

ERA EXCHANGE

YOUR GUIDE TO ELECTRICAL REBUILDING

September 2016 \$12.95

VALEO SPRINTER ALTERNATOR
Power to Spare

OVERCRANK PROTECTION
Educate Your Customers

PLUG CODES PART TWO
Bosch 2 Pin – Used on Sprinter Vans

PLAIN TALK | AVOID THE BLUE LIGHTS



A WORD FROM THE PRESIDENT

Finding the Right Help



In the last few issues I've written about the importance of a dedicated website for any business operating in today's world. Older well-established shops may feel that they don't really need one. That is only true if they have so much work that they do not want any new customers. Raise your hand if that's you.

I admit that the task of getting a website looks intimidating. It is easy to put it off until later – but “later” never comes. The reason I know is because I have been there. You actually have many more choices than you think, today more than ever before. You may not believe it but some cost next to nothing.

Finding a local web developer is relatively easy, and frankly that is how I got my first website about 10 years ago. It seemed like the best way for me at the time. I hired one person to do it all. The cost was about \$500 for a simple website. Keep in mind that this is a one time expense so long as I did not need to make any changes later. Over 10 years, that's \$50 per year or about \$1 week.

Not a bad price for the amount of exposure that it gave me – a lot cheaper than the phone book.

That first website was OK, but not great. It provided what I wanted at the time and has proven to have more than paid for itself. Each year, an increasing number of new

customers find me from the website. I've even picked up new industrial accounts because other business owners search the web too.

But as time passed I could see there was room for improvement. I wanted to add to my website but put off going back to the developer. When I moved my

“It is easy to put it off until later – but “later” never comes.”

business phone service to CenturyLink several years ago, they offered me a bundle deal that included Internet, free hosting for a website and access to their web-based do-it-yourself tools for building my own website.

I had already saved quite a bit by changing my Internet and telephone service. The hosting and web tools were basically free if I wanted to use them. I was leery at first, but eventually decided that I should at least give it a try. With very limited basic skills and knowledge I used their tools to build my current

“You actually have many more choices than you think, today more than ever before.”

website – working a few hours each night for about two weeks. Check it out: www.actionalternator.com

Last week I received a phone call from a trucker in Florida who found my website. He told me he wanted to upgrade his alternator to a 320 amp Leece Neville. He was scheduled to be in my area in two weeks and asked me if I could get him the alternator and do the installation. That kind of sale is only possible when you have a good web presence.

Mike Dietrich

NEW ERA MEMBERS

Grove DC Electric, Inc.
Fox Lake, Illinois

Johnny's Auto & Marine Electric
Garner, North Carolina

Starter Alternator Specialists
Billings, Montana

ABOUT THE COVER

This 220A Valeo Sprinter alternator is self-excited and is charging with the LIN signal turned off.

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Rebuilding is Recycling!

PLAIN TALK — AVOID THE BLUE LIGHTS

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International Winding Inc. 1-630-832-8264



BY ROB BUKSAR

This last week around Chicagoland has been one overwhelming mass of heat, rain and humidity. If you don't work in an air-conditioned environment, getting through the day is like trying to operate inside a hot damp sponge! Along with that unpleasant climate, we are also blessed with a little pesky critter called a "floodwater mosquito". They breed in shallow pools of water, puddles and roadside ditches. Their purpose in life is to make more mosquitoes. The male's life span is three to five days. The females mate once, but continue laying eggs after every blood meal. Under the best of circumstances, she can last a month or two. Every time she has a blood meal, she will lay another batch of eggs.

Reproducing is her only mission and she is ultimately determined. How many times have you been sitting somewhere and found yourself being driven nuts by a pesky mosquito. No matter what you did, you just couldn't stop it from coming back over and over again! You want a role model for determination? Take a moment and fathom that little bug.

You see, Mother Nature genetically-coded the mosquito with one sole purpose in life. Failure is not an option for a mosquito. Finding and feeding on a blood source is its only means of success. There can be no distraction, stiff breeze, fly swatter or insecticide to dissuade it. Someway, somehow, through thick or thin and endless adversities that mosquito will relentlessly attack until she either succeeds or dies trying.

Now, if you thought that I was going to use my time and space to write about bugs then you haven't learned much about me. What I suggest today is that all of us have gone a little "buggy". The people who study bugs (mosquitoes) and the pest control folks discovered something about the insect's nature. As mentioned earlier, Mother Nature coded a singular genetic purpose in that mosquito. She will relentlessly pursue her mission and as all of us are painfully aware of she succeeds too often. However, if you want to neutralize her as a pest, two things have to happen. First and foremost; distract her from her mission and lead her in a different direction. Second; insure the distraction leads to her destruction, henceforth, the "Bug Zapper".

The bug zapper, as most of you are aware, is a soft blue neon light surrounded by an electrically-charged screen. I don't know why or how the blue light attracts mosquitoes away from what they need to survive but it does!

Our country has been through all sorts of ups and downs over the last 100 years or so. Yet, whether the problem was war, economics, agriculture, industrial or education, when we were leading with focus, we overcame and accomplished great things. There's a lot to say about American exceptionalism!

Are we without fault? Heck no! Yet, do a little homework on your own. In our imperfection as a nation, we have accomplished bigger and better things than any nation that preceded us, ever. We built great big things and were the center of the planet's industry and innovation.

We were also the world's bread basket, we cured the disease and pestilence that plagued mankind for eons, and we developed

the world's greatest economy and provided the best standard of living for most who lived here. We fostered the greatest musicians, artists and scientists. No one in this country has been without food, clothing and shelter who desired it. There has been no loin-cloth jungle living in the USA. Being poor in the US meant you only had basic cable.

Yet, someway, we have become terribly distracted. The last 15 years we have been in a race to the bottom! Remember John Kennedy's America? He tasked the nation with putting a man on the moon, and we did. This government wanted to put a man in the woman's restroom, we did that too! See the difference?

My message today is simply this. Examine your own circumstances and insure you haven't been distracted also. Small business has never been easy. In past times, it has been easier but these days, it's never been this hard.

High taxes, crazy regulations and stupid trade agreements, we all have our hands full. Further, the multi-nationals and our own suppliers continue to attack the market that we depend on shortening the supply of potential customers.

None of the above is going to change anytime soon. Yet, most of us can continue to grow and prosper but a few things will have to occur if that's going to happen.

1. Redefine what our missions is.
2. Rededicate ourselves and inspire our staff to get on board with that mission.
3. Eliminate any and all distractions from the accomplishment of that mission.

Life always has distractions. Yet, I don't think that there has ever been a time or place where there have been so many.

People who are without jobs or are under-employed are concerned with acquiring the latest cell phones. We chase home remodeling, vacations and entertainment and are no longer focused on dwindling income or shrinking customer base. The pope just recently admonished the world's youth to put down the distraction of Pokémon Go and do something productive and proactive with their time.

The darn thing about it is that we know all this stuff. We Know Better! Someway, somehow there has been some "mystic blue light" subliminally introduced to the game that has distracted far too many of us. We're not flying toward fame, fortune and a prosperous future. If we continue towards those blue lights, we will end up on the bottom of the big bug zapper with the rest of the distracted souls.

This isn't a prediction or even a suggestion. Just look around you and take a hard, clear gaze at what's happening. Some are doing very well, exceptionally so. Then there's a bunch who aren't. Are the ones doing well just lucky? I don't think so. They're focused and stay on their mission. Then it's simple; attack, attack, attack, until success is achieved. Who knows, maybe too many of us have been distracted by the blue light.

It's time to take a break, re-evaluate, re-calibrate and charge forward in an undistracted fashion. A dedicated focus will put many of us back in the game in good fashion. Remember, the life, children and business you will save, will be your own! Nobody is going to do it for you. God Bless our little industry.

VALEO SPRINTER ALTERNATOR

Power to Spare



BY BOB THOMAS

It has been nearly 15 years since Daimler-Benz introduced Sprinter cargo vans to the US market, at first exclusively through Freightliner dealerships. Sprinters were also offered under the Dodge brand beginning in 2003. Since the Benz-Chrysler breakup, Sprinters sales have been handed over to Mercedes dealerships while Freightliner continues to handle all commercial chassis sales.

It is no wonder that Sprinter vans have become a familiar sight nearly everywhere in North America. Well over 200,000 have been sold in the US alone and another 30,000 in Canada. The vast majority are being used in commercial service of one type or another. While several different alternators have been used on the North American models, one has become a familiar sight to rebuilders – Valeo TG23C019 or Lester 11457.

It is a 220 amp unit (see Figures 1, 2 and 3) with four bolt pad mounting and a seven-groove clutch pulley. It was installed as a popular option beginning in 2007. In 2010, a nearly identical 180 amp version, TG17C030B (Lester 11306), became standard equipment while the higher amperage TG23C019 continued as an option.

Both alternators are self exciting with the regulator's voltage set point being controlled by the PCM through the van's data network. While you can bench test these alternators in default mode, you cannot test complete regulator function without a test lead or apparatus that can mimic the LIN communication recognized by this regulator.

The price of these test tools has come down in recent years. Rebuilding one or two of these alternators can easily pay for the tool which will allow you to test other alternators that are using network communication technology. A recent online price check prior to this writing revealed that this 220A Valeo alternator is being sold for prices that start above \$500.



Figure 1 – This Valeo alternator (TG23C019) for Sprinter vans can provide up to 220 amps of power. It uses a 7-groove clutch pulley.

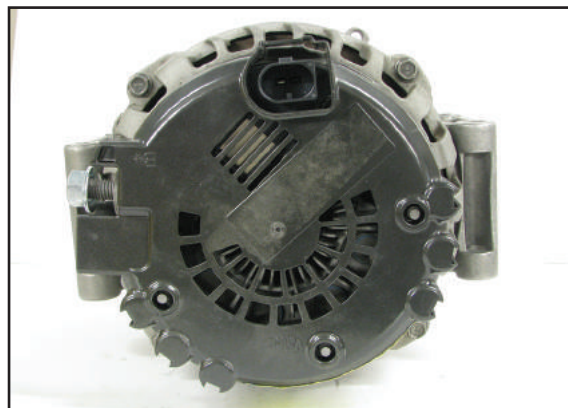


Figure 2 – The battery post (shown here at 3:00) is 8mm. The single-pin harness connection at 12:00 receives LIN communication from the PCM.



Figure 3 – This side view shows that the pad-mount bolt locations are not in a square pattern, making test bench mounting a challenge.



Figure 4 – This Valeo rotor has eight permanent magnets that are epoxied in four evenly spaced locations around the rotor.

VALEO SPRINTER ALTERNATOR

Both alternators present rebuilding opportunities. As you would expect, the clutch pulleys are the fastest wearing part on vehicles used primarily in the cities and often the first to fail. The bearings are both common sizes – 6202 on the slip ring end and 6303 on the drive end. Brushes, voltage regulator and other parts are all available at reasonable prices.

There are a few things that you must be aware of when rebuilding this alternator, starting with the rotor (see Figures 4 and 5). As you can in the photos, there are four sets of permanent magnets glued on each side of every other drive end pole claw. It is most important to mark the slip ring leads when changing them so as to not oppose the polarity of the permanent magnets. It is also prudent to test this rotor in the same polarity it will normally operate at (see Figure 6).

While these magnets will contribute some magnetism during charging, that is not their main purpose. They are there primarily to assure self excitation. This alternator's regulator voltage set point is controlled by LIN communication. But the regulator cannot be turned on by that communication. It is purely self-exciting. In the absence of a LIN communication, it will charge at a default rate of approximately 14.2 volts. If a LIN communication is present on the vehicle or when bench testing, the voltage set point will vary from 12.6 to 16.0 volts, depending upon the LIN command, loads, battery condition and state of charge.

This regulator has a single terminal (see Figure 7). As you can see in the photo, pin 1 is LIN and pin 2 is missing altogether - so there is “no connection”. This is plug code 063, one of six covered by Scott Scharrer's plug Code article in this issue. Adjusting the regulator's voltage set point is relatively simple when you have the proper tool to do it (see Figures 8, 9 and 10). As you can see in the photos, charging voltage may be tested at several levels to verify that the alternator will perform properly with the PCM's LIN communication once installed on a vehicle.

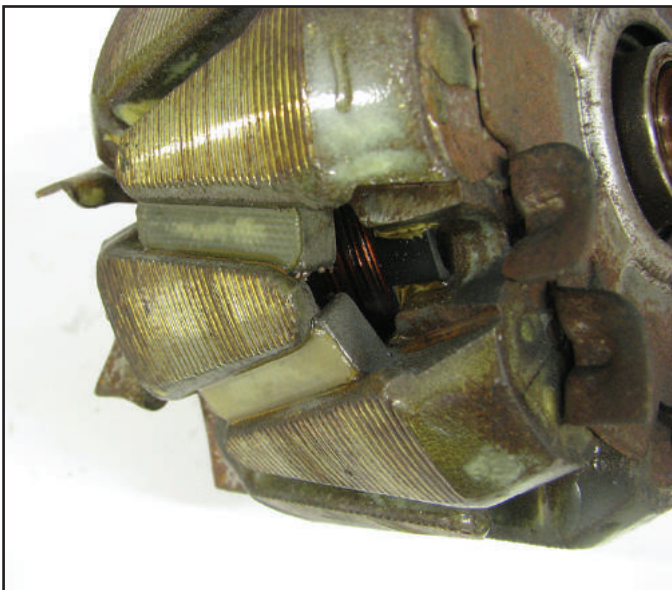


Figure 5 – Here you can see that each magnet abuts one side of a drive end pole claw, creating sufficient magnetic force to guarantee self excitation at idle engine speed.

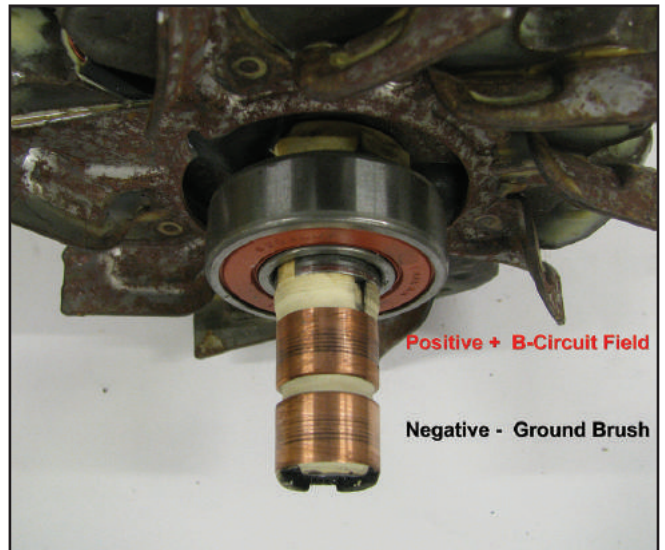


Figure 6 – This rotor's polarity must be observed. Reversing polarity works against the magnets. When replacing slip rings, mark coil leads to ensure that polarity is not reversed.

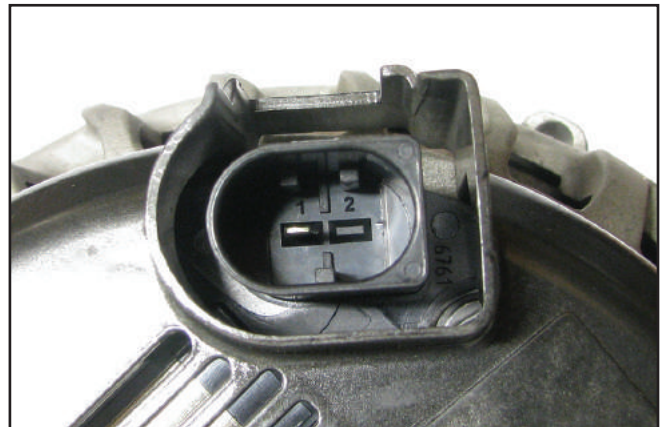


Figure 7 – This regulator uses a fairly common two pin Bosch connector, but notice that it only has one pin – used for LIN communication. Space 2 in the plug is blank or “no connection.”

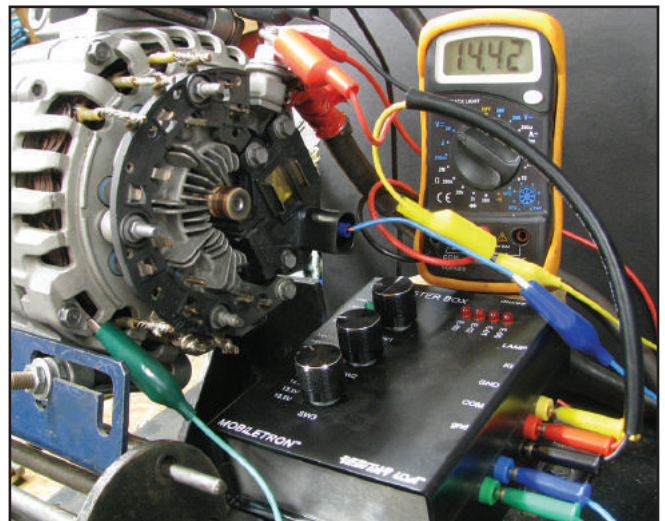


Figure 8 – Here the alternator has self excited and is charging at the default rate. The LIN signal is turned off on the test box. Note the adjustable mounting bracket that was helpful to keep the belt straight.

VALEO SPRINTER ALTERNATOR

The 12 diode rectifier and slip ring end housing (see Figure 11) is a single part that can be replaced or repaired with new diodes. The six lead double wound stator is secured in the drive end housing with a rubber-like, two-part epoxy. The compound holds the stator in place, dampens noise-causing vibrations and conducts heat away from the stator lamination stack. You can watch a video of the relatively simple process of installing it on the ERA website's Video Library under Valeo TG Series Statcool Alternators – Changing the Stator.

Note: Both Bosch and Delco offer lower-priced alternators that will fit this application. The Delco unit is an 18SI, part number 8600763, rated at 175 amps. The Bosch alternator is part number 0-124-625-023, rated at 180 amps.

Special thanks to Lynn Gross, owner of Churubusco Auto Electric Inc in Churubusco, IN for lending me an alternator to test and photograph.

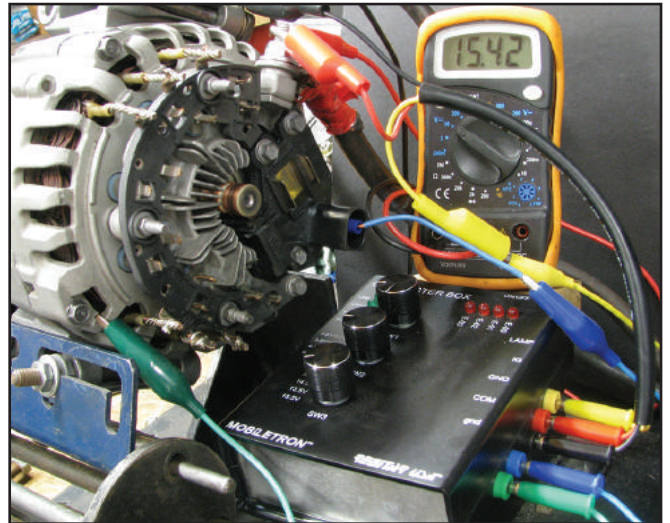


Figure 10 – Here the LIN signal has been switched to the highest setting on the test box.

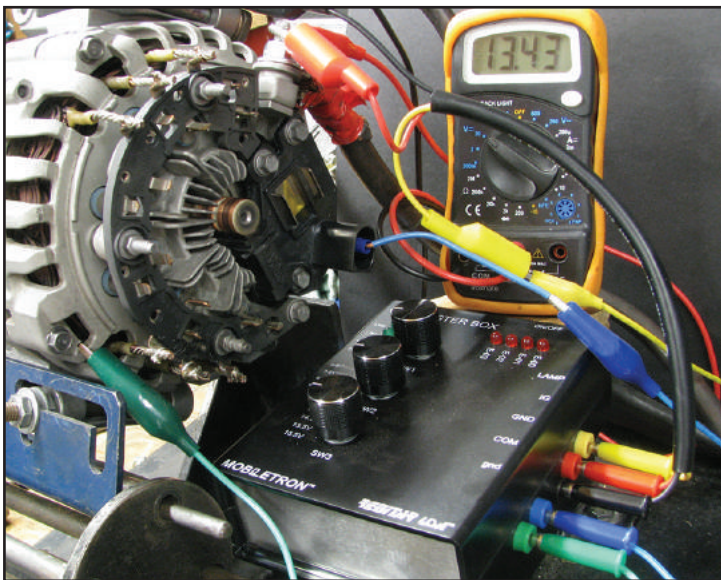


Figure 9– Here the LIN signal has been switched to the test box's low setting.

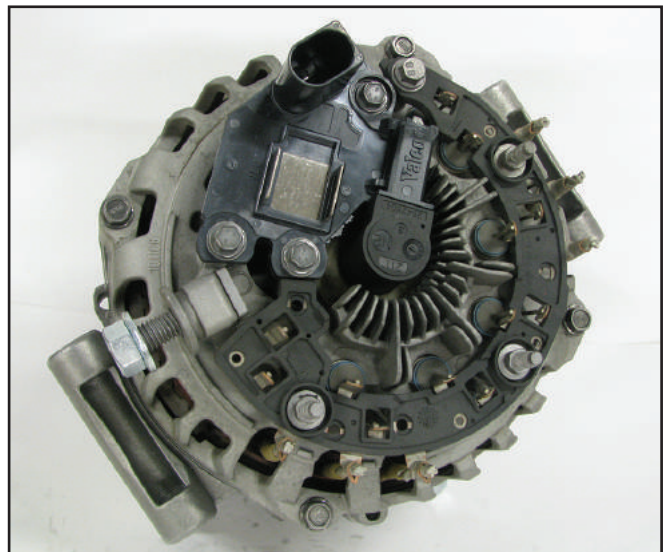

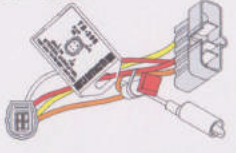
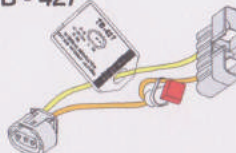
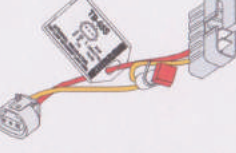
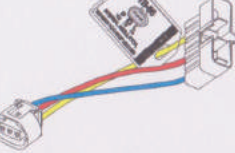



Figure 11 – The stator leads are spot welded to tinned stator leads. Breaking the spot welds without damaging the lead takes patience. Search: "Tool Tip Valeo Alternator" on the ERA website to find the Exchange article explaining a proven technique.

I'll bet you don't have these!



Scott Scharrer
Equipment Manager
JIMCO, Inc.

<p>INTERNAL REG., LESTER PLUG CODE: 298 4 terminal plug "IG" "C" "L" "F". Late model HONDA with small connector.</p> <p>TB - 298</p>  <p>TB-298 INTERNAL REGULATOR TEST LEAD "NO CHARGE" LIGHT USE</p>	<p>INTERNAL REG., Denso Alternator (made by Denso Poong Sung in Korea) for Hyundai and KIA. Lester plug code 427 with a two terminal plug "L" "FR".</p> <p>TB - 427</p>  <p>TB-427 INTERNAL REGULATOR TEST LEAD "NO CHARGE" LIGHT USE</p>	<p>INTERNAL REG., LESTER PLUG CODES: 317 "C" "IG" "L", 318 "D" "G" or "IG" "L", 319 "D" "S" "L" and 325 "C" "S" "L".</p> <p>TB - 55S</p>  <p>TB-55S INTERNAL REGULATOR, ALTERNATOR DOES NOT USE BICOE TRIO USE TB-40 OR "F-4-L" UNITS</p>	<p>OVAL PLUG, 3 TERM., INTERNAL REG.</p> <p>TB - 86 "P" "IG" "L" TERMINALS</p>  <p>TB-86 INTERNAL REGULATOR, ALTERNATOR DOES NOT USE BICOE TRIO USE TB-40 OR "F-4-L" UNITS</p>
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OVERCRANK PROTECTION Educate Your Customers



BY BOB THOMAS

We have all heard the sound at one time or another - a starter turning an engine that is not starting for reasons unknown. On thing is for sure when you or I hear it. It is highly unlikely that the starter is at fault. It could be a lack of fuel pressure, flooded cylinders or an absence of a spark, but that sound of a starter turning over and over is one that I find particularly annoying.

Nothing can destroy a perfectly performing starter any faster than continuous cranking. In spite of the universally accepted name "starter", cranking motors can only rotate an engine's crankshaft to enable it to start. Fuel and air in the proper mixture and a timed spark in the case of gasoline engines are also required. This is elementary to you and I perhaps, but not to many equipment operators or most drivers on the road today for that matter. They do not know the risk they are taking that increases with each second that they continue.

Some auto manufactures clearly understand that and have taken steps to prevent drivers from over-cranking on recent vehicles. A growing number of cars today are using electronics to control cranking, even though the driver may not know it. While still turning a key in many cases, most drivers today are only initiating a crank cycle.

General Motors introduced their first version of this type of starting circuit in 2003 (see Figure 1). Quite simply, the key switch, connected to the powertrain control module (PCM) through a fuse only signals the driver's desire to start the engine, no matter how long or how short they hold the key. The PCM activates a starter relay by applying ground to the relay's coil which then applies power to the the starter's solenoid switch terminal. At that point the PCM is controlling the starter. The instant that engine's crankshaft exceeds a predetermined speed, the PCM turns the starter relay off.

In 2007, GM made the circuit a little more complicated by introducing the body control module (BCM) into the equation (see Figure 2). Here, the ignition switch is connected to the BCM, which then communicates the desire to start to the engine control module (ECM) through the vehicle's data line network. The ECM activates the starter relay by applying positive voltage to its coil. It is a little more complicated but still reacts at the speed of light. The only delay is the time that it takes for the relay's contacts to open.

Electronic circuits such as these can drop power to the starter's solenoid much quicker than a human driver can release a key switch, saving a second or more of engagement with each start. Those seconds over thousands of starts will add up to extended starter life. They also make it possible to use a smaller and lighter roller clutch drive along with weight savings on other internal wearing parts. But most importantly, it prevents operators from over cranking. Starters that are being controlled electronically should outlast their predecessors by many years.

What happens when an engine fails to start while being cranked by an electronic module? The start cycles are timed to stop after a specific number of rotations or period of time has

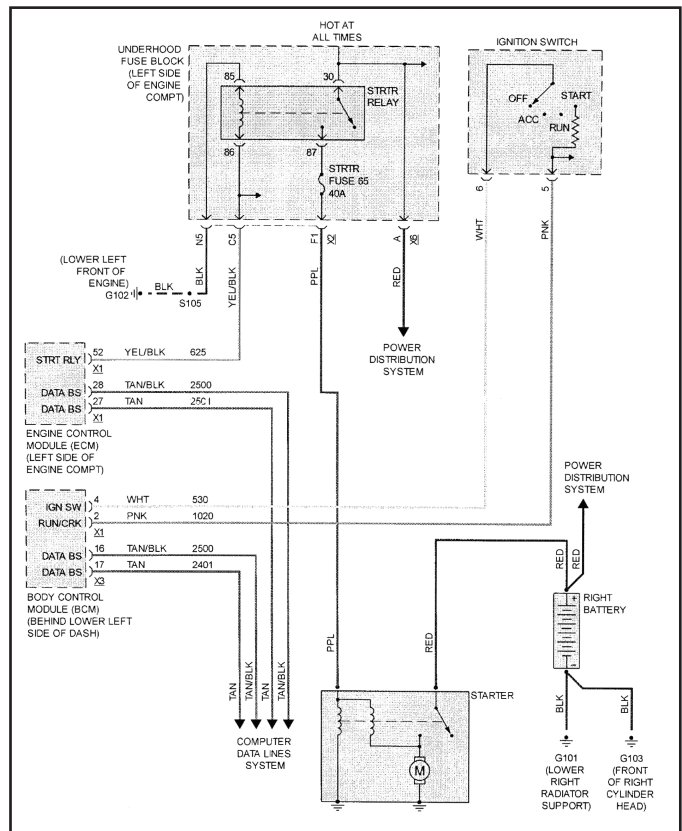


Figure 1 – Electronically controlled starter circuit for 2003 Suburban.

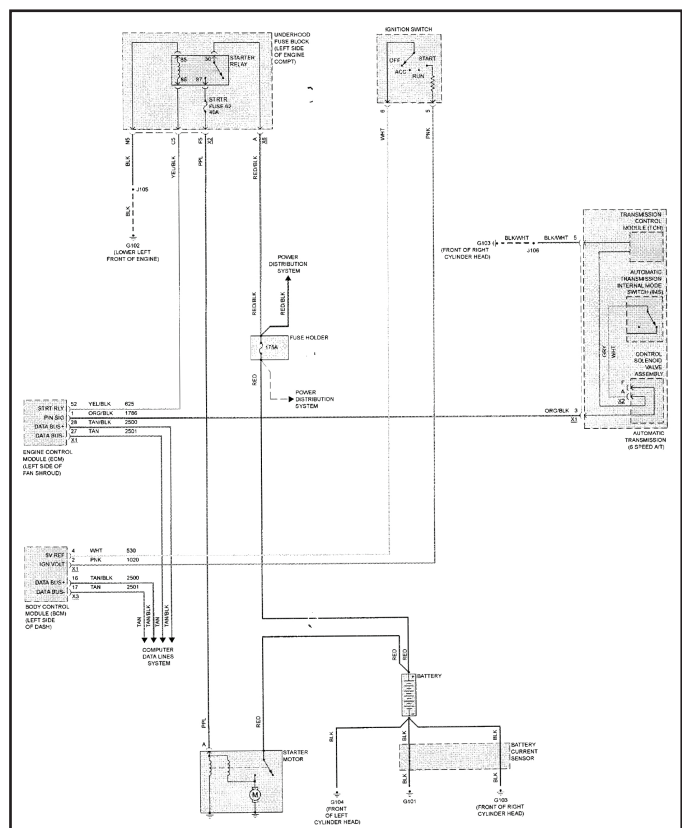


Figure 2 – Electronically controlled starter circuit for 2007 Suburban.

OVERCRANK PROTECTION

passed. The PCM can count and keep time too. The exact length of those start cycles will vary by vehicle while staying within safe limits.

Most auto makers that are selling in the US today are using this technology to control starters on at least some of their models. It is also now finding its way into heavy duty, industrial and agricultural starter circuits. However, over cranking can still be a problem on vehicles or equipment that does not have an electronically controlled starter.

Over crank protection (OCP) has been used to prevent overheating on some starters, most prominently diesel applications. OCP was an option on Delco's 37MT and 42MT diesel starters. It is standard equipment on all new Delco 39MT and 44MT starters (see Figure 3 and 4). Delco's OCP utilizes a thermal circuit breaker that opens the solenoid's ground when overheated. Once the starter cools, the breaker will close again to allow another attempt.

Some Denso's diesel starters like the 3 kW PA90S have fused field coil connections (see Figure 5) that are designed to burn open if cranking limits are exceeded. Last month's issue showed

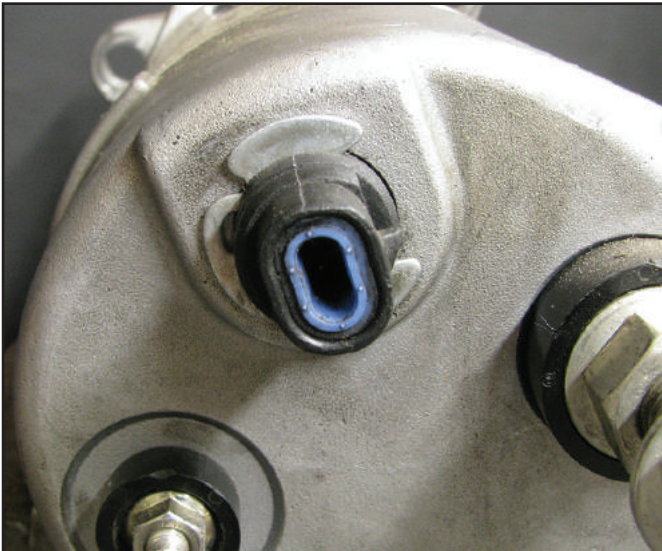


Figure 3 – Over Crank Protection (OCP) connector on Delco's 39MT interrupts the solenoids ground to prevent over cranking.

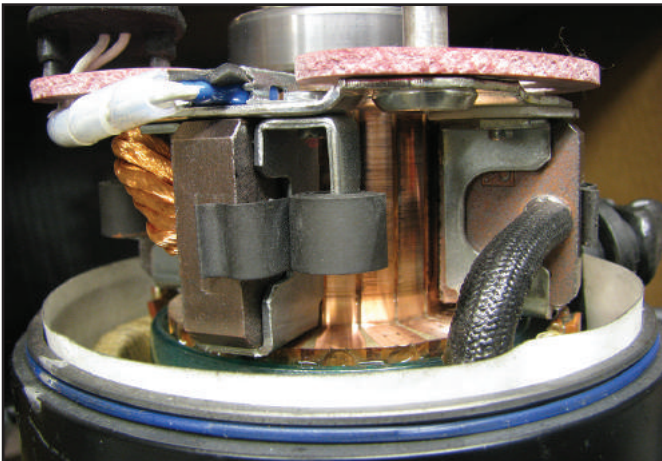


Figure 4 – The 39MT's OCP thermal breaker is attached to the brush holder plate, right above a ground brush.

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OVERCRANK PROTECTION

a 2 kW Denso starter with a similar arrangement. While the fused field coils will prevent an overzealous operator from burning the whole starter to a crisp, they also make the starter inoperative until the field coils are replaced or repaired.

Few end users truly understand the full impact of extended over-cranking on a starter. It falls upon you, the rebuilder to educate them, especially if the starter they bring in for repair or exchange has been damaged by over-cranking. When you see the signs of over-cranking in a core, explain how it happened and what your customer can do to prevent it from happening again.

Most people have used a toaster and know that it only takes a few seconds for its elements to get red hot. While it takes a starter a little longer than that to light up and glow inside, it is still the same principle. Show them their parts that burned. Most armature wire today is coated with a heat resistant insulation material that is rated to withstand temperatures into the 400 F range. Those materials begin to burn above 500 (see Figure 6).

Once the insulation is burned away, the coil turns short together causing the starter to draw even more current. When cranking continues beyond that point, the heat builds up very quickly. Above 2000 the copper wire itself will melt. Diesel applications are the most susceptible to this scenario because of the high amount of amperage that they require. On some starter designs the field coils may burn before the armature's wire.

So how long can you crank without causing damage? Maximum crank times will vary greatly, depending primarily on the kilowatt rating and design of the starter. A general rule that will protect all starters is about five seconds. Then allow five minutes for the heat to dissipate before cranking again. Of course, most starters can survive longer than that, but over 10 seconds is definitely getting close to risky territory. With electronic ignition, fuel heaters on diesels and fuel injection, any engine should start almost instantly. If it does not, then abusing the starter is not going to help.

An old sea captain once told me that the best bilge pump is a worried sailor with a bucket. The best over-crank protection is an informed operator who worries about burning up another starter.

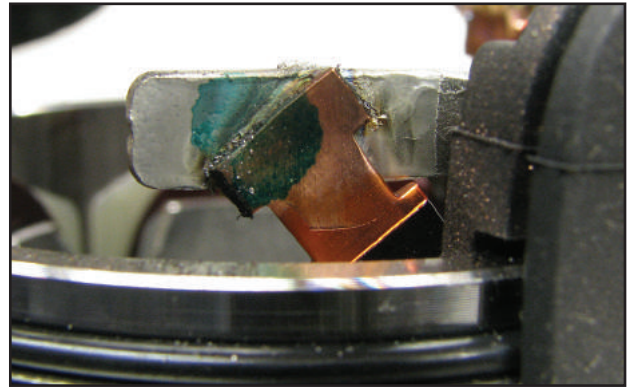


Figure 5– This is a field coil fuse on Denso's PA90S, positioned between the field lead and the coils.

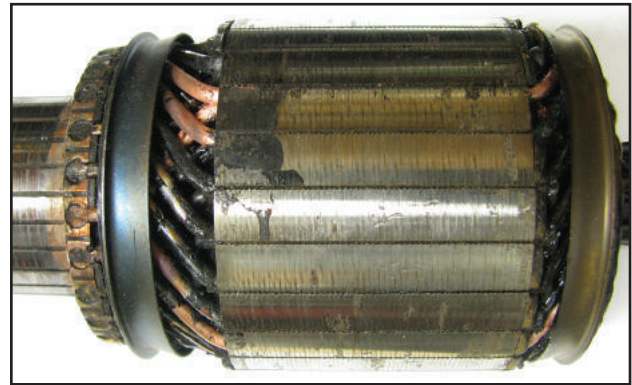


Figure 6 – This Bosch 223 series diesel armature shows signs of severe heating, evidence that the starter was cranked far too long.

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PLUG CODES PART TWO

Bosch 2 Pin – Used on Sprinter Vans



BY SCOTT SCHARRER

The connector type that I will cover in this article is a 2-pin Bosch that has been causing some confusion. It was used on many German branded vehicles including the popular Sprinter vans since 2007 (see Figure 1). Bosch, Delco and Valeo have all manufactured alternators using this regulator plug style.

Several of these plug codes have BSS or LIN terminals, often referred to as a COM “communication” terminal. While this is technically correct, it is important for you to know which “COM” you are working on. These terminals require a special test lead that mimics the data sent from the vehicle’s control system. Not all test leads have the ability to test both communication styles. Most that can test either one will require you to change the settings to do so.

At present there are six different plug codes that cover this particular connector, but only five have been assigned plug code numbers as of this writing. That could change by the time you read it. I’ll explain more about that later. But be aware that there are other 2-pin Bosch connectors that look somewhat similar but may not plug into a regulator because the orientation indents are slightly different. No doubt, this is to help prevent the wrong alternator from being installed on a vehicle. For testing, always identify your connection pins and make sure that your test lead matches. Also, don’t force a connection. You could damage a new regulator.

At present, the ERA is working with a team of individuals to compile a complete and accurate database of plug codes for any alternator that you might encounter. The end goal is to have an online tool where alternator testing information can be obtained very quickly. Apptrak, JIMCO, AMFOR Electronics, WAI, and Regitar are all helping to make this possible. When it is ready for your use, you will read about it here.

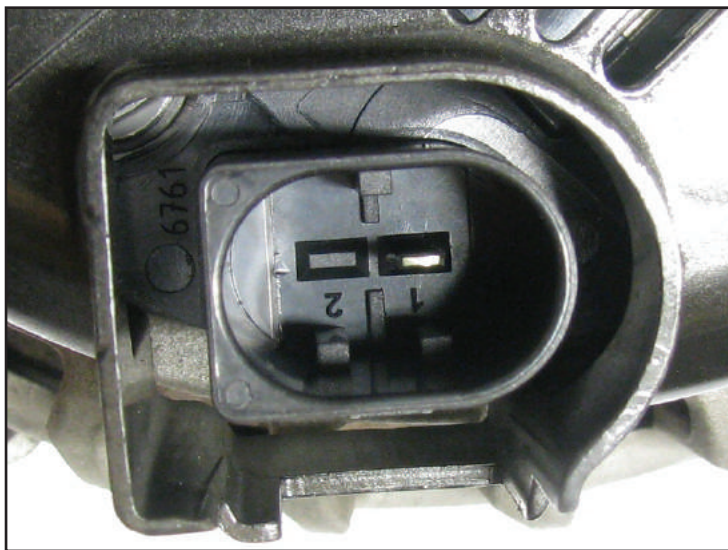


Figure 1 – This 2-pin Bosch plug has been used on Valeo and Delco alternators in addition to Bosch. It covers six different plug codes.

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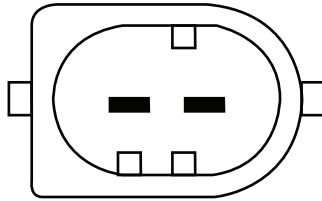
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PLUG CODES PART TWO

Plug Code 063 NC - COM

NC = No Connection

COM = LIN = Local Interconnect Network. This terminal requires a special test lead that mimics the LIN data sent from the vehicle's control system. It may also be identified by the less specific COM

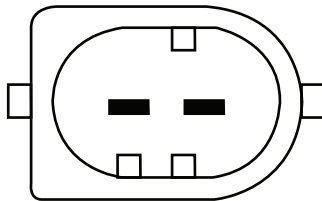


**NC COM
PLUG CODE 063**

Plug Code 064 NC - BSS

NC = No Connection

BSS = Bit Synchronous Single wire network. This terminal requires a special test lead that mimics the BSS data sent from the vehicle's control system. It may also be identified by the less specific COM.



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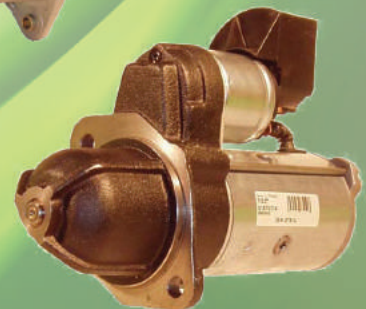


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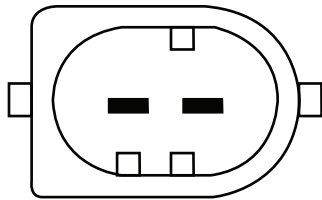
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PLUG CODES PART TWO

Plug Code 078 DFM - COM

DFM = Dynamo Field Monitor. This terminal is a monitoring terminal for the vehicle's computer. You can take a reading on this terminal with an auxiliary meter or hand held volt meter. Voltage should increase as output amperage increases.

COM = BSS = Bit Synchronous Single wire network. This terminal requires a special test lead that mimics the BSS data sent from the vehicle's control system. It may be identified by the less specific COM.

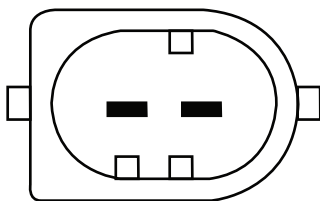


**DFM COM
PLUG CODE 078**

Plug Code 364 D - L

D = Dummy = NC = No Connection

L = Light. This terminal grounds the charge lamp until the regulator opens the circuit to put out the no charge light.

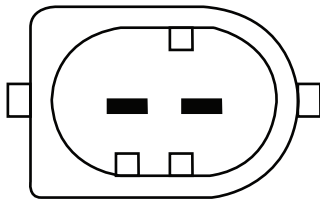


**D L
PLUG CODE 364**

Plug Code 367 DFM - L

DFM = Dynamo Field Monitor. This terminal is a monitoring terminal for the vehicle's computer. You can take a reading on this terminal with an auxiliary meter or hand held volt meter. Voltage should increase as output amperage increases.

L = Light. This terminal grounds the charge lamp until the regulator opens the circuit to put out the no charge light.



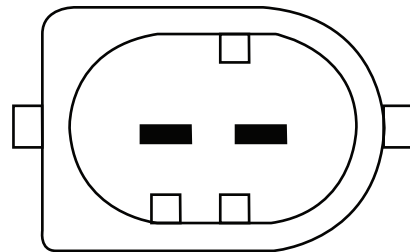
**DFM L
PLUG CODE 367**

Plug Code ??? L - 15

This plug ID has not been assigned a plug code yet.

L = Light. This terminal grounds the charge lamp until the regulator opens the circuit to put out the no charge light.

15 = Ignition. This terminal should have battery voltage with the key on and motor running. Disconnecting should stop the alternator from charging.



**L 15
PLUG CODE ???**

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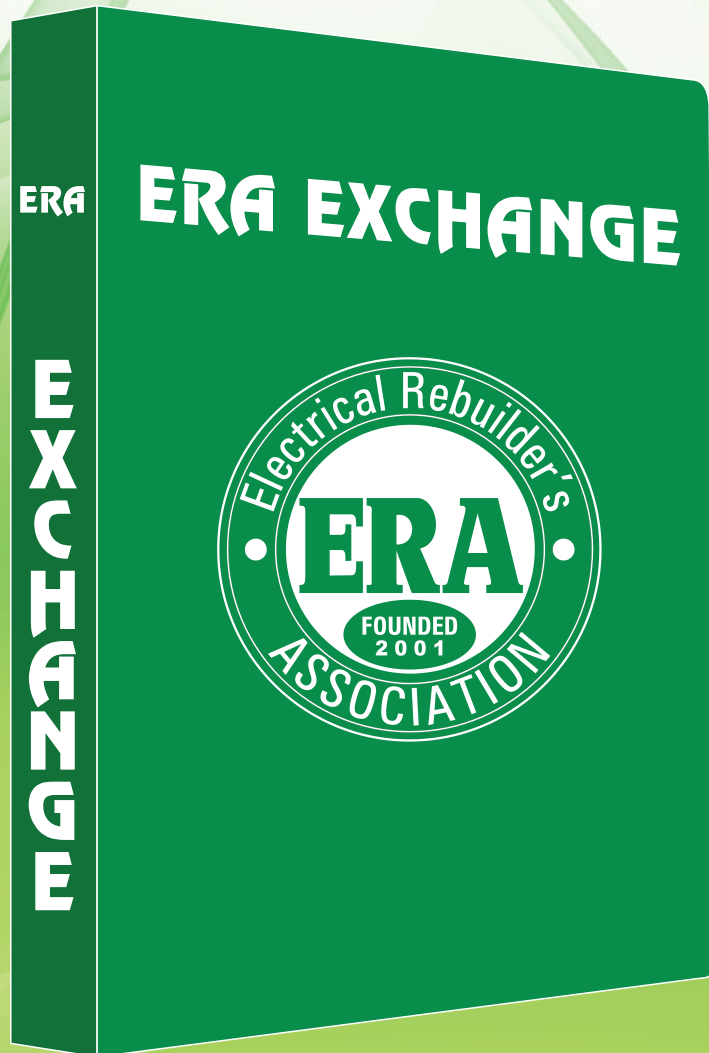


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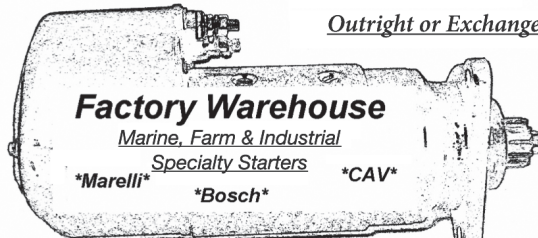
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