# ERA EXCHANGE

YOUR GUIDE TO ELECTRICAL REBUILDING

June 2020 $12.95

## AUTO ELECTRIC CORNER
Housing Repair, Internet Follies, Alternator Fuse and Old Stock Sale

## BATTERY CHARGER REPAIR
The Basics - Part 1

## ERA TECH TIP
Unique John Deere Charge Light Circuit

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2020 ERA Tradeshow Announcement

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## COMMON SENSE
Caveat Emptor - Let the Buyer Beware

# A WORD FROM THE PRESIDENT
## Website Additions & ERA Expo 2020



For those members that visit our website regularly you may have noticed some added features to the homepage. For those that don't use our website regularly, I encourage you to do so as you are not getting the full value of your membership. We have introduced two new features to the homepage menu.

The first is an ERA Products page along with a new shopping cart feature at the right side of the top menu labeled Cart. This will make it a lot easier for you to find and purchase items and labels that the ERA offers to members. The products page is a directory of everything that the ERA has available. Once there, you can choose any of the listed items which then takes you to that item's page for a full description.

The ERA's shopping cart works just like Amazon, eBay or any other online store. Once the purchase is completed, your order along with your shipping information is sent directly to the ERA Office where it will be processed and shipped. You no longer have to buy items individually.

The other new addition to our website is a link page to Malhe/Letrika's E-catalog that was graciously provided by their USA representative Bob Hopko who happens to be the ERA North Central Regional Vice-President. You will find it on the left side menu as Mahle Ecat.. That takes you to a Mahle Ecat main menu, where you choose any one of the 6 look-up tools – look-up technical data for a particular unit, look-up units by application, cross reference OE manufacturer numbers to Mahle number, look-up Malhe unit numbers to find other Mahle units that can be substituted, spare parts to find component part numbers, and a list of the newest Malhe electrical parts.

My favorite is their spare parts tool where you search by a Mahle, Letrica or Iskra unit number and it displays a illustrated parts breakdown (within seconds) along with all current component part numbers. This feature has been greatly diminished by our current suppliers website's B.O.M. programs. For the members not aware of the Malhe/Letrika E-Catalog Website your ERA Membership will give you the benefit of easy fingertip access to this information to enhance your business operation.

Now on the topic that everyone is anxiously awaiting to hear about, the 2020 ERA Trade Show Expo. Unfortunately the Governor of Ohio has announced that the restriction on any gatherings of more than 50 people will not be lifted until some point in July at the earliest, making our June date officially a no-go. With that information, the decision to regretfully cancel the 2020 ERA Expo in Cincinnati Ohio for this year was inevitable as no other later dates were open this year.

As for information regarding refunds - all registrants and exhibitors should have been notified via phone call or email by the time that you read this. A notice should also be posted on the ERA's website. Due to the loss of the revenue that the ERA Trade Show Expo provides, I will be initiating a spending freeze on all non-essential products and services as well as on going developing projects.

*Ken Plourde*

## NEW ERA MEMBERS

Southern Starters
Houma, Louisiana

Kautz Electric
Atchison, Kansas
*Recruited by Juan Grube at JIMCO*

Chargers Auto Electric
Machesney Park, Illinois

Starter Alternator Repair
Centreville, Michigan

**ABOUT THE COVER**

Battery charger transformer and rectifier.


# ERA EXCHANGE

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Rebuilding *is* Recycling!

# INDUSTRY NEWS
## & ANNOUNCEMENTS

## 2020 ERA Tradeshow Announcement

Due to government restrictions concerning the COVID-19 virus, the ERA Tradeshow Committee is announcing the cancellation of the 2020 ERA Tradeshow in Cincinnati.

The tradeshow has been rescheduled for **March 25-28, 2021** at the same hotel, The Holiday Inn Airport in Erlanger, Kentucky. J&N Electric is still opening their facilities for us to tour. Refunds will be made for registrations. **Please be patient until the ERA Office contacts you about your refund!** The hotel is cancelling your reservation so you will have to reserve your room for next year's show again in the future. Please watch for more announcements for the next show. Thank you for your support!

## JIMCO Under New Ownership – The Torch Has Been Passed

On May 1, Juan and Carolyn Grube finalized the sale of the assets of their business, JIMCO Inc. in Raymore, MO, to Ryder Keller, an electrical rebuilder and ERA member since 2004. He is the owner of Del Ray Electrical Rebuilding and Del Ray Voltage Systems, both in Aurora, NE.

JIMCO, Inc. is a major manufacturer of test equipment, test leads and replacement wiring parts for the automotive aftermarket. Their equipment line includes alternator - generator - starter test benches, quality control alternator testers and alternator component testers. With few exceptions, JIMCO manufactures every item that it sells. As a manufacturer, its sales are primarily to automotive electrical rebuilders and to their suppliers. JIMCO is well known throughout the industry for its technical information and testing manuals.

"Juan called me last October to inquire if I might be interested in purchasing JIMCO," Ryder recalled. "Of course I knew the products. We use the products and a JIMCO test bench, so I was excited about the prospect from the very start. I made the 5-hour drive to Raymore a week or two later to talk the Juan and Carolyn. My initial thought was that I would load up the equipment and inventory and move it up to Nebraska, but after meeting the employees, seeing the scope of everything JIMCO does, and the details and quality that goes into every product, I realized that I had to rethink that.

"JIMCO tries to buy everything possible locally in the Raymore-Kansas City area. They have established long-time relationships with those vendors which is very important to getting consistent lead times and quality materials. I realized that I had to try to put together a budget that would work so that we could keep JIMCO in Raymore."

"I am excited about this sale," Juan stated. "Ryder is the only person that we talked to about selling over the last five years who knows enough about the business." "We both realized that it was time," Carolyn added. "We are in our mid-70's now and felt like JIMCO deserved stronger leadership than we are able to provide."

"On the first meeting with Juan and Carolyn," Ryder remembers, " they explained that they had seen a few of their friends, also suppliers to the rebuilding industry, sell their businesses, which had not gone well. It was very important to them from the the start that this transition go well to maintain their product and reputation. I'm excited about this opportunity to take over such a well known, well respected company in our industry and will do everything in my power to maintain and build on the JIMCO legacy.

"I will be managing the company remotely and will be available by phone daily. I have been and plan to continue to make the drive to Raymore every other week into the foreseeable future, more to learn about the products and assembly procedures but also to manage the company. The new company name is Jimco Technologies LLC, but I'm calling it Jimco 2.0. I wanted to incorporate under that name, but the State of Nebraska would not let me.

"I would like to encourage any rebuilders or suppliers to call me with any questions, concerns or thoughts on the Jimco products they may have - updates, improvements or product additions.....I'm interested in hearing from everyone. With the state of the world as it is through this pandemic I feel that buying American is more important than ever to keep manufacturing in the USA."

"I have never had a day in the last 35 to 40 years, that I was not thinking about the business," Juan concluded. "It's going to be a challenging transition for me in that regard. I'm going to try to assist Ryder when I can. But I've come terms with the fact that the business decisions are going to be his, not mine."

# AUTO ELECTRIC CORNER — Housing Repair, Internet Follies, Alternator Fuse and Old Stock Sale



BY MOHAMMAD SAMII

## DE Housing Repair Fixture

In a thread of discussion on the ERA forum about repairing a worn and egg-shaped housing's bushing cavity, I remembered one of my old shop tools that I have had for many years. I decided to show it here in this column rather than posting it as a volatile Forum response, to allow more members to see it.

I am not quite sure who this tool was made by but Auto Electric Engineering of Florida comes to mind. It is made of a solid piece of casting, machined on both sides to accommodate various size starter DE housings, with provision for 3 different length support guides for the supplied set of reamers (*see Figure 1*).

First the damaged housing with the appropriate length reamer support are placed on the base and tightened up. Then the whole thing will be placed under the drill press where the damaged bushing cavity is drilled out squarely as if it was done by a competent machinist using a vertical mill (*see Figure 2*). Once done, an appropriate size bushing can be installed and the housing can be returned into service, saving time and money (*see Figure 3*). The tool was used often when a lot of 10-MT starters for passenger cars and light trucks were around but as they phased out, we use this fixture now often on AG and Industrial Delco DE housings that are hard to find and expensive if available.

I have had this fixture for over 30 years and it is one of those tools that has paid for itself many times over. The pictures are for a Massey-Ferguson starter for a Model MF-1105 tractor with Waukesha gas engine (1107329, Lester 4368). Both housing and complete starters are available at a cost of $50 or $200 respectively with shipping, so the 15-minute's work to repair the housing was well justified and made for a quick turn-around and at a great price.




*Figure 1 – The DE housing repair fixture*




*Figure 2 – Housing ready to be drilled out*

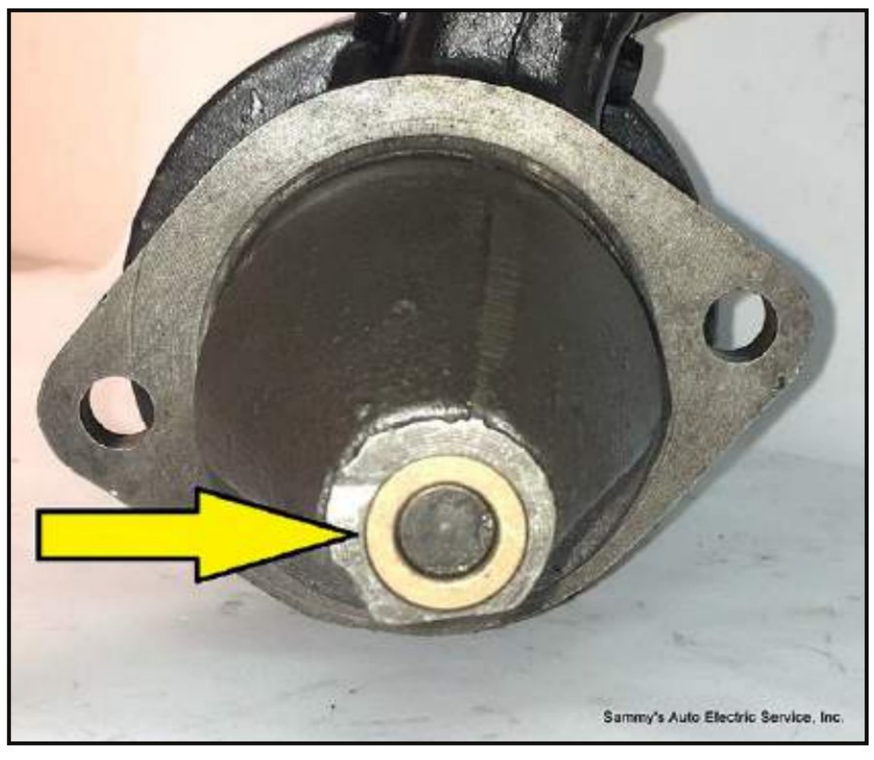



*Figure 3 – Repaired housing returned to service*

## Internet Sale Follies…!

A gentlemen who never said what local company he worked for called with a Unipoint part number for a 28-MT starter. He stated he has purchased this starter recently (via a web-store) but it is the wrong one because of its DE housing miss-matched for his application. We asked him to bring it in to see what he has, and if we can help him, but I was not going to spend my time to search his Unipoint number to see if the internet store had sold him the right one or not. Customers who buy their units from web-stores and then realize they got a wrong or a defective one do not usually earn my undivided attention.

He showed up with the starter and explained to us what he needed to have. Simply said, he needed a 6585 starter but what the web-store had sold him was something else. The Unpoint tag, still attached, did not cross to the correct starter because someone (perhaps at the web-store) had obviously changed the field case of this starter and did not bother to remove the Unipoint tag that no longer matched the starter they sold.

After a new replacement was handed to him, he delightedly claimed this was for a piece of equipment that was needed badly and was happy that we could help him. Then he went to his truck and brought in another 28-MT starter which had a broken housing and asked if we could match that one. That was easy as the Delco's part number was still attached and it crossed to a 6573 starter that was

again handed to him right away (*see Figure 4*). So a wrong tag attached to a web-store purchased starter resulted in the sale of two 28-MT starters which not only benefited us, but got him going. He never told us which local company he worked for  or what his position was.

Would this experience make him understand that such problems can be easily solved locally by professionals rather than going to a web-store?! That is a question that the answer remains to be seen.

## Alternator Fuse

We had this 2007 Acura TL that was sent to us from another shop for not charging. Upon some inspection we found out that the alternator fuse was blown. Once the alternator output post was temporarily jumped to +B with a heavy enough wire, it started charging fine. We also discovered that the battery was really weak and had very little CCA left that was not sufficient for cranking.

A set of jumper wires in front of the passenger seat revealed 1), the problem of a bad battery was perhaps not unknown to the owner and 2), that it may as well be the cause of the blown alternator fuse. That could have happened either by mistakenly jumping the car backwards in one of their many attempts, or the alternator went to max output after jump-starting, and the resulting surge blew the fuse.  The fuse in question is a single part but with two different fuses inside (*see Figure 5*), a 120-Amp for the alternator, and a 70-Amp for the other +B circuits. Being an Acura (we do not have a local dealer), it forces us to call our local Honda dealer. If the said fuse (or any part) is also used in a Honda vehicle, the dealer can get it, but if it was only for an Acura application, they could not as Honda dealers are prohibited form ordering parts for an Acura, even though both lines belong to Honda Motor Company.

In our case the fuse (Part # 38231SFY003, about $12) did have a Honda application, thus it was ordered, came in

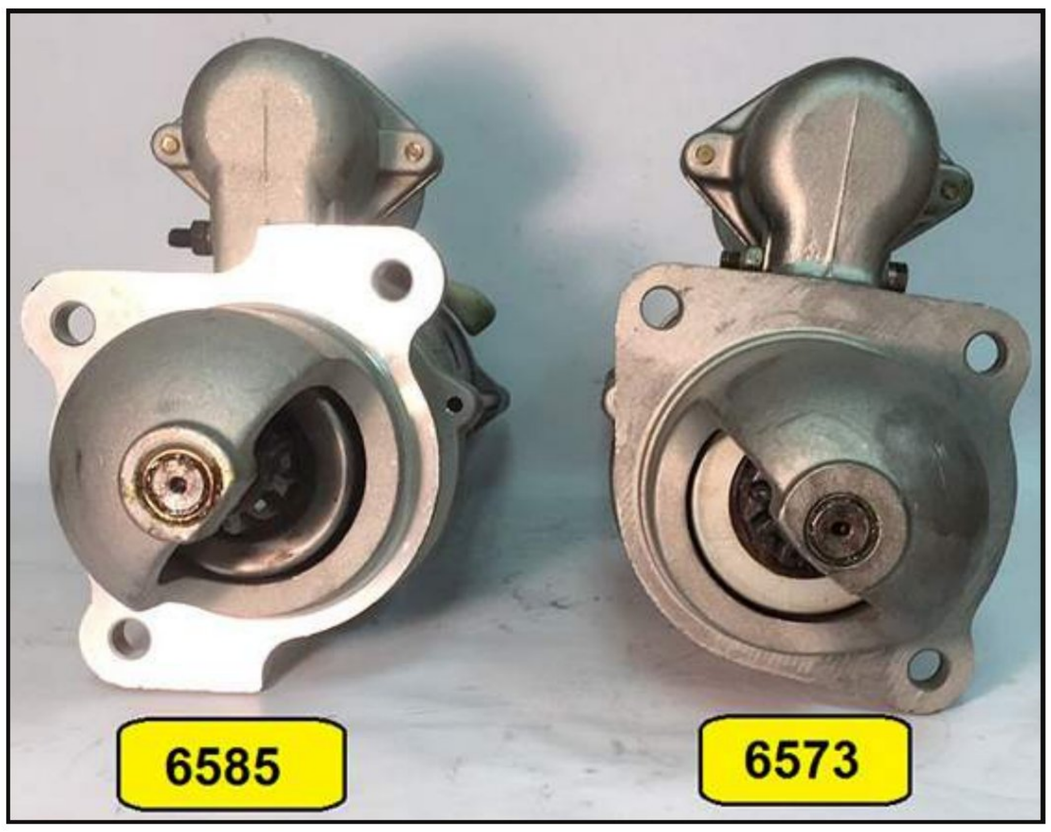



*Figure 4 – Starters sold to a web customer by default…!*



the next morning. The car was finished after a new battery was installed.

The new trend in the design of fuses is not very technician or consumer-friendly. It has become a routine design feature to build multiple fuses into one single package that feeds many circuits (*see Figure 6*). Once a fuse blows, the entire package must be replaced.

Just imagine if a problem circuit and the short to ground that blew the fuse was not correctly identified and repaired, the replacement fuse package cannot be expected to last very long. It can blow again and again, and the repair becomes a frustratingly expensive ordeal for the technician, and understandably it makes for a very irate customer. The diagnostic and repair must be precise, unlike the days not too long ago that a shorted circuit only blew a ATO or ATC fuse worth 50 cents or less, or jumping a battery with incorrect polarity blew a fusible link that was easily repairable.

## Old Stock Becomes Needed

For the last couple of months I have been thinning our older stock to make more room for the newer units, but as a rebuilder it is hard to part with a unit that you feel may become needed someday…thus the hesitation and hoarding that is not uncommon amongst us…!

Of the thinned out units I somehow hung onto an 8158 alternator that is a CS-130D used on some early to mid-90's Pontiac Bonnevilles, Olds 98s, and Buick Park Avenues with 3.8L engine. The interesting thing about this application is the said vehicles, depending on their RPO, may have a CS-130, CS-130D, CS-144 (124-amp) or a CS-144 (140-amp) alternator.

As a side note; GM's RPO (Regular Production Option) code is a




*Figure 5 – Acura master fuse*

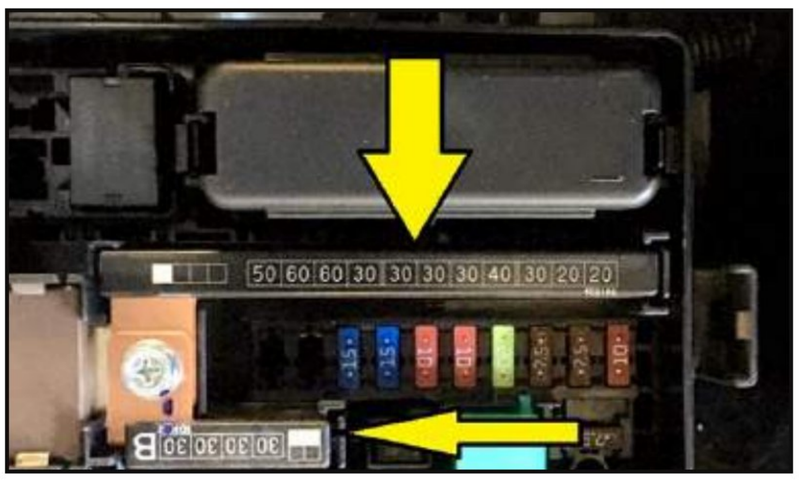


*Figure 6 – Ganged fuses on a 2016 Honda CR-V*



series of 3-digit alpha-numeric codes printed on a sticker usually found inside the glove box showing the details of the accessories that came on that very car from the factory. It is a very important source of information for finding a specific part on a particular vehicle (*see Figure 7*).

The caller wanted an alternator with a round (oval) plug...! The part store that handed him the wrong replacement (square plug) had then sent the core back and none of the alternators they had or could get was a CS-130D (the only option with an oval plug). Simply said, he needed our lone 8158 (*see Figure 8*) alternator and was glad that we had one to be sold outright. Needless to say it was at a good price that included a core charge. Now we are out of stock on the 8158 and I do not plan to build another one unless called for. This re-enforces that old adage: "You cannot sell what you don't have."

Well, that's all for this issue. Until I see you again, keep up the good work.

*You can contact Mohammad Samii by email at: sammyselectric@sbcglobal.net, or by calling the ERA Tech Help Line at 636-584-8324*

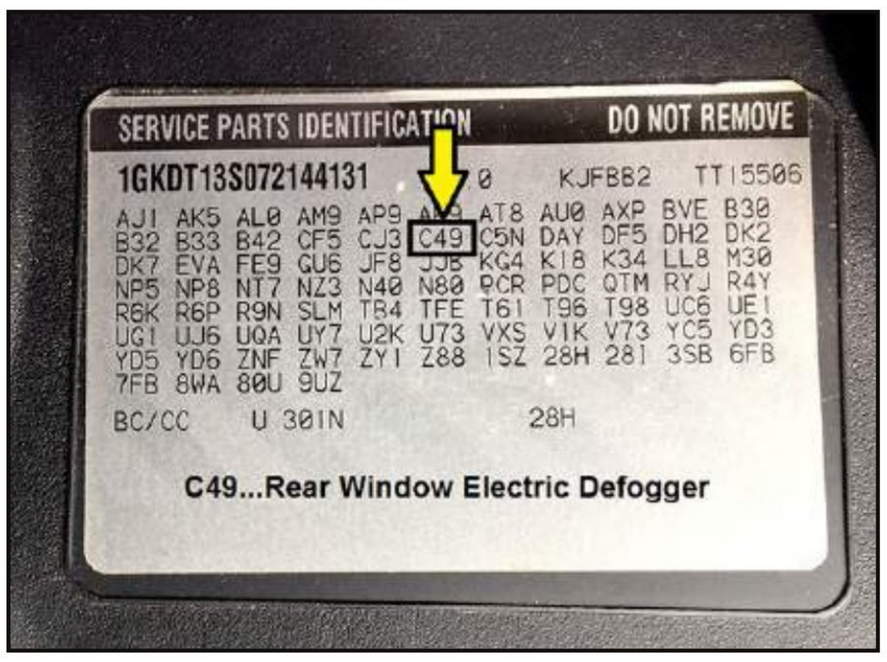



*Figure 7 – RPO tag in the glove box*




*Figure 8 – 8158 alternator for the Bonneville*



# COMMON SENSE —
## Caveat Emptor – Let the Buyer Beware



BY BOB THOMAS

This story began with a phone call from an ERA member in Ohio. It concerned a generator problem that had him baffled. The unit was actually a once fairly common motor/generator, used primarily on small garden tractors in the 1960's and 70's.

It was a new unit, made in China, that he had purchased from one of our industry's largest suppliers. I was told that the original core was completely burned up and the customer preferred a new unit if available. The choice had seemed simple, until it was discovered that the new generator would not charge through a voltage regulator.

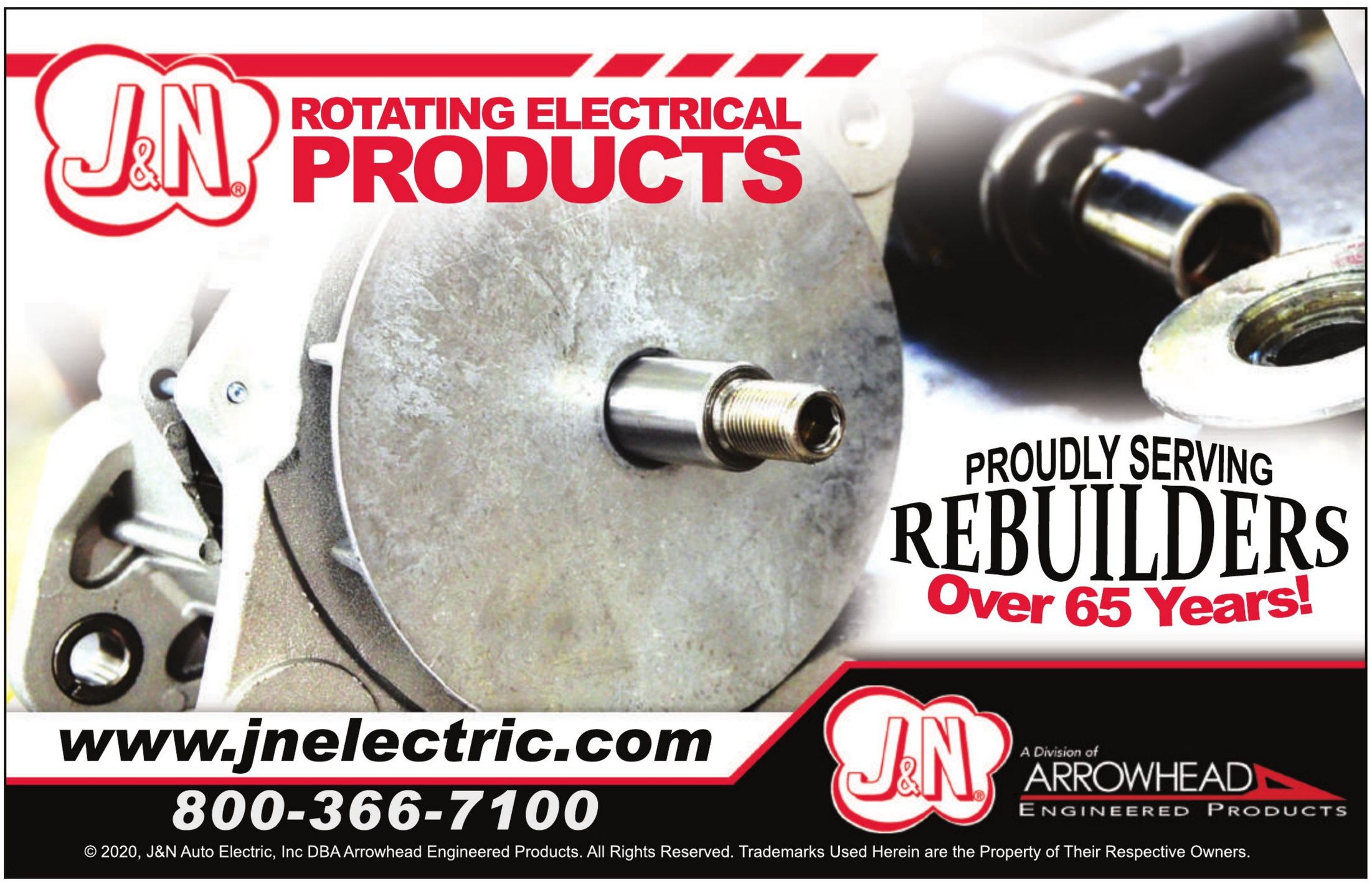
He had already called the supplier who had emailed him detailed instructions on testing a generator, which pretty much followed exactly what he had been doing already. It was then that he called me for advice. He confirmed that it passed a motor test and would charge if connected directly to a battery.

I instructed him to test it with light bulb. That is to connect a 12v automotive tail lamp between the armature terminal and generator's case. Then use a jumper wire to ground the generator's field terminal to the case (A-circuit bypass). "If it does not light the lamp on its own when you spin it", I told him, "something is definitely wrong inside."

His second call the following day confirmed that it would not light the lamp, so I suggested that he look inside the generator to see if it could be something simple, like a stuck brush or a loose connection. These small engine motor/generators are sealed units, so you cannot see anything inside without taking it apart. Although hesitant at first to open a brand new unit, he eventually agreed with me.

His third call confirmed that both brush screws were indeed loose. He tightened one of them only to find that the other had been over-tighten so much that the threads were stripped out of the brush holder. He replaced that screw with a small bolt and nut, feeling confident that this was going to solve his problem. But he soon discovered that it would still not light the lamp. While the unit was apart he tested the armature and field coils, which seemed to be fine.

Out of desperation he ordered another generator from a different major supplier. It had

arrived, been tested with a lamp and it too failed to pass the test. It was then that he called me again, feeling that he must be doing something wrong. How could two brand new units from two different suppliers both be defective?

I suggested that he look very closely and compare the generators "Are there any noticeable differences between the them – in the paint, hardware, castings or machining of the parts?" He confirmed that they appeared to be identical – most likely coming from the same source.

I had my suspicions on what was preventing them from self-starting and asked if he owned a Gauss meter. If my hunch was correct, he would need one to verify it. He did not, so I offered to check the unit for him if he was willing to ship it to me. It arrived a few days later.

The first thing that I did was to check the amperage draw of the generator side field coil, which seemed acceptable at 2 amps. Then I bench tested the generator myself, using three different methods. First, I hooked it to a brand new, USA manufactured, A-circuit regulator which confirmed what he had already told me.

Then I hooked it to the light bulb and it was unable to illuminate it. Lastly, connected to an analog voltmeter, which I had used in the past. The major difference is the minimal load of the analog meter compared to the bulb. The meter also allows you to physically watch the armature's voltage build upon itself.

Using either method requires a variable speed motor and taking great care to not let the voltage get away from you. The only control that you have over voltage is the generator's speed. Uncontrolled with no load, voltage can go over 100 volts very quickly if the speed is too high, which can destroy a set of field coils in seconds.

The problem generator did produce some voltage, but I had to spin it very fast to get anything, and even at the bench's top speed, it never got nearly high enough to close a cutout relay's contacts on a 12 volt system. I suspected the problem was insufficient residual magnetism in the pole shoes because of the quality of the magnet steel that was used to manufacture them.

A Gauss meter measures the strength of a magnetic field. In this case, it is not expected to be what we might consider a strong force. But it does have to be strong enough to create a certain level of voltage in the armature.

Following the meters instructions, I moved the probe around on the surface of the problem generator's pole shoe, searching for the highest reading (*see Figure 1*). As you can see, it was barely past one Gauss. Not knowing what it should be, I checked an original working Ford 6 volt generator that I had on hand to compare it with (*see Figure 2*). In today's world of rare earth magnets, three Gauss may not seem like much, but it was 200% higher than the new unit.

Although my analog Gauss meter may not prove that the quality of the steel is the only problem, I strongly suspect that it is a contributing factor at least. At any rate, this is yet another example of a new unit that was obviously never tested properly, if it was tested at all. The motor function worked fine, because voltage was being supplied by an outside force.

I will say that the supplier of the first generator has offered to accept it back for full credit. But the rebuilder still had to pay for the shipping of a heavy part – twice. Perhaps that is the most that they can do given their circumstances. But the big question is will these suppliers remove all of these units from their shelves, or at least test them before selling any more?

*Special thanks to Clay Arbogast, Clay's Repair Shop in Oak Hill, OH for his co-operation in sharing his experience. You can email Bob Thomas at ere.bobt@gmail.com or call him at 904-673-7301.*

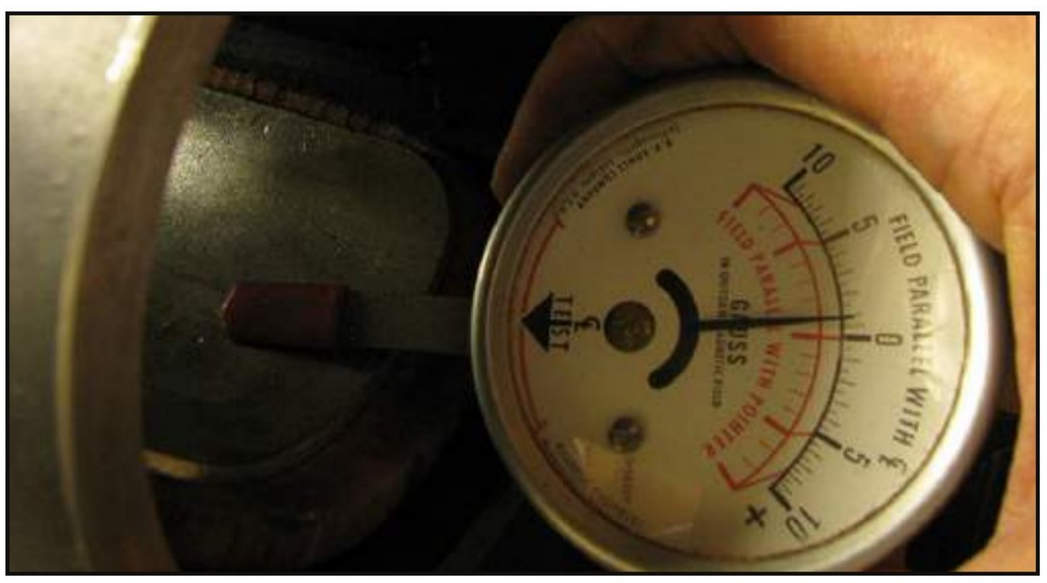



*Figure 1 – The best reading was one Gauss on the pole shoe of the China-made generator.*

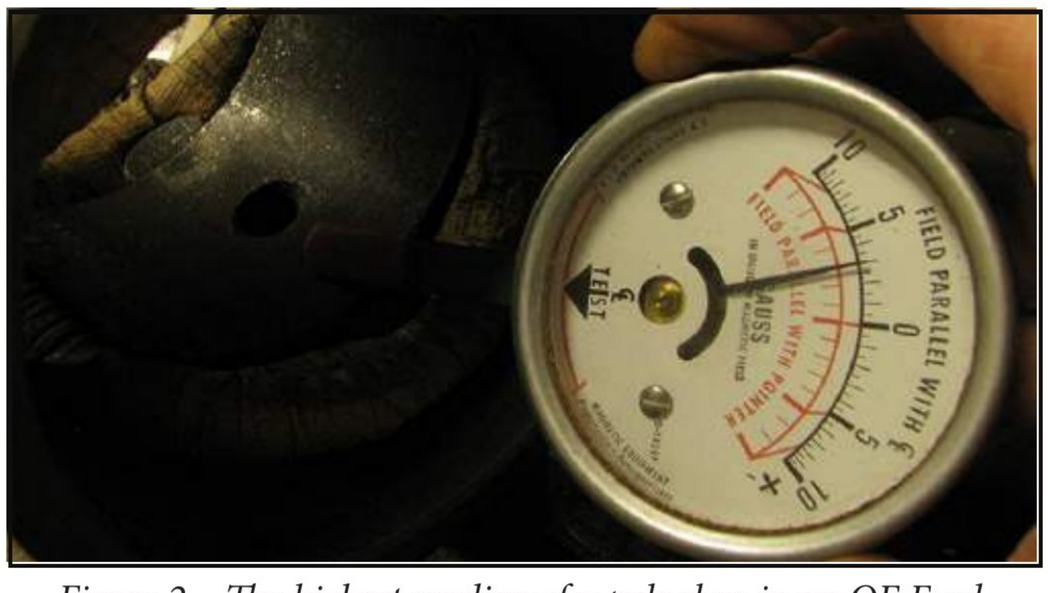



*Figure 2 – The highest reading of a pole shoe in an OE Ford generator was 200% higher.*

# ERA TECH TIP — Unique John Deere Charge Light Circuit



BY DWIGHT KUEPFER

I recently had an alternator here to be rebuilt from a John Deere 550G dozer, Motorola number 8EM2020NB. The complaint was the battery light stayed on after start up, but it usually went out with enough throttle.

I rebuilt the alternator with new diode trio, rectifier, regulator, brush holder assembly and bearings. The customer then re-installed the unit, and soon called with a alternator charging-light stays on complaint. I drove the 33 miles to check it out.

He had the technical manual for the machine which had wire numbers and alternator terminals marked. His manual clearly showed that D+ was not used, while sense, excite, B+,and W were.

I puzzled over it for a while and finally decided I needed to research this more before proceeding. The John Deere tech manual nicely skips wiring diagrams. You need to buy that separately. I was able to get some info from a friend who has access to John Deere technical and repair information, which help me solve the real problem.

This dozer's no charge light set up seemed unusual to me (see Figure 1). It has a 6 volt relay that uses output from the W terminal to power the relay which is normally providing a ground (terminal 87A) to the indicator light (terminal 30). Once it begins charging, the W terminal of the alternator powers this relay, which connects terminal 30 to 87 which is 12 volt positive and the light goes out. This charge lamp relay could be used on other John Deere applications using a Motorola alternator with a wire going to the W terminal. Be especially suspicious if the customer complains about a "no charge light" staying on.

*Dwight Kuepfer is with Witmer's Electrical & Automotive, LLC in Seneca Falls, NY.*

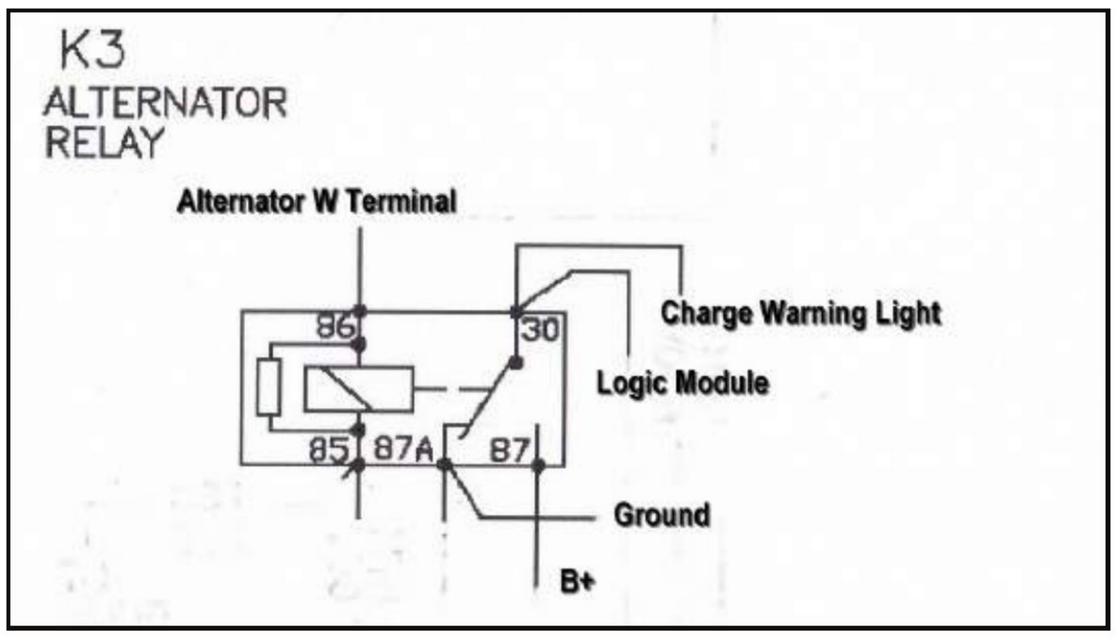
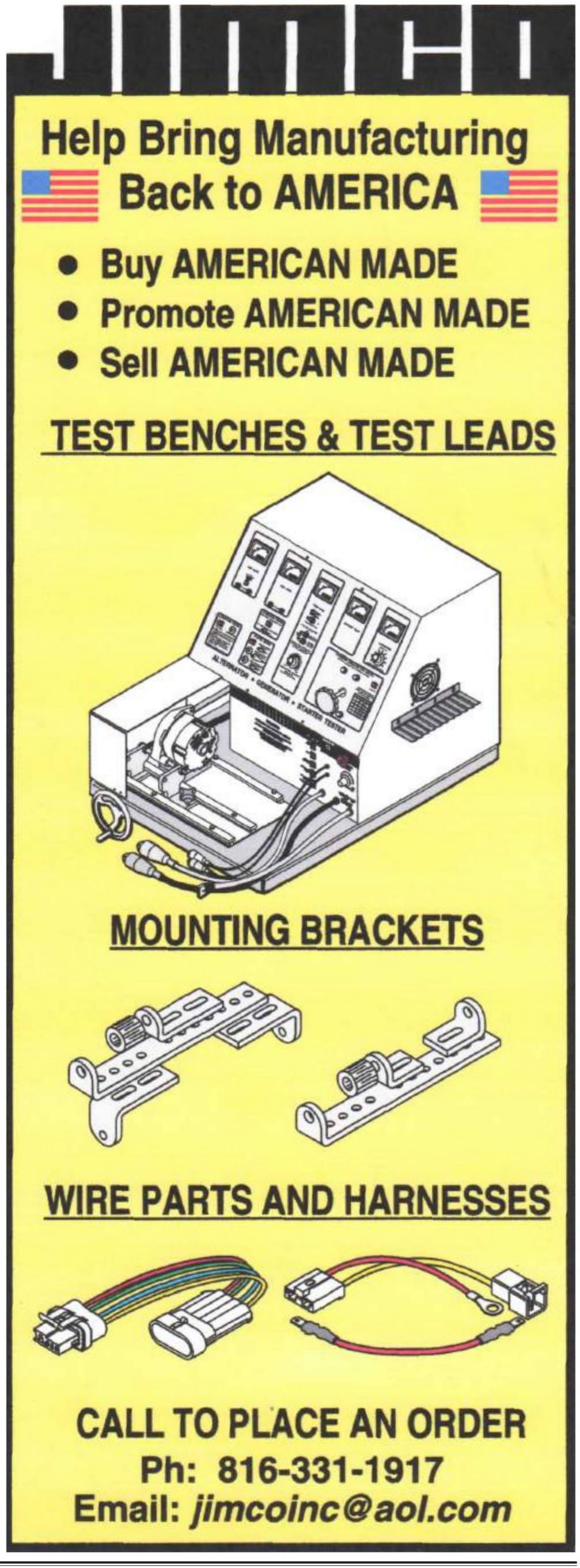



*Figure 1 – Diagram of the 6 volt relay which is activated by the alternator's W terminal. It controls the charge warning lamp on some pieces of John Deere equipment, including the 550G dozer.*

# BATTERY CHARGER REPAIR
## The Basics – Part 1





BY BOB THOMAS & RICK POLETE

Has a customer ever called or walked into your shop to ask about getting a battery charger repaired? What first comes to mind is the small portable charger, like those being sold for less than fifty bucks. They have an off-and-on switch and a meter or some lights to let you know that it is charging or that the charge is complete. While those chargers can be a quick $10-to-$20 repair and most customers are grateful, the real profit is in the higher end battery chargers.

Many of your commercial customers, who are already buying alternators and starters from you, are using professional grade chargers that are much more expensive to replace. And some of them may already have a broken charger collecting dust because they have no idea where or how to get it repaired. Repairing those chargers is a lot simpler and more profitable than you might think.

A battery charger's components can be divided into three basic units or functions. The switches, gauges, timer and circuit breaker make up the control part of a charger. In the case of automatic chargers, they may have an electronic control board to replace some or all of those components. Their sole purpose is to control and monitor output to the battery, which is accomplished by controlling input from the wall plug. Some of the parts on the control side can break or fail, but replacements are available at reasonable prices from an ERA supplier member, PLP Battery in Murphysboro, IL. Their website, plpbattery.com, makes finding parts easy. You can buy them online and they ship orders promptly.

The remaining two major components of a battery charger are the transformer and the rectifier. Combined, they provide the "juice" to charge a battery. If a transformer is bad, then the charger is not worth repairing, but transformers rarely fail.

By and large, the last major part, the diodes that make up the the charger's rectifier, are the most likely component to fail. These are affordable parts, some of which you may already have in stock. But they are also available as kits from PLP Battery. PLP also carries some other common charger parts, like replacement cooling fans and cables.

You likely already have all of the tools and equipment needed to test and repair battery chargers. If you are not already doing this, or have tried it once and lost money on the job, then what follows is a step by step guide. It will explain how to test, diagnose and repair battery chargers as a profitable part of your business.

**Is It Worth Repairing?**

This is the first question that must be answered up front and quickly. Before you spend any time on a broken battery charger you must know what the job is worth. What is the cost of a new replacement? How much is the customer willing to spend on a repair? This is where both you and the customer need to know the true value of a repair compared to what it would cost to buy a new equivalent. Do not turn away a job because of a charger's age. Some of the older chargers are the easiest to work on and they usually outperform more the modern designs. Older chargers typically have much heavier transformers than newer models with copper wire vs aluminum.

At PLP Battery, they use a 50% rule in their repair shop. They explain it to the customer when they drop off a charger for estimate/repair. If they can repair the charger for 50% or less than the cost of a new equivalent replacement charger, they simply repair it and prepare an invoice for up to that amount. For most professional grade chargers, this means that they have authorization to proceed with a repair up to $200-250 minimum. If it's going to cost more than 50%, they contact the customer before proceeding.

**What Tools Do You Need?**

You will need a good AC/DC voltmeter and a diode tester, which I bet you already have. You will also need a good battery to test the charger with. A used battery is fine, but it has to be serviceable. A battery that lacks capacitance (ability to accept a charge) will give you bad test results and run you in circles. A load tester is helpful when your test battery is fully charged and it can also be used to test the "boost" performance of the charger. You will need a variety of small hand tools like nut drivers, screwdrivers, assorted pliers, a 1/4" socket set and a battery powered drill or screwdriver to save time opening the cabinet.

**Charger Circuit Basics**

All transformer-based chargers operate the same way, converting a high-voltage low-amp current into a low-voltage high-amp current. The transformer is two coils wound around a common iron core. The primary coil is wound with small wire, which carries the incoming 120 volts AC (some specialized chargers exist that may run on 240 volts). The secondary winding is made of a much heavier wire that supplies the low voltage output.

Usually, the primary coil is tapped with extra leads at several different locations. This allows for selecting a different number of turns to be utilized with each setting. That provides a variety of output voltages from the secondarily side of the transformer. For example, they might be low 6 volts, high 6 volts, low 12 volts, high 12 volts. Actual charging voltages will vary from one charger to the next and can be affected by the condition of the battery being charged.

As a general rule, if the transformer's coils do not look burned, it is going to be OK. Most problems are either going to be in the control circuit or the rectifier, or sometimes both. Control circuits differ greatly from one charger to another. For now, just remember that you control the primary to achieve the desired output voltage in the secondary. Both are still AC voltage which must be rectified to charge a battery. In the next issue, we will cover transformers and control circuit in much more detail.

**Rectifiers**

Battery charger transformers that plug into a standard 120 volt outlet put out single phase alternating current from the secondary winding. The vast majority of chargers only rectify one side of that, either the positive or the negative charging cable. Being used to working on alternators, where both the positive and negative sides are rectified, that may seem strange. But for the purpose of charging a lead-acid battery, that is all that is needed. However, many, if not all commercial chargers will use two rectifiers in parallel to share that load (*see Figure 1*). These rectifiers were both connected between one side of the secondary coil and the positive cable. The negative charging cable was connected directly to the other end of the secondary coil.

Selenium rectifiers were commonly used in the past and you may run into them on an older battery charger like the one in the photo (*see Figure 2*), which is probably around 50 years old. They look nothing like any diode ever used in an alternator. You can identify them by their appearance as a coated aluminum plate (or plates) with two heavy wires attached (*see Figure 3*). You can visually check a selenium rectifier. If you see small burned pinholes in the "tin can lid", it's bad and must be replaced. In the photo, you can see where we clipped the wires that were once attached. This charger had two rectifiers connected in parallel, one on each inside end of the cabinet.

Selenium rectifiers can be replaced with heavy duty 1/4" stud diodes (*see Figure 4*), which are much more reliable. If it's a larger charger, and there is sufficient space, a multi-diode rectifier is usually an easier installation and more robust than the stud diodes. In this particular charger, there was not enough room. If you add heat sinks in a switch over to a multi-diode rectifier, make sure that they are well insulated from the cabinet.

More modern chargers will likely already have silicone diodes, either stud mounted or ceramic button diodes as shown (*see Figure 5*). The orange o-ring supplies the pressure to hold the diodes in place on this popular style of rectifier. Nothing is soldered. When this type of rectifier fails, you will likely find diodes missing or rattling around inside the charger. Disassembled, the rectifier will look like this (*see Figure 6*). Almost all of these diodes were shorted, which can be caused by reverse polarity (momentarily connecting to a battery backwards – even is the charger is turned off) or extended use of boost while cranking an engine with a dead battery.

The result is that the pinwheel shaped conductors that hold the diodes in place burn away at their narrowest points, allowing the shorted diode to fall away. A kit sold by PLP contains everything that you need to completely rebuild one of these rectifiers (*see Figures 7 and 8*), a 10 minute job and the most common problem you will find.

Like any other new alternator or starter that comes to you for service, the first one always takes

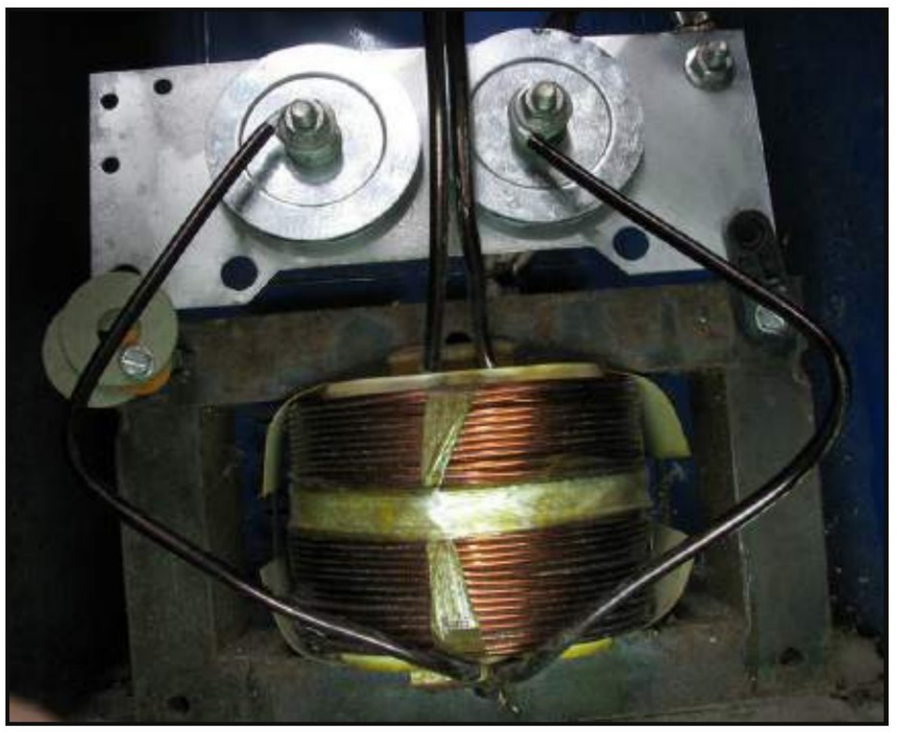


*Figure 1 – These rectifiers work in parallel, connected to the same end of the transformer's secondary coil.*

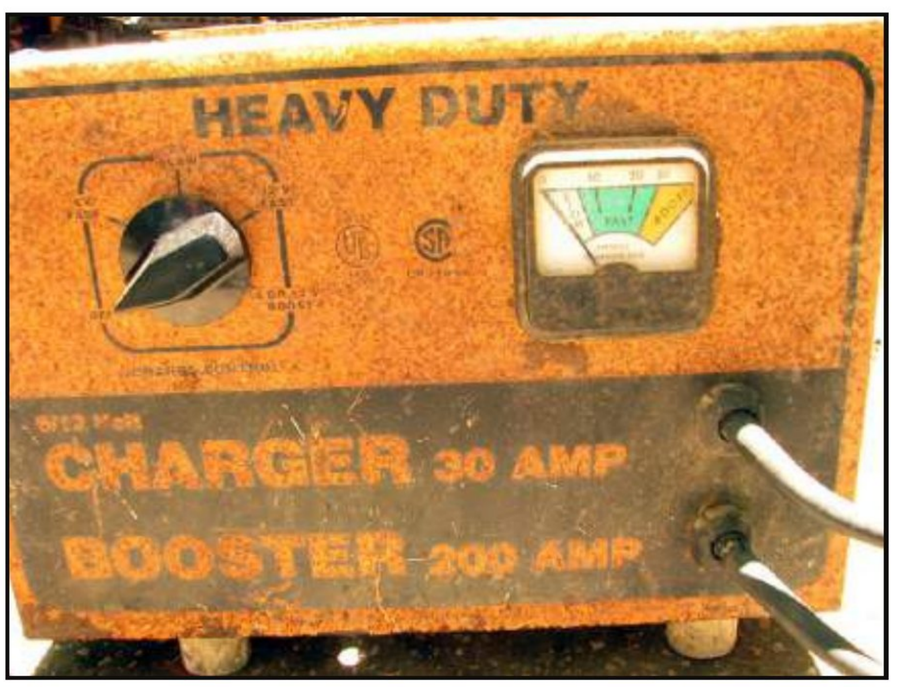



*Figure 2 – This portable charger is probably around 50 years old, but was worth repairing.*



*Figure 3 – This is one of the two original selenium diodes. Note where we clipped the lead wires to redirect them to new silicone diodes.*

a lot longer to finish. But you learn with each one that you do. With practice, you progressively become more proficient and in no time at all, repairing battery chargers becomes second nature. But you will never get there unless you take the initiative to go after this business. It is out there just waiting for someone to provide the service. You can fill this need in your market.

*Rick Polete is one of the original founders of PLP Battery and he has been repairing battery chargers for over 30 years. His expertise made this article possible. You can contact Bob Thomas by email at: ere.bobt@gmail.com or by phone at 904-673-7301.*

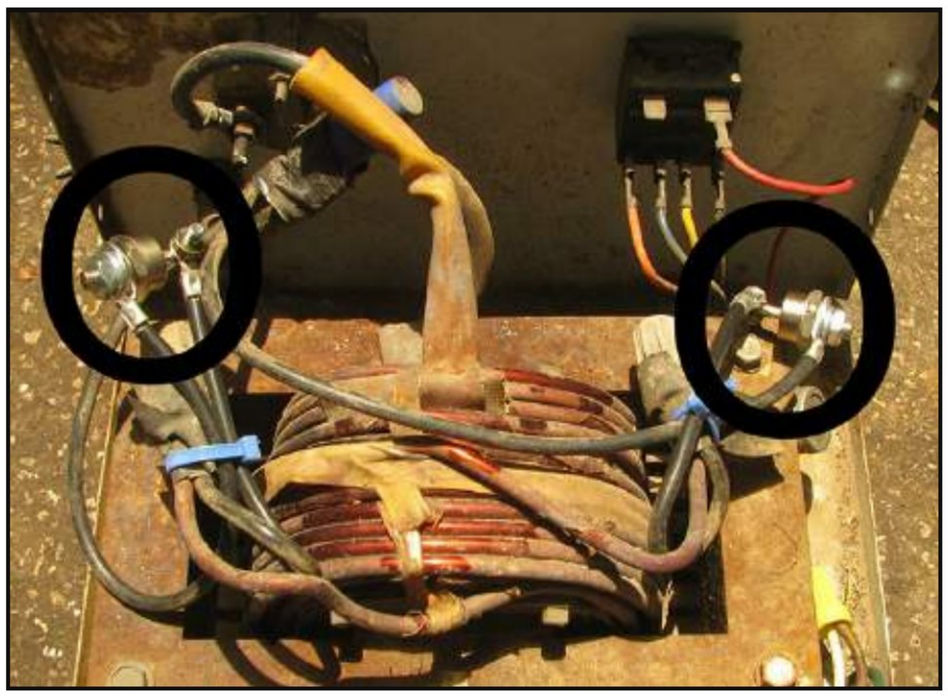


*Figure 4 – Here we installed 1/4" stud mounted diodes to replace the selenium rectifiers.*

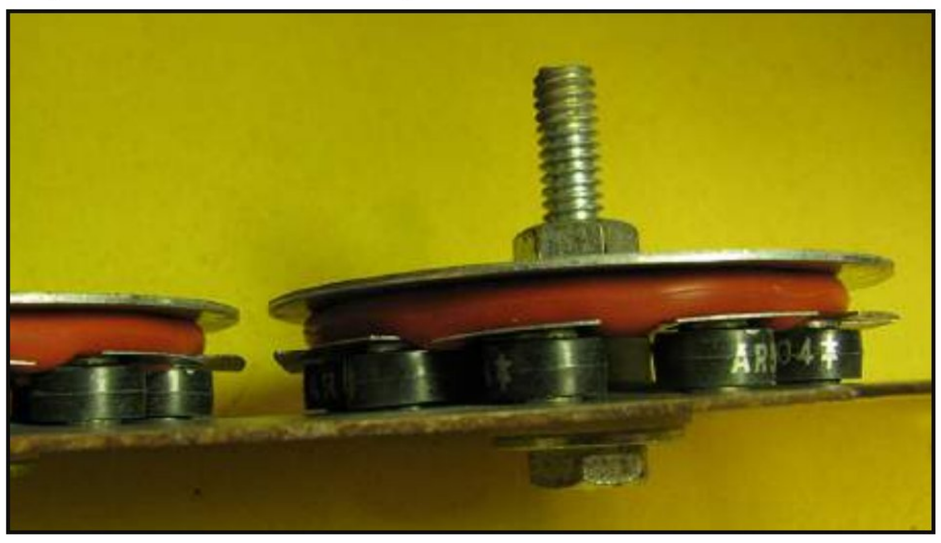


*Figure 5 – Most modern chargers use a cluster of ceramic button diodes to rectify current.*

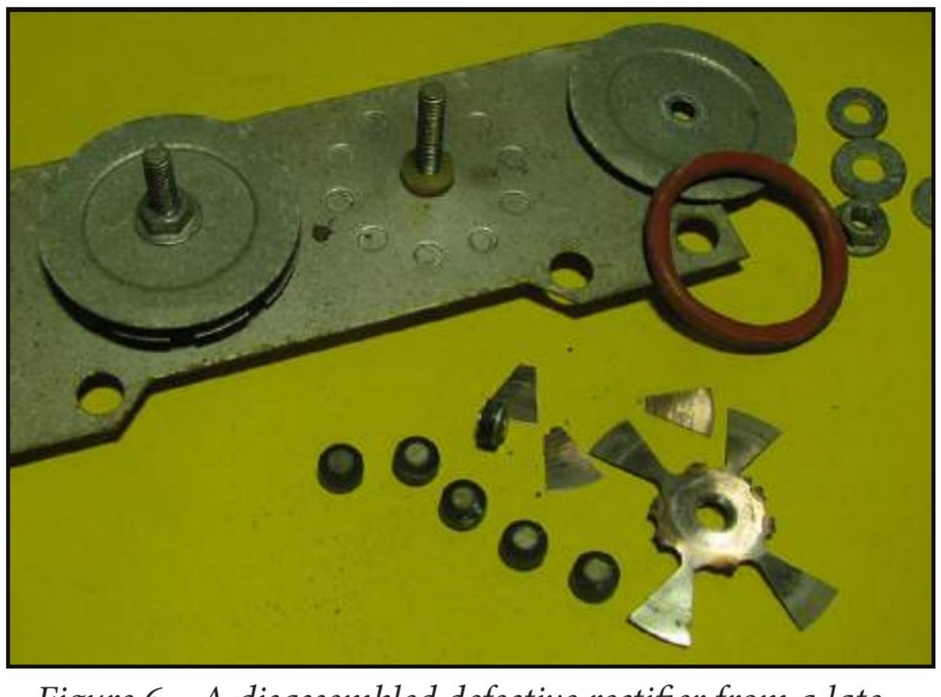


*Figure 6 – A disassembled defective rectifier from a late model Associated Equipment charger.*



*Figure 7 – A PLP Battery repair kit was used to replace all of these diodes.*

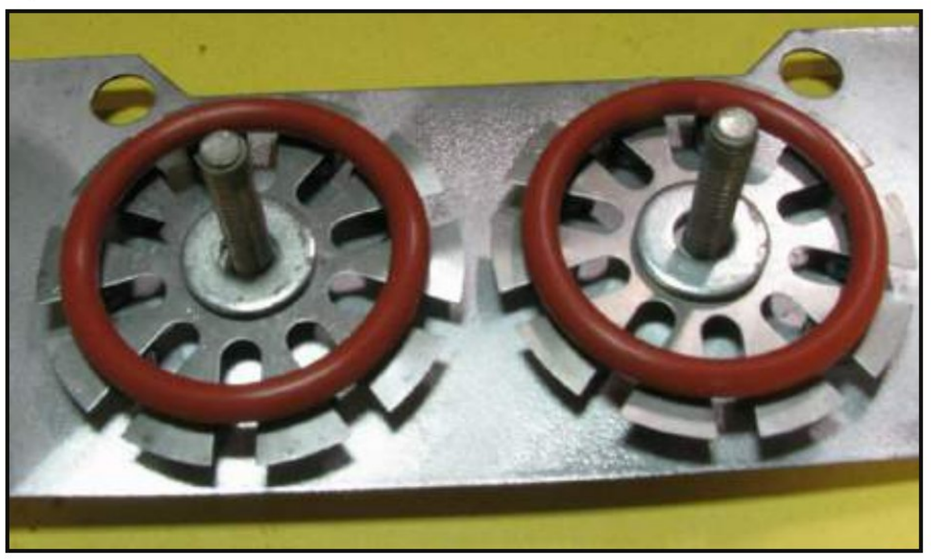


*Figure 8 – The PLP kit includes all parts except the heat sink base plate, which varies by model and manufacturer.*



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