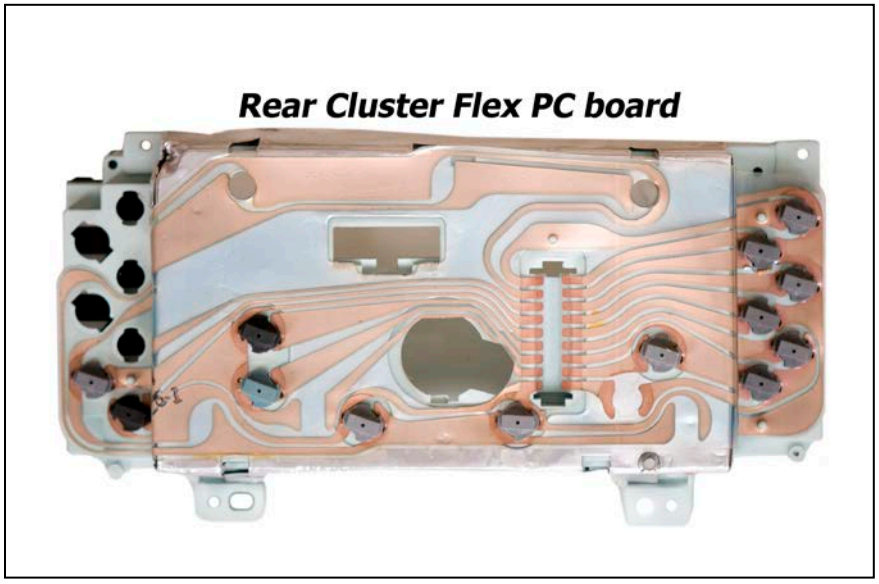
This corrosion caused the VOLTS light to lose its connection to the bulb, and ultimately, to the alternator. **This particular failure caused the owner of the car to spend over $600 to find it;** flatbed towing, new alternator, new battery cables, three hours of mechanic labor, and finally, sent me the dash to diagnose the problem. The fix was simple, but not understanding why can get very expensive!



In this view, you can see how the corrosion from the brass socket has transferred to the stainless steel wire terminal on the light bulb itself. This corrosion introduces a barrier between the metals, reducing or eliminating the electrical connection between the conductors. With a bit of skill, the corrosion can be cleaned off of the contact area, and the bulb assembly will then function normally again.

So now what? How can this be prevented? What can we do to ensure a properly charged battery? First, let's take this charging system a step further and look at how the light bulb connection ultimately makes its way to the alternator.

Going back to the dash cluster, the connection is made through a flexible PC board that is positioned behind the dash cluster. In this view, you can see the circuit board:



The flex board connects all of the lamps from the Telltale assemblies to the dash wiring harness, using a "bow" connector that is sandwiched between the dash cluster and the dash cradle. The bow connector must be perfectly aligned and utilizes the clamping force between the cluster and the cradle. If the cluster is not properly aligned, the clamping force will be reduced, and the connection between the bow connector and the flex board will not be adequate.

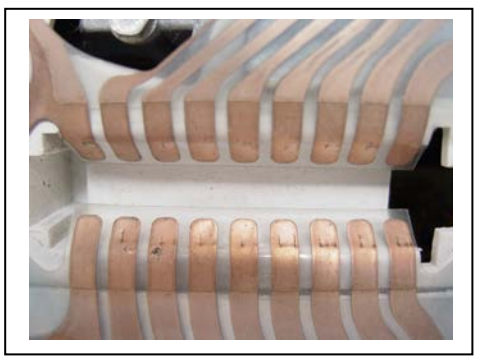
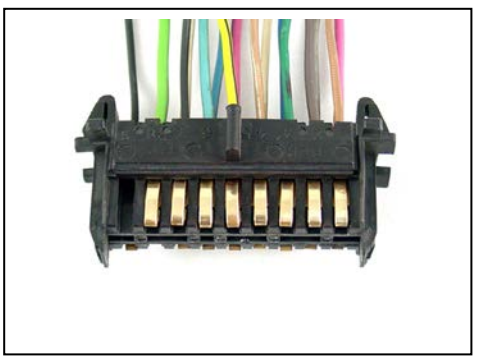


Image on the left shows the flex PC board contacts that engage to the bow connector, as shown on the right. The bow connector is latched into the dash cradle. Be sure that both latches are positioned correctly when the connector is in place.



The flex PC board uses a layered plastic material, with the copper conductors exposed. Since the conductors are bare copper, they are prone to oxidation, which adds resistance to the connections and reduces the electrical conduction. Therefore, routine maintenance includes cleaning and de-oxidizing the copper traces. I'll let you in on a little secret that I used to clean these copper traces. It's called Lysol Toilet Bowl Cleaner. Stay with me here...It's a caustic liquid that should be used sparingly, so here is how you can use it to clean the copper and brass components:

Remove all of the lamp sockets from your dash cluster. Using a Q-Tip and one drop of this cleaner, wipe it on each copper conductor. You will not believe how quickly this stuff works. After the copper is perfectly cleaned, saturate a cloth in water and wash the cleaned copper down so as not to leave any traces of the cleaner on the flex board. Once the traces are clean and dry, use a pencil eraser to polish the copper contacts. Be very careful with the bow contacts in particular; they are damaged easily and can come loose from the plastic base. While I'm on the subject, this liquid will clean anything made of brass or copper more efficiently than the best commercial cleaners on the market. I restored an antique brass cash register using it (throwing this in for effect):

Before

After

OK, back to the core subject. Once you clean the copper traces, take a look at each lamp socket/bulb combination. You will find that some of these lamps don't work, even though they appear to be good. Back to that contact corrosion, you will find it. Remove each bulb and look for the signs (you may want to use a magnifying glass here). Using an modeling knife, scrape away the corrosion if you see it. This includes looking at the brass contacts for corrosion. If it's excessive, you might opt to replace the sockets and bulbs.

Once the bulb is re-assembled into the socket, you can use a 9-volt battery to test them, but you will need to jury-rig a way to make a connection between the battery terminals and the bulb socket. By testing each bulb prior to re-installing the dash, you'll save yourself one big headache!

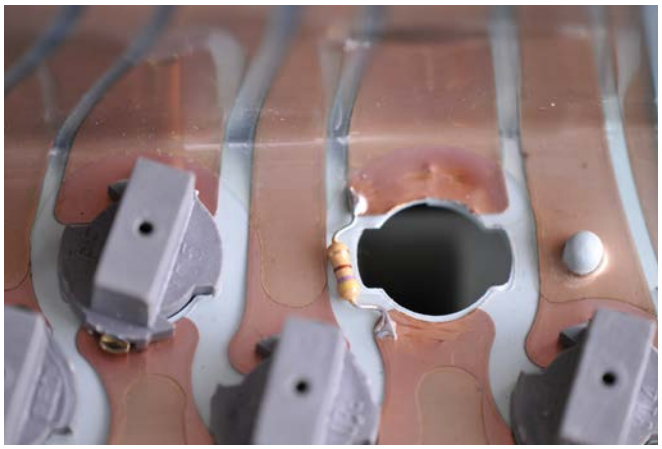
After cleaning the copper traces (and the small brass contacts on each bulb socket), the result will be better and more efficient electrical connections, brighter bulbs, reliable battery charging and so on.

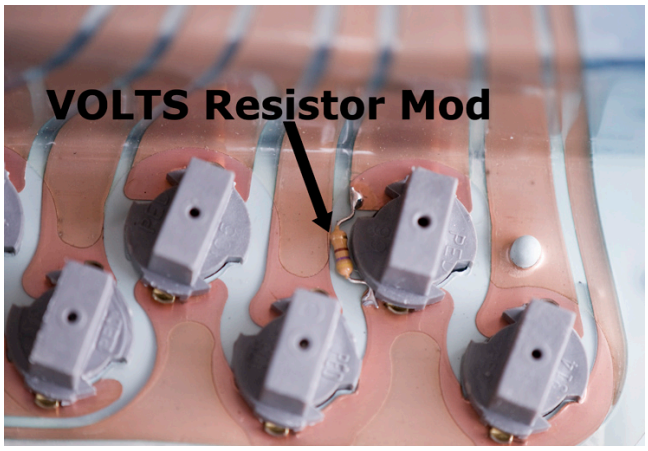
Some of the turbo Regals and Grand Nationals were fitted with a "resistor bulb" assembly. The purpose of this was to enable the alternator to produce current in the event of a burned-out bulb. The specially made socket is easily identified:

Left: Resistor Bulb Socket.

Right: inside view of the specially made socket with a 470 ohm resistor.

Why only some of the turbo Regal production cars had this part and others didn't remains a mystery. Still, it's not an absolute problem-solver. But this procedure takes it a step further:





In this image, the VOLTS lamp was removed, and a 470 ohm 1/4 watt resistor is soldered - albeit VERY carefully - onto the flex PC board. Then, the bulb is put back into its location. The result? Current will always pass through to the alternator, even if the bulb is removed completely. This way, the alternator will always charge when necessary. This modification is standard when your cluster is sent to Caspers for repair and upgrade. It's a permanent fix for the potential (and common) problem, as long as the dash doesn't experience flex board failure. As a footnote, a blown LPS fuse will prevent the alternator from charging, as that fuse supplies 12 volts to the VOLTS lamp.

Here is a reference to various lamps and sockets found in the dash clusters. Note the color of the bead is relative to the intensity of the bulb; brown bead being the brightest wedge lamp.