ERA EXCHANGE

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AUTO ELECTRIC CORNER
Calipers, Jeep 11114 Alternator and Voltage Fluctuations

HIGH AMP ALTERNATORS
How Do They Do That?

INADEQUATE QUALITY CONTROL
Multiple CS144 Failures

A WORD FROM THE PRESIDENT

The Show Will Go On



It appears that the Corona virus pandemic is moving in the negative direction. Here in my home state of Connecticut today, the Corona virus positivity rate is 2.3%. The vaccine delivery program is moving at full speed without shortages or lack of participation.

Speaking with the ERA office I was informed that the Holiday Inn that will host our show in Erlanger, KY (near the airport that services Cincinnati) recently hosted an event with a gathering of 300 last month (February 13) that went off without any issues. This positive news was a great welcome and encouragement that the 2020-2021 ERA Trade Show Expo that is tentatively scheduled the weekend of May 20 – 23, 2021 will be held as planned.

Just some FYI: there are a number of events and seminars that were on last year's show schedule that may have to be changed. But the Trade Show Committee is hard at work to fill in those events and seminars to bring an informational and event full weekend to the attendees.

On the subject of the ERA Exchange magazine, I am fully aware of the lack of delivery to the membership of the January & February Issues of the ERA Exchange magazine. FYI - Those issues are available digitally on the ERA website. For the record, this problem is the result of the incompetence of the United States Postal Service. Both January and February ERA Exchange magazines were delivered by the printer on the contracted delivery date to the USPS's Bulk Mail Center in St. Louis. The ERA Board of Directors agreed that to keep the delivery expense of the ERA Exchange magazine within the association's budget they must use 3rd Class bulk mailing with the caveat that Canadian members are sent 1st Class as this was the only option for Canadian Delivery. As far as I know all Canadian members have received their monthly issues of the ERA Exchange magazine.

The office has been diligently working on this problem with the USPS Bulk Mail Center in St. Louis, where they apparently still are. We were assured that once they find the lost mail bags of the Exchange magazines that they will expedite their delivery through the system. On behalf of the Board Of Directors we apologize for this inconvenience. With any luck, you will have already received them by the time that you read this. Thank you for your patience.

Ken Plourde

NEW ERA MEMBERS

Jerry's Sales & Service
Northbend, Nebraska

ABOUT THE COVER

Denso SC stator

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& ANNOUNCEMENTS



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AUTO ELECTRIC CORNER —
Calipers, Jeep 11114 Alternator and Voltage Fluctuations



BY MOHAMMAD SAMII

Fractional Measurement Caliper

As electronics advances finds its way into our shop tools, you occasionally run into devices that were unthinkable a decade or so ago but now you can have them inexpensively in your arsenal.

I recently purchased a digital caliper that can measure in thousandths of an Inch, millimeters, and surprisingly, in fractions of an inch! All of the values can be changed with the push of a button from one to another (*see Figure 1*).

This caliper of course is not a brand name tool like Starrett or Mitutoyo but for less than $30, its usefulness cannot be dismissed. One good use that we found so far is for sorting out a box full of mixed up drill bits - their exact sizes unknown. Now, sorting them out and arranging them by size helps us to pick the right one easily and save time spent rummaging through the whole pile to find the right one!

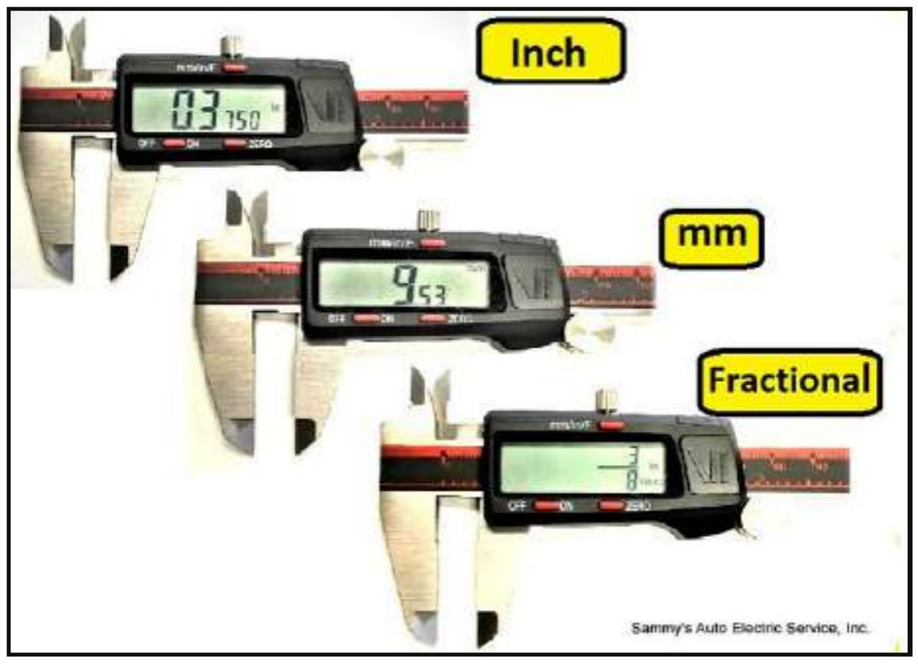

Figure 1 – Caliper with Standard, Metric, and Fractional reading

Jeep Liberty 11114 Alternator

This alternator was on a thread of discussion on the ERA website's Forums. Since its operation slightly differs from units used in other Chrysler products, I decided to discuss it in a little more detail for readers who are interested.

The 11114, Denso 102210-4240 is an SC-type (hairpin), 150-Amp alternator that uses a Litens Decoupler pulley (*see Figure 2*). What makes it different is its application. It was used on a rather rare 2.8L diesel engine in the 2005-2006 Jeep Liberty, The 2.8L diesel engine is made in Cento, Italy by VM Motori S.p.A which is currently owned by Fiat Group Automobiles. It is extensively used in some European made vehicles.

Even though this alternator was used in a Chrysler/Jeep application (FCA), its regulation is not via the vehicle's PCM as almost all other Chrysler products are. This alternator has a built-in voltage regulator much like many such alternators used on Ford, GM, Toyota, Honda, Hyundai and numerous others.



Figure 2 – 11114 (104210-4240) alternator for Jeep Liberty with 2.8L Diesel

The voltage regulator 126600-7002 (WAI IN-317 and Regitar VRH2005-83) is identified with plug code 425, which has 2 pins, L and M (or sometimes D). This regulator is extensively used in European cars such as Citroen and Peugeot, showing the origins of its Euro application, thus being used on this Italian made diesel engine (*see Figure 3*).

The alternator is activated through its "L" terminal by the vehicle's BCM (Body Control Module) that is an integral part for the main Fuse Box/Junction block assembly, and not by the PCM.

PCM (or BCM, as in this application) activation of the regulator and the changes that the applied voltage goes through was discussed in detail in the December 2020 issue of the Exchange in this column. The same thing happens here. The applied voltage from the BCM is first pulled low, then when the alternator charges, it bounces back to the level that was applied (5 or 10V). When the BCM sees this dip and bounce, it takes a look at the battery voltage and once it finds

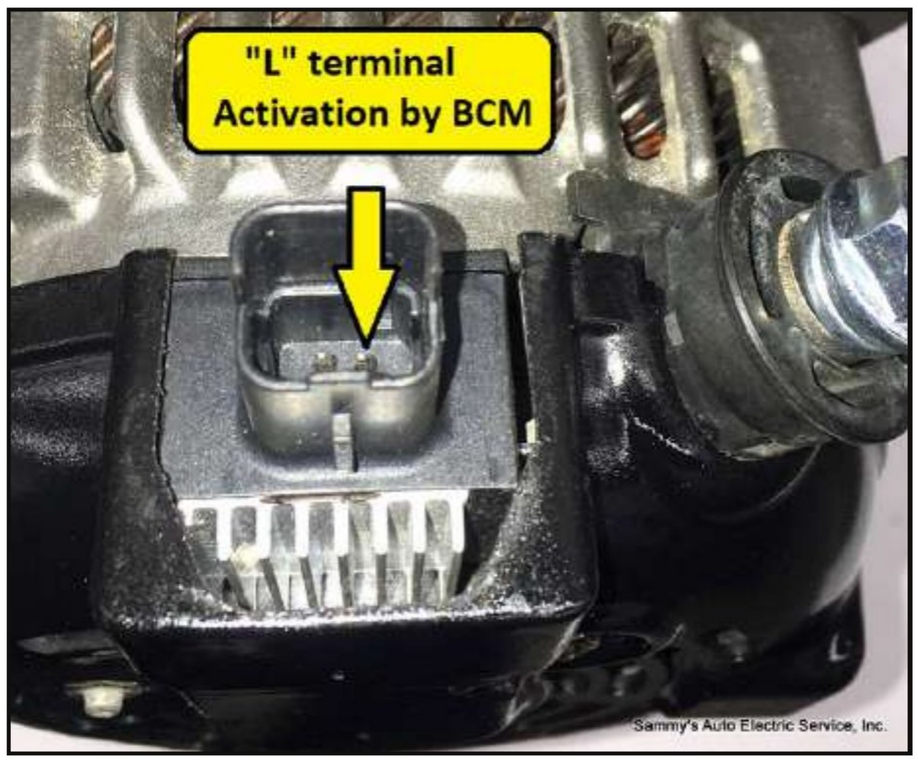

Figure 3 – Voltage regulator's plug code # 425

that it is within its programmed limits, it communicates with PCM that in turn will apply the right code to the communication bus which turns the warning light off in the cluster (*see Figure 4*).

There are regulators that due to their light circuit's design that do not light up a 194 bulb or such. Bosch 13804 used on Saturn was good example of this. That alternator was discussed in an article I wrote long ago in the APRA's Reman Connection where I used to write for before joining ERA. For that application I had made a test lead that included a miniature bulb that would turn on by the regulator and go off when charging. Such a test lead can be set up to check 11114 alternator and similar ones when a test lead consisting of a 194 bulb may not light (*see Figure 5*).

To have an operating test light connected to the "L" terminal that comes ON and goes OFF when the alternator charges, is imperative for knowing that the alternator will function properly on the vehicle like the above Jeep. In other words, a properly functioning light confirms that the switching of "L" terminal voltage from high to low and back from low to high exists because that is what the BCM is looking for to turn the warning light off.

The 11114 alternator itself (its DE and SRE housings) looks much like the common 13870 or 13871 alternators that were widely used on Chrysler Town & County and Dodge Caravans through the 2001 to 2008 model years. The rectifier assembly has 12 avalanche diodes. The regulator (*see Figure 6*) and the Litens IDP's are all available and its IDP looks very close to the one used on the 13871 alternator.

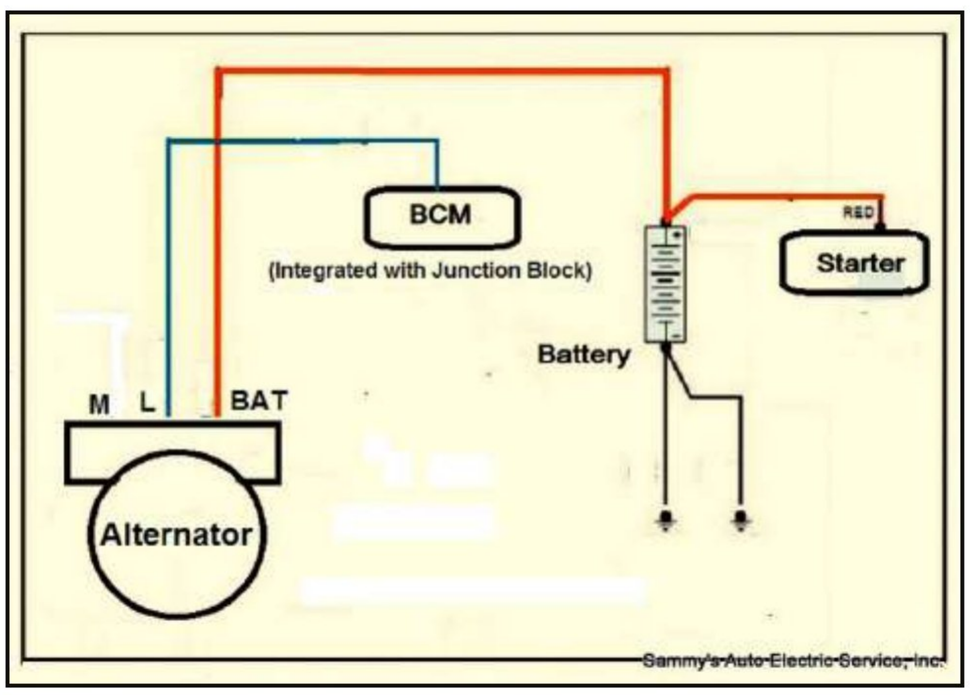

Figure 4 – Jeep's charging schematic block diagram (Partial)

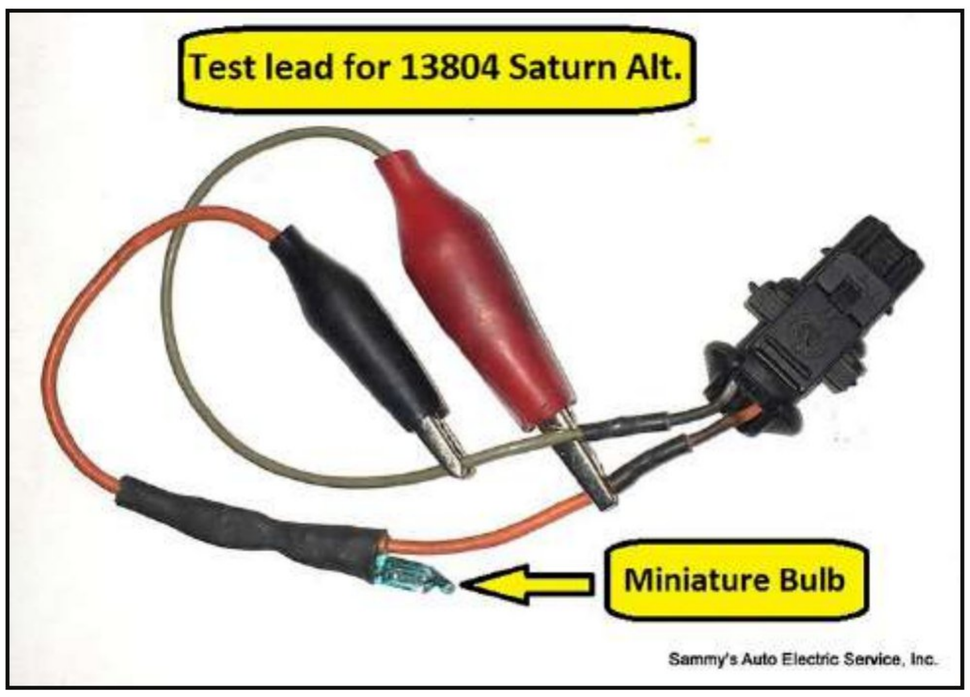

Figure 5 – Home-made test lead with miniature light

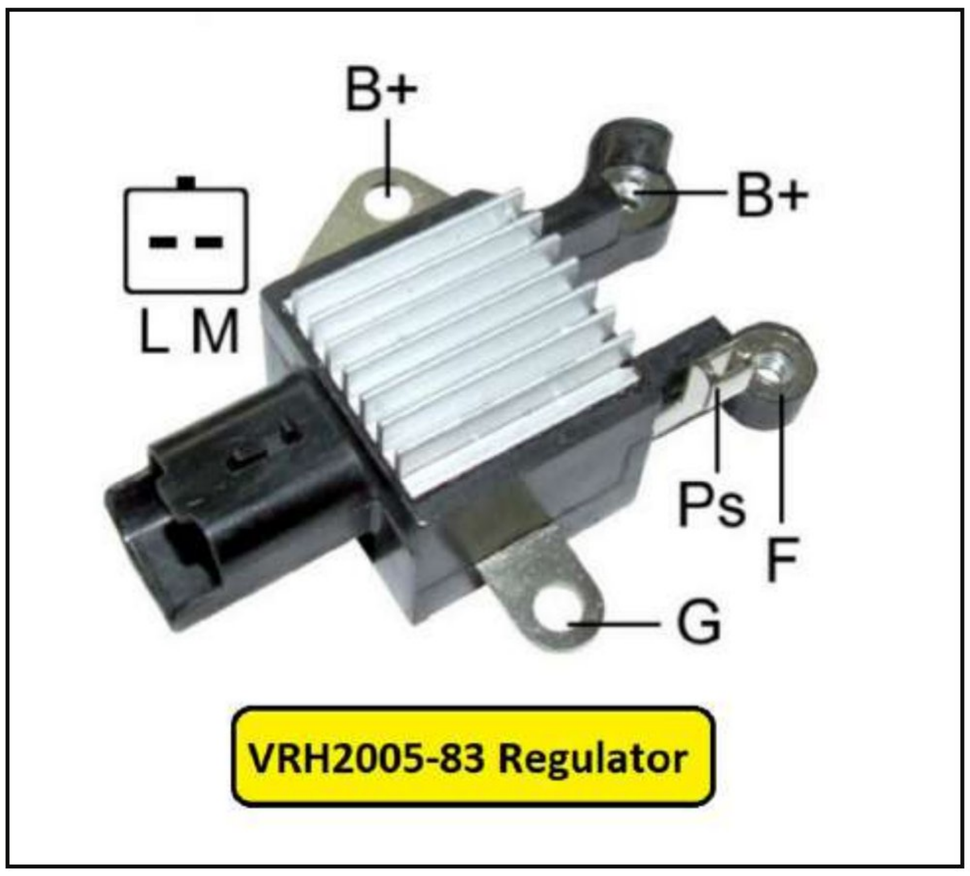

Figure 6 – Regulator for 11114 alternator (Photo courtesy Regitar USA)

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By extracting performance data from an OE sample we came up with a performance curve and data that is shown in the graph on our test bench (*see Figure 7*). It is important to know that the output figure on the chart is what the alternator puts out and the Min and Max figures are arbitrary numbers that I put in, based on my own experience in analyzing various alternators of this family.

The 11114 application is indeed rare, as Partref data shows a mere 10,500 vehicles are registered in the US. Thus, having one in your stock depends on its usage in your area, but you can always modify a 13871 alternator with a regulator change, and a very slight modification of the SRE housing to accommodate the regulator.

Voltage fluctuation

One of the failures that annoys any customer is voltage fluctuation. When there is voltage fluctuation in the headlights, it may be hard to notice, but it can be easily seen in the dome lights and instrument cluster. It is an annoying phenomenon that is often requested to be attended to, depending on its severity and the customers liking.

We recently had a couple of such cases that needed to be addressed but the causes were so different from each other that I decided to write about it in this issue:

1. 1999 Chevy C-10 truck

This vehicle had a serious voltage fluctuation that was evident in the headlights, interior lights, as well as instrument cluster. The common 8206 (CS-130D) alternator of this truck is activated by the "L" pin of the regulator, and that is the only wire that exists in the plug.

I had made this simple test lead for isolating this sort of problem for CS130-D and AD units, especially the ones that have a sense wire, mostly used on GM passenger cars (*see Figure 8*).

This test lead simply goes in series between the vehicle wiring harness and the alternator with provisions to get to the "L" and "F" pins of the regulator for testing and diagnostic work. Connecting the red clip shown in the picture to a clean +B post eliminates any sensing issues in the vehicle's wiring. So, if the fluctuation stops,

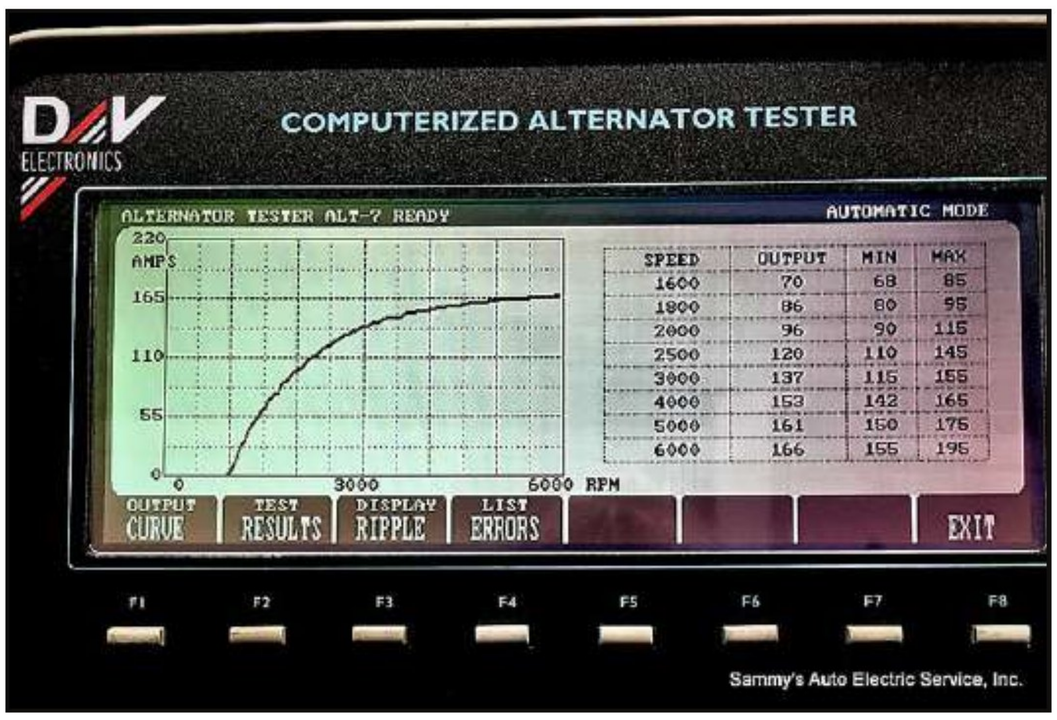

Figure 7 – Performance curve of 11114 alternator and limits



we know the problem is in the sensing circuit as the slightest bit of corrosion results in a nearly unmeasurable voltage drop at the "Sense" fuse circuit which causes confusion for the regulator.

If after connecting the test-lead wire to +B the fluctuation still exists, we know the problem could be internal to the alternator and perhaps the regulator is not switching between its External Sensing to Internal Sensing modes for whatever reason, and that requires an alternator removal for further investigation and fix.

In our case, hooking up our test lead and giving it a clean +B stopped the fluctuation. So, in this case the problem was an internal sensing case, as there was no "S" wire to the regulator plug. We could have probably changed the plug and added a sense wire to it to solve the problem, but the condition of the hi-mileage alternator and an agreeable customer allowed us to replace it. Once our reman alternator was installed the voltage stabilized even though the alternator did not have a "sense" wire attached to its plug.

Upon teardown, we noticed excessive corrosion and loose hardware (regulator screw) at the location shown (*see Figure 9*), but we did replace the regulator with a Taditel T-719 for reliability.

2. 2016 Jeep Grand Cherokee

This very clean vehicle was sent to us for a voltage fluctuation that was quite visible on the interior lights. A check of charging system showed it was charging fine and the grounds in the engine compartment seemed very clean. A PCM scan showed no codes related to charging system and battery temperature sensor.

Going by experience, I asked the customer if this vehicle has been in any frontal collision, which the answer was no. I also asked if there has been any repair done to this vehicle which after that the voltage fluctuation had started. His answer that was the key to the problem was no, but he added the problem started after a battery change at the local Twilight Zone auto part store…!

After attaching our battery cart to the new battery we noticed the fluctuation stopped. This vehicle requires an expensive AGM battery but the owner was sold a regular lead-acid battery. Whether the wrong battery or any internal problem with his new battery had caused the issue is an open question, but all we had to do to fix this vehicle was to install a brand name and correct AGM battery (Interstate MTX-49/H8) to get the job done.

Well, that's all for this issue, until I see you again, keep up the good work and remain healthy.

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

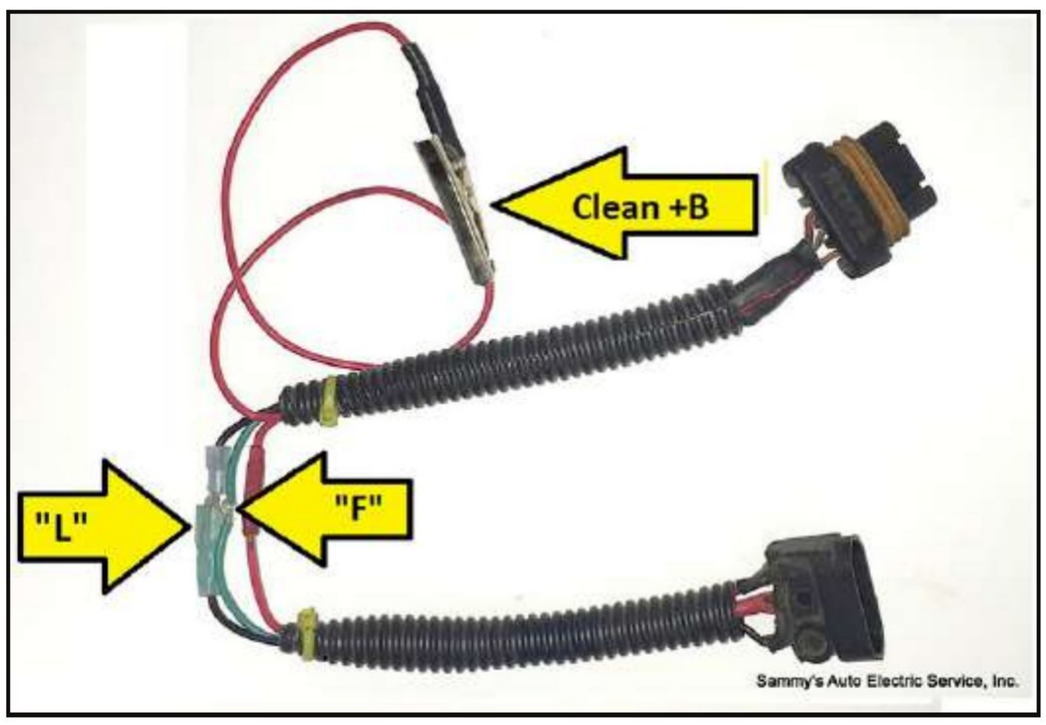

Figure 8 – CS-130D/AD test lead for accessing various regulator pins



Figure 9 – 8206's loose regulator screw causing fluctuation



Schedule of Events
2021 ERA Expo – Cincinnati, OH
Holiday Inn Airport Hotel

THURSDAY, MAY 20

9:00 - 12:00
Seminar: Feature Presentation of Vendors Online Parts Ordering Websites
with Amsco VF, IAT, J&N, Romaine and WAI

12:00 - 1:00
Lunch

1:00 – 5:00
Seminar:

Live Demonstrations of Analog and Digital Scopes Displaying Various Scope Patterns, Pass and Fail, of Alternators.

Live Demonstration of BSS/LIN COM Test Boxes Available to Rebuilders Today

Seminar will include latest updates of BSS/LIN regulators; explaination of acronyms and terms used for scope, scanner and regulator technology

Demonstrations will be presented using equipment and alternators furnished by JIMCO, WAI and J&N

Presenters:
Ryder Keller, JIMCO
Mohammad Samii, ERA Technical Instructor

THURSDAY, MAY 20 (cont.)

5:00 – 7:00
Dinner Break

7:00 – 9:00
Roundtable Open Discussion *with Dan Smith of J&N Electric & Bob Thomas, ERA Exchange Editor*

FRIDAY, MAY 21

8:00 – 9:00
Seminar: Market Outlook, Rebuilding, Buy vs. Rebuild Decisions
with Nick Staub of Romaine Electric

9:00 – 10:30
Seminar: Challenges in Heavy Duty Rebuilding
with Paul Sailon of Sailon Auto Electric

10:30 – 12:00
Seminar: Measuring & Effects of Voltage Drop in Charging & Starting Systems
with Dan Marinucci of Communique

12:00 – 1:00
Lunch

1:00 – 7:00
ERA EXPO

SATURDAY, MAY 22

9:00 - 1:00
ERA EXPO
Raffles begin at 10:00

1:00 – 2:00
Lunch

2:00 - 3:00
Seminar: Lathes, Cutting Tools, and Shop Practices Expanded
with Mike Dietrich of Action Alternator

3:00 – 4:30
Seminar: Updates, Rebuilding Techniques, Pictorials, etc.
with Mohammad Samii, ERA Tech Advisor

5:15
Load Buses to Sign Museum

6:00 - 10:00
Happy Hour & Dinner, Tour Museum, Tour Neon Sign Workshop, Performance by Ventriloquist

10:00
Return to Hotel

SUNDAY, MAY 23

8:00 – 9:00
Annual ERA Board of Directors Meeting

REBUILDER REGISTRATION FORM

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4)					
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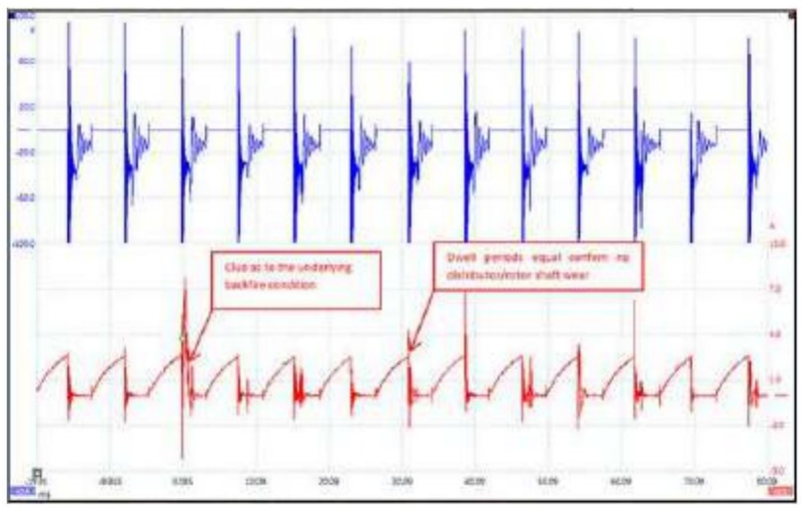
7)					
				TOTAL ⇨	

Cancellation Policy: Cancellations are subject to a 15% processing fee. **NO REFUNDS** will be made after April 27th.

DON'T MISS THURSDAY AFTERNOON'S SEMINAR!

- Learn about the latest ECM/Alternator communication.
- Learn scope patterns demonstrated on analog and digital scopes.
- Learn the terminology and definitions used for this communication.







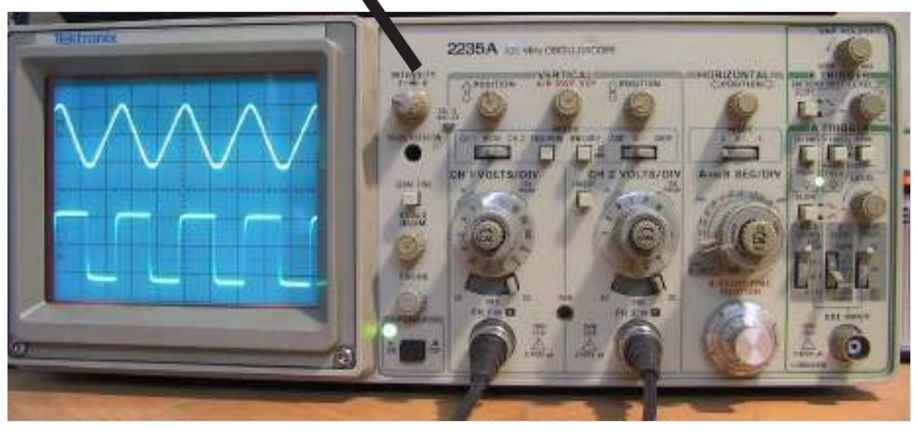
Live demos of various BSS/LIN test boxes.

Live demos of analog & digital scopes.



What is..?
- COM
- Protocol
- Baud Rate
- Duty Cycle
- LIN
- BSS
- Sine Wave
- Square Wave
- Hz





Spend Saturday Evening at the American Sign Museum

What is the American Sign Museum?



The American Sign Museum is dedicated to the art and history of commercial signs and sign making. The American Sign Museum is proud to be the largest public museum dedicated to signs in the United States! Covering more than 100 years of American sign history in 20,000 square feet of indoor space, the museum is a walk through the ages of technology and design.

The storefront-laden Signs on Main Street display recreates a typical "Main Street USA", with shop windows full of sign-related objects, curiosities, and samples.

Guided tours or an audio tour on your phone are great ways to explore the Museum. Explaining the larger topics, as well as surprising stories about the signs themselves, paints a clearer picture of the collection and is highly recommended. At the end of guided tours, don't forget to check out Neonworks of Cincinnati, the full-time neon workshop located inside of the museum! You can see tube-benders working their craft making signs for sign companies today.

End the Evening with a Laugh

The ERA Trade Show Committee has hired a ventriloquist to top off the 2021 show with an evening of laughs. David Crone will be joining us on Saturday at the American Sign Museum to let off some steam and enjoy a night of good, clean fun.



I'M NO DUMMY PRODUCTIONS

ImNoDummy.com

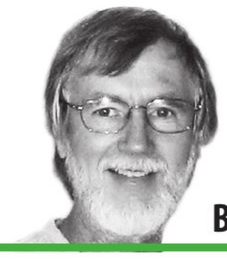
David Crone has been performing on stage for more than 30 years. A former corporate executive, David left the comforts of the corner office for a rugged life on the road when his busy performance schedule no longer allowed him to "do both".

His unique perspective on office life, incredible ventriloquism skills, and cast of crazy characters combine to create a program like no other.

From pure comedy entertainment, to highly customized serious messages on leadership, service, and living life on purpose, David leaves the audience ready to take on their next big challenge with renewed energy, and best of all, joy and laughter.

Everything he does is driven by his personal mission statement: Making the world a better place, one laugh at a time.

HIGH AMP ALTERNATORS
How Do They Do That?



BY BOB THOMAS

A couple of months ago an ERA member sent an email requesting an article on building high output alternators using the Denso SC (hairpin) platform. He specifically mentioned one online business that is selling a 370 amp unit capable of putting out over 200 amps at idle.

My initial reaction was that modifying a Denso SC alternator, designed by a team of engineers with the resources of Denso behind them, was beyond my level of experience. But after searching online, I found a dozen sellers that are offering exactly what he was asking for. So I felt obligated to pursue the matter.

I first contacted a friend who had years of experience in this niche market. Some of his contacts have been in the high output business for decades, and most are now primarily using the Denso SC platform. He shared some of the problems that they have encountered and some additional hurdles that have to be overcome.

To begin, I would like to break down the alternator into the two basic components that determine its AC output, prior to rectification – the rotor and stator. It is those two alone that determine any alternator's output capabilities. In the past, 10SI stators in particular have been rewound in the aftermarket to produce a higher output, so I will start there.

The Stator

Any stator's output capability is determined by the number of turns in each coil, the resistance of each coil and the number of coils used in that stator (normally three but could be six or more in multiples of three). Resistance matters greatly because it limits amperage output per coil based on Ohm's Law. Resistance is determined by the gauge (or diameter) of the wire and the length of that wire used in each coil.

If you increase the number of turns, it has the potential to increase output. If you increase the size of the wire (lower resistance), you have the potential to increase output. But doing either one takes up more space, which is limited to what is in the lamination's slots

Denso has already maximized the amount of copper in each slot, using a square wire (*see Figure 1*), hence the hairpin nickname. You could remove some of the lamination's steel to enlarge the slots to make room for more turns or larger wire. But the loss of iron would likely negate any gain. For it is the iron in the lamination that provides a conduit for the rotor's electromagnetic lines of force which moves the electrons in the copper wire. The steel also plays a large part in the dissipation of heat, generated within the stator's coils. In the photo, notice how much steel Denso used, particularly around the lamination's outside edge.

The way the coils are connected or configured (delta vs wye) also affects output, but in a different sort of way.



Given two stators that have identical coils but one of them delta configured and the other wye, the delta will have the higher top end output but the wye will outperform it at lower shaft speeds. Denso has been creative with some of their SC stators, incorporating seemingly both configurations into one (*see Figure 2*).

This stator has two identical sets of coils in parallel. Each set has six coils in total. Three form a delta connection in the middle, but then the other three turn the delta's output connections into a wye connection. This is the stator used in 104210-6220 or Lester 11627, rated at 215 amps and used on Ford F series Super Duty diesel trucks from 2011 to 2016. I would point out that Denso's output ratings have always been on the conservative side, and most SC alternators typically outperform their ratings by 5% or more.

Another variable that is worth mentioning is the magnetic quality or permeability of the electric steel used to manufacture any stator's lamination stack. The OE manufacturer's use only the highest quality electric steel to insure that they get the best possible performance from every design. That type of steel must be carbon free – or contain less than 0.005% carbon. It is very expensive to manufacture, no matter where it is made.

Aftermarket stators are more likely to have been manufactured using a substandard electric steel to varying degrees (more carbon than normally allowed). It is one way that they can control cost. If you would like to know more about electric steel, how it is made and the different types, look up the February 2016 issue in the Exchange archives on our ERA website and read Magnetic Permeability, What Does It Mean To You?

The point here is that you need a lamination of the highest permeability possible to get the best performance from the windings. Unless you have unlimited resources, you will have to start out with an OE stator and rewind or more likely reconfigure it to get a higher amperage out of it. That is the challenge of improving the output of any Denso SC stator.

My source told me that most of his contacts in the high output market are doing just that, making modifications to OE Denso stators. But he agreed with me that those modifications will change the performance curve.

The Rotor

The rotor plays a greater part in an alternator's output than most people realize. It provides the magnetic field that moves electrons back and forth through the stator's coils. If you can increase the magnetic strength of the rotor, you can improve the stator's amperage within the electrical limits of its coils, but most of it will be on the lower end of the RPM scale where arguably it is most needed. Back in the early days of high amp alternators (Lestek, Powerline and Pentax) the rotors played a large part in improving amperage output, particularly at low shaft speeds.

More turns and/or more current flowing through the rotor's coil will increase the strength of the rotor's magnetic field. While the electric steel is slightly different from that used to make a stator lamination (grain oriented for the rotor as opposed to non-grain oriented for the stator) the same quality standards apply. The grain oriented soft iron used to make rotors is also expensive.

You will run into the same space limitations when rewinding a rotor for higher amperage as you would with a stator. More turns and/or a larger gauge wire both require more space and there is a limit to what you can do there too (*see Figure 3*). If you increase wire size to lower resistance the result would be fewer turns. Or you



Figure 1 – Cut-a-way view of a Denso SC stator's square wire.

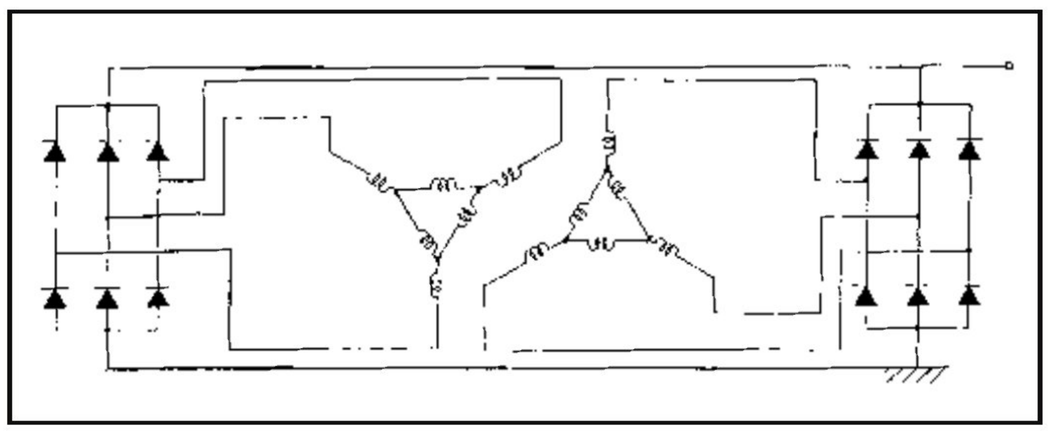


Figure 2 – Diagram of a 210A Denso SC alternator showing its unique coil configuration.

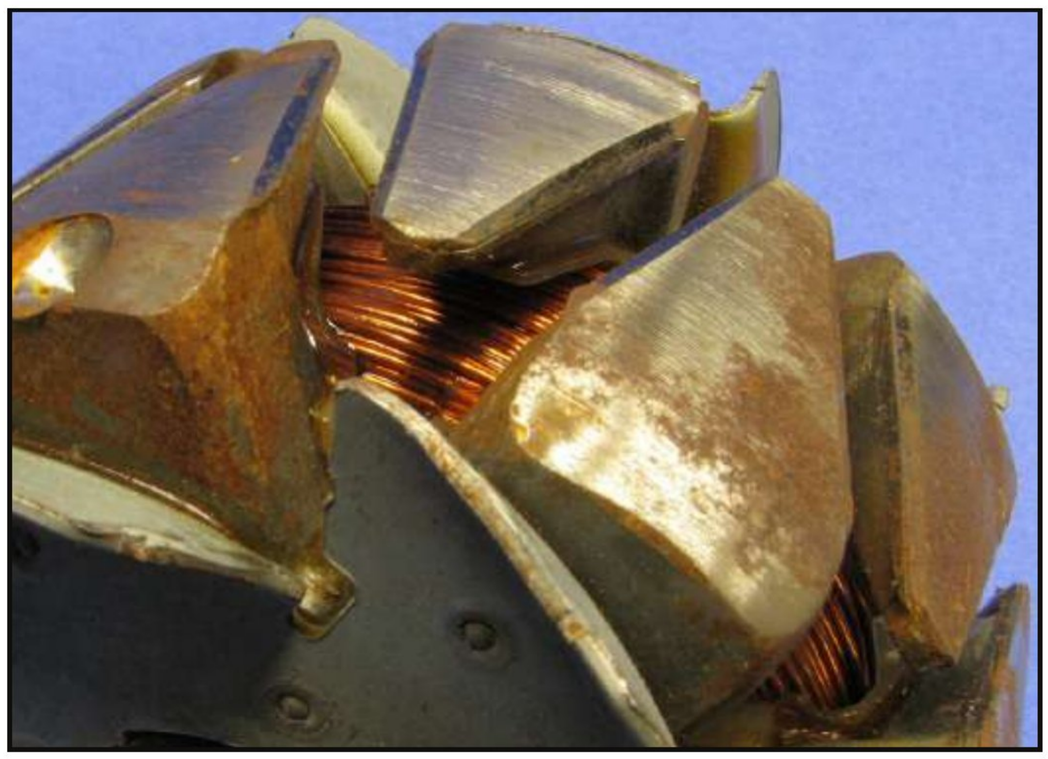


Figure 3 – Denso SC rotor.

could increase the turns with smaller wire, but it would raise resistance. In addition, you can be sure that Denso has already maximized the bobbin space in their rotors, leaving little room for improvement.

We have seen some rotors with permanent magnets embedded between the poles in a few applications – both from Delco (Cadillac) and Valeo (Mercedes Benz). However, Denso has not used it yet (that I am aware of) and that sort of modification is far beyond the capabilities and resources of most rebuilding shops.

Also keep in mind that rotor current must be handled by the regulator, so you have to stay within the range that the regulator can handle or go to a heavier duty regulator.

Alan Melton, a founding board member of the ERA and owner of AmFor Electronics in Portland, OR told me that when they owned Wrangler, a high output alternator specialty company, they always started with the regulator for each application. "Number one," he said, "the regulator has to be comparable with the vehicle. We always started with the OE regulator." He also said that they started with the highest amperage optional OE alternator that was available for that application.

"We found that many times the manufacturer's were offering a higher output option," he added, often not advertised but available. "Today, you can find them easier online where dealerships offer build options for each model. As you work through the option list there is almost always at least one high amperage option and they are even offering dual alternators as a factory option on some applications." That means that you can buy the brackets and belts for a dual alternator system right from the dealer as opposed to trying to design your own."

Rectifying the AC

Let us assume that you have made modifications to the rotor or stator and have successfully converted a 240 amp Denso alternator to put out 350 amps. How are you going to rectify that current? So you must also source a heavier duty rectifier that will fit the alternator if you want it to last for any length of time.

Denso's highest amperage rectifiers are already using double 50A press fit diodes (12 in total). And as my source pointed out, there is a limited amount of space on any given Denso SC heat sink. In this case, there is simply not enough room to add a third set (*see Figure 4*). Even if you could squeeze them in, the heat sink could not dissipate the 50% increase in heat that the extra diodes would create.

The space inside a 1/2" press-fit can is limited to the size of a 50 amp die (the actual silicone diode inside the copper container). A higher amp die will not fit in a 1/2" can (*see Figure 5*). The die is the narrow piece sandwiched between the S-shaped connector to the stem (above it) and the solder (below it). Notice the thickness of the can's wall. All of that copper is needed to dissipate the heat generated in the die.

My source told me that his contacts are having the most return problems today with blown rectifiers that simply cannot handle higher current for any extended length of time without overheating. Most of the limited number of OE Denso SC failures that we have seen have been in the diodes.

Input vs Output

A 370 amp alternator operating wide open at 14 volts would produce a whopping 4,440 watts of electrical power under a full load. But that level of output requires an input of mechanical power of more than 9 horsepower, given the losses in converting mechanical power to electrical power. All of the lost energy ends up being turned into heat, produced in the rotor, stator and diodes. While 9 HP may not be an excessively heavy load on a big engine,it is a tremendous load for the typical automotive accessory drive belt system. Depending upon



Figure 4 – This Denso SC rectifier already has 12 diodes.

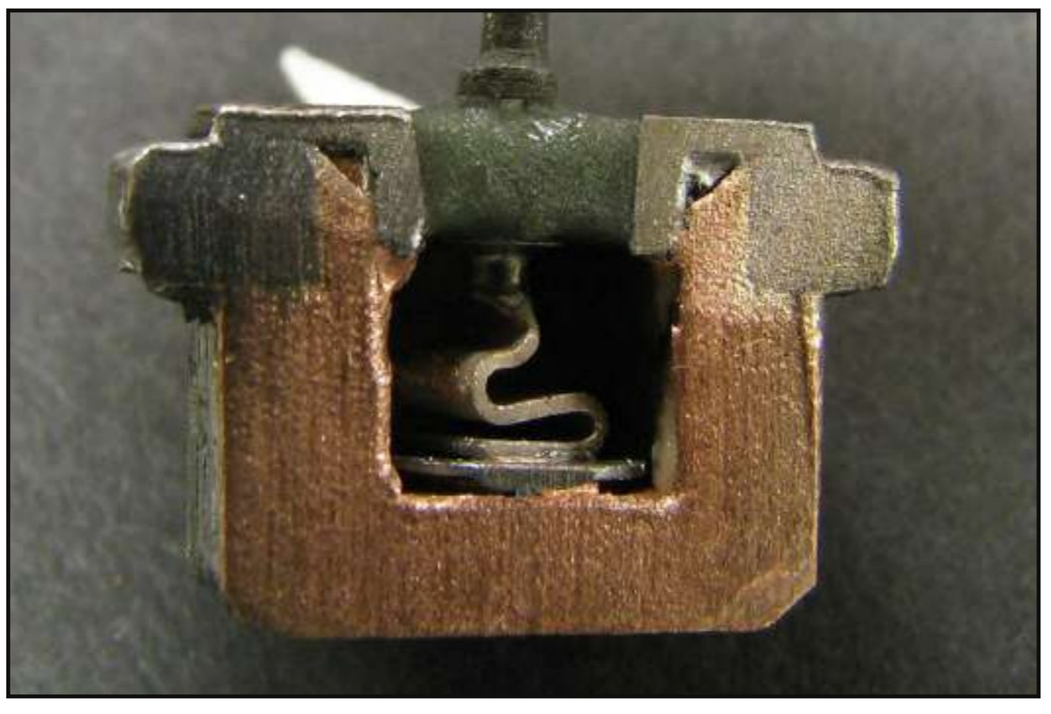


Figure 5 – Cut-a-way view of a 1/2" press fit diode.

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the actual application, a new belt system with a much wider belt might be needed, especially on applications that came from the factory with alternators of significantly lower output.

Melton explained that a decoupler pulley can help to reduce some belt slippage. He also said that they ran their Wrangler alternators for a minimum of three hours at full load while monitoring the temperature of the diodes in particular. He recommends using a solder with a high melting point and a narrow mushy state (when it is no longer a liquid but not really a solid yet either).

Conclusions

There are many obstacles to overcome for any small shop that would like to compete in the high output alternator market. While the pricing may seem high enough to generate large margins, the actual up front cost to become a serious competitor will be high. There are no suppliers out there currently advertising high amp components that I could find. The major players in this market are having their parts manufactured to their own specifications or they are making modifications on their own.

How well they actually perform is really unknown unless you have actually tested one. If I were planning to break into this market, I would start by taking a close look at the competition. I would buy a few of these alternators from different sellers and test them myself, compare the actual performance to their claims and look inside to see what modifications had been made. It is not rocket science. Anyone can test rotors for current draw and compare their stator's configuration to an OE stator. Read the article published in the December 2016 issue, Denso SC Alternators Part 2 – Stator and Rotor Combinations. It could be of some help in making comparisons.

You will also need a test bench that can handle that kind of load (over 10 HP) and that can accurately test the alternator's performance at a variety of speeds.

An easier option might be becoming a distributor for a company that has been doing this for a long time. The up front cost to explore that approach is only a few phone calls to see if any are interested. What you have to offer them is additional sales that they might not get otherwise.

I wish that I had better news. If any reader knows more about this topic and would be willing to share it with other members, please contact me at the email address or phone number below. I would be happy to help you share that knowledge in a future issue.

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

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INADEQUATE QUALITY CONTROL
Multiple CS144 Failures

BY DWIGHT DERSTINE

Back in October of last year I sold a customer a CS144 for his 1998 C3500 Chevy truck. I had ordered him a new aftermarket alternator (as opposed to rebuilding his core) to lessen his down time. It only lasted him several weeks, a pattern that would repeat itself several times. I installed the third one myself on New Year's Day and it failed 28 days later.

The supplier was very good about replacing them every time, but I've had to pay the return freight on each one, which had been steadily adding up. I was told by the supplier that each one that I returned proved to be defective on their bench test, but I learned that nobody was looking inside to determine exactly what part was failing.

After the first one came back, they told me that this regulator (a 411 type) needed a sense wire to work properly, but the original wiring harness on the truck was intact, with just one wire, ignition for turn on. The original regulator never needed a sense wire. They also told me that out of the 200+ units of this part number that they'd sold, only one other beside my three had failed, causing me to believe that it must be me, doing something wrong. So I called my friend Bob Thomas for some advice on what I was missing.

The first thing that he said was that if he were in my position, he would disassemble the failed alternator and see exactly where the problem was. "You need to know that before you do anything else," he told me.

Of course, I explained why I was hesitant to do that because it would void the warranty. "What good is a warranty," he asked, "when they keep sending you another alternator that is highly likely at this point to fail too?" He suggested that, whatever was causing the failure would probably be obvious and possibly simple to fix.

Since it had quit working altogether, he suggested that most likely I would find an open field circuit. "It could be a brush problem, a regulator failure or an open rotor," he predicted. He asked me if I still had the core, which I did. "If the rotor failed," he said, "replace it with the OE rotor in the core." He pointed out that I could probably fix it myself for less money than the cost of shipping it back.

So I followed his advice and what I found was what looked like a broken brush lead. The rotor tested good. I installed a new loaded brush holder and a new regulator that I had in stock just be be safe. Then I tested the alternator on the bench and installed it back on the customer's pickup myself. It has been working fine ever since.

Bob asked me to send him the broken brush so that he could get a close look at it, so I sent the brushes and regulator to him. He sent me some closeup photos of the brush where it broke, right where it was connected to terminal clip (*see Figure 1*). He said that to him, it looked like whomever manufactured the brushes, had attempted to spot weld the crimp or had applied too much heat there for whatever reason when attaching the braided brush lead to the terminal clip (*see Figure 2*).

The excessive heat had probably damaged the braided copper brush lead right where it was attached (*see Figure 3*) and left a weak link that easily passed a final line test and inspection, but was destined to fail on the vehicle, running under load with vibration from the engine.

Dwight Derstine is the owner of Maysville Repair in Apple Creek, Ohio.



Figure 1

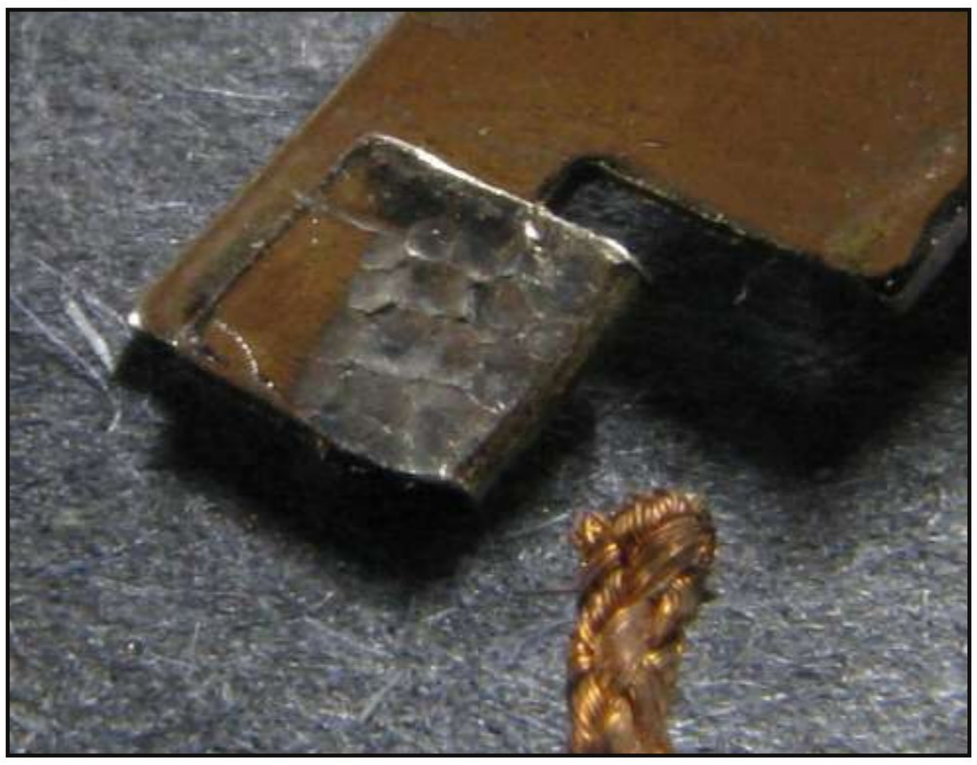

Figure 2



Figure 3

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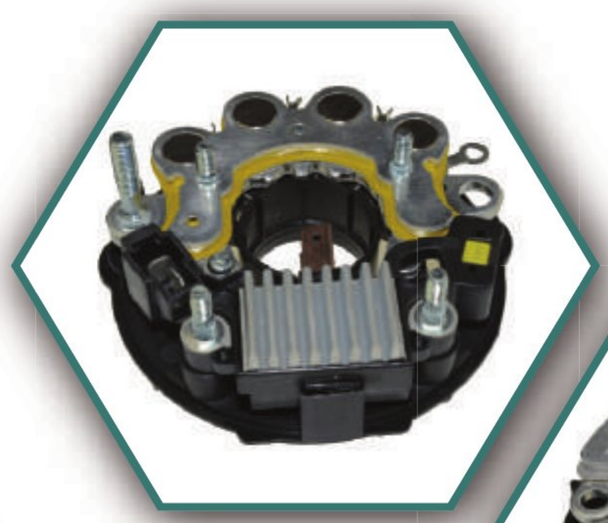



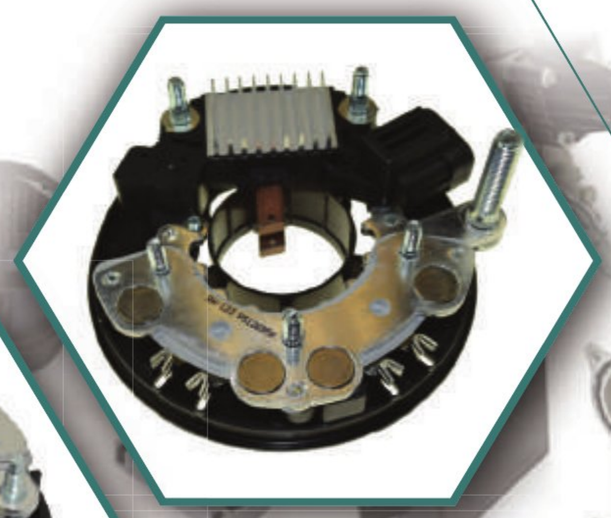

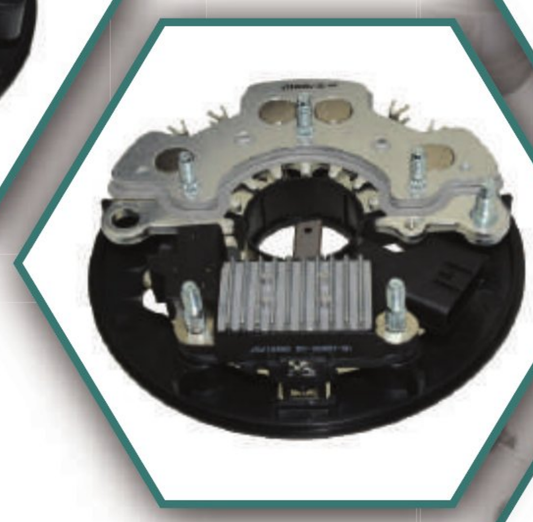



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