

ERA EXCHANGE

YOUR GUIDE TO ELECTRICAL REBUILDING

September 2018 \$12.95

AUTO ELECTRIC CORNER

**A 32 Volt 40-MT and One-Wire
10SI Woes**

CORROSION – CAUSE AND EFFECT

Oxidation, Galvanic and Electrolytic

COMMON SENSE | OVER OR UNDER SELLING
There Is A Better Way



A WORD FROM THE PRESIDENT

Strong Web Presence



I am still surprised at how many of our members are lacking a good web presence. What is a good web presence? It means that anyone searching for the goods and services that you offer will be driven to your door. That is - they will find a web page or pages that sell them on giving you their business. Without it you are missing opportunities.

If you have not done so recently, I strongly suggest that you do a series of web searches using key words like: alternator, starter, battery and the town and state in which you are located. You may be amazed by the number of free listings that you already have. But those are not a strong web presence. They will only help those who are already looking for you to find you - like the business white pages once did. Those listings never drove customers to your door. If you remember, they were also free. You needed an ad in the Yellow Pages to attract business 20 years ago. Today, that Yellow Page ad is a website.

There was a time no so long ago that you had to pay a web developer to build and manage a website. You may have once explored the idea and rejected it based on the cost. Well, there is good news. Prices have dropped drastically. It costs a lot less than it did just a few years ago. Improving your shop's web presence may seem like an intimidating task, but it is easier and less expensive than you think.

Web hosting sites want your business and believe me, they will help you do it yourself. If you have some basic computer skills, time and patience, you can do it. While I am far from being an expert, I have taken that

step myself. A website does not have to be elaborate to be effective. But your success will depend heavily on the amount of effort that you put into it.

First you must define what you want. Do some research on your own. Look at your competition's websites. Look at the websites of other ERA member's. Look at the websites of other small businesses in your area. Make notes. Write down or sketch your ideas. Plan what you think want. That is the first step. Do that over the next few weeks and next month I'll explain where to go from there.

Think of a website as a billboard along a busy highway - but one in which the drivers place themselves only in front of web pages showing products that they are looking for right now. Without a website, you are losing those drivers every single day.

Mike Dietrich

NEW ERA MEMBERS

Mike's Electric & Small Engine Repair
St. Ignatius, Montana

ABOUT THE COVER

Air, moisture and steel = RUST

Announcing the 2019
ERA Trade Show
to be held in

Springfield

Missouri

Check back in later
issues for more
show information,
including dates and
hotel reservation
details.

ERA EXCHANGE

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office@electricalrebuilders.org

EDITORIAL ASSISTANT / Bob Thomas

DESIGN & PRODUCTION / Stephanie Schroeder

CONTRIBUTING WRITERS / Mike Dietrich,

Mohammad Samii, Bob Thomas

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Rebuilding is Recycling!

INDUSTRY NEWS

& ANNOUNCEMENTS

Correction and Clarification

In the last issue, we featured a new solenoid for 6 volt positive ground vehicles. ERA Technical Advisor Mohammad Samii pointed out that the way we described it was incorrect.

He wrote: "In the Industry News & Announcement section of the August 2018 issue, the headline reads "6V Ford Positive Ground Solenoid". I believe this solenoid is not exclusively for positive ground applications and would also work with negative ground applications as well. This was also repeated by a comment from our colleague, Larry Hagemeister of HEI (Lebanon, OR) saying "....I am really glad that we now once again have this part to offer our customers who own vehicles with 6 volt positive ground systems...". Unless there is more to the construction of this relay in addition to an "I" terminal, I do not see any reason to consider it to be for positive ground applications only.

And since the discussion is about the polarity, it should be mentioned (as I explained it on the Forum some time ago), the spark ignition system, regardless of the voltage (6-12-24,...etc.) and the type, is always a positive ground system, which allows the spark to jump from the center electrode

outward toward the tab or tabs, and not the other way around.

This is true for old, new, DIS, and COP (coil-on-plug) and all newer ignition systems of today, where the ignition coil construction allows this reversal of polarity to happen. In older car and tractor applications where the system's polarity was switched (usually from positive ground to negative ground) the ignition coil wires had to be switched also so the spark could still maintain its polarity and be a positive ground system for the spark only."

Editor's Note – *The misunderstanding was my fault for not explaining the new solenoid's purpose fully and misquoting Larry Hagemeister. From what I understand, no vender offered a 6 volt fender mounted solenoid with an I terminal until Turbo Supply brought it back into production – unless of course you could find an obsolete part. While this solenoid was designed to be used on 6v Fords, it can be used on any 6 volt application calling for a fender mounted solenoid – either positive or negative ground. A thank you goes out to Mr. Samii for noticing our omission and taking the time to clarify why all ignition systems are positive ground.*

ERA Unit ID Labels

Don't forget about our new ERA Unit ID Labels! For label specifications and order inquiries, see page 14.

Give us a shout!

Is there a topic or article that you'd like to see covered in the ERA Exchange? Call Bob Thomas and let him know about it – 904-673-7301. The ERA wants to help you!

AUTO ELECTRIC CORNER — A 32 Volt 40-MT and One-Wire 10SI Woes



BY MOHAMMAD SAMI

The new ERA label that was introduced during the last ERA Show is a unique and useful product that can give your rebuilt units a professional look. A part number can be very useful for units that lack one, which in turn can help the next rebuilder with identification. You can also use your own number or any other part number for your own identification purposes in the future.

The price is a very reasonable \$11.00 per sheet of 18 (cost is less if you buy more), which comes to a mere 60 cents for each label. Once you try it, you will like the professional look that it brings to your products, not to mention the help it can give you or another colleague down the road later (see Figure 1).



Figure 1 – ERA ID Tag on an early type rebuilt starter.

32V 40-MT Starter...!

A lot of 40-MT starters have been replaced by a 42-MT or with the later 39-MT along with a variety of other reduction gear starters, but there is no denial that the 40's were very robust and solidly built. A good reman 40-MT with a quality armature, field coils, solenoid and Posi-Tork drive would last a long time if not abused by an operator, exposed to mediocre batteries, or poor cable connections.

There are still a lot of them around, especially on older machinery and farm trucks where the owners prefer to have the original rebuilt rather than something newer that looks unfamiliar to them.

There are other specialized applications where rebuilding the original is the only option. One such case was a pair of 32V 40-MT starters that we rebuilt a couple of weeks ago, brought to us by a good mobile technician/customer who strictly works on HD and large Ag/Industrial machinery. We were told that the starters fit a small locomotive that is used as a switch engine to shuffle railroad cars at a railroad yard about 40 miles away. The second starter was an identical spare to be kept on-hand for emergencies.

The armatures used in these starters were the common 1945500 (2023) 24/32V, however the field coils had a pronounced difference as compared to familiar 40-MT coils. They had a thin shunt coil wrapped into two opposing coils to make the fields a peculiar series-parallel arrangement. The shunt works as a sort of speed limiter, which I believe is exclusive to these and/or higher voltage starters such the 64V or other such units (see Figure 2).

The higher operating voltage does not allow for much recovery of parts as the field coils, armature, brush holder and solenoid contacts are not reusable if the starter has been subject to abuse, arcing, low battery condition or over-cranking. One of the field coils that did not look burned and seemed to be usable was put in its field case, but under a hi-voltage test (we use our own home-made 110 volt test fixture), it started arcing, then a little smoking (see Figure 3), and then the oil residue soaked up by the coils caught on fire! (see Figure 4)



Figure 2 – The 32V (1951048, J&N's 261-12112) field coil.



Figure 3 – Developed smoke under Hi-Voltage testing.

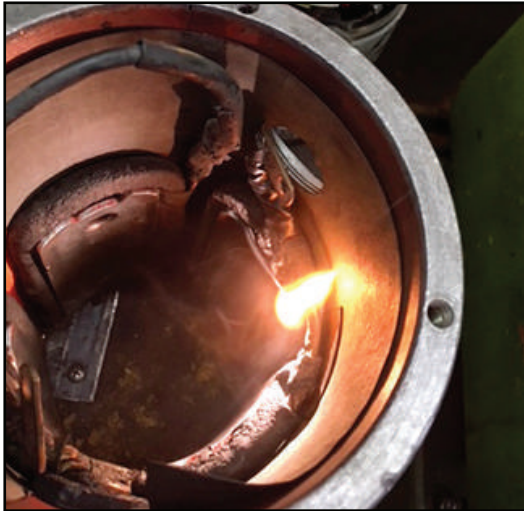


Figure 4 - Flames when the oil and solvent residue caught on fire!

Needless to say a new field coil (Delco 1951048, J&N's 261-12112) is not inexpensive but had to be used. The 32V (1115560) solenoids used on these units were also destroyed and were replaced by a pair of 245-12073, J&N's premium solenoids. For testing the unit we used our 24V power supply pack (two 12V batteries in series) and added the 6V battery that we use for generator testing to come up with a total of 30V which was close enough for a free-run test and pinion adjustment.

One point that is often ignored is to consider that pricing such work must go beyond the price of parts and labor. A 32V 40-MT starter with all new components used for a locomotive is not something that can be easily purchased at an auto parts or web store. Thus the pricing should reflect the value of the unit in the market, and not merely the sum of parts, mark-up, and labor involved.

Self-exciting alternators...!

I am not a big fan of making self-exciting one-wire alternators. I know they have their place in our field and sometimes are a practical fit or a necessity for older machinery that is kept outside and their wiring deteriorated by age and weather. Having said so, I refuse to make single-wire alternators for cars and trucks that can be driven to our shop and be repaired properly. I cringe by the calls on the ERA Help-Line when asked for the SE regulators to modify a PCM-driven Ford 6-G, a CS-130D, or a Denso alternator, just because the owner does not want to spend the money to have it done right, but I also do understand the exceptional cases. Here I share the details of two such alternators that happened to be 10-SI, that are the most common candidate for single wire modification:

1 - This shiny chrome 10-SI alternator that was purchased off Ebay and was brought in because it did not last more than a week, according to the customer. It was used on some sort of racing car, which I was never told the type. I am not a fan of car racing at all. If you are one, more power to you!

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AUTO ELECTRIC CORNER

The voltage regulator was blown, and I mean it literally! The high-voltage spike that was generated was so strong that it blew out the electronic circuit to where you could see the traces of soot and smoke generated on the face of the regulator (see Figure 5).

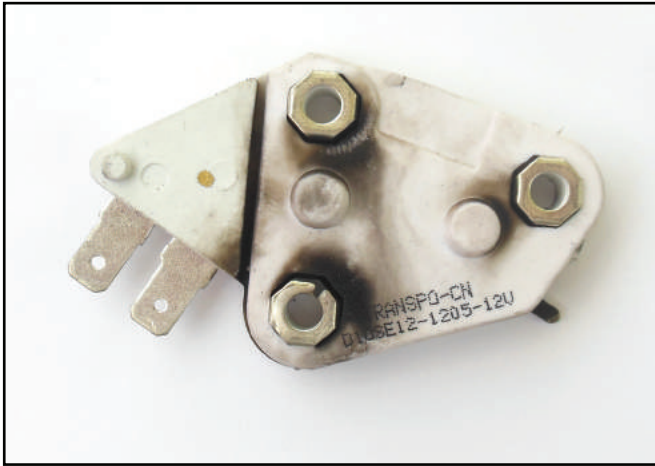


Figure 5 – A regulator destroyed by a severe load-dump.

I believe that according to some racing rules, these cars must have a master battery disconnect switch accessible from outside the car, where a rescue crew can reach and disconnect it in the case of an accident or emergency. At times, the drivers and/or technicians

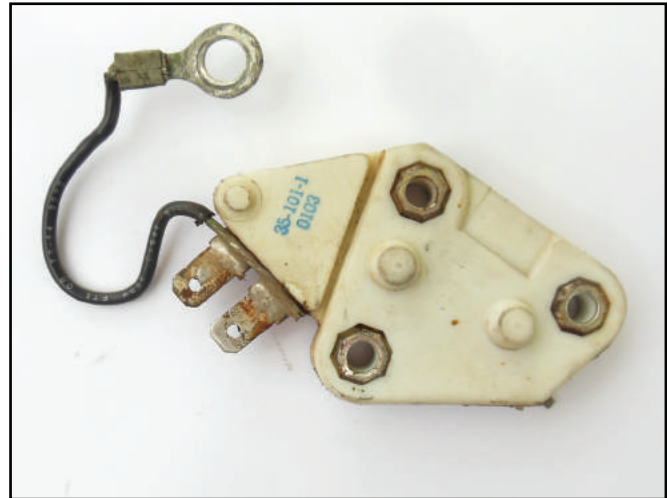


Figure 6 – A sub-par effort to make self-exciting 10-SI regulator...!

used this switch as a kind of quick engine shut-down. Disconnecting a running and charging alternator from its power source (+B) creates a serious load-dump. The resulting high voltage spikes that creates can burn holes in the regulator chip. It will be analogues to running over a tube of toothpaste with a car...! That was exactly what happened to our customer's alternator with repeated disconnections. He was not aware that this procedure is a no-no and he should never try it again. A lesson that he could not have learned from Ebay...!

2 - The second 10-SI was used on an older farm tractor that the owner said had replaced the original generator - also a single wire alternator. We were told that it charged fine when running but after being parked overnight or even for a few hours, the battery would go completely dead and had to be recharged to start the tractor. This was a problem that he obviously did not have with the old generator.

Upon tear-down, we noticed that the single wire modification consisted of using a regular 10-SI regulator, a wire soldered to connect the two pins, and attaching it to the battery post internally by an eyelet! The reason for the battery being discharged completely is obviously not a surprise to you now...! (see Figure 6)

I just wish that I knew the rebuilder who did this, were able to bring him onboard, and let him learn from our amazing resources of people and information that we have in our association. A half-hearted attempt to replace a generator with an alternator that is not right has a negative effect on all of us who try to do a professional job.

That's all for this issue. Until I see you again, keep up the good work. sammyselectric@sbcglobal.net

NEW ERA MEMBER BENEFIT

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Members Helping Members

COMMON SENSE — OVER OR UNDER SELLING

There Is A Better Way



BY BOB THOMAS

Several months ago, my youngest son Matt called to ask me a business question. He owns and operates an independent furniture store that he opened about eight years ago with the help of a small loan.

Matt started selling furniture on commission as a summer job in high school, made too much money for a 17-year-old to handle and dropped out of a work-study curriculum half way through his senior year. He never graduated nor sought a GED. But he was born with a gift for persuasion and has always had the ability to sell anything.

In that first job he broke the store's daily sales record his first day on the sales floor. He quickly became the top salesperson at that location and soon after within his district that included ten other stores. By the time he reached the age of 19, his district manager offered him the job of running a new store in Orlando. At the time, I tried to dissuade him from accepting that offer even though I knew that he was going to take it anyway. There are some things that we just have to learn on our own.

But that was 20 years ago. Since then he left the national chain, opened and closed two independent furniture stores in which he had partners, sold used cars at tent sales all around the US and even worked as a telephone debt collector for a while. He partied as hard as he worked, got himself in legal trouble, was addicted to alcohol and drugs and has been through rehab more than once. You could say he's earned a PHD from the school of hard knocks.

He traveled a long road to get where he is today and I'm glad that he has learned from all those experiences – both good and bad. So when he wanted to ask me a business question, it really peaked my curiosity.

As it turned out, he wanted my opinion on whether it is better to over-sell or under-sell. I thought that this was a strange question for him. Matt had been a high volume salesman for most of his life. He had made a lot of money overselling. He had been an over-seller from an early age, spinning yarns to get himself out of trouble in grade school. It had been his method of choice for most of his life.

But then I realized that Matt was actually questioning his own past behavior. He had evolved beyond that, or he would not be asking for my opinion on hard selling versus soft. He was searching for guidance and possible confirmation about something that he had actually already figured out on his own.

Without hesitation, I told him that I believed that underselling is always the better approach for any local business in the long term. You may not close as many sales as you would when over-selling, but your customers will not depart with inflated or false expectations either. A hard sell inevitably influences what your customers expect. Some of them will then regret those purchases later. In their mind, it was your fault.

When the only incentive is to sell as much as possible, the seller puts any long-term business relationship at risk. If that customer happens to have a large social network, the sacrifice can be multiplied ten fold or more. In today's world of instant communication, a single disenfranchised customer can cost you untold future sales.

Over-sellers fail to recognize that they can generate significantly more income from referrals and return customers than they ever will by misleading customers into buying things that they don't really need or want.

On the other hand, under-selling your product has a downside too. You will lose some honest sales if you consistently under-sell your products. This may appear to be a dilemma – where you are damned if you do and damned if you don't, but there is another choice.

Over and under selling are both focused on the sale. The alternative is consultative or need-based selling which focuses on identifying and fulfilling the customer's needs. With this approach you are no longer a salesperson, but now a technical consultant. Asking questions is the key to this type of selling. It is the only way for you to truly understand your customer's situation and figure out how you can help. Asking questions also tells the customer that his or her needs are your primary concern.

Need-based selling fits right in with our line of work. In our industry, potential customers call us or walk in because of a real need. The key to turning that into a sale is determining exactly what that need is and offering real solutions that only you can supply.

Sometimes, maybe even often, our customers do not know exactly what they need or may even be mistaken about what they believe they need. If they think their need is a starter or alternator, and you have any doubts that they really do, you should at least share that with them in a polite way. When you genuinely want what is best for each customer, you hold off discussing your product or service until you understand their needs.

Does it mean that you have to spend more time with each customer? Yes it does. Is it worth that extra time? Consider this: **It is the one thing that you can do to set yourself apart from all other shopping options.** When you get good at this, you become invaluable to every customer.

Last week, I dropped by Matt's store for a visit. It was a busy day and he was tied up with customers. I sat down nearby on a comfortable sofa and just watched and listened to his conversations. An hour passed before he could get free to talk. Not once during that time did I hear Matt or any of his employees say anything that sounded like a sales pitch. Yet most the people who came in while I was there found and bought what they were looking for.

CORROSION – CAUSE AND EFFECT

Oxidation, Galvanic and Electrolytic



BY BOB THOMAS

A true story was passed on to me at the last trade show by ERA member Dan Bell of Bellingham, WA, the owner of Whatcom Electric and the Aptrak Online database. The tale that he told had to do with a ferry boat that was taken out of service annually for inspections, preventative maintenance and repairs.

This vessel is powered by two diesel engines. For several years, the cylinder sleeves on one engine had suffered a serious re-occurring problem - some or all of them on that engine were badly pitted and had to be replaced. The cylinders in the other engine had been totally unaffected. Believing the problem might be connected to electric current flow, the county brought in an electrical specialist from outside the area to determine why one engine was eating liners.

The engines were basically identical and isolated from one another electrically. Each had its own battery bank and negative ground alternator. Apparently most of the vessel's 12 volt loads were connected to one battery bank – not surprisingly the one that had needed repairs every year. The specialist measured for stray current and determined that they needed to tie the grounds together for both engines. They followed his advice. The following year both engines needed new liners.

It was then that someone recommended a hometown electrical expert, Dan Bell. “We determined that the way it was wired was forcing all return current to flow through the engines – making them a part of the charging circuit,” Bell explained. “It was an invitation for electrolysis, which is corrosion times three. We recommended that they install isolated ground Leece Neville 110-555 alternators on both engines. That way we were able to isolate the grounds between the alternators and the engines.”

Twelve months later the next annual service was performed. The cylinder walls of both engines passed inspection. This story is but a small example of the kind of damage that unbridled electrolysis can do.

While marine applications in particular are especially prone to corrosion, do not forget that equipment used and stored outside are exposed to similar conditions – the presence of moisture, air and salt (from fertilizers, chemicals or deicers) is an open invitation for all types of corrosion.

There are three kinds of corrosion that can take place on any metal part found in or around a charging or starting circuit. They are oxidation, galvanic corrosion and electrolytic corrosion. Any one of them can cause a loss of metal and inhibit the flow of current in alternators, starters or any parts of their circuits. Each one is caused by its own unique set of circumstances. To prevent or at least mitigate them, you need to understand what causes each one to occur, and what you can do to minimize them in relation to your products. Being able to identify and correct corrosion problems for your customers will go a long way toward exceeding their expectations.

Oxidation – Rust by Another Name

Oxidation is a natural chemical reaction in which metallic atoms give up electrons to oxygen molecules, bonding the two together to form an oxide. Many natural metal ores are oxides, so in a way, oxidation is the process of a pure metal or alloy returning

to its natural state.

One of the more common and highly visible is rust, which is a hydrated iron oxide. Moisture in the form of water or humidity in the air is required (*see Figure 1*). As you can see in the photo, rust leaves a flaky surface that is porous, meaning that the reaction can penetrate deep into the metal. Any iron object exposed to air and moisture will convert entirely into rust given enough time. Salt accelerates the conversion.



Figure 1 – This wiper motor mounts under the cowling on a Santa Fe, where it is exposed to moisture every time it rains.

Most metals will oxidize to some extent from oxygen in air. Electrons leap from the metal to attach to oxygen molecules. These negative oxygen ions penetrate into the metal, causing the growth of an oxide surface. As the oxide layer grows the rate of electron transfer decreases. The corrosion eventually stops and the metal is made passive. The oxidation process may continue, however, if the electrons succeed in entering the metal through cracks or impurities or if the oxide layer is dissolved.

What should concern us most is the fact that many metal oxides are poor conductors at best. Some even have insulating properties. When aluminum is anodized for example, a hard surface layer of aluminum oxide is formed. This protects the underlying aluminum from exposure, but the anodized surface is now non-conductive. Alternators that have been anodized must have their oxidized layer removed from its grounding contact surfaces or be equipped with a ground stud (*see Figure 2*).

Since aluminum is widely used for alternator and starter housings, they are susceptible to the formation of a layer of oxidation. Aluminum that has oxidized naturally in a moist environment will form hydrated aluminum oxide, a white crystalline coating (*see Figure 3*). Like rust on iron, moisture accelerates the formation.

It is worth mentioning that there are many rust converters on the market today that do an excellent job of protecting an iron or steel surface from rusting any further. They are perfect for protecting tools that are used outdoors, but should not be applied to any surface that must make an

CORROSION – CAUSE AND EFFECT

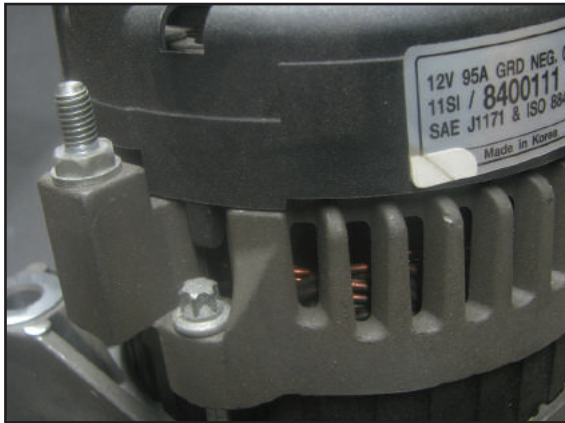


Figure 2 – This anodized 11SI Delco alternator fits marine applications. Note the ground post to insure a good negative connection.



Figure 3 – This alternator has been exposed to moisture laden air and is covered with hydrated aluminum oxide.

electrical connection. These converters work by penetrating the rust and using chemical reactions to change it into a polymer that effectively seals the surface and thus prevents any further exposure to air or moisture. But that polymer is also an effective insulator that prevents current flow.

Galvanic Corrosion – Makes Its Own Current

Galvanic corrosion is an electro-chemical reaction that takes place whenever two dissimilar metals make contact in the presence of an electrolyte. The electrolyte can be any liquid that is not an insulator, even something as simple as rainwater that has been slightly contaminated by carbon dust, road dirt, fertilizer or salt. Where those conditions exist, galvanic corrosion will take place.

The difference between the electropotential of the two metals drives the reaction. The galvanic table (see Figure 4) lists some of the more common metals in the order of their potential. Any two of these can react with the lower number becoming the anode and the higher number becoming the cathode. The anode metal will begin to dissolve into the electrolyte. At the same time, corrosion of the cathode metal is inhibited. The farther they are apart on the chart, the greater the reaction. You have probably seen the results of galvanic corrosion on aluminum commutator end housings that are connected electrically to steel brush holders, field cases or both (see Figures 5 and 6). Notice that they are only two places apart on the table.

Figure 4

1	Aluminum
2	Zinc
3	Steel
4	Iron
5	Nickel
6	Stainless Steel 400 Series
7	Tin
8	Lead
9	Brass
10	Copper
11	Bronze
12	Stainless Steel 300 Series

Lower numbers are more anodic (+)
Higher numbers are more cathodic (-)

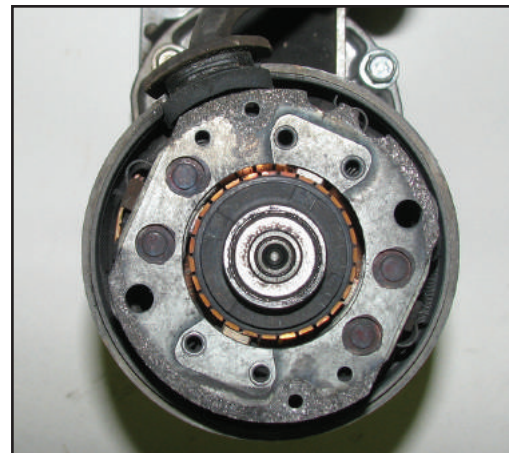


Figure 5 – You can see a ring of deposited aluminum around the outside of the steel brush holder in this Hitachi Duramax starter.



Figure 6 – This is the Duramax starter's aluminum CE housing with a matching ring of missing material.

CORROSION – CAUSE AND EFFECT

You can prevent this type of damage from taking place inside your starters, even in the harshest of conditions, encountered in marine, agricultural or outdoor equipment. The method is as simple as applying dielectric grease to the contact areas (see Figure 7). This will effectively seal those surfaces and prevent any moisture from getting to them.



Figure 7 – The application of dielectric grease to the contact surface on this Bosch CE will fill any air gaps that might accumulate moisture.

Galvanic corrosion also attacks the tin plated copper battery clamps that are now used by all auto manufacturers. In a past issue, Dan Marinucci explained how dielectric grease can be used to protect them. If you have ever looked closely at the battery connections on a new vehicle, you may have noticed that the manufacturers have been using it there – sparingly as you might expect, but it is applied on the assembly line none the less. As Marinucci demonstrated, contrary to myth, this use does not hamper the integrity of the connection in any way. It simply fills the air gaps that are always present and never able to conduct current anyway. That in turn prevents any moisture from getting into those air gaps.

Electrolytic Corrosion – A Form Of Electrolysis

Electrolytic corrosion is somewhat similar to galvanic corrosion in that they both involve current flow and require an electrolyte. In galvanic reactions, the source of the current comes from within, taking place between two dissimilar metals and the electrolyte. Together, they essentially form a galvanic cell that functions in the same way as the cells of a battery. Since voltage levels are low in a single cell, galvanic corrosion takes place gradually, over time, sometimes taking years before it causes serious problems.

Electrolytic corrosion on the other hand is caused by current flow from an outside source, like an alternator, a set of batteries or an AC to DC inverter. Consequently, voltages are much higher and the reactions and damage they cause happens at an accelerated rate – hence Dan Bell's reference to “corrosion times three!”. As voltage

ERA REBUILDER UNIT LABELS

All labels are printed in bright color on a heavy heat-resistant stock with high-bond adhesive backing. They are laminated with a clear layer that is resistant to oil, gas and water. They will give your products a professional look that will set them apart from the competition. Labels are affordably priced and can be ordered right off of the ERA website or by calling the ERA office at: 636-584-7400. All prices include free shipping.



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WATER DAMAGE MAY VOID WARRANTY
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Sold in sheets of 18
\$6.50 1 sheet
\$5.20 3 sheets
\$4.20 6 sheets or more



DO NOT STRIKE
Size: 1.5" x 3.0"
Sold in sheets of 18
\$6.50 1 sheet
\$5.20 3 sheets
\$4.20 6 sheets or more



START ONLY FROM SEAT
Size: 1.5" x 3.0"
Sold in sheets of 18
\$6.50 1 sheet
\$5.20 3 sheets
\$4.20 6 sheets or more



CORROSION – CAUSE AND EFFECT

increases the corrosion rate is amplified and it is constant for as long as the current flows.

Under a controlled environment, electrolysis has many useful purposes, including electroplating, ore refinement, the production of industrial chemicals and the production of oxygen. But when it is unintentionally introduced, as with in the engines of the Bellingham Ferry, electrolysis can cause a lot of damage in a relatively short period of time.

While the presence of direct current is required for an electrolytic reaction to take place, in some cases, stray current from an AC source – like shore power on a boat – can cause damage when the circumstances are favorable. For that reason, marine wiring codes and insulation requirements are designed to limit electrolysis as much as possible. Grounding circuits for all electrical equipment should be kept isolated. This is especially important for aluminum or steel hulled boats.

If a boat owner should bring in an isolated ground alternator, do not sell him a case grounded replacement off your shelf to save them a few dollars or an extra day of turn around time. A costly internal engine problem down the road, traced back to your case-grounded alternator, could create a serious liability problem for you.

Special thanks to Dan Bell for sharing his story and suggesting this topic.

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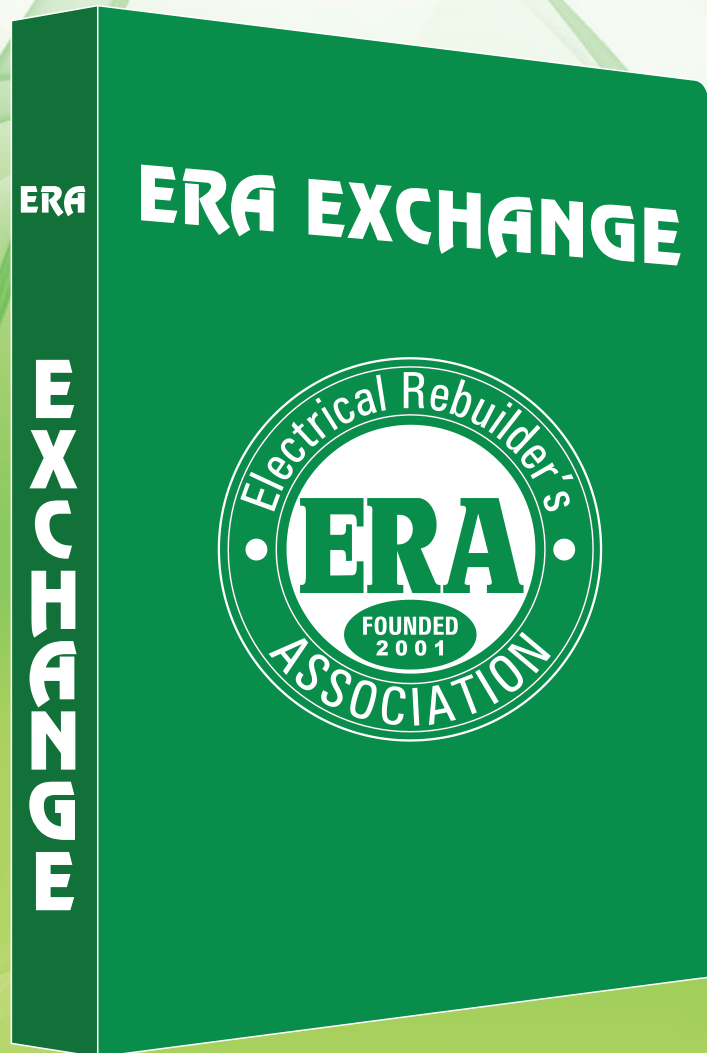
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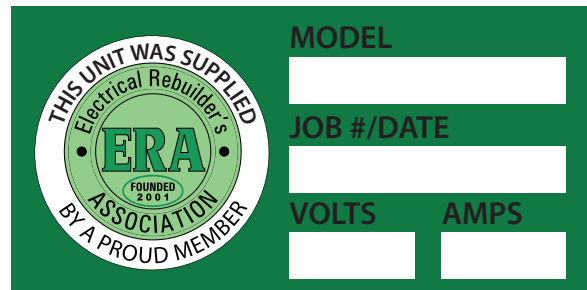
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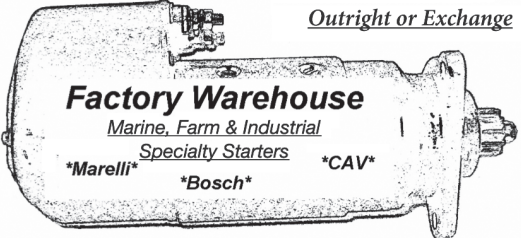
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