THE EXCHANGE

AN ELECTRICAL REBUILDER'S ASSOCIATION PUBLICATION

SHOW ISSUE

VOLUME 32, NO. 7 | Published monthly since 1983 | MARCH 2015

ERA Expo 2015 schedule and registration Page 10

The Last Exchange

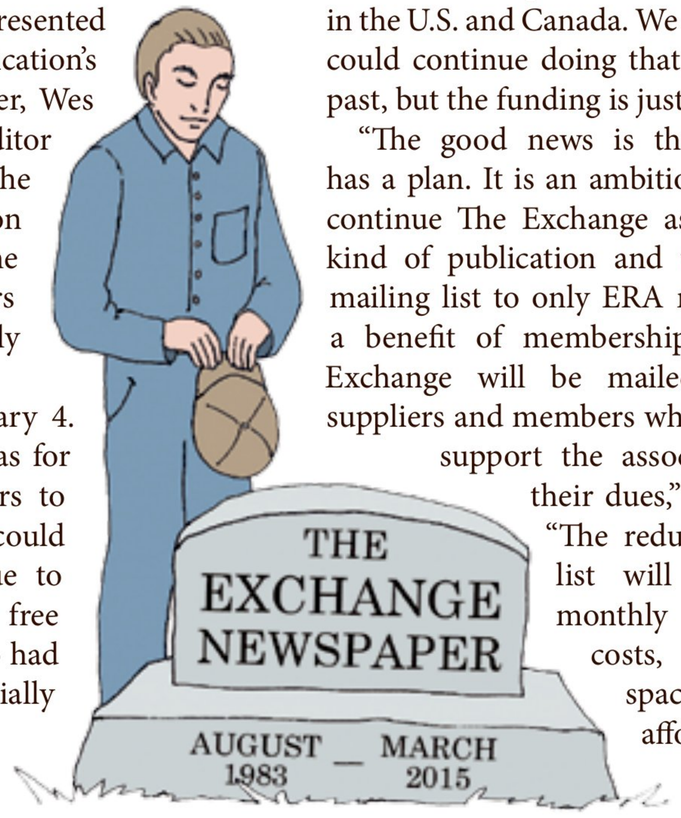
This issue of The Exchange will be the last one that you will read as a tabloid-sized newspaper.

For over three decades, this familiar and popular newspaper has been mailed to electrical rebuilding businesses all across the U.S. Since the beginning, it has been funded primarily by advertising. Some paid subscriptions have provided marginal support, but advertising is what made The Exchange possible.

When the ERA was founded in 2002, a portion of members' dues were set aside for subscriptions to offset the increasing cost of printing and mailing the publication to all electrical rebuilders. That income boost alone enabled the newspaper to thrive for nearly a decade.

When the ERA officially acquired the The Exchange newspaper in 2013, a business plan was put in place that included both advertising and ERA funding. That plan was successful for nearly two years. However, advertising continues to decline for all publications nationwide, especially those using a newspaper format. Income dropped as expenses increased. It became obvious that a change was required to save the publication.

On January 27, the Executive Board of the ERA reviewed the income vs. cost statistics presented by the publication's production manager, Wes Grueninger and editor Bob Thomas. The same information was provided to the Board of Directors at their monthly teleconference meeting on February 4. As difficult as it was for the board members to accept, the ERA could no longer continue to print and mail free issues to those who had failed to financially support it.



"Sadly, we simply had no other option," ERA President Henry Henke admitted. "This publication has served the electrical rebuilding industry since 1983. The ERA's intention was always to continue it in the same format and purpose in which it was founded—as a newspaper—to serve and help **all** electrical rebuilders in the U.S. and Canada. We wish that we could continue doing that, as in years past, but the funding is just not there.

"The good news is that the ERA has a plan. It is an ambitious plan—to continue The Exchange as a different kind of publication and to limit the mailing list to only ERA members, as a benefit of membership. The ERA Exchange will be mailed to those suppliers and members who financially support the association with their dues," Henke said. "The reduced mailing list will lower our monthly production costs, making ad space more affordable for our advertisers. Many of them have already agreed to support the new publication.

"However, we are still dependent on their advertising to make this publication possible, so I encourage every one of you Exchange-readers to use your buying power to prove to those supplier-advertisers that you appreciate what they are doing to help your association," Henke added.

Plans for the new publication are still being finalized as of press time. The ERA board has been assured by Grueninger and Thomas that it will be ready for its first edition sometime in April. The first issue of The New ERA Exchange will provide news and photos from the ERA's upcoming trade show in the Quad-Cities on March 13-15. Future issues will always include helpful rebuilding tips and technical information, along with all of the other types of articles which the Exchange readers have come to expect each month.

The size, format, paper, color-quality and printing will be very different from that of the newspaper that had become an icon of rebuilding in the U.S. and Canada. You may not recognize The New ERA Exchange ... so, you ERA members should watch your mailboxes carefully in April. Something new and exciting will be coming your way.

Current paid-up subscribers to The Exchange newspaper will be receiving the new publication through the remainder of their subscriptions.

ERA

You Don't Want To Miss This

BY ERA STAFF

Editor's Note: Last month, we published a detailed description of the John Deere Harvester Works Tour that was scheduled for attendees of the ERA Expo 2015 in Davenport, Iowa on March 13. Just days after that issue was mailed, John Deere canceled the tour of their harvester plant but offered another tour in place of it. We deeply regret this and apologize.

The good news is that there will still be a tour with bus transportation, which includes the John Deere Pavilion and the John Deere Seeding Group facility, where planters are assembled. The seeding group tour is a walking tour. As mentioned last month, no cameras, videos or cell phones are permitted inside any of the factories. Plant tours are also restricted for anyone under 13 years of age.

Visitors to the Pavilion are invited to take cameras inside, and there are no age restrictions. The Pavilion has visiting hours all weekend, and admission and parking are free. As we go to press, the ERA tour is booked to capacity with a waiting list. However, those who have their own transportation can still visit the Pavilion on their

(See SHOW, pg. 15)

A SHOW NOT TO BE MISSED!

Electrical Rebuilder's ERA 27th Annual EXPO 2015

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THE EXCHANGE

AN ELECTRICAL REBUILDER'S ASSOCIATION PUBLICATION

Serving the automotive electrical aftermarket

SINCE • 1983

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Published each month and mailed third class by:

The Exchange
16930 W Beloit Rd, New Berlin WI 53151

Phone 386-328-2761 • FAX 262-679-7028
E-mail: ere.bobt@gmail.com • ere.wesg@gmail.com

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The subscription rate for one year is $30, Canada/Mexico $55 and all other countries $60.

SEND MATERIAL FOR PUBLICATION TO THE EXCHANGE, 16930 W BELOIT RD, NEW BERLIN WI 53151 BY THE 10TH OF THE PRECEDING MONTH.

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Writer's Guidelines: Submissions are always welcome at *The Exchange*. For stories, we prefer Word attachments sent via email, but paper versions sent via postal mail are acceptable. All digital photos should be high resolution (300 dpi or more) and can be sent as attachments via email or on a CD through postal mail. Scan photo prints at 100% at high resolution and send via email or send prints via postal mail. Photos can be returned upon request. Submitting material does not guarantee publication.

Metamorphosis
Things change

BY BOB THOMAS

For those readers who are disappointed to hear the news that broke on the front page, I sympathize with you. In fact, I am sure that I am more disappointed than anyone. I closed a business sooner than planned, to have more time to spend on The Exchange.

I had my rebuilding business for only a few years when I received my first copy of the Electrical Rebuilder's Exchange in the mail. It was issue number three. There was already a slick-looking trade publication that catered to the automotive rebuilding trades, but it was focused mostly on industry news, new products and commercial advertising, with very little else to offer the independent electrical rebuilder. But the rough-at-the-edges, letterpress-printed Electrical Rebuilder's Exchange was something completely different. It contained helpful information ... technical information … valuable information worth saving. I still have that first issue that I received. The subscription form has been clipped out, because I mailed it back to Ralph Albares with a check.

By the time I felt qualified to write about the trade myself, Ralph had passed away, and his step-daughter Polly was running the business. The Electrical Rebuilder's Exchange was more polished by then—offset-printed with some color. It took me more than a decade to feel confident enough in my knowledge of the industry to submit an article for publication myself.

I had always enjoyed putting thoughts into words. I chose to major in journalism at college, because most of the courses looked like they would be easy. Some of them were. I did enjoy writing my first series of articles for The Exchange about "the question of quality." When I look back at those articles now, with all I've learned since then, I do not believe I would change them much.

Progress can happen only with change, but change alone does not guarantee progress. Publications come and go. Hundreds of small town newspapers have been forced to downsize or close altogether. There was no reason to expect that this little newspaper would continue on forever, even though many of us did not want to admit it.

Direct-mail advertising, telemarketing and the Internet have all contributed to the decline of print advertising and the printed publications that require ads to survive. Most would agree that the Internet is progress, but it does come with a price. Brick and mortar stores are finding it impossible to compete with online behemoths like Amazon, at least on price, variety and availability. Physical stores' uphill battle with online giants will become only more difficult as things continue to change. Such was our case at The Exchange.

I have said many times that the glory days of electrical rebuilding were the late 80s and early 90s, brought about primarily by two alternators, Delco's CS130 and Ford's 2G. Both GM and Ford failed to replace those alternators with anything better for nearly 10 years. Any rebuilder who was supplying the automotive aftermarket then, could make money by just showing up for work. It was easy for rebuilders to see the weaknesses in those units and rebuild them to last longer than the originals. Our suppliers helped us by designing replacement parts that were better than the originals in some cases. It was too easy then. It is not that easy any more, because alternators have changed. They are better today, lasting much longer. That is progress for Ford and GM.

There will always be a demand for the services that rebuilders can provide. But today, the "easy money" (and most of the competition) is from selling inexpensive replacement units. Selling them requires little-to-no product knowledge and little-to-no skill. Anyone with a computer, Internet access and salesmanship can do it, and many have chosen that path. There will always be those of you who find rewards and make their living by rebuilding generators, alternators, starters, DC motors and similar electrical parts. If you have not joined the Electrical Rebuilder's Association, we will not be here for you next month.

There is a positive side to this story. In this case, the beneficiaries will be those who are members of the ERA. They will continue to receive a helpful informational publication which focuses on the needs of independent rebuilders and electrical repair shops. "The Exchange" will survive. It will metamorphose into a new format that you might not immediately recognize and reappear sometime in April as "The New ERA Exchange."

As the third and final editor of The Exchange newspaper, and the one with the least amount of tenure, I would like to thank all of those who advertised, those who have contributed, those who have subscribed and those who have joined the ERA. I will be back for all of you next month with something that is completely different, but hopefully still familiar in many ways

Bob Thomas

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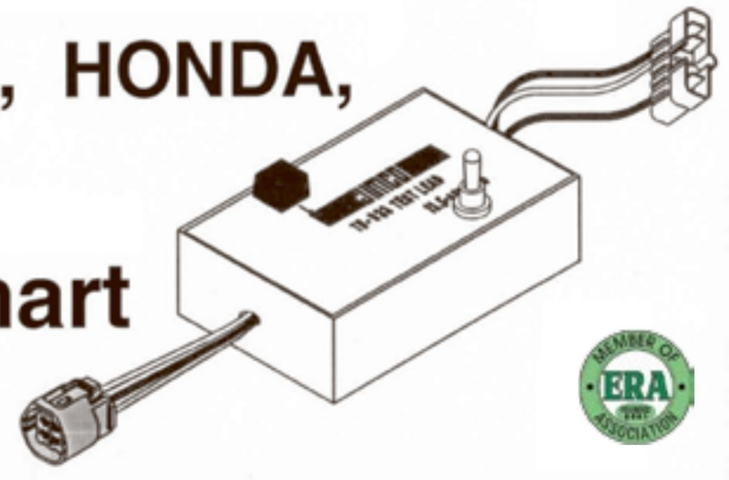

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WHY AM I AN ERA MEMBER?



"We help one another."

Glen McLaughlin
Alternator-Starter Service
Myrtle Beach S.C.

"I'm an ERA member because it is the largest group of people I've ever been around that makes me feel like they are all here to help me. It's the crew aspect of the ERA. We help one another. If a member has a question or runs into a problem of some sort (and we all do at times) others step in to offer help and advise. The ERA has been a wonderful experience for me. It's difficult for me to understand why more rebuilders out there don't take advantage of it."

Letter To The Editor

Editor's Note: The following letter was received in response to the page-two editorial in the February edition of The Exchange. A special word of thanks goes out to John Prinvale for taking the time to write about his experience.

You Are 100% Right!!

A fellow came into my shop with a Delco Remy motor generator on Friday (January 30, 2015 ... the same day I got The Exchange newspaper.) I pulled the unit apart in front of him and his son, and I showed him the burned up field coil. I took the time to explain how it worked. Then I told him that he could go on line and get one, but that the quality of an aftermarket replacement left a lot to be desired.

I gave him a rough estimate of the cost to repair his unit. He thought about it, asked me more questions and then told me to go ahead.

The reason he gave me for leaving it with me, was that he trusted me, and BOTH HE AND HIS SON HAD LEARNED FROM ME!!!

I cannot and I will not compete on price, but I CAN PROVIDE BETTER SERVICE than any parts store. Price was secondary once the customer knew that I could and would provide service to him. He will also be bringing in the voltage regulator—just as you spoke about in your article on the old Buick generator, in the last issue of The Exchange.

Also, I told him that I would go out to his house after hours, to make sure that it was installed properly. I am in a small rural town, so I can do things like that.

Service will win over price most of the time, unless price is the only consideration.

I really enjoy the articles in The Exchange and the ERA forums.

Thank You,

John L. Prinvale
John's Automotive
Quincy, California

P.S. Talking about providing service ... I had a fellow from near Quincy, Massachusetts call with problems that he was having with a Ford truck. He did not realize that he was calling Quincy, California! This was on a Saturday. I helped him out, and he sent me a check for my time!

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CONTACT NAME _____

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Plain Talk
New beginnings

BY ROB BUKSAR



Back a few weeks ago, a long-time friend and customer stopped by the shop to drop something off. He had a lot to say from an incredibly different perspective than he formerly had. He talked about his shrinking customer base and diminished sales. He also talked about the incredible amount of additional work, distance, time and money that it's taking just to keep pace. Growth didn't seem to be in the cards any longer. It's now become all about maintaining. When I expressed this very same thing to him a few years earlier about my own business, he couldn't see it, because at that point, his business wasn't affected. Now it is! He also said something else worth mentioning. He said that it's become a real tough pill to swallow to be in the rebuilding business and not be able to compete in the market place! I said, "Welcome to my world," and reminded him that when we had this same conversation a few years earlier, that he thought I was out of touch and maybe a little crazy. Now that we're both walking in the same footsteps, I don't look as out of touch or "crazy" as I might have earlier.

To dispel a bunch of misinformation and wrong conclusions, this is a really good time to mention this. When we lose a supplier or a rebuilder, large or small, too many still feel that the customers they formerly had are now available for other businesses to pick up. I suppose in some cases that's true, but not as true as it used to be. In days past, those customers would be looking for a new vendor. These days, most of those customers no longer exist. They were lost to the global supply chain, big-box distribution or some other source that took them out of the rebuilders' market. Bottom line is this … If you lose a customer in your traditional market, there's a pretty good chance that there may not be one to take their place. That's why shops are failing at the rate they are.

I got involved with Polly and The Exchange somewhere between 1994 and 1996 at one of her trade shows. I suppose the exact date isn't really important here. Yet, this I can tell you, the ball game was a whole lot different than it is now. We had a whole host of suppliers, many of which manufactured or remanned their own product lines. A lot of those guys no longer exist today. The Rebuilder's Exchange used to be mailed out to over 13,000 companies. Today, that number has diminished to less than 5800.

Friends, for reasons that have been discussed in this paper for years, our industry has dramatically shrunk and continues to do so.

I was recently informed that our small yet beloved publication has to modify and downsize to survive. This issue will be the last in its traditional newspaper format. It is also the last issue to be mailed out free to non-ERA members. As in most things in life, all good things come to an end, and the free subscription has ended, because it has to.

For the suppliers who continue to advertise, your commitment to the industry and the ERA is admirable, and we all thank you. The future of this publication wouldn't be possible without you.

The New Exchange will be a more compact and affordable way to keep us all connected. You will find it is just as valuable and probably more so, as we all try to plow through a confusing future in our little industry.

This is no time to sell yourself short. If you haven't done so in the past, now is the time to join the ERA. Keep in mind that knowledge and information is power, and we're going to need all that we can get. The ERA is the only place that it's readily available for a token membership fee. Hope to see you all in the future! Let us all make a commitment to ensure that our little publication is there with us. Thanks in advance for your support!

God Bless our little industry.

Rob Buksar is the owner of Hoosier Electric Co., Gary, Indiana

ERA

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Chrysler Charging Systems
1961–1987

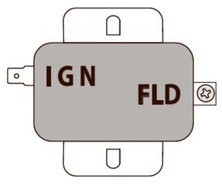
BY WES GRUENINGER, SR.

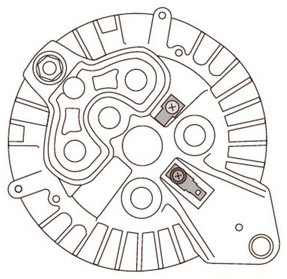
Chrysler was one of the first automakers to use alternators. They made the complete switch from generators to alternators in 1961. This first system used a single field-terminal alternator with an external mechanical B-circuit voltage regulator, and it remained unchanged until 1970. In 1970, Chrysler changed to a dual field-terminal alternator with an external electronic A-circuit voltage regulator. This system was used until the mid-1980s when the voltage regulator was moved inside the engine's electronic control module.

There are two "oddball" variations that were used by Chrysler during that time span. The first was the 1969 Imperial, which had an alternator and voltage regulator that fit only that one year and model. The second was introduced in 1974 on cars that were fitted with the large case 100-amp Chrysler alternator. A special *Field and Load relay* was installed for those applications to remove the accessories' electrical load and the alternator's mechanical load from the engine while the starter was cranking.

This guide is divided into the subsections shown to the right:

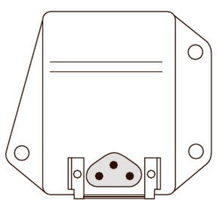
(See CHRYSLER, pg. 6)

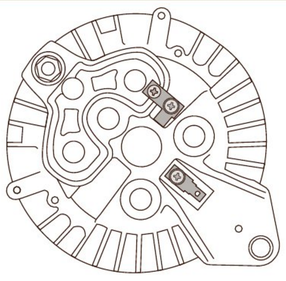




1961-1969 SINGLE FIELD-TERMINAL

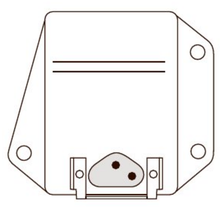
- One spade-connector field terminal on alternator.
- Voltage regulator is mechanical (not solid state).
- Use section **1961-1969 ONE FIELD-TERMINAL**

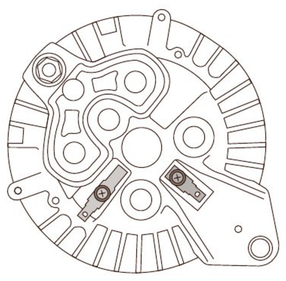




1969 IMPERIAL

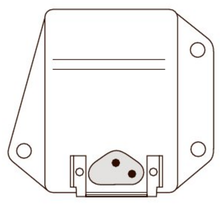
- One spade-connector field terminal on alternator.
- Voltage regulator is solid state with ***three*** terminals
- Use section **1969 IMPERIAL ONLY**

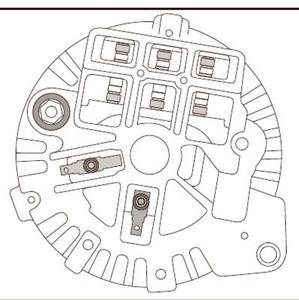




1970-1971 TWO FIELD-TERMINAL

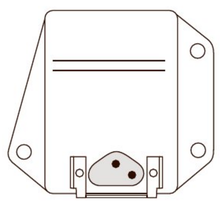
- Two spade-connector field terminals on alternator.
- Voltage regulator is solid state with ***two*** terminals
- Use section **1970-1987 TWO FIELD-TERMINAL**

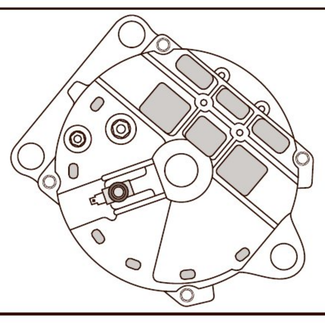




1972-1987 TWO FIELD-TERMINAL

- Two spade-connector field terminals on alternator.
- Voltage regulator is solid state with ***two*** terminals
- Use section **1970-1987 TWO FIELD-TERMINAL**





1974-1987 TWO FIELD-TERMINAL LARGE-CASE

- Two spade-connector field terminals on alternator.
- Voltage regulator is solid state with ***two*** terminals
- Some vehicles use a ***Field and Load relay*** (1974-1976)
- Use section **1970-1987 TWO FIELD-TERMINAL**

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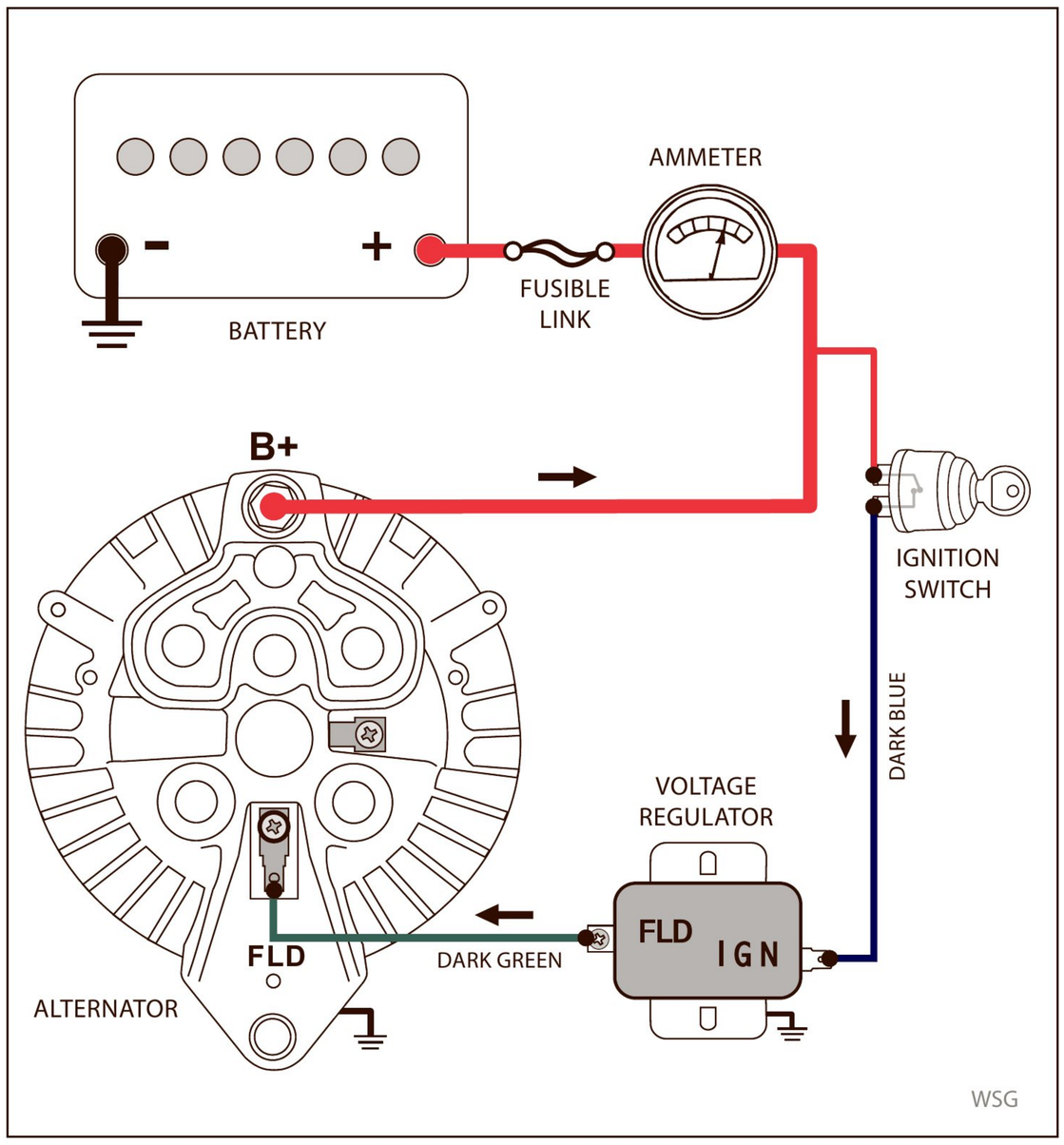

Figure 1—1961–1969 Charging System

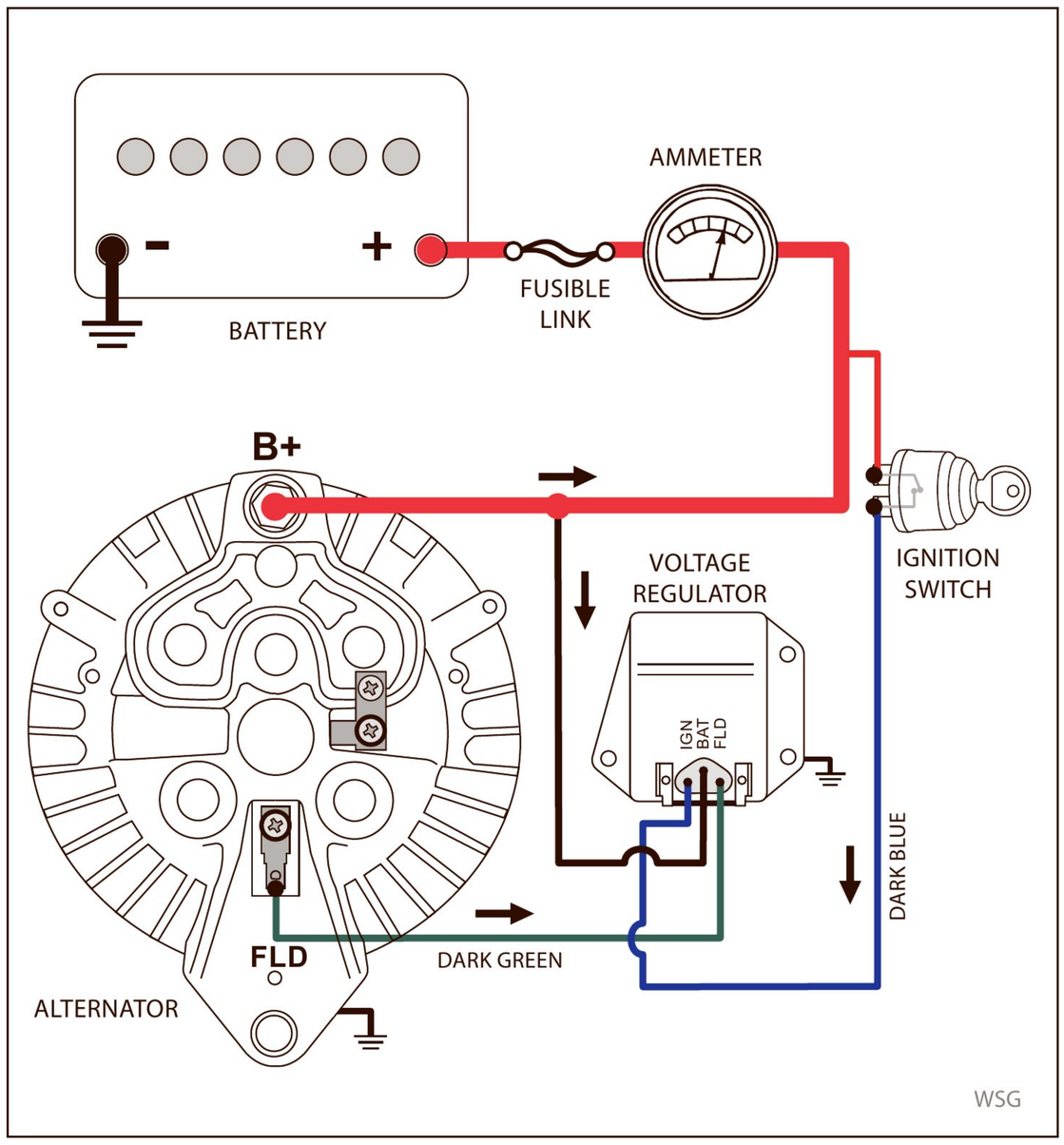

Figure 2—1969 Imperial only

1961-1969 SINGLE FIELD-TERMINAL ALTERNATORS

How it works:

With the engine running, current flows from the battery ⇨ through the fusible link ⇨ through the ammeter ⇨ through the ignition switch ⇨ to the voltage regulator IGN terminal. The voltage regulator controls alternator charging by varying the current it sends to the alternator FLD terminal.

When the alternator is charging, current flows from the alternator B+ terminal ⇨ through the ammeter ⇨ through the fusible link ⇨ to the battery positive terminal.

How to test and repair:

1. Remove the IGN connector from the voltage regulator. With the key on and the engine off, test for battery voltage at the wire that goes to the voltage regulator IGN terminal. If no voltage or low voltage is found, check the wiring, fuse, or fusible link and repair as needed. Reconnect the wire to the voltage regulator IGN terminal.
2. The voltage regulator must be properly grounded. Inspect the screws and body area where it mounts and restore to bright metal connection. Remove the FLD wire from the voltage regulator. With the key on and the engine off, test for battery voltage at the voltage regulator FLD terminal. If no voltage is found, the voltage regulator is bad and must be replaced. If the regulator is bad, read the section at the end of this guide titled ROTOR WARNING.
3. Remove the belt from the alternator. Remove both the FLD and the IGN wires from the voltage regulator. Connect the two wires removed from the voltage regulator together. With the key on and the engine off, place the flat blade of a screwdriver against the rear bearing of the alternator. If the alternator field circuit is good, you will feel a magnetic pull on the screwdriver. Slowly turn the pulley while performing this test. If the magnetic pull goes on and off while turning the pulley, or if there is no magnetic pull, the alternator is bad and must be replaced.
4. Test for battery voltage at the alternator B+ terminal. If low or no voltage, check the positive battery cable, the fusible link (some early cars do not have fusible links), and the ammeter. Many of the 1960s cars use a direct-style ammeter. This style ammeter passes all the charging current through the meter. It is common for this circuit to go "open" and not allow any current flow. The primary problem areas are where the circuit passes through the firewall connector and where the wires are attached to the studs on the ammeter on the back of the instrument cluster. This circuit was not designed to handle any more than 60 amps, and then only for a short period of time. Recharging a low battery after a jump start, especially with a high amp alternator, will cause these connection points to overheat and fail.
5. Reconnect all wires and perform the Charging System Test described at the end of this guide.

1969 IMPERIAL ONLY

How it works:

Field current is supplied to the rotor from a jumper strap connected from the positive rectifier to the brush shown in the 3:00 position in Figure 2.

With the engine running, current flows from the battery ⇨ through the fusible link ⇨ through the ammeter ⇨ through the ignition switch ⇨ to the voltage regulator IGN terminal. The voltage regulator controls alternator charging by grounding the current sent to it from the alternator FLD terminal.

When the alternator is charging, current flows from the alternator B+ terminal ⇨ through the ammeter ⇨ through the fusible link ⇨ to the battery positive terminal.

How to test and repair:

1. Start by doing these tests in the order below:
2. Test for battery voltage at the alternator B+ terminal. If low or no voltage, check the positive battery cable and the fusible link (some early cars do not have fusible links).
3. Disconnect the plug from the voltage regulator. With the key on and the engine off, test for battery voltage at the voltage regulator plug IGN and BAT terminals. If no voltage or low voltage is found, check the wiring, fuse, or fusible link and repair as needed.
4. With the plug still disconnected from the voltage regulator, remove the belt from the alternator. Using a jumper wire, connect the FLD wire of the voltage regulator plug (usually dark green) to ground. With the key on and the engine off, place the flat blade of a screwdriver against the rear bearing of the alternator. If the alternator field circuit is good, you will feel a magnetic pull on the screwdriver. Slowly turn the pulley while performing this test. If the magnetic pull goes on and off while turning the pulley, or if there is no magnetic pull, the alternator is bad and must be replaced. Reconnect the plug to the voltage regulator.
5. The voltage regulator must be properly grounded. Inspect the screws and body area where it mounts and remove any corrosion.
6. Perform the Charging System Test described at the end of this guide.

(See CHRYSLER, pg. 16)



1969 Chrysler Imperial

Leece-Neville 2500JB

Converting to external sense for use with battery isolator

BY BOB THOMAS

When installing a second battery and battery isolator into a charging system, be aware that some alternators require special consideration. The diodes in the isolator allow voltage to flow from the alternator to the batteries but not in reverse. When the alternator is not operating, there will be no voltage on the B+ terminal. Most alternators being manufactured today, and many of those from the past, require voltage on the B+ before they can turn on. The Leece-Neville JB series is among them. External sensing from one of the batteries is required for these alternators to operate with an isolator.

Leece-Neville solved this problem years ago by way of what they named the Duvac Charging System. It basically just moved the voltage regulator's red sense wire from the positive rectifier to an external sense terminal that was added to the a special brush holder. Most Duvac alternators also used an ignition terminal for excitation. Any

(See DUVAC, pg. 13)

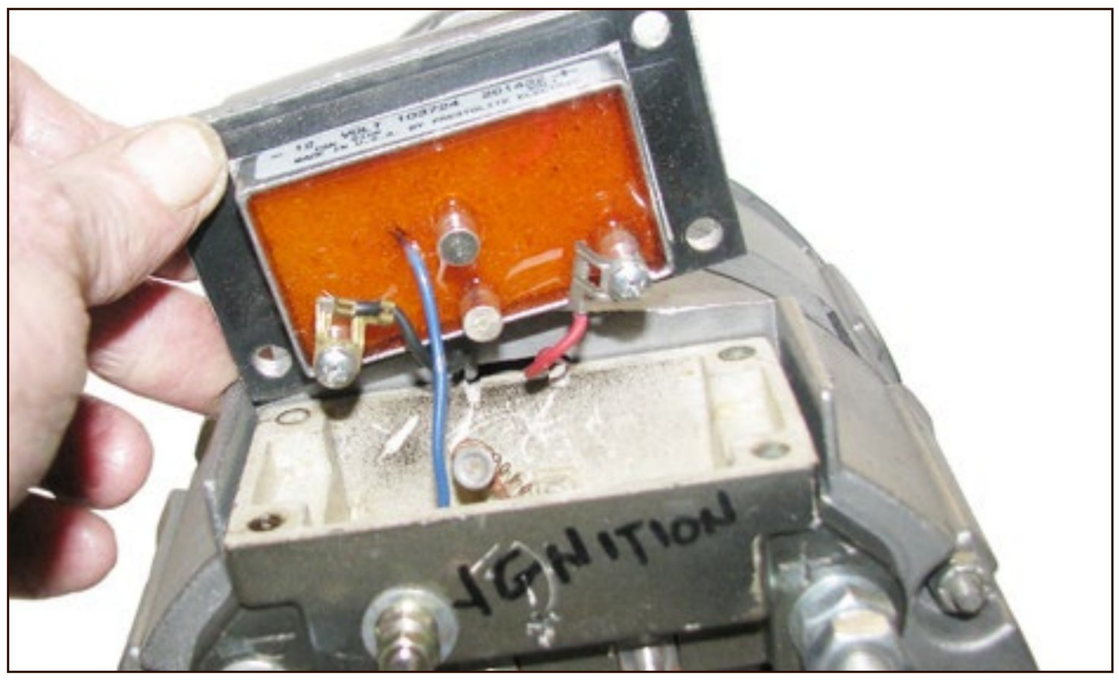

Figure 2—The removal of the regulator allows access to the connections.

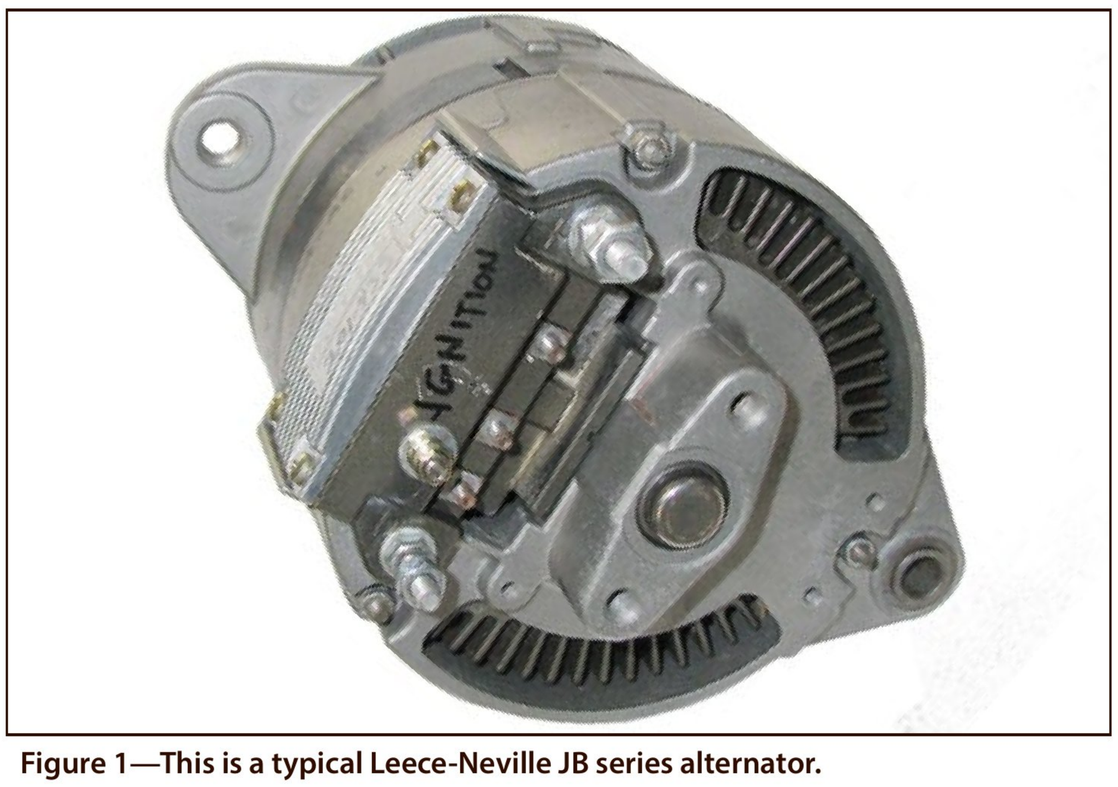

Figure 1—This is a typical Leece-Neville JB series alternator.

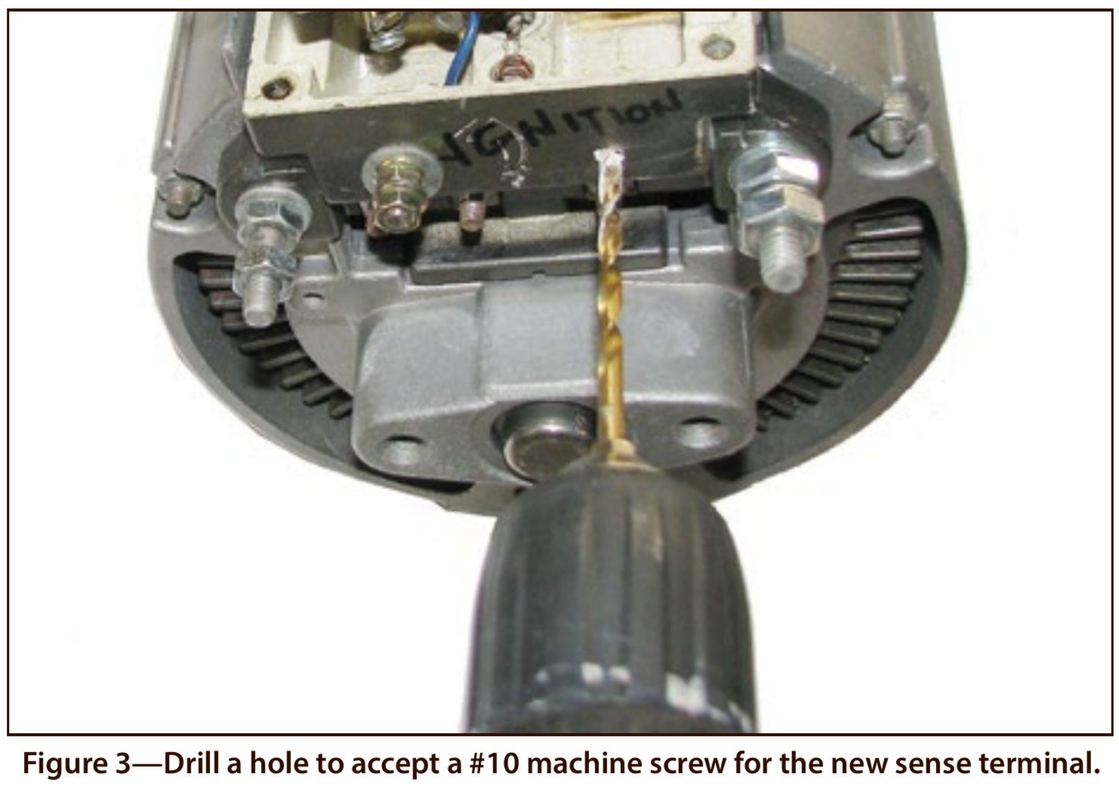

Figure 3—Drill a hole to accept a #10 machine screw for the new sense terminal.

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Tech Tip
Installing Delco external shift lever springs

BOB THOMAS

While Delco starters of the 1950s are not exactly fast movers, these cars now have true antique status, and nearly every rebuilding shop runs into one of them at least once or twice a year. I have seen my fair share of them, and I always seem to waste a lot of time getting the spring, shift lever, drive-end housing and spring bolt back together quickly.

Recently, I found myself re-assembling and struggling with one of these starters yet again. I decided to find a better way, and here is how I suspect this one was assembled when it was put together on an assembly line in 1952. The entire process took only a few seconds once I discovered this efficient procedure.

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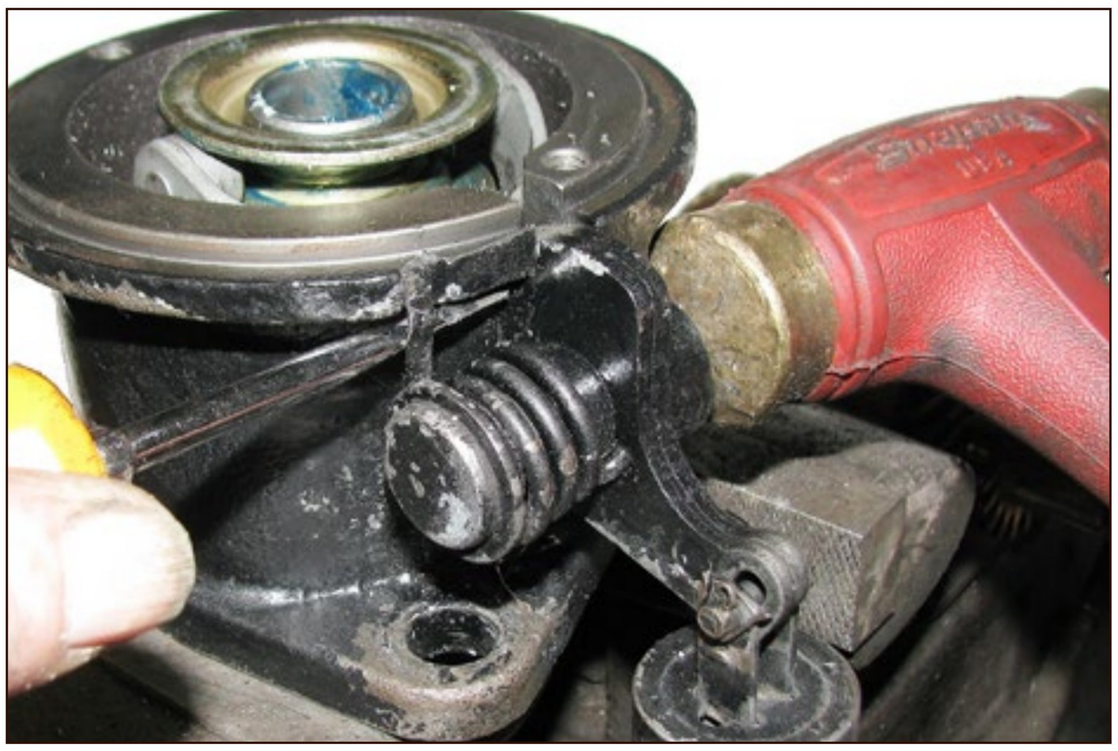

Figure 1—This is the quick method for removing the shift lever and spring during disassembly. It requires a hammer and screwdriver after the locking nut has been removed from the back side.



Figure 2—The first step in re-assembly is to position the shift lever and spring. The openings for the bolt through the spring, shift lever and housing will not be lined up. That is not as important as you might think it is.



Figure 3—Push the bolt through the spring and shift lever, which requires slight pressure on the shift lever with your right hand. The hole in the housing is still misaligned, but no need to worry.



Figure 4—Give the bolt a hands-free soft tap with the hammer.

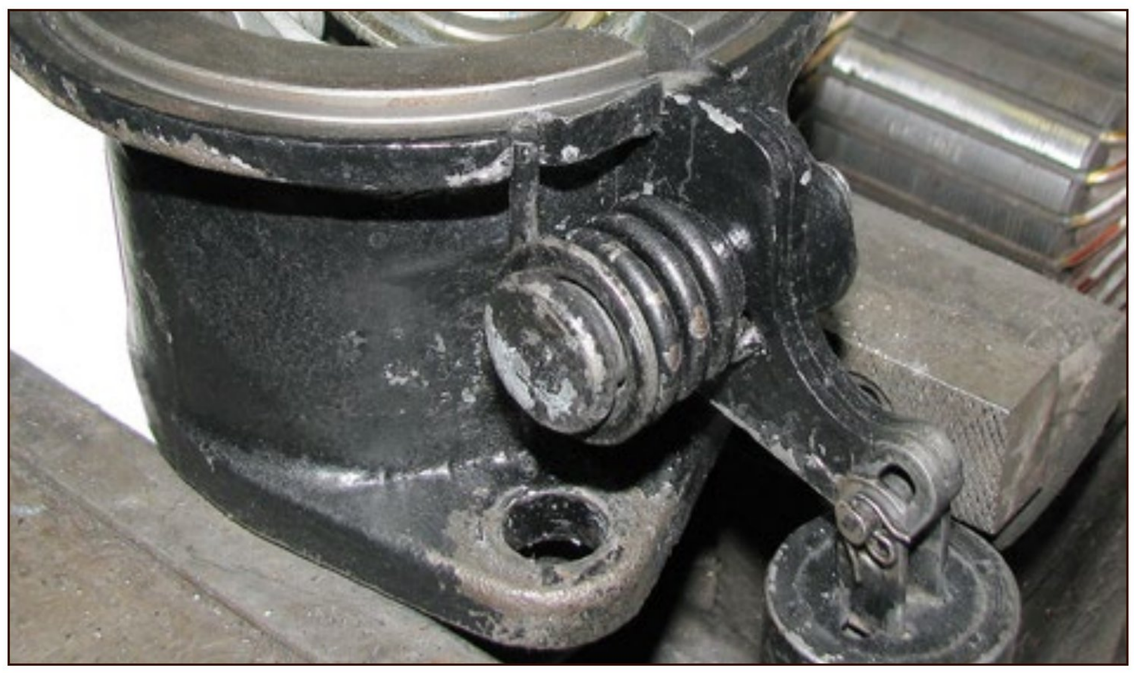

Figure 5—It slides right in place. All that is left now is to attach the nut on the other side and tighten it.



Just The Facts
Avalanche diodes vs. Zener diodes

BY BOB THOMAS

The terms, "avalanche diode" and "Zener diode" have been confused at times and even interchanged in error. Although they are similar in what they do, they are also very different in several ways. We will attempt to explain those differences along with where and why each diode is used in alternators today.

Like the standard diodes that rectify alternating current in many devices, including alternators and battery chargers, avalanche and Zener diodes allow current to flow in the forward direction while blocking current in the reverse direction. What differentiates them from the more common diode, is a phenomenon known as ***reverse voltage breakdown***. At breakdown, current is allowed to flow in the reverse direction in both the Zener and the avalanche diode. So in that way, they are the same.

To understand the key difference between the two, you have to understand that all diodes, no matter what kind they are, have some reverse-bias leakage—a minimal amount of reverse current that is always present. This very small leakage is normal and measures no more than a few milliamperes or less. But, in the case of Zener and avalanche diodes, once breakdown voltage is reached, the diode goes full reverse-bias, allowing current to flow in the reverse direction.

Zener and avalanche diodes are manufactured in exactly the same way as standard diodes, by exposing the crystalline silicon to certain impurities during a process called doping. The impurities, or elements used during doping, are the same for standard, Zener and avalanche diodes. However the ***level of doping*** is altered when making a Zener or an avalanche diode. This seemingly small alteration in the process changes the reverse-bias characteristics.

In the case of avalanche diodes, doping is lighter. Doping density is used to control breakdown voltage. An avalanche diode can be doped to reach breakdown at high voltage levels and can carry higher current flow in reverse-bias than a Zener diode. These characteristics make it ideal to clamp or suppress large sudden increases in voltage without damage to the diode. That is why they are now used in many alternators for specific applications where additional suppression is needed.

We note here that using a rectifier with avalanche diodes in an alternator or application that did not originally have them, will not affect performance or reliability in any way. However, substituting a rectifier with standard diodes in an application that originally had avalanche diodes, could cause damage to a vehicle's electronic components that are were being protected by the avalanche diodes in the original alternator. That could result in an angry customer or much worse.

In the manufacture of Zener diodes, doping is heavier. Again, doping density is used to control the breakdown voltage. Zener diodes reach breakdown and perform better at lower voltages and typically cannot handle high current flow in reverse-bias. In the case of Zener diodes, current must be limited. They can be used to suppress sudden changes in voltage as long as current is controlled, such as the discharge from a coil in a single small relay. However, because the Zener diodes work best at lower voltage, they are ideal for voltage reference and control in electronic circuits. You might say that the Zener diode is what made electronic voltage regulators possible.

Neither Zener nor avalanche diode breakdown is destructive to the diode's primary purpose. That is, they are not damaged from being reverse-biased. However, the heat generated by high current can cause damage, so either the current must be limited, and/or adequate heat sinking must be used. In the case of avalanche diodes used in rectifiers, the heat sinking is sufficient.

In addition, it is worth knowing that all diodes block any current flow below 0.6 volts, and current is allowed to flow freely above 0.7 volts. Therefore, a voltage drop occurs across all diodes and accounts for most of the heat generated by the rectification process.

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Tech Tip
Chrysler external voltage regulators

BY BOB THOMAS

As pointed out in the article on page five, the mechanical B-circuit voltage regulators (*see Figure 1*) that were originally used with Chrysler's first alternator from 1961 to 1969 are unable to handle field-current loads over 3 amps. Normal rotor field-current draw for a Chrysler single-field alternator with a mechanical regulator is 2.3 to 2.7 amps. Checking and verifying rotor amperage draw is vital when rebuilding one of these alternators. Rotors that require higher amperage will damage mechanical regulators.

Note also, that electronic versions of the B-circuit regulator are able to handle higher field current. Electronic replacement regulators have been readily available in the aftermarket for many years now and can be easily identified by their lighter weight. Mechanical regulators are heavier, because of the relay which has an iron core. Mechanical regulators also require wire-wound resistors that are usually visible on the bottom the regulator (*see Figure 2*).

If a rotor from a later model year alternator is substituted, it is very likely that it will cause trouble with a mechanical regulator, and problems may not surface immediately. While many of those later rotors had the same physical dimensions, the coils in them have significantly lower resistance, and their field draw is higher than a mechanical regulator can withstand. Field draw on some later Chrysler alternators can be as high as 7 amps, nearly three times what

(See REGULATORS, pg. 14)

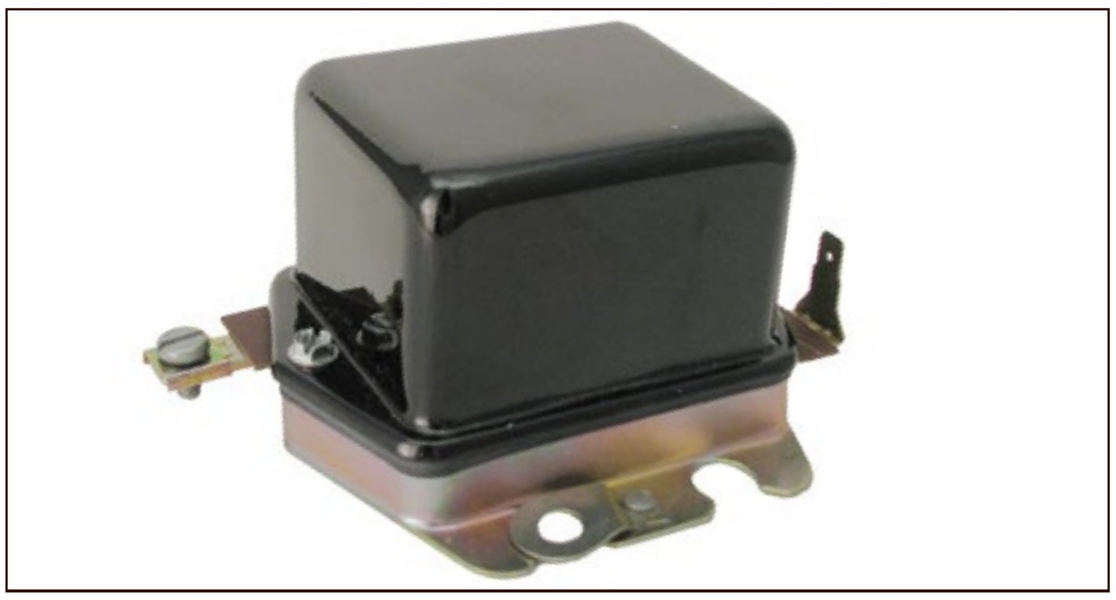

Figure 1—Chrysler mechanical voltage regulator 1961–1969

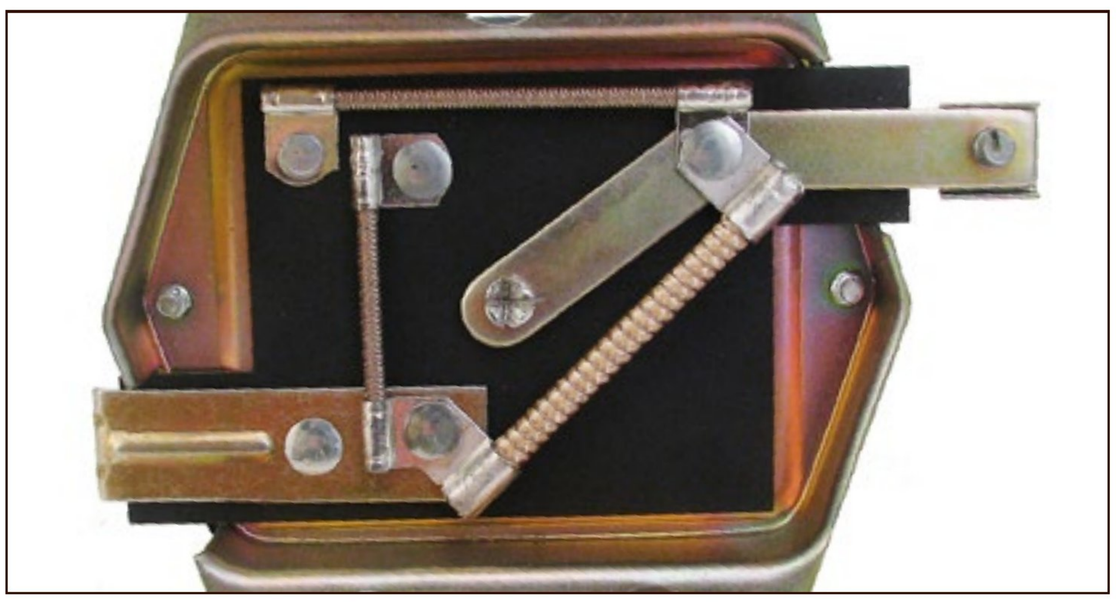

Figure 2—Resistors verify that this regulator is mechanical.

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Seminar—12:30 to 2:30 p.m., Dan Marinucci—*"Battery Drain Test Tips You Should Know"*

Seminar—3 to 4 p.m., Chris Walters, Lester Catalog—*"Internet Marketing 101"*

Reception*—4 to 5 p.m., Pizza Buffet and Cash Bar

EXHIBITION—5 to 8 p.m.

Saturday , March 14

Seminar—7:30 to 9:30 a.m., Joe Davis—*"Understanding Generator Charging Systems"*

Seminar—9:30 to 11a.m., Rich Malin, Standard Magneto—*"Introduction to Rebuilding Magnetos"*

EXHIBITION—11a.m. to 4 p.m.

Rebuilder's Roundtable—4 to 6 p.m., Alan Melton leads an open discussion about rebuilding topics, moderated by a panel of industry veterans.

Sunday , March 15

ERA Annual Meeting/Breakfast —7 to 8:45 a.m.

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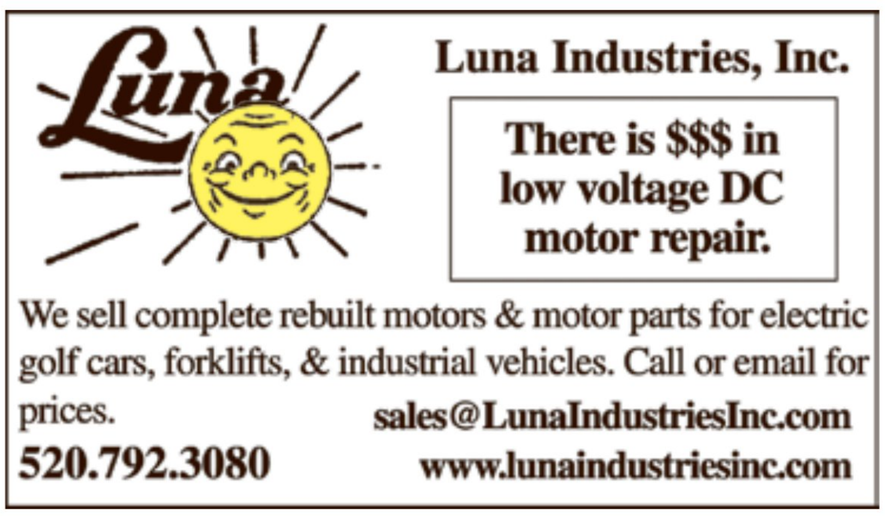

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Vehicle History
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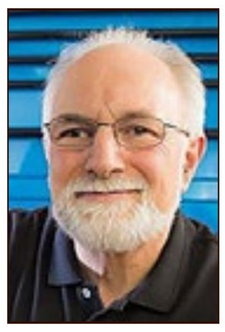

An accurate vehicle history may be the most valuable part of any battery drain diagnosis. Don't overlook or undervalue vehicle history, because it's often the key to a profitable job.

Suppose your business performs retail electrical service. Or perhaps it does on-vehicle electrical diagnosis as a subcontractor to other businesses, such as general repair shops, tire dealers and new-car dealers.

Next, suppose that you must diagnose a vehicle on which the battery dies repeatedly. That is, the battery discharges ("goes flat") after the vehicle sits for some period of time. This time period could be anything from overnight to a week or more. Whenever a battery continues to go dead, it's very tempting to leap to a variety of conclusions.

However, experience shows that gathering an accurate vehicle history may spell the difference between a straightforward, profitable job and an automotive nightmare. What's more, my field experience has been that gleaning vehicle history is anything but a foregone conclusion. Too often, it seems, installer technicians and auto electricians don't gather vehicle history until they're mired in a sticky, unprofitable diagnosis.

Some savvy shop managers have created customer questionnaires. Their rule is that they don't touch a vehicle with a battery-drain issue until they've got some kind of vehicle history written down. The sooner they receive it, the better. The more detailed the history, the better. Mind you, it doesn't matter if the car owner leaves the vehicle or someone from another shop leaves the vehicle—***someone*** has to deliver the history. Today, you have the advantage of facsimile machines and email. So, there's more than one way to deliver vehicle history to you.

Yes, we live in a fast-paced society. But time is money—it always has been. It's easy for someone to complain that they don't have time for questionnaires.



Figure 1—In today's world, a battery's reserve capacity (RC) is more important than the cold cranking amperage (CCA) rating. Reserve capacity represents the number of minutes a fully charged battery at 80°F can sustain a 25-amp discharge before dropping below 10.5 volts.

But once again, experience shows that a vehicle owner can commit the time to a vehicle history now, or pay the consequences later with an unnecessarily difficult diagnosis.

WHERE HUMAN HANDS TOUCHED

OK, suppose the customer provides some kind of vehicle history. To me, the first thing to consider is this: Where did human hands last touch this vehicle? One of my favorite examples is a Mitsubishi Eclipse on which the battery continued discharging. A repair shop had tried two new batteries. Later, its crew tried two different brands of alternators. But if the car wasn't run for a day or two, the battery died.

I had presented some electrical seminars in that area for a local jobber. A frustrated sales manager at the jobber store telephoned me about the car. I urged him to begin at the beginning with a careful visual inspection. Look for signs that someone touched the car. Then, inspect that spot closely.

Lo and behold, the salesman found a ball of fresh wiring tucked into one corner of the engine compartment. The owner of the Eclipse never mentioned that someone had installed a security system on the car recently. What's more, the fellows at the repair shop didn't notice the system, either. If they saw this unusual ball of wire, they ignored it. The battery drain problem began ***after*** the security system installation.

The salesman carefully disconnected the power supply wire to this burglar alarm. Then the shop owner instructed the customer to drive the car for the rest of the week. The battery drain problem disappeared! Later on, the Eclipse owner exchanged the defective security system for a new one. Then everyone lived happily ever after.

Unfortunately for that repair shop, the job devoured hours and hours of time that the guys would never recoup. Worse yet, they needlessly swapped a bunch of parts.

A CHANGE IN VEHICLE USAGE

Here's one more example of how vehicle history can point you to a quicker diagnosis. A vehicle comes into your facility. The car owner complains that the battery went dead when he parked the car—even though the battery's only several weeks old. Meanwhile, someone at the retail store where he purchased the battery, tested it. He claimed that battery tested good.

OK, the last place human hands touched here was replacing the battery. Closer inspection—reading the battery's label—revealed that the battery had inadequate reserve capacity (commonly abbreviated RC). The inadequate RC wasn't an issue as long as Dad was driving the car every day as he normally did.

Truth be told, the only time the battery died was when his daughter borrowed the car. She was attending a week-long conference and had to park the car at the airport. To cut to the chase, the battery's inadequate RC couldn't keep the battery alive for six straight days inside an airport parking garage.

I'll be discussing battery drain diagnostic tips during my seminar on Friday afternoon, March 13th at the ERA Show. I hope to see you there!

Dan Marinucci, a former automotive technician who is ASE certified, is a regular contributor to trade journals such as Motor and Tire Center.

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DUVAC

(Continued from page 7)

JB Series alternator (*see Figure 1*) can be easily converted to operate with an isolator without disassembly by simply adding a sense terminal and moving the regulator sense to it, as shown in the series of photos.

The first step in the conversion is removing the regulator's mounting screws (*see Figure 2*) and disconnecting the red B+ wire from the regulator. If the alternator is already disassembled, you can disconnect it from the rectifier too. If not, you can cover the end of the conductor and move it away from the regulator inside the confines of the brush holder.

Drill a hole to accept a #10 machine screw as shown (*see Figure 3*). The hole must be located so that it does not interfere with the brushes. The alternator we are converting here was already ignition-activated. We drilled the new sense terminal hole at a position that was the same distance from the brushes as the IGN terminal, but on the opposite side.

We then removed the red wire from the regulator, covered the end with electrical tape and tucked it out of the way. Then we replaced it with a new sense wire (white in the photo) that was connected to the new sense terminal (*see Figure 4*).

After replacing the regulator, be sure to label both terminals (*see Figure 5*) to avoid confusion during installation.

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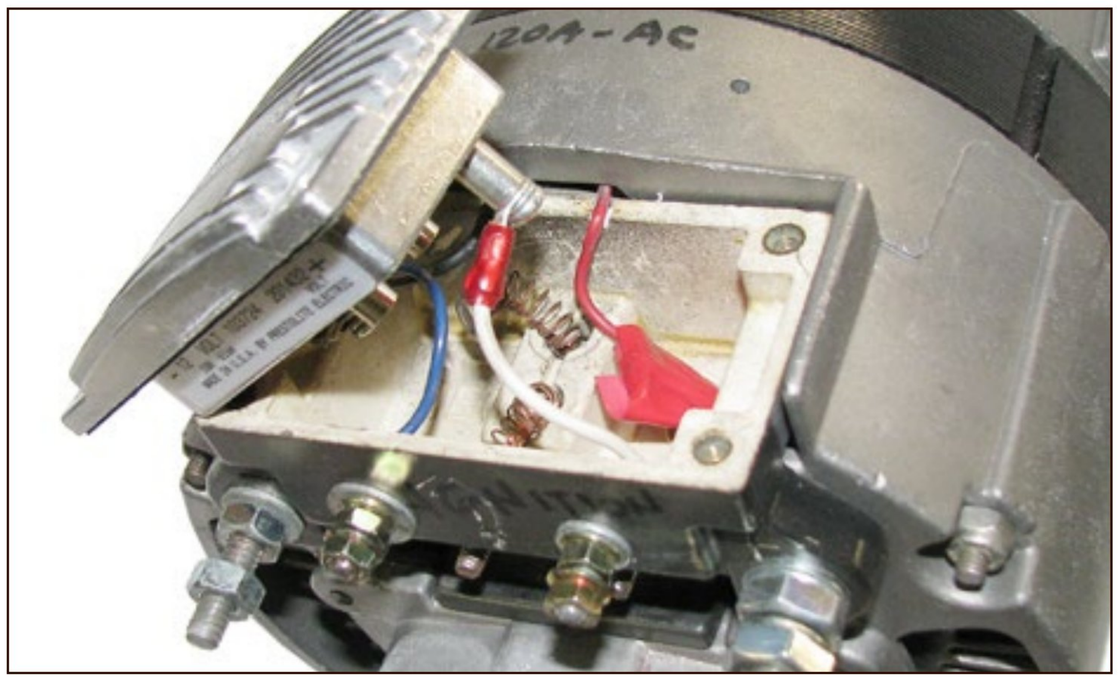

Figure 4—Install the sense terminal with new lead wire to connect to regulator.



Figure 5—Label the terminals to ensure correct installation.

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REGULATORS

(Continued from page 9)

would be normal draw for a mechanical regulator.

If you happen to encounter a Chrysler vehicle from the 1960s with a failed regulator, you should carefully examine and test both the rotor and the regulator. With the cover removed, notice that this mechanical regulator has a small wire connecting the ignition terminal to the relay (*see Figure 3*). That wire is actually a fuse link. It is there to protect the ignition circuit in the event that the rotor shorts internally to ground. In the original Chrysler regulators, this fuse link was even smaller and more sensitive. Chrysler, like most manufacturers of the 1960s, did not run their ignition circuit through a fuse.

If you find that the regulator's fuse link has burned in two, then the field draw was excessive, or the rotor, brush or field terminal were very likely shorted to ground in the alternator. That fuse link can be repaired or replaced with the same size and length fuse link. The fuse link in the original Chrysler regulators, for these applications, had a smaller more sensitive fuse link wire than our example. Some aftermarket mechanical regulators have since substituted a glass or plastic fuse for the fuse link. Installing a fuse in place of a burned fuse link is another option for repairing a mechanical regulator of this type.

High amperage draw from the

(See REGULATORS, pg. 19)

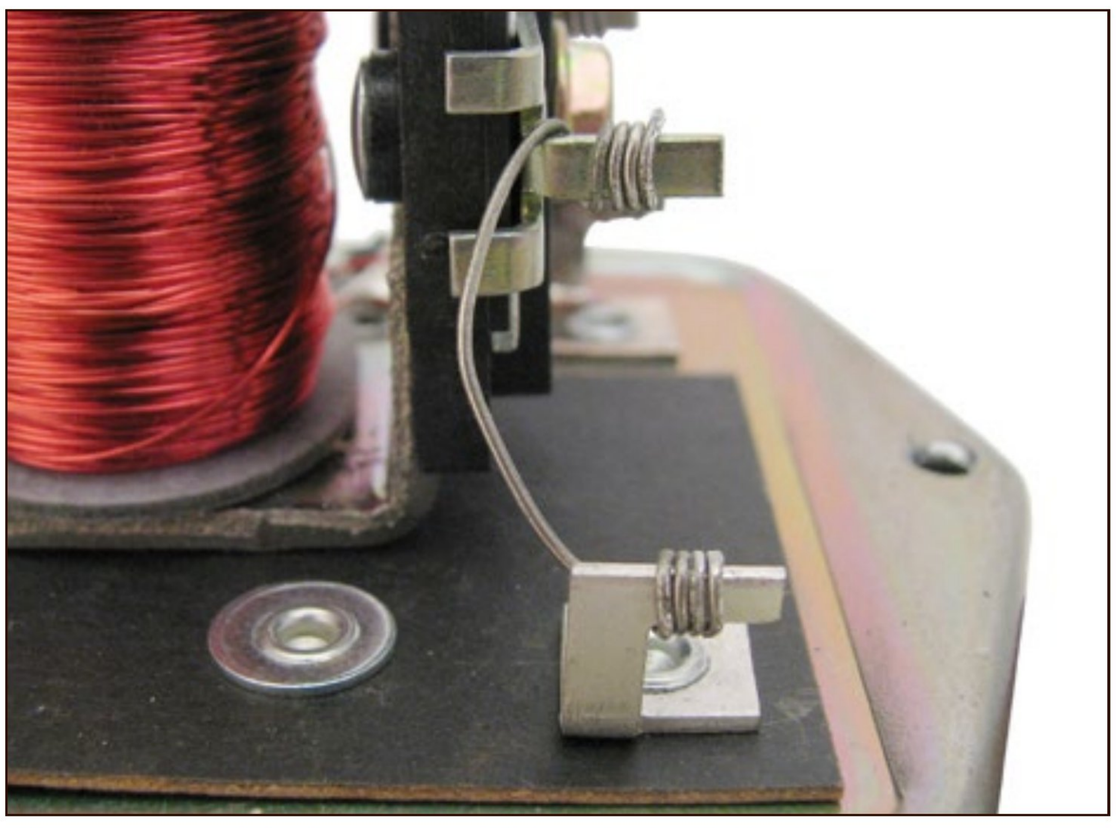

Figure 3—Fuse link wire connects IGN terminal to field relay.

What Happened Here?

The blue commutator

BY ERA STAFF

This armature was removed from a new aftermarket Valeo starter that was on the vehicle for a few days. The customer complained that it cranked slowly when it was first installed, but it did start the engine. After two days, it suddenly quit working altogether.

What made this armature crank slowly and quit working? What is that blue stuff? Are the two related?

Nobody supplied the correct answer as this edition was sent to the printer.

Answer: This blue coating appears to be "marking blue" that is commonly used in machine work. It serves as a highly visible means of identifying what metal surface has been machined. If applied to an unfinished commutator, it would show what area has not been cut. How it got on this commutator and into a new starter is anyone's guess. It is possible that this armature was not completely finished before it was installed. Marking blue is comprised of methylated spirits, shellac and gentian violet. When marking blue dries, the methylated spirits evaporate, and a very thin coat of violet-tinted shellac remains. Shellac is an insulator.

You can see that some of the bars on this commutator are not blue, and those bars show no sign of arcing. However, the bars that have the blue on them show that significant arcing was taking place. It appears that the "blue" was the cause of the customer's cranking problem.

Polishing the commutator to remove the marking blue and all of the arcing marks, restored this starter to perfect working condition. The big question



that remains unanswered is, how did this starter produce the performance test results that were recorded on the test sheet put into the boxed with it?

If you think you know the answer to that question, send the editor an email at ere.bobt@gmail.com or call The Exchange editorial office at 386-328-2761. The first correct answer will be acknowledged in the next issue.

Thanks to Patrick Rester at Irwin Auto in Pine Bluff, Arizona for providing the mystery and the photo..

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SHOW

(Continued from page 1)

own.

Another nearby attraction that we failed to mention before is the Iowa 80 Trucking Museum, located just 14 miles from the Clarion Hotel on I-80 west of Davenport. The truck collection was started by Iowa 80 Truckstop founder, Bill Moon, who had a passion for trucks, especially old ones. There are now over 100 antique trucks in the collection with 60 of them on display in the museum. A visit to their website provides just a sample of what you can see. They also have 304 original petroleum signs and 24 vintage fuel pumps. Right next door is the Iowa 80 Truck Stop, the largest truck stop in the world. There, visitors have a choice of places to eat lunch, including the famed Iowa 80 Kitchen.

Of course, the main reason for the Expo is not tours or entertainment. It is the exposition itself and the seminars. You will find a full schedule on page 10, listing the hours that the show floor will be open on both Friday evening and Saturday afternoon. You will also find the list of seminars. Rebuilders can register for the exposition at the door for a nominal charge. Seminar registration is extra and is also available on site.

Not only has the tour sold out early, but the booths have all been filled, too. A complete list of exhibitors can be found underneath the schedule on page ten. Do not forget about the reception on Friday afternoon—a free Pizza Buffet sponsored by the ERA and exhibitors. ERA Expo 2015 is far more than just another trade show. You do not want to miss it.

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(Continued from page 6)

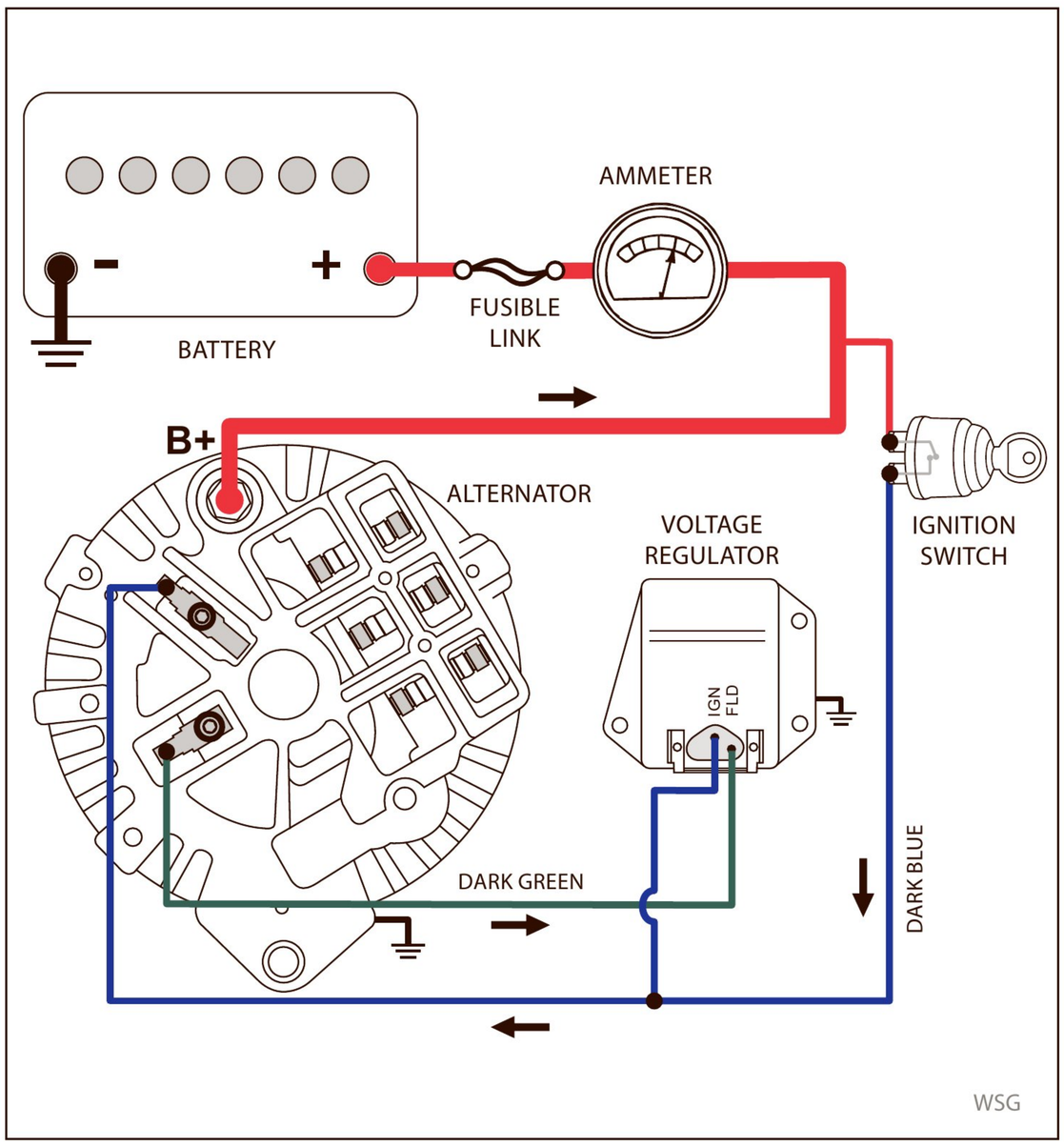
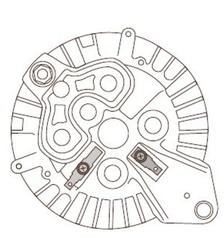


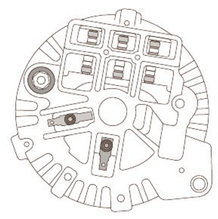
Figure 3—1970–1987 Charging System

1970-1987 TWO FIELD-TERMINAL ALTERNATORS

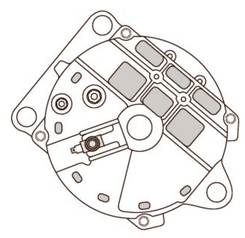
Two field-terminal alternator styles used:



1970–1970



1972–1987



1974–1987

How it works:

With the engine running, current flows from the battery ⇨ through the fusible link ⇨ through the ammeter ⇨ through the ignition switch ⇨ to the voltage regulator IGN terminal. The voltage regulator controls alternator charging by grounding the current sent to it from the alternator FLD terminal.

When the alternator is charging, current flows from the alternator B+ terminal ⇨ through the ammeter ⇨ through the fusible link ⇨ to the battery positive terminal.

How to test and repair:

Start by doing these tests in the order below:

1. Test for battery voltage at the alternator B+ terminal. If low or no voltage, check the positive battery cable and the fusible link (some early cars do not have fusible links).
2. Disconnect the plug from the voltage regulator. With the key on and the engine off, test for battery voltage at the voltage regulator plug IGN terminal. If no voltage or low voltage is found, check the wiring, fuse, or fusible link and repair as needed.
3. With the plug still disconnected from the voltage regulator, remove the belt from the alternator. Using a jumper wire, connect the FLD wire of the voltage regulator plug (usually dark green) to ground. With the key on and the engine off, place the flat blade of a screwdriver against the rear bearing of the alternator. If the alternator field circuit is good, you will feel a magnetic pull on the screwdriver. Slowly turn the pulley while performing this test. If the magnetic pull goes on and off while turning the pulley, or if there is no magnetic pull, the alternator is bad and must be replaced. Reconnect the plug to the voltage regulator.
4. The voltage regulator must be properly grounded. Inspect the screws and body area where it mounts and remove any corrosion.
5. Perform the Charging System Test described at the end of this guide.

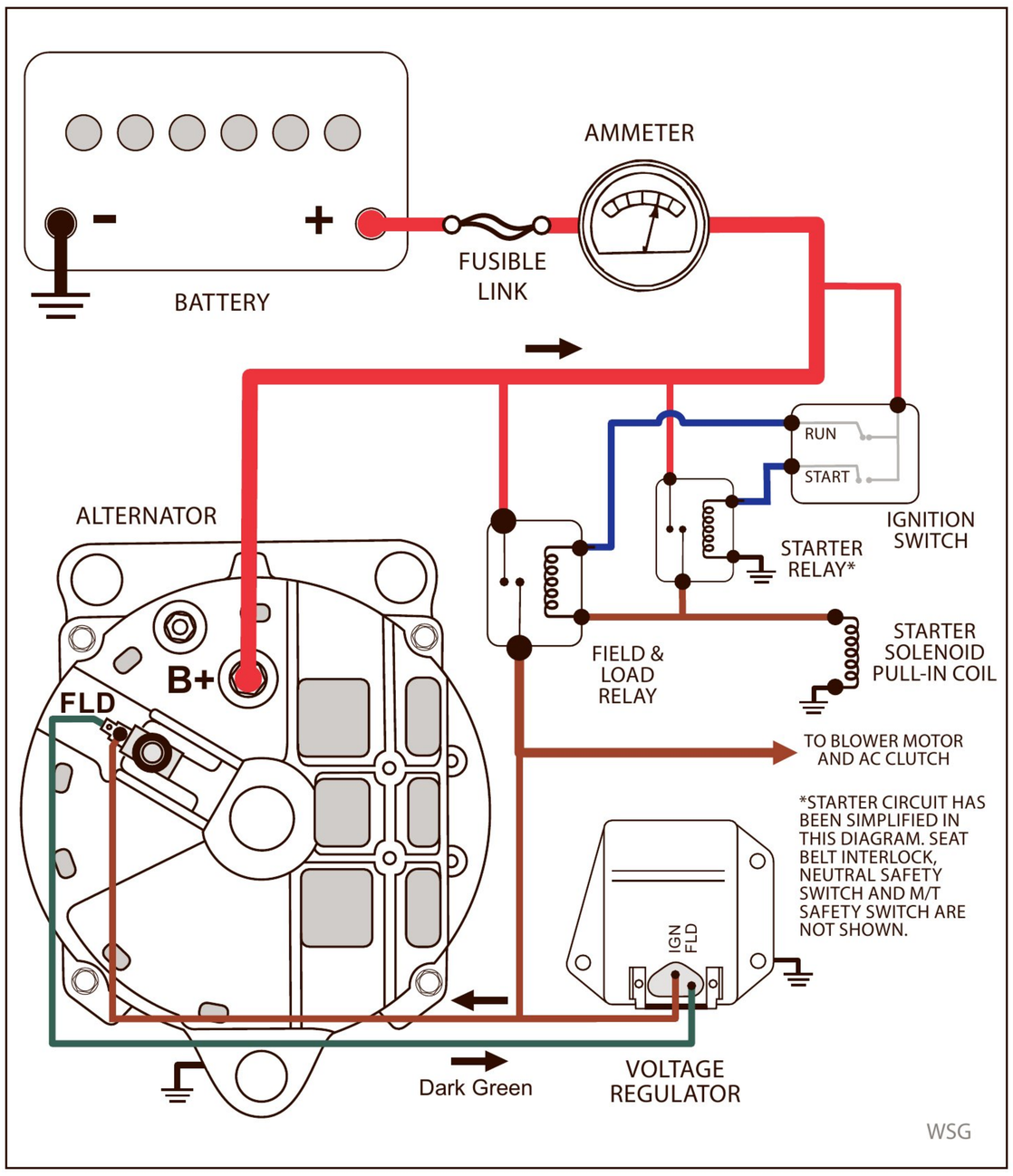


Figure 4—1974–1976 charging system with Field and Load relay

FIELD and LOAD RELAY 1974 to 1976

The Field and Load relay was introduced in 1974 and used only on police vehicles with heavy duty charging systems. In 1975 and 1976 it was used on all vehicles that had the large case 100-amp alternator installed. In 1977 the use of the Field and Load relay was discontinued, although Chrysler still used the large case alternator until 1987.

How it works:

The purpose of the Field and Load relay is to reduce the mechanical and electrical load while the starter is cranking the engine.

When the engine is running the Field and Load relay coil is closed and providing power to the alternator field, the voltage regulator, the blower motor and the air conditioning clutch.

When the ignition switch is turned to the start position, current flows from the ignition switch run terminal one side of the Field and Load relay coil. It also flows from the starter relay S terminal to the other side Field and Load relay coil. Since the same voltage is present on both sides of the Field and Load relay coil, no current can flow and the relay points remain open. This prevents current from flowing to the voltage regulator, alternator field, blower motor and AC clutch.

When the engine has started and the ignition switch is in the run position, current flows from the ignition switch ⇨ through the Field and Load relay coil ⇨ to the starter relay S terminal. It completes the circuit to ground through the starter solenoid pull-in coil. This causes the Field and Load relay points to close and powers up the voltage regulator, alternator field, blower motor and AC clutch.

Other than the use of the Field and Load relay, this system is the same as all other two field-terminal systems. Use section 1970-1987 TWO FIELD-TERMINAL ALTERNATORS to check the wiring and components.

(See CHRYSLER, pg. 18)

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CHRYSLER

(Continued from page 17)

ROTOR WARNING

Alternators produced in the 1960s were designed to be used with mechanical, point-style voltage regulators. These are single field-terminal alternators described in the section 1961-1969 Single Field-Terminal Alternators. The rotor field-coil amperage draw is low—only 2.3 to 2.7 amps. Voltage regulator points cannot handle current above that without arcing and destroying themselves or sticking closed and causing extreme overcharging.

Alternators produced in the 1970s were designed to be used with electronic voltage regulators. These are the two field-terminal alternators described in the section 1970-1987 Two Field-Terminal Alternators. The rotor amperage draw is much higher than the 1960s rotors—some are as high as 7 amps. The transistors in the electronic voltage regulators are able to handle much higher current flow than points could.

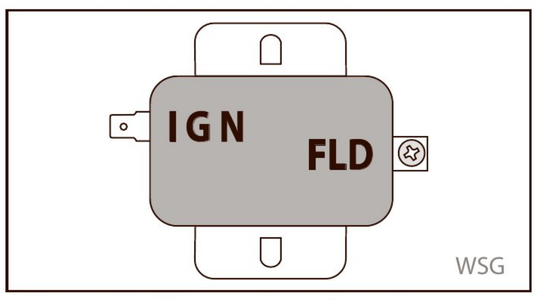


Figure 1—The early style voltage regulator used from 1961–1969 has mechanical points. Maximum rotor amps: 2.7

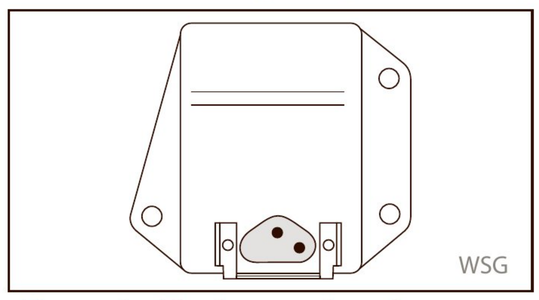
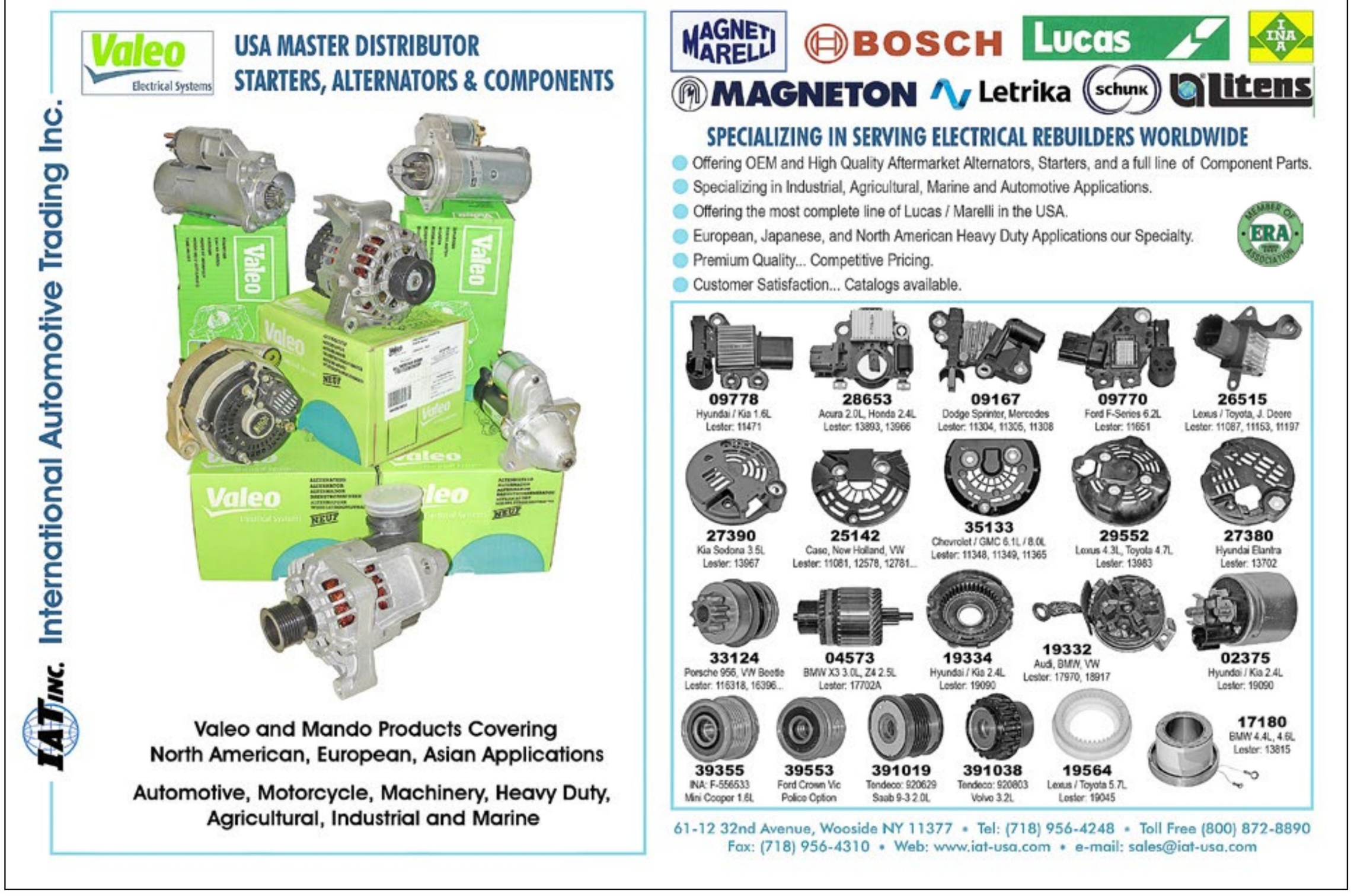


Figure 1—The later style voltage regulator used from 1970–1987 is electronic. Maximum rotor amps: 7.0

If you install an alternator with a high-amp rotor on a vehicle with a mechanical point-style voltage regulator, the voltage regulator will fail in a very short time. Some alternator remanufacturers sell only the 1970-1980 two field-terminal alternators with high-amp rotors. They include hardware and instructions on how to convert the two field-terminal alternator to a single field-terminal alternator. We do not recommend doing this, as it is sure to cause voltage regulator problems. If you have a 1960s car that keeps going through voltage regulators, rotor amperage draw is the place to start looking. The best way to determine rotor amperage draw is to remove the alternator and have it bench tested.

Today, electronic versions of the early Chrysler B-circuit regulators are readily available and can be used reliably with the high-amp rotors.

(See CHRYSLER, pg. 19)



CHRYSLER

(Continued from page 18)

CHARGING SYSTEM TEST

At this point you have verified all the wiring and connections for the system you are checking.

The battery must be fully charged and load tested. The engine must be off. Be sure the alternator belt is properly tensioned. Connect the negative lead of a voltmeter to the negative battery post and the positive voltmeter lead to the positive battery post. Write down this reading—it will be referred to as base voltage. Do both of the following tests:

LOAD TEST: Start the engine. Turn the headlights on and the heater/AC motor to high. Increase engine speed to 2000 rpm. Check the voltage across the battery terminals. See chart for results.

LOAD TEST READINGS	RESULT
Voltage increases at least .5 volts over base voltage	PASS
Voltage does not increase at least .5 volts over base voltage	FAIL

NO-LOAD TEST: Turn off the accessories, decrease engine speed to 1500 rpm and check the voltage across the battery terminals again. See chart for results.

NO-LOAD TEST READINGS	RESULT
Voltage is less than 2.0 volts over base voltage	PASS
Voltage is more than 2.0 volts over base voltage	FAIL

- If both LOAD TEST and NO-LOAD TEST Pass, the charging system is working correctly
- If LOAD TEST Fails, remove the alternator and have it bench tested. Replace if it is bad and retest. If LOAD TEST still fails, replace the voltage regulator.
- If NO-LOAD TEST Fails, replace the voltage regulator and retest.

E R A

REGULATORS

(Continued from page 14)

wrong rotor can also burn the regulator's upper contact set or even cause the contacts to fuse together and stick. This can cause either a no-charge if open or overcharging if stuck closed (*see Figure 4*).

It is worth mentioning that most of these vehicles were equipped with ammeters built into the instrument cluster. All current flow into or out of the battery, with the exception of that required to crank the engine, has to pass through the ammeter circuit. The wiring harnesses of these vehicles were also assembled from sub harnesses. The engine harness is connected to the inside harness by way of spade connections on each side of the firewall.

All alternator current must pass through a single spade connection at the firewall and then on to one side of the ammeter. Also connected to that same side is a distribution wire, which feeds the electrical loads of the vehicle, including ignition, lighting, and other accessories. The other side of the ammeter is connected to a wire leading back to another spade connection at the firewall and then on to a fuse link and the battery. With very few exceptions, this wiring harness was designed to handle no more amperage than the original alternator could produce. Even then, it was being pushed to the limit.

The most common problem areas on this charging system are the spade connections at the firewall, both going into the ammeter and coming back out to the battery. Voltage will drop at the firewall in both directions. Deterioration of these connections is inevitable over time. When combined with prolonged high amperage, as in recharging a low battery, the terminals will lose their tension and exacerbate the problem. Repair options are: replacing the entire wiring harness or bypassing the firewall connections for both of these 10-gauge wires.

The other problem you may encounter is resistance at the back of the ammeter, where its two studs are bolted through a plastic instrument cluster housing. If excessive amounts of current flow through these connections, the ammeter and studs can heat up and melt the plastic through which they mount, allowing the fastening nuts to loosen. The resulting condition, if not corrected, can destroy the plastic housing and the ammeter. While it is difficult to see these connections because of their location, they can be reached and felt by hand to check for tightness when servicing a vintage Chrysler vehicle with an ammeter. Doing this "feel" test with the engine running while loading the battery will allow you to feel for heat at the same time. If there is excessive resistance at the ammeter studs, you will be able to feel them warm up quickly.

E R A

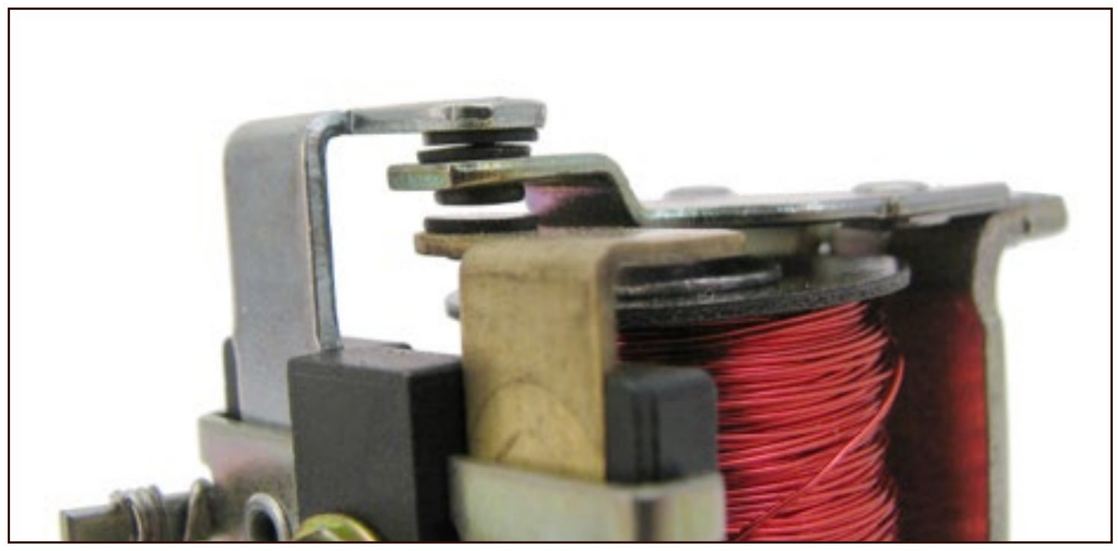


Figure 4—Upper contacts can stick if the wrong rotor is used.

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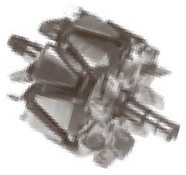
ROTORS



STATORS



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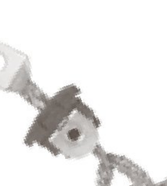


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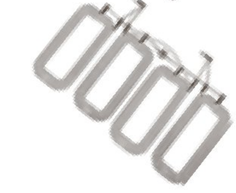


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