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AUTO ELECTRIC CORNER
ASE A-6 Workshop

MAGNETO CHARGING SYSTEMS
Testing Kokusan-Denki Alternators

FORD'S BATTERY MONITORING SYSTEM AND LOAD TEST STRATEGY:
2013 Ford F-150 Case Study

SUPER A FARMALL MYSTERY
An Intermittent No Crank

PLAIN TALK | LEAVE THEM
With A Great Lasting Impression

Electrical Rebuilder's Association ERA FOUNDED 2001

A WORD FROM A BOARD MEMBER
Just Fix It

In our part of the country a lot of the diesel pickup trucks last a very long time - no salt on the roads here. We often see trucks with 400 thousand miles and even more sometimes. The Dodge with the Cummins diesel seems to just go and go. Many of these are older mid-90s to mid-2000 year models.

The regulation field control often fails in the PCM and in some cases the computer is no longer available. Again, these are old ranch trucks that the owners have somehow managed to keep them running. Now they just need and want a charging system that works.

We have installed many external regulators to keep them working for customers. But one of the systems that we came up with is making up a Denso one-wire bolt-on replacement using a 13302 alternator and an IN220SE regulator. The spades in the regulator have no function. We cut the plugin part of the regulator down just below the locking clip tab and install a cap/ plug cover over it. The cap is easily found at a hardware store. It fits nicely under the SRE Cover. We use a different brush holder assembly WAI# 39-8203-1 and a new SRE Cover WAI# 46-82471. This cover fits perfectly without any modifications.

One last thing - there is a tab on the regulator that needs to be removed. I'm not one to modify or change an original equipment design. But when a customer has a real need and is ready to

spend $250.00 or more in some cases, we are going to find a way to keep them going. It is a simple fix. Also don't forget that he cannot get that kind of service from a parts store. So now you gain that customer too.

Larry Hagemeister

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ABOUT THE COVER

Kokusan-Denki stator, used on many small Japanese engines.

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office@electricalrebuilders.org

EDITORIAL ASSISTANT / Bob Thomas

DESIGN & PRODUCTION / Stephanie Schroeder

CONTRIBUTING WRITERS / Larry Hagemeister, Mohammad Samii, Rob Buksar, Bob Thomas, Jessica Myers, Ken Plourde

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Rebuilding is Recycling!

AUTO ELECTRIC CORNER — ASE A-6 Workshop

BY MOHAMMAD SAMII

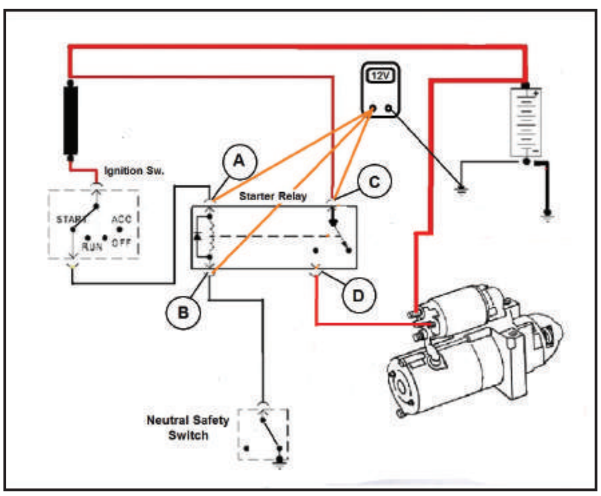
Early last June, I was invited by ASE (Automotive Service Excellence) to join a panel of industry technicians/trainers (OE as well as aftermarket) to take part in the workshop that prepares test questions for the A-6 certification. A-6, the Electrical-Electronic Systems is used to certify participating technicians. The event that is almost a week long takes place in ASE Headquarters in Leesburg, VA, a short distance outside of Washington DC.

This is the second time I have been invited to join the ASE workshop for writing test questions. The process, contrary to the beliefs of some technicians and other nay-sayers is very detailed and thorough. A syllabus (Task List) is laid out first and updated, depicting what a technician needs to know on the particular subject. Then a series of question is written in each task's sub-category and carefully analyzed by all on the panel and voted on for the approval. When the details are worked out, that test question will enter ASE's roster of test questions which will run alongside other questions that have been through the process already. A detailed analysis of the field results will take place next, and the questions that are shown to be too easy or too hard (passed or failed by majority) are re-evaluated, re-written and run again. The current design of the tests reflects the industry trend as there are less concern regarding particular components (starter and alternator) but more about the system configuration as a whole and diagnosing issues related to electrical/electronic systems.

I am not at liberty to show exact test question but will include a sample to give you an idea:

In the schematic below, after the key is turned to start position the starter does not crank. Measured voltages at points A, B, and C are 12V or slightly above, but 0V at point (D). Considering there is no wiring issues, what could be the cause?

(a) Defective ignition switch
(b) Defective Neutral safety switch
(c) Defective starter relay
(d) Defective starter



Answer in the next month's issue, with additional discussion on the website.

Crumbliss Blues…!

My Crumbliss 2450 test bench was purchased new sometime in late 80's and has been working well ever since. It is a 5HP 3-phase machine and is built well for its time. A few issues regarding variable speed drive motor and related mechanism were solved, and by keeping it clean and serviced, we have gotten satisfactory service from it. I have recently added a digital voltmeter in addition to its analog meter to get a quicker grasp of the voltage reading. (*Figure 1*)

I had noticed recently that the voltage and amperage reading were a little low for respective alternators. Since we have other test benches, namely a D&V's JBT-5P and an ALT-7, we could easily confirm that our readings were indeed low. Given that Crumbliss has a relay inside for routing the power, and the fact I have added an external SPDT relay and switch in-line to make a 12 to 6V changeover without talking any cable off the 12V battery (perhaps a subject for a future article), I thought maybe the amount of voltage drop has exceeded an acceptable figure, and that is why the tester is showing lower voltage and amperage readings.

A voltage drop test between the cables and the 12V battery's positive and negative posts did not show any unusual figure, until I noticed if I check the ground circuit between the battery and the body of the alternator, I will see well over 0.7V (700 mV) drop on my DMM. Obviously while the cables were intact, the mounting carriage of the test bench has developed a poor connection between the stationary part (where our negative cable was connected) and the movable part (that holds the alternator). That part moves by turning the tensioning wheel and its jackscrew to tighten the belt…!

So, to make a quick fix that did not require us to remove and clean the entire mounting carriage, we installed a lug to the moveable part to connect the ground cable, in addition to adding a ground strap to eliminate the poor connection that

Figure 1 – Digital Readout for the Crumbliss

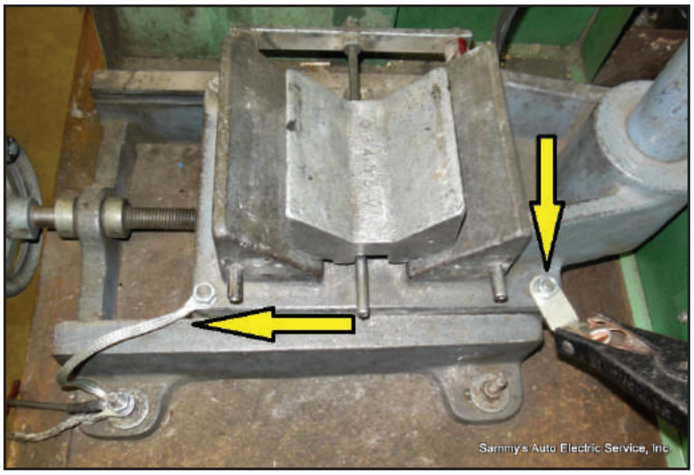


Figure 2 – Added Grounds for Less Voltage Drop

was causing the excessive voltage drop. Since then, the chagrining voltage has stabilized and starter free run test sounds a lot better! (*Figure 2*)

The Hunt for the Stator…!

A good industrial customer of ours who has many cranes and is large enough to operate in a few neighboring states as well as home, brought a Bosch alternator (core) that was in a box with a Mercedes A1041545302 number printed on the box but no number on the unit. Obviously they needed it so bad that got a new one and like many other units that he stocks, needed this one to be rebuilt to keep as a spare.

Plugging the number into various websites did not show a replacement or breakdown for this 24V 100A alternator but Wagner crossed it over to a Bosch 0-124-555-065 to which J&N offered a replacement, AND a stator (340-24035) for it. One was ordered but I found out immediately that it was not the correct stator for the unit. The mistake I made was going by the number on the new Mercedes box, assuming (!) it to be the same for the alternator they took off. It was not. In hindsight, I should have disassembled the alternator first and made notes of the stator's dimensions before ordering one.

The next choice was to send the stator for R&R but the dwindling number of the existing stator winders, in addition to the time, distance and the cost is making it a little prohibitive in most applications. I then remember during the bygone years I had seen an exhibitor in an event with the name of Alfa Auto Electric, a supplier in Quebec, Canada, showing their rewound stators. A quick question on the ERA website resulted in finding his phone number, supplied by our knowledgeable friend and contributor Nathan Unger who is well known by many.

As it turned out Alfa Auto Electric is a very sophisticated stator winder with very hi-tech machinery, similar to ones you see at OE manufacturing and places like Dixie or such. A call to George at Alfa and explaining what I was looking for, directed me to his part number (1101-106), that when pulled up on his online catalog, showed the exact picture and the dimensions of the stator that I needed. (*Figure 3*)

The picture not only showed the stator, but the numbers identified the notch for the through-bolt, and its location in relationship to the first lead of the stator. A feature that helps greatly to identify that you have the correct stator. The price and delivery, given it was shipped all the way from Quebec, Canada, was very reasonable and we had it within a week with no core to worry about. Alfa Auto Electric (Electrique) can be found online at www.alfastator.com which is well worth of a visit. Maybe this persuades him to have a booth at the 2018 ERA Show…!

Now on the ERA Website!

I am very excited and grateful that ERA has given me a special place on the ERA website under Auto Electric Corner heading. In addition for posting the monthly column there, I am hoping it could be used for ongoing conversation regarding the discussed subjects to hear different viewpoints and different approaches. Since the space on the ERA Exchange Magazine is limited, I am planning to use the website for posting additional pictures accompanying my column or other subjects of interest.

Having said so, I feel I have been in a slow start regarding my new tasks, venue, and column. I have no excuse but a few recent trips took me away from work and am a little overwhelmed by the volume of the things left to do. This will of course pass and things will be back to normal, allowing me to participate more on the website and keep the exchange of the ideas going.

Until I see you again, keep up the good work.

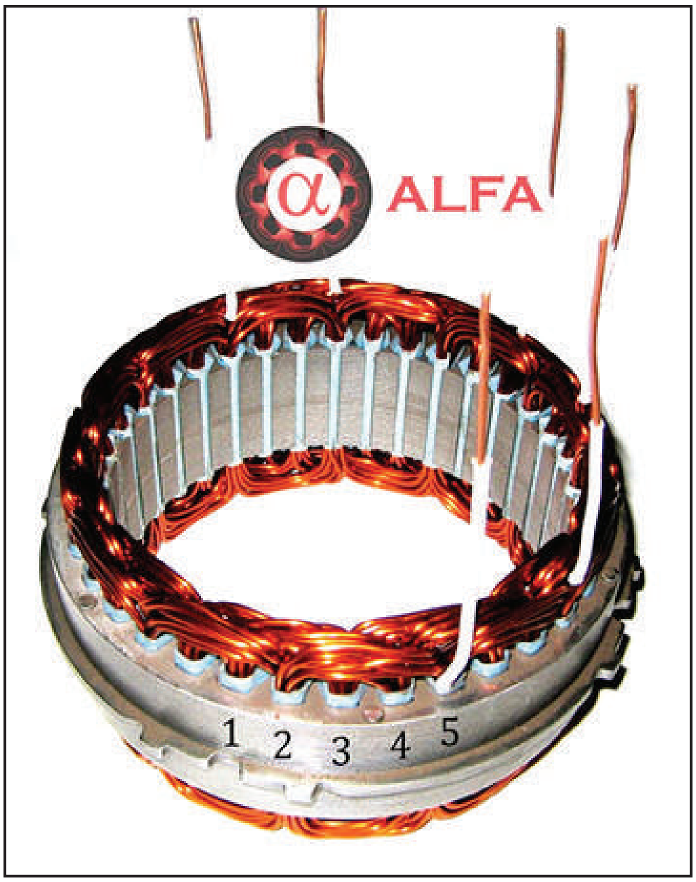


Figure 3 – Bosch Stator Picture from Alfa Auto Electric

PLAIN TALK — LEAVE THEM With A Great Lasting Impression

BY ROB BUKSAR

Most all of us have been stuck waiting while a mile and a half freight train, double-stacked with 48 foot shipping containers, lumbers through a railroad crossing. Yes, it is nerve-wracking. Yet, did you ever stop to think what is in all those containers? They are chock-full of Asian manufactured goods, mostly Chinese, everything from hammocks to hams. Most all of that stuff, at one time, was made here which isn't what this is about so I'll skip around that for now. Chinese factories do not compete against each other as we do here. If a Chinese factory makes TV screens, they make them all. They're just packaged according to the customer's box and logo. Nevertheless, no matter whose brand you buy, it's the same because it comes out of the same place!

Many major metropolitan shopping areas are loaded with commercial outlets; they're just about stacked upon one another. In my area, we have between 3 and 5 auto parts stores within walking distance of each other. Major retailers are sitting on the same real estate. Fast food and restaurants are endless. The wild aspect of all of this is most competitors will match the other guys' price and in most cases, better it somehow.

Prior to really dumb trade deals and globalization, we all pretty much practiced what I call "*thug marketing*". Thug marketers were the guys that felt that anyone who didn't see things their way were morons. After WWII, the demand for consumer goods of all types was simply remarkable! We just didn't have enough of anything to go around. Hang out a shingle, open the door and wait for the customers to line up. And did they!. If a customer wasn't excited about the price or warranty, then you tell them, not ask, to step aside because there was a line behind them waiting to purchase. It was almost impossible to not make a ton of money in those days and most did. The seller was king, regardless of what was being sold. Because of those bountiful decades, most all of us felt it unnecessary to expand our educations and overall, just become better. It just didn't see it as important or necessary!

A super industrialized orient and global economic system has sure changed that. The U.S. has now become the dump for almost all of the planet's industrial output. We have no shortage of anything. We actually have too much. Hardware and auto parts are a good example, containers full of "stuff" come in everyday and there's actually no more room in warehousing to store and inventory all this stuff. Corporate America finds it cheaper just to build another store, and another and another. In lots of cases, we have many markets that are at their saturation point. That means too much stuff and not enough need. Because of this, everyone out there has jumped into everyone else's market trying to sell something where there's still some profit in it. Why? Because their own market has been flooded with too much stuff it's now become difficult to give it away because the need has been filled.

So, here's what the specific purpose of this article is all about. How does anyone grow a business and expand a customer base when everyone else carries the same stuff, has more of it and is willing to match and/or better the deal in order to make the sale? Folks, all we have left is customer service and I don't mean just good customer service. I'm talking about "extraordinary customer service"! Ask yourself? When a customer has a need for something, is your name on the top of their speed dial? Or, is what you do and how you do it so common that customers wouldn't give you a second thought and immediately start shopping elsewhere?

I do a lot of milling around for my own research purposes. Sadly, most vendors are more concerned that their employees are familiar with their computer programs instead of having them say good morning, how can I help you and most important, thank you for stopping by. Anything else that you might need, here's our card with our phone, website and contact info. If we can be of further assistance, feel free to call anytime and ask for me. If you don't get me the first time around, ask for my co-worker Figmo. He will surely help you. If you're not comfortable with that then I'll surely return your call in short order.

> "Folks, all we have left is customer service and I don't mean just good customer service."

Instead of the above, many stores, shops and service centers have zombies handling customer service and they wonder why there's no repeat business? Their approach is not different than anyone of the others, it stinks! We've become hell-on-wheels when it concerns our computers but we've forgot to insist our frontline folks be friendly, serving and most important, grateful. Do you have thugs taking care of your customers? Are you a thug?

It's important for me to divulge the inspiration for this article. I live in a small farm community called Lowell, Indiana. Even though we're small, we have not escaped the scourge of corporate America. We have more stuff than we know what to do with. We also have more than our share of auto repair and oil change shops. Yet, it dawned on me last week that I drive 15 miles north to have my car serviced when I could do it 5 minutes away. Why would I do that? Extraordinary customer service! There is a Duke of Oil/Auto Fix on US41 in Highland, Indiana. I just don't know if it's time, chance or circumstance but this particular crew has rewritten the book concerning great customer service. Aside from being totally up-to-date, competent, professional and timely, they always do more than what is asked of them. They add value. The icing on the cake is this, all of the principle staff knows me by name and my girlfriend. They call and remind me to check all my fluids, lights and tire pressure. They keep a watchful eye out for tire wear and filter conditions at no charge and they abuse nothing. When my vehicle was going to be laid-up for a couple of days, they took care of a car rental for me at a great price then returned it for me when my vehicle was done. I can't imagine taking my business elsewhere along with many other of their satisfied customers. They have won us over. If anyone can win over 20% of their customers and convert them into a regular after a year, you have a fantastic customer base. So it's Sean, Glenn, Mark, Eric, young Bob and super Larry, best tech anywhere, atta boy, guys! You are the best of the best. You'll have earned the distinction of being at the top of my speed dial along with a sea of other customers. You guys did it right! You earned it.

So, here's the bottom line. The sales we all desperately need are in those shipping containers and stacked up corporate outlets. Corporate America is so busy building new stores that they have a critical shortage of employees with the "right stuff" to run them. They may be good computer geeks but good customer service folks, ha, they suck! There lies the answer; winning over customers with extraordinary customer service is not "kissing everyone's butt" as I often hear! It's just not taking your customer for granted but with gratitude thus adding value to the transaction as the Duke of Oil/Auto Fix crew has. Keep in mind, these days everybody carries the same stuff. So make yourself different by not being a thug and practicing extraordinary customer service. You only need 1 out of 5 so add value and win back your customers.

God bless America and our little industry.

Rob can be reached at International Winding, Inc
800-323-7521 or hoosierelectric@comcast.net

MAGNETO CHARGING SYSTEMS
Testing Kokusan-Denki Alternators

BY BOB THOMAS

Most electrical rebuilding shops have, by now, seen at least one Kokusan-Denki alternator. They are those little permanent magnet alternators that have been used on small Japanese industrial engines for compact tractors, mowers or other types of equipment. Denki alternators differ greatly from the automotive variety that we are most accustomed to seeing.

They utilize permanent magnets to produce AC (alternating current)in place of a rotor with a field coil. With no brushes to wear out, they usually last until the bearings fail. If caught early enough the bearings can be easily replaced. However testing them has been a challenge because most alternator test benches are designed to test DC (direct current) output connected to a battery. By the way, this alternator is technically a magneto.

A magneto is any electrical generator that uses permanent magnets to create AC. Unlike generators or dynamos that use a commutator and brushes to produce DC, a magneto moves permanent magnets past a coil wound around an iron core to induce a pulsing AC into that coil. The first magneto was built in 1832 by a Frenchman named Hippolyte Pixii based on Michael Faraday's principle of magnetic induction. Although Pixii never found a practical use for his new device, others eventually did. The ringers on Bell's first telephones were hand cranked magnetos.

Magnetos have been in use on engines for well over 100 years to provide the power to fire spark plugs. They have been used on cars, trucks, tractors, outboard motors, lawn mowers and a wide variety powered equipment. Almost all piston driven aircraft in use today have dual independent magneto fired ignition systems that are totally separate of the planes electrical system as a safeguard against in-flight failures. In a growing number of small engines today, they can also maintain a battery's charge if the engine has electric start. Most of those are built into the engine with the magnets on the flywheel. But the Denki alternator provides a universal solution, belt driven and capable of producing more power.

Figure 1 – The most common Denki alternators look like this one.

Figure 2 – This Denki alternator used on some tractors has a rectifier/regulator attached.

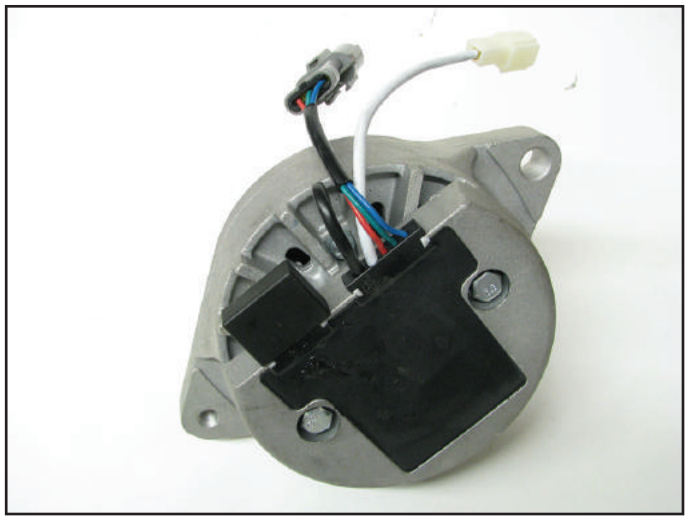


Figure 3 – This rear view shows the solid state rectifier/regulator.

Denki alternators are low amp units but capable of producing up to 20 amps if needed. The most common one (*see Figure 1*) operates in conjunction with a separate rectifier/regulator to provide stable DC charge voltage. They were designed to supply minimal power to maintain a battery, supply current for engine management and power a few warning lights. A later version (*see Figures 2 and 3*) that was used on small tractors has a rectifier/regulator bolted to it. Therefore his Denki alternator produces DC output and can be tested the same as any other alternator.

If you look inside a Denki magneto, you can see that the stator poles (*see Figure 4*) are stationary, mounted to the rear frame that does not turn. Notice that each pole has a coil around it, made from one continuous length of wire. Therefore the stator coils are in series, alternately wound CW – CCW - CW – CCW around the poles (*see Figure 5*).

Generally, if the coils appear to look good they are probably OK. But I would still advise that you test them. I tested our

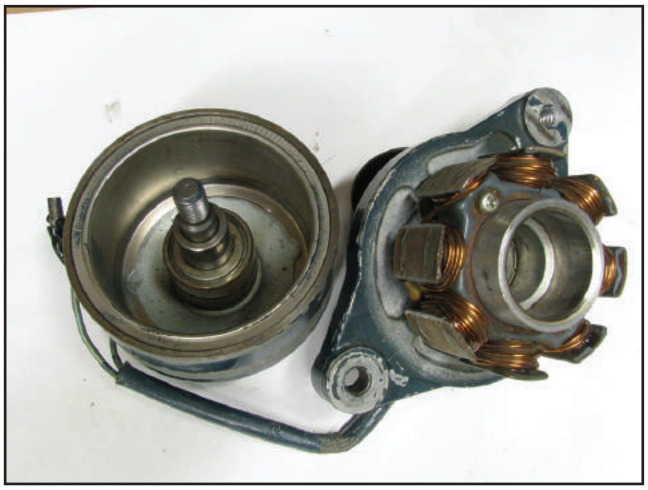


Figure 4 – The rotor that houses eight magnets rotates around the outside of the stator.

Figure 5 – The eight coils are wound in series from one continuous piece of wire, resulting in two leads.

subject alternator for both resistance and current draw. Since resistance is low, you will need a low ohm meter to measure it (*see Figure 6*). As you can see in our photo, this stator read out at about 1.7 ohms. Other Denki alternators may vary slightly from that.

What is more important is to insure there are no shorts to ground – meaning copper to steel, coil to pole. I used a stator tester to load test the coil and check for shorts to ground (*see figure 7*). The number here is not important unless you happen to have the same Ace tester.

Here is a good place to mention that this alternator had failed in the field while the stator coils appeared to be in good condition. What I found when testing it was that the female bullet connector on one of the stator leads had not been making a good connection. Both bullet connectors had been hot enough melt the heat shrink covering. Had I not load tested it, I might have missed that. If your stator tests open under load but looks OK, clip off the connectors and test it using the coils lead wires.

The rotor contains eight permanent magnets. The magnets are not visible but I used a Gauss meter to count them (*see Figures 8 and 9*). As you can see, they alternate between north and south. They are secured and sealed in place by a thin

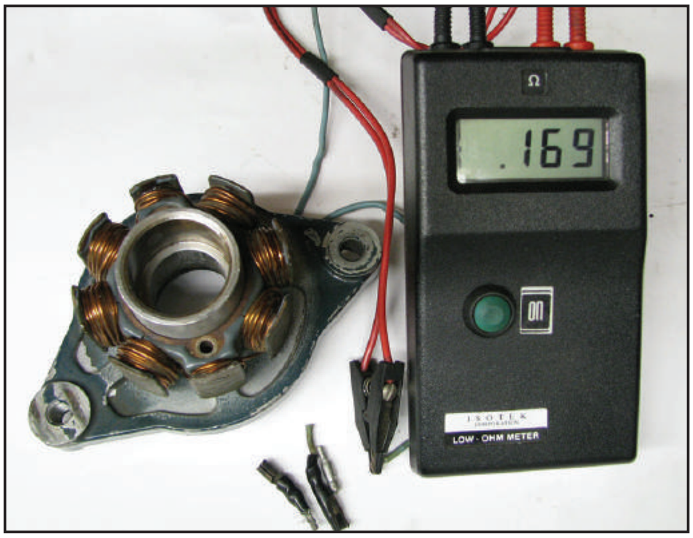


Figure 6 – Testing the stator for resistance value showed it to be about 1.7 ohms.

Figure 7 – A stator tester verified continuity under load and allowed a short to ground test by moving one lead to a steel surface.

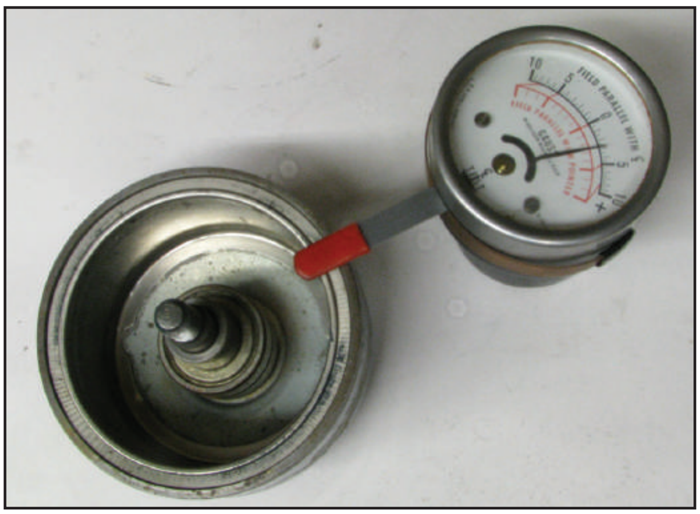


Figure 8 – Here I used a Gauss meter to count the magnets.

stainless steel shield. Since stainless steel contains no iron, the shield does not inhibit the magnetic flux lines as they move around the stator's poles. The rotor housing also serves as half of the pulley.

The rotor is supported by three 6201 bearings, two on the pulley side of the stator frame and one on the back side (*see Figure 10*). There are two spacers on the shaft to take up space between the front and back bearings. One M10 x 1.25 bolt holds everything together (*see Figure 11*). These alternators can usually be disassembled within a few minutes. Just be careful to not use a hammer to strike the rotor that holds the magnets. Tapping the bolt out while supporting the pulley end is the quickest way to get it apart.

The 6201 bearings are a reasonably-priced common size. There is not much that can go wrong other that a complete bearing failure that destroys the magnets. For about $5 in parts, you can easily turn one of these around in 20 to 30 minutes.

There are two ways to test this alternator on your test bench. The first is as described in the JIMCO diagrams, by connecting the two output wires to any automotive rectifier (*see Figure 12*). I used a common 10-SI rectifier but any one with good diodes will work. Then connect the positive and negative sides of the rectifier to your test bench leads. Keep in mind that you have no voltage control using this method other than varying shaft speed or applying a load to match the output. Keep a close eye on output voltage, using loads or shaft speed to stay below 15 volts.

The second method checks AC but does not test the alternator at full output. Connect a 12 volt automotive bulb to

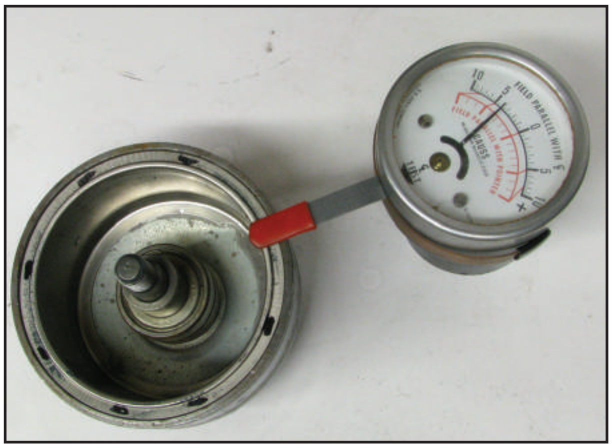


Figure 9 – Here you can see where I marked the center of each coil.

Figure 10 – One bolt holds all of these rotor pieces together and attached to the stator frame.

the stator leads and measure output in AC voltage with your meter (*see Figure 13*). For this test you must use variable speed to control voltage. If it illuminates the bulb and produces voltage, it is working. There is no need to take it up to 14 volts. Use shaft speed to limit voltage to protect the bulb.

Special thanks to Joe Davis for the loan of our subject alternator and Juan Grube for JIMCO's Kokusan-Denki testing information.

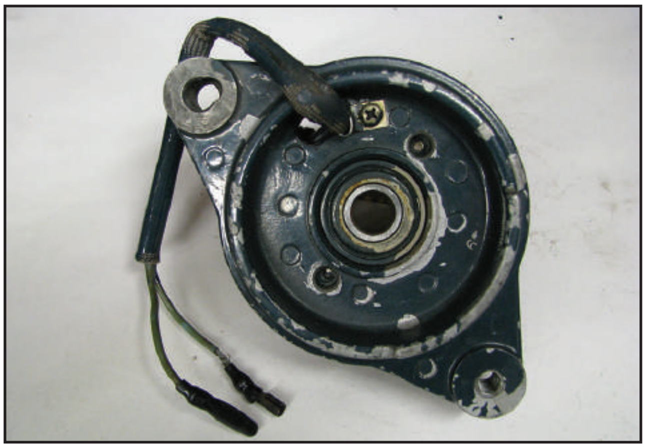


Figure 11 – The rear bearing must be knocked out of the back side of the stator frame.

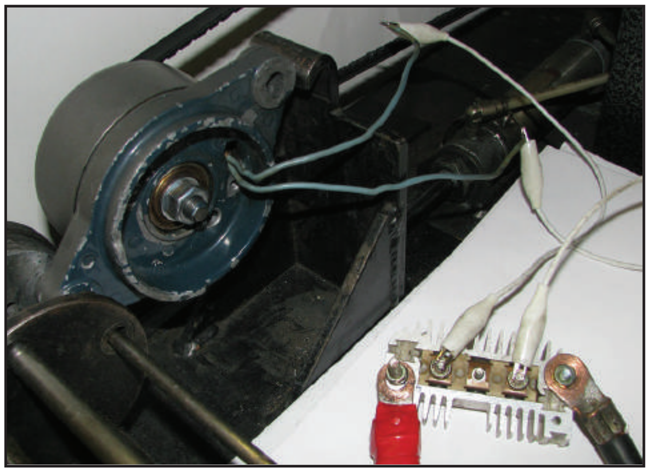


Figure 12 – Here we are testing the Denki alternator using a 10SI rectfier to convert AC to DC.

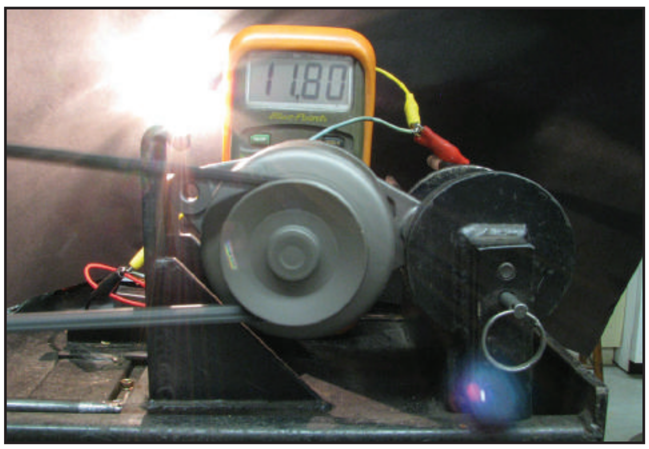


Figure 13 – Here we are testing the Denki alternator's AC voltage using a meter with a 3157 lamp for a load.

FORD'S BATTERY MONITORING SYSTEM
AND LOAD SHED STRATEGY: 2013 Ford F-150 Case Study

BY KEN PLOURDE

Since 2013, Ford has been using a current sensor on the negative battery cable of some vehicles to monitor battery discharge rate (*see Figure 1*). This type of sensor is not totally new to the automotive industry. General Motors used a strikingly similar one as a part of their RVC charging system. But GM used their current sensor's information to adjust alternator voltage set point, while Ford's new sensor is a key component of their BMS (Battery Monitoring System). The BMS is used to control parasitic loads when the engine is not running or the alternator is not keeping up with vehicle loads when it is running.

Figure 1 – This current sensor on the negative battery cable is a key part of Ford's Battery Monitoring System.

Once the engine is turned off and all doors are close, the BCM (body control module) monitors the discharge rate through the battery current sensor along with battery voltage from two independent B+ sense circuits. The BCM uses that information to calculate the battery's **state of charge** as it drops due to normal parasitic drains. If the discharge is seen as being too high, the BCM begins shutting down accessory loads.

Ford calls this "load shed strategy". It begins when the engine shuts down and continues for up to 8 hours after the ignition is turned off and all doors have been closed. In the event that the switch is turned to run, accessory, or delayed accessory positions, instead of off, the system reminds the driver to shut down the audio and navigational systems, or restart the engine once the battery is below a given state of charge. All of this is done through the BCM.

When low voltage or a discharge is sensed by the BCM with the engine running, the BCM sends a message to automatically shut down climate controlled seats, rear defrost, heated mirrors and a second AC blower if so equipped. When this happens. A message may be displayed warning of low voltage and a notification that load shedding is taking place. This could happen at idle even when the alternator is working normally if excessive aftermarket loads have been installed on the vehicle.

I first ran into this system on a 2013 Ford F150 pickup with a gas engine. It was also used on other Ford vehicles including Explorer, Expedition, Edge, Flex, Fusion, Taurus, Transit, Police Utility, Police Sedan, Lincoln MKS, MKT, MKX and MKZ models. Ford's BMS can cause you problems if you replace or recharge a battery in one of these vehicles.

The official Ford protocal for replacing a battery calls for the use of a scan tool on the BCM to reset the monitoring system. In the event that cannot be done, it takes the BCM about 8 hours to learn a new battery state of charge. During this time, the vehicle must remain completely undisturbed. That means no doors opened or keyless entry buttons pushed. If the BCM is prevented from learning the new battery's state

Figure 2 – Ford's alternator current sensor in the F150 is located out view, under the upper radiator hose.

Figure 3 – Ford's current sensors utilize three wires as you can see in this familiar looking Ford plug connection.

of charge, the engine-off load shedding may occur sooner than normal and a battery warning message may be displayed.

Ford has a specific procedure to follow when charging a battery in any of these vehicles. First and foremost, a charger must never be connected directly to the negative battery terminal, which would effectively corrupt the state of charge programming. For that reason the charger's negative cable must be connected to the engine or chassis. The same applies to any added devices that require a battery connection. They must be grounded to the chassis or engine and never directly to the battery's negative terminal. In the event that the vehicle has been jump started, a warning message may be displayed until the BCM determines that the battery's state of charge is above 40%.

Interestingly, the charging system of most of these same vehicles also uses a current sensor, but this one is in a new location that we had not seen previously. It is on the alternator's output cable (*see Figure 2*). On the F150 truck, it is not very easy to see, located directly beneath the upper radiator hose. This current sensor is used by the PCM (powertrain control module) to monitor alternator output current, which has a direct relationship to the mechanical load that the alternator is placing on the engine. That information is used by the PCM to manage engine idle. Up until 2013, Ford's voltage regulator duty cycle on the FR terminal served that purpose. You may also notice that Ford's current sensors use three wires to communicate (*see Figure 3*) with their respective control modules as shown in the wiring diagram (*see Figure 4*).

Note: Several sources seem to indicate that BMS may have been used on on some Ford trucks starting as early as 2011. The key to recognizing this system is the telltale battery current sensor on the negative cable near the battery. Also keep in mind that Ford's BMS software was coded for the original battery. Replacement with a battery of different capacity or chemistry may affect displayed warning messages.

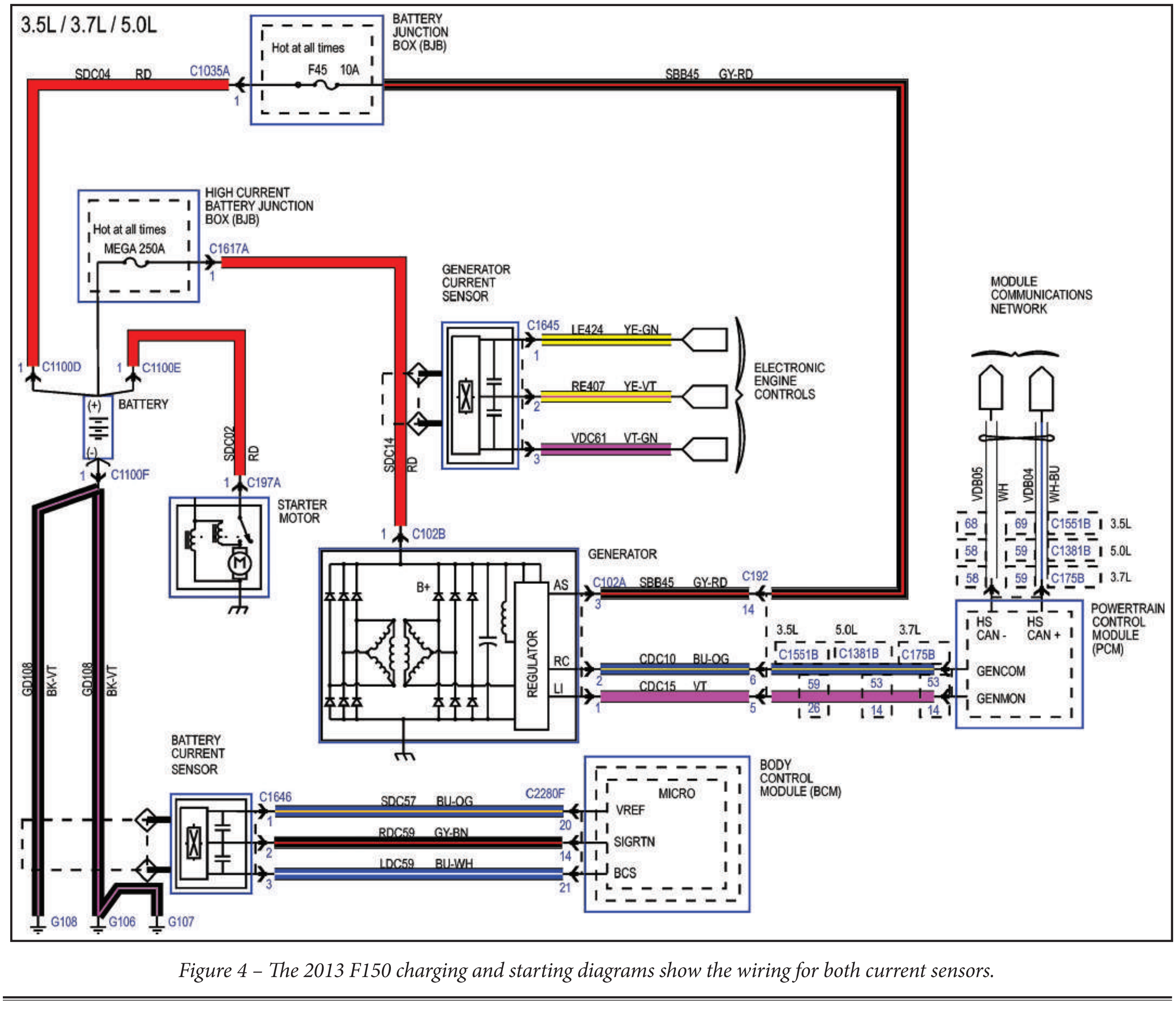


Figure 4 – The 2013 F150 charging and starting diagrams show the wiring for both current sensors.

EXPLORE THE ERA WEBSITE
Using the Forums Part 5: Community

BY JESSICA MYERS
& BOB THOMAS

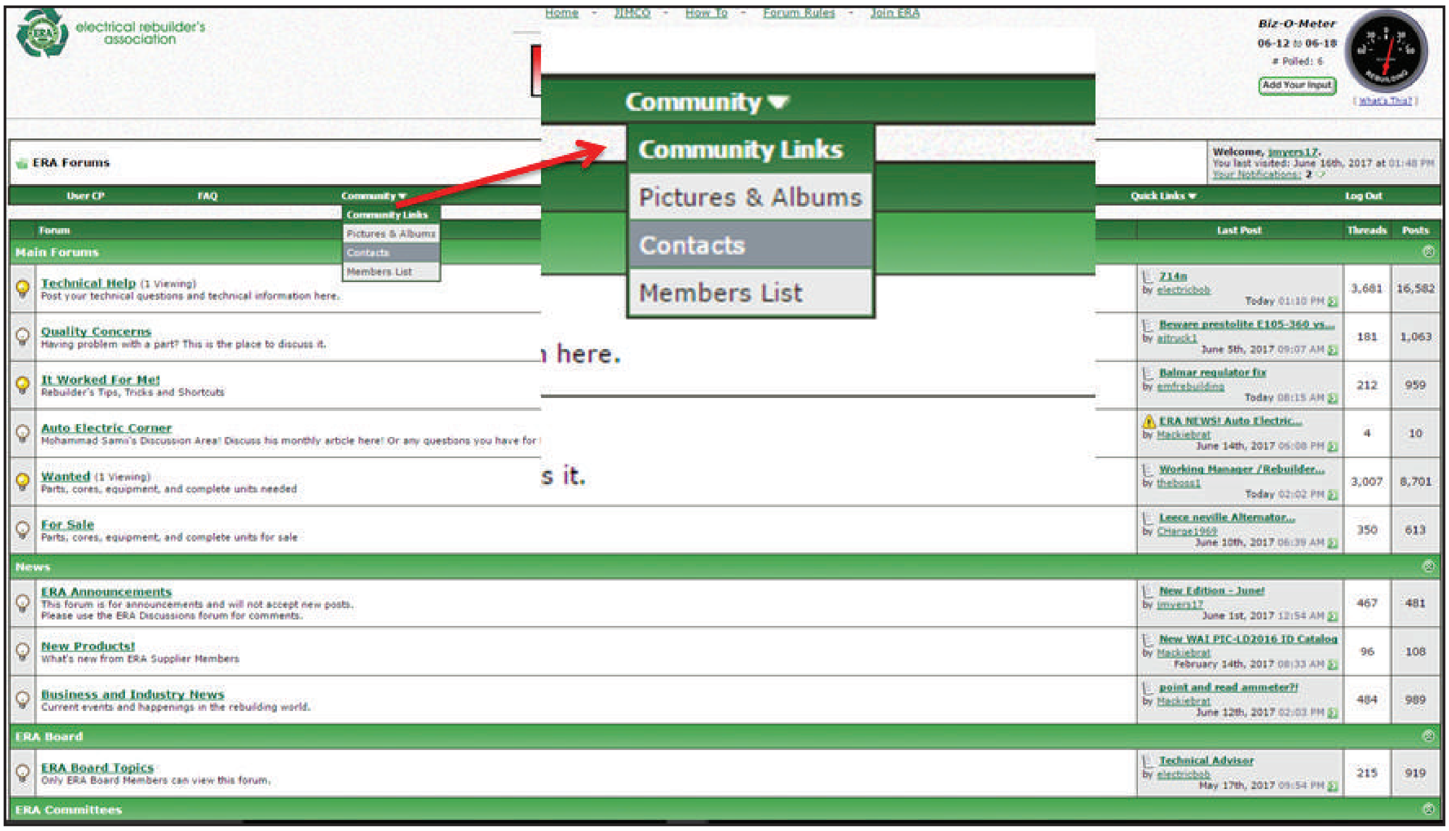
Those readers who use the Forums regularly already understand what being a part of a close-knit community is like. ERA members that have not used the Forums do not know what they are missing. If you are one of those, take a the time to have a look around. The Forums hosts dozens of information exchanges daily, all posted online. You will be surprised at what you can learn just by reading a few posts.

This issue we will explain some features that are designed to help you make the most out of that ERA community. Once you access the Forums, on the green menu bar, between FAQ and Calendar, you will see "Community" (*see Figure 1*). If you right click on it, a drop down menu appears with three choices: Pictures & Albums, Contacts and Members List.

Pictures & Albums is a way for you to share your own photos with other members. Uploading photos here is basically the same as uploading photos to a Forum post, as described in last month's issue.

Contacts is way for you to easily access contact information for the friends and acquaintances that you get to know on the Forums. To add a member to your contact page, simply type their username into the box and hit Save Contact. When you do that, their name and avitar will appear. Any time that you need their phone number, mailing address or email address, you'll be able to find it quickly without typing in a single word, by simply clicking on Contacts.

Member List is similar to a phone book but with a lot more information than a phone number. It allows you to look up any member's contact information quickly using their Forum username. Listings are in alphabetical order. At the top of the page is an index that will take you straight to all usernames that begin with the same letter. This database includes anyone who has ever been a member, although some of the expired member information may be out of date. If you need to get in touch with any ERA member, this is a quick way to access it.



SUPER A FARMALL MYSTERY
An Intermittent No Crank

BY BOB THOMAS

Sometimes the clue that you need need to solve an electrical problem can appear in a strange or mysterious way. Such was the case with a Farmall Super A tractor that my neighbor brought over to me for testing (*see Figure 1*). I had rebuilt this starter previously and converted it to 12 volts for him at the same time. Both the drive and drive end housing had been damaged from cranking it on 12 volts prior to that. Now I was being told that it would work fine at times but make no noise at all when it intermittently refused to crank.

Figure 1 – This Super A Farmall is patiently awaiting some much needed attention.

The battery was brand new but its state of charge was below 60%. After recharging, it load tested very well. Overnight it even held the surface charge from the day before. As often happens with intermittent problems, this starter cranked the engine for me once connected to a voltmeter, but the engine was not firing off. Did they drain the battery low by cranking it excessively because of a fuel or ignition problem?

A new 2 gauge positive cable had been installed. The ground cable looked old but definitely not the original braided type. The ground side voltage drop was minimal while I was cranking it. Not withstanding, there was also a shifting problem with the transmission, in that there was no neutral. That necessitated holding in the clutch for starting.

In addition to that, the lever on the mechanical switch was missing. Without the lever, the original starter actuation handle was not connected to anything (*see Figure 2*). The only way to activate the starter was to push on the mechanical switch directly - in other words, one foot on the clutch and the other stretched out to hit the button on the mechanical switch. A feat that I can attest was not very easy to do. I surmised all sorts of scenarios that might explain the "intermittent" no crank, most of them pointing directly toward the operator, who was an employee of my neighbor.

The tractor had been sitting in my yard for a few more days when the neighbor showed up with a helper to work on the transmission's shift mechanism. As they removed the gearbox cover with shift forks attached, I explained the testing that I had done. I told them that neither the battery nor the starter were causing their problem. Once we manually put the transmission into neutral, I offered to demonstrate how well the starter worked.

But to my embarrassment, it failed to do anything as if it had a mind of its own - dead set on proving me wrong. Since the sky was beginning to darken with storm clouds, we covered

Figure 2 – The actuating lever linking the mechanical switch to the starter's actuating rod was missing.

the open transmission and I pulled the starter off for inspection inside the garage. In the haste to beat the rain, I overlooked the wisdom of performing a second voltage drop test with the starter not working. As you have probably already guessed, I was unable to find anything wrong with the starter. Night fell under a light Florida rain.

Around midnight a heavy thunderstorm passed through that the rain gauge later confirmed to have dropped over an inch of water. Later, about 2 am, I woke up and walked to the kitchen to get a drink of water. Standing at the sink, I caught a glimpse of a strange light in the yard, which turned out to be the illuminated trunk of our pecan tree. I had never seen it lit up like that before and began to imagine all kinds of uncomfortable explanations.

I ventured outside to investigate with a flashlight, only to discovered that it was the left side headlamp on the Farmall that happened to be pointed right at the tree. Having been out in the yard with our dog before going to bed just a few hours earlier, I was sure that someone or something had to have turned the Farmall's headlight switch on after that. I looked all around, saw no one, turned the headlight off and went back to bed. There I laid awake for about an hour wondering who or what could have turned that headlight switch to the "on" position. I was not buying my wife's suggestion that the cat could have done it.

The following morning, I remembered that my neighbor had been playing with the Farmall's switches while his helper was removing the transmission's cover bolts. Could he have accidentally left the headlight switch on? Could it be that they did not work then because of a bad ground and the same bad ground had also prevented the starter from working for me? And if it was a bad ground, how did it suddenly "fix itself" in the middle of the night?

I checked battery voltage and found it to be 12.7 volts, proof enough that the headlight had not been on for very long when I turned it off at 2 am. Visually following the suspect ground circuit revealed multiple questionable connections. The engine side of the ground cable was attached to a steel bracket that held the fuel tank above and behind the battery (*see Figure 3*). That bracket in

Figure 3 – The negative battery cable was bolted to a bracket under the fuel tank, above and behind the battery.

turn was bolted to the tractors hydraulic pump, which was in turn attached to the bell housing to which the starter was bolted.

I had been told that this tractor was sitting unused for at least a decade before my neighbor bought it. Every steel surface was rusted. Once I removed the ground cable, I could see just how rusted the threaded hole was for the negative cable (*see Figure 4*). To insure that the starter received a good ground, I made up a new negative cable and attached it directly to one of the starter's mounting bolts (*see Figure 5*).

Considering the missing lever on the mechanical switch, I told my neighbor that I could easily convert the starter to a push-button start if he so desired. We both knew that the missing lever was available from various sources. But the owner's main concern was to get the old machine running again and not make it into a restoration project. He enthusiastically took me up on the offer. I saved the old parts for him just in case a future owner decides to restore it.

I replaced the mechanical switch's motor stud on the field case with a modified 5/16 early Ford starter battery post. After drilling and tapping an extra hole in the field case I mounted a Cole Hersey starter solenoid on the side of the starter (*see Figure 6*). Then I connected it to a push button switch that I mounted on the left side below the driver's seat (*see Figure 7*).

With the starter problem solved, I would now be able to move on to other jobs, except for lingering unanswered questions. How did an essentially open, bad ground suddenly disappear in the middle of the night? Could the rain have had anything to do with it? Would the starter have worked too after it rained if I had tried it?

Honestly, I cannot say for sure. But I suspect that the heavy rain soaked deep into those rusted connection points to dissolve salt residue to form an electrolyte – one strong enough to re-establish the headlight circuit and possibly even capable of cranking the engine had I tried it. Without a doubt, the starter had been working intermittently for months off and on. But I'm sure that it also turned the engine noticeably faster after the cable was moved.

Figure 4 – Once the ground cable bolt was removed, the condition of that electrical connection became obvious.

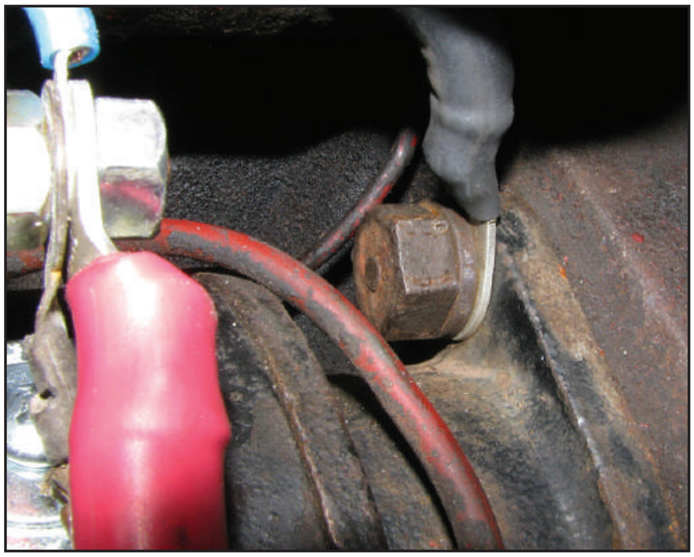


Figure 5 – The new ground cable was attached directly to the starter by way of its mounting bolt.

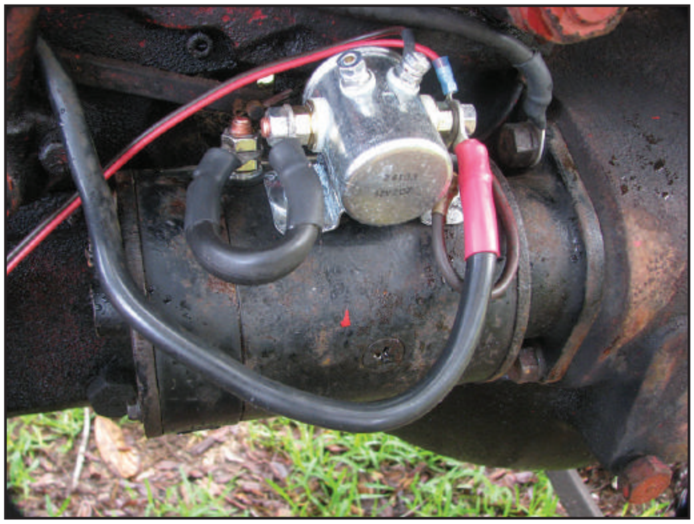
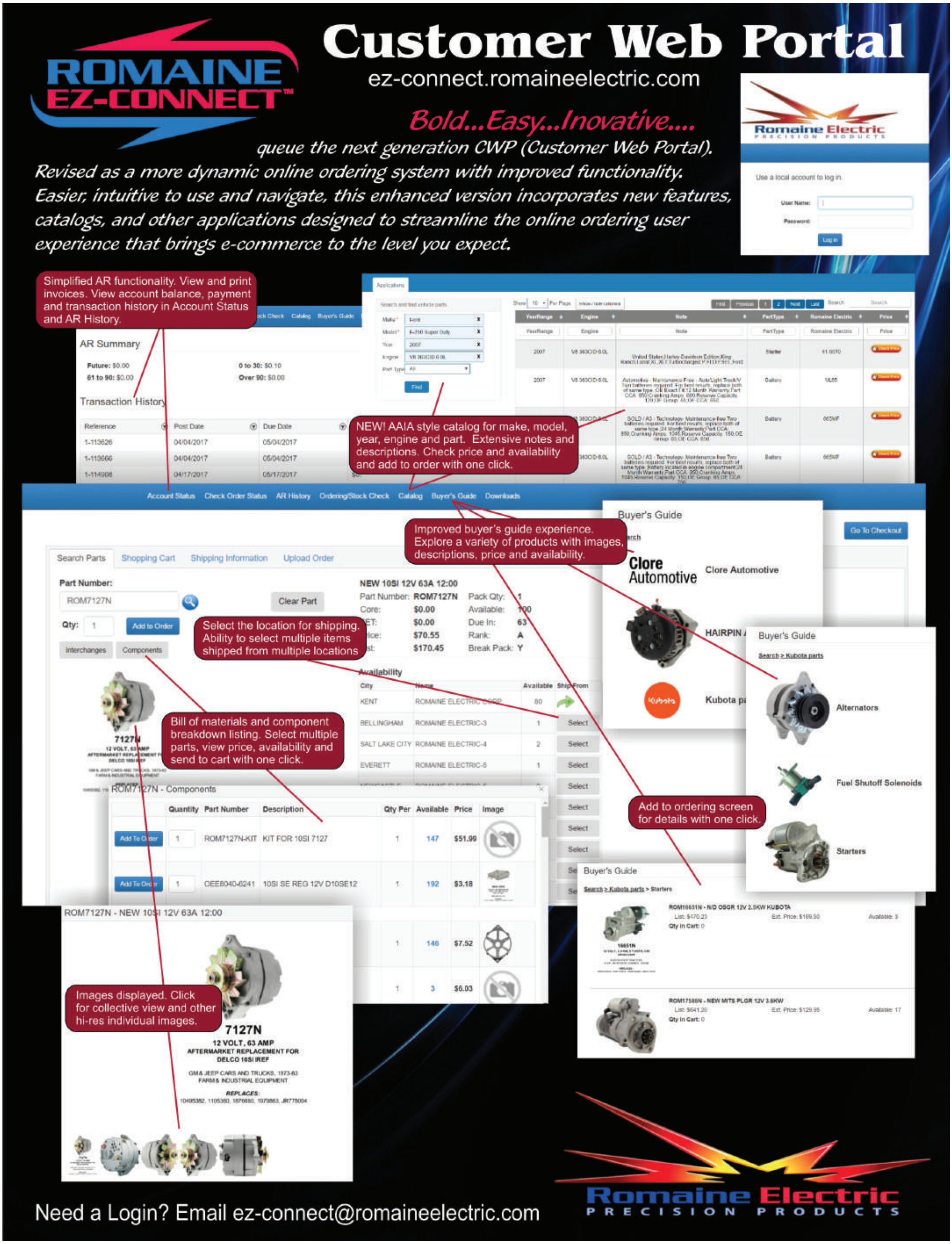


Figure 6 – A starter solenoid was mounted on the starter's to replace the mechanical switch.

Figure 7 – A push button starter switch was installed just below the driver's seat on the left side.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