ERA EXCHANGE

YOUR GUIDE TO ELECTRICAL REBUILDING

January 2018 $12.95

AUTO ELECTRIC CORNER
Reasonable Upgrades and Testing PM Alternators

KOHLER RECTIFIER/REGULATOR OR NOT
Beware of Two Part Numbers

TORQUE VS HORSEPOWER
Mechanical or Electrical?

2018 ERA TRADE SHOW SCHEDULE

PLAIN TALK | Relationships – YES

Electrical Rebuilder's ERA Association
FOUNDED 2001

A WORD FROM THE PRESIDENT
It's Who You Know

With the holiday's now past and another month or two of winter remaining, I am looking forward to the spring season and our upcoming trade show in Montgomery, AL. You can read more about the city, the hotel, the seminars, plant tours and Regitar-USA's riverboat dinner cruise elsewhere in this issue.

But I would like to share what I think is the least-appreciated benefit of attending this annual event – one that you seldom hear mentioned. It is simply what you can learn from other members over a beer, a cup of coffee or a meal. Based on previous shows it is fair to say that we'll have more than 100 different businesses represented – all involved in the same industry – rebuilding and/or selling rotating electrical products.

I have heard more than one attendee tell me that they learned one thing, from one other person at a show, that made them enough money over 12 months to pay the full cost of attending the event. It sounds like a sales pitch but it's a fact. It can happen to you too.

The secret to making this work for you is first, planning now to attend. And second, make the most of it once you get there by taking a list of your greatest challenges with you. Start now by making your reservations and sending in your registration form. Then, keep a pen and pad somewhere handy to jot down those challenges as you encounter them throughout the day. Start now and you have three months.

Then, all you have to do is engage in conversations. It is a lot easier than making sales calls because you'll discover that other members want to talk to you too. This publication that you are reading is named "Exchange" for a reason. Our organization was founded so that members could exchange information and share their knowledge. There is no better way to do that than live and in person.

"It is not so much who you are – **it's who you get to know.**

One thing that I've learned over the years is that all of our businesses are remarkably similar. Sure, some are located in large cities while others may be 50 or 100 miles from one. But our customers and the products and services that we sell to them are pretty much the same. And the headaches and heartaches that come from running a business are the same too.

Your membership in the ERA puts you one step ahead of your competition already. If you'd like to increase that lead by several more steps, come to this show and make the most of it. It is not so much who you are – it's who you get to know.

Mike Dietrich

NEW ERA MEMBERS

Parts Exchange Co. Inc
Beaumont, Texas

ABOUT THE COVER

These Kohler rectifiers look alike – but they are very different.

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Rebuilding is Recycling!

INDUSTRY NEWS
& ANNOUNCEMENTS

Montgomery, AL

Embassy Suites by Hilton Montgomery
300 Tallapoosa St, Montgomery, AL 36104
(334) 269-5055
Group Rate: $114 per night + tax
Group code: ERA

ERA Expo 2018, to be held April 12-15, promises to be a very special event. The host hotel, Embassy Suites by Hilton, is located in downtown Montgomery, AL, and was chosen based on value and location.

The value is in the hotel's amenities that are included in the room rate. They begin with a full breakfast buffet with omelet bar each morning from 6:00 to 9:00 and continue each evening with a manager's reception where guests are provided complementary beverages, both alcoholic and non-alcoholic in a relaxed atmosphere from 5:30 to 7:30. Free high-speed wireless internet is available throughout the hotel for all Hilton Honors members – which you can join at no cost – any time online before you make your reservations or as late as when you check-in at the desk.

Each room in this facility is a two-room suite, with a living area separate from the sleeping room. Each of the suite's rooms has its own 36" flat screen TV. The living room has a sleeper sofa, work desk, 2-line direct dial phone with voice-mail, wet bar, refrigerator, microwave and coffeemaker. Bed rooms are available with two double beds or one king size bed.

The hotel provides free shuttle service to and from the nearby Montgomery Regional Airport, which is serviced by both American and Delta. The Embassy Suites offers gated parking for $14 per day, with free public parking within walking distance.

Of course, the show itself and most of the seminars will take place within the hotel. Transportation (included as part of your registration) for the Hyundai and Regitar-USA tours will depart and return from there. Regitar's Saturday evening riverboat cruise aboard the Harriott II departs from its dock on the Alabama River just one block away from the Embassy Suites.

The hotel is located in the historic section of downtown with the Hank Williams and Rosa Parks Museum within two blocks. Overlook Park is on the river nearby.

AUTO ELECTRIC CORNER — Reasonable Upgrades and Testing PM Alternators

BY MOHAMMAD SAMII

The Story of Two Alternators…!

Upgrading alternators for high and higher output is a common practice that many rebuilders contemplate with various degrees of success. I am not going to debate the merits of upgrading an OE alternator with simply a rectifier and stator change, as I give a lot more credit to OE engineers who have the knowledge, budget, and skill to maximize the efficiency of their alternators. Looking at the big picture, they probably know well that if a stator and rectifier change was all it took to come up with a unit with twice the output of the original, then they would have done so…but that is another story and not what I am going to write about now…!

Staying with the same size and configuration, the choices are more limited when the application is an old tractor or industrial engine, running a 3/8 V-belt and do not need all that much more power, but just a little more! Our case was a construction company who had an early 60's Clark forklift with a 10-DN (7111) alternator and external regulator. Their complaint was the system was charging but would not keep the battery up, perhaps due to higher demand for the extra installed lighting on a machine running inside their not-so-bright warehouse. I suggested that they bring the alternator and regulator in so that I could make a workable suggestion.

The 10-DN alternator and the external regulator were connected together and run on our D&V's JBT-5 Pro that has graphing and printing capabilities. You can see the performance curve of the customer's original alternator (*Figure 1*), which gives us a baseline of what we had and an idea how much more was needed.

An upgrade to a 10-SI seemed to be a logical choice, but since some wiring changes would be necessary on the machine and the operator may not have the skill to do it properly, creating additional problems, we decided on a self-exciting 10-SI alternator, built with a B-circuit AC activated regulator that is readily available by many industry suppliers. We also used a rewound 7127S stator. This alternator was run and the performance was graphed as shown (*Figure 2*).

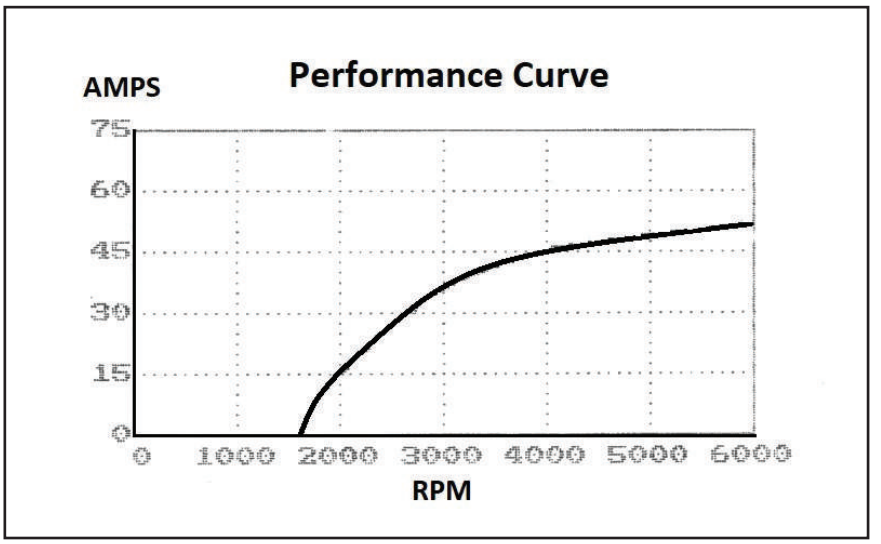

Figure 1 – The 10-DN's performance curve (run with external regulator)

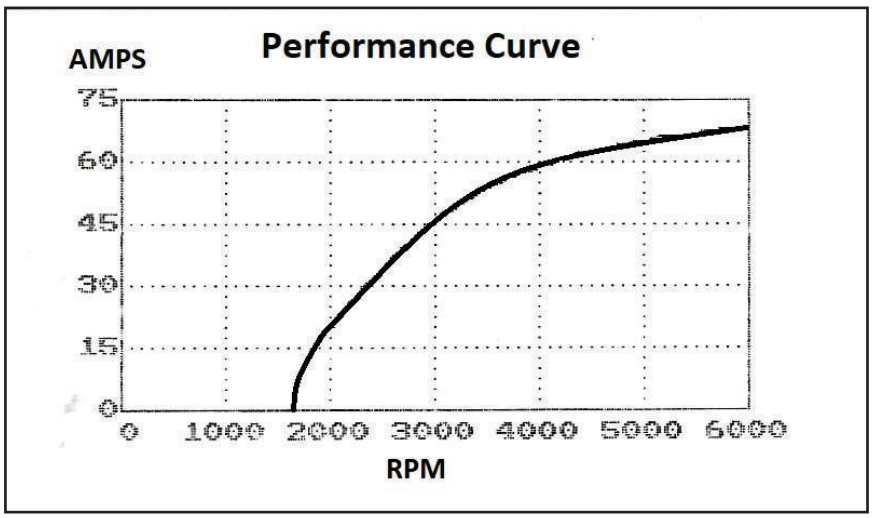

Figure 2 – Our 10-SI's performance curve (built with AC excited B-circuit regulator)

A simple side-by-side comparison showed that the 10-SI put out 10 to 15 more amps in the alternator's 2500-4000 RPM range, which is the most realistic engine operating speed for a common forklift laboring inside an warehouse and even a little better performance at a higher engine speed. Would this additional output be enough to solve the problem that they had? Well, I thought it would and a couple of follow-up calls indicated the battery is staying up and there have been no more starting issues. They seem to be happy with the money that they spent with us, and at the end of the day that is really what matters the most…a happy customer and a good sale!

PM Alternator Testing…!

The Kokusan Denki brand of PM alternators is the most common type that comes in for repair. They are usually sound electrically but bearing failures are what normally brings them in. If the windings are burned or the magnets are broken, then a replacement is necessary as a suitable alternative to repairing them.

They can be installed and run on most test benches with a little effort or improvisation, and for checking the output you can connect a test light across the 2 AC output wires and run it. The RPM must be kept low as the voltage rises quickly and blows the bulb. In the past, I have used 110V 40-60W bulbs and connected it with some wires and clips attached to the light socket.

In order to put an actual load on the alternator, I dug up an unused rotor coil (Chrysler square-back alternator) that was gathering dust and connected its leads to AC output. I also added a test light (194 bulb) in parallel with the coil as a visual indicator of the voltage (*see Figure 3*). This

is a nearly realistic set up to apply some real load to the alternator. The coil warms up after a minute or so of running, indicating that the PM alternator is actually doing some work and not breaking down, and you can control the speed to a point that gives you a bright light. Is this a scientific method for testing PM alternators? Probably not… but it is certainly a better test than simply lighting up a test light by alternator output..!

The probes you see in the picture are for the PicoScope to capture the wave form. These alternators have the cleanest AC wave- forms I have seen with no distortion or drop offs (*see Figure 4*).

As a side note: Kokusan Denki has been bought by Mahle (just as they did Letrika). Its operations in Japan and elsewhere have been incorporated into the company. With nearly $130M annual sales, PM alternators are a very small portion of the electrical and electronic components made by Kokusan-Denki. They are very big in making various electronic ignition modules at the OEM level for many different manufacturers as well as many other sophisticated electronic components.

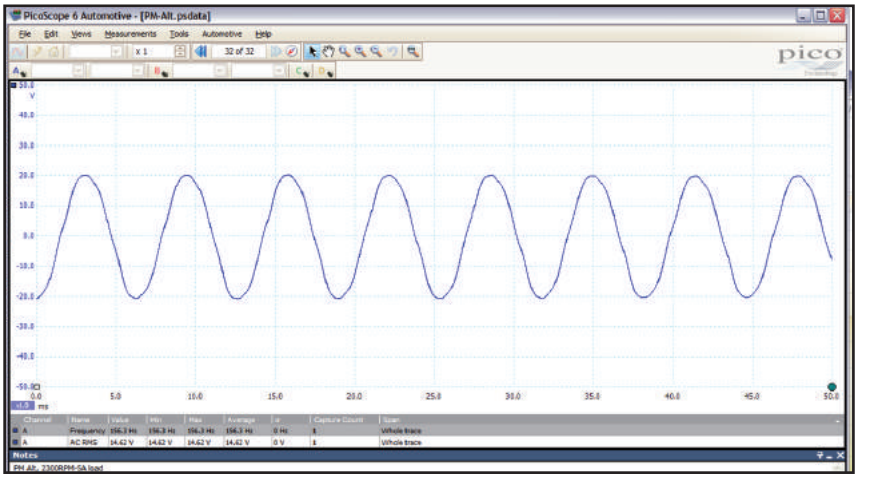

Figure 4 – Clean AC waveform of the PM alternator output

VW Fuse Junction Block

If you rebuild alternators for VW New Beatles and similar VW cars, you may want to know there are some serious problems with the fuse block located innocuously right above the battery in the engine compartment (*see Figure 5*). Disconnecting the battery cables for electrical service or even a battery change does not require the box be opened up and looked into, but if you find your rebuilt alternator is not charging high enough and there are other unexplained electrical gremlins that changing the alternator did not solve, there is a very good chance the battery fuse/junction block (called Fuse Bracket in the schematics) may be nearly melted and must be replaced (*see Figure 6*).

The picture shows an overheated and deteriorated fuse bracket on a 2005 VW Beetle we were working on. The overheating had additionally worked into the cables which required a lot of work by cutting, extending, and installing the correct size lugs for connection to the new fuse box. The dealer's recommendation was to replace the entire engine compartment wiring harness which with parts and labor would have cost in the thousands of dollars.

Figure 5 – Location of the fuse bracket on top of the battery (2005 VW Beetle)

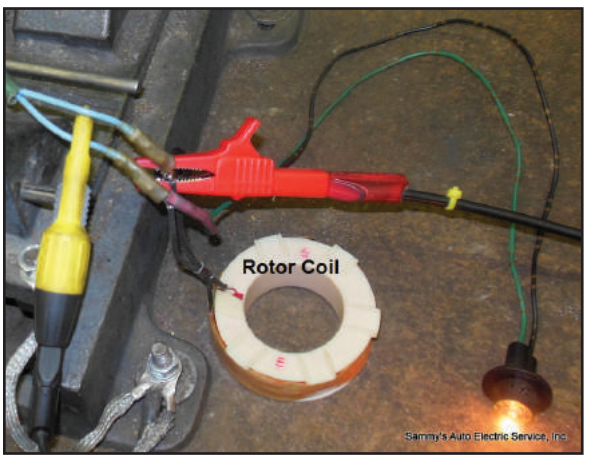

Figure 3 – Using a rotor coil as load for a PM alternator

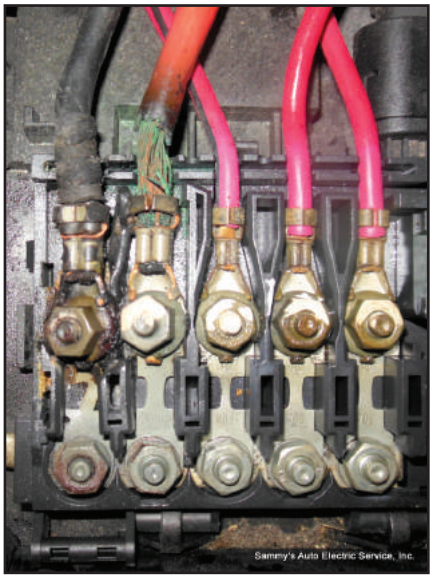

Figure 6 – Damaged fuse block and overheated alternator output wire

The demand for this part is so high that some aftermarket suppliers offer a reasonably priced replacement. Doorman's Product - part# 924-680, as an example, is readily available in most auto part stores or could be had for overnight delivery. Until I see you again, keep up the good work.

PLAIN TALK — Relationships – YES

BY ROB BUKSAR

Every week I chat with a rebuilder somewhere with an incredibly depleted business. He usually blames his circumstances on the large domestic rebuilder across town. "If he wasn't there, I'd be in good shape." That rational might have flown a couple of decades ago but as far as today; "Nice try but no cigar." The guy across town is seldom the factor and is probably suffering as well.

I'll go out on a limb and give you two reasons why your orbit is decaying. Then, I'll suggest an idea that could prevent you from crashing and burning.

First, there are better vehicles and equipment. The junk yards are full of powertrains with wrecked or rotted out bodies. The engine and components keep working, not like the old days.

The second is the world economy and globalization, which I've written critically about for the last twenty years. It makes a handful wealthy at the expense of countries like ours. Never have so many paid for the wealth of so few. Google this interesting fact, if you need further explanation.

All your competition is now global. The 4 or 5 parts stores in your little town are global. OEM is global. Your rebuilder neighbor is not global, henceforth; he is no longer your competition. We are stuck in between the big boys, duking it out for the available market dollars. We are not even a blip on a screen to the big boys!

The key here is to find a way to compete globally on a local level. This leads me to suggest what was once the standard practice before self-service gas stations and drive-thru diners.

My sister is a professional fund-raiser for a major university. She is publicly recognized as the best fund-raiser in the state of Indiana. When asked, what is the secret of her success, she will tell you that it's all about relationships! If you have bridges built and great relationships with your donors, they will dig deep and frequently, if needed. You see, they know your cause is good, just and that you're of good character making you easy to work with. You're there to help! Also, try getting a million bucks out of someone when you don't know the names of their wife and kids to begin with. Not much of a relationship there, don't you think?

Are you still welcome in your children's lives? Parents have to endear themselves to their kids. The kids won't endear themselves to the parents. No more than customers endearing themselves to you for no other reason than you've known them for a long time. If you don't make the effort to keep the relationship with your customer alive and healthy, you will cease to exist. It's not your customer's job and he isn't going to do it.

Most of us do not have drive-thru windows where we exchange goods for cash. We have accounts and many that we've serviced for years. But because of those years we assume that these accounts will remain loyal. Maybe or maybe not? The pressure to do business with your global competition is unyielding. On top of killer pricing, their sales effort is intense and appealing; it's almost foolish not to trade with them. Super discounts, buying incentives, gift cards, golf outings or free merchandise! That's not to mention they are close, cheap and usually very fast. The new faces of competition are global and very intense. We're really not a part of it, just in the middle of it and getting beaten-up.

Our survival chances with our major accounts are going to hinge on how good our relationship is with our customer and how great of an asset we are to his company.

Can you court your entire customer list? Of course not. Yet, there's a good chance that 80% of your business came from 20% of your customers, Do the math, 20% isn't as many as you thought. I'm confident that you can treat that 20% a whole lot better than you have been because sadly, too many have not been proactive at all. I've polled many of my smaller rebuilder friends, who consistently cry about their lack of business. When did they last call their best customers? How about taking the time to stop by and visit? This was their answer in almost every case. "No, I haven't called or visited. Just haven't found the time and if I did, I doubt if it would do any good." Well, if you have little if any work in the shop, what the hell are you doing during the day, watching cleaning solvent evaporate?

There are more than a few shops, who are doing really well, courting the 20% in a big way. They have become friends and "go-to-guys". In spite of price differences, they still get the business because on top of becoming friends, they've made themselves too valuable of an asset for their customer to throw them under the bus. Because of the bridges built, these rebuilders have been able to develop new revenue streams helping each customer accomplish his objectives. This type of thing just wouldn't happen without good free-flowing communication and without a trusting relationship.

Yes, global competition is intense and it's everywhere! Yet, David took Goliath down with a sling and a rock. It's not easy but success isn't for everyone and not guaranteed. We all need to do a bigger and better job. So, start tomorrow by improving those relationships and becoming the problem-solving go-to-guy your customer can trust and count on. Once you've affirmed or enhanced these relationships there won't be room enough to stack the rewards. To quote Winston Churchill, "Success is not final, failure is not fatal; it is the courage to continue that counts."

God bless America and our small industry.

Rob can be reached at: hoosierelectric@comcast.net, 219-545-8682, or at Sluiter Auto Electric: 708-338-5000.

KOHLER RECTIFIER/REGULATOR OR NOT
Beware of Two Part Numbers

BY BOB THOMAS

Most of you who have serviced or repaired small equipment with Kohler engines will probably recognize the three-terminal regulator/rectifier that is commonly used on many garden tractors and riding mowers (*see Figure 1*). This small rectifier/regulator was covered in detail in a technical document that can be found in the Technical Library on ERA's website. It is titled: *Small Engine Charging Systems: Permanent-Magnet Alternators – Kohler.* In it we showed how you can test the components in that charging system on the engine.

As was explained in that article, permanent magnets on the flywheel induce AC current into the stator's coil once the engine is running (*see Figure 2*). The current is then rectified on the ground side which is switched off and on to regulate voltage. It is a simple yet very effective charging system. The most common problem is poor grounding of the rectifier/regulator.

However, you should be aware that there is another less-common "look-alike" rectifier that has no voltage regulation (*see Figure 3*). As you can see from the photo, they look identical, except for the part numbers. The rectifier-only version will be found mostly on commercial walk-behind mowers with recoil starting and an electric PTO clutch. In some cases the mower may have a sulkie for the operator to stand on instead of walking. These mowers have will have a low-amperage permanent-magnet charging system with no starter and **no battery!**

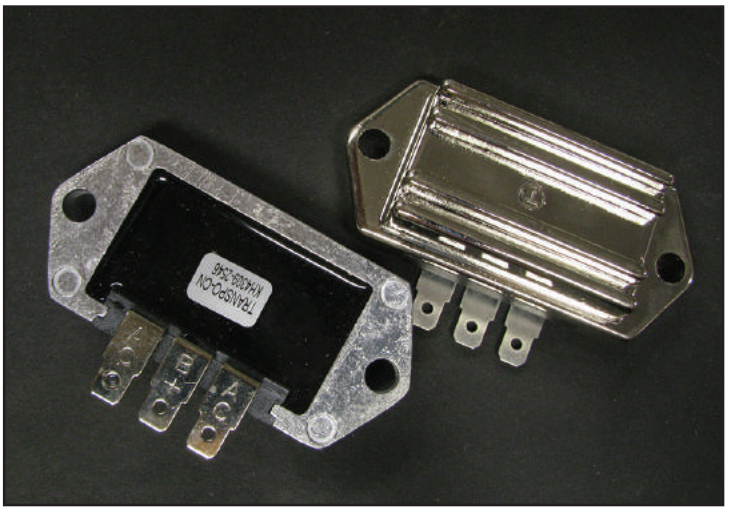

Figure 1 – This common Kohler rectifier-regulator was used many garden tractors and mowers.

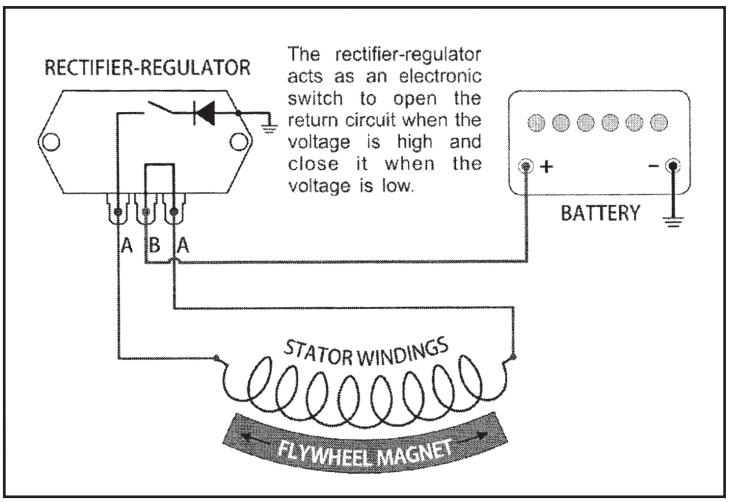

Figure 2 – This diagram shows a typical charging circuit using the Kohler rectifier/regulator.

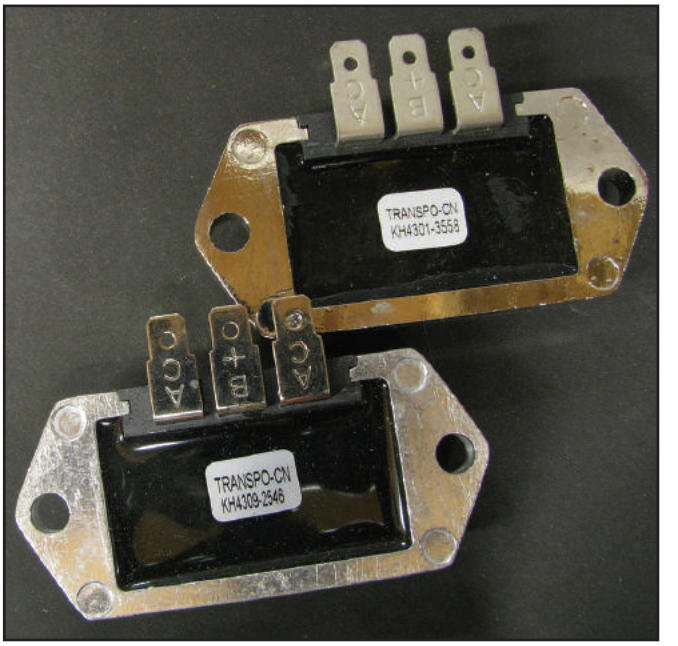

Figure 3 – Beware of a similar Kohler rectifier that has no voltage regulation!

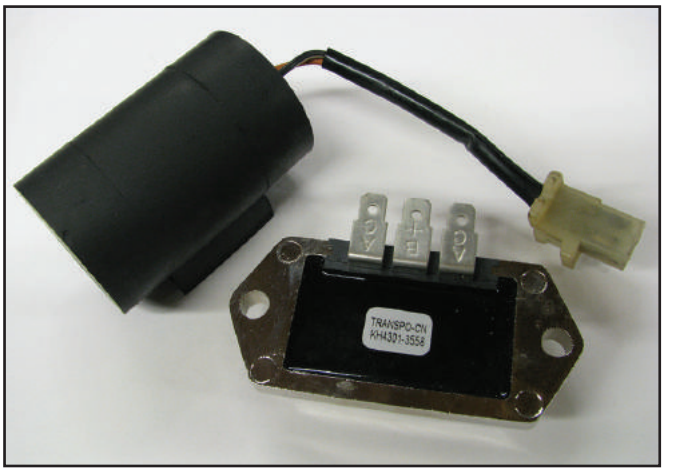

Figure 4 – This rectifier-only part was used on machines with recoil start and no battery, but with an electrolytic capacitor in its place.

In the absence of a battery, this charging system utilizes a large electrolytic capacitor (*see Figures 4*) to both store electrical energy and stabilize system voltage. This type of capacitor is polarity sensitive and capable of storing large amounts of energy. As shown in the diagram (*see Figure 5*), it is connected to the system where a battery would normally

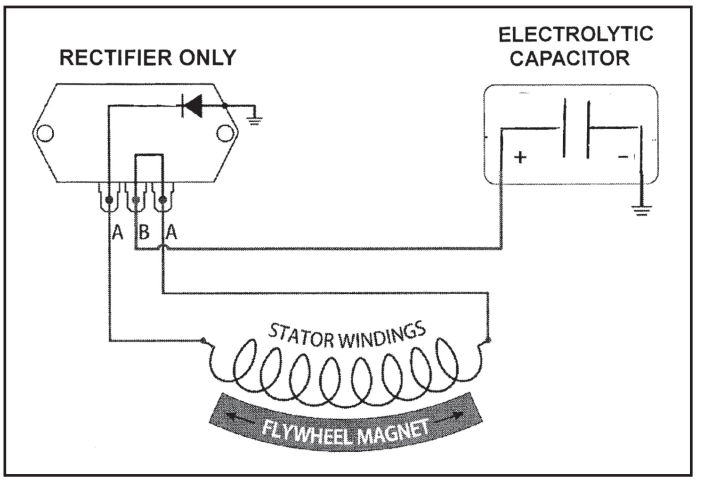

Figure 5 – This diagram shows the charging circuit using the rectifier without voltage regulation.

be found. After starting, alternator output charges the capacitor through the rectifier, which provides some of the inrush current needed to engage the PTO clutch when it is switched on. Without regulation, system voltage will run higher than you would expect until the PTO is activated.

These parts cannot be interchanged. Should a customer bring you a Kohler rectifier/regulator, looking for a replacement, do not assume it is the one that you are most familiar with. Ask the question. Does it have electric or recoil starting? If it is recoil start, check the part numbers below.

Electronic Regulator/Rectifier, 12v, 14.4v set point
Used with Kohler 10 to 15A permanent-magnet alternators on engine models KT17 through KT19 & M8 through MV20.
John Deere AM106357, AM34738
Kohler 2575503, 2575503S, 4140305, 4140306, 4140309
Tecumseh 610479
Transpo KH4309
J&N 230-22032

Electronic Rectifier, 12v (*no voltage regulation*)
Used with Kohler engines on commercial mowers with recoil start and electric PTO clutch
John Deere M131287
Kohler 1240301
Transpo KH4301
J&N 230-22037

Testing either of these parts is fairly simple, using two phase connections on any alternator that you can full field on your test bench. In the photo (*see Figure 6*), I am using a 10SI alternator that I've made all connections external. I have full-fielded the rotor to simulate permanent magnets (field polarity is inconsequential) and I have connected the Kohler rectifier to two of the 10SI's stator leads. Then I connected the rectifier-regulator itself to the test bench battery. If you perform this test, be sure that you do not exceed the normal 10 amp output of the Kohler system. You can do that by controlling the alternator's speed. It can exceed 10 amps very quickly if you run it too fast. The regulated rectifier should keep voltage close to 14 volts while the unregulated rectifier will quickly exceed 15 volts with no limit other than battery capacitance.

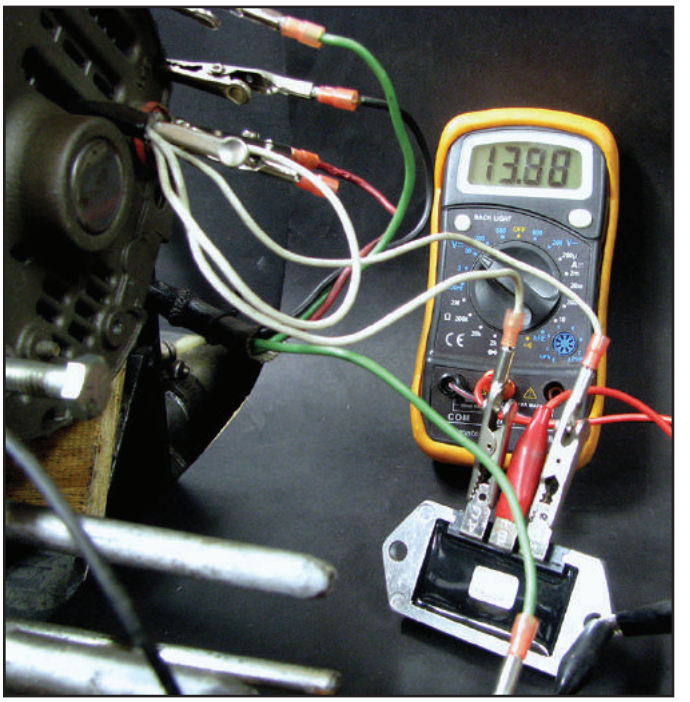

Figure 6 – Here we are bench testing a Kohler rectifier/regulator using AC voltage directly off the stator of a 10SI alternator.

WE'RE IN IT TO WIN
Sales and Cow Pies

BY DOUG SLUITER

I mentioned in my first article that my brother and I are second generation rebuilders. We were born into this racket! My dad's shop was in our basement. I think he would have preferred to stay there. Nevertheless, let me tell you; with ever-present rebuilding in your life, it was difficult to even think of another career. Of course, my dad encouraged us to do whatever we wanted, to follow our dreams, so to speak. Under our life circumstances, that wasn't impossible but wildly difficult!

That I'm talking to you right now should make our choices clear to you. Both of us finished high school and jumped head first into dad's business. My brother and I are life-long rebuilders.

Dad had a good lock on the market **at that time** and was quite innovative. He built one heck of a successful money machine. He took great pride in having the highest paid employees in the industry for a rebuilding shop. Few, if any, did it better than Don (dad).

We all continued to be faithful to dad's business model because it worked so well for so long. "If it's not broke, don't fix it!"

After 10 years or so, we knew the industry was in the midst of evolving but it didn't seem to be affecting us all that much. Yet, shortly after dad passed away, change was upon us also. There was a foreseeable reduction in our sales volume. We were opening up new accounts left and right and dropping large inventories in new locations. Problem was the sales per customer were dropping like **lead balloons.** We could no longer stock a customer with everything that they needed because there were too many part numbers. So, what the heck were we doing spending and investing more money, increasing overhead, driving sales cost higher for a whole lot less return on our investments. That was a fast track to bankruptcy.

The industry passed the tipping point and everything you already know about our shrinking industry came to pass for us. Dad's business model, the former money machine, no longer fit the bill and was now killing us slowly. Talk about a culture shock! We needed to change.

Dad would never sell to parts stores or any type of discounted distribution. We sold to gas stations, repair centers and maintenance facilities only. We had hundreds of them, most of them with our consigned inventories that weren't selling all that well any longer. Of course, every town we were in now had five parts stores that weren't there when dad was alive. Competition was now redefined. We had to get with the *here and now* or perish.

We started by courting independently-owned parts stores. This was something new for us. The big corporate types wouldn't talk to us, still won't. I don't think they're allowed.

We started succeeding and our sales volume was picking up. Of course, we were now *working a lot harder for a lot less money.* This seems to be the new mantra for our

industry. At least, this was better than the alternative!

Yes, things were better, but we still were not keeping pace and instinctively knew something was tilted somewhere. It was probably us but what was it? *We could not see the problem.*

An opportunity arose to buy out a large failing rebuilder with many pre-existing parts store customers. There was no equipment or fixtures in the shop that was of any interest. The customer list and good paying pre-existing clients is all that we wanted. I insisted on visiting and meeting all the active customers before we closed the deal. Once I was comfortable that we could retain most of the active customers, we jumped in over our heads with a big bank loan. I must say, we were blessed because the purchase worked out. The new business was life-saving! Yet, there was reluctance from the new customers to order as big as they did with the former owner. *We could not see* what the problems were but they were sure there.

Shortly after the buyout, we hired 5 of the former owner's top people. After a week or so, the new folks revealed that we did a better job of rebuilding than they formally did. However, their rebuilts looked brand new; ours reminded them of over-sprayed cores!

We never saw this! This is how we always did it, and in dad's world, the appearance didn't make a difference. Well folks, it was that simple. *Our market changed but we didn't.*

Further, I had to fight tooth and nail with my original staff. They would rather fight than switch, and they did. It took a little time but I finally got everyone on board. Once we were in line with market demands, orders increased handsomely! I'm a life-long rebuilder. I've never done anything else. I really thought that there was nothing about this business that I didn't know. *How wrong I was and almost fatally so!*

I want to leave you with two important points. First; you can **never have enough customers.** For reasons out of your control, you can lose customers weekly. Then, there are the ones you screw up and lose. You constantly have to be looking for new places to sell your products or services. This effort can never end. **It can't even slow down!**

Second; welcome fresh eyes to evaluate your operation and maybe even seek them out. Becoming blind and accustomed to your behavior and procedures are fatal. The best way to explain this is to pass on this short story.

A salesman stopped to secure a motel room for the night. The only one available was next to a gigantic cattle-feeding lot. The entire area reeked of cattle manure. While registering, the salesman, who was gasping and panting for breath, asked the motel clerk; "How do you tolerate the stench?" The clerk smiled and replied, "What stench?" We all get accustomed to the "stench", it's part of the human condition. That's why fresh eyes and noses are imperative for our health, physical and economic.

So, keep making those sales calls and be careful where you step. None of us have enough customers and we're all surrounded by cattle feeding lots.

May God Bless all of you!

We're in it to win it.

You can reach Doug at Sluiter Auto Electric, Inc
708-333-5000 www.sluiterelectric.com

TORQUE VS HORSEPOWER
Mechanical or Electrical?

BY BOB THOMAS

The words torque, horsepower and kilowatt are often used in our industry in the descriptions of starters, but there has been some confusion among rebuilders about what each term actually means.

To begin with, torque is the level of force applied to an axis or more commonly referred to as a **twisting force.** Most of you have probably used a torque wrench at some point to measure the level of torque when tightening a bolt or fastener (*see Figure 1*). Torque is the product of two variables. One is the level of force being applied and the other is the distance or length of leverage being used between the point of force and the axis (*see Figure 2*).

Consequently, the units of measurement must include force and distance. The force of gravity on a weight in pounds was the original unit of force used In England and North America, with the distance measured in feet or inches and torque being foot-pounds or inch-pounds.

After World War 2, metric measurements were introduced internationally. Kilogram-meters, renamed newton-meters gained acceptance worldwide. Today, torque specifications are often given in both standard and metric form. Conversion tools online make it easy to go from one to the other.

The basic concept of torque dates back to antiquity when the Greek mathematician and scientist Archimedes studied the use of levers. But the name torque was not coined until late in the 17th century, attributed to British engineer James Thomson, who was coincidentally the brother of Lord Kelvin.

Figure 1

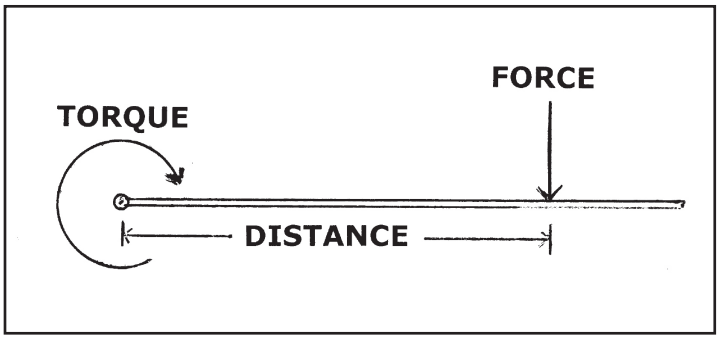

Figure 2

On the other hand, horsepower and kilowatt are different units of measurements for the same thing, which is the **rate** at which work can be done. In other words, the capability to do a specific amount of work or apply a specific force over a specified period of time.

The word horsepower goes back to the 1700's when the first steam engines were developed in England. One horsepower was thought of as being the amount of work that one draft horse could accomplish over a given period of time, originally one day and later one hour because horses were usually worked in shifts. As you might expect, not all work horses produced the same "horsepower" either.

James Watt was among the first to use the term to help sell a new and improved steam engine – needing some way to compare the engine's performance to that of the animal. Legend has it that one of his first customers was a brewer who demanded an engine that could match a horse. For comparison testing, the brewer selected his strongest draft horse and then drove the poor animal to its limit to establish an amount of work equal to one horsepower. Watt was aware of the customer's ploy and built an engine that was capable of exceeding the horse for the challenge. The story goes that it was the output of that steam engine that became one horsepower.

Over the years, there have been may different standards and methods of measuring horsepower. Today, one mechanical horsepower is equal to 550 foot-pounds per second. That is equal to 745.7 mechanical watts, or roughly three-quarters of a kilowatt. The mechanical measurement unit "watt" was named in honor of James Watt.

You may have noticed that a specific level of torque, 550 foot-pounds, is used to describe one horsepower, but the "per second" makes it something different. Maximum torque is achieved and typically measured just before or at the stall point, whereas horsepower is sustained by definition. In the late 60's and early 70's, muscle car manufacturers touted their vehicles "maximum torque" and "horsepower". What they did not advertise was that the horsepower ratings were measured off the crankshaft, with an engine bolted directly to a dynomometer, meaning before the transmission and drive-train. Torque was generally measured or calculated at the rear wheels. It was torque that got the car moving quickly off the line but it was horsepower that allowed it to continue to accelerate until it reached its top speed.

Keep in mind that kilowatt can also be used to describe 1,000 watts of *electrical power.* So a kilowatt could be electrical consumption or mechanical output. One electrical watt is equal to one ampere of current at one volt. To determine the watts consumed electrically by a device, you simply multiply the amperage being used by the power supply's voltage. But an electrical watt has no direct relationship to a mechanical watt.

TESTING FOR PARASITIC BATTERY DRAINS
Using Voltage to Locate Amperage

BY KEN PLOURDE

Parasitic battery drains can be difficult to diagnosis due to their often intermittent nature. When a battery drain is small (100 milliamps or lower) most inductive amp clamps that are large enough to fit around a battery cable lack the resolution to accurately measure down to that level. You will often need to connect your multimeter leads to a low amp scale and place them in series with the battery cable using a parasitic drain tool or knife switch. With the switch in the closed position the current path is not interrupted and the vehicle can be tested accurately.

With all electrical accessories turned off and doors closed, you can connect your meter across the switch prior to opening it. Since this places the meter in series with the battery cable, opening the switch does not kill power to the vehicle. It simply reroutes it through the meter.

Using a test light in series with the the battery to detect an excessive parasitic drain is no longer helpful and not recommended. The proliferation of electronic modules on vehicles today have made that test obsolete. The last thing you want to do with any intermittent problem is to do anything that makes the problem vanish while you are working on it. You cannot allow battery power to the vehicle drop to zero while connecting test equipment. Keep the system powered up and give it time for all the modules to go into sleep mode. That can be as long as hour.

After waiting a sufficient length of time, check your meter. If it is showing 300 mA instead of a more tolerable 30 mA, it is time to put your multimeter into voltage mode to check for an abnormal amount of voltage drop in millivolts across live fuses. A millivolt is one-thousandths of a volt – very small!

Any voltage drop (including only a few mV) indicates that a circuit has some amount of battery drain. The older method of removing a fuse to install a fuse buddy, ammeter or removing fuses one at a time to see if the drain measured at the battery has gone down is no longer recommended. The offending circuit with the excessive parasitic drain may be supplying power to solid state electronics. The result can be more minutes or hours of waiting for those modules to "wake up" and then "go back to sleep" after a fuse was removed and re-installed into the fuse panel.

A passive method is measuring voltage drop at individual fuses to identify the offending circuit. Unlike removing fuses, this method allows the parasitic drain to keep on doing its thing while you move your voltmeter probes from fuse to fuse looking for the circuit with the excessive drain. When a circuit is completely off/inactive there should be 0.0 amps of current flow and therefore 0.0 mV of voltage drop.

Fused circuits that are live but only with a normal amount amount of current draw (for example 5 mA) will have a mV size voltage drop, even across the most clean & tightest fitting fuse terminals. For example , you might only see a voltage drop of say 0.1 mV (that is more than 0.0) which calculates to 22 mV of paracitic current draw when measuring that across a 15 amp mini-fuse (for example). For one fuse, that is slightly high but still acceptable as long as the entire vehicle's paracitic current draw is lower than around 50 mA. That same 15 amp mini fuse could be feeding an HVAC head and a couple of other items on a particular circuit. If however, with the ignition off & doors closed you measure 1.0 m V of voltage drop across that fuse, that fuse's circuits are drawing in excess of 200 mA. 200 mA is enough to drain the battery to a no crank condition within a few days or even less depending on the battery's condition and ambient temperatures.

This method can help you at least find the circuit causing the drain. Power probe has a complete set of fuse charts on their website that can be printed and saved for reference. You can find them at:
info.powerprobe.com/fusechartsdownload

You should be aware that there are some China-made fuses on the market that were sold by a well-known discount tool chain that were super inexpensive but had one serious drawback. Their resistance values failed to match OE specifications and sometimes they didn't blow when they were supposed to. One rated at 10 amps might easily pass 30 or 40 amps of current draw. Obviously, this test and the charts are based on OE fuse resistance values. If you run into suspect fuses in a customer's car, it would be wise to inform the customer. They can be identified by their poor craftsmanship and a lack of a clearly legible amperage rating, If you see any in a fuse box, they have a tendency to stand out for what they are.

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1:00 – 2:30
Hyundai VIP Plant Tour

3:00 – 4:00
Seminar: Challenges of Rebuilding & Testing Today's Units - Part 1
with Mohammad Samii

4:15 – 5:30
Seminar: Cataloging Options
with Dan Bell & Dennis Jacinto

5:30 – 7:30
Free Managers Reception

FRIDAY, APRIL 13

6:00 – 9:00
Free Breakfast Buffet

7:30 – 7:45
Load Shuttles to Regitar

8:00 – 10:30
Seminar: Manufacturing Tour of Mobiltron in Taiwan - Live
with Gene Kaiser

10:30 – 11:45
Seminar: Understanding PCM – Alternator Communications
with Mohammad Samii

FRIDAY, APRIL 13

12:00 – 1:00
Luncheon Buffet

1:00 – 1:30
Seminar: Navigating ERA Website
with Jessica Myers, Bob Thomas & Ken Plourde

1:30 – 2:30
Seminar: Roundtable Open Discussion
with Ken Plourde, Jessica Myers & Bob Thomas

2:30 – 5:30
ERA Expo Show Floor Open

5:30 – 7:30
Free Managers Reception

SATURDAY, APRIL 14

6:00 – 9:00
Free Breakfast Buffet

8:00 - 9:15
Seminar: DC Motor Rebuilding
with Sam Casolina

9:30 – 10:30
Seminar: Topic to be announced
with WAI speaker to be announced

SATURDAY, APRIL 14

10:45 – 12:00
Seminar: How to Survive in Today's Marketplace
with Dan Smith & Nick Staub

12:00 – 1:00
Luncheon Buffet

1:00 – 4:00
ERA Expo Show Floor Open

4:00 – 5:15
Seminar: Challenges of Rebuilding & Testing Today's Units - Part 2
with Mohammad Samii

5:30 – 7:30
Free Managers Reception

7:45 – 8:00
Board Riverboat

8:00 – 10:00
Riverboat Dinner Cruise aboard the Harriott II - Dinner Served @ 8:30 pm

SUNDAY, APRIL 15

7:00 – 8:00
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8:00 – 9:00
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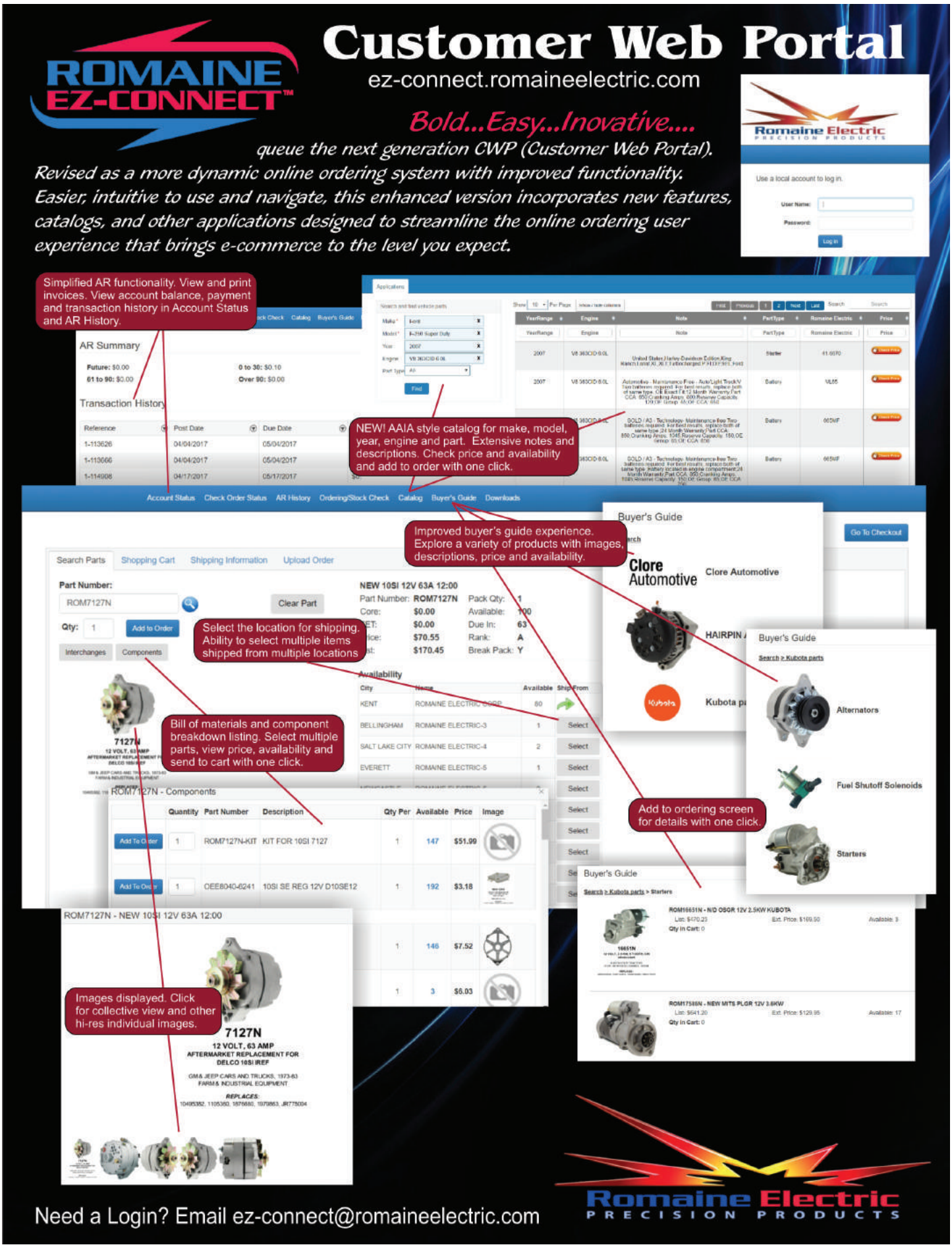
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3 – Only current Rebuilder and Honorary ERA members are eligible.
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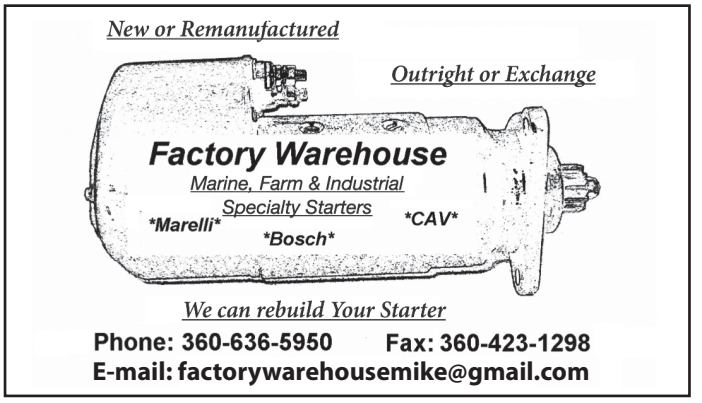

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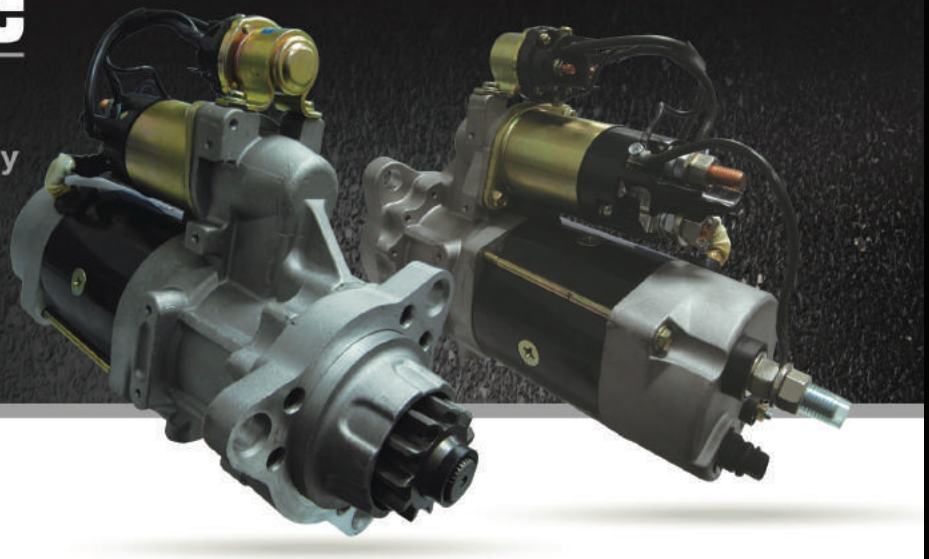

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