# ERA EXCHANGE

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October 2020 $12.95

## AUTO ELECTRIC CORNER
## Battery Powered AC, Relay Recap and Goldwing CS121D

## NEW REVERSING POWER RELAY
## For Permanent Magnet Motors

## COMMON SENSE | Some Good News At Last

Electrical Rebuilder's ERA FOUNDED 2001 ASSOCIATION

# A WORD FROM THE PRESIDENT

## Update Your Forums Control Panel



Last month I explained how you can help with our ongoing project of updating and reviving the ERA website's search feature. A great amount of progress has taken place and the search function is now operating at a limited basis, with new keywords being added to documents that previously had none.

I encourage all of you to try using the search box when looking for information on a specific topic. You will find the search box on the homepage just above the left-side menu. As with all web search tools, key words typed into the search box will aid you in finding the information that you are looking for. I would suggest that you practice using this option by typing in some common key words such as 6G, 41MT, 22SI, or 39MT.. Then see what the search brings you to. The more that you practice using this feature, the more you will think of using key words to find what you are looking for. It is a lot quicker than trying to manually search by scrolling through the 300+ documents in our Tech Library or the 240 back issues of the *ERA Exchange* magazine and *Electrical Rebuilders Exchange* newspaper archive.

As I mentioned last month, all members will have another homework assignment for October to help the Board Of Directors goal of updating all membership information on the Forums. Since the Forums has its own database, apart of the main website, your own contact information there may need to be updated too.

Please log into the ERA Forums. Once there, the first item on the green tool bar across the top of the page (below the banner ad) is User CP. If you left click on it, it will open your Control Panel Page with an expanded menu down the left side. Click on the first item ,Your Profile. This will show you the contact information that the Forums currently has for you. Please check it over carefully and correct any errors that you may find by selecting Edit Your Details on the same menu. Don't forget to save your changes!

I encourage all of you to visit your User CP and review all 22 of the listed drop down boxes. Using those, you may customize your Forums User Profile to best fit your needs. Your help in completing this homework assignment will greatly help the ERA Board of Directors to complete our ongoing project of updating and upgrading the ERA Website. I will again send out a email reminder to complete this month's homework assignment. Thank you for your help.

*Ken Plourde*

## NEW ERA MEMBERS

Troyers Welding
Millersburg, Ohio

Stewart Auto Electrical
North Coburg, Victoria, Australia

### ABOUT THE COVER

Solenoid inside of a newer style power relay.




# ERA EXCHANGE

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CONTENTS


2 A WORD FROM THE PRESIDENT
2 NEW ERA MEMBERS
3 INDUSTRY NEWS
4 AUTO ELECTRIC CORNER — Battery Powered AC, Relay Recap and Goldwing CS121D
10 COMMON SENSE — Some Good News At Last
11 NEW REVERSING POWER RELAY For Permanent Magnet Motors
15 CLASSIFIED ADS



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# INDUSTRY NEWS
## & ANNOUNCEMENTS

## Regitar's COM02 Named Motor Magazine Top Tool

Motor Magazine has chosen Regitar USA's COM02 regulator tester as one of the top diagnostic tools for 2020. Their 20 top tool winners were announced in the magazine's September issue. The VR-COM02 Voltage Regulator Tester is not new to our industry, but it is new to professional installers who can use it to test any digital communication signal (BSS or LIN) between a PCM or ECM and the alternator's voltage regulator, without removing the alternator from the vehicle. The COM02 can also be used to test regulators as a separate component part in conjunction with a standard type regulator tester or as a complete alternator using any alternator test bench.

The COM02's LED screen displays which system is in use (LIN or BSS), plus the baud rate, bytes, supplier code and duty cycle. All of this is done automatically. It also checks five different voltage settings for digital communication as well as General Motors RVC alternators and voltage regulators. Users can also select from a range of voltage settings manually.

A USB port allows for easy updating when a vehicle manufacturer changes parameters or switches to a new communication standard. Updates can be downloaded from Regitar's website any time of day, any day of the week. This insures that users will never be caught off guard by encountering a new standard for the first time.







## One More Time

In last month's issue, we corrected a number of problems with an article comparing two armatures that were used in 20, 22, 25 and 27MT starters. Everything in the text of that correction was accurate, but the wrong test chart for Figure 3 was used in error again. To set the record straight and satisfy those who would like to see the real charts for comparison, they are printed here (*see Figures 3 and 4*).

| Test **1898** | Speed [RPM] | Current [Amps] | | Voltage [Volts] | Torque [Nm] | Power [Watts] | Efficiency [%] | Trq. Const. [Nm/A] | Voltage Drop [Volts] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2498 | 248 | **3804** | 10.01 | 4.84 | 1265 | 50.9 | 0.0194 | 0.03 |
| 2 | 2000 | 299 | **4084** | 9.60 | 7.26 | 1520 | 53.0 | 0.0242 | 0.03 |
| 3 | 1499 | 373 | **4344** | 9.01 | 11.09 | 1740 | 51.7 | 0.0297 | 0.04 |
| 4 | 999 | 481 | **4445** | 8.17 | 16.91 | 1768 | 45.0 | 0.0351 | 0.05 |
| 5 | 749 | 544 | **4508** | 7.65 | 20.74 | 1627 | 39.0 | 0.0381 | 0.05 |
| 6 | 599 | 584 | **4292** | 7.35 | 23.04 | 1445 | 33.6 | 0.0394 | 0.05 |

*Figure 3 – D&V test results using the 1898 armature.*

| Test **2204** | Speed [RPM] | Current [Amps] | | Voltage [Volts] | Torque [Nm] | Power [Watts] | Efficiency [%] | Trq. Const. [Nm/A] | Voltage Drop [Volts] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2501 | 454 | **3804** | 8.38 | 7.62 | 1994 | 52.3 | 0.0167 | 0.01 |
| 2 | 2001 | 523 | **4084** | 7.81 | 9.83 | 2058 | 50.3 | 0.0187 | 0.01 |
| 3 | 1499 | 611 | **4344** | 7.11 | 12.68 | 1990 | 45.7 | 0.0207 | 0.02 |
| 4 | 999 | 707 | **4445** | 6.35 | 15.83 | 1655 | 36.8 | 0.0223 | 0.02 |
| 5 | 749 | 759 | **4508** | 5.94 | 17.70 | 1387 | 30.7 | 0.0233 | 0.02 |
| 6 | 599 | 787 | **4485** | 5.70 | 18.65 | 1169 | 26.0 | 0.0236 | 0.02 |

*Figure 4 – D&V test results using the 2204 armature.*

# AUTO ELECTRIC CORNER —
## Battery Powered AC, Relay Recap and Goldwing CS121D



BY MOHAMMAD SAMII

### Navistar No-Idle AC Unit

ASE offers free webinars on most Friday afternoons covering a variety of subjects, and some of them are interesting to me. These sessions that usually take an hour (3 PM CDT) cover a variety of automotive and HD applications. The last one that I attended indirectly relates to electrical rebuilding and alternator business.

The subject was Navistar's MaxxPower No-Idle Battery Powered AC unit. This compact self-contained device is designed to cool the sleeping compartment of a truck by providing air-conditioning comfort for the driver without running the truck's engine. Tightening of emission regulations for truck operations as well as many large carriers' decision for economy, limits the use of extended idling. This device provides the necessary cooling (or heating) for the sleeping quarter independent from truck's engine (*see Figure 1*).

The source of power for this device is a bank of specially-made Exide AGM valve regulated lead-acid (VRLA) batteries. The manufacturer claims that they have twice the cycling ability and 40% greater charge acceptance than a normal lead-acid battery, meaning that they have better deep-cycle ability and can be recharged quicker. They are not a part of truck's power supply of starting batteries. The AC unit is a completely independent unit and does not have any connection with the truck's primary air-conditioning system.

The two main operating conditions are that the truck's engine MUST be shut off and the parking brake MUST be applied, otherwise the rather sophisticated electronics of the unit and its control power module will not allow it to run. The company claims that with fully charged batteries it can run 8 to 12 hours, but that is highly dependent on the outside and selected air temperatures, as well as the selected fan speed. The batteries are charged via the truck's main charging system (the alternator) but the regulation of the charge rate is controlled via its own electronics and not the truck's voltage regulator setting.

The unit is built by Bergstrom, now an international company that is a leading manufacturer of mobile and bus/truck air-conditioning systems world-wide with over 70 years of experience and headquartered in Rockford, Illinois. The bottom-line is larger and more powerful alternators will be needed to handle the extra load that this unit will no doubt put on the truck's main electrical system. Something to look for, plan for, and to be aware of in the near future.

### More about the Relays…!

In the April issue of the Exchange I wrote about the quality of some can-type starter power relays that are commonly called solenoids. I showed an example of a cheaper one that had failed prematurely. The relay's coil wires simply twisted around the "S" post at one end, while the other end was just lying in the bottom of the can to make a ground. By pressing the coil in the can, the manufacturer hoped it will make a solid contact for the life of the relay, but it did not. It might have seemed practical in theory but in reality it does not work that way. The bottom of the can may in certain applications look as shown in the photo (*see Figure 2*), certainly not a place to make a reliable solid ground connection. Vibration and a heavy build-up of corrosion made this solenoid useless within a short time.

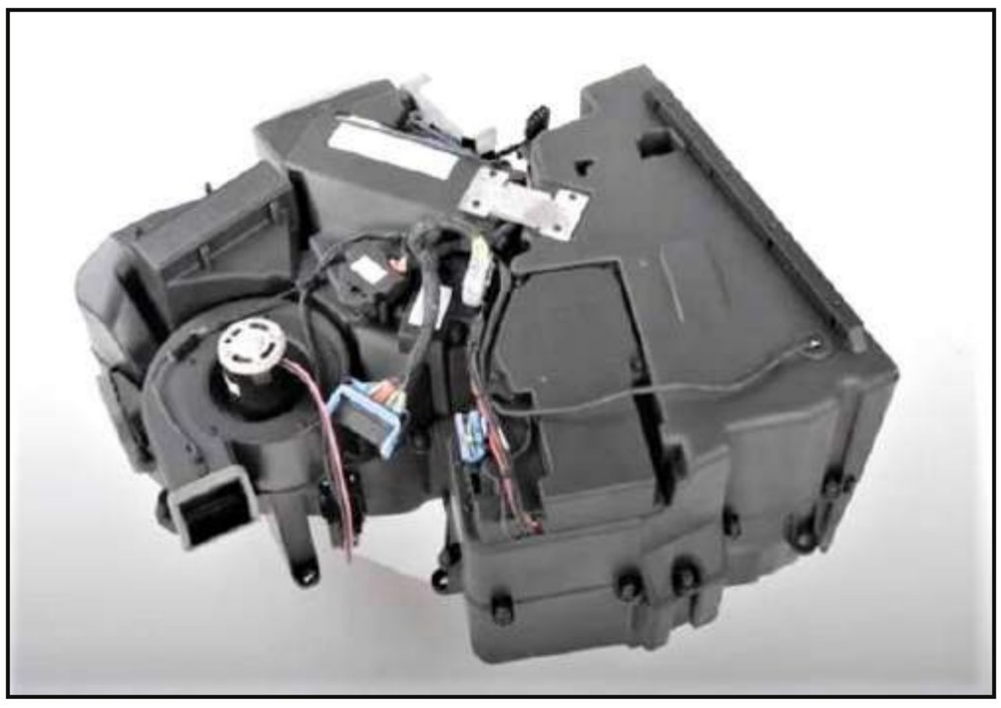


*Figure 1 – Navistar's No-Idle Battery-Powered AC Unit*

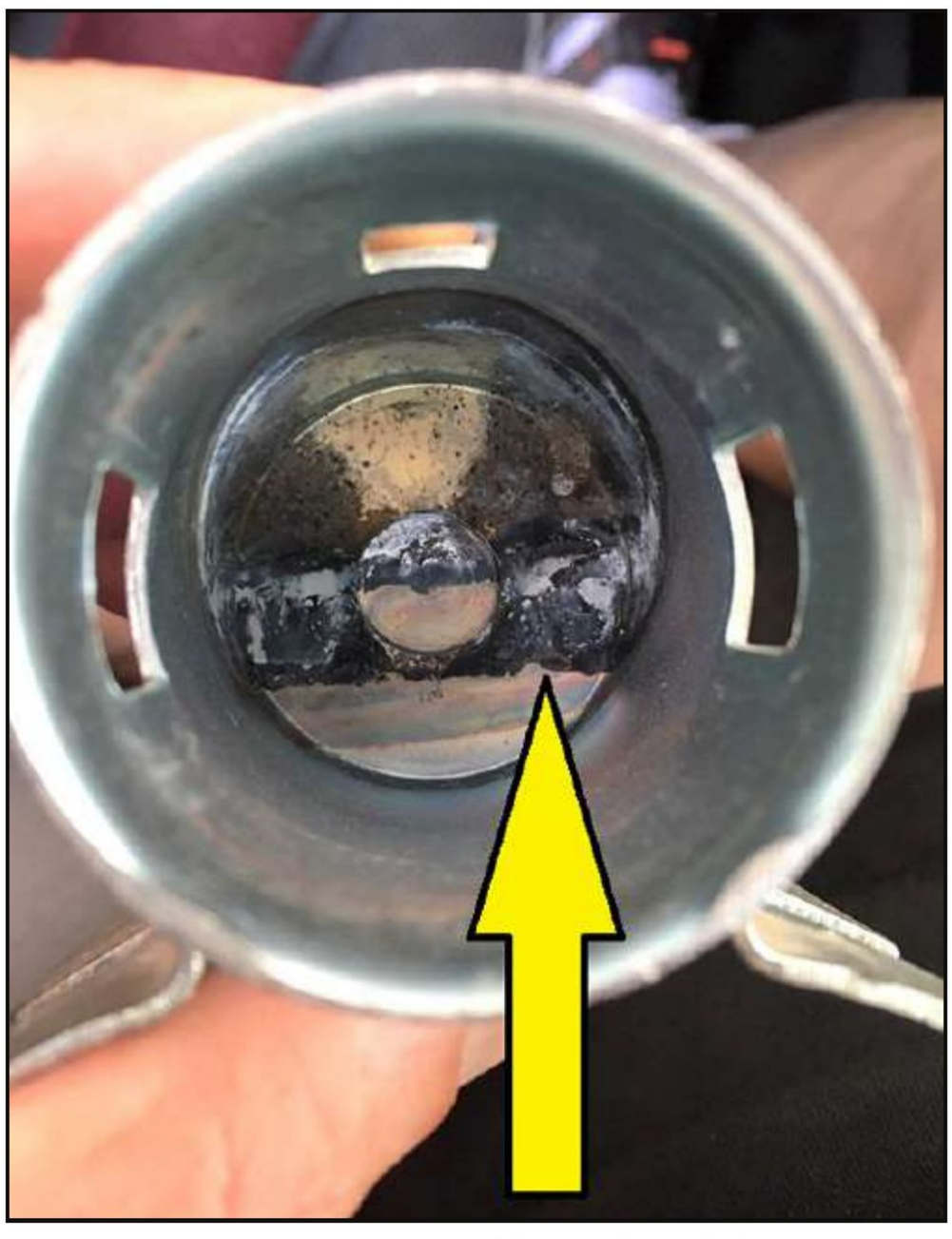


*Figure 2 – Corrosion Buildup in the Relay's Can*

Since it seems that the quality of these solenoids (relays) have become an obsession with me, I curiously opened up an older (and perhaps OE) version of this relay that came in on an old IH starter for comparison. The differences were quite significant.

The coil wire was welded to the "S" post. The other end of the coil wire was scraped clean from varnish and sandwiched between two discs (*see Figure 3*). The discs were then solidly riveted with a strong steel rivet to the bottom of the can, making for a very solid connection, immune to any corrosion or vibration (*see Figure 4*).

This was of course a much older relay. I am not sure how the new brand-name relays are constructed these days and will continue my search to find out. But from what I have seen so far, I am convinced to spend a few more dollars, to buy known brand names, and stay away from the unreliable cheaper relays to perhaps send out a better unit. Spending a few dollars more for reliability is certainly worth the time and trouble associated with a warranty of a starter or a hydraulic power unit.

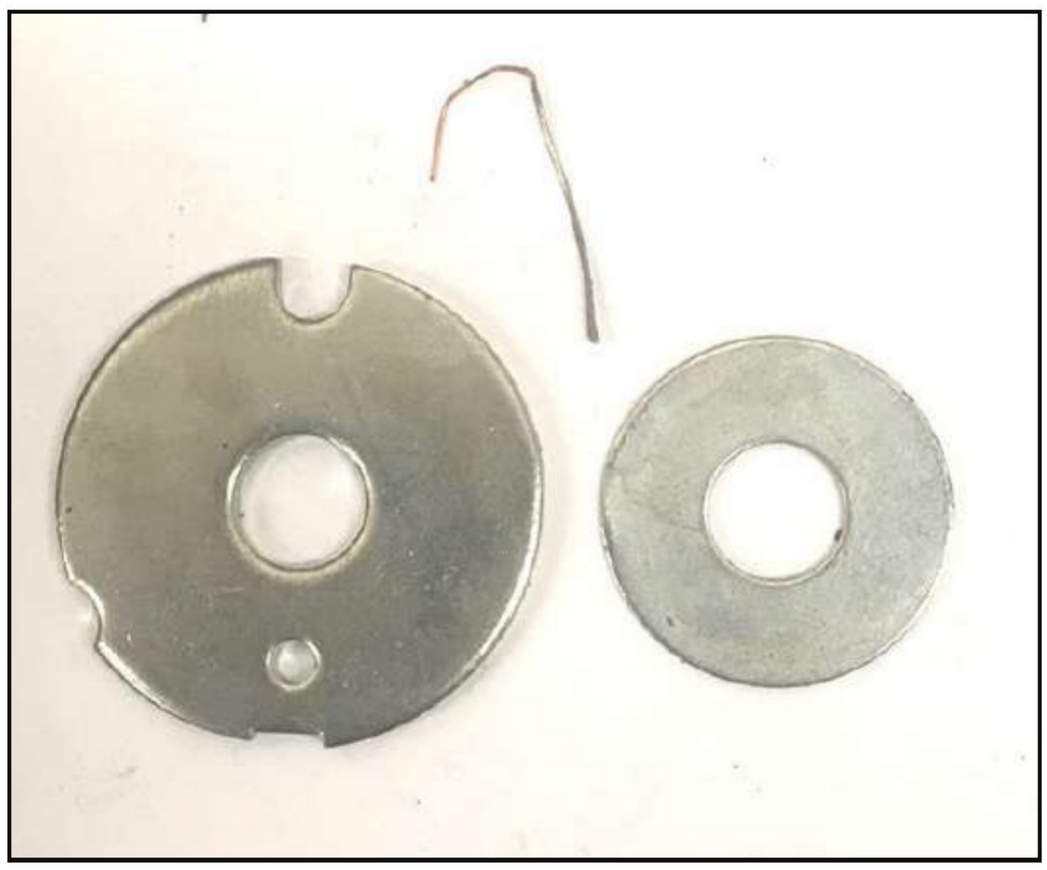


*Figure 3 – End of Coil Wire Sandwiched Between Two Discs*

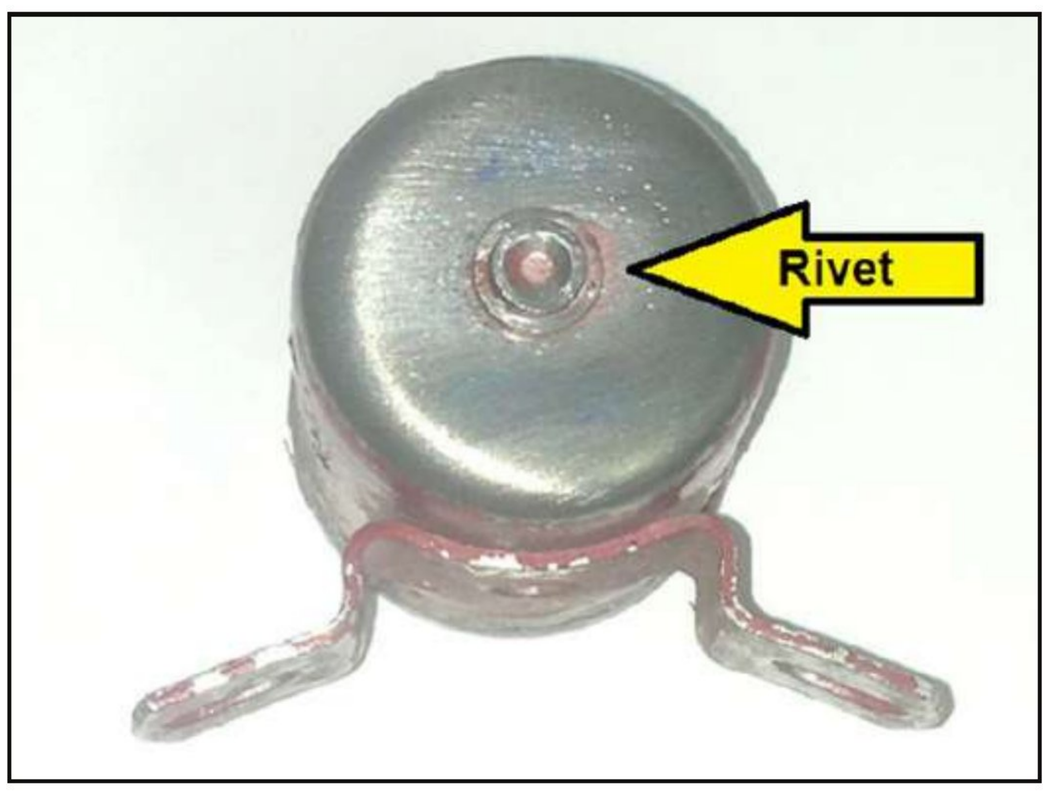


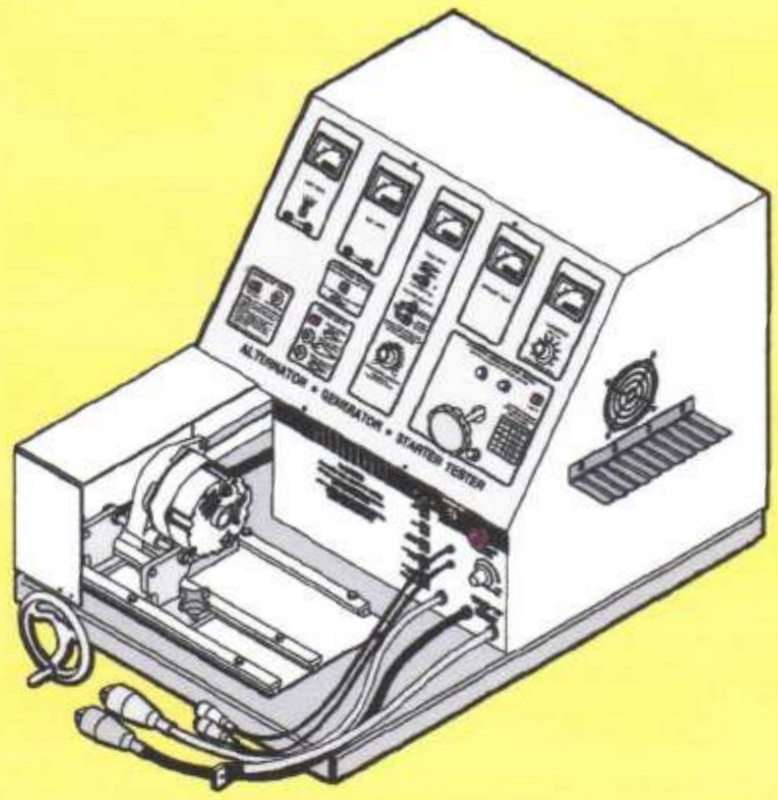

*Figure 4 – Discs Riveted to the Bottom of the Can*

JIMCO

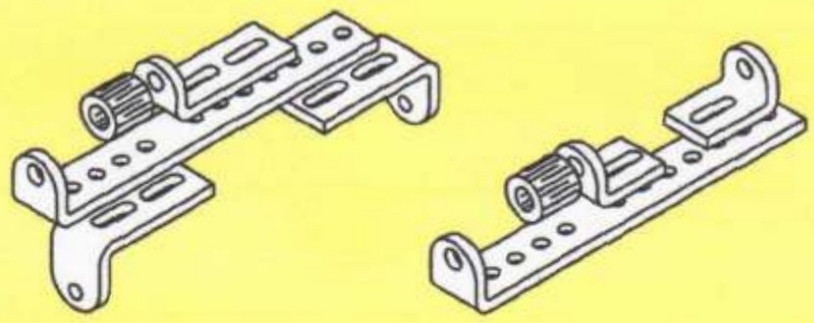
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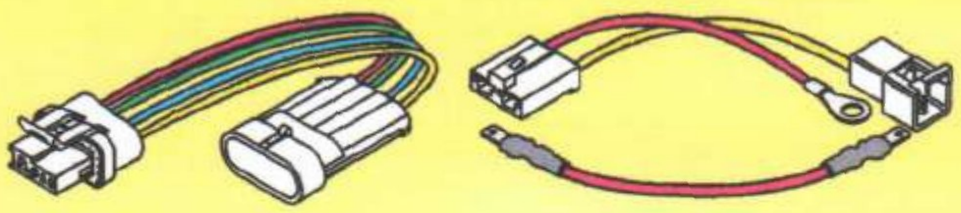
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**Honda Goldwing CS-121D alternator…!**

Of the uncommon units that we occasionally run into was a modified alternator for a Honda Goldwing motorcycle (*see Figure 5*). This unit was basically a CS-121D alternator such as the 8232 used on some Saturn cars. Its 90-amp rated output was twice that of the original Hitachi 12485 alternator that were known for rotor problems. The main and most significant difference from an 8232 was its DE housing that was designed to adapt this alternator to fit the Goldwing application. It incorporated an internal seal to protect the DE bearing from oil intrusion and an O-ring typical to the design of this alternator that prevents oil from leaking out of the crankcase at the alternator mount (*see Figure 6*).

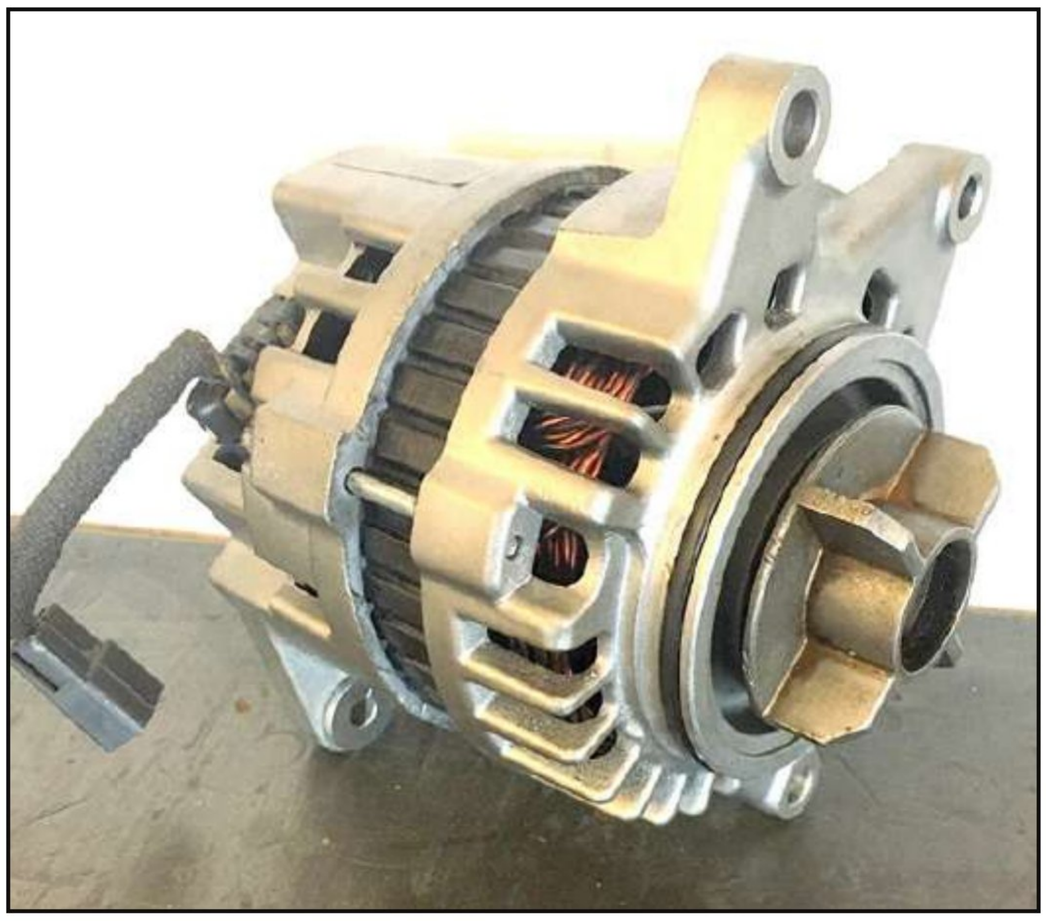


*Figure 5 – Honda Goldwing MOD Alternator*

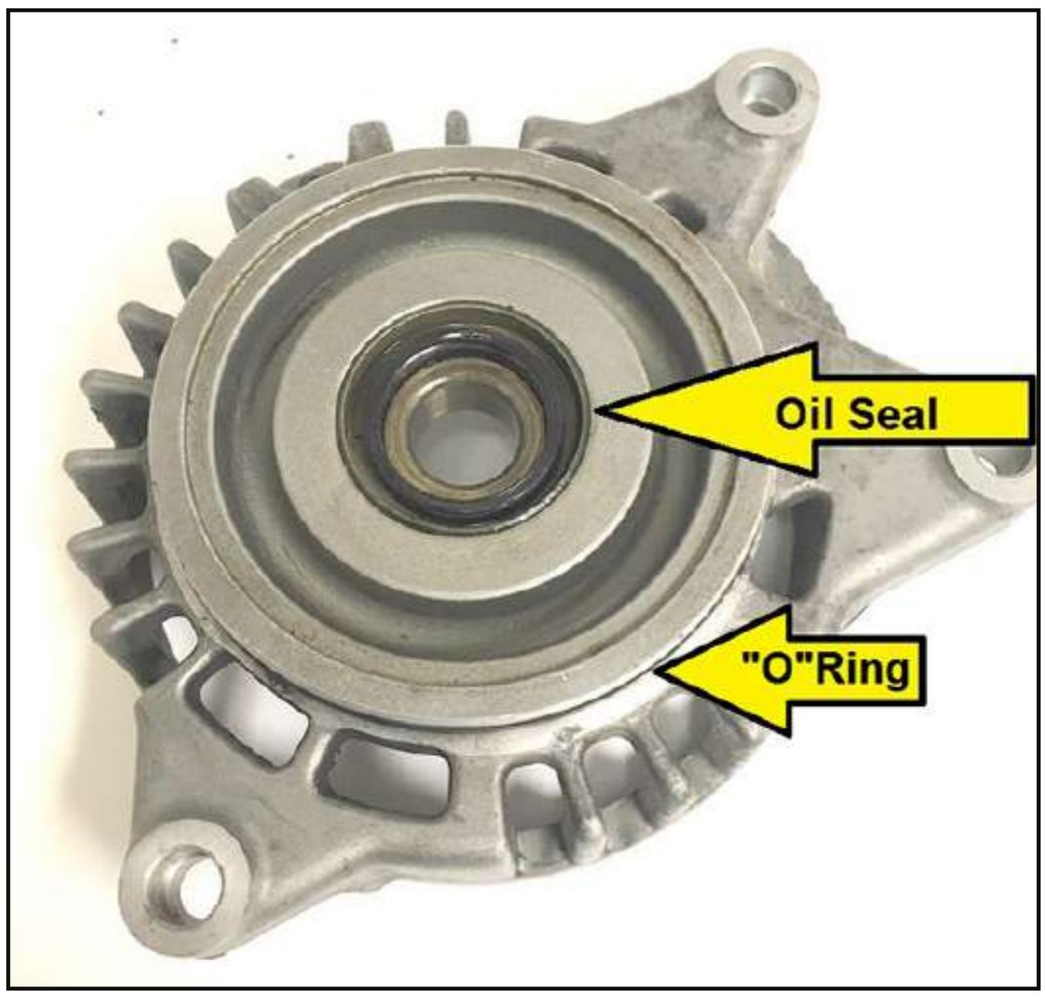
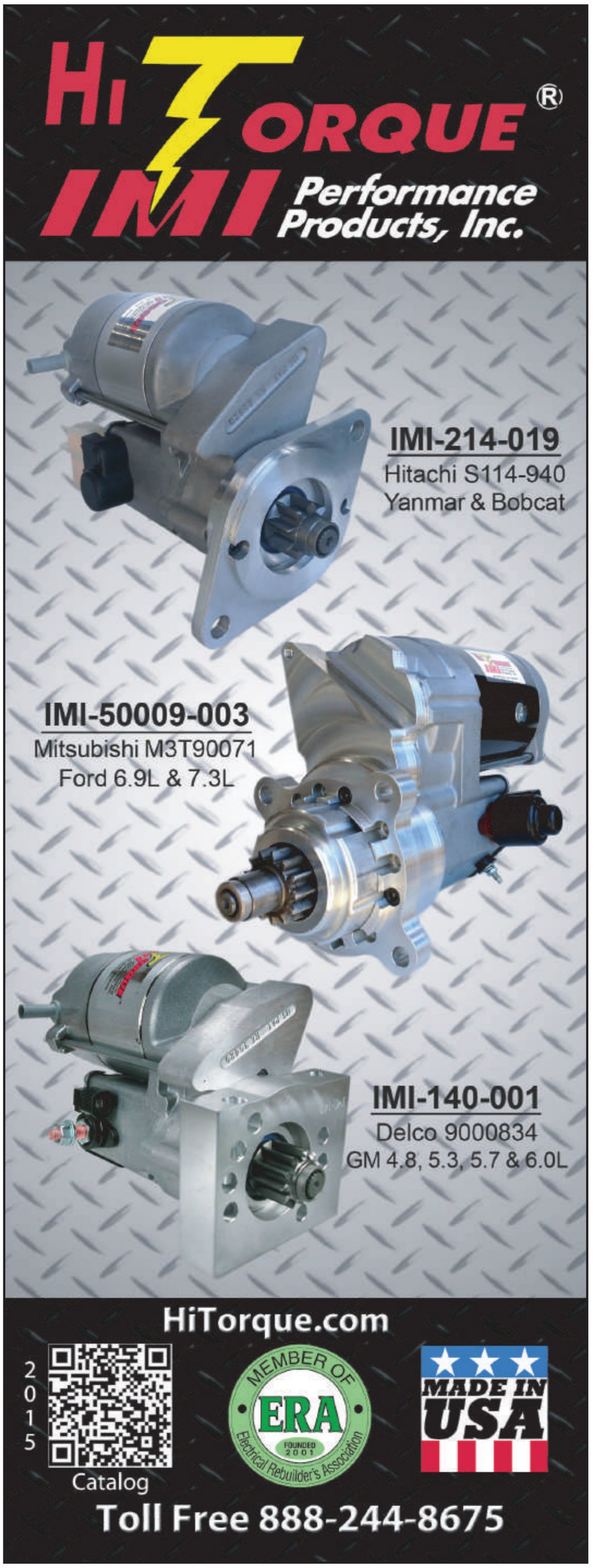



*Figure 6 – DE Housing of the MOD Alternator*



Spinning this alternator on the test bench required the removal of its 4-prong impeller-type coupler that is driven by a cushioned mechanism in the engine. It is threaded onto the rotor shaft. Unscrewing it became a challenge so as not to not damage this non-available part. To break it loose, I held it tight in the bench vise across two of its prong (*see Figure 7*), put an 8mm Allen socket into the rotor's shaft, and spun it (the rotor) CCW with the strongest ½ air impact gun that we had. That screwed the rotor right out of the impeller…!

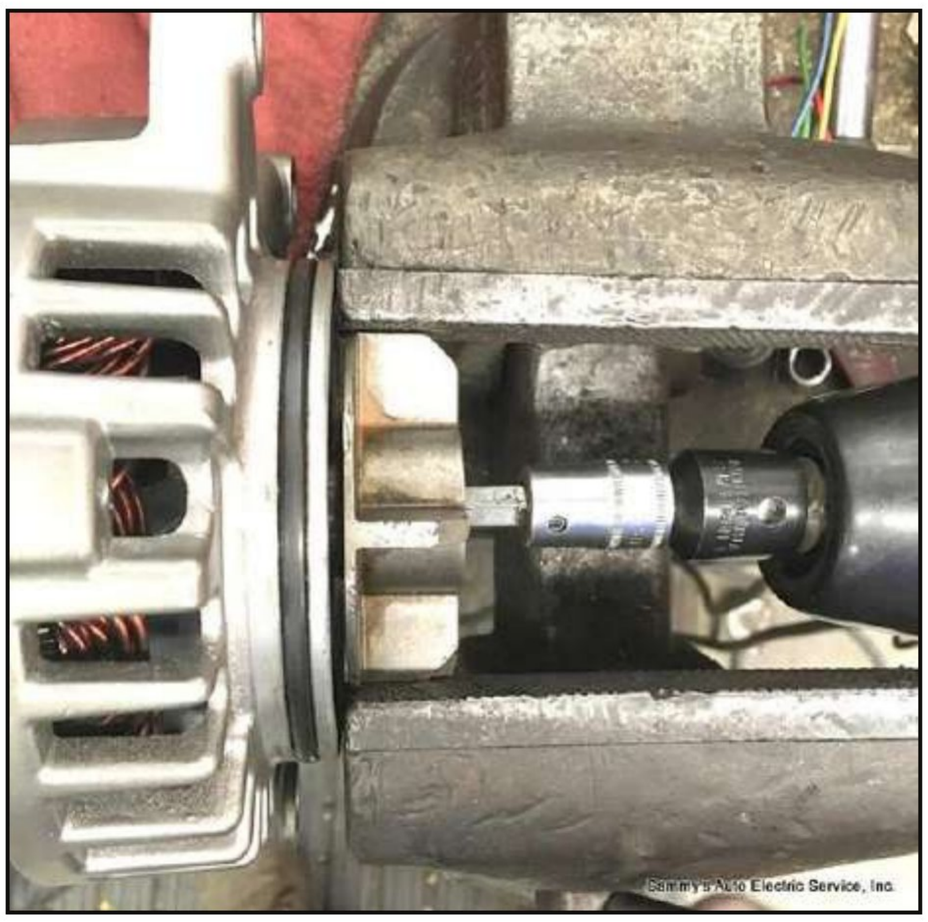



*Figure 7 – Coupling Tightly in the Vise for Removal*

The next step was to adapt a pulley for bench testing. I machined off the inside groove of a 6-groove Ford 8250 alternator pulley (because we had an extra one!) that has a 52mm diameter (*see Figure 8*). Actually, any diameter such pulley will do. My now 5-groove pulley fit the shaft just fine and cleared the DE housing with plenty of room for a nut to secure it. That made it easy to run on the test bench (*see Figure 9*). There was no output.



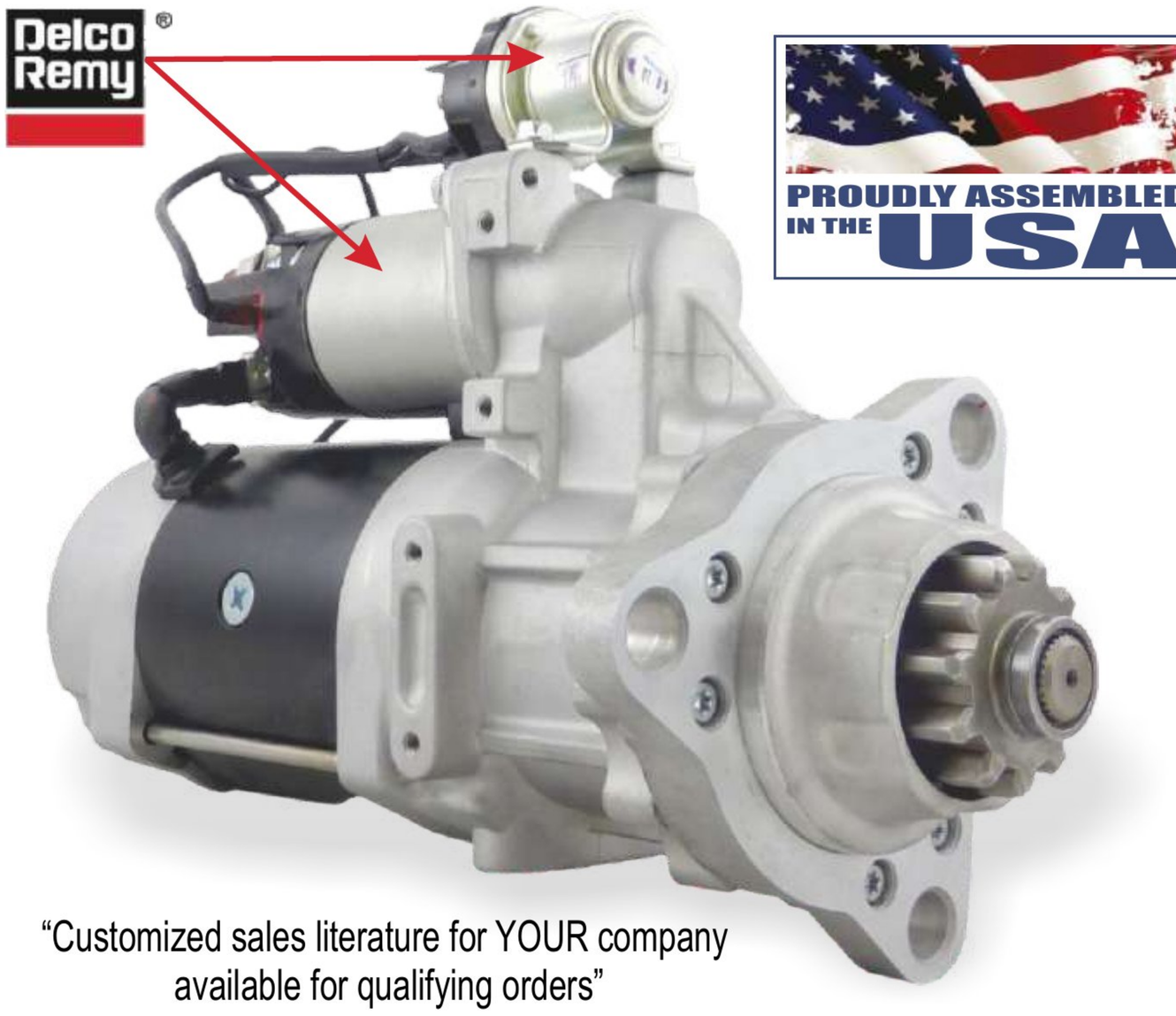
*Figure 8 – Our Test Pulley for MOD Goldwing Alternator*



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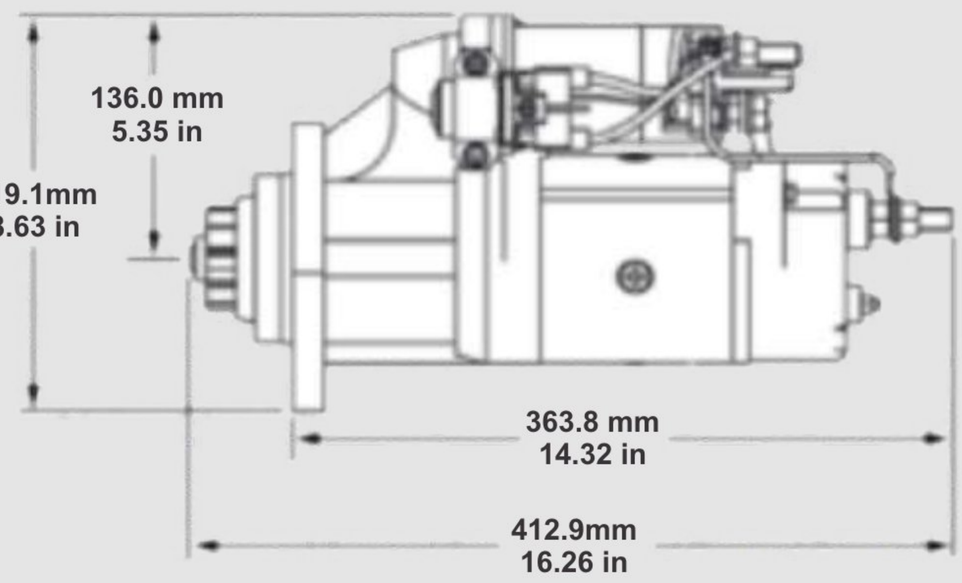
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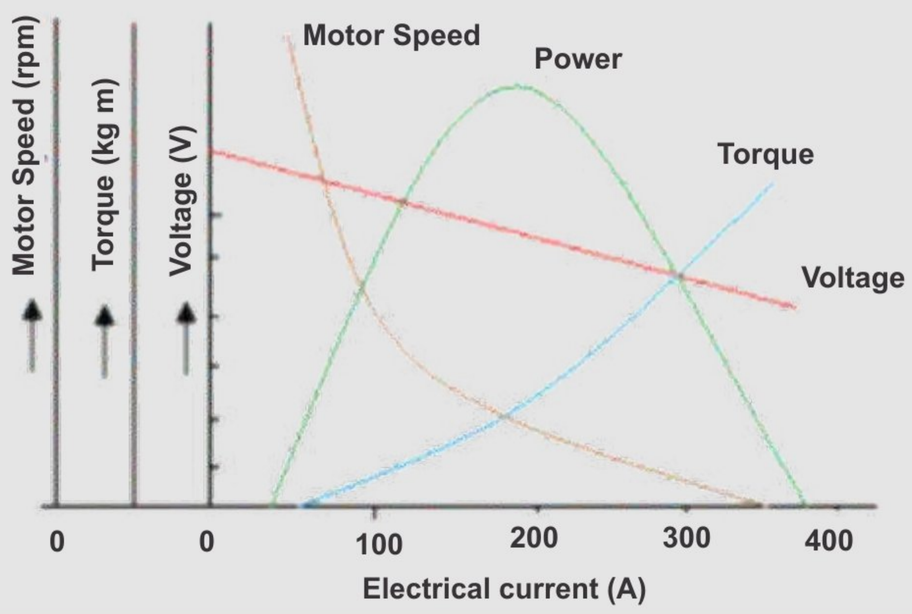
- **6823N-USA**
  24V 12T 45mm
- **6837N-USA**
  24V 11T 56mm
- **6907N-USA**
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After a teardown for inspection, we realized our customer's unit had an open rotor coil…an issue prevalent to Goldwing's OE Hitachi alternators! The easiest solution was to use a rotor from an extra 8232 core that we had laying around as the rest of its components like rectifier, regulator, and stator all checked fine. Once our rotor was cleaned and prepared, I noticed that its slip-ring was too thin and needed to be replaced. This rotor uses the same slip-ring (WAI's 28-1854) as a CS-121 or CS-130 rotor. So the slip-ring was replaced, machined and the rotor was installed in the alternator (*see Figure 10*).

This alternator uses the Delco 19009702 (Taditel T719) regulator which has a P-L-I-S designation. Original Goldwing Hitachi alternators did not use an "L" terminal and are activated via a direct ignition feed to the IG terminal of their (IH-258) regulator. Thus make sure the adapter cable they are using is wired properly and the "I" pin is being used, as applying a direct ignition feed to an "L" terminal of almost any modern regulator will damage it. We had one of such case a while back that caused us some grief. That particular modified Goldwing alternator was based on a CS-121 alternator with a common 1116411 regulator that had failed. Once it was rebuilt and sent out, the customer brought it back as defective, as the new regulator had indeed failed.



*Figure 9 – Running the Alternator on the Test Bench*



*Figure 10 – Defective and Our Used Replacement Rotor*

Since I had a hard time believing two such robust regulators had failed back to back, I asked the owner to bring the adapter wire with him. It was indeed wired up incorrectly. The regulator was changed again, the activation wire was moved from "L" to the "I" terminal and the unit was handed to back to the skeptical customer. We never heard any complaints from him again except for an apology a week later.

These alternators (the CS-121D design) are sold in the $400-$450 price range on the web. If you rebuild one, make you're that your price reflects the true value, as the customers' options are limited.

That's all for this issue. Until I see you again, keep up with the good work.

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

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# COMMON SENSE —
# Some Good News At Last



BY BOB THOMAS

While I am not a doctor and never even enjoyed biology class, I am still interested in the subject as it pertains to human health. I like to understand how things work, all things, whether it is an electric motor or an internal organ in my own body. The SARS-CoV2 virus grabbed my attention weeks before anyone in the US was diagnosed with it.

One of the problems that has plagued doctors in fighting to save COVID-19 patients has been the inability to understand why the disease seems to have such a wide variety of effects on different people. Researchers have been finding themselves being led down dead end streets. No theory, up until now has been able to account for all of the symptoms being reported.

How can so many people become infected, but have no obvious symptoms whatsoever yet still be contagious and pass the virus on to others? Or why does this particular corona-virus seem to attack different organs in different people leaving many of those who do recover with permanent damage to their hearts, lungs, kidneys, intestines or brains? And why do respirators seem to fail miserably in saving patients that cannot breath on their own, often seeming to make their conditions to worsen.

By the time that you read this you may have already heard that a team of computational systems biology scientists at the Oak Ridge National Laboratory in Tennessee used the lab's supercomputer Summit to analyze more than 40,000 genes from 17,000 genetic samples taken from different COVID-19 patents. The process took the world's second fastest supercomputer 10 days to complete as it analyzed all possible combinations - 2.5 billion of them.

What was discovered in the results seems to answer not only why and how the virus affects people differently, but it also provides some clues on how it might be combated in patients who are fighting for their lives now in intensive care units around the world. Summit's analysis revealed a model that explains much of what doctors have been reporting, including most of the more bizarre symptoms.

Still a theory for now, the report suggests that SARS-COV2 hijacks the ACE2 receptors that were already known to be the virus's point of entry. Those receptors are most plentiful in our noses. Simply put, once in control of these receptors it deregulates them or makes them stop doing what they normally do. One of their functions is removing excess amounts of a polypeptide, bradykinin, which is normally used by our body to regulate blood pressure.

At the same time, the virus also hijacks the renin-angiotensin system (RAS) that produces bradykinin, causing it to produce more. With more being produced and nonebeing removed, the patient's body becomes flooded with high levels of bradykinin. The result is what the research team has referred to as a bradykinin storm.

Unchecked, a bradykinin storm sweeps throughout the bodies of patients through their bloodstream. One of its effects is to cause the blood vessels carrying it to leak fluid into places it would not normally be, including the air sacs of the lungs. This also allows immune cells to pass through which causes inflammation. At the same time, using another mechanism, the virus can increase production of hyaluronic acid (HLA) in the lungs. Normally used minimally to absorb fluids, the HLA combines with the leaking fluids to form a thick hydrogel, which can fill up the lung's air sacs and suffocate the patient no matter how much oxygen is pumped in with a ventilator.

The virus passes throughout the body through the host's blood vessels, finding and entering more ACE2 receptors in organs, like the intestines, kidneys and heart. One in five hospitalized COVID-19 patients end up with permanent damage to their hearts, even though they had no cardiac issues before their infection. Sports teams have reported permanent damage to the hearts of a growing number of athletes who had tested positive but were asymptomatic. The virus also hijacks the system that produces ACE2 and increases production of the very receptor that allows it to multiply.

Your brain is normally protected from disease by a blood-brain barrier that acts as a filter to keep infections like a virus from getting to the brain and other parts of the central nervous system. But SARS-CoV2 in high doses can overpower that barrier. Doctors have reported some neurological symptoms (dizziness, delirium, seizures, or stroke) in as many as half of all hospitalized cases. A study in France reported that MRI evidence from many COVID-19 patients had leaking blood vessels in their brain.

While the US has not done much random testing, other nations have and are. Their data seems to indicate that nearly half of all those infected have little or no symptoms. Those asymptomatic cases have baffled the medical community and the big question has always been why? One suspicion is that it is linked to the size of the dose of the virus that infects the patient. In other words, the body of a person with a relatively healthy immune system who is exposed to a small does may be able to handle the virus well before it reaches a point capable of causing any symptoms. While masks cannot keep all viruses out, they can greatly limit the amount that gets through.

The report also suggests several drugs that are already known to reduce bradykinin production and could be used to help some patients deal with COVID-19. If the bradykinin hypothesis is confirmed – which looks likely at this point, it will be a giant step forward in finding cures and treatments for COVID-19.

If you would like to read more about the supercomputer's analysis, Google: elemental bradykinin storm. Be safe and take care.

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

# NEW REVERSING POWER RELAY For Permanent Magnet Motors



BY WES GRUENINGER SR. AND BOB THOMAS



Traditionally, DC electric motors of any significant size that operate in either direction, CW or CCW, required at least two power relays. These types of motors are primarily used in winches, lifts or similar pieces of equipment. In a few applications they may even incorporate four relays.

The circuit configurations that are used to control those types of motors are known as H circuits for the shape that they form on a wiring diagram. There is a seven-page ERA Technical Document on all of the different H circuit motor control variations on the ERA website. You can find it under Miscellaneous in the Technical DOCS section on the left side menu. Copies can be easily downloaded and printed for use in your business.

But we noticed a different kind of power relay on a vendor's sales flyer several months ago that did not exist when that H-Circuit document was written. This newer relay was designed to take the place of two standard relays in an H circuit. Then an ERA member contacted us a short time later, looking for a technical document that described how this relay operates and how it should be connected when replacing a two-relay configuration. The member said that he often uses ERA technical documents to help his customers get the parts that he sells them installed properly. Many of the ERA's technical documents have been written to serve as a ready-made set of detailed instructions and could be used that way.

This newer type of power relay was designed for use with PM (permanent magnet) winch motors, although that fact is not always made clear in the part's descriptions that are listed online. There is a reason for it precluding conventional motors with copper field coils. Permanent magnet motors require a lot less amperage than an equivalent conventional DC motor using field coils. Curious about how it worked internally, we procured one to experiment with (*see Figure 1*). The Sharpie pen is for size comparison.

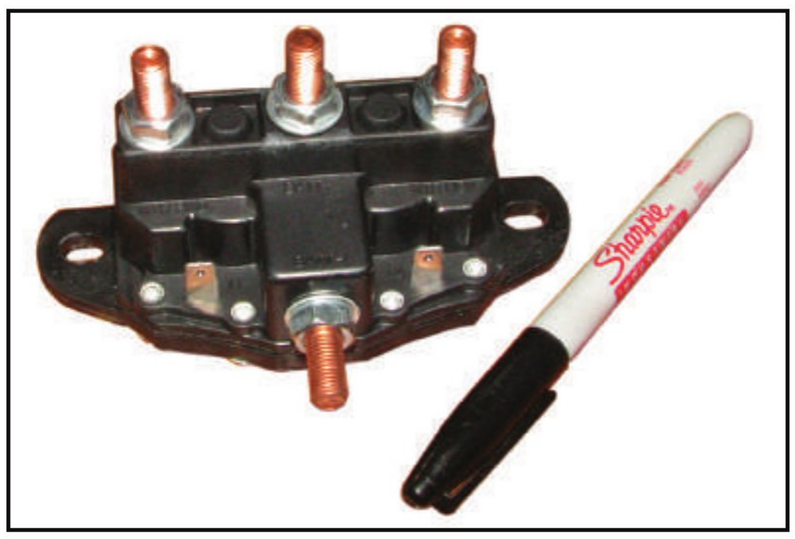



*Figure 1 – The newer style reversing power relay with a Sharpie pen for size comparison.*



## NEW REVERSING POWER RELAY

The operation of this power relay is like having two relays in one that share the same battery terminals. This simplifies the wiring when using this type of relay (*see Figure 2*) because it eliminates the need for battery cables going to two different relays. It also saves space as control relays are often located in a confined area close to the motor.

In the cut-a-way photo (*see Figure 3*) you can see the ground stud contact in the center at the very bottom. In this "at rest" position (not energized) two springs push down to hold both moving contacts tight against the lower sides of the slots that are cut to form each motor terminal's contacts. Notice that the slots are wide enough to allow room for the moving contacts to also be pushed up to the B+ stud directly above the ground contact. This means that the motor terminal contacts are always connected to one of the battery's terminals and ground is their default connection.

I measured the contact area where a moving contact mates with a motor stud. It is an oval shaped area that is roughly 3.5mm wide (*see Figure 4*) – somewhat smaller than the contact areas of most conventional power relays, which probably explains why it should only be used with PM motors.

There are two solenoids inside this power relay, each controlling its own moving contact and drawing about two amps of current when energized. One solenoid controls the M1 motor terminal while the other controls the M2 motor terminal. Both motor terminals are connected to B- (ground) when neither are activated. There is no current flow (*see Figure 5*).

This position causes a braking effect on the motor. When an armature in a PM motor is rotating, it produces voltage. So when this relay shuts down, both motor terminals go to ground which places a significant load on the generating armature. This braking effect brings it to a complete stop quickly, an additional benefit that PM motors have over conventional DC motors.

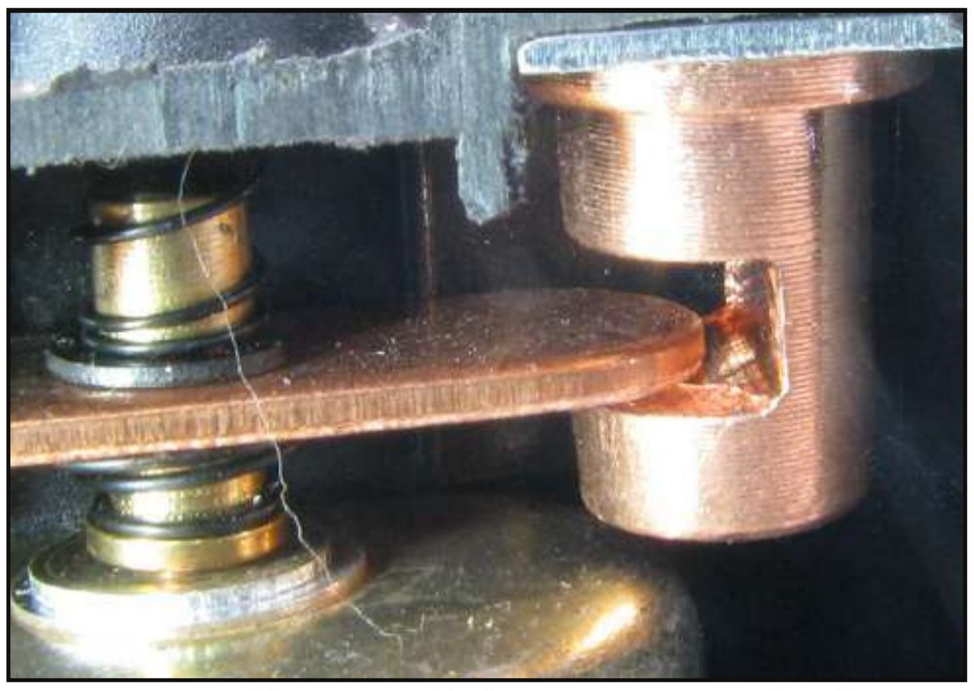


*Figure 4 – Close view of relay motor terminal and its moving contact.*

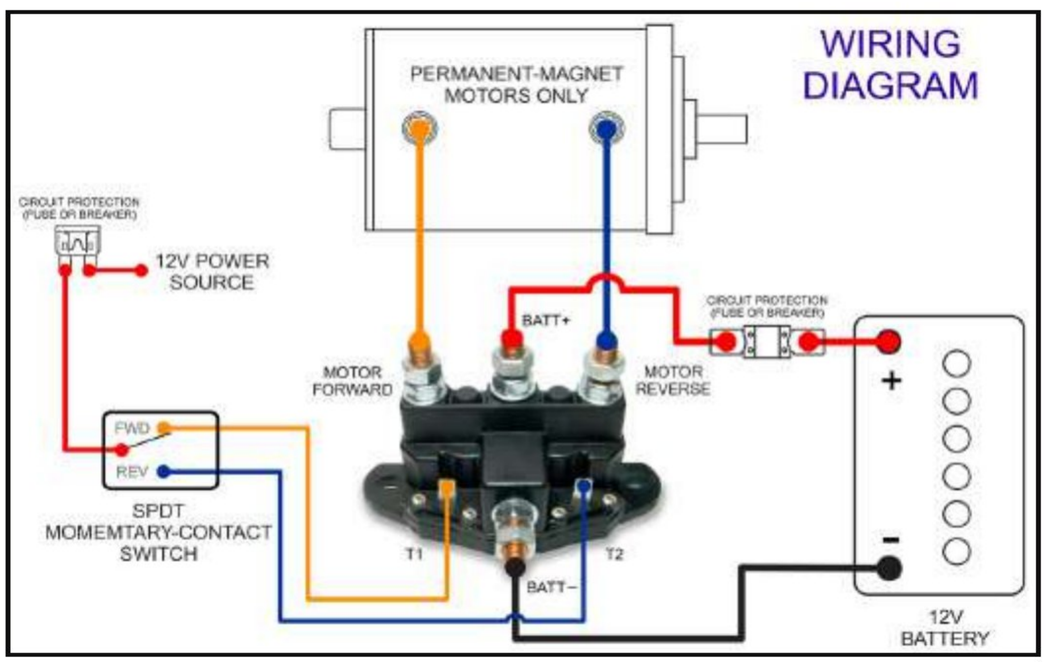



*Figure 2 – Wiring diagram for connecting the power relay, battery and PM motor.*

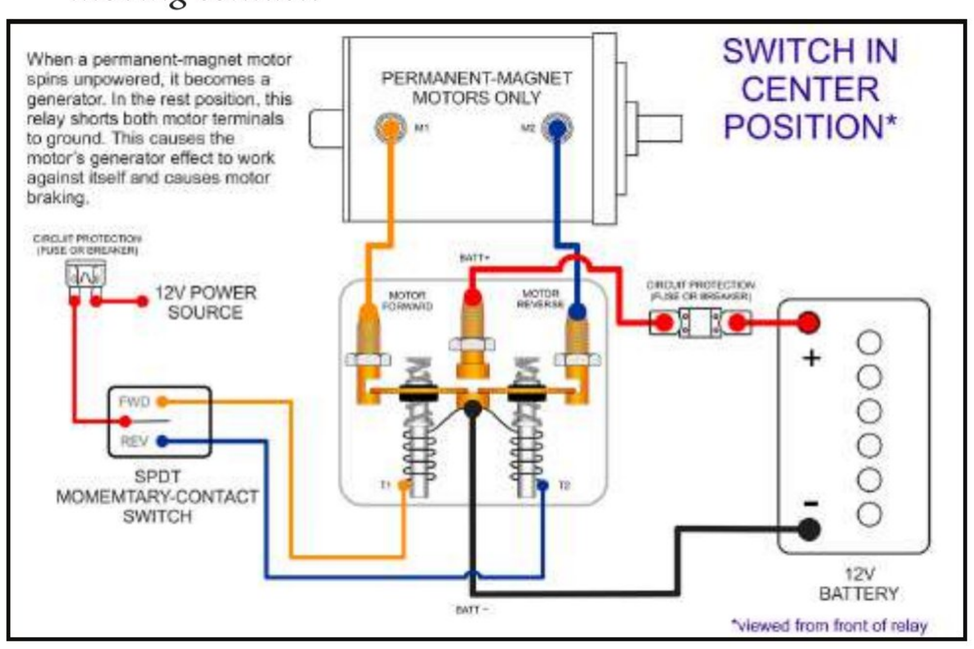



*Figure 5 – No current flow with both motor terminals connected to ground.*

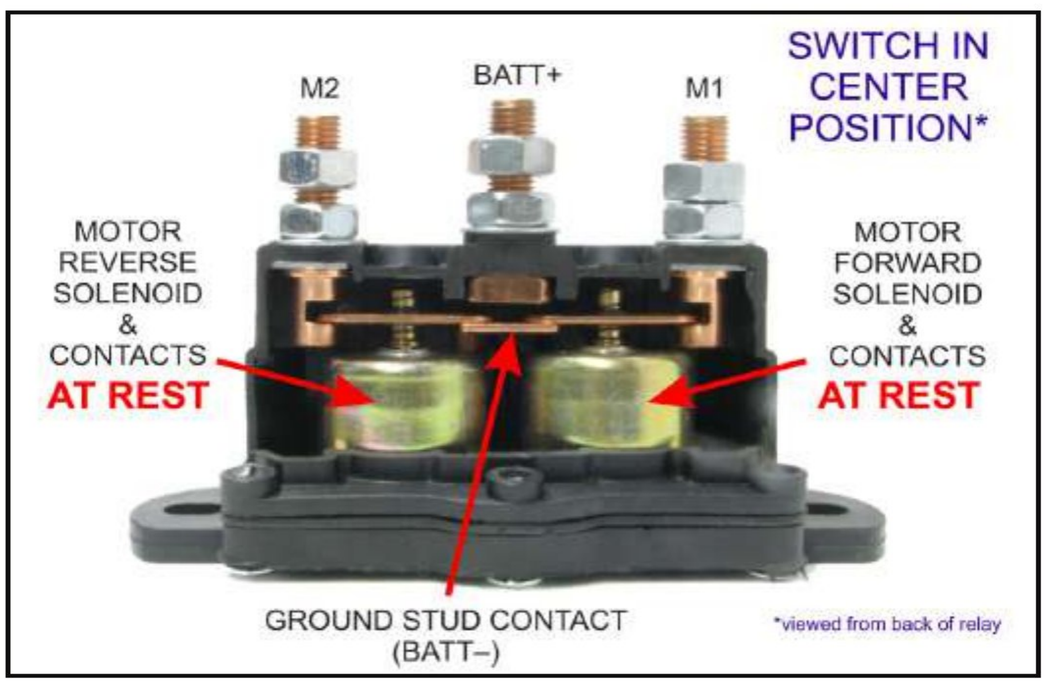



*Figure 3 – Cut-a-way photo of relay contacts at rest (not energized).*

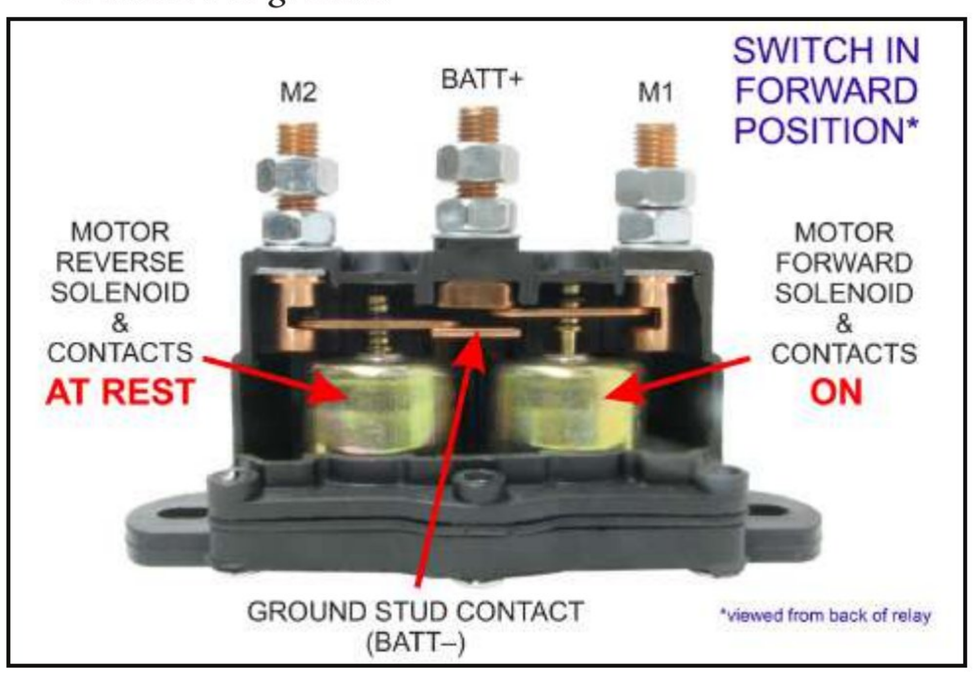



*Figure 6 – Motor forward contact connected to B+.*

## NEW REVERSING POWER RELAY

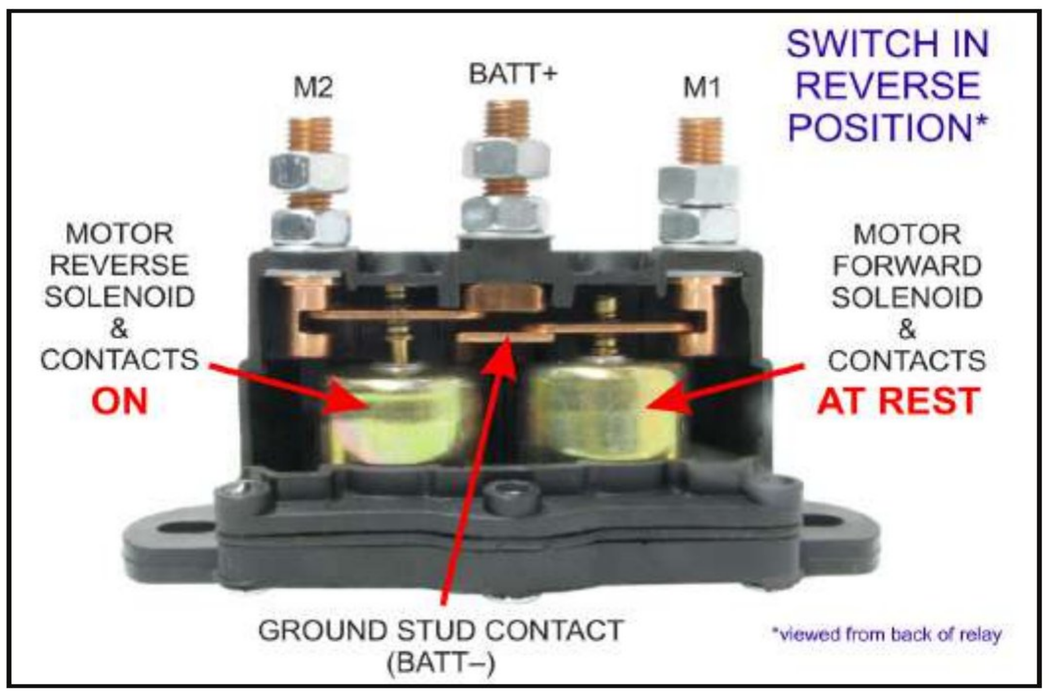



*Figure 7 – Current flow with contacts in forward.*

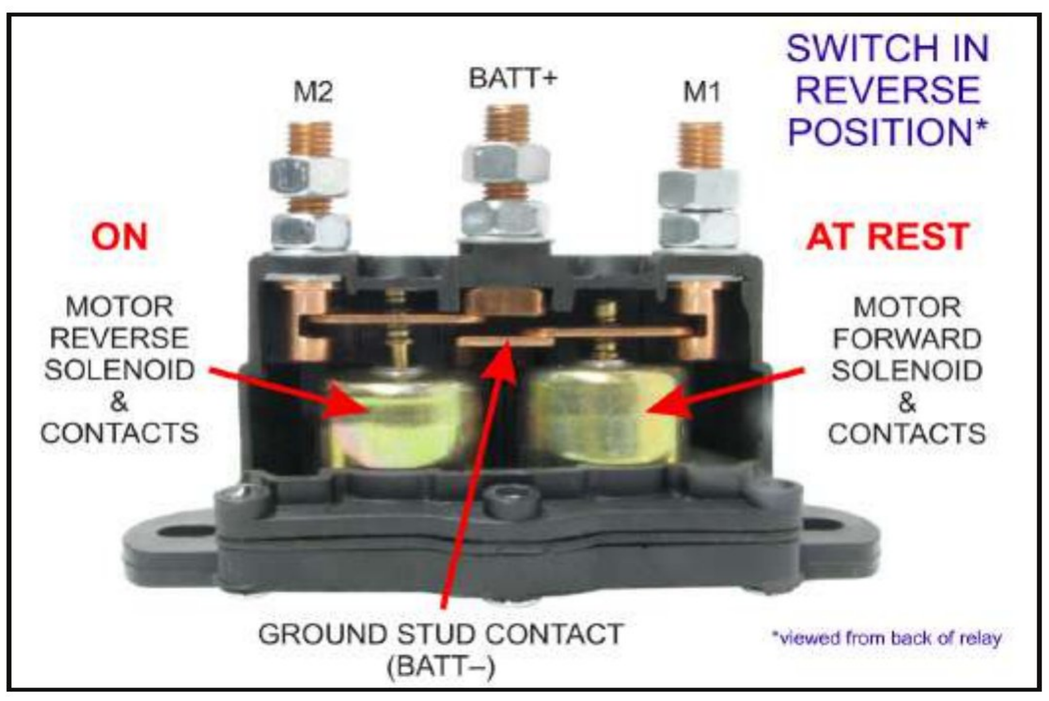



*Figure 8 – Motor reverse contact connected to B+.*

When the forward solenoid is activated, it switches the M1 motor terminal from ground to B+, creating a complete circuit because M2 is still connected to ground. That causes current to flow as shown in the circuit diagram which forces the motor to turn in the forward direction (*see Figures 6 and 7*).

When the reverse solenoid is activated, it switches the M2 motor terminal from ground to B+, creating a complete circuit in the opposite direction because M1 is connected to ground. That forces the motor to turn in the reverse direction (*see Figures 8 and 9*).

*You can contact Bob Thomas by email at ere.bobt@gmail.com or by phone at 904-673-7301. You can contact Wes Grueninger Sr. by email at ere.wesg@gmail.com.*

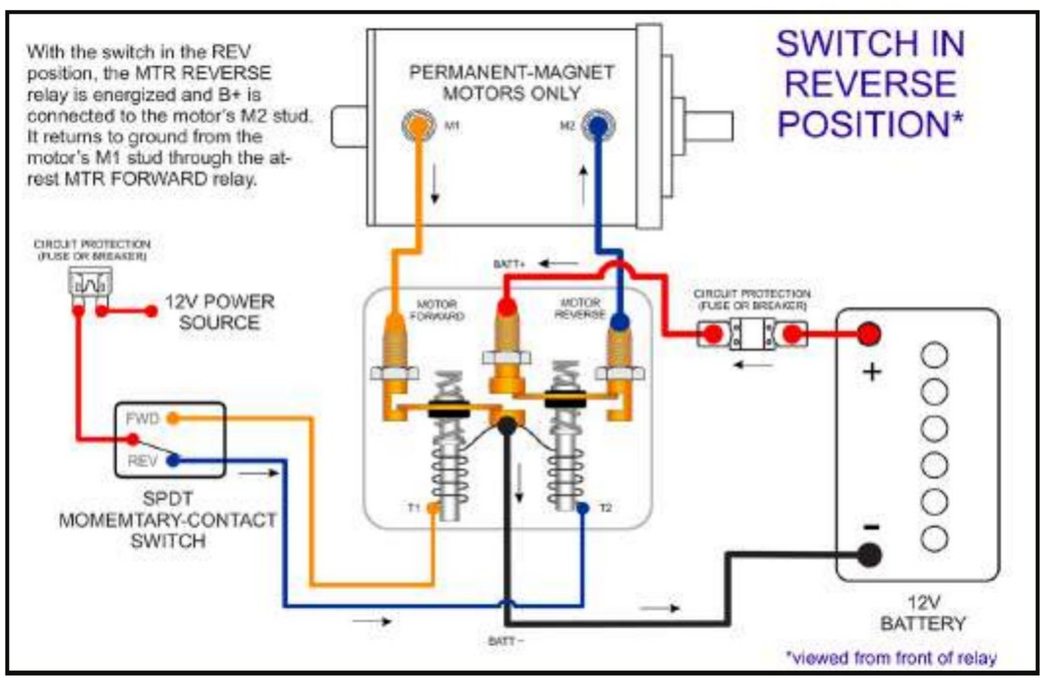



*Figure 9 – Current flow with contacts in reverse.*


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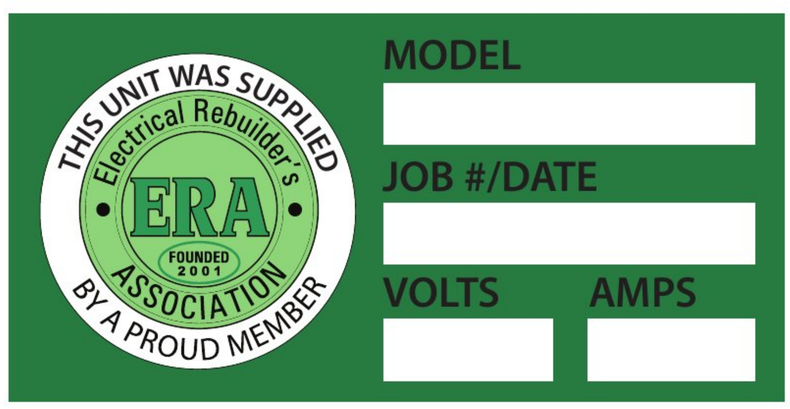
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