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STARTER BRUSHES: Do Not Take Them Lightly

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2016 ERA SHOW REGISTRATION!

PLAIN TALK | Ode To Billy Maxwell

A WORD FROM THE PRESIDENT
Use Your Knowledge



Sometimes the most profitable sale to a customer is not to push your product, but to define that customer's actual needs and solve their problem. For example, when you try to sell a heavy duty or high amp alternator to solve a repetitive failure situation, you might end up causing yourself and your customer additional money and lost time. This is not a good scenario for promoting customer loyalty or enhancing your bottom line.

Parts stores are already doing just that. They concentrate on selling parts and they are very good at it. When it comes to just selling parts a small automotive electrical shop is out gunned by the parts chain stores. They have the buying power, marketing tools and sales strategies that will blow you out of the water. They can sell a part, warranty it for two or three times what you can and still make a profit. I believe that if the majority of your customer base is all about the lowest price and longest warranty, you will soon be out of business. The parts stores are very aware of the skill level that their sales counter people have. They train them to sell parts and avoid the unprofitable situations.

In my market area, when it involves auto electrical issues, those unprofitable situations usually find their way to my door. Now it is time to solve the problems, not just throw parts at them. If you just try to sell parts, you have just inherited another business's unprofitable situation. I know that what I am saying here is not ground breaking information, but the point I am trying to make is that it is all about mind set. It is only natural for a small business owner to want to sell every product that he has, but if that becomes your main objective, you are fighting an army of giants and you will eventually lose. The only possible exception being that you have no local competition from the big chains. But even then your survival is unlikely because competition is only a few key strokes away via the Internet.

Some may claim that their competitors can't compete with their quality. This might be true, because every rebuilder I have ever met believes that "they build the best unit money can buy." But quality is only part of what it takes to make a profitable sale. If you have the mind set to seek out and solve your customer's problems, then you can make a profitable sale and keep your high quality unit from showing back up on your counter damaged or destroyed by that problem you failed to address.

From the very nature of our industry comes an advantage that we have over our competition that just sells parts. That advantage is product knowledge. We know how it works, we know why it fails and we know what can make it fail. A few questions asked at the point of sale will allow you to apply your product knowledge to help you solve your customer's problems. You might find as I have, that taking this approach leads to more satisfied customers, an increase in referrals and additional product sales.

PS - Don't forget to register early for the ERA Exposition in Memphis, March 18-20. Details are further back in this issue. There will be new seminar topics, new vendors and more money making opportunities for your business. Everyone who registers early will have a chance of winning free hotel room and show registration. I'll be looking forward to seeing you there.

Mike Dietrich

NEW ERA MEMBERS

Martin Rebuilding Co.
Wautoma, Wisconsin

Columbia Starter & Alternator
Columbia, Mississippi

ABOUT THE COVER
42MT Delco Remy starter with CE cover removed to inspect commutator and brushes.

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Rebuilding *is* Recycling!

PLAIN TALK— Ode To Billy Maxwell



BY ROB BUKSAR

September 17, 2013 is the day the earth stood still for me. I was carted by ambulance to the hospital semi-conscious, knocking on Death's door. I spent the next two months connected to IV's, oxygen and bed pans. None of which were remotely pleasant.

The experience was life-altering. It's no different than being in a severe crash or accident, especially when you're injured. At first, when you come to and become aware of yourself, you start doing a mental inventory of your parts. Can you see, hear, and move your head? Are your arms, legs and fingers still attached and working? Once you're past that then you become very aware of the general area where you've been injured. Pain makes one acutely aware of where those problem areas are. By the way, if and when you run across someone who has been hurt in any form or fashion, please do not try to counsel them on what might appear to you as a negative attitude. The injured person that you're trying to correct is hurt, in pain and currently suffering because of the injury. They don't need some "Dim-wit" trying to correct them about their attitude while they're in a body cast and hurting! That is not encouragement for those too thick-headed to understand.

Four weeks into my hospital stay with no end in sight, I was far from my bubbly-best. A dear friend retrieved my personal mail from my home and shop and brought it over to me. In the stack was a small envelope from a fellow named Bill Maxwell. At that time, Bill was 93 years old and had been retired from the rebuilding industry for almost 30 years. Bill claimed that he had been following my articles for the last 15 years and had most of them in a folder. He said that after all of these years of reading my stuff, he felt that he had come to know me pretty well. He said the only way that he knew something was wrong was when the paper reprinted an old article of mine. At that time, I wasn't doing any writing or much of anything else. Bill contacted the paper and they told him that I was currently sidelined. That my friends, was the beginning of a wonderful friendship!

Bill became my 93 year old pen pal. He'd send me a six or seven page letter about every three weeks. Bill was always positive, supportive, encouraging and very forward-looking and yet never corrective. Bill was recovering from a heart attack that he had the previous year and was itching to get back out to his garage and rebuild a van that he planned to use to take one last cross-country trip with his daughter.

I failed to mention that at 93, Bill's mind was as sharp as a razor and his recall was nothing less than remarkable. He was there at the beginning of rebuilding as an industry. He also claimed that he was a blessed recipient of all the abundance the industry had to offer in the "good ole' days".

He spoke not only of rebuilding but small business in general. According to Bill, and he was there in the "good ole' days", the U.S. was at its greatest. The opportunities were unlimited for the average guy to go into business and really prosper. The streets were literally paved with gold! Bill regularly expressed his remorse for those trying to "cut the mustard" these days. He clearly saw how big business in collusion with our government pulled the rug out from under the feet of the average guy. We now have become a sorry excuse of our former greatness and continue to decline. Sadly, Bill expressed, are those still fortunate to be doing well. They are dazed and confused by their present prosperity and blinded. You can't see the foundation from the penthouse which is where the high-rollers live. They look down with critical disdain and judge those who live on the lower floors to be lazy and unmotivated. They will harbor that attitude until the entire building crashes down because the foundation has been washed away without their knowledge. How could they have not seen something so obvious? Simply because they were too busy eating, drinking and being merry and criticizing those less fortunate. This has happened over and over in my long life. Although, this time when we fall, and we will, we may not have the horse power to rise again. It's all in God's hands. Hopefully, he will be merciful again? You see Rob, we have become too busy trying to "get" rather than "give", and that's not how this country became great!

Bill always reminded me that I had a greater responsibility other than myself. Many folks had a connection with me and they just might wither away if I wasn't there to be plugged into in some fashion. It's like that for all of us to one degree or another. "Get well, Rob. Stay up, stay motivated and convince the hospital staff that you really need their best so that you can recover and resume".

There was no shortage of Bill's wit and wisdom. I'm deeply grateful our lives crossed paths. Who knows? I may not be here today if it weren't for his coaching. Bill gave me far more than I could have ever given him. I got the better end of the deal! Bill practiced what he preached. He focused on giving and not getting.

Call it time, chance, circumstance or maybe dumb luck. Maybe, it was an answered prayer. My conclusions are my own but I will tell you this; for me, Bill Maxwell was the right guy at the right time with the right message. I needed help out of that hospital bed and state of mind and Bill helped me back into the game. For this I will be forever grateful.

I'm sorry to report that shortly after Bill's 95th birthday that he passed away. His daughter notified me by mail. When I initially saw the envelope, I thought it was another welcome letter from Bill. To my surprise and heart-breaking dismay, it was his death notice.

I'm <u>so sad</u> that he has passed yet understood that he was given more years than most and it all has to end sometime. Yet, I'm <u>so glad</u> that Bill was given enough time to become my friend and encourage me out of that hospital bed and back into life. <u>I'm not sure</u> if I could have done it without him. I was one sick puppy!

To the friends and family Bill leaves behind; take pride and humble satisfaction that there is more than a grave stone that represents the time Bill spent with us. Bill has left an indelible mark on the hearts and minds of all those he touched in his lifetime. Bill certainly left one on me!

Rest in Peace, my friend. Your wit and wisdom lives on in the hearts and minds of many of us. Go to your rest, you will be warmly welcomed yet I will always miss you.

God Bless Our Little Industry.

Rob can be found at International Winding Inc. 1-800-323-7521

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STARTER BRUSHES
Do Not Take Them Lightly



BY BOB THOMAS

Brushes are perhaps the most under appreciated and least understood component in any starter (see Figure 1). We expect them to wear out before any of the other parts do. Most rebuilders simply replace all brushes without closely inspecting the used ones being removed. Too many of us believe that a brush is just piece of carbon with wires attached.

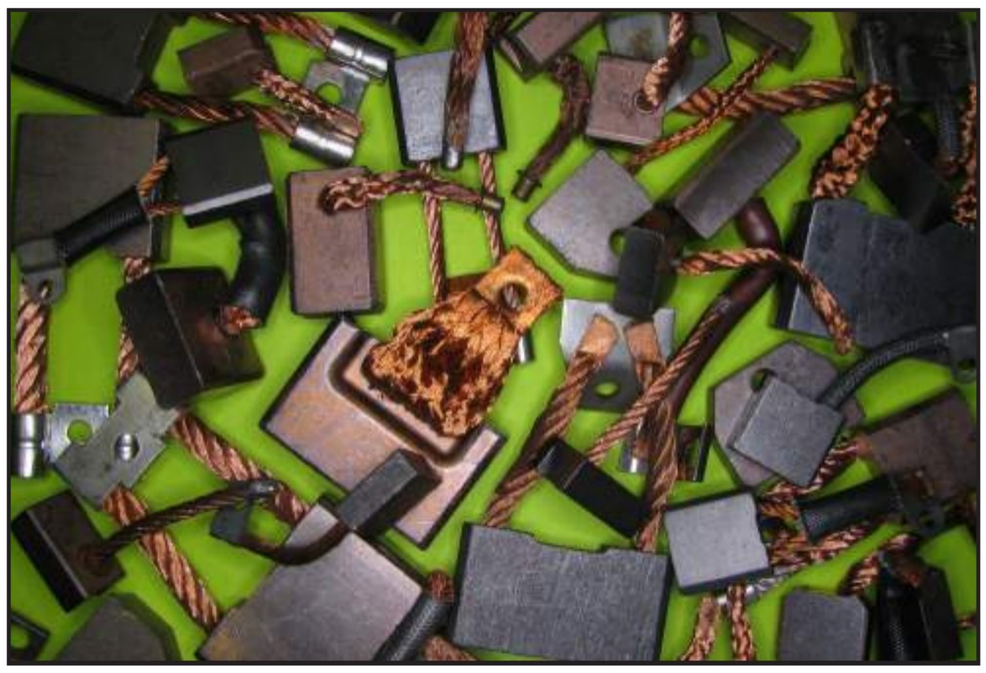

Figure 1 – Starter brushes have been manufactured in many different shapes, sizes and compositions.

Consequently, brush purchasing is often based upon price alone, under the assumption that duplicating a brush formula is a simple task and that all brushes are created equal. Nothing could be further from the truth. In reality, a lot more goes into brush-making than mixing powdered carbon with other materials, molding it into a shape and attaching lead wires. The science behind brush manufacturing is well over a century old, it has never been simple and it is constantly changing.

Brushes that are used in heavy duty starters must carry a significant amount of amperage and transfer that current to a moving commutator with minimal brush loss and damage. If you can visualize the circuit of the typical series-wound DC starter, current flows into the motor at the field lead, passes through the field coils to the positive brushes, to the commutator, through the armature's coils, back to the negative brushes and then ground. This could be any starter, but let us say for example that it is a 12 volt 42MT with a peak output of 7,300 watts. Operating at 11 volts under load, this starter will consume over 650 amps, or 325 amps through each brush!

Total resistance in any heavy duty starter must be low so that current can be high. Power is measured in watts, determined by multiplying voltage times amperage. The field coils in the 42MT are solid copper, the armature's commutator and hairpins are copper, while the brushes are a mix of carbon, copper with other materials we will discuss shortly. Our 42MT starter's total resistance from field terminal to ground is a mere 2 milliohms, or two-thousandths of one ohm. From a dead start, much of that resistance is in the brushes themselves and their electrical connection to the commutator's bars.

The moment any starter engages the ring gear, maximum power is needed to get the engine turning. It is no different than pushing a vehicle by hand from a dead stop. The hardest part is getting it to move a little. Once it begins to move, pushing gets easier. The same is true for starters. Initially, every starter is very close to a dead short. But after it gets the engine turning, the amperage draw will drop dramatically. You may wonder why that happens when the circuit above stays the same. The answer is that it does not stay the same. It changes the moment the armature moves and continues to change with armature speed.

As the armature turns, it begins to generate its own voltage, which is reverse of the applied voltage from the battery. This is often called back voltage or more properly, reverse electro-motive force. Reverse EMF generated within the armature acts as a resistance to current flow during cranking. In a free spin bench test, it also limits the maximum speed at which the armature can turn. There is always a direct correlation between cranking speed and amperage draw.

Any starter's performance depends heavily upon the brushes having the correct amount of resistance. Changing that resistance by even a small amount will affect the starter's cranking ability, current consumption, commutator wear and brush life. While brushes are the least costly of all starter components, they are the key part in providing durability and performance to a customer.

MAKING BRUSHES

It is relatively easy for a brush manufacturer to measure the resistance of any competitor's brush and determine the amounts of carbon, copper and any other metals that might have been used in its making. But that is only a small part of what goes into a brush. The binders that hold the brush together and the temperature curves and timing in a complex heat treating processes change the atomic structure of the carbon and greatly affect both longevity and performance. Brush making is based on ceramic technologies and each manufacturer has developed their own techniques that are constantly evolving.

The main ingredient used to make brushes is **carbon.** It is the sixth most plentiful element in the universe and can be found in different mineral forms called allotrpes. **Graphite** is the carbon allotrope used in brush making because it is a good conductor, excellent lubricant and relatively inexpensive. Another



well-known allotrope of carbon is diamond, which just happens to be the exact opposite - a fantastic insulator, hard enough to cut granite and price prohibitively expensive. Both minerals are comprised entirely of pure carbon atoms but they have been naturally exposed to different pressures over thousands of years, causing variations in their crystalline structures. It is the structure of the carbon atoms that determines its allotrope and gives graphite its appearance and very unique properties.

All fossil fuels are carbon based and graphite occurs naturally as the highest grade of coal, just above anthracite. It is one of the oldest known minerals and has been used by man since antiquity. While it is still mined today in some parts of the world as a raw mineral, it can also be manufactured artificially as synthetic graphite. It is used in pencils, steel-making, batteries, brake linings, lubricants, resistors, microphones and brushes.

Starter brush manufacturing begins with finely ground graphite. The grain size is tightly controlled and dependent upon the specific application. The powdered graphite is then mixed with a thermoplastic binder at elevated temperatures. Typically, these binders are composed of phenol (carbonic acid) resins. Petroleum cokes, pitch cokes or carbon black are also added. The cokes and carbon black are man-made by exposing raw carbon fuels to an incomplete combustion process by baking them at very high temperatures in the absence of oxygen.

In brush making, binder recipes are engineered in-house and as such are considered closely guarded secrets. These binders are virtually impossible to reverse engineer, making exact brush duplication by another manufacturer a true long shot. In the case of starter brushes, powdered copper is also added at this point. The size of grain of the copper is also tightly controlled and the exact amount is calculated to achieve a specific resistance.

Once these ingredients are thoroughly mixed they are formed into blocks that are called "green bodies" using injection or die molding. The pressures used in this molding process will vary, but may be as high as 60,000 PSI (pounds per square inch).

The green bodies are then baked, or heat treated in ovens at temperatures up to 2,000 degrees Fahrenheit under an artificial atmosphere that has been purged of oxygen. Hydrogen and nitrogen are used to displace outside air. The length of time and exact temperature curve of the baking process also varies by the end application. During the heat-treating, which is referred to as pyrolysis, the binders decompose. The result is a very hard substance called **hard carbon** or **carbon/graphite.** It can be used at this point in mechanical applications where a hard material with self lubricating properties is needed – such as sliding rings or bearings. But carbon/graphite is not suitable for use as brush material just yet.

The next step is called graphitization, which requires a second heat treatment at temperatures up to 5,500 degrees Fahrenheit. While this can be accomplished in ovens, it is often performed by passing current through the material itself. Sandwiched between two electrodes, the natural resistance of the hard carbon ensures even heating throughout the block. Current from the secondary side of a transformer enables precise control of both the time and temperature during this process, in which the graphite is re-crystalized into a higher degree of orientation. Here, orientation refers to the compactness of the crystalline structure at an atomic level.



The temperature curve of the second heat treatment is closely monitored and controlled to fine tune the final degree of orientation. That is when both the level of hardness and electrical properties of the finished product are created. In addition to the binder's composition, the temperature curve is the second big secret of each brush manufacturer. The result is a unique material that is nearly impossible for anyone to copy successfully.

Once re-crystalized, the graphitized carbon is now called **electrographite** – the stuff all brushes are made of. Electrographite is an excellent conductor with very low electrical resistance. It also has high thermal conductivity, excellent sliding properties and is naturally resistant to corrosion. While that sounds like a finished product we are not done yet. It must be cut into individual brush blanks and each blank is then machined or ground into the proper shape.

The material can be impregnated with synthetic resins to seal up pours that remain in the binder, making it impermeable to liquids and gases. Metal impregnation can be used to increase hardness and strength. Coatings made of silicon carbide or treated carbon can also be used as a sealer to further inhibit corrosion.

Brush leads, called "shunts" by the manufacturers, are usually attached by tamping. The lead end may be tinned or attached to a copper rivet prior to tamping. The shunt is inserted into a hole that has been drilled into the brush. A thero-setting resin is then injected and tamped around the shunt's wire. The resin may be cured by heating or chemical reaction. Today phenolic resins mixed with powdered copper are used most often to secure shunts, providing stability to the tamped connection. The size of the shunt's wire must be heavy enough to handle the current that the starter was designed to consume. It's resistance is part of the brushes total resistance.

BRUSH WEAR

As was mentioned in the first paragraph, all brushes are expected to wear out eventually. They are tasked with providing an electrical connection sufficient to carry a high amount of amperage to a surface that is constantly moving. Brush wear is not just related to a brush's hardness. Their longevity is dependent upon many factors with hardness being only one of them. Lubricating qualities, the volume of the current being carried, the surface speed and condition of the commutator, the starter's ability to brake the armature after an engine start and spring tension all affect brush life.

Any discussion on brush wear must begin with the commutator's surface. If not for a thin oxide film, brushes would wear away like chalk on a board. This film is only a few angstroms thick. An angstrom is a metric unit that is equal to one ten-billionth of a meter, which is so thin it is hard to compare it with anything you can see without a microscope. It forms rather quickly on its own during operation when small particles of copper are transferred from the commutator to the brush. The copper powder is vaporized by heat on the face of the brush where it combines with air and moisture. Then it deposits itself back onto the commutator's surface as a metal oxide coating. Graphite from the brush is deposited along with it. Coincidentally, the film is also non-conducting. But no matter – it is thin enough for current to flow through it even at low voltages.

Sometimes called patina, this film creates a surface that is very low in friction and prolongs brush life (see Figure 2). The appearance of the film is controlled by the amount of graphite in it. A thick, dark and shiny patina contains an abundant deposit of graphite that is perfect for starting motors. It permits moderate brush wear and minimizes commutator wear.

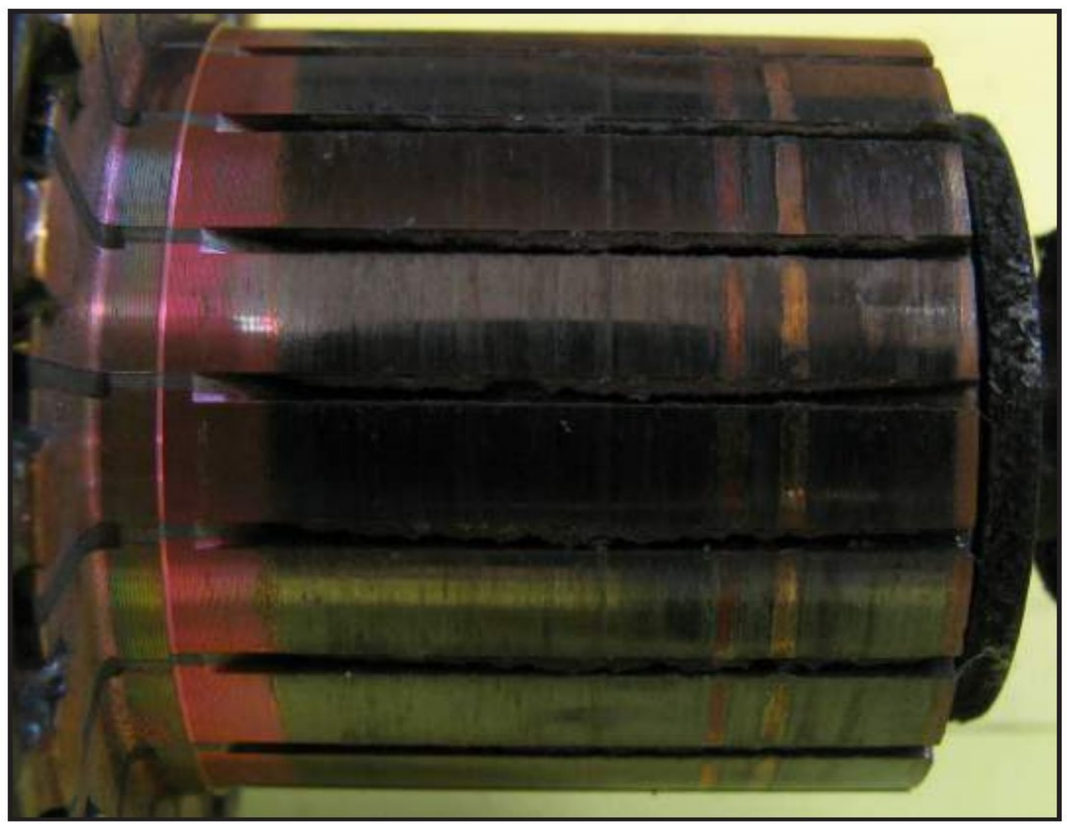

Figure 2 – Good brush film should be dark, shiny and uniform. The two lines on the right indicate areas where current flow was absent.

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STARTER BRUSHES

But in spite of how smooth the brush and commutator may appear, only 10% of the brush face actually makes mechanical contact with the commutator at any given time. Current flow concentrates on the small points of contact and creates the streak marks often seen on a used commutator. Ideally, they are evenly distributed across the face of the bar. Evenly distributed streaking is normal. You may also find the trailing edge of each bar to be slightly darker (see Figure 3), as on this flat commutator. That is also normal, caused by **reactance voltage.**

An armature is made up of interconnected coils, attached between those coils by individual commutator bars. Commutation is the switching of current flow from one set of coils to the next. As each bar separates from a brush the current flow is moved on

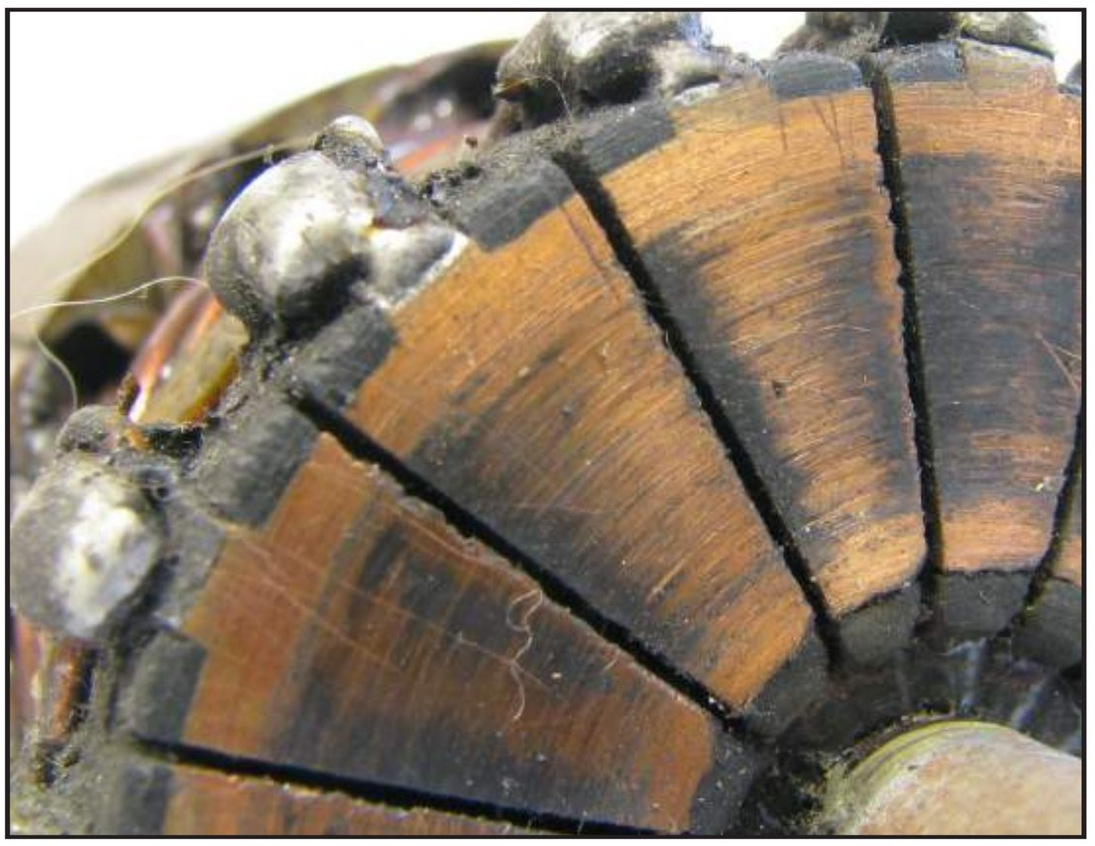

Figure 3 – The darkened areas along the trailing edge of the bars on this flat commutator were caused by reactance voltage. It is normal.



Figure 4 – This 42MT commutator shows damage by reactance voltage in addition to excessive arcing from over cranking.

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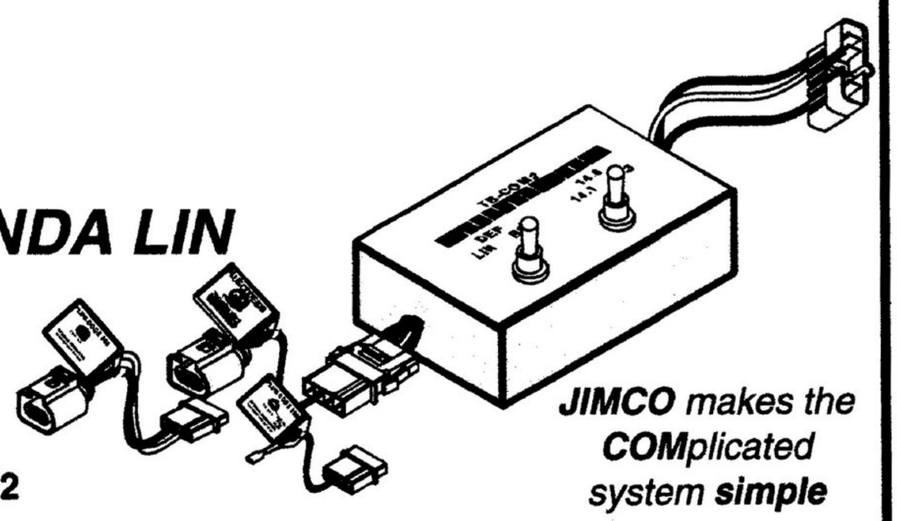

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to the following bar. But when electric current is flowing through any coil, it cannot be stopped instantly. Reactance voltage causes current to flow for a brief time after the circuit is broken. This can be witnessed physically as sparks when any switch is opened. The magnitude of reactance voltage is a directly proportional to the amount of amperage that is flowing when the circuit is broken. Therefore, heavy duty starters drawing hundreds amps will exhibit these signs much more prominently (see Figure 4). The trailing side of the brush will usually show signs where carbon was transferred away to the commutator by reactance voltage (see Figure 5).

SPRING TENSION

To understand just how important the springs are, consider that total brush resistance is actually the sum of the resistance of the physical brush and the resistance caused by the contact between the face of the brush and the commutator, referred to as **contact resistance.** All electrical connections, no matter how clean and tight they are, have some resistance that contributes to the

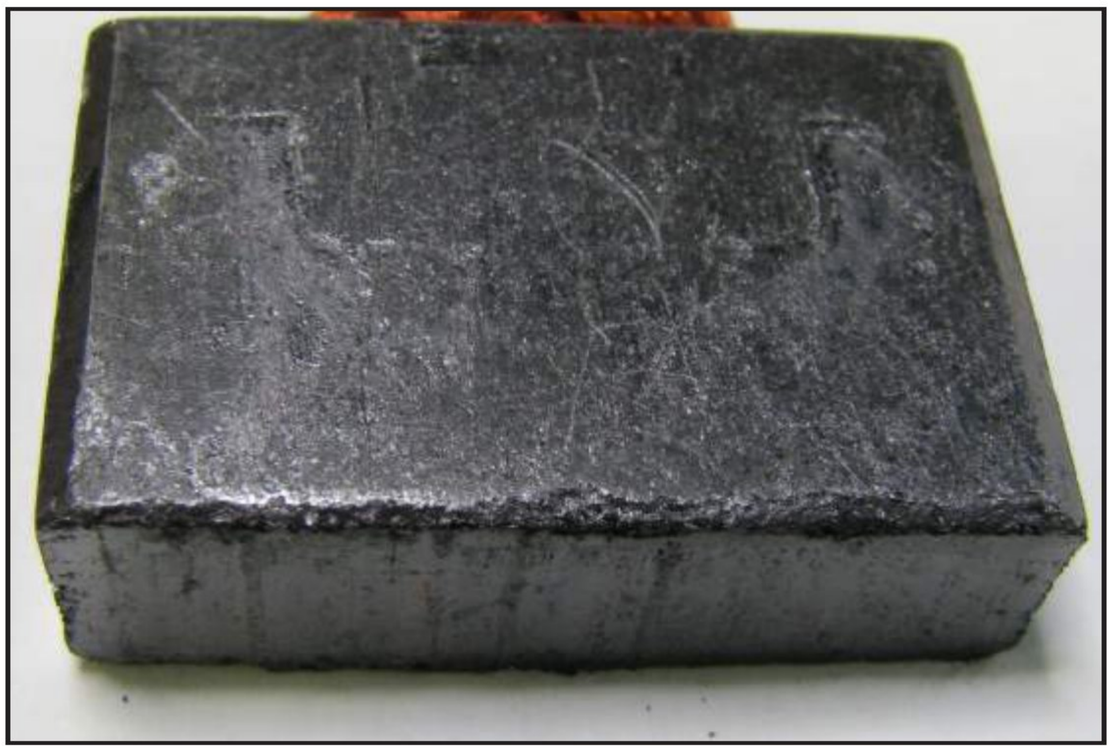
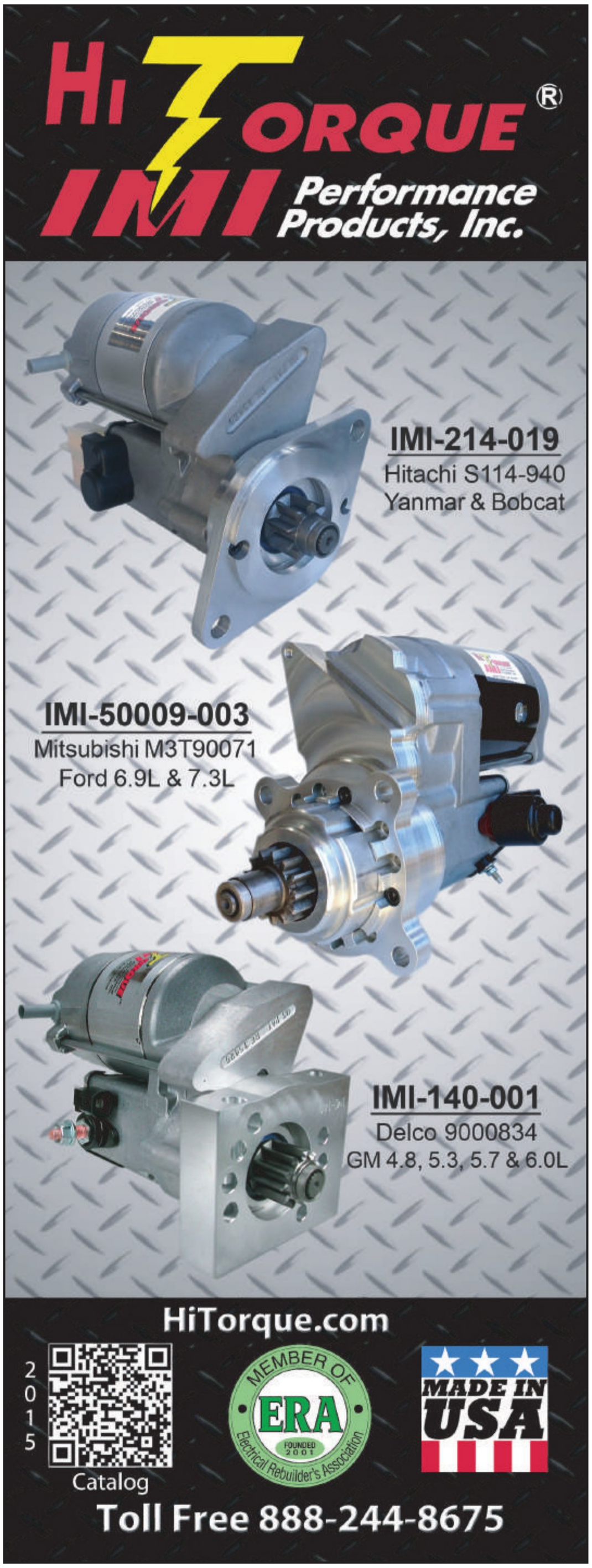


Figure 5 – The 42MT brush from the same starter clearly shows a loss of material all along the trailing edge.



Figure 6 – These 40MT brushes are for different voltages - less copper and smaller wire for 32 volts - more copper and heavier wire for 12 volts.



total resistance of a circuit. In the case of brushes, that connection is less than ideal.

The contact resistance of a brush is affected primarily by the brush's composition, the size of the brush face (contact area) and the spring pressure being applied to the brush. Obviously, the greater that pressure, the lower the contact resistance. However, brush wear is also affected by that pressure. Greater pressure wears the brush faster. Engineering a perfect brush spring pressure for any starter is a delicate balance the between brush wear and contact resistance.

Higher contact resistance from a weaker spring not only reduces the starter's power by restricting current, but it also generates significant heat and causes excessive arcing. In over-cranking scenarios, weak springs can damage both the brushes and the commutator within a short period of time. On the other hand, a stronger spring will improve conductivity, lower resistance and increase amperage flow. The trade off for that is an increase in brush wear and a reduction in service life. There is little doubt that a weak spring can do a lot of damage. Staying with original spring pressure is always prudent, but unfortunately, few stater manufacturer's publish those specifications. If you change springs, keep them all the same and err on the side of higher tension if you are unsure of original spring pressure.

ELECTRICAL LOADS

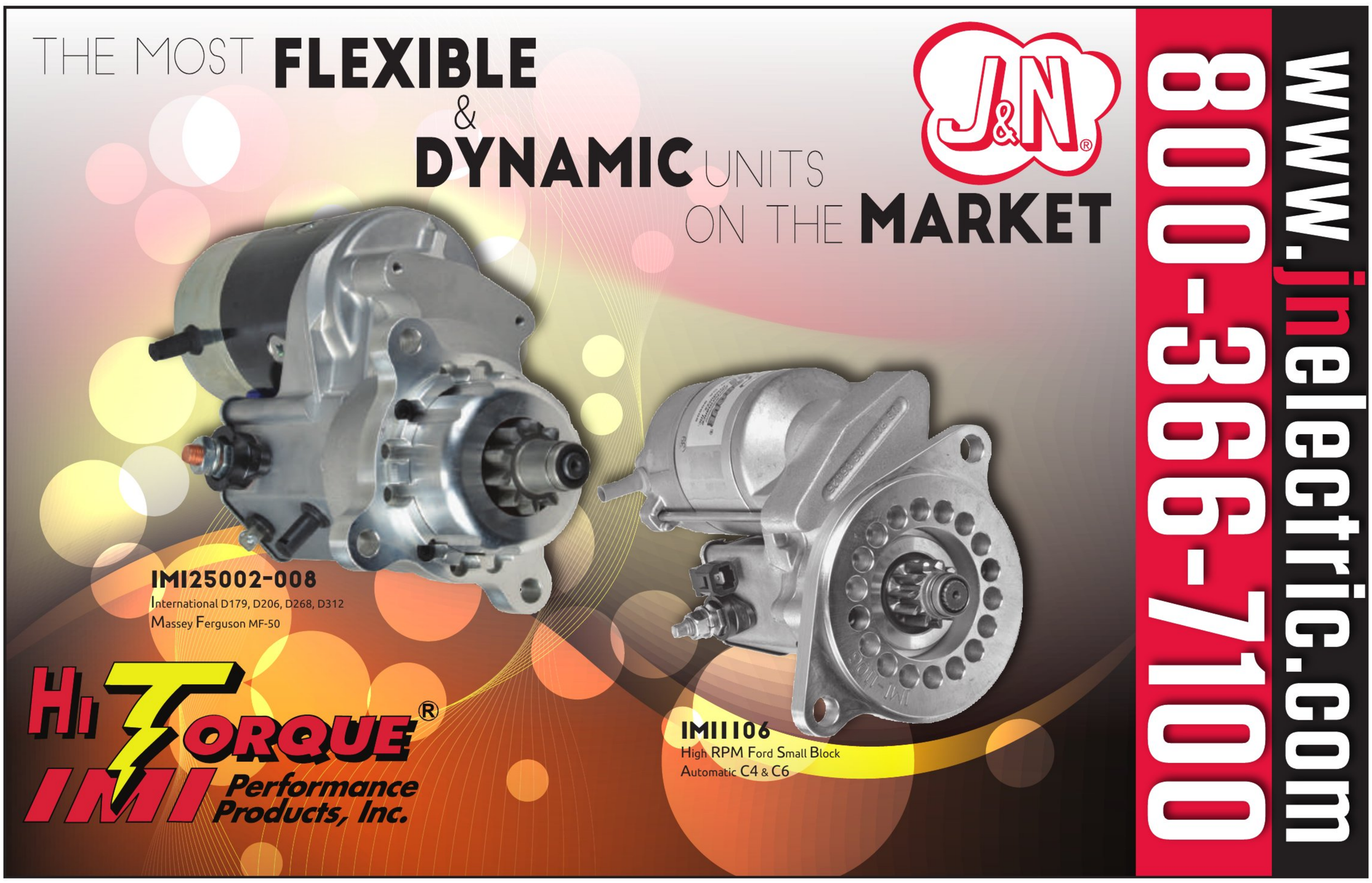
Electrical loads affect brush wear too, but not in the way you might think. Brushes actually wear faster under light loads or no load at all, as in the case of a starter spinning down after engine start-up. This happens because **current flow reduces brush wear.**

While that may seem hard to believe, there is a reason it happens. As current flows between the brush and commutator, both surfaces are rapidly heated. The heat and current together cause plasma to form across the face of the brush. During cranking this plasma carries current and limits brush wear. When the current is cut off after engine start, the plasma dissipates immediately. Wear from abrasion between the brush and commutator increases greatly in the absence of current flow. Under normal operation, most brush and commutator wear actually takes place during the slow down period of a starter after dis-engagement. For that reason, braking is always important and should never be overlooked.

RESISTIVITY VS VOLTAGE

While most of the starters that you encounter are probably for use in 12 volt systems, you undoubtedly run into some 6 and 24 volt units. Occasionally you may even come across a 32 or 48 volt starter. Generally, a lower voltage starter requires a lower resistance brush while higher voltage starters must have higher resistance brushes. If you compare brushes for the same series but different voltage ratings, you can usually tell them apart visually (see Figures 6 and 7). The amount of copper present in the brush versus carbon and the size of the shunts (lead wires) are the easiest way to differentiate them. Using the same brush as the original manufacturer is almost always the best choice.

However, experienced rebuilders sometimes substitute a brush of **higher resistance** for a specific reason. Keep in mind that Ohm's Law always applies. When resistance is increased and voltage remains the same, amperage must come down. So



the end result of such a substitution is a reduction in current and a subsequent loss of power because voltage times amperage equates to power. You may wonder why an experienced rebuilder might do this, especially after this article began by emphasizing the importance of brush resistance.

An example can be seen in the 42MT commutator on the cover photo. Notice the marks on the bars that resemble pockmarks (see Figure 8) . Those have been caused by severe arcing across the brush face. This particular armature was removed from a remanufactured starter that had the latest version of Delco brushes in it. The new brushes (see Figure 9) are packaged with new springs to insure proper tension. Note the wide braided shunts on the new brushes, compared to the older version 42MT brush on the right. The new brushes are designed for extremely low resistance. Weak springs did not cause this damage. This starter had been cranked for an extended period of time, as was evidenced by the reddish discoloration on the commutator and the brushes (see Figure 10).

Several production rebuilders that I have communicated with have confided that they routinely install 24 volt brushes in all of their 12 volt 42MT starters to limit that kind of arcing. The same policy extends to their 39MT starters. They use higher resistance brushes to protect their starters from over-cranking by the end operators.

The downside of a higher resistance brush is a reduction in power, but evidently it is not enough to matter in the vast majority of applications. This is not a blanket endorsement to install higher resistance brushes in all starters. But it can certainly be beneficial in cases where an application or customer is prone to over-cranking. Everyone that I spoke to about the practice told me that it has greatly reduced their warranties on 42MT and 39MT starters while none of their customers have noticed or complained of slower starting.



Figure 7 – The early style 42MT brush on the left is 24 volts while the one on the right is 12 volts.



Figure 8 – This 42MT commutator shows evidence of extended over-cranking. The discoloration indicates extreme over heating. The burn marks are from arcing.



Figure 9 – Notice the difference in the shunts between the latest version and the original on on the right.



Figure 10 – Notice the reddish discoloration of the used brush on the right, caused by extended over-cranking.

A second example involves using 12 volt brushes in 6 volt starters. In some cases, the 6 volt brush may be obsolete and no longer available. Or, you may simply not have the 6 volt brush in stock. Personally, I have made this substitution many times. The measured loss of amperage draw was barely detectable. However, some applications in which a starter's power rating is marginal for the engine's size and compression may make them poor candidates for this type of substitution.

Note that these examples are both going from a lower to a higher resistance brush and not the other way around. Substituting a lower resistance brush is more apt to cause a warranty, especially if it is ever over cranked. A lower resistance brush will increase the starter's amperage draw and power. But it will also cause it to heat up much faster and drastically reduce the length of time it can be operated without damaging itself.

PERMANENT MAGNET STARTERS

Up to this point, the examples have have all been series-wound starter motors. Once common across the spectrum, they are mostly used today on heavy duty applications. The vast majority of automotive, marine and small industrial engines today utilize permanent magnets in place of field coils. When you replace the field coils in a starter circuit with magnets it changes brush resistance requirements because the brushes have to make up for the lost resistance that was in the field coils.

Therefore all PM starters must have brushes of higher resistance, which means they contain less copper depending upon the application and power requirements . In addition, most PM starters today are planetary gear reduction, meaning the armature will be turning much faster than a direct drive starter – up to 5 times faster. The minimal amount of copper and higher resistance do not necessarily mandate a softer brush. The size of the brushes and their shunts can be used to increase resistance.

Generally, PMGR starters require a hard brush for longevity, a high level of lubrication to protect a fragile commutator, and high resistance. PMGR commutator's are for the most part not designed to be serviced. The bars are too thin for that. When the brushes wear out, a persistent operator determined to get one more crank out of the starter can easily destroy the armature by overheating a bar that is making insufficient contact. If contact resistance is high enough, the bar can quickly heat to a point that it melts the phenolic material used to hold it in place. For that reason, brush composition in PMGR starters is especially important. When composition and hardness are not right, the brushes can easily wear out within the warranty period. When that happens, the armature is often destroyed too.

BALANCE BRUSHES

Balance is not normally a big problem because most rebuilders routinely replace all brushes as a complete set. But it is worth mentioning that all brushes in a single starter should be identical. Different brush manufacturers should never be mixed because no two make exactly the same brush – even though they may appear to be the same. Unbalanced brushes will affect both performance and longevity. A set of brushes that is unbalanced can cause uneven wear or damage to the commutator. Brushes are a key part in providing your customer with a reliable starter. Do not make the mistake of under-estimating their importance.



Mark this date now! March 18-20, 2016

TENTATIVE 2016 MEMPHIS SHOW SCHEDULE:

FRIDAY MARCH 18

8:00 – 10:00
Seminar: Dan Marinucci
— with Communique' —
Scope Testing Alternators

10:30 – 1:30
Plant Tour – WAI Global Distribution Center – BBQ Lunch provided by WAI

2:00 – 3:30
Seminar: Juan Grube
— with Jimco —
Permanent Magnet Charging Systems

4:00 – 5:00
Reception with Cash Bar

5:00 – 8:00
Exposition Open

SATURDAY, MARCH 19

8:00 – 9:00
Seminar: Murl Reiman
— with PLP Battery —
Battery Charger Repair

9:30 - 10:30
Roundtable

10:30 – Noon
Hot Buffet Lunch

Noon – 4:30
Exposition Open

5:00 – 11:30
Downtown Shuttle Service:
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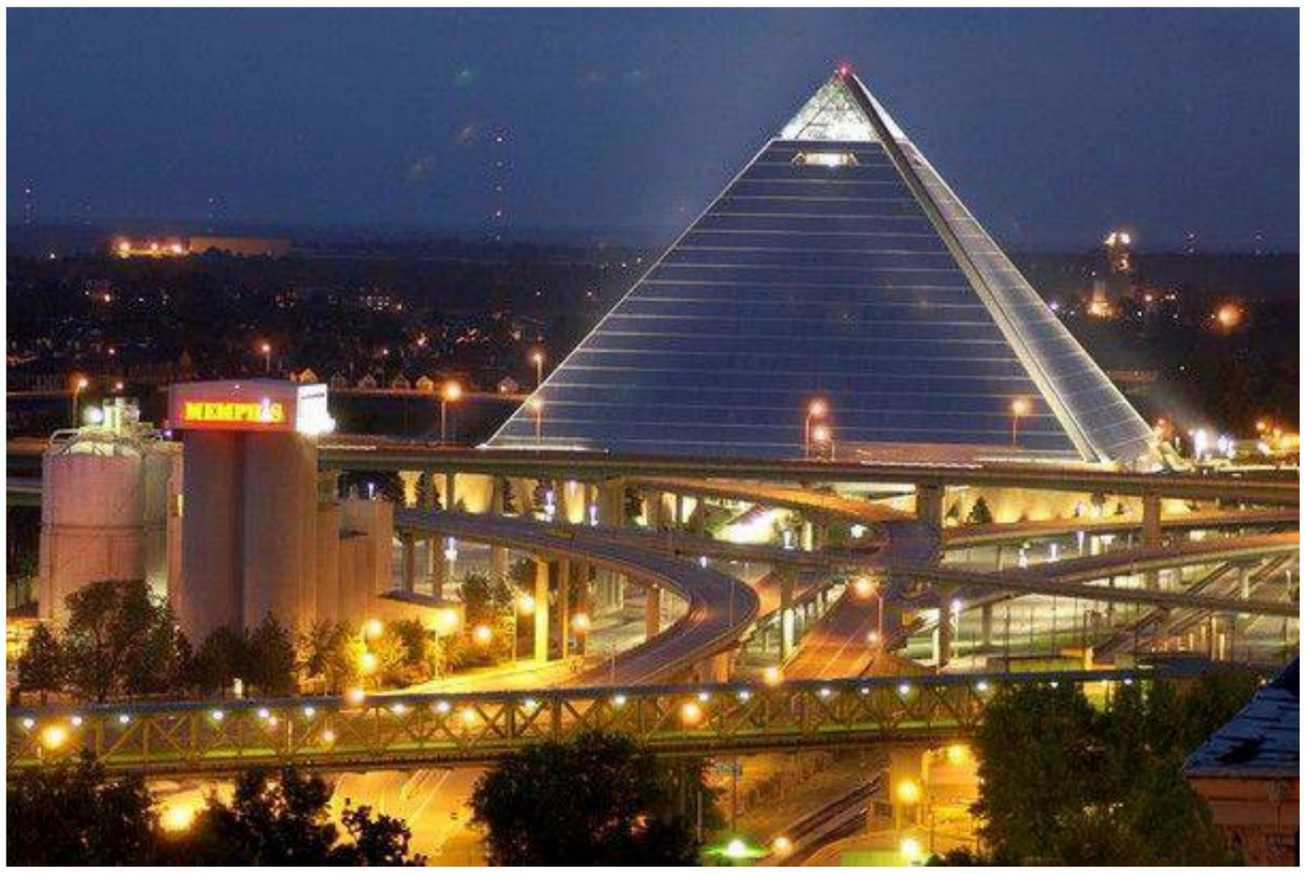
SUNDAY, MARCH 20

7:00 – 9:00
ERA Breakfast & Annual Meeting

9:00 – 11:30
Seminar: Mohammad Samii
— with Sammy's Auto Electic —
Newer Starter and Alternator, Testing, Rebuilding, and Case-Studies





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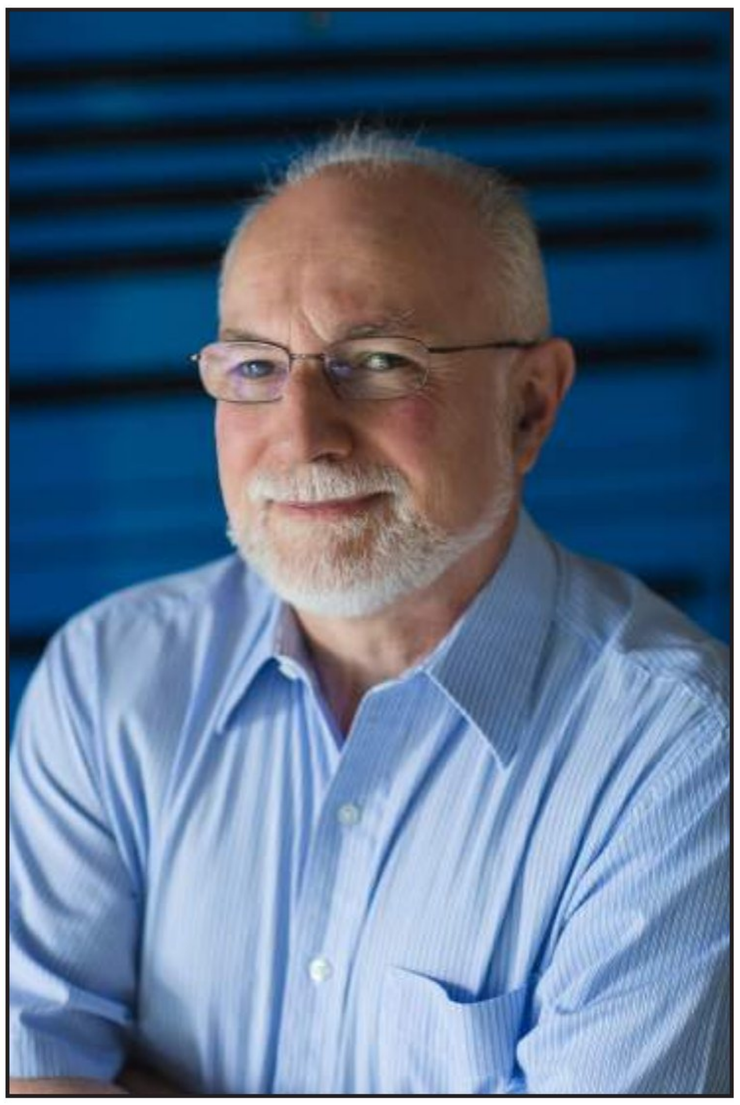
Meet the Presenters



Dan Marinucci with Communique'

Friday, March 18th 8:00-10:00 a.m.
Topic: Scope Testing Alternators

Dan is an ERA member who has presented a variety of seminars for the association over the years. He's also a member of the North American Council of Automotive Teachers (NACAT).

He has been reporting on the automotive service industry since 1976, writing for ***MOTOR/AGE, UNDERCAR DIGEST, IMPORT SERVICE and ELECTRICAL REBUILDERS EXCHANGE.***

What's more, he has written ***MOTOR Magazine's*** monthly "Foreign Service" column for nearly 27 years. (***MOTOR Magazine*** is a Hearst publication that has served the professional auto repair market since the 1920's.

Dan has written the twice-monthly "Automotive Management" column in ***TIRE BUSINESS*** for 26 years. (***TIRE BUSINESS*** is a Crain journal serving the tire dealer market since 1983.)

Dan has been presenting tech training seminars for installer-technicians nationwide since 1993. He has taught these classes in 38 states and across Canada. Dan gathers data for his seminars by investing countless hours in hands-on testing. As just one example, he has captured more than ***4000*** oscilloscope patterns during his research.

His depth of knowledge and ongoing data-gathering give Dan a unique perspective on the automotive service business.

Juan (John) C. Grube with Jimco

Friday, March 18th 2:00-3:30 p.m.
Topic: Permanent Magnet Charging Systems

"You can fix anything once you know how it works…until then you're a parts changer."

Juan Grube, owner and President of JIMCO, Inc., grew up on a dairy farm in Raymore, Missouri. He learned to repair, not replace, the farm equipment and to make things last.

Following high school, he attended Central Missouri State University where he earned a degree in Industrial Engineering. He's fond of saying that the last two weeks in May, 1969, were his most traumatic ever: he graduated from college one weekend, got married the next weekend and had to go to work the following week!

In 1976, he and his wife Carolyn bought the newly incorporated JIMCO from his brother. The product line changed dramatically in 1980 with the introduction of the JIMCO line of alternator test benches, designed by Juan.

Today Juan heads JIMCO, Inc., still actively involved in the design and engineering of the equipment. He spends much of his time providing technical assistance to rebuilders around the country.





Murl Reiman with PLP Battery

Saturday, March 19th 8:00-9:00 a.m.
Topic: Battery Charger Repair

PLP Battery Supply, a family owned and operated company, is located in Murphysboro, Illinois. PLP has been in business since 1982, they specialize in battery sales for everything from a watch to batteries for airplanes. PLP is an authorized sales and repair center for many battery charger manufacturers such as Associated, Century/Solar, Japlar/Schauer and RN chargers. They stock and sell parts for many other charger manufacturers, like Lester, EZ-GO Textron, and Powerwise. They also specialize in repair of obsolete brands of chargers. Owner Pete Polete explains that many of his best customers are starter and alternator shops throughout the US and Canada.

Murl Reiman started his career at PLP 20 years ago, delivering batteries on a regular route. He has worked his way up the ladder and is now one of a team of repair specialists employed at PLP. He has hands-on experience working with all types of chargers and has become a seasoned veteran in this specialty field.

Murl is married and has two daughters. On his days off, he enjoys hunting and fishing in southern Illinois.

Mohammad Samii with Sammy's Auto Electric

Sunday, March 20th 9:00-11:30 a.m.
Topic: Newer Starter and Alternator, Testing, Rebuilding, and Case-Studies



Mohammad Samii or "Sammy" as he is often called has been involved with electrical rebuilding since 1972 and currently is president and owner of Sammy's Auto Electric Service, Inc., in Champaign, Illinois which he established in 1979.

His company does custom electrical rebuilding, electrical/electronic diagnostics and installation on various vehicles, and modifications and customizing of charging starting systems for higher power and torque. He is a member of the Society of Automotive Engineers (SAE), an ASE certified technician. Sammy serves on the board of governors of the Electrical Division of the Automotive Parts Remanufacturers Association (APRA). His monthly column, "Auto Electric Corner" appears in the Global Connection (APRA's monthly newspaper) which he has been sharing his experience with his peers since 1992.

He teaches various courses in installation, rebuilding, and diagnostics throughout the U.S. and Canada for rebuilders as well as technicians and mechanics. He has been involved with teaching APRA's Electrical Clinics as well as conducting many training sessions for ERA during their annual ERA Show in the past several years.

Mohammad is a graduate of the Iranian Air Force Academy as well as USAF Air University at Maxwell Air Force, with a degree in aircraft maintenance engineering.

His career in electrical rebuilding since 1973 coincided with the introduction of power electronics in automotive applications, where his educational background made him quickly grasp the new technology. Invention of computers and their introduction into the automotive field peaked his interest where diagnosing some hard to find electrical/electronic problems remains his interest and is part of his daily work, in addition to rebuilding rotating electrical units.

He has lived in Champaign, Illinois since 1979 with his wife and 3 children who are now all grown. As a private pilot he enjoys General Aviation and flying various single engine airplanes, and is an avid tennis player who enjoys playing the game and watching various tennis tournaments.

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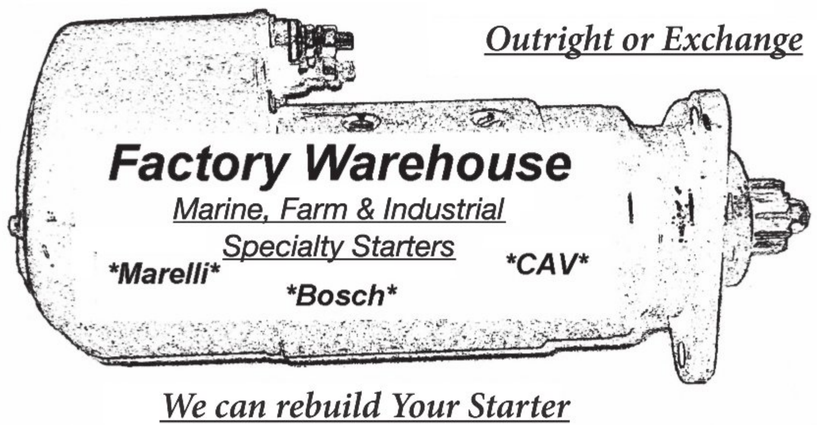

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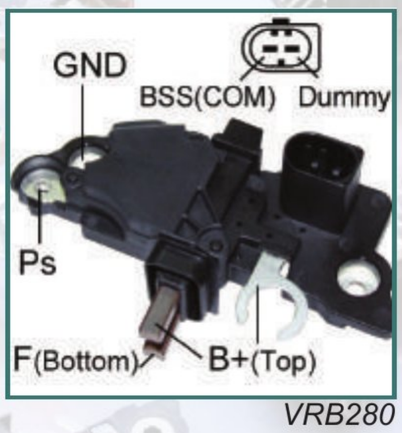

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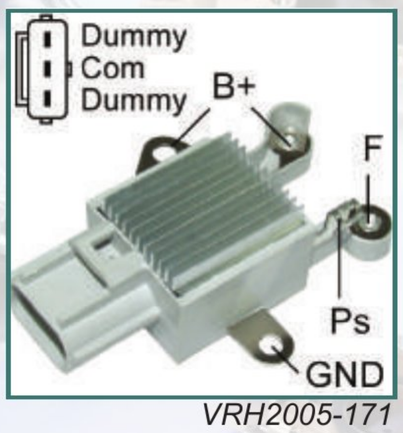

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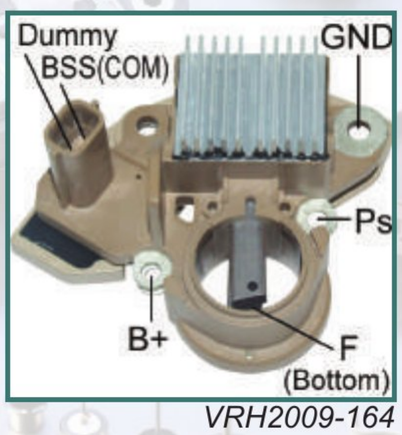

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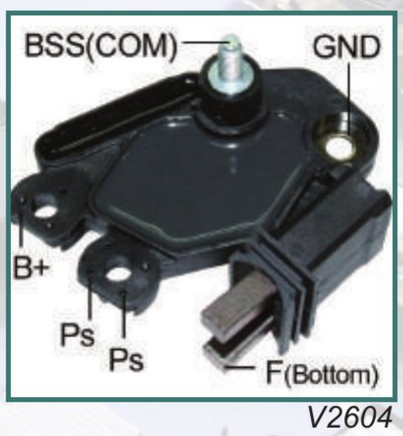

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