ERA EXCHANGE

YOUR GUIDE TO ELECTRICAL REBUILDING

September 2017 $12.95

AUTO ELECTRIC CORNER
P-D Mazda, RVC GM and Sebring Fuse

SWITCHES, RELAYS AND SOLENOIDS PT. 2
What Happens When Contacts Close and Open?

2018 ERA TRADE SHOW

PLAIN TALK | DON'T STAY LONELY AND BROKE
Waiting For A Phone Call That Never Came

Electrical Rebuilder's ERA Association FOUNDED 2001

In Loving Memory

Darlene Schroeder, who served as the office manager for the Electrical Rebuilder's Association since 2003, passed away on Tuesday, August 22, 2017, following a heart attack on August 19th. She performed her office duties for the last time on August 18th.

"She will be greatly missed by all who knew her," stated ERA President Mike Dietrich. "Darlene has been a regular fixture at ERA shows for as long as I can remember. We spent many an hour in conversation while sitting in the ERA booth. She could talk to anyone."

Darlene deeply enjoyed serving the members of the ERA and attended every trade show during her tour of service. She looked forward to seeing members, matching faces to the names she was already familiar with, especially those that she came to know well because she saw them each year.

She was born in Washington, MO in 1935 and was educated in Union public schools. She married Don Schroeder in 1956 and had two sons, ERA Treasurer Mike and Don Jr. She worked as a data processor in the Franklin County Government Center from 1986 to 2002 when she retired. A year later she returned to work part time for the ERA, a job that she took very seriously. She had three granddaughters, including the Exchange's Design and Production Manager Stephanie and ten great grandchildren.

"Mom had already made her own funeral arrangements, down to the clothes she planned to wear," Mike Schroeder confided. "She had given away many of her clothes to younger friends and shared some of her prize-winning recipes with close family members." She was obviously as ready as anyone could ever be. That was Darlene - organized to the end.

Darlene was a long-time member of the Zion United Church Of Christ in Union, MO and until recently an active member of the choir. In lieu of flowers, memorials may be given to Zion UCC or Shriner's Children's Hospital.

NEW ERA MEMBERS

Tarpon Starter & Alternator
Tarpon Springs, Florida

Maysville Repair
Apple Creek, Ohio

Lutone Remanufacturing
Orlando, Florida

ABOUT THE COVER

Contact arcing taking place inside a 1.2 kW Denso silver body starter.

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Rebuilding is Recycling!

AUTO ELECTRIC CORNER —
P-D Mazda, RVC GM and Sebring Fuse

BY MOHAMMAD SAMII

The incoming calls on the ERA's Technical Help Line covers a wide variety of issues. As I see it, there are lots of questions (or confusion) regarding the systems that have been written about and discussed repeatedly. But unfortunately the caller is either unaware of the available resources at our disposal on the ERA website, or they have never or have rarely attended any technical training that discusses the newer systems and technologies. The ERA Exchange Magazine that is supposed to provide information for the ones who may lack access to PC and website does also seem to be highly under-utilized, as it may provide a lot of answers if read and filed accordingly, but obviously it is not.

The next couple examples are a sample of questions that were asked over ERA's Tech Help Line:

Alternators with P-D Regulator (Plug code 303)

A few calls were regarding the Mitsubishi (Mazda) alternators with P-D terminals and how to test it. Mitsubishi alternators with the P-D regulator plug have been around since late 90's for Mazda and other applications. What is unique about the operation of the alternator is that the voltage regulator is split into 2 parts. The thinking or logic part is built into the vehicles' PCM, and the muscle part (Field Control) that included the power transistor is built into the alternator. Both halves of the regulator, from PCM to the alternator are hardwired together with 2 lines named "D" for Driver and "P" for Phase.

"D" is the PCM signal that commands the regulator to respond to the changing load. The "P" is simply a phase signal (1/2 of the system voltage) that is fed to PCM. There is a 1KΩ (1000 Ohm) resistor inside the alternator (in the Field Control) to limit the current from "P" terminal to PCM, thus the "P" voltage in a working system reads a little less than half of system voltage, around 4.5V.

The PCM's command voltage ("D") is a 240 Hz pulse-train and measures between 0.5V to about 1.5V from low to high load while measured by a DMM on DC scale.

The details of the system along with scope captures and a case-study are part of my presentation for the 2018 ERA Show, to be followed by an article for the ERA archives for the ones who may still have questions about this system. Testing these alternators on the test bench is done by the use of appropriate test boxes that are readily available at nominal prices. Without them, this type of alternator cannot be tested properly. Jimco's TB-82 test box was made for such alternators (*see Figure 1*).

The P-D system, which going by the order of S-L in a typical code #300 plug should be called D-P (in my opinion!), also uses a 3-pin oval plug (code #341) with only two active pins in some newer D-P alternators.

Mitsubishi/GM Regulator Confusion

Another call that could be easily answered had the caller checked his copies of the ERA Exchange was regarding a 2008 Pontiac G8. The replacement new alternator would eventually kick in and charge, but the alternator light ("BAT" light) would stay on.

He admitted that he did not rebuild the alternator but

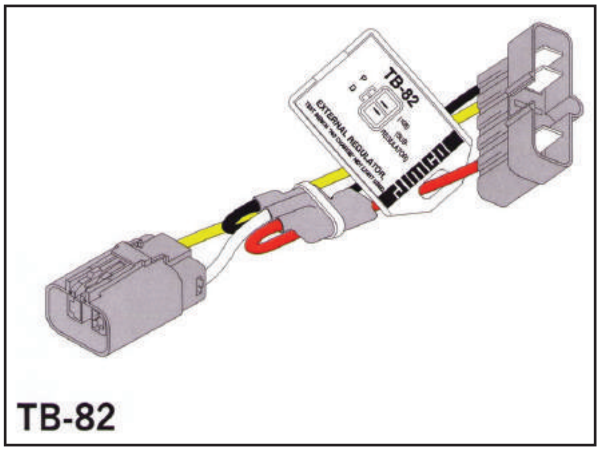

Figure 1 – Jimco's TB-82 Test Box for D-P Alternator Testing

purchased it from an industry supplier. After going over the part number, cross checking the application, and measuring "L" terminal voltage, we realized he was using an 11097 alternator for this application that called for an 11418 alternator. The units look identical with the same plug configuration and letters L and F, but they have different regulators and function differently.

This was the subject a very comprehensive article in the August 2016 issue of the Exchange, where Gene Kaiser (Regitar USA, Inc.) explained such a case encountered by our colleague Lynn Gross. The issue is where both alternators (11097 and 11418) have identical looking regulators; the latter is a typical GM RVC (Regulated Voltage Control) system and the former is not, thus not interchangeable.

The details of the RVC have been discussed in many seminars, and there is a great article by Bob Thomas and Wes Grueninger in the Technical Article Library on the website regarding RVC. Short of making a long part number research and detailed on-vehicle measurements, one sure way of knowing if the system is RVC or not is to look at the battery's negative cable. If there is a Battery Current Sensor (*see Figure 2*) attached to the negative cable near the battery; that is a sure sign that the vehicle is an RVC regulator.

2005 Sebring Fuse!

We have seen similar cases quite a few times when the complaint is a blowing fuse when turning the key to start position, and then nothing…No crank, thus no start.

This was exactly the complaint about the 2005 Chrysler Sebring with 2.7L engine that was brought in. After checking a few vital signs, going purely by experience and instinct, we diagnosed the problem as a defective (worn) starter, and recommended a replacement.

It was difficult to explain this to the inquiring customer, knowing the limitation of their knowledge about inner-workings of the starter, but the cause is the interaction of the pull-in and hold-in coils of the starter when the contacts are worn. See the starting system schematic below (*see Figure 3*).

Putting it into a simple term, suffice to say at the start of a cranking cycle, the two coils (Pull-in, and Hold-in) are in parallel. That is to say the current going through the "S" terminal of the starter is the sum current draw of each coil. This initial draw exceeds a 20-Amp fuse that feeds the starter relay and protects the system, but the duration of high current is so short that it is over before the fuse heats up, thus the fuse does not blow in normal operation.

As soon as the solenoid is activated and the contacts are closed, there will be is no current passing through the pull-in coil, and the cranking cycle begins. In disengagement phase, the 2 coils will be in series, same amount of current will be passing through both, and the balanced magnetic force of each coil cancels each other, then the plunger spring helps to easily retract the drive away from the flywheel.

Now if the starter only clicks but does not crank, the pull-in coil remains active and the initial high current does not subside as it supposed to. This high current is what was blowing the 20-Amp fuse that was the power feed to the starter relay for the above car. This is something that did not exist in older cars, and excessive clicking used to result in a lot of ignition switch failures, but newer systems have starter relays that are protected by a fuse.

The 17929 starter on this vehicle requires removal of the front engine mount for access, but the job progressed with no surprises. Upon teardown, I removed the cap off the solenoid, where the poor contact resulting occasional clicking was obvious (*see Figure 4*).

Until I see you again, keep up the good work.

Figure 2 – The Battery Current Sensor on a GM Application with RVC

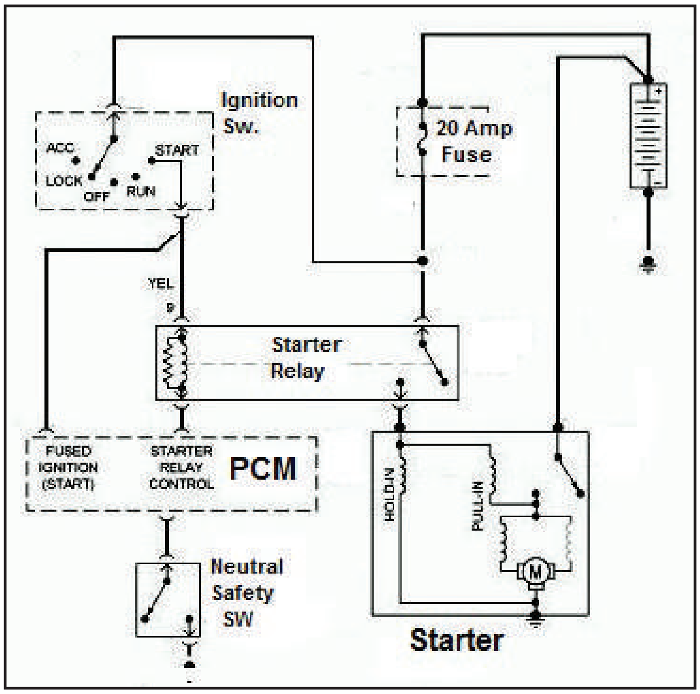

Figure 3 – Starting System Schematic for 2005 Chrysler Sebring (Partial)

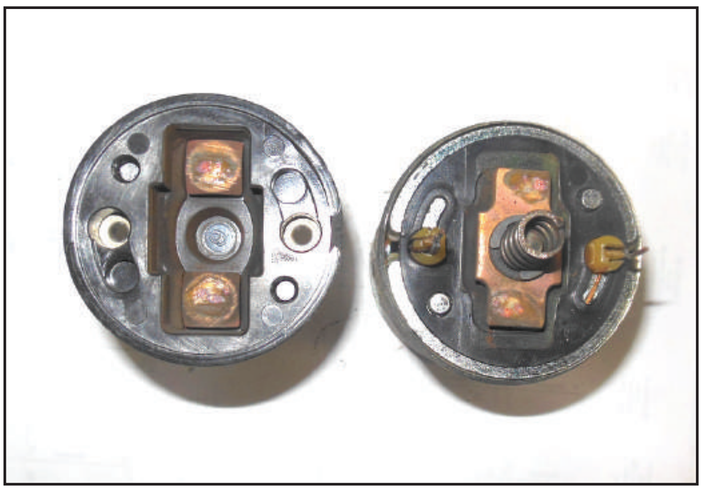

Figure 4 – 17929 Starter Solenoid's Worn Contacts

PLAIN TALK — DON'T STAY LONELY AND BROKE
Waiting For A Phone Call That Never Came

BY ROB BUKSAR

Remember the lonely Maytag repairman? We've talked about him before. His sole purpose was to wait around for a Maytag to breakdown so he could do a service call and run out and fix it. The thrust of the commercial was Maytags were so well-built that they just didn't break down. Henceforth, the lonely Maytag repairman just sat around not producing and unprofitably waiting for a phone call that never came and stayed lonely and broke!

I think of that commercial frequently because it's indicative of too many small rebuilders struggling to keep their doors open to make a little money. At this juncture, I need to remind everyone that the Maytag serviceman only did one thing; he worked on Maytag washers and nothing else.

In early days, washers, televisions, radios, autos, lawn mowers and most everything else were all maintenance heavy. It broke a lot because it really wasn't made all that well. In those days, American manufacturing was still focused on making huge quantities of pretty good but far from great stuff. The wartime manufacturing mentality was still with us into the sixties. It gave birth to many domestic service and repair industries of which rebuilding was but one. Of course, globalization and "building quality in" changed all of that. I'll save the rest of that story for another time.

Today, products are far better and more available than ever. Computers, fuel-injection and gear-reduced starters will crank at 20 below zero without breathing hard. Further, when one is needed, many communities have 3 parts stores on one block with all the replacement parts anyone can imagine. What this boils down to is simply this - less demand and unlimited supply. That is certainly not a good environment for the home team!

Are you just waiting around for the phone to ring or watching the door, hoping for a unit to fix? What do you do if the phone doesn't ring and no one shows up at your door?

If dead days have become a regular thing, it may be too late. I'm not aware of your specific circumstances. However, if there's still wind in your sails, there is no time to loose.

Generally speaking, rebuilding is a regional business. In other words, most of your customers are probably within reasonable driving distance. I suggest that you get a box full of business cards, pens, pads or whatever else has your name and number on it and visit each and every one of your customers. I can almost assure you that these visits will net you a good bump in your sales. Your customers are busy, distracted, overworked and have a hell of a lot more choices than they used to. A lot of those choices are more convenient and cheaper. Yet, if you stop and see them, they will throw you some business. These visits will also enlighten you as to why they are not calling. This will be your opportunity to fix that too. If you're not willing to do this then prepare to reap the whirlwind!

Also, pay attention to corporate America. They are not drawing in (downsizing). They are expanding their product line any way they can. Most of your big retailers will cut your hair, clean your teeth, do your nails, fill your prescriptions and on and on and on. Once they get you in their store, they will work very hard getting as much money out of your pocket as they can. Why not, isn't that the basic idea?

Many of our rebuilders have moved into vehicle ignition work, electrical diagnosis, general mechanical, clutches, drive shafts and fuel injection. Some of our brethren are now into D.C. motors, powder coating, power generators and specialized parts sales.

The common denominator between a big guy and a one-man operation is simply this; your phone has to ring with some sort of business many times a day. No one can sit around waiting like the Maytag repairman and expect to survive.

Many of us who remain in this industry are old-timers. We were around when all that was necessary was hanging out a shingle and folks started lining up to buy. Having lived through that, doing all the work and diversity that's necessary today sure seems like too much work! You know what, it is too much work. Sorry to say for most of us, it's imperative that it's done. A few because of unique geography will escape the brutal effort needed. If that's you, you're lucky! Yet, no one stays lucky forever. Be smart and don't sit on your hands, find ways to enhance your products and service. It's great survival insurance.

> "No one stays lucky forever."

Let me leave you on this note. If a potential customer or even one of your regulars, calls and says: I have called everyone and I just can't find this part anywhere, can you help me? This guy is telling you up front that he has tried everyone else in the phone book first and you were his last call. If he would have found his part higher up the chain then you would have never been called! That should speak volumes to you about the status of your business.

Your objective needs to be to put yourself at the top of the speed dial. It killed the Maytag repairman; but it doesn't have to kill you and me.

God Bless America and our little industry!

Rob can be reached at hoosierleectric@comcast.net or 219-545-8682

SWITCHES, RELAYS AND SOLENOIDS – PART TWO
What Happens When Contacts Close and Open?

BY BOB THOMAS &
WES GRUENINGER, SR

Switches, solenoids and relays have one important part in common—a set of make-or-break contacts. These contacts are the critical component that controls current flow. They must be able to repeatedly establish and break a loaded electrical connection. That sounds like a simple task … allowing current to flow only when the contacts are closed and then immediately cease that current flow when the contacts open. But unfortunately, life underneath a solenoid cap is not that simple.

The electrical phenomenon known as "arcing" is the unwanted flow of current which occurs prior to complete contact closure and immediately following the opening of the contacts. Anyone who has ever closely examined a set of worn out solenoid contacts, has seen what repeated arcing can do over time (*see Figure 1*). This type of wear is to be expected under normal use after many hundreds of on-off cycles. Each arc event transfers some material from one contact to the other—positive to negative. However, severe arcing can destroy a set of contacts rather quickly (*see Figure 2*)—or even cause them to weld together!

In a starter solenoid, one stationary contact is typically connected directly to the positive side of the battery, while the other contact is connected to a very low resistance path to ground through an at-rest motor. In the case of a diesel engine starter, that ground path can carry a thousand amperes or more. A good battery bank can easily supply that kind of current. A gap of only a few millimeters between the open contacts, electrically separates the battery positive from the battery negative.

An Arc is Formed

While a new set of solenoid contacts may look perfectly smooth to the naked eye, they are microscopically quite rough (*see Figure 3*). High spots and low spots abound. With each use, the contact surfaces will wear, which will inevitably amplify the roughness. You have probably noticed that contact surface designs can differ greatly between manufacturers. Some have embossed patterns on their mating surfaces. Each design reflects an attempt to minimize arcing.

If you could see inside a solenoid while it is activated and record what takes place with a close-up high-speed camera, you would observe what appears to be a catastrophic event! (*see Figure 4*) As the contacts begin to close, one tiny spot makes the first point of connection between the two surfaces. In technical terms, that point is known as a constriction, and all available current rushes toward it. The resulting sudden intense flow of electrons creates an extremely hot spot on the contact surface at the constriction. In the case of a diesel starter's solenoid, this is equivalent to forcing hundreds of amperes through the head of a pin.

Though the duration of this condition is only a few nano-seconds, the temperature at the surface of the constriction may reach 8,000 degrees Fahrenheit or more. This extreme heat not only melts the surface of the contacts at the constriction, but it also boils the metal, which can cause it to explode. The air surrounding the hot spot is then super-heated by the explosion

Figure 1 – Used Denso 2.5 kW solenoid contacts, motor terminal (negative) on the left and battery (positive) on the right.

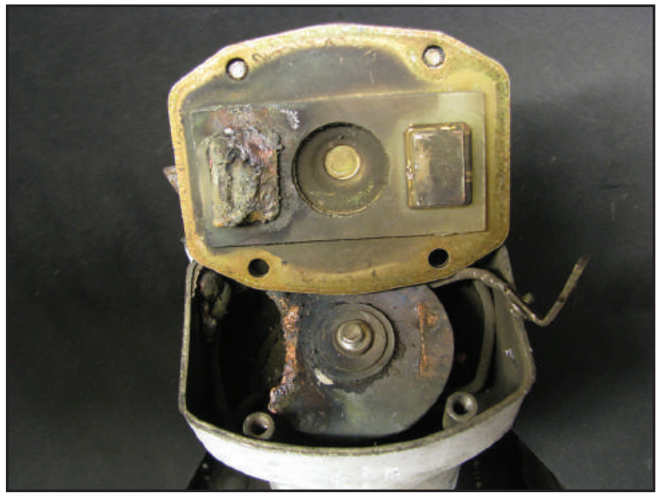

Figure 2 – This 32 volt 40MT starter solenoid was destroyed by severe arcing. Notice that nearly all damage is on the battery contact (left) – positive side.

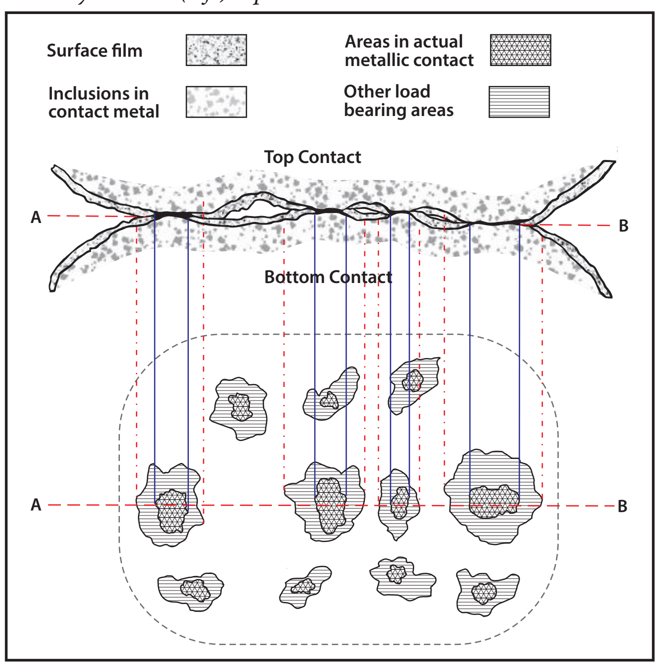

Figure 3 – This diagram shows a microscopic view of the high spots on the surfaces of a set of contacts.

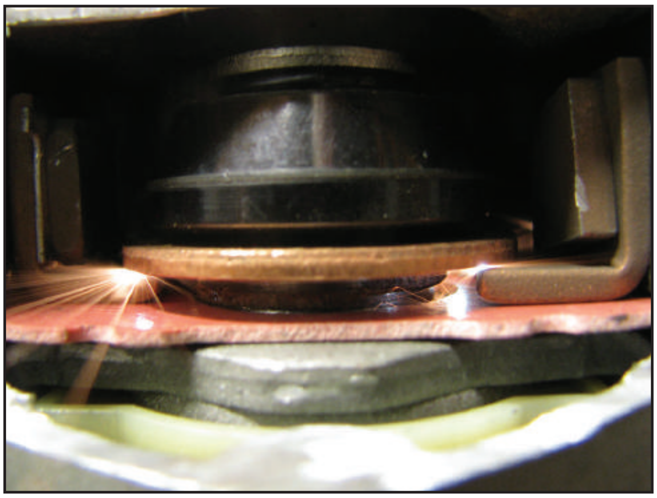

Figure 4 – These are making arcs between the center moving contact and both stationary contacts on a 1.2kW Denso starter during free spin testing.

and is ionized when its electrons are stripped away. At this point, the ionized air (or plasma) itself begins to conduct current. Around the constriction and in the proximity of the explosion, an electrical arc is formed.

That arc, conducted by ionized air, will exist until the next high spot forms another constriction. Then, the previously explained chain of events repeats itself, over and over. As each new arc is established, the previous arc is extinguished. Each arc transfers some contact material. Arcing cascades across the surfaces of the contacts, until the contacts are finally forced tightly together—splattering any remaining melted metal upon impact. This results in the loss of even more contact material (the copper dust you often find inside a used solenoid.)

Once the contacts close completely, the last arc will be extinguished as the current flow is dispersed across the contact surfaces. The extreme temperatures that caused the arcing, begin to dissipate. As the molten metal cools, the contacts actually become fused together in a weak bond while the engine is being cranked. That bond is a "soft weld", which can be broken by the solenoid's release spring.

The Grand Finale

When the solenoid is de-energized, the release spring starts to break the contacts apart, with full-load current still flowing. As the contacts begin to move apart, the area of their touching surfaces decreases … until all flowing current is funneled into the last small area to break. The metal at that point becomes super-heated again and begins to melt. As the contacts move farther apart, a bridge of the molten metal forms between them and is stretched across the gap.

With full-load current still flowing through it, the liquid metal bridge is stretched thinner, until it explodes into a shower of metallic ions (*see Figures 5 and 6*). As you recall, the conducting plasma, which was created when the contacts first touched, was made of ionized air. Now, the gap between the breaking contacts is filled with ionized liquid metal, causing an arc of a grander scale to be formed! Since the contacts are now opening, this arc (a breaking-arc) cannot be extinguished in the same way as the arc made when the contacts were closing (a making-arc.) The making-arc was terminated when current flowing through it was ultimately given a path of lower resistance to take (when the contact surfaces came tightly together). The breaking-arc will be sustained as long as there is sufficient energy to supply it—and as long as the arc exists, it will continue to transfer metal.

The making-arcs and breaking-arcs are different in several ways. Making-arcs are numerous and brief, compared to the extended single breaking-arc (or occasional multiple breaking-arcs.) A breaking-arc is much more violent, because it is made up of metallic ions, unlike the making-arc plasma, which is composed of ionized air. In addition, a breaking-arc has no definite ending. But the making-arc does end, when the contacts finally close completely—detouring the current to a path of lower resistance—essentially bypassing the plasma.

The breaking-arc can be extinguished only by opening the circuit at another point (not very practical) or by exceeding the current's impedance with more distance between the contacts.

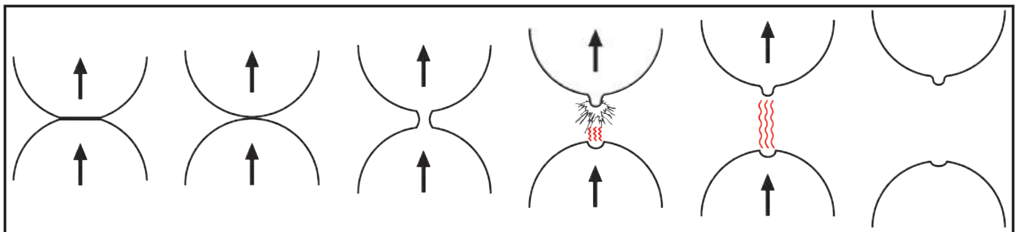

Figure 5 – This sequence of diagrams shows how a breaking arc is formed as a set of contacts open.

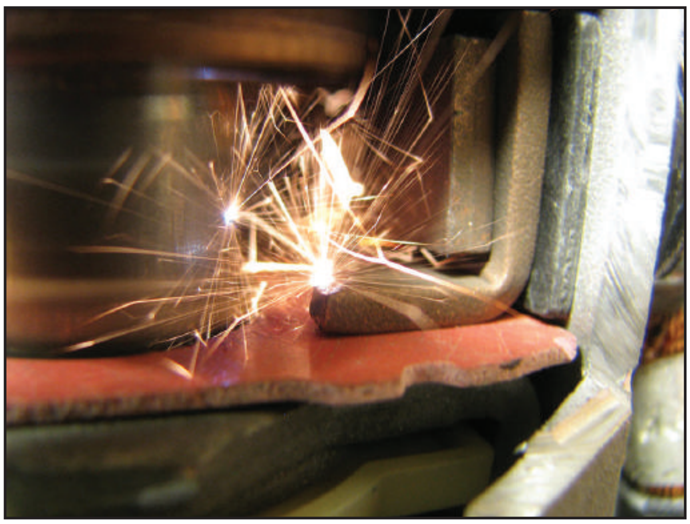

Figure 6 – This is an actual breaking arc on the battery side contacts of the same Denso starter during a free spin test.

Impedance is the opposition to change in an electric current flow. Once current flow is established, it has resistance to change. As current increases so does impedance. It is directly proportional to the load of the starter's motor.

The at-rest air gap of a solenoid's open contacts must be substantial enough to extinguish a breaking-arc's impedance, based on highest possible load for that application.

Perhaps now, you can better appreciate why solenoid contacts may show signs of damage or wear after just a few starts.

When Things Go Wrong

Under some conditions, a set of solenoid contacts may weld closed during cranking. This can happen in two ways. The first is a dynamic weld (*see Figure 7*). It is caused when contacts "bounce" during closing—when they "make", "break" and "make" again in rapid succession. The resulting arcs (both making and breaking) produce molten metal which can partially solidify following a break. During the final "make", the normally soft weld becomes a hard weld, which the solenoid's release spring is unable to break.

More commonly, starter solenoids fall victim to a static weld (*see Figure 8*), which is caused by a sudden short burst of extremely high current flowing through closed contacts. This can happen if a starter is over-cranked until it stalls while turning the engine. A stalled starter motor is almost a dead short, causing electrical current to increase significantly. While faulty batteries and cables can contribute to this scenario, obviously, the operator plays the largest role.

Other Factors at Play

There are other factors involved that can greatly influence arcing between contacts. They are: the composition of the contacts, their design or shape, and the pressures applied in both making and breaking.

Copper has a conductivity rating that is exceeded only by silver. Its low cost makes it the obvious choice for solenoid contacts. However, pure copper is lacking in the mechanical qualities required for solenoids. At temperatures above 320 degrees Fahrenheit, pure copper begins to lose its rigidity. Therefore, solenoid contacts must be manufactured using a copper alloy, with smaller amounts of nickel, zinc, tin, tungsten or silver added to improve its mechanical strength and durability. Cadmium has also been used in manufacturing contacts, but to a lesser extent in recent years. This is because research has shown that long-term exposure to cadmium can lead to serious health issues. The group of metals generally used in solenoid contacts is known as high copper alloys. Each one contains no more than 99.3% copper, but no less than 94%.

In addition to alloys, there are some solenoids in higher voltage applications (24 volts or more) that may utilize a silver alloy inlay on a copper contact (see Figure 9). This type of inlay provides the full durability of a silver contact without its high cost.

Most solenoids incorporate a moving contact with two stationary contacts—one for B+ and one for the load or motor.

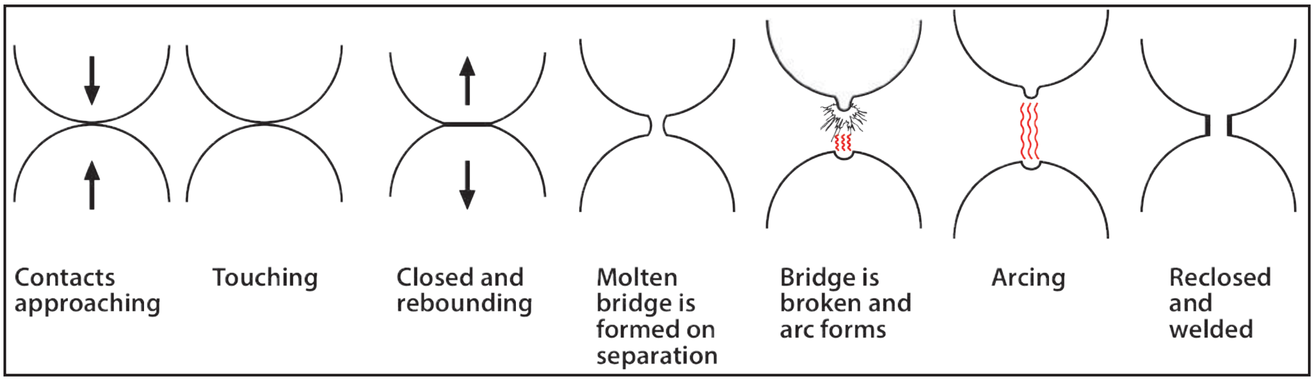

Figure 7 – Here you can see how dynamic welding happens when the moving contact bounces on initial impact.

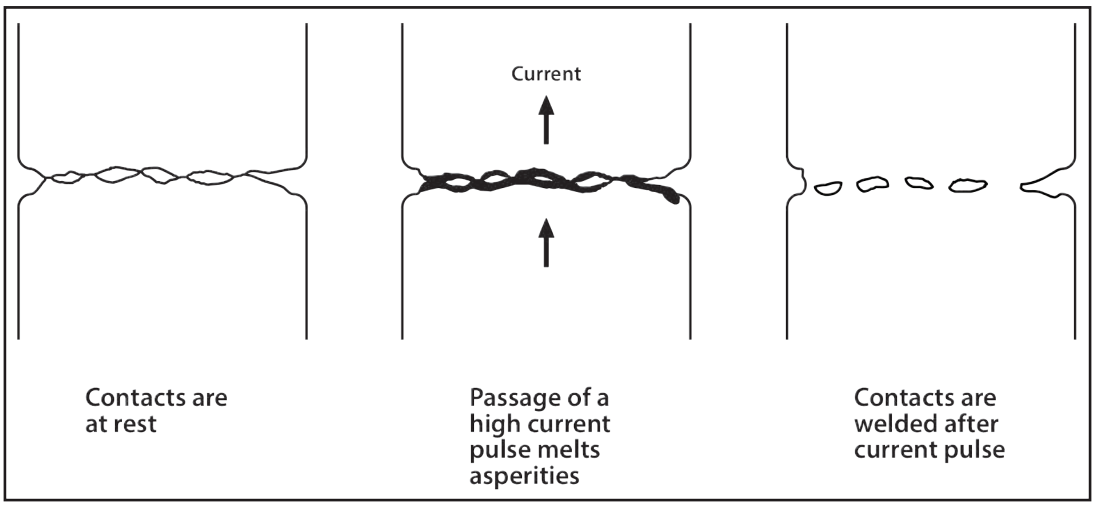

Figure 8 – This diagram shows how static welding occurs when a surge of high current passes briefly through a set of contacts.

While many contact surfaces are flat, to increase the area of conduction, some manufacturers have tried other shapes to reduce arcing.

The embossed patterns you see on the contact surfaces in some solenoids are intended to offer sacrificial material across the contact. This helps to create multiple but much smaller breaking-arcs to dissipate the heat—reducing the transfer of material, reducing breaking-arc impedance and extending the life of the contacts. Each pattern attempts to disperse the hot spots across the entire contact mating surface, thus allowing for better heat dissipation. Bosch, Denso, Delco and Mitsuba have all used this method on some applications (see Figures 10, 11 and 12).

Figure 9 – This 24 volt Denso contact has a silver inlay to reduce arcing under the higher voltage.

The magnetic strength of each solenoid's pull-in coil, affects the time it takes to make a complete contact connection. Increasing that magnetic force would decrease the time it takes to accomplish this and would limit arcing. The high current draw of some diesel starter solenoids (like Delco's 39MT) seems to be aimed at closing the contacts faster. A weaker pull-in coil force increases the closing time, allowing for more arcing to take place.

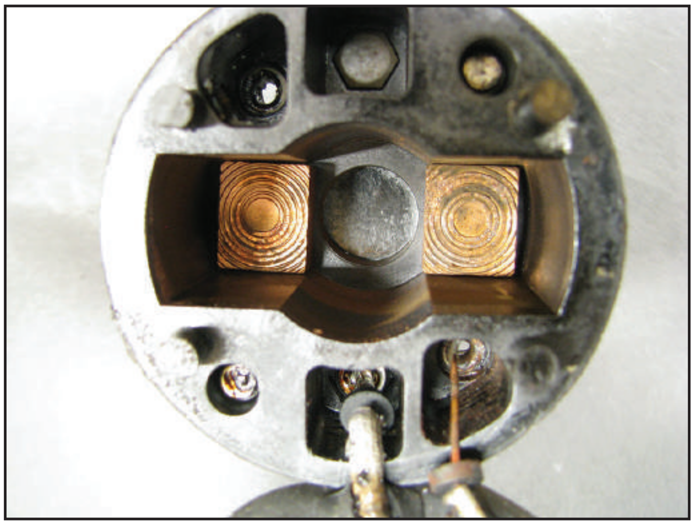

Figure 10 – The contacts of this aftermarket 39MT solenoid are embossed with circular ridges to reduce damage from arcing.

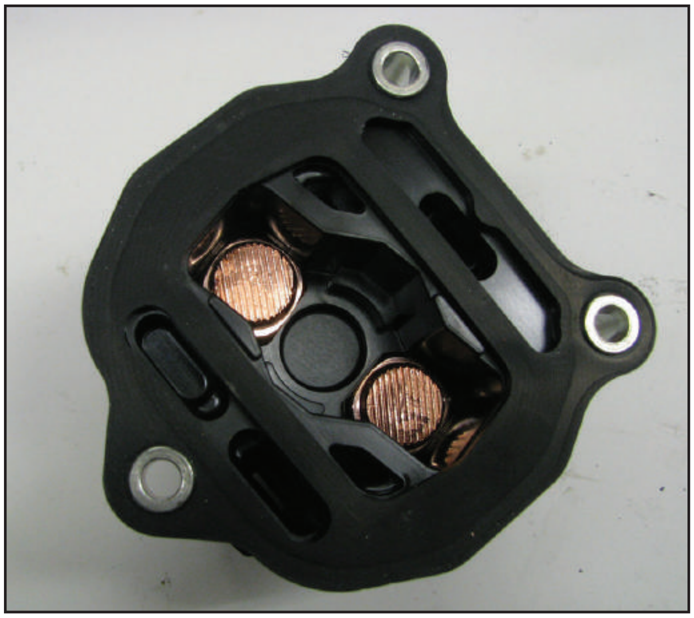

Figure 11 – This Denso PA90S solenoid utilizes straight ridges to limit arcing.

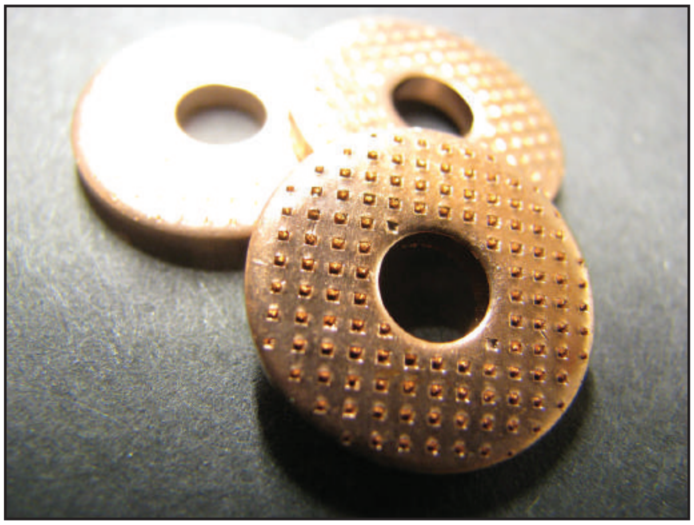

Figure 12 – Mitsuba embossed the moving contact in their SM612 starter to reduce arcing damage.

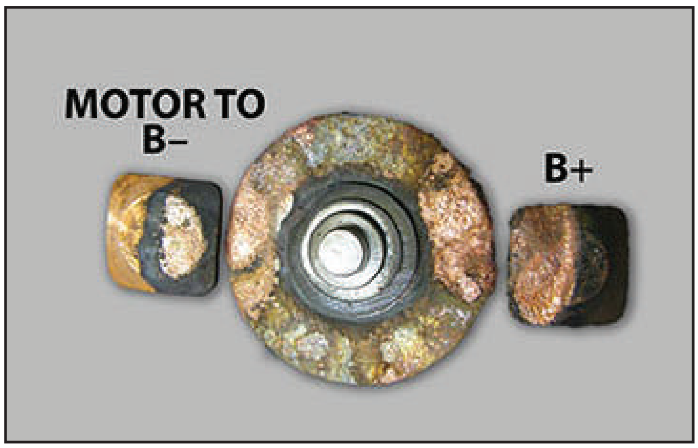

Figure 13 – The battery side (positive) contact from a 42MT solenoid has been damaged by severe arcing.

The tension of the contact's release spring must be strong enough to break the contacts. A stronger spring would obviously break them more quickly. But remember that the solenoid's magnetic force must also overcome that spring to force the contacts closed. Also, the hold-in coil must be able to overcome the spring's strength in order to hold the contacts tightly closed. Increasing the strength of the release spring to reduce arcing during "breaking", would require increasing the magnetic field in the hold-in coil to overcome it. Every change or modification comes with a trade-off.

As you can see, a lot of engineering must go into a starter solenoid, as the different forces must interact with each other to limit arcing. (So, when you remanufacture solenoids, be sure that any replacement springs or coils have the same specifications as the original equipment parts.) Hopefully, this understanding of arcing will help you to better serve your customers when a solenoid sticks, or the contacts come back melted. There is a

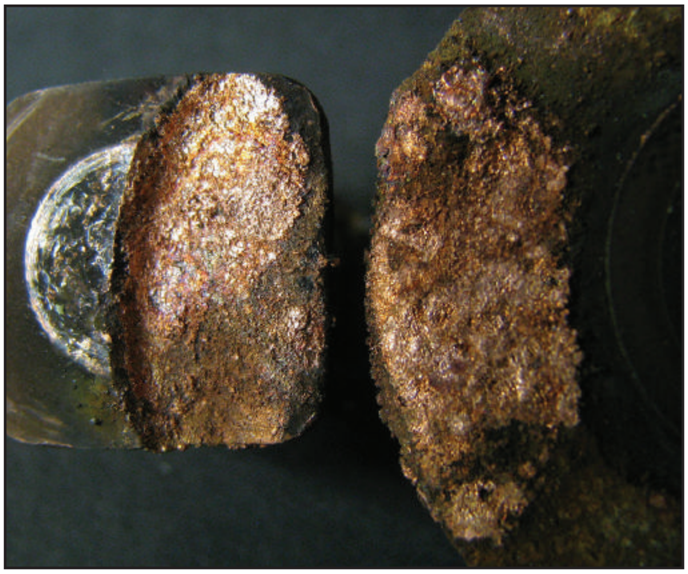

Figure 14 – Note the roughness of the contacting surfaces in this close up view.

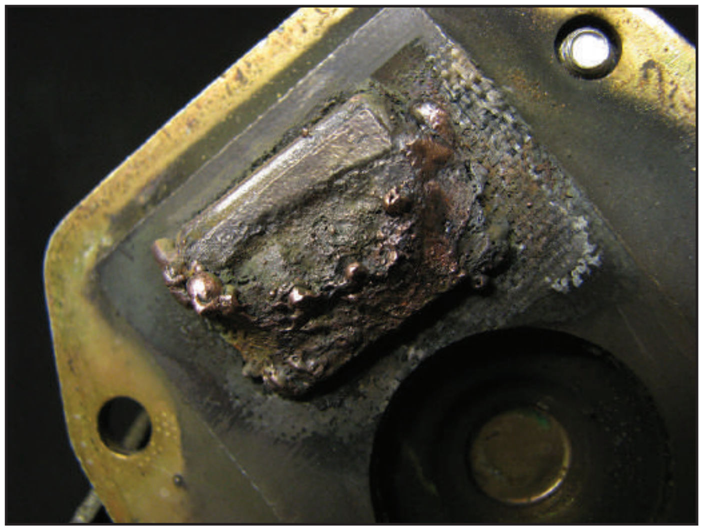

Figure 15 – A close up view of the 32 volt solenoid's battery contact, shown earlier.

difference between wear and abuse that is not always black and white. It is normal for the positive stationary contact to lose metal as it wears. The motor-side contact will wear significantly less. The moving contact will typically show the least wear of all.

Over-cranking or extended-crank cycles will overheat the contacts to their melting point deep into their surfaces. When this has taken place, the surfaces will be extremely rough (see Figures 13 and 14). When one extended-crank cycle is followed closely by another, the still-molten metal will splatter upon contact-impact and leave signs, such as a deformed positive contact (see Figure 15) and large particles of once-molten copper inside the solenoid (see Figure 16).

In a future article, we will explain how different types of electrical loads affect arcing and contact wear in distinctly unique ways.

The following table provides some basic information on copper alloys used in low-voltage direct-current applications.

Figure 16 – This copper residue was once part of the moving contact where it last touched the battery contact.

TYPE OF DEVICE OR CONTACT	REQUIRED PROPERTIES	MATERIAL *	SHAPE OF CONTACT
Rotary switch on printed circuit	Resistance to frictional wear, low contact resistance	Fixed: Au on Ni; Sliding: AgPd, AgCu	Fixed: plated; Sliding: plated, welded or riveted
Sealed relay in metal can	Very reliable and long life, fast bounce-free switching	PdCu, Mo with Au-plating	Fixed: plated parts or welded foils; Blades: FeNiplated with Mo and Au
Large Low Voltage contactors with arcing contacts	Withstanding high short circuits On make andbreak, low resistance on rated current, anti-weld	Arcing contacts Cu. WAg. Main contacts AgCu, AgNi, AgCdO, AgZnO, AgSnO	Solid contacts in Cu. others brazed or welded
Rotary switch, Manually operated	Reliable switching of rated and overcurrent with compact shape	AgCu, AgNiCu, phosphor bronze	Rivets, solid or faced, automatically welded, profiled
Generator, commutator alternator	Hard, creep resistant low contact resistance	Cu + 0.1% Ag	Solid
Sliprings	Low mechanical wear under brushes easy manufacturing	Cu, gummetal, Cupronickel, "Monel", for corrosive atmospheres	Cast and machined
High current d.c. breakers	Low transfer, low erosion at high current, low contact resistance	Cu	Laminated strip
Small circuit breakers	Anti-weld on short-circuit, low temperature rise at rated current, moderate erosion	Dependent on rating and construction Cu,AgCdO, AgW, AgWC, AgC mixed: AgC against Cu	Profiled, pressed, brazed, welded

*Ag – silver, Au - gold, Pd - palladium, Rh - rhodium, Ni - nickel, W - tungsten, Zn - zinc, Cd - cadmium, Mo - molybdenum, O - oxide, e.g. CdO = Cadmium oxide, C - carbon, Sn - tin

References Cited (in this document): Copper Developement Association (CDA), 1980, Copper in Electrical Contacts, Technical Note 23, CDA, 5 Grovelands Business Centre, Boundary Way, Hemel Hempsted, HP2 7TE, UK

INDUSTRY NEWS

WAI Global is pleased to announce that Mark Hoogterp has been named Senior Director of Sales, North American Rebuilders. Hoogterp comes to WAI through their 2016 acquisition of DuBois Marketing, where he spent 37 years in sales and operations management. Hoogterp will lead all U.S. and Canada rebuilders sales efforts, and will work out of WAI headquarters in Miramar, FL.

ERA REBUILDER UNIT LABELS

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All labels are printed in bright color on a heavy heat-resistant stock with high-bond adhesive backing. They are laminated with a clear layer that is resistant to oil, gas and water. They will give your products a professional look that will set them apart from the competition. Labels are affordably priced and can be ordered right off of the ERA website or by calling the ERA office at: 636-584-7400. All prices include free shipping.

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$5.20 3 sheets
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WATER DAMAGE MAY VOID WARRANTY
Size: 1.5" x 3.0"
Sold in sheets of 18
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$5.20 3 sheets
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START ONLY FROM SEAT
Size: 1.5" x 3.0"
Sold in sheets of 18
$6.50 1 sheet
$5.20 3 sheets
$4.20 6 sheets or more

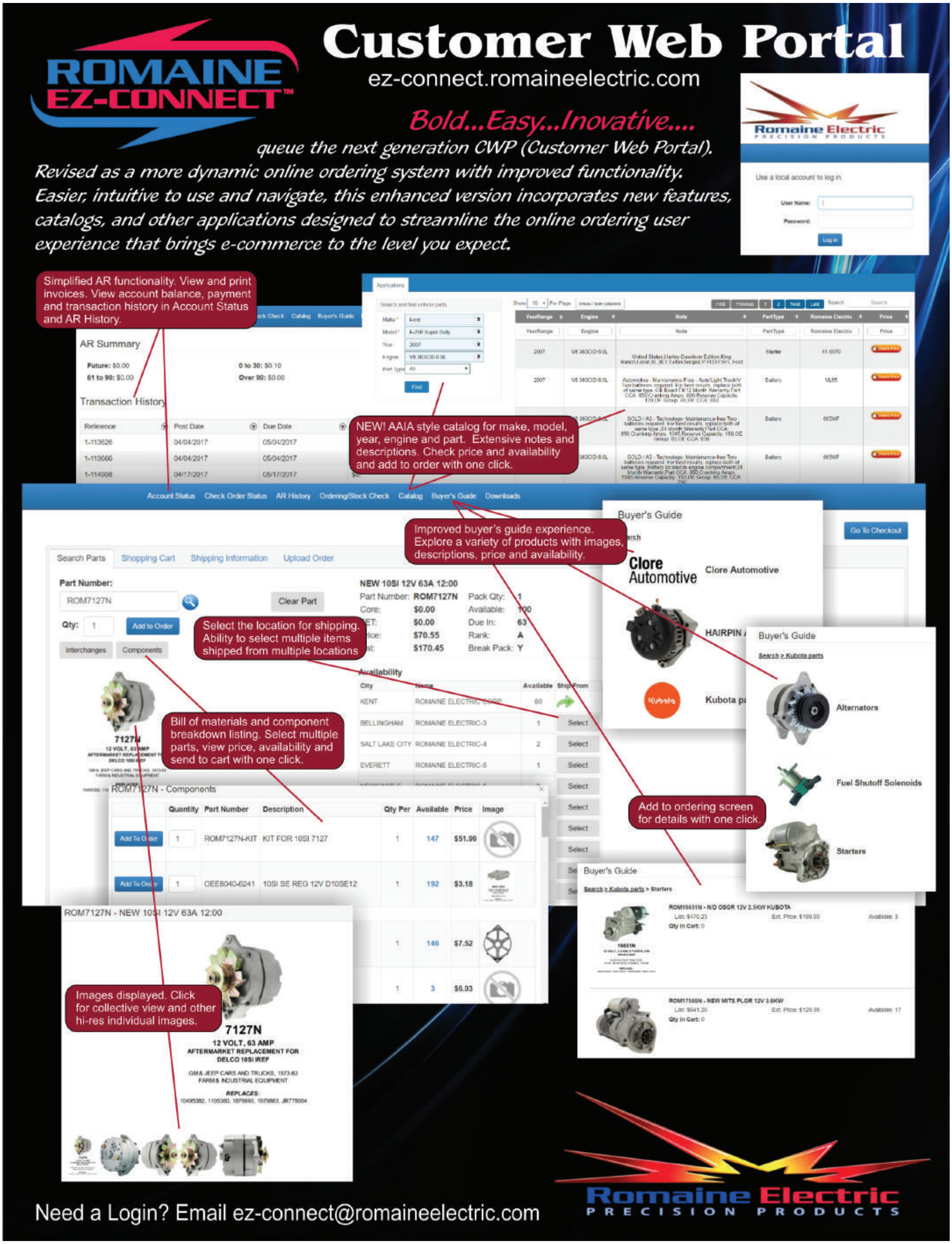
ERA EXPO 2018

Montgomery, Alabama

"The date has been set. The 2018 ERA Expo will be held in Montgomery, AL on April 13-15," stated ERA President Mike Dietrich. "The show committee held it's first planning meeting on August 9 to OK the date and venue. The event will be held at the Embassy Suites by Hilton & Conference Center, located in downtown Montgomery, just one block away from the Alabama River and Wright Brothers Park."

"This is a very unique facility, unlike any we have ever used in the past," Dietrich explained. As the name implies, all accommodations are spacious two-room suites. Included with each room is a free buffet or cooked-to-order breakfast each morning in the hotel's dining room and a nightly managers reception with complementary appetizers and drinks from 5:30 to 7:30 PM. Complete details and a preliminary schedule will be ironed out in time for the next issue.

Regitar USA, headquartered in Montgomery is working closely with the ERA to make this a very special event. Tours and technical seminars are still in the planning stages. Mark your calendar now.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NEED HELP?
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1-636-584-TECH (8324)

Tech Help from Mohammad Samii

Do you need help testing an alternator or getting it to work as it should on a vehicle? Call the ERA Tech Help Line and talk to an industry veteran that has over 40 years of rebuilding and on-car experience. Mohammad Samii can help you to find the answers that you need to solve any rebuilding problem. No question is too difficult. "Sammy" has a formidable list of resources at his disposal and is backed up by a line of regular ERA Forum contributors. The ERA is there to help when you need it.

VIDEOS WANTED
for the era website

The ERA needs your help. Share your rebuilding tricks, tips or techniques with other ERA members. You may receive recognition and earn a reward.

THE RULES:

1 – Any video submitted between May 1, 2017 and January 31, 2018 that is used on the website will be rewarded $50.
2 – The three best videos will receive an additional $200. The winners will be announced at the 2018 Trade Show in Montgomery, AL.
3 – Only current Rebuilder and Honorary ERA members are eligible.
4 – The ERA reserves the right to edit any video that is submitted but this does not affect the reward.

Experience is the best teacher – Share your experience with other ERA members.

- To submit ideas for videos that you would like to see done, contact the Technical Committee at: techideas@electricalrebuilders.org
- To submit videos for approval, contact the Technical Committee at: techvideos@electricalrebuilders.org
- For any website/video help or information contact Web Developer at: webmaster@electricalrebuilders.org or jmyers0017@hotmail.com

PROMOTE YOUR MEMBERSHIP!!

MEMBER OF ERA FOUNDED 2001 ASSOCIATION

The Electrical Rebuilders Association is now offering glossy, laminated, high performance vinyl stickers for your vehicle or storefront windows. Show off your membership and let your customers know they're in good hands.

Call the ERA office to order: 636-584-7400.

8-inch round: $9.75 plus shipping
12-inch round: $19.50 plus shipping

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New and used machinery/testers for the electrical rebuilder. Extensive offering of surplus units, component parts, and cores. HD, agricultural, and automotive. We buy cores and shop liquidations. Please visit our website at www.AgAutoElectrical.com. Call Dave at 608-630-6132

BUSINESS FOR SALE

For sale starter & alternator rebuilding shop. Have 700 plus units ready for sale. Equipment shelving and more. Will sale with property or without. 304-568-4326 or 304-568-2049

Johnny's Auto & Marine Electric, A 46 year old buisness, needs an experienced alternator and starter rebuilder Mondays through Fridays. Must be able to work with customers and have knowledge of parts and experience with suppliers. We're in Garner, NC at the Raleigh/Garner line. Send resume to jae1573@yahoo.com and we'll contact you.

For sale 35 years of rebuilding inventory below todays wholesale prices. Everything to set up shop and start rebuilding. All parts to complete units, HD, industrial, farm, offroad. Some test equipment and Chilton, Mitchel, L/N manuals and wiring diagrams. Asking $80,000 OBO. 417-962-4055

WELL ESTABLISHED, TURN KEY STARTER AND ALTERNATOR REBUILDING BUSINESS in Wi. Includes units, parts, equipment, forklift and customer base. With or without property. (920) 460-4845

STARTER AND ALTERNATOR SHOP FOR SALE IN THE NEAR FUTURE. Located in Tarpon Spring, Florida. Owner is approaching retirement and looking for someone to take over the business while he helps with the transaction. Marine and Heavy Equipment units are the main sellers, not too much automotive. No competition closeby. The shop has a great reputation. Freestanding building can go with the sale or be rented. Large inventory mostly new WAI. Call if you have any questions. 727-943-0711

SERVICES

R&R ALL STARTER DRIVES. North Atlantic Starter Drive, 741 Broadway, Pawtucket, RI 02861 800-822-2735 Email: popsy26@verizon.net

Employment Opportunity: Looking for a rebuilder in Kansas City Mo. Must have experience with not only starters and alternators, but also DC traction motors. Must be able to work directly with customers and have basic computer skills. National supplier. Good pay and benefits. Please email resume or inquires to the ERA at office@electricalrebuilders.org

Rebuilder Needed: Tired of the cold, looking to relocate? Sunny Florida is looking for a friendly, experienced person to rebuild/install starters and alternators for high volume auto electrical shop. Please fax resume to 727-528-8823.

PARTS, SUPPLIES, EQUIPMENT FOR SALE

Vintage starter and generator field coils. Ace, Autolite, IPM, Preferred Electric and Vulcan part numbers. Listed in Excel spread sheet to send via email. Call 860-528-8174 or email ken@guyselectric.com

Rebuilt OE units ready to install. Mitsubishi 215A alternator (A8TU0091): 200A 31SI alternator (19011105): 24V Iskra starter (11130977). Call Mike at 850-623-5111 CST.

TEST EQUIPMENT: D&V ALT-99 Alternator Tester, Electrocheck 83 HD Alternator Starter Load Testers, D&V JBT-3 Testers, Regulator Testers, Ground Fault Analyzers, Diode Testers: p.falk@straucon.com www.straucon.com

A-Z SHOP EQUIPMENT. Blaster, Reg/Rect Tester, Cleaning Equipment, Hydro Presser, Components Parts and more. For more info/pic's go to www.electricalrebuilders.com

3500 AND 3599 CORES. Contact Larry at Hagemeister Enterprises. 800-944-0494

LEECE-NEVILLE 24-VOLT (40MT size) starter cores. Paying $35.00 each. FOB Miami. Contact Howard at 305-633-1524 or email: hy@cmearma.com

Test Equipment for sale: D&V ALT99 Alternator Computerized Test bench: Master alternator profile comparison. Database storage. Test print out capable.Light usage, good condition. Please contact: troy.light@waiglobal.com.

ADVERTISING: **If you'd like to submit a classified ad, email smsdesigns@hotmail.com. ERA members receive the first 25 words free. It's an ERA benefit!**

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