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YOUR GUIDE TO ELECTRICAL REBUILDING

November 2016 $12.95



DELCO 24SI
A Long Haul Workhorse

DENSO SC ALTERNATOR
Hairpin By Another Name

A CLOSE CALL
Hurricane Matthew

PLAIN TALK | HUDDLE UP

Electrical Rebuilder's ERA FOUNDED 2001 ASSOCIATION

A WORD FROM THE PRESIDENT
Developing A Business Plan



This is the time of year that I start developing my business plan for next year. I try to have it completed by the end of year, so that we have a good vision of the direction we want to go next year. I believe having a business plan is a very valuable tool for managing and staying focused on business objectives. Sometimes I have a habit of getting side tracked by day to day activities and do not see the forest for the trees. Having a business plan helps keep me on track.

I start by looking at what worked this year and what did not work. The best tools to do this with are a good profit and loss statement and product sales reports. In other words, your own bottom line. Without a positive bottom line, you cannot stay in business long or you just have an expensive hobby.

My business plan consists of several objectives, such as customer service strategy, markets, new product lines, old product lines, shop improvements, labor, inventory, etc. My first plan was a five year plan, but in today's world of our industry constantly changing, I have found it more effective to react to changes that can impact long term goals. I believe a good business plan is a work in progress and can be changed when data or circumstances tell you to do so.

That is why I grade my plan at least once a year. I keep my plan simple, but yet make sure it gives me a sense of direction to help achieve goals and objectives. I have seen posts on the forums and listened to discussions at our trade shows of members looking for new product lines and business ideas. There have been a lot of good responses and ideas discussed on this issue. Some of these ideas do not require a lot of investment as long as you have a plan to initiate and evaluate whether or not it is a good thing for your business. Just make sure it is thought out and detailed enough to give it a chance.

There is a lot of information on the internet about how to go about developing a plan that is workable for your business. I believe the key to having a successful business is not having the best or most unique idea - it is about implementing and making a good idea or strategy work. There is no single key to success, but having a road map definitely helps. Make sure your business plan includes belonging to and participating in a good trade organization such as the ERA.

"I believe the key to having a successful business is not having the best or most unique idea - it is about implementing and making a good idea or strategy work."

Mike Dietrich

** Don't forget, the 2017 ERA Trade Show in Dearborn/Detroit, MI is approaching. See page 13 for a tentative schedule of events for this year's show.

NEW ERA MEMBERS

Superior Alternator & Starter
Cross Plains, Texas

Cawley's Repair
Scottsbluff, Nebraska

ABOUT THE COVER

Delco 24SI stator

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Rebuilding is Recycling!

PLAIN TALK — HUDDLE UP



BY ROB BUKSAR

Have you ever wondered why great quarterbacks make as much money as they do? Furthermore, once retired, they are in high demand and sought after by businesses and industry.

It certainly isn't due to their looks, even though a good appearance has never hurt anyone. It's really pretty simple when you stop and think about it. Here's a guy who has the demonstrated ability and the shogun arm to move a team downfield and across a goal line against another team who is probably just as talented and determined to prevent him from doing so. There is no magic to this and luck seldom enters into the picture. Of course, everyone gets a "lucky break" now and then but really not all that often.

What it takes is an intimate understanding of the game and current information concerning what you're up against. Without that, all the other attributes won't take you very far. Furthermore, a football line is a group of very talented, highly-motivated and skilled specialists who need clear ongoing direction on how the quarterback intends to move the ball and most importantly, what each and every players' role in the play is going to be.

Most importantly, at the end of every play, good or bad, what happens? The quarterback calls a huddle. In a very expedient manner, the QB directs his team regarding the next play. The purpose being? To coordinate moving the ball downfield and across the goal line through an opposing force doing their level best to try to prevent them from doing so. Sometimes you win, sometimes you lose. There are lots of factors involved. Here are the common denominators. *You don't quit, you continue to try different plays and you communicate to one and all, what the plan is and the roles that have to be played by one and all. It's called the huddle.*

If you're a one-man operation, my heart goes out to you. You're the chief, cook and bottle washer and have to find a way to do all of the above on your own, at least in part. At the very least, you need to establish where you want to go and some play on how you're going to get there. Without that, you're a bird without wings just trying to dodge or avoid being eaten or run over!

For those of you who have employees, at least consider what I'm about to suggest. Monday morning have the coffee and donuts waiting for your regular huddle. Re-establish the objectives that you're trying to achieve. (Where's the goal line?) Review the previous week and go over the activities. Acknowledge the successes and learn from them. Recognize the mistakes and discuss how they can be avoided. No one gets personally attacked here for fault. You are going to address situations and not people.

Review the plans and objectives for the current week and lay out what you want to achieve. Who, what, where, when and how.

A very important aspect of employees is simply this. They have their own agenda! Your goals and objectives are yours and not theirs. You have hired them for a moment like this to achieve yours. If you're like most of us, you haven't bothered to share your goals with your help. Maybe you don't know yourself what your goals are or if you even have any. You need to stop and think about that. "If you don't know where you want to go then how do you formulate a plan for getting there and how will you know when you arrive?"

In the absence of clearly defined goals, we become strangely loyal to performing daily acts of trivia. By the way, this sad shortcoming is magnified thorough our employees. We all grovel trying to find good help; it's the biggest complaint out there. However, before you become too judgmental, you might look at yourself in the mirror and make sure you're not a part of the problem. All teams need a QB or captain to provide leadership and continued direction. How often do you huddle with your team? Are you one of those bosses who leads from behind (only communicate and yell when mistakes are made)? Or do you "assume" everyone knows what's in your head and the help will instinctively do the right thing at the right time. I don't think so! It's best to get out in front!

Enough said - you get the drift. Look around and make note of the companies, small and large alike staying ahead of the curve. Without exception, they are huddling in some form or fashion. In order to move the ball successfully downfield and across the goal, communication and coordination is imperative. That won't happen without regular huddles with your crew. If you've never done this before, it will be a little awkward at first but it gets easier as you go along. Your employees will appreciate the direction and will respond well! If you commit and follow through, you will be shocked at how fast you begin to net some real positive returns. This is real important so I want to say it one more time. "You cannot expect your employees to perform at their best without leadership, a destination, coordination and direction. You may have to start talking to your folks or at least more frequently than you have been. A weekly huddle will increase your level of success, and the best motivating factor there is; **IS SUCCESS.** Huddle up!

God Bless our little industry.

Rob Buksar can be reached at International Winding, Inc.
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DELCO 24SI
A Long Haul Workhorse



BY BOB THOMAS

When Bosch introduced the AL9960 Long Haul alternator in 2007 (*see Figure 1*), it received a lot of attention. A two-year or 250,000 mile warranty and a low introductory price helped to insure that many of them were sold. At the time, Delco's competition was the aging 22SI, a modification of the 21SI that had been in service since 1998. Delco Remy was forced to respond with something comparable or loose market share. They did that in 2008 with the 24SI.

If the 24SI looks similar to the Bosch AL9960 (*see Figure 2*), there is a good reason. Delco knew that they had to match the AL9960's compact size, output performance and reduced weight. That required using dual internal fans on the rotor. Internal fan alternators were not new. Denso began using them a quarter of a century before the AL9960. The 20DN employed dual internal fans long before that. But the AL9960 employed larger openings in the aluminum end housings to allow for the maximum amount of airflow for cooling. Delco had to follow suite, with improvement in mind.

Like all new alternator designs, the good ones take time to show up for rebuilding. Even shops that do not specialize in heavy duty are beginning to see them now. With an over-abundance of new OE and aftermarket units being sold, good cores are both affordable and easy to find. This is a relatively easy alternator to rebuild.

The 24SI (*see Figure 3 and 4*) is manufactured in either 12 or 24 volts in both J or pad mount. Unlike its 22SI predecessor, the 24SI does not use a diode trio to supply power for the field circuit. The source of field current is the positive rectifier. All 24SI alternators are self-exciting, using the phase connection for activation. Turn on is very quick. There are two regulator configurations – both B-circuit.

The more common has ignition and relay terminals (*see Figure 5*). The relay terminal provides phase voltage for applications that require it. The ignition terminal can be used optionally. But the regulator will not turn on until stator phase voltage reaches 0.3 volts, even with the ignition terminal powered. This feature is what Delco calls "soft start", to prevent the alternator from being activated during cranking. In bench testing, our 24SI turned on repeatedly at a phase voltage of 0.3v, with or without ignition voltage. In fact, this particular unit was a take-off core obtained in 2014 from a truck dealership. It self-excited well below what would be normal idle speed, in spite of sitting on a shelf, disconnected from a battery, for over two years.

Keep in mind that a leaking positive diode or salt contamination on the rectifier can prevent any phase activated regulator from turning off when the engine is shut down. When testing one of these alternators, you should carefully check to insure that there is no voltage on the stator unless the rotor is turning.

The less common version of the 24SI incorporates a regulator with a CS130D-type plug (*see Figure 6*). This version accommodates applications that require a charge lamp terminal, remote battery sense or a field monitor terminal. The

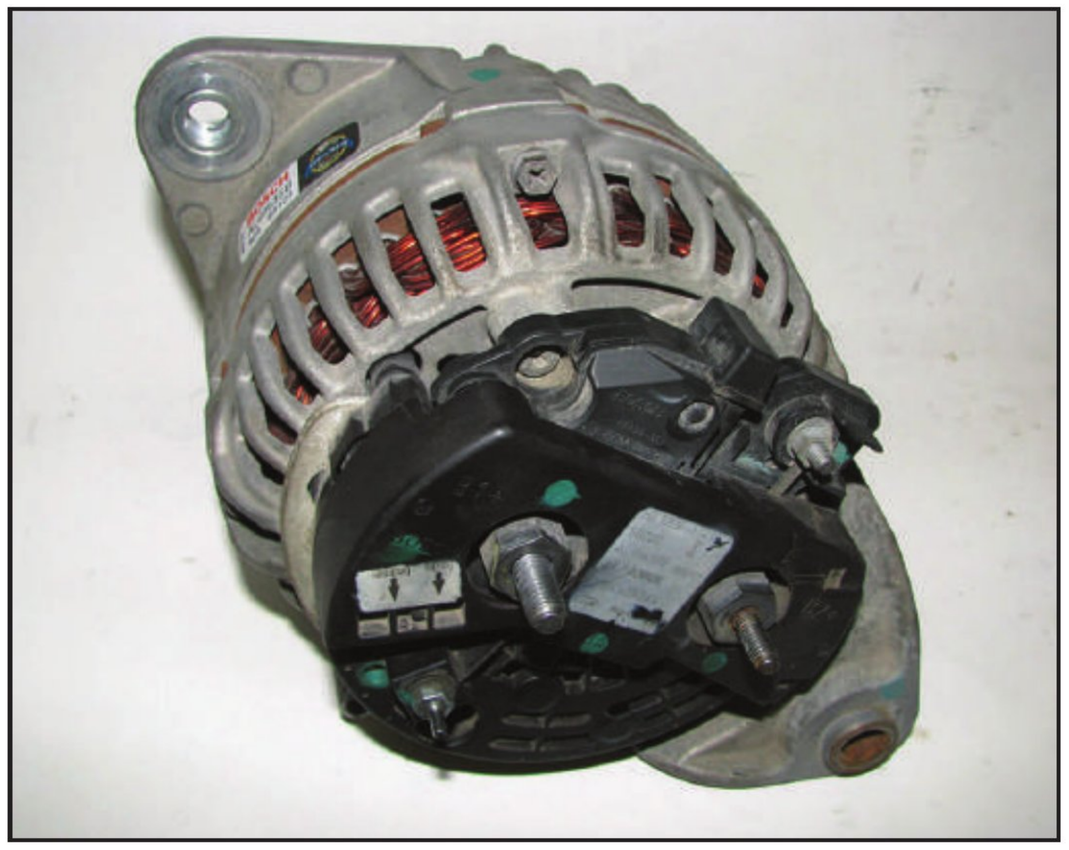

Figure 1 – Bosch AL9960 Long Haul alternator, introduced in 2007.



Figure 2 – Delco 24SI and Bosch AL9960 side by side – similar in performance, efficiency, size and weight.

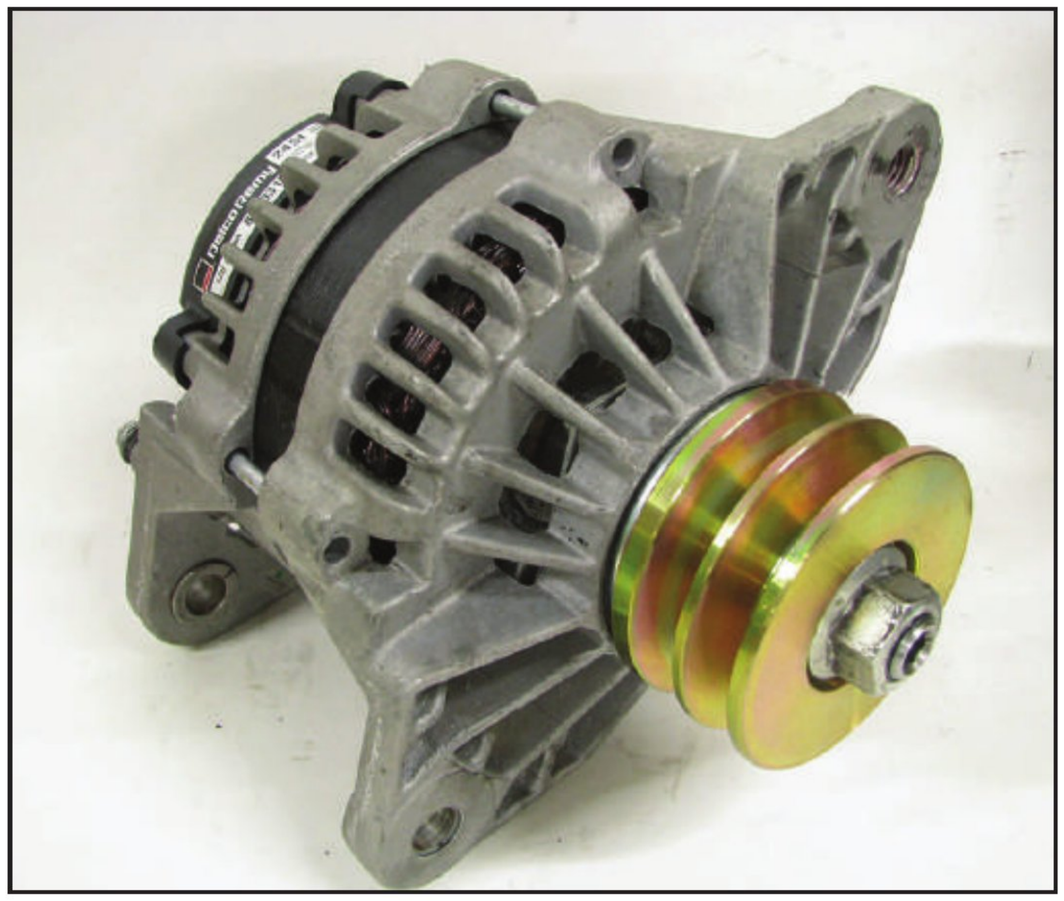

Figure 3 – From the front, you can see the 24SI's large openings that allow maximum air flow for cooling.

back cover on this version is slightly different. By stocking two parts, you can convert one version to the other in a matter of minutes. Both regulators will self excite in the absence of any voltage input other than the B+ terminal.

This alternator can be disassembled in minutes with few tools. Other than the pulley jam nut which accepts a common 15/16th socket, all fasteners attaching the rectifier and regulator take an E5 female Torx socket while the thru bolts take an E8. The stator rectifier connections are soldered and easy to separate, as is the phase connection between the rectifier and regulator. It would appear that this alternator was designed to be easily serviced – a pleasant departure from what we have been seeing from some other manufacturers.

Once the back cover is off (*see Figure 7*), all fasteners and solder connections are exposed and accessible. If the brush holder looks familiar, it is because it is very similar to those used in the 5SI, 7SI and 11SI alternators. The rectifier lead frame connections are thick gauge copper and can be opened quite easily without breaking once the solder is melted (*see Figure 8*). You can see that the stator has dual windings in parallel allowing more copper to fit into the slots. The slot insulators are heavy duty too (*see Figure 9*).

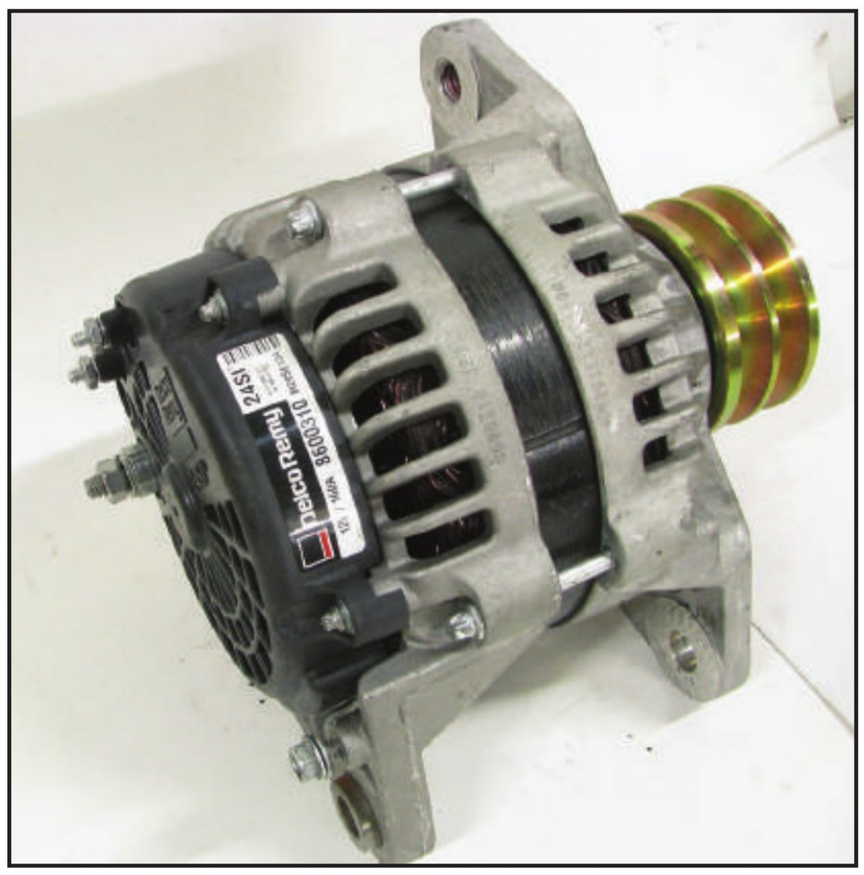

Figure 4 – Delco did not enclose the 24SI's stator, similar to their AD series and Denso hairpin alternators.

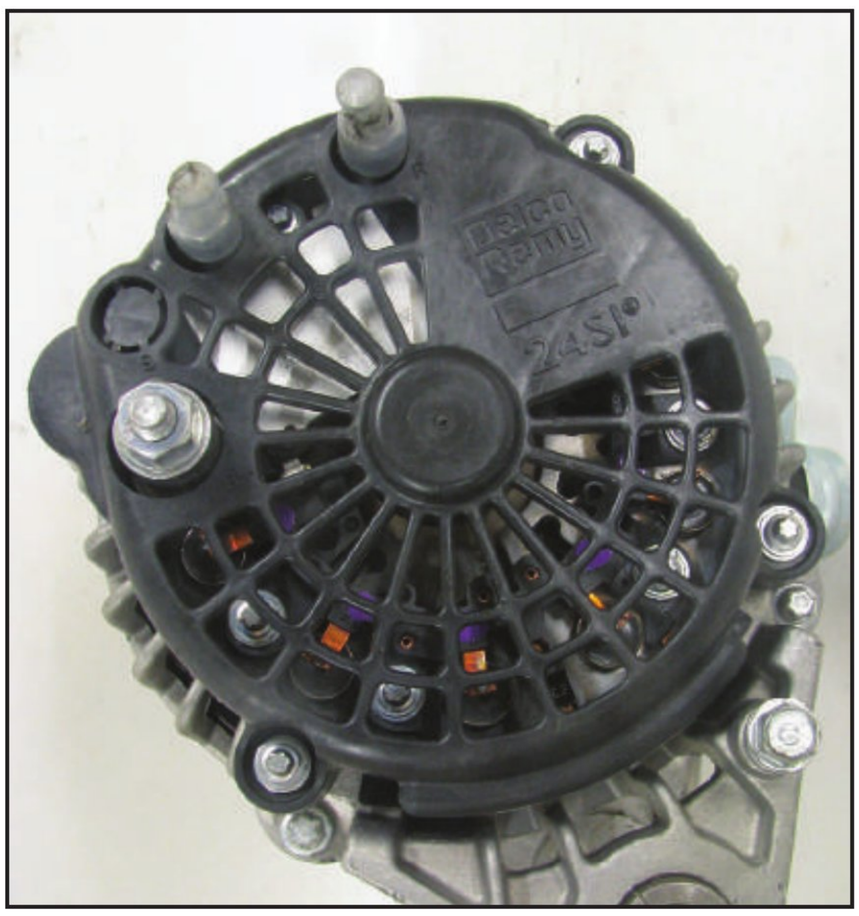

Figure 5 – The more common 24SI is shown here with ignition and relay terminals.

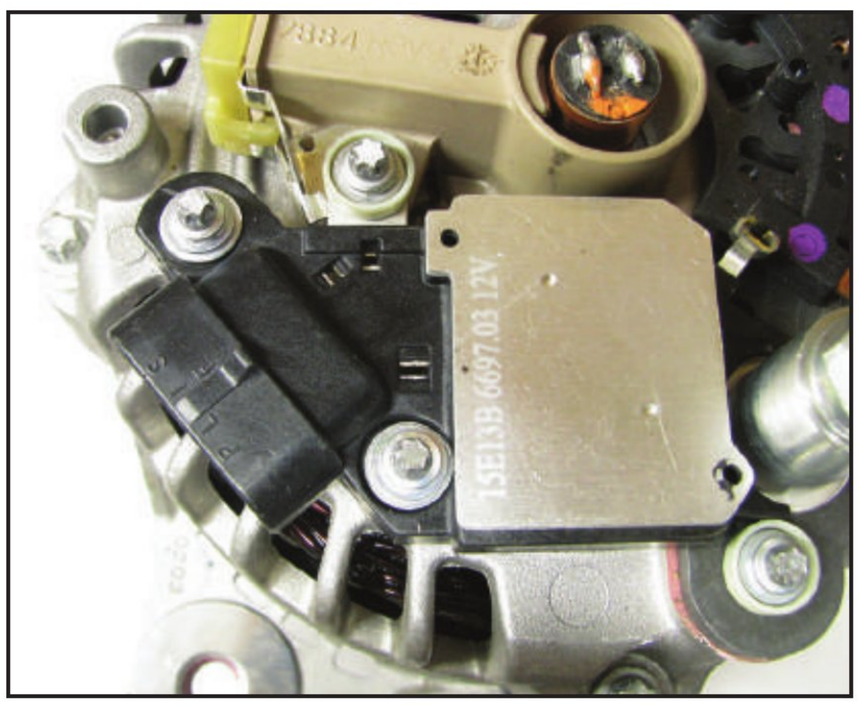

Figure 6 – A different regulator offers remote sense, field monitor, light driver and phase terminals in a 130D plug.

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DELCO 24SI

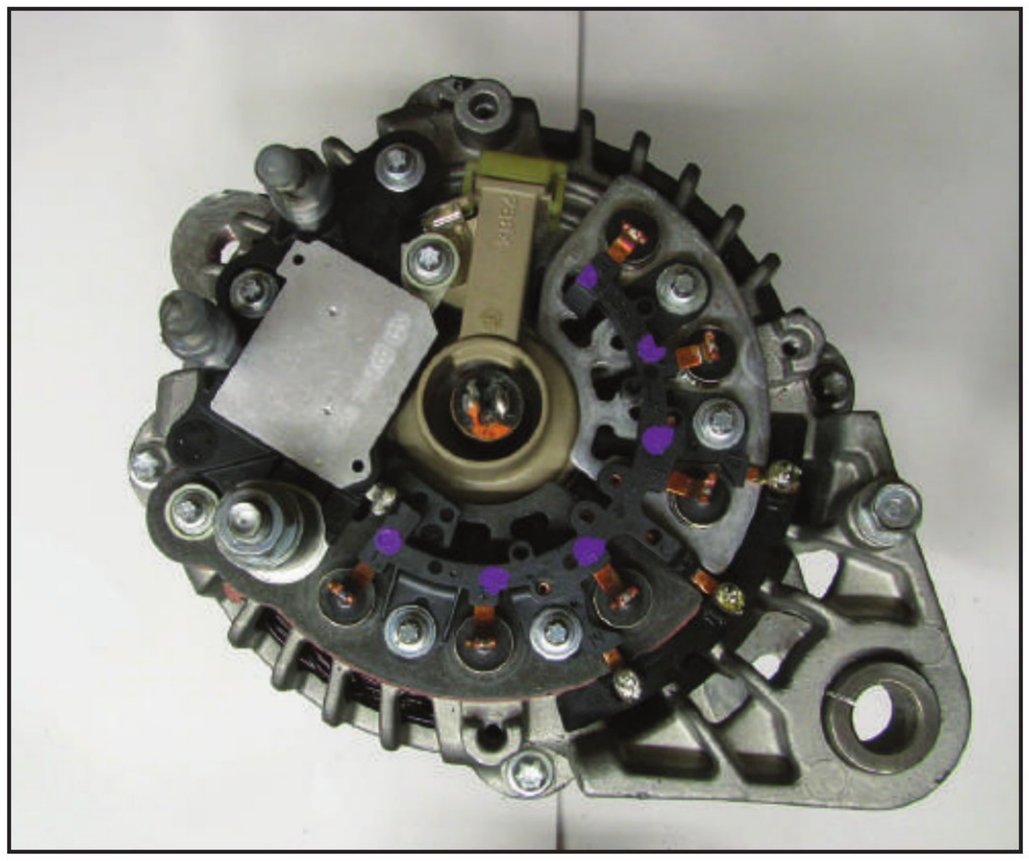

Figure 7 – With the cover removed, all components are accessible for testing.

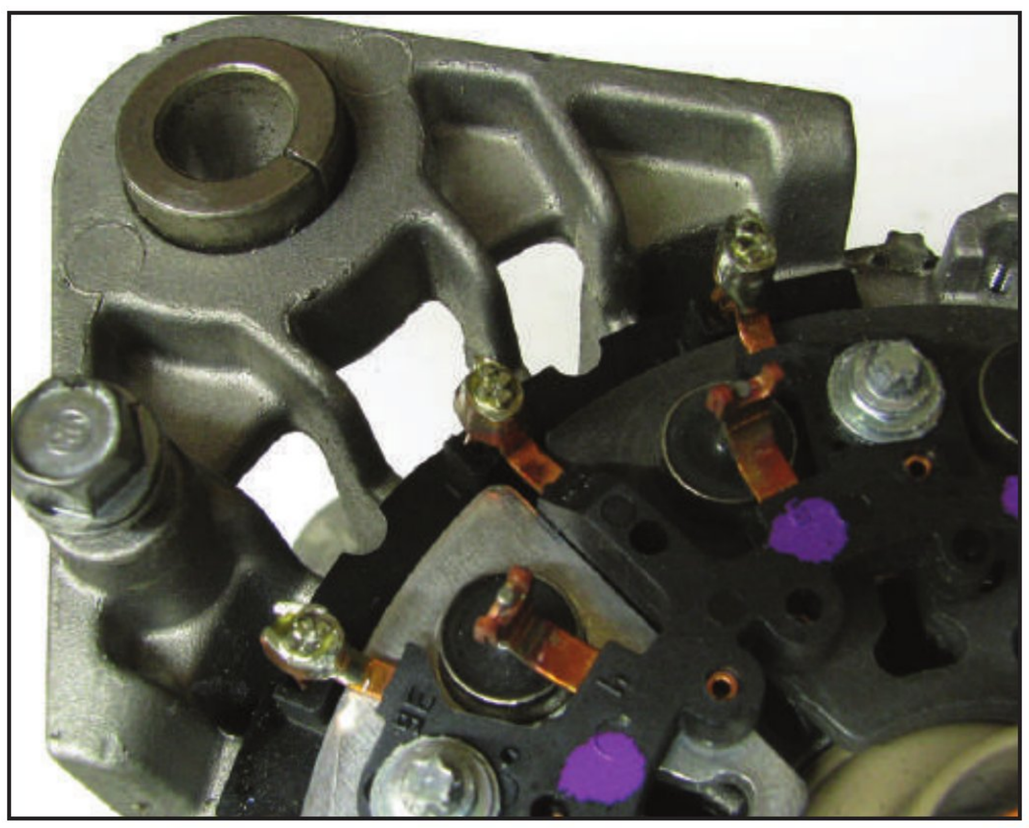

Figure 8 – The rectifier's lead frame stator connections are heavy duty, making them easy to open without breaking.

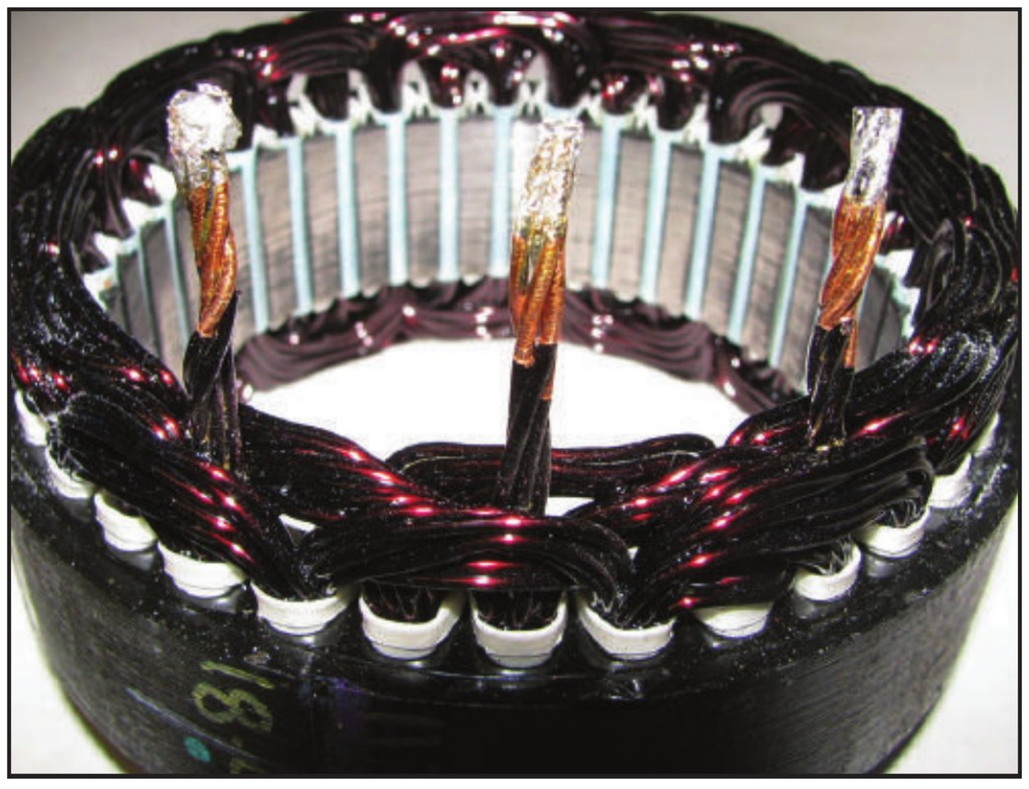

Figure 9 – The 24SI stator features dual parallel coils.

Be careful removing the regulator's mounting screws (*see Figure 10*). As you can see, there is a small aluminum spacer below each one. These spacer bushings are not attached to the regulator and could easily become lost. Both regulators use these spacers.

Once the B+ terminal spacer is removed, you may notice what appears to be a small O ring on the threads (*see Figure 11*). It seems to be there to prevent moisture from getting to the regulator connection at the base of the spacer. During reassembly, a little silicone dielectic paste can be used to better seal the cavity between the spacer and threaded post (*see Figure 12*).

The rectifier and positive heat sink insulator look very similar to those used in AD series alternators (*see Figure 13*). You will note that Delco only applied a small amount of heat transfer compound at the contact points of the negative diode cans (*see Figure 13*). They did this to insure maximum metal to metal contact between the housing and the negative heat sink. The housing is machined smooth where the rectifier mounts (*see Figure 14*) which helps to minimize any air gaps. Do not over-use heat transfer compound in this application.

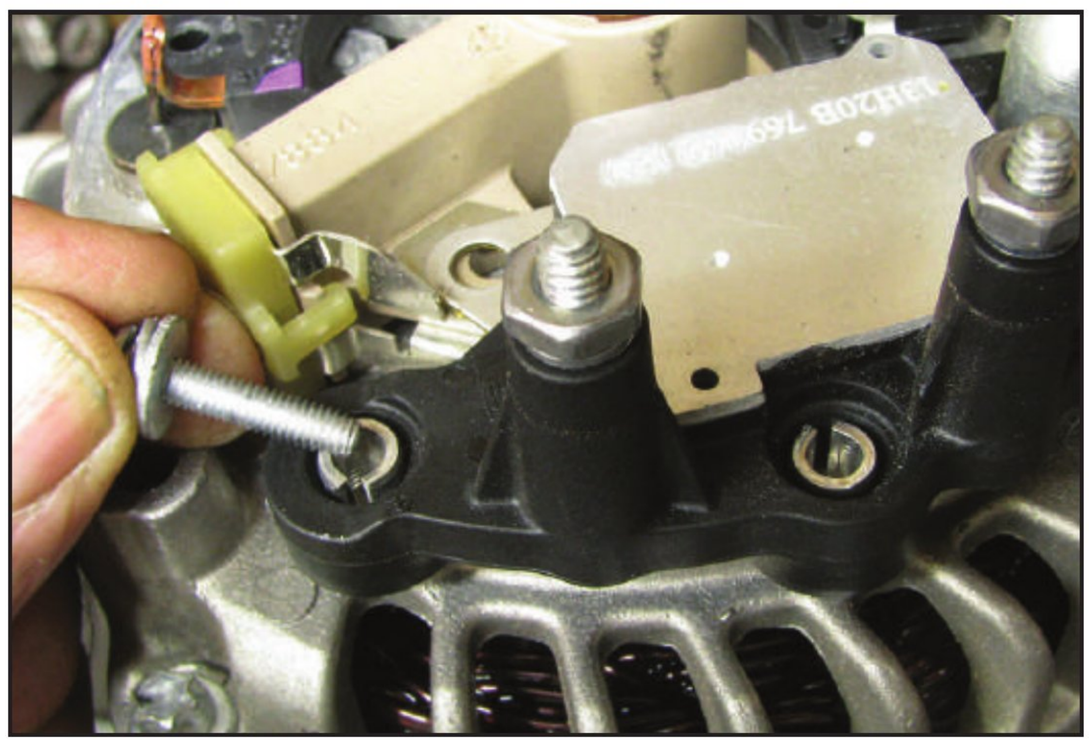

Figure 10 – Beneath the regulator's mounting screws you will find small aluminum spacers are that are not attached to the regulator.

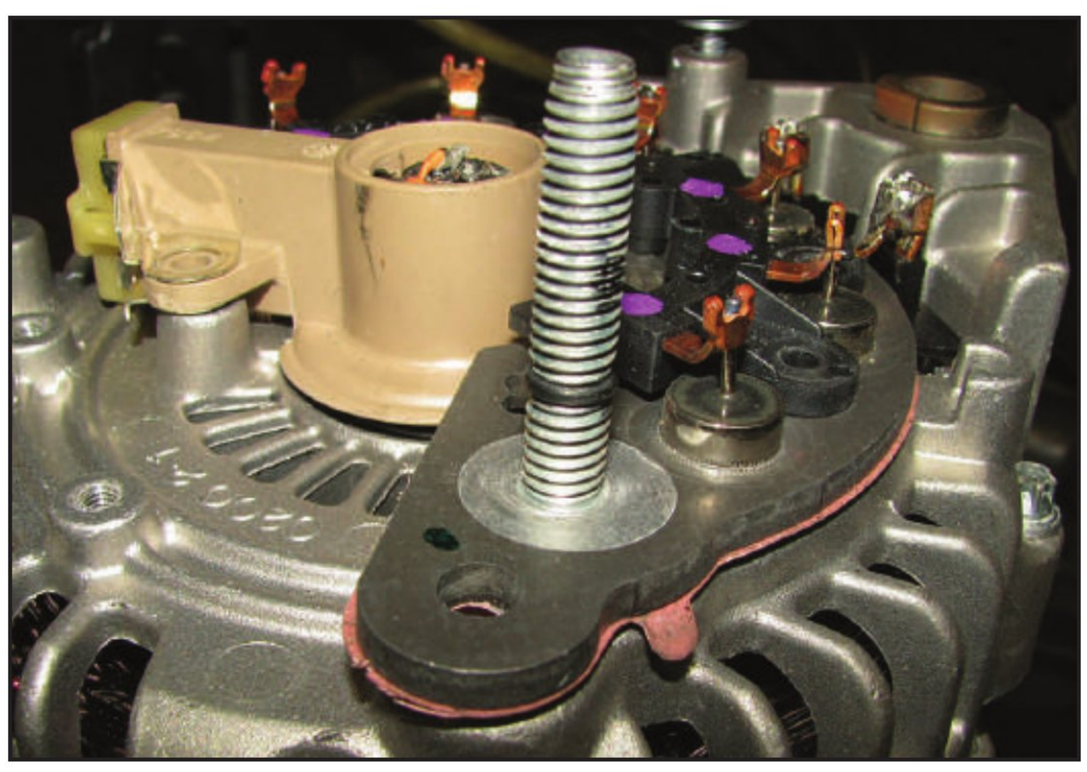

Figure 11 – Note what appears to be an O ring on the threads of the B+ post.

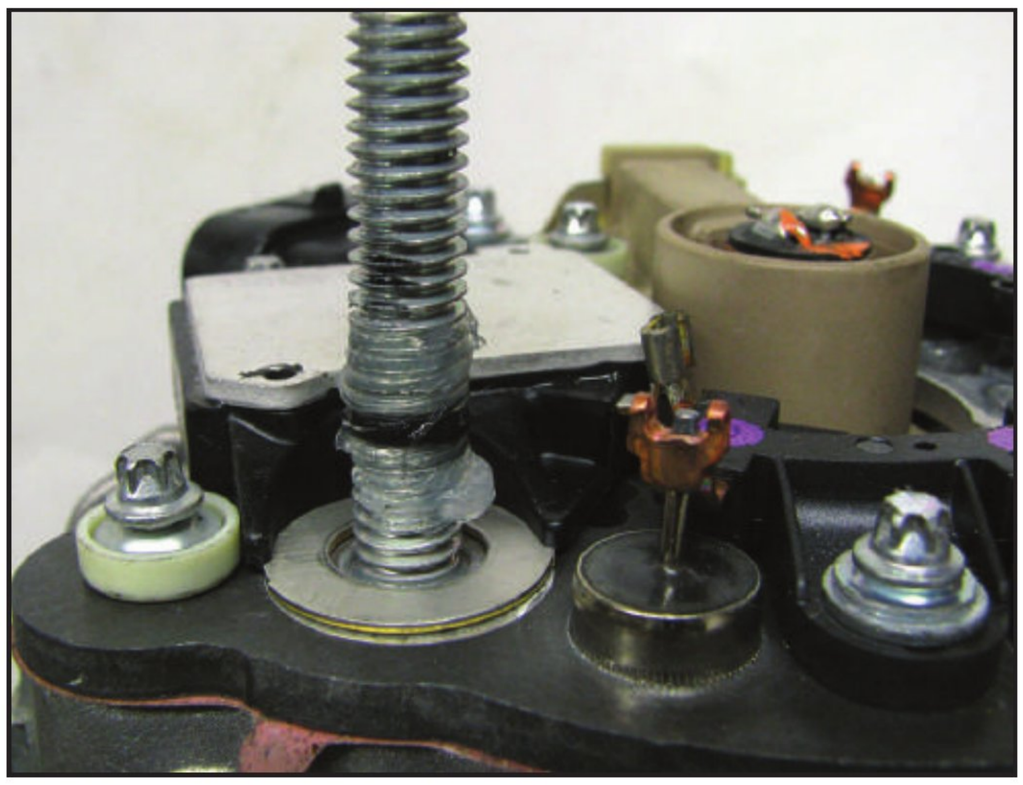

Figure 12 – A bit of silicone paste on the O ring and threads during re-assembly will help to eliminate corrosion.

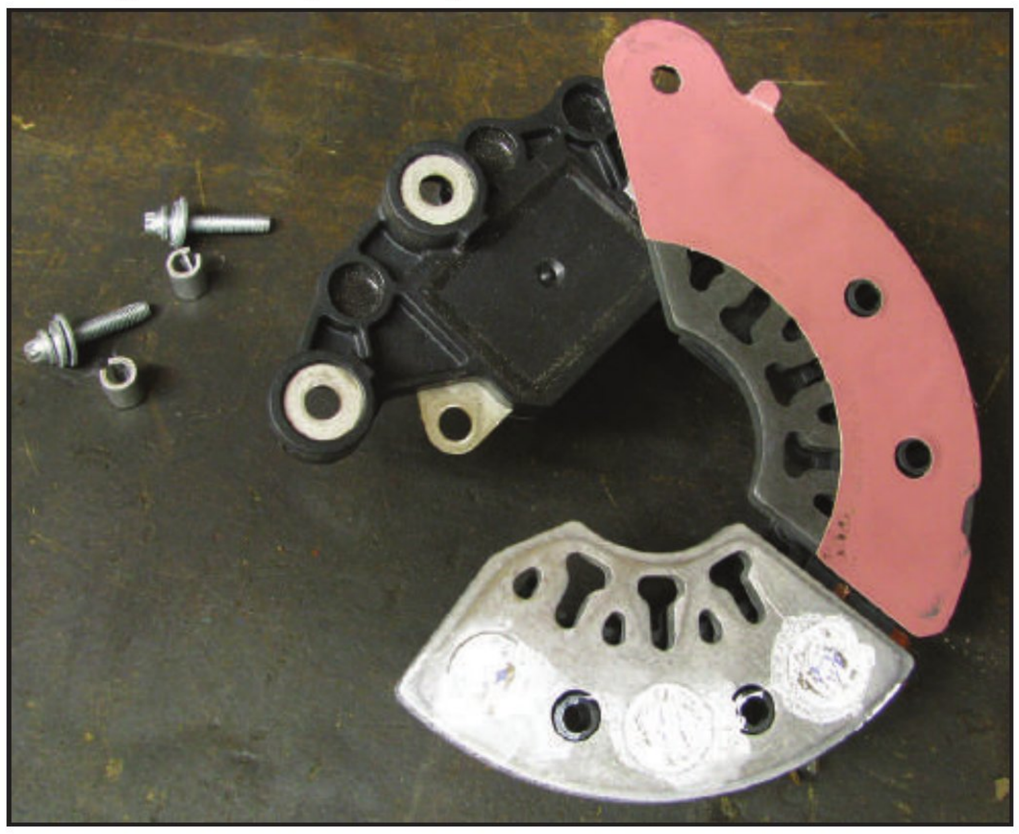

Figure 13 – The rectifier and regulator viewed from the bottom here. Note that Delco only applies heat transfer compound to the negative diode cans.

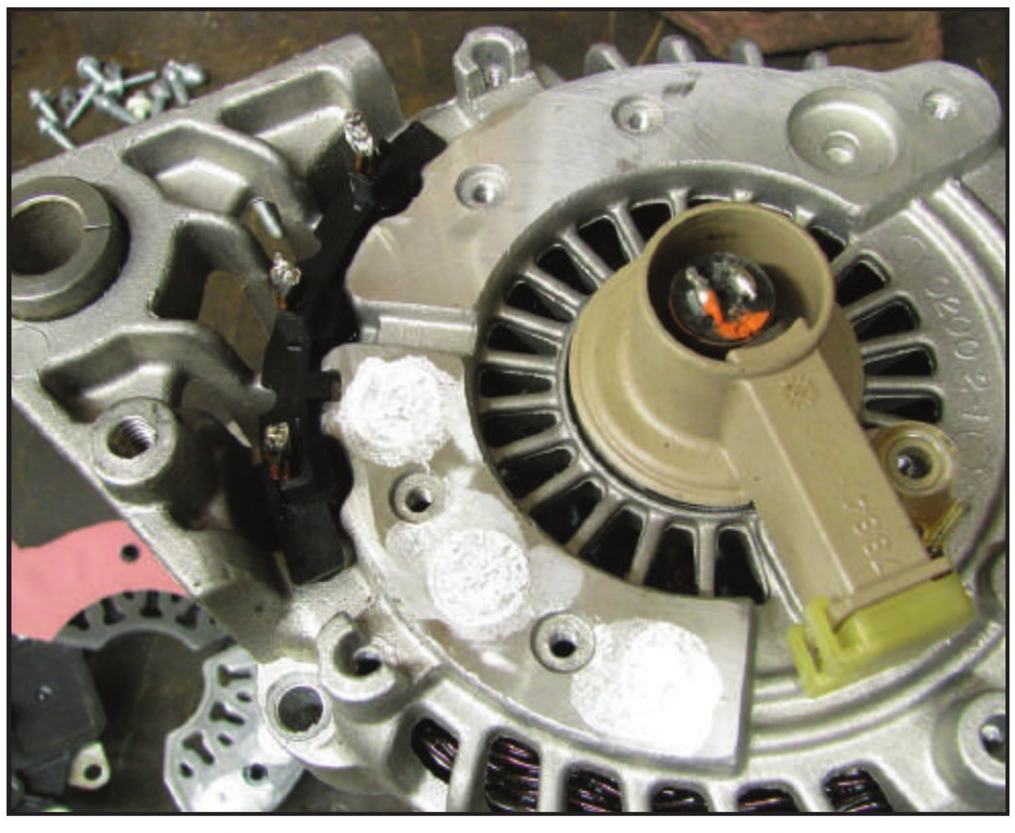

Figure 14 – The SRE housing is machined smooth where the heat sinks mount. A small amount of heat transfer compound can be seen here on the negative side.



DELCO 24SI

The plastic tolerance ring in the SRE frame, similar to the AD series alternators, can be reclaimed if it is not worn (*see Figure 15*). The rotor incorporates a beefy plastic fan on the rear (*see Figure 16*). The SRE bearing is a common 6202 (*see Figure 17*). New slip rings are available and appear to be simple to change. Take notice that there is a metal spacer washer (*see Figure 18*) on the drive end of the rotor's shaft that also serves to protect the 6305 bearing. The field draw of our 12 volt rotor was 8 amps.

One of the key reasons that the 24SI is able to dissipate heat is the size of the air flow openings and the design and size of the cooling fins surrounding them (see Figure 19).

Many aftermarket copies of the 24SI are being offered at amperages as high as 300 amps. While the original 160 amp unit has proven to be reliable, I am not sure that the same air flow and heat sinking can handle 250-300 amps. In addition, the original 24SI will put out over 100 amps at even low engine idle speeds. In today's world, idle output is by far the most important kind. Some upgrades sacrifice idle output to gain amperage at the top end. This is something to keep in mind when a customer asks for more amperage.

Special thanks to Lynn Gross, Churubusco for his help in making this article possible.



Figure 15 – This tolerance ring was in good condition. The ring is available from Delco in a service pack that includes all hardware, plastic parts and insulator.

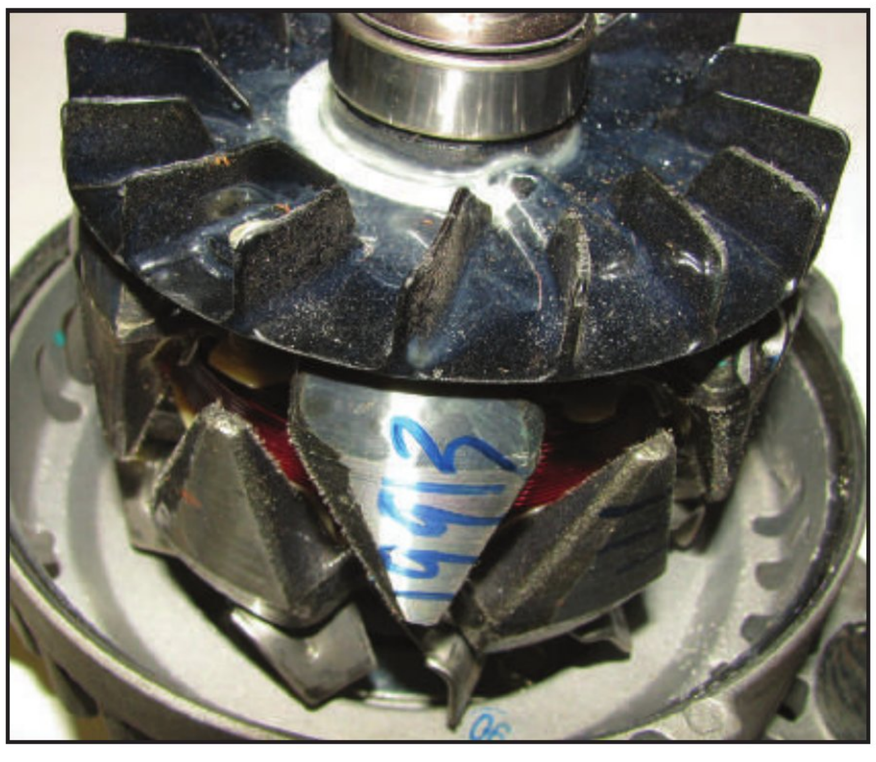

Figure 16 – The SRE fan on the rotor is made of a plastic composite material similar to the 7SI.

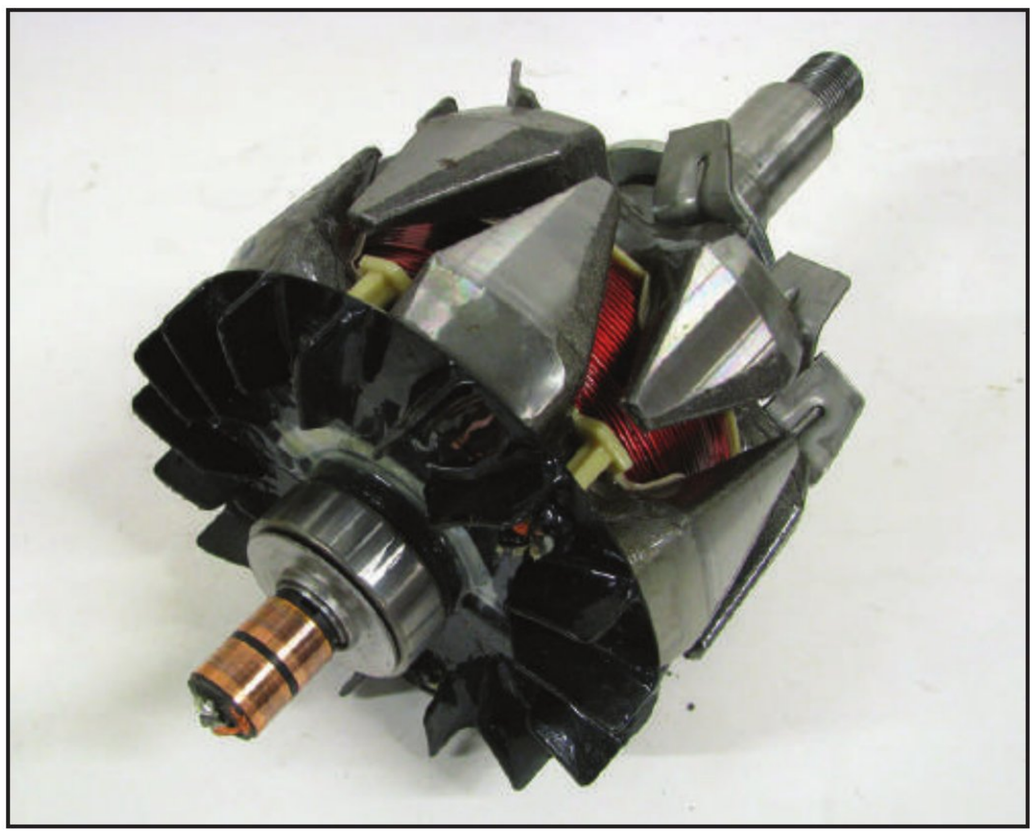

Figure 17 – Note the dust cover protecting the 6202 SRE bearing.



Figure 18 – Note the steel spacer on the DE of the rotor shaft.

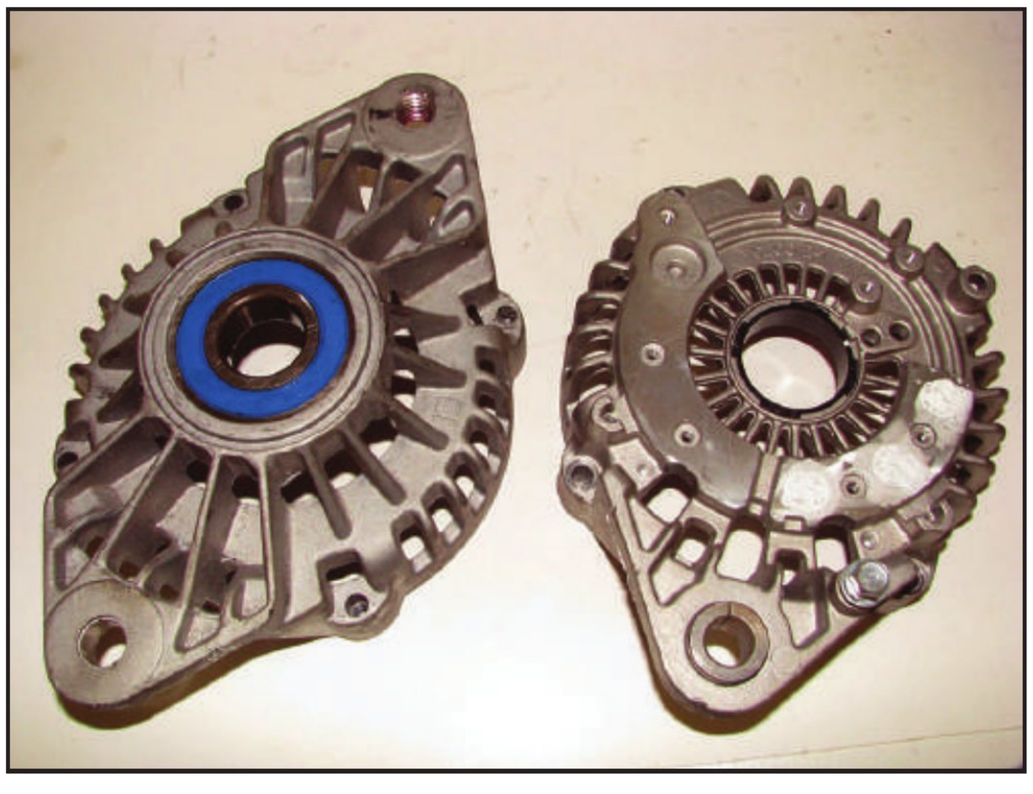

Figure 19 – Here you can see both housings with plenty of open area for airflow and rugged fins to direct air and dissipate heat.

DENSO SC ALTERNATOR — Hairpin By Another Name



BY BOB THOMAS

What our industry has nicknamed the "Denso Hairpin" was introduced in 2000 and first appeared in numbers in 2001 on several Dodge and Chrysler models. Most rebuilders likely first encountered one of these alternators on a Dodge Caravan with a "noisy bearing" complaint. However, the "noise" was usually being caused by a failing decoupler pulley (*see Figure 1*). Most of those alternators easily outlasted their pulleys, incidentally a service item that Chrysler expected to wear out before the alternator.

Denso's proper name for this alternator series is Segment Conductor or SC for short. The conductor in this case refers to the stator wire, which is square, as opposed to the round wire in most stators. The coils of an SC stator are comprised of many individual segments which are inserted into the slots, twisted and then connected in series by welding the segment ends together. They can be easily identified by the epoxy-coated welds on the drive end of the alternator (*see Figure 2 and 3*). The innovation was patented by Denso in 1999 under US patent 6144136.

The square wire and method of assembly provides for an extremely tight fit with very little room for airgap in the lamination's slots. This allows for a much higher density of copper than could ever be possible using round wire (*see Figure 4*) - 70% as opposed to 45% according to Denso. This high slot fill cuts coil resistance in half over a round wire stator. Overall efficiency increases greatly. At the same time it reduces the magnetic pulsation that resonates alternator noise – that high pitched whine that you hear every time that you test an alternator. The SC is noticeably quieter.

All alternators convert some of the engine's mechanical energy into electrical energy. Whenever energy is converted there is always some loss, mostly in the form of heat. Efficiency is the driving force in alternator design today, to reduce fuel consumption. SC alternators operate with greater efficiency than any previous design, providing more electrical power while putting less mechanical load on the engine. While the

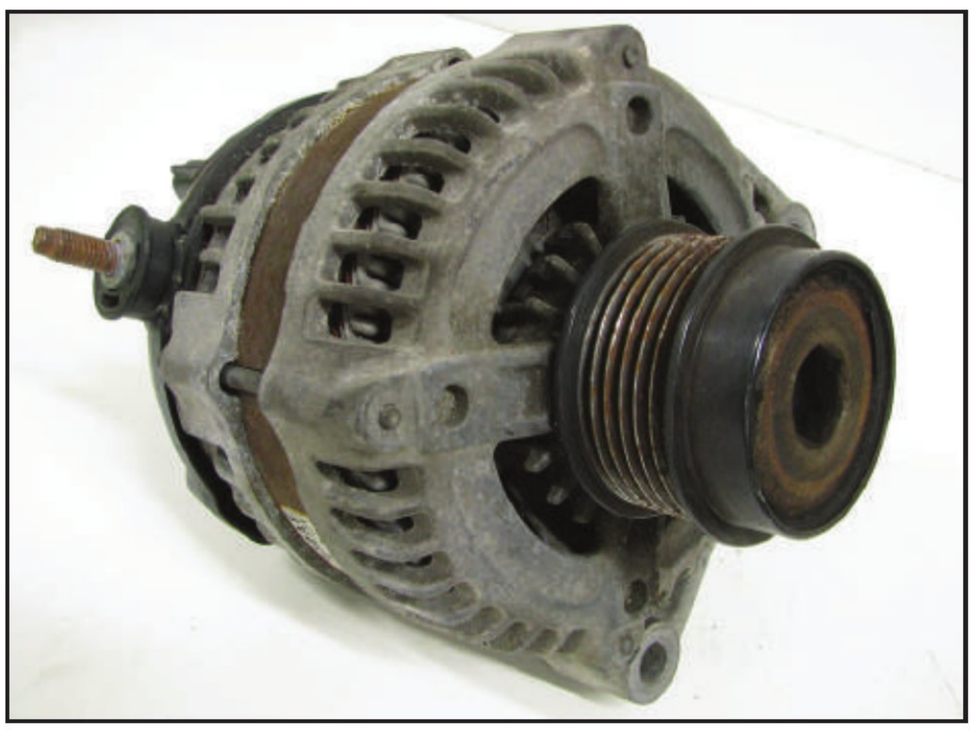

Figure 1 – This is Lester 13870, one of the first Denso SC alternators. It was used on Chrysler mini-vans from 2001 to 2007.



Figure 2 – The SC Series alternator can be easily identified by the gray epoxy coating on the welded drive end side of the stator.



Scott Scharrer
Equipment Manager
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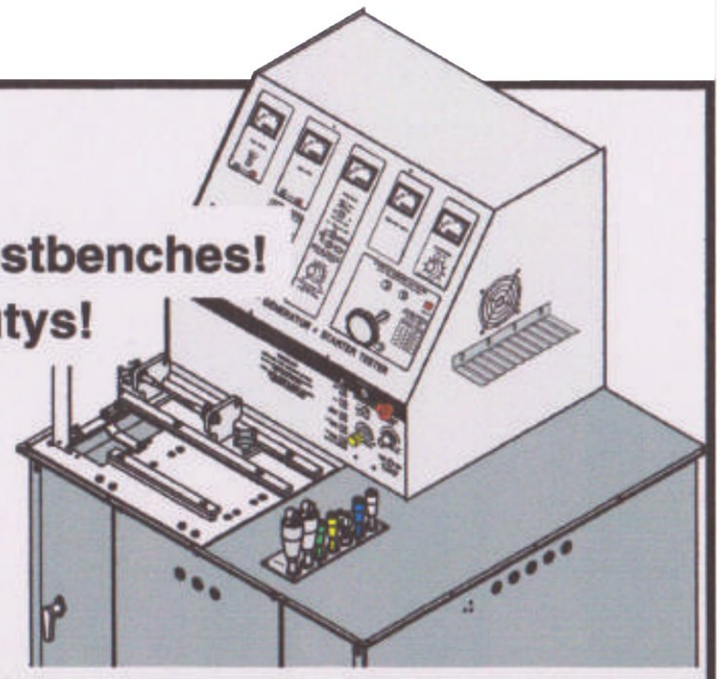

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energy gain is not something that an individual driver will ever notice, it can become quite significant when multiplied by millions of vehicles. Denso claims that the SC is 20% lighter and produces 50% more power than conventional alternators.

That is why SC alternators have been appearing on many vehicles from different manufacturers, including Chrysler, Toyota, Ford, GM and Honda. Some of those were in applications with high electrical demands. Many are now over 10 years old and every rebuilder that I've talked to has encountered them.

In the next issue, we will look into some of their weaknesses and the challenges that they can present when rebuilding them.

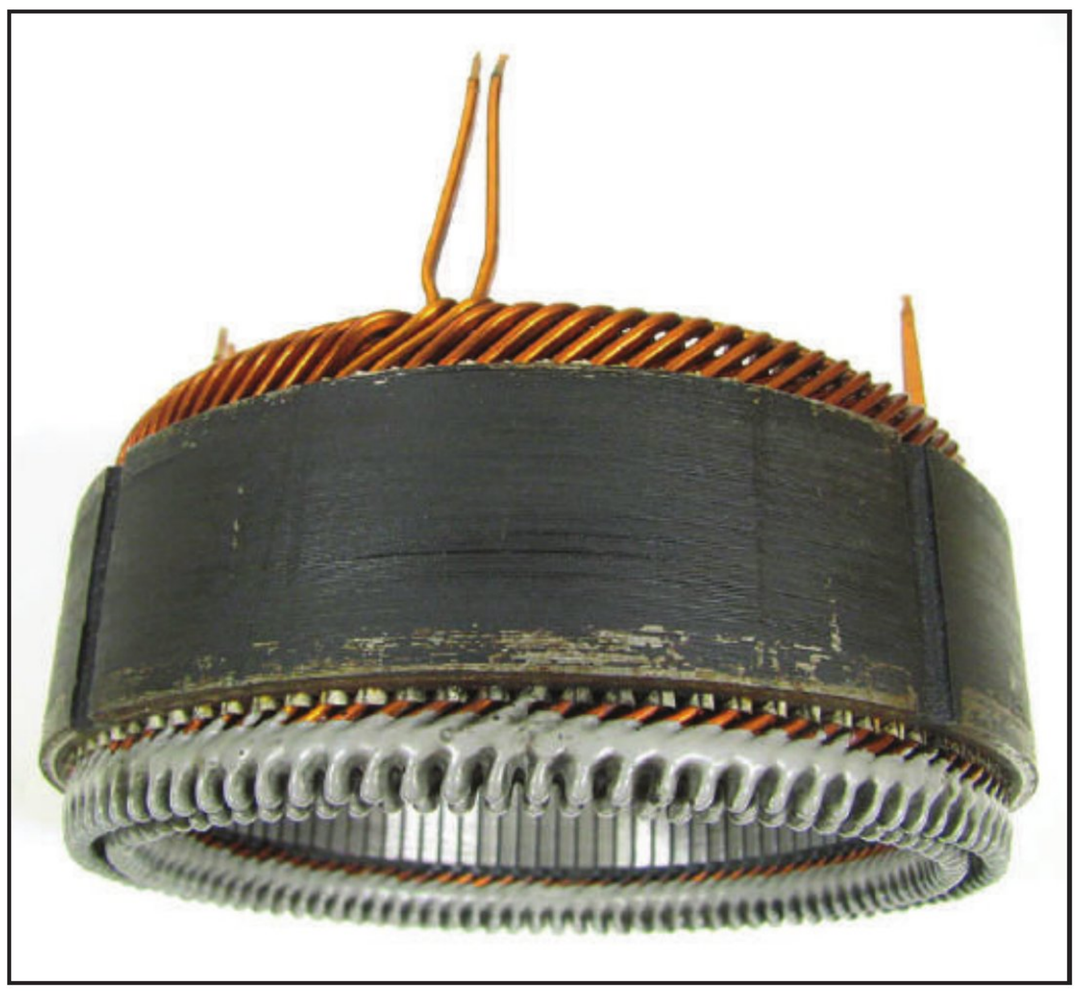

Figure 3 – Here is better view of the stator. The square wire segments are inserted from the top. The segment ends are then twisted and welded into series coils at the bottom.

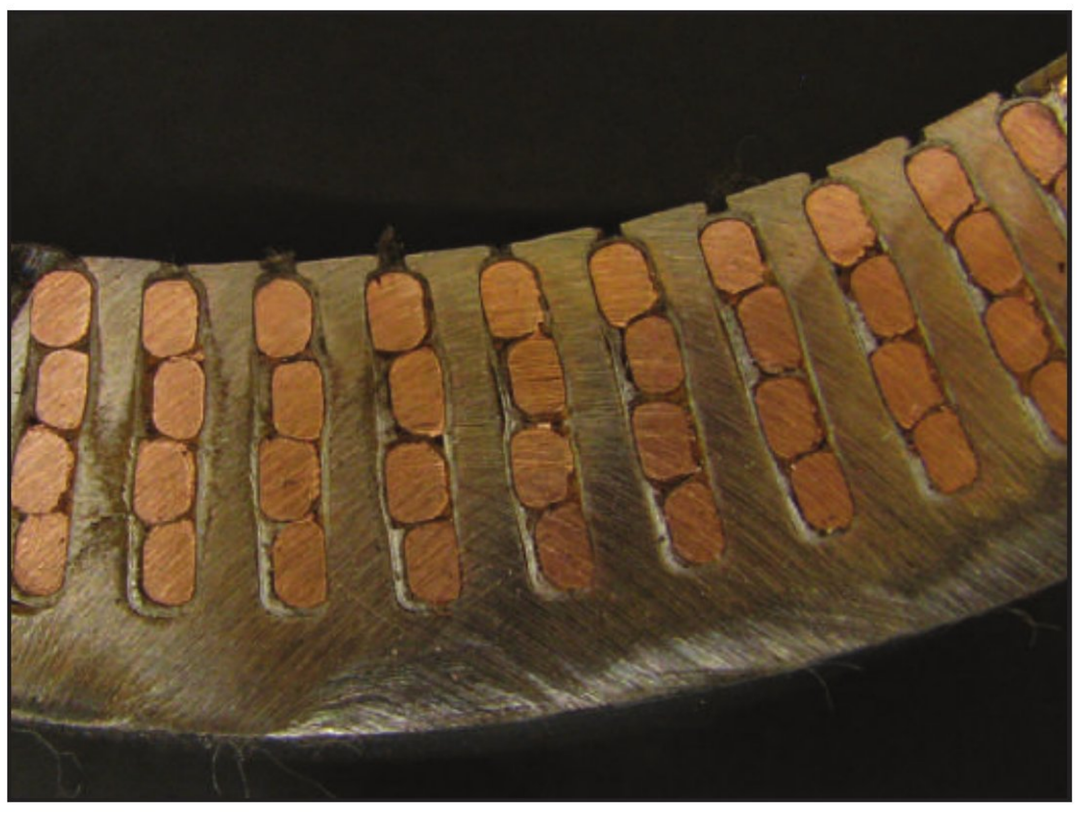

Figure 4 – Here is a cutaway view showing the wire filling the slot.



A CLOSE CALL — Hurricane Matthew



BY BOB THOMAS

The name Matthew will most likely be retired this year by the National Hurricane Center (NHC). Whenever a major hurricane impacts land in the US, retiring the name is standard procedure. While Matthew certainly impacted land in Florida, Georgia, South Carolina and North Carolina, it could have been much worse, especially for Florida's 400-mile long east coast.

This storm at one point intensified from a Category 1 hurricane to Category 5 in just 24 hours. After devastating the western tip of Haiti with 130 mph winds and crossing the eastern tip of Cuba on Tuesday, October 4, it passed through the Bahama Islands taking aim at Florida at an angle that would roughly parallel the coast. As the slow-moving storm wobbled and turned, it became apparent that just a few degrees east or west would make as much difference as its varying and unpredictable strength. With each update, the path projected by the NHC shifted a little to the east or west. On Thursday morning as it approached the state, nobody knew exactly where it would be on Friday morning when it reached Florida.
The best you can do under those circumstances is prepare for the worst and evacuate if advised to do so. We had an offer to shelter out of harms way in Tallahassee with my brother and his wife. My dad called us three times on Thursday urging us to do that. But my wife Sarah and I decided to prepare and stay.

Our home is roughly 20 miles inland, due west of Crescent Beach, which is just south of St. Augustine. We live on the eastern bank of the St Johns River, a mile wide at this point. The river flows north to Jacksonville and then east to the Atlantic. It looked certain the storm would pass to our east, which would give us NNE wind from the CCW rotation. We knew that our most damaging wind would come in from that direction, where it would have over five miles of open river to build waves before reaching our dock. That same wind would also create a storm surge at the mouth of the river. Unfortunately, tides were already running higher than normal because of the bi-annual Spring Tides of October and a strong northeaster fueled by a lingering weak stationary front.

We secured our little sail boat with double lines. Cars were parked clear of trees with full tanks of gas - just in case. All loose objects were put inside or tied down. Then, all you can do is follow the track and wait. Our power went off at 8 am on Friday morning as the center of the storm closed toward the coastline east of Cape Canaveral, 150 miles to our south. We turned on an old transistor radio for location reports, transferred food items we planned to use to an ice chest and I switched our water over to artesian pressure. Knowing the worst was hours away, I took naps to pass the time between location reports.



A CLOSE CALL

We watched the wind and rain increase slowly for hours. Whitecaps topping four and five foot waves came down the river as the water rose. They tested the pilings and lines holding the boats and plowed through the dock's decking. The river breached our bulkhead around 4 pm.

Late in the afternoon as the winds shifted to come from the north, I knew the center was due east of us. What I did not know then was that the it was only about 20 miles offshore but the hurricane had weakened to Cat 1. The wind shift calmed the waves that were pounding the boats and dock, but the river continued to rise, still being pushed by the storm surge at the mouth of the river north of us. That surge, we learned later was over four feet.

As night fell a high tide, the surge and over five inches of rain that had to drain somewhere were combining to swell the river. By Saturday morning the water in the yard was knee-deep in places. Our 70-year old wood frame house was built above grade (off the ground). Water came to within inches of the floor joists, but the house stayed dry inside. Our wind never exceeded 60 mph. Our 28-year-old shingles survived.

By Sunday morning the river was back on its own side of the bulkhead. About 60 feet of dock decking was gone, lifted by the waves. We had a yard full of broken tree branches, Spanish Moss, and debris from the river. But all of that can be corrected.

We were very fortunate. The entire east coast of Florida was very, very fortunate. Due east of us, a weakened Matthew narrowly missed the coast, but still washed away a 1.3 mile section of scenic A1A. It was a close call.





Figure 1 – By 11 am on Friday morning the river was beginning to flow over the bulkhead.



Figure 2 – By 4 pm in the afternoon the yard was flooded and the dock was under water.



Figure 3 – A section of the dock's decking was lifted and washed away.

Mark this date now! April 7-9, 2017

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FRIDAY, APRIL 7

8:30
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for Ford Tour

9:00 – 11:30
Ford Tour

11:30 – 12:00
Return to Hotel

12:00 – 1:00
Hot Lunch Buffet

1:00 – 2:30
Seminar: Tim Weyandt
— with Allegiant Power —
AGM Batteries Explained

2:30 – 4:00
Seminar: Bill Bowman
— retired from Delco Remy —
Alternator Electronics

4:00 – 5:00
Reception with Cash Bar

5:00 – 8:00
Exposition Open

SATURDAY, APRIL 8

8:00 – 10:15
Seminar: Dan Marinucci
— with Communique' —
Vital On-Vehicle Tests That Minimize Starter/Alternator Returns

10:30 - 11:30
Roundtable

11:30 – 1:00
Hot Lunch Buffet

1:00 – 5:00
Exposition Open

SUNDAY, APRIL 9

7:00 – 8:45
ERA Breakfast
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9:00 – 11:30
Seminar: Mohammad Samii
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More details will be announced later. Mark your calendar now.



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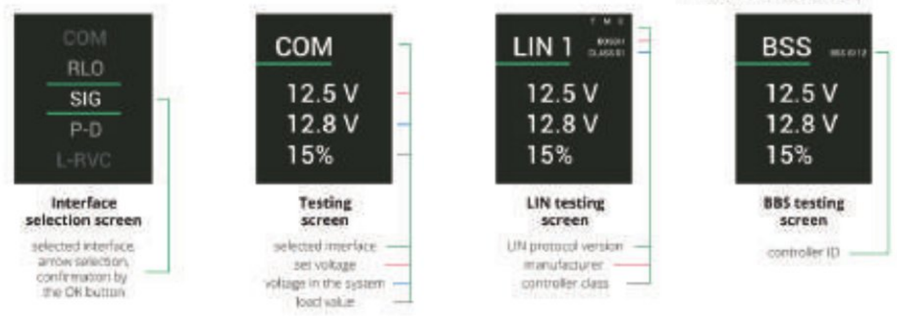

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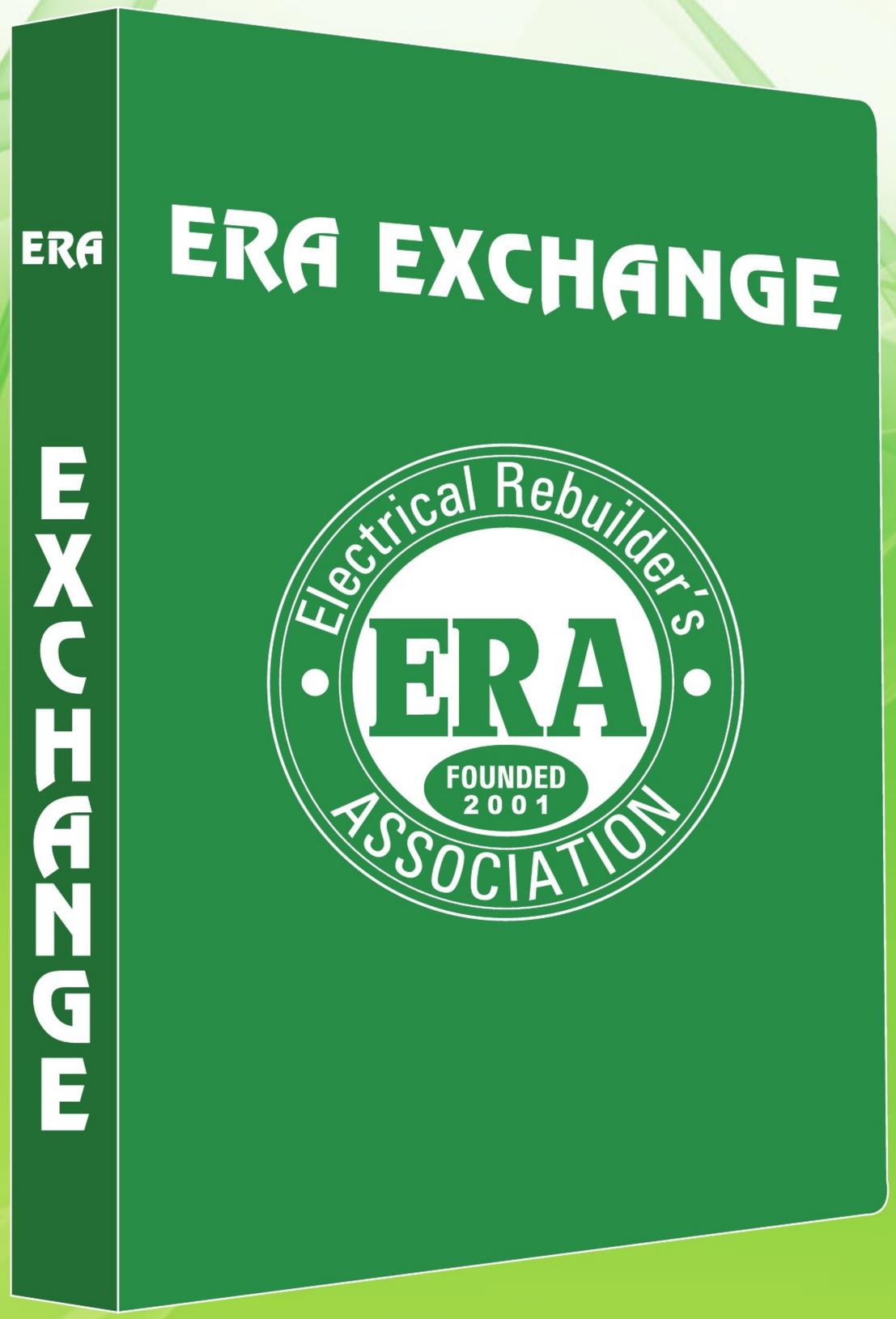

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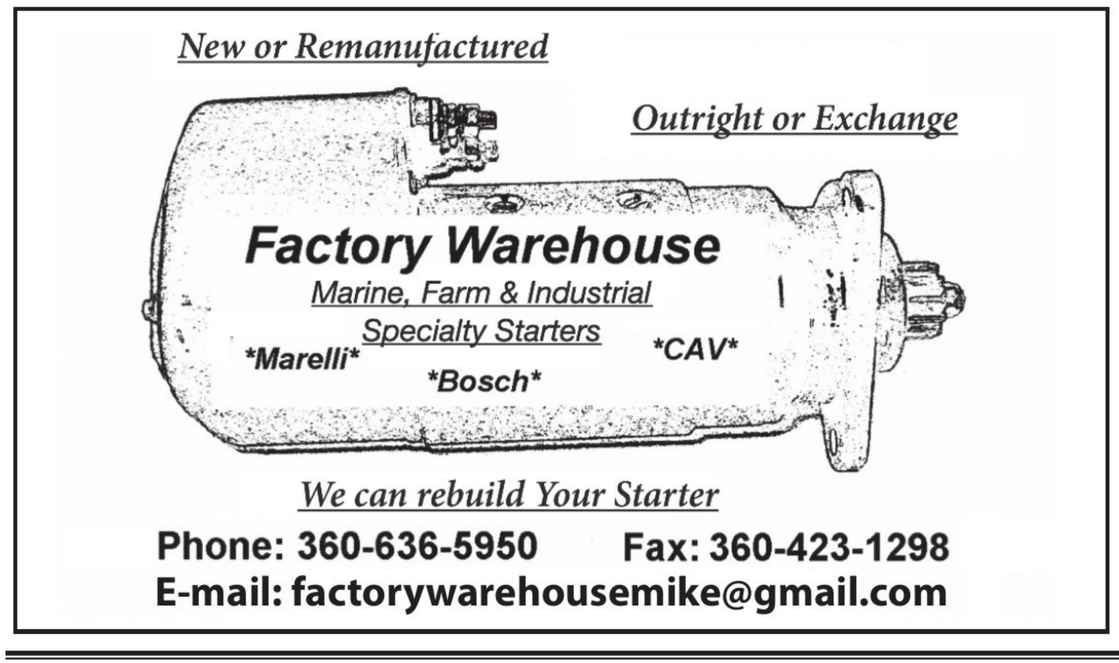



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