ERA EXCHANGE

YOUR GUIDE TO ELECTRICAL REBUILDING

May 2020 $12.95

AUTO ELECTRIC CORNER
33-SI Rectifier Dilemma, Honda Starter Bolt & Regulator Modification

TESTING GENERATOR ARMATURES
Three Tests to Qualify Any Armature

COMMON SENSE
Unknown Territory: Understand It & Adapt to Survive

Electrical Rebuilder's ERA FOUNDED 2001 ASSOCIATION

A WORD FROM THE PRESIDENT
Don't Wait To Take Action



Well, it has been six weeks since our country has been in mitigation/ self-distancing mode and as I write this President's Message, it looks like we will be continuing for another 6 weeks.

If you are curious of how my business is doing, Aww What Business? But I did enroll in the Federal Government's SBA. (Small Business Administration) CARES (Coronavirus Aid, Relief, and Economic Security) Act and the PPP. (Paycheck Protection Program). Both of these were part of the massive relief bill passed by Congress and signed by the President in response the pandemic, to help small businesses get past a point of no return.

I would encourage all of you to file for these loan applications for a chance of receiving this financial aid to help get you by, While they are loans guaranteed by our Federal Government through your bank, they are interest free with possible forgiveness based upon individual circumstances and outcomes.

I personally hand delivered my filled out applications to my business bank on Monday March 30th. Two weeks later, while writing this message, I am anxiously still waiting an approval response. But hey it's the government. They have never been known to be prompt. Please, I urge all of you to apply for this program. You have nothing to lose as the outcome may be what you need to keep your doors open during and after this pandemic. To check out this program go to www.sba.gov website.

On another front, our annual 2020 ERA Expo Trade Show, the ERA's Executive Board along with the Trade Show Committee will meet at the middle of this month to decide the fate of this year's event, currently rescheduled for June 11 – 14.. Announcement and information of our decision will be provided immediately on our website's home page, our Facebook page, and by direct e-mail notification to all trade show registrants. I can assure you that our decision will be hugely based on the safety and well-being of fellow members, their families and their friends. Sacrifices have been made by all and the ERA will be no exception. Our association will survive this and learn from it. And with time, we will continue to move forward. Please stay safe and healthy.

Ken Plourde

NEW ERA MEMBERS

American Magneto & Starter Service
Batavia, Ohio

Phillip Hulsey
Cornelia, Georgia

ABOUT THE COVER

A rewound Ford generator armature

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Rebuilding is Recycling!

INDUSTRY NEWS
& ANNOUNCEMENTS

Sad News

ERA member James C Rodden Jr, passed away on November 7, 2019, after a long battle with several illnesses including cancer. He was a regular attendee to ERA shows since opening a small rebuilding business in 2011 and joining the ERA. His last show was in Montgomery, where he brought his wife along.

Mahle/Letrica/Iskra Component Parts Breakdowns Available Online

ERA Regional Vice-President Bob Hopko recently provided a link to Mahle's Online Component Parts Look-up system to ERA members. You will find the link on the left side menu on the ERA homepage under Mahle/Letrica/Iskra Online.

While many of our suppliers offer OE Mahle component parts, they do not always offer a way to find the part number that you need for a particular unit. This tool allows ERA members a quick way to find the exact part number that they need, which is half of the battle in locating a part. Check it out, and follow the instructions to get the correct component part number for any Mahle/ Letrika or Iskra unit number.



AUTO ELECTRIC CORNER — 33-SI Rectifier Dilemma, Honda Starter Bolt & Regulator Modification



BY MOHAMMAD SAMII

Search for Rectifier

At times I get calls or suggestions from rebuilders who have found some way to repair something or substitute a part for an unavailable one to finish a job. I welcome all of these calls and try to accommodate them in this column when I find it to be useful. Actually, the whole purpose of our association is to promote our industry and that is best served when we share our information and pool our knowledge.

This particular tip was brought to my attention by our own ERA Treasurer Mike Schroeder (Central Auto Electric, Union, MO). It was regarding the issues we encounter repairing some new aftermarket alternators because of internal differences or deviation from the OE design.

Mike had upgraded a few alternators for rock drilling machines used by a customer of his. The OE unit was not sufficient to run the cab's air-conditioning at full force, which is what was needed to keep these machines working during the hot summer days in a rock quarry. The OE 60-Amp alternator did not have sufficient power to keep up with the loads, so they were replaced by using a 100-Amp 24V Delco 33-SI (Lester 8085) that Mike provided.

The upgrades were a success and lasted until one of those alternators eventually came in for service due to a blown rectifier. Going by the most common published break-down listings, the needed rectifier was DR-5173, but here is the problem. The rectifier used in that 8085 alternator, in addition to having a built-in capacitor, also had an extension to the rectifier that connects it to the output post of the alternator. DR-5173 does not have a built-in capacitor nor an extension long enough to be connected to the output post. So, to get the unit going, a DR5173 was used, an additional external capacitor was added, and with the help of a longer battery strap, Mike got the unit going (*see Figure 1*).

Not being content with the fix, Mike did an extensive search that finally paid off. He came across a DR-5185 that is nearly identical to what was used originally in the aftermarket 33SI alternator. The DR-5185 is used in the 24V 23-SI alternators. It has 50-Amp avalanche diodes (38-42V) and includes the built-in capacitor, making it an ideal replacement (*see Figure 2*).

New aftermarket units are not always repairable with OE or OE equivalent parts, and that is an issue that at times makes repairing such units very frustrating. I thank Mike for sharing this information to be passed along, and hopefully it helps a colleague down the road.

Honda Starter Bolt

I am aware that most of our readers do not do any on-vehicle work, but occasionally things come up that to be aware of may not necessarily be a bad thing. Knowledge of this starter mounting bolt may help you or one of your customers down the line.

Case in point is this 2008 Honda CR-V starter (Lester 19009) that resembles the 17844 starter used on earlier models but with a different "S" terminal (*see Figure 3*). The starter attaching bolt to the transmission goes all the way through and sticks out with a few threads showing. Those exposed threads often rust and deteriorate. When that bolt is removed for a starter change, those damaged 12mm threads require a lot of torque to get them through the transmission housing. The removal process will damage the threads in the housing on their way out. So running a tap through the hole to clear the threads is often done to make the installation go smoother.

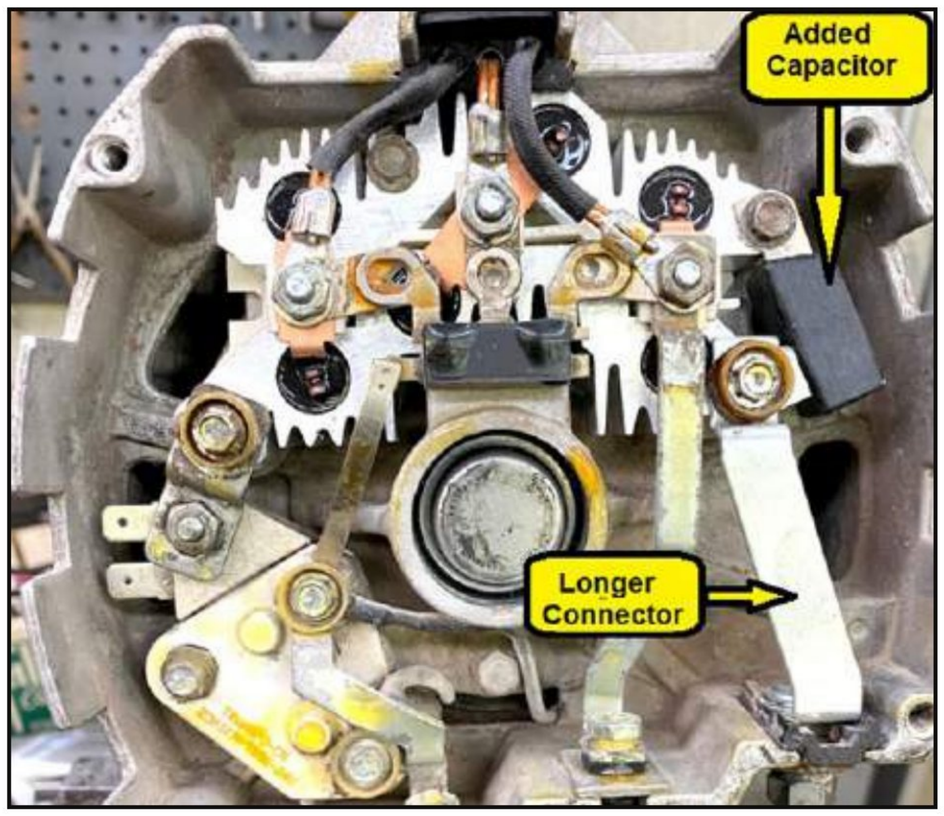

Figure 1 – Using a DR-5173 in an aftermarket 33-SI alternator

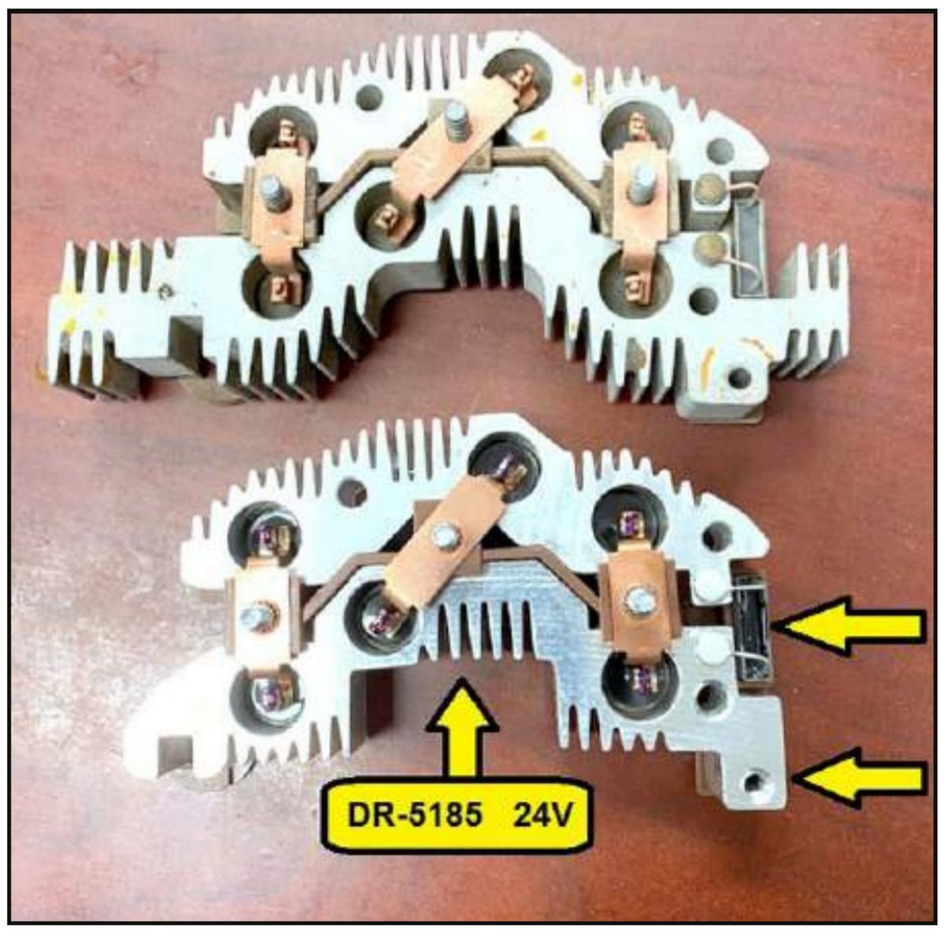

Figure 2 – Showing WAI DR-5185 as a suitable replacement

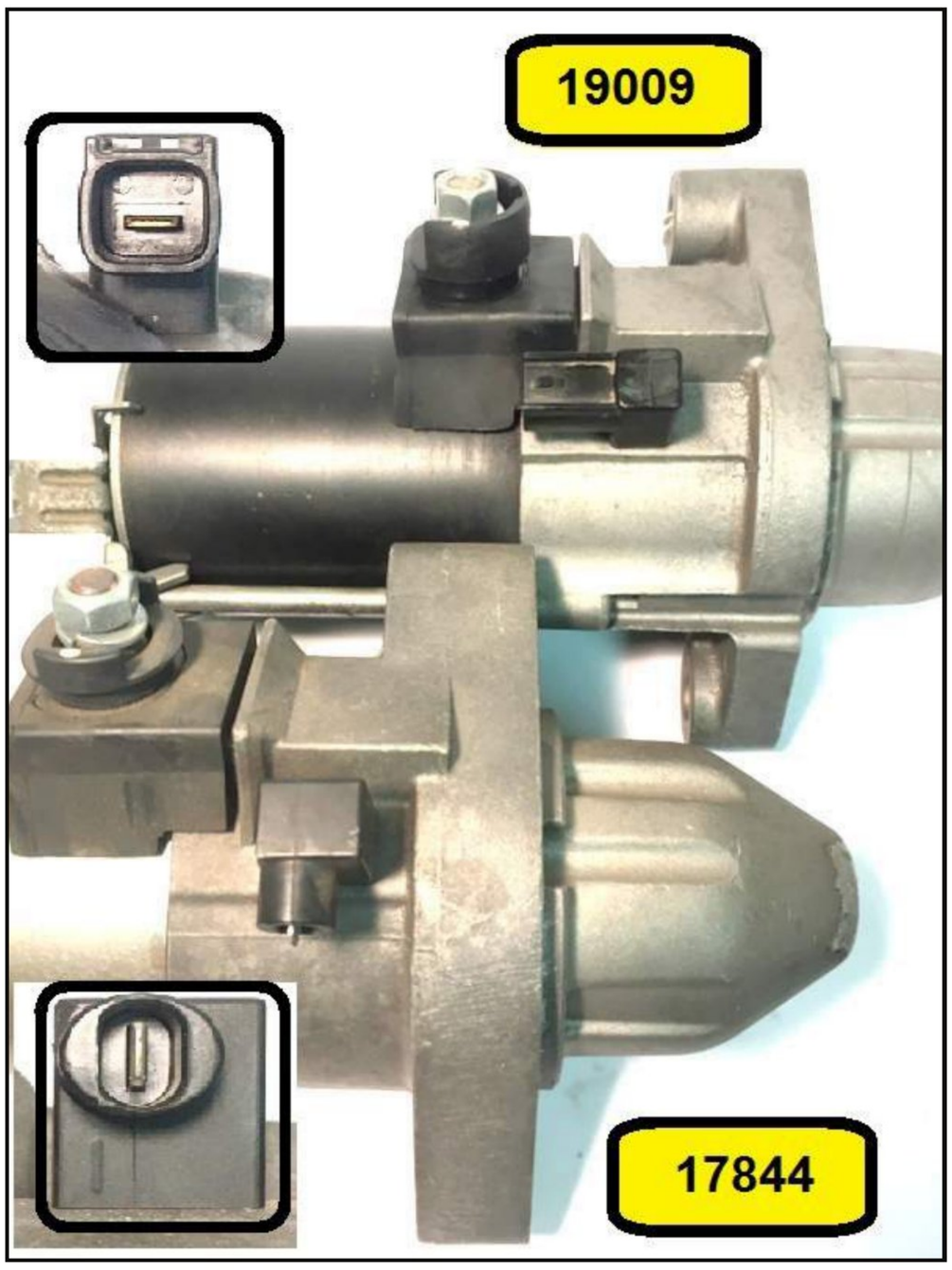

Figure 3 – Popular Mitsuba/Honda starters

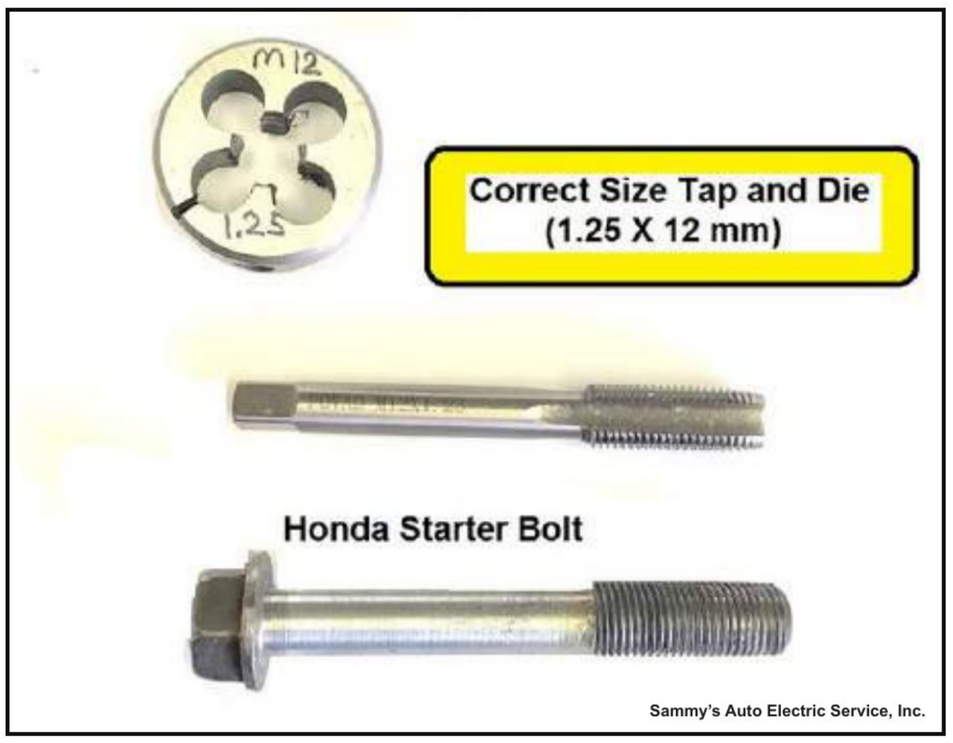

Figure 4 – Uncommon thread pitch for Honda starter bolts

What makes it interesting is the uncommon thread pitch of those mounting bolts. The 12 mm bolts are usually either Fine Thread (1.50 X 12mm) or Course Thread (1.75 X 12mm). But the bolts used here are extra fine 1.25 X 12mm. A difference that cannot be determined easily by looking at it unless you use a thread gauge. The problem arises when the technician tries to chase the scored threads in the transmission housing with a common fine tread (1.50 X 12mm) tap, and then you can imagine the damages to the housing that now cannot accept an original new bolt (*see Figure 4*).



The right size tap and die has been in my tool box for a long time for an obvious reason, and new bolts are also available at Honda dealers for around five or six dollars each. But by using the wrong size tap on the transmission housing, even a new bolt becomes useless as they would not go in without being cross-threaded, and then the damage to the housing would be catastrophic. Just a little point to remember if you sell one of these to an installer..

Modifying a CS130-D for 19V…!

A CS130-D was brought in to be rebuilt and mortified to single wire self-exciting and to charge at 19 Volts…!

I understand there are cases that a self-exciting alternator may be a viable or the only option for some old machinery, like tractors, forklifts and assorted equipment. But I am not a big advocate of single wire alternators. On cars and trucks if economically feasible, I prefer to repair the related wiring properly rather than hanging an SE alternator on and letting it go. In the case of this customer, considering he was going to use it on a racing application, I agreed to it, especially when he accepted my price…!

So the alternator was rebuilt and then it came time for installing a CS130-D-SE regulator that charges at 19V. To be brief, there are none to be found. Regitar had discontinued their version due to lack of interest and low sales a long time ago and no other supplier has such a regulator, to the best of my knowledge. After a little search, I found that CS130 SE regulators such as WAI's D411SE190 or Regitar's D694W-SEL are plentiful and available, so why not try to fit that into a CS130-D alternator…?!

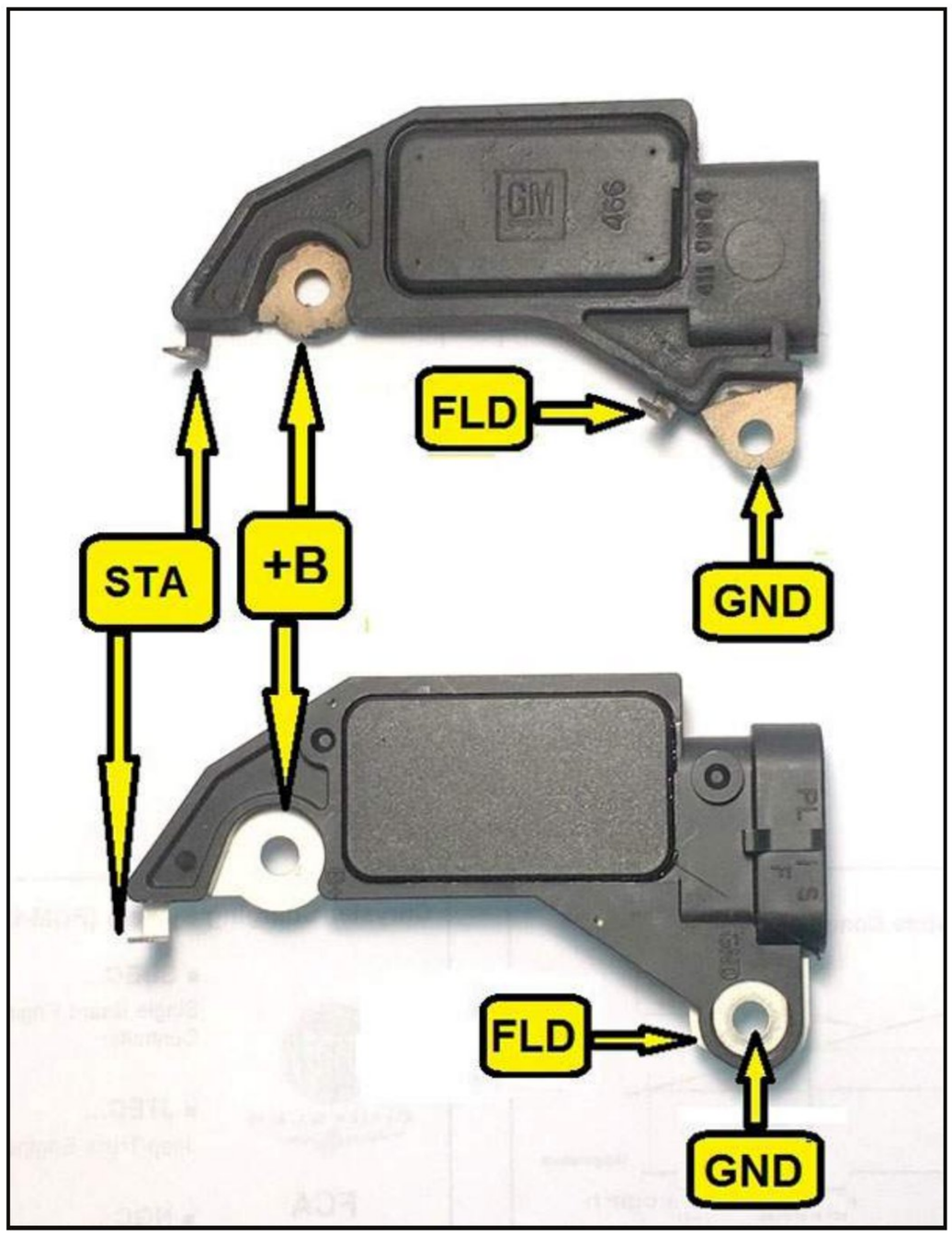

Figure 5 – Pin configuration of CS-130 and CS-130D regulators

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The regulator mounting is of identical size and their operation is similar (B-Circuit), but the location of certain pins are slightly different (*see Figure 5*). Our shop foreman Denny Tuttle, who has a keen eye for such things, suggested we could insulate the field brush of the CS130-D and run a wire from the FLD pin of the CS130 regulator to the FLD brush of the CS130-D. It looked like we could probably make this thing to work, and that is exactly what he did, and it indeed worked!

He added the an insulator to isolate the FLD brush from ground (*see Figure 6*), and added a jumper from the CS-130's regulator FLD to the CS130-D's FLD brush (*see Figure 7*). There was no interference installing the cover, and the alignment of the plug with the opening of the cover did not matter, as no plug-in was to be used or necessary. The job was finished and delivered to a happy customer.

Well, that's all for this issue, I am hoping to see many of you soon. Until then, 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

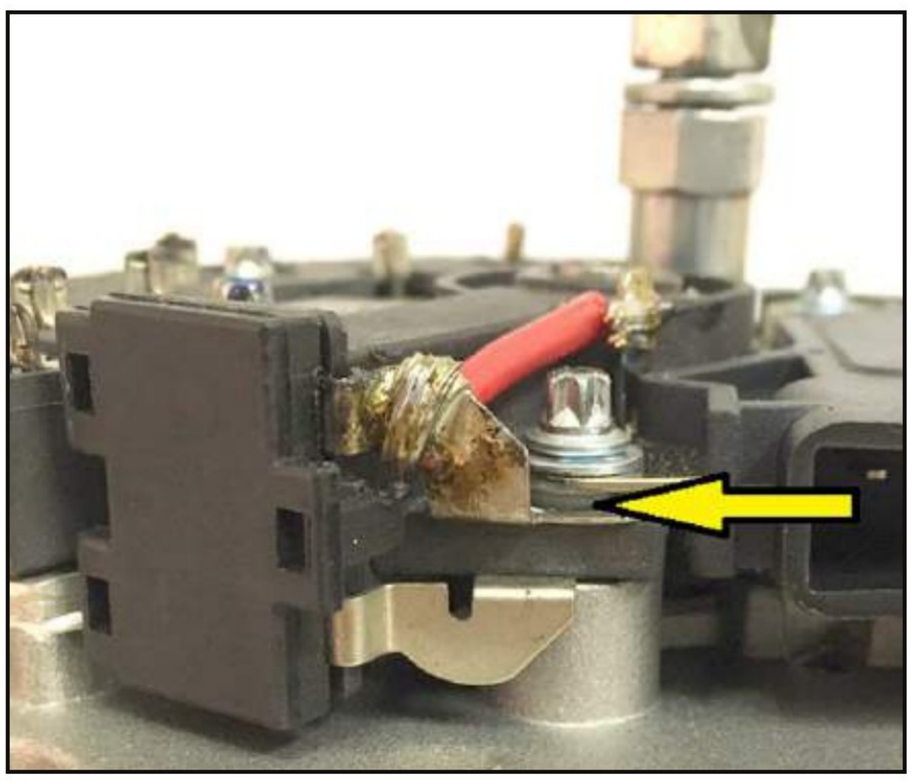

Figure 6 – Placing insulator to isolate FLD brush

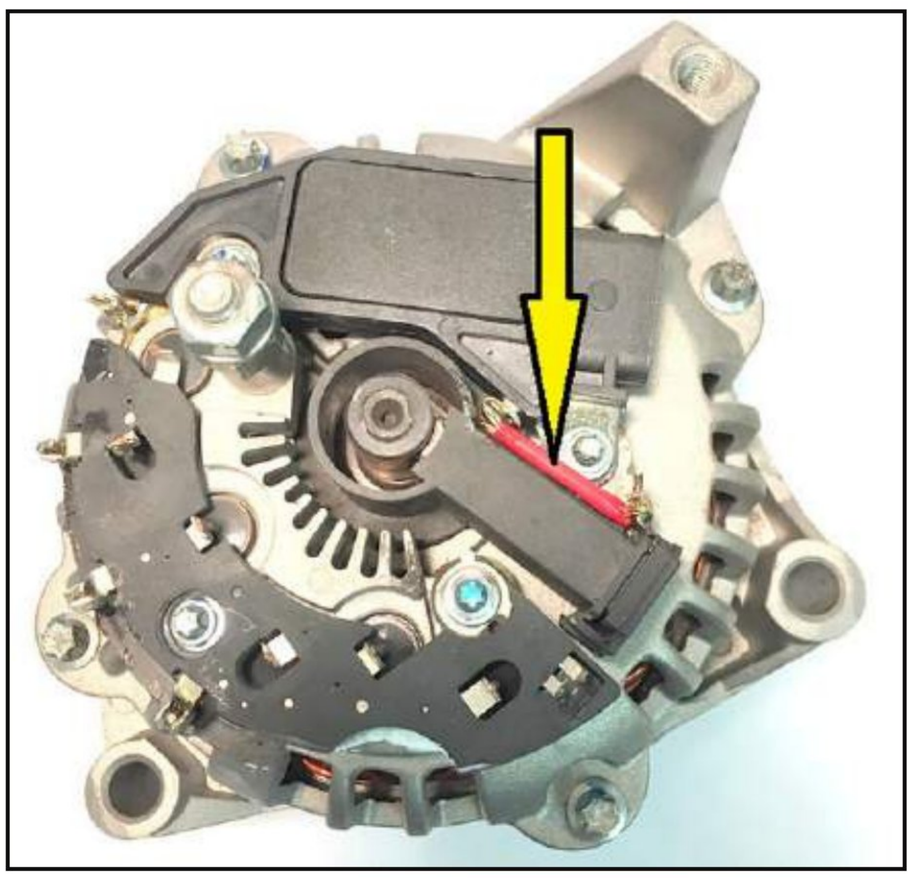

Figure 7 – Added wire to FLD brush from the CS130 regulator

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COMMON SENSE — Unknown Territory
Understand It and Adapt To Survive



BY BOB THOMAS

By the time that you read this, it will have been just a little over four months since the news of a new strain of corona-virus was breaking out in Wuhan, a city in an industrialized providence of China. Early indications were that it was highly contagious and deadly. The virus was named SARS-CoV-2 and the disease that it causes is COVID-19 (corona-virus disease 2019). Within 30 days, travelers had spread the contagion worldwide.

Governments around the world, including our own, downplayed the severity of the impending pandemic, each worried about spooking their own economies. That early neglect allowed the virus to get a head start in Europe and the US, causing markets everywhere to fall anyway.

By now most people realize that we are in a global recession of historic proportions. All forms of business and industry are being affected, most especially those smaller locally-owned and operated like most of ours. Several ERA members have called me to ask for advice as they face what they see as unknown territory.

While the days ahead may seem to be troubling to say the least, it is not the end of the world. Keep that thought in the back of your mind. It is not a global thermonuclear war nor is it an asteroid about to strike earth. But understanding what is happening, accepting the facts as they are and looking ahead to where it will eventually go along the way are all key for your business to survive this unknown territory.

This is the first global pandemic in one hundred years and we have much better science now to combat it than we did in 1918. But today, the world population has grown to nearly eight billion people, many of them living in crowed metropolitan areas. And today far more people travel routinely around the nation, around the world and frankly around their own small towns.

The absolute worst thing that you can do is to hope that it ends quickly and wait to see if that happens. You'll be in for a huge disappointment. Before this can be truly behind us, 70% of the population (at least) will have to become

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immune. The only way to become immune is to catch the disease and recover (in theory), or to be immunized with a vaccine - which does not as of yet exist.

Vaccines normally take about two years to be developed, tested through a series of trials, first in animals and eventually in humans, and then manufactured in quantities large enough to cover a population. There are currently thousands of people working around the world to develop a vaccine against SARS-CoV-2. Even if the testing is fast tracked, it will be nearly impossible to have a reliable and safe vaccine available before the end of this year. But sometime next year is almost assured.

Aside from following the basic suggestions from the Center for Disease Control to slow down the spread of the disease, you need to be making plans and backup plans for the survival of your own business. A large part of the population is already out of work. People will be driving less – a lot less. But essential business and government services will go on. The need for the parts and services that we all provide will be less in demand, but they will not go away. As such, supplying electrical parts is considered an essential service. In other words, there will be work for us, but we will have to survive on less of it for many months at least. A total economic recovery will take years (that's plural). But our economy will recover. It always does.

Isolation is the only way to keep the number of serious cases at a level that our medical system can handle. Most people are finally beginning to figure that out after seeing field hospitals being set up in parking lots in some major cities. Protect yourself, your family, your employees and your customers as much as you can. We are in this for the long haul. Adapt your business model to fit that and you will be OK.

I hope that by the time you read this, that the number of daily new cases will be on the decrease. But whenever that happens, we cannot expect things to go back to normal. Doing business, in the ways that we had become accustomed to are over for the foreseeable future. Understand that and adapt to the new reality, and you can survive long enough to be around to prosper when it really is behind us - when there are no more new cases and no more new deaths.

You can contact Bob Thomas by email: ere.bobt@gmail.com or by phone: 904-673-7301



TESTING GENERATOR ARMATURES
Three Tests to Qualify Any Armature



BY BOB THOMAS

Most electrical rebuilders know how to test a generator armature, or at least believe that they do. However, anyone who has rebuilt more than a handful has experienced a puzzling problem. Every component part in the generator tests OK, yet it fails to charge when installed on a vehicle or bench tested using a regulator.

If that sounds familiar, it is because you are not testing generator armatures properly. There are three conditions that can prevent a generator armature from performing as it should. They are shorts to ground, **shorts between coils and excessive internal resistance.** With a good growler and the skills to use it, you may be able to test for all three.

But to comprehend the purpose for each test, you have to understand the part that the armature plays in a generator charging system. On a vehicle, a generator has no direct connection to the battery because it must charge through a cutout relay. As such, a generator must be capable of self-excitation, which is accomplished by using the residual magnetism held in a generator's pole shoes.

When a generator is spun on a vehicle or on your test bench, the armature must produce enough voltage for some current to flow through its field coils, which will complement the magnetism that is already there. Excitation is not instantaneous, but as the voltage builds, more current begins to flow through the field coils.

All generator systems require a brief period, a second or two, to achieve the level of current needed to fully power the field coils. At that point, the voltage will quickly increase which closes the cutout relay's contacts, thereby connecting the generator to the battery and the electrical system on the vehicle. That is why a generator light continues to glow for a few seconds after an engine start with a generator system.

Test 1 - Shorts To Ground

Testing for shorts to ground (copper to steel) is best done using a voltage that is significantly higher than charging voltage. You may already have a tester that does this. Some growlers have them built in. Several different types of testers have been sold over the years (*see Figure 1*) called high voltage potential short detectors or simply hi-pots. Or you may be using what is probably the most common type, a 120v incandescent light bulb with two probes to simply touch any steel and copper surfaces. Any of these will do the job of finding shorts to ground. Higher voltage is better for finding insulation breakdown that has the potential to develop into a short.

Test 2 - Internal Shorts

Growlers are used to test an armature for shorts between coils (copper to copper). The armature sits on the ends of a strong electro-magnet, formed in the shape of a V. Since the growler uses AC current, the magnetic field is reversing itself 60 times a second. If there are any shorts between coils, current induced into the coil being subjected to magnetism (down in the V) will leak into a coil or coils above. Then the steel lamination on the top half of the armature (farthest from the V) will become magnetized. This can be located easily using any flat piece of steel, a worn out hacksaw blade being the tool of choice (*see Figure 2*) . Quite simply, the blade will vibrate rapidly



Figure 1 – Testing for a short to ground with 250 volts



Figure 2 – Testing for shorts between coils using a growler

making a "buzzing" sound. The vibrations can also be felt on the blade.

Test 3 - Excessive Resistance

Since the armature's circuits are coils of copper wire and their ends are connected to copper bars on the commutator, there is really only one place for an armature to develop any unwanted resistance. That is in those connections where the coil ends are soldered to the slots in the commutator. The resistance only has to be in the connections of a few of the bars to inhibit or prevent start-up. For each time a brush crosses a bar with high resistance, the magnetic field drops for an instant, and the process of building enough voltage for current to flow must start all over again.

For that reason, re-soldering those connections will usually cure the problem, a practice that many experienced rebuilders routinely perform on every generator armature that they reclaim.

Some growlers have a built-in ammeter with two probes. Using the ammeter to find poor connections is possible, but requires a lot of practice to develop the skills needed to do it accurately. The probes are placed on two commutator bars, several bars apart, with the growler turned on. The precise spacing of the probes is dependent upon the width of that armature's coils, which will vary. Generally they are spaced so that several bars separate them. You have to experiment to find the spacing that gives you the highest reading for the armature you are testing.

Once you have the spacing right, you have to move the probes around the top half of the commutator while watching the ammeter again to find the highest amperage reading. The position will be dependent on how that particular armature has been wound. So it takes some time to find that "sweet spot". Then, holding the probes stationary, you must slowly rotate the armature, 360 degrees, thereby checking each coil. They should all read the same.

In the 1940's and 50's, a worker in a rebuilding plant could do this often enough to get good at it. Obviously, it took a lot practice. It requires holding two probes with one hand, while turning the armature which is being held down by the growler's magnet with the other. Move the probes a little bit off and you might fail a good armature. The last thing any of us want to do is disqualify a good reusable part that today costs us $50 to $100.

What has always bothered me was the fact that there was not an easier way to test for excessive resistance. Assembling a generator only to find this fault wasted time. And re-soldering was not 100% effective. Some generator armatures like the ones used by Bosch on early German cars are nearly impossible to re-solder without a solder pot. About 25 years ago, Vensel Enterprises offered an armature analyzer that when used with a scope, could identify armatures that required re-soldering because of weak connections. But it required the use of a scope and enough practice to get good at identifying the faults. To the best of my knowledge, it is no longer available.

Speaking with Joe Davis following last year's show, we discussed a possible simple test using the generator's brushes and brush holder to test for locations on the commutator with any excessive resistance. Since then I have experimented with several ideas – like taking resistance measurements with a low ohm meter or passing a large amount of current through the circuit to the read voltage drop between the brushes. None of those experiments panned out.

The solution came to me by testing a generator open circuit at a very low RPM to determine exactly how much current and voltage were actually required for excitation to occur, When I say open circuit, I mean no connection was made to the field terminal because I did not want to build any additional magnetism. I wanted to measure voltage generated by the residual magnetism only at low armature speed.

But in real life, start-up current must flow through the field coils too, which meant that I needed to add resistance equal to a set of field coils to replicate that load on the armature. After testing various common automotive lamps, I discovered that the tail lamp filament of a 3157 bulb, drew about 2 amps at 7 volts – close enough to simulate the resistance of a set of 6 volt generator field coils.

A voltmeter and the bulb were connected in parallel to the armature and ground terminals of a known good, 6 volt Ford generator (*see Figure 3*). I wanted to see how much voltage it produced at idle RPM. The armature put



Figure 3 – Ford generator producing half a volt on residual magentism under the load of the lamp

out a little over half a volt on residual magnetism alone, even with the lamp pulling it down. Again, this was turning at a very low speed.

The idea for my test was to apply a similar low amount of voltage to an armature and measure the current flow through each coil in it. If there were no poor connections, the amperage should be the same all the way around. If there was any resistance, it should lower the amount of current.

Knowing that I'd need several used armatures and hoping that at least one of them would have some degraded connections, I called upon a box of Ford Model T generator parts. I had four used armatures, all of unknown condition. They all passed both short circuit tests. I would utilize a Model T brush holder to apply the voltage to the armature and the brushes would maintain perfect spacing all the way around the commutator (*see Figure 4*).

Since the Model T generator has a third brush to supply field current, I used it and the ground brush for the test. A constant voltage supply allowed me to keep the applied voltage the same, as I tested all the way around each armature. A mark on the armature help to keep track of where I started and insured that I read each bar using the narrower third brush as a guide (*see Figure 5*). It only to took about a minute to work my way around each armature and maybe another minute to unset and reset the brushes to test the next one.

The first two were uniform all the way around, fluctuating for a second as the commutator moved on the brush but always returning to the same reading when stopped (*see Figure 6*). That would be the benchmark of a good armature.

The third armature that I tested produced obviously different results. At a few locations the current dropped dramatically (*see Figure 7*) and even the highest amperage reading was a few tenths lower than the previous two armatures.



Figure 4 – Model T generator brush holder used for reistance testing the armatures

While utilizing the brush holder made testing easy, I wondered if the same test could be conducted using just the power supply leads. The hard part was keeping the armature still, so I made a set of wooded blocks with groves to set it on, making it easier to rotate at the same time. This would eliminate resistance in the brushes and alligator clips, so I was expecting to see slightly higher current readings.

The model T armature has 21 bars and the output and ground brushes are 90 degrees apart. I elected to use a four bar spacing between the probes (*see Figure 8*). A

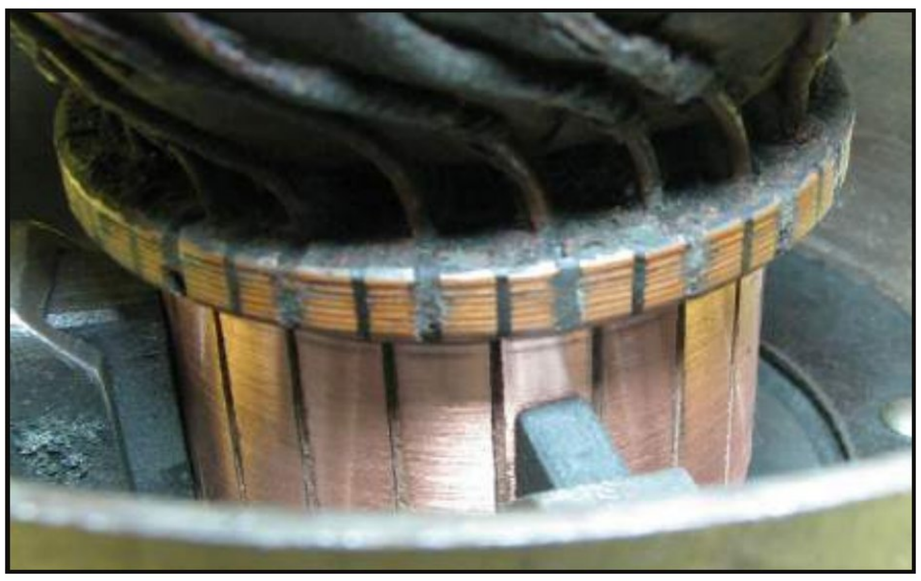

Figure 5 – The narrow third brush was centered on each bar for the test



Figure 6 – This armature registered uniform current flow all the way around



Figure 7 – This armature registered significantly lower readings at several locations

good armature produced the same amperage reading, when tested both ways. The armature that failed the brush holder test failed the direct test too (*see Figure 9*).

You could use either method to test any generator armature, but using the brush holder does take more time. In addition, the brush holders of many generators are attached to the field case, not the CE housing.

Using this test requires a little practice, but it is not difficult if you have something to hold the armature still, while allowing you to rotate it. With a probe in each hand, I was easily able to use my finger tips that were holding the probes to move the armature. Of course, the number of bars pretty much determines the time this test requires. It took twice as long to test a 30 bar Bosch armature, or about 2 minutes.

You may not want to test every generator armature this way. As for me, I would use this test only after an armature has passed both short circuit tests, but before putting it into a rebuilt generator.

You can contact Bob Thomas by email at bob@electricbob.com, or by phone at 904-673-7301.



Figure 8 – Here the test was conducted on a good Model T armature using only the voltage supply leads



Figure 9 – The armature that failed the first test registered one tenth of an amp higher, but still failed



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