

Benchmarks: Looking at mechanical woes

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For me, one of the greatest things about being an independent business owner of a small electrical rebuilding shop is the everyday challenges that I face. I'm not talking about the challenge of trying to keep the doors open for business and creating a profit during the current economic downturn. I'm talking about the continuous changes being made in the products we rebuild on a daily basis. Just think of all those new regulator colors and different plug configurations along with enough letter designations to start a new dictionary. Most of the time the electrical characteristics of alternators and starters make us think harder than the mechanics does. This month we will look at some mechanical woes that may slow you down. Also we will review the RVC technology and one of the units it's used in.

Special puller needed

Several months ago I received a phone call from a potential customer looking for an alternator for a 2004 Pontiac Grand Prix with a 3.8 liter engine. A quick look into the application book revealed that this was Lester no. 8293 with a Delphi AD237 125-amp alternator. I informed the customer I did not have this particular unit in stock but that I could rebuild theirs. The next day the unit was brought in to be rebuilt. The customer said the alternator was working fine except it was very noisy. A quick spin of the pulley did reveal rough bear-

ings. As always, I asked how many miles were on the given unit, and the customer replied 94,000. I gave the customer a price and said the unit would be ready in a couple hours.

What's the big deal? It's just an AD unit that is very similar to the popular CS130D. The unit was tested first to verify the customer's claims and then off to the rebuild bench it went. The unit came apart very easily. The rotor was removed from the DE housing in preparation for the SRE bearing to be removed. Now, this is where the process came to a screeching halt. This particular Delphi AD unit utilizes one of the new-style slip rings that are starting to show up in several late model Delco units. It can be identified by the rotor coil wires being soldered to the top.

Looking at the bottom half of Figure 1 you can see that there is room for a puller under the bearing but nothing to push against. The new-style slip ring is very similar in size as the CS130D slip ring. The biggest difference in the two is that the latest-style slip ring has the rotor coil wires soldered on top. These wires are now located in the very area that a puller would contact, resulting in damage to the slip ring and/or coil wires. To complete this unit in a timely manner I used an older-style AD rotor, made similar to that of a CS130D. The original AD rotor, with the new-style slip ring, was put to the side for later consideration of how to remove the bearing.

A couple days later the bearing removal consideration became a "now thing." A fleet customer of mine dropped off several Delco 24SIs to be rebuilt. Knowing that parts were available for these units now, the customer was informed that

we would have them ready in a couple days. Upon disassembly of the units the new-style slip ring was observed yet again. With no spare rotors to grab to bail me out of this situation, I was forced to come up with a way to remove these bearings. The lower half of Figure 2, page 18, shows the Delco 24SI rotor.

Let's look at several options for removing the SRE bearing, which is referenced as a 202. When the wires are desoldered and the slip ring is removed, the shaft that is exposed is merely the size of about three toothpicks put together. It would not take much pressure to bend or mushroom the shaft, making it difficult or impossible to re-install the slip ring. If this portion of the rotor shaft is even slightly bent, then the slip ring would have run-out problems causing brush bounce, broken brush leads or short regulator life. Looking back at Figure 2 you can see the plastic fan has been designed in a way under the bearing that makes it difficult for any puller to fit under the bearing.

Before you go off on some engineer for designing the plastic fan in this fashion there might be a viable answer for the design. My thinking is just as they use a metal slinger on top of the bearing to protect it from foreign particles, the close and wide plastic fan under the bearing does the same. The last option is to break the bearing and grind or cut off the inner race. Although I have had to revert to the latter option before, when no other option was available, I have discovered that this bearing removal problem is going to be seen many times a day on a regular basis in the near future.

Looking back at Figures 1 and 2 you will see two more rotors that have the same bearing removal problem. The rotor



Figure 1



Figure 2

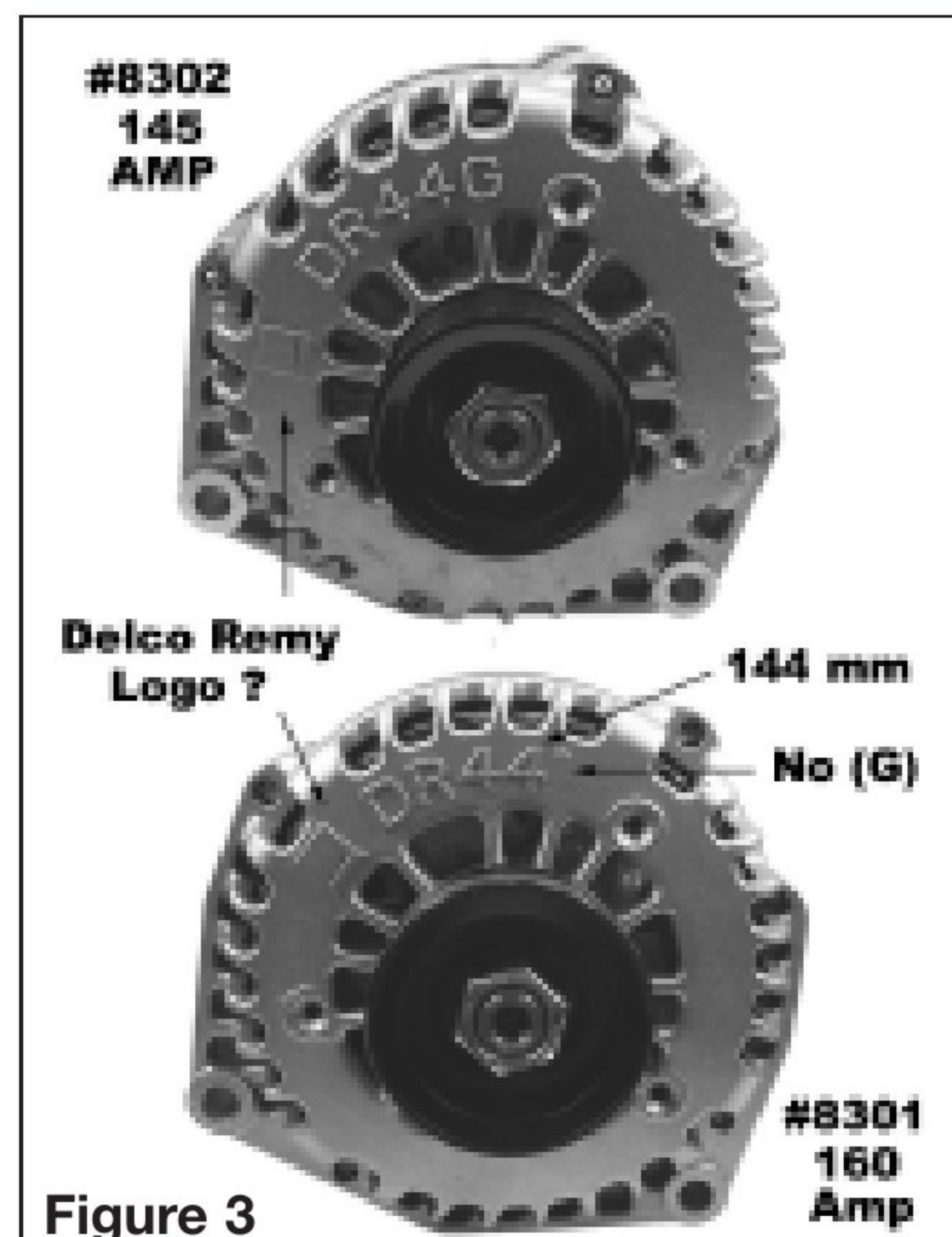


Figure 3

in Figure 1 is from the DR44 family which uses the new-style slip ring and has the similar problems of the Delco 24SI rotor regarding the plastic fan being close to the bearing. The rotor in Figure 2 is from the Denso hairpin family which uses a SRE bearing with the same OD as the 202 but is a little wider. The problem with removing the bearing on this rotor is that the metal fan forms a shroud around the bearing making it difficult, if not impossible, to use any known puller on the market today. Late Delphi AD, DR44, DR44G, Delco 24SI, Denso hairpin and possibly other alternators with this bearing removal problem make up millions of units that are in use today and showing up in the rebuild shop.

RVC technology

General Motors introduced regulated voltage control (RVC) technology in 2004. They hope it will improve gas mileage and extend battery life. With the vast number of on-board computers and the communication between them, it would only make sense to include the control of the alternator in this orchestra. The voltage regulator mounted in the alternator is controlled by the electronic control module (ECM) or generator battery control module (GBCM) depending on the year and model of the vehicle. The body control module (BCM) and ECM or PCM and other modules monitor several parameters of the vehicle in making a determination as to what mode to be in.

Depending on year of the vehicle, there are up to nine different modes the charging system could be in at any given time. Each one of these modes has their own targeted voltage setting. The alternator receives the signal, a 5-volt pulse width modulation of 128 hertz, via the

“L” terminal of the voltage regulator. The “L” terminal has nothing to do with the charge lamp. The instrument cluster panel controls the charge lamp indicator by way of messages from the GBCM, BCM and/or the ECM depending on the year of the vehicle. If a fault does occur in the system, it is also capable of storing diagnostic trouble codes (DTC).

The “F” terminal of the regulator provides a feedback signal to the ECM or GBCM depending on the year of vehicle. One of the objectives of this system was to have the ability to turn the alternator off to increase gas mileage when the battery was satisfied and turn the alternator back on when additional voltage was needed. However, when the alternator is turned off the charge indicator light will not illuminate, but the instrument panel voltmeter will reflect the fluctuation in the voltage. This has caused concerns for some vehicle owners and is a characteristic of the RVC system (no repairs necessary).

DR44 and DR44G

One of the first units to receive the RVC technology in 2004 was Lester no. 8302, a 145-amp unit from the DR44G family. In late 2006 there was another version of this unit, Lester no. 8301, 160-amp, released from the DR44 family. Figure 3 shows the DE housings and their markings for the two units. These markings have become comical to me because they are all over the board. Just for fun, here is what I have seen so far: When no. 8302 was released it had the DR44G marking. When no. 8301 was released it had the DR44 marking minus the “G,” but also now included a trademark. Both no. 8301 and no. 8302 use the RVC regulator.

OK, so I thought that was the end of the story but it gets even better. Now I have seen the DR44G with the trademark. While I have only seen the DR44G in the 145-amp version, I have seen the DR44 in the 145- and 160-amp versions. The DR44G and the DR44 not only make use of the RVC regulator but can have the standard four pin regulator. When comparing date codes there seems to be no correlation between all of the versions and their markings.

What is not so funny about these units is the way that they are constructed. In my opinion these units were built with performance and longevity in mind. When the Delco CS130 unit was released back in the late ‘80s it marked the beginning of

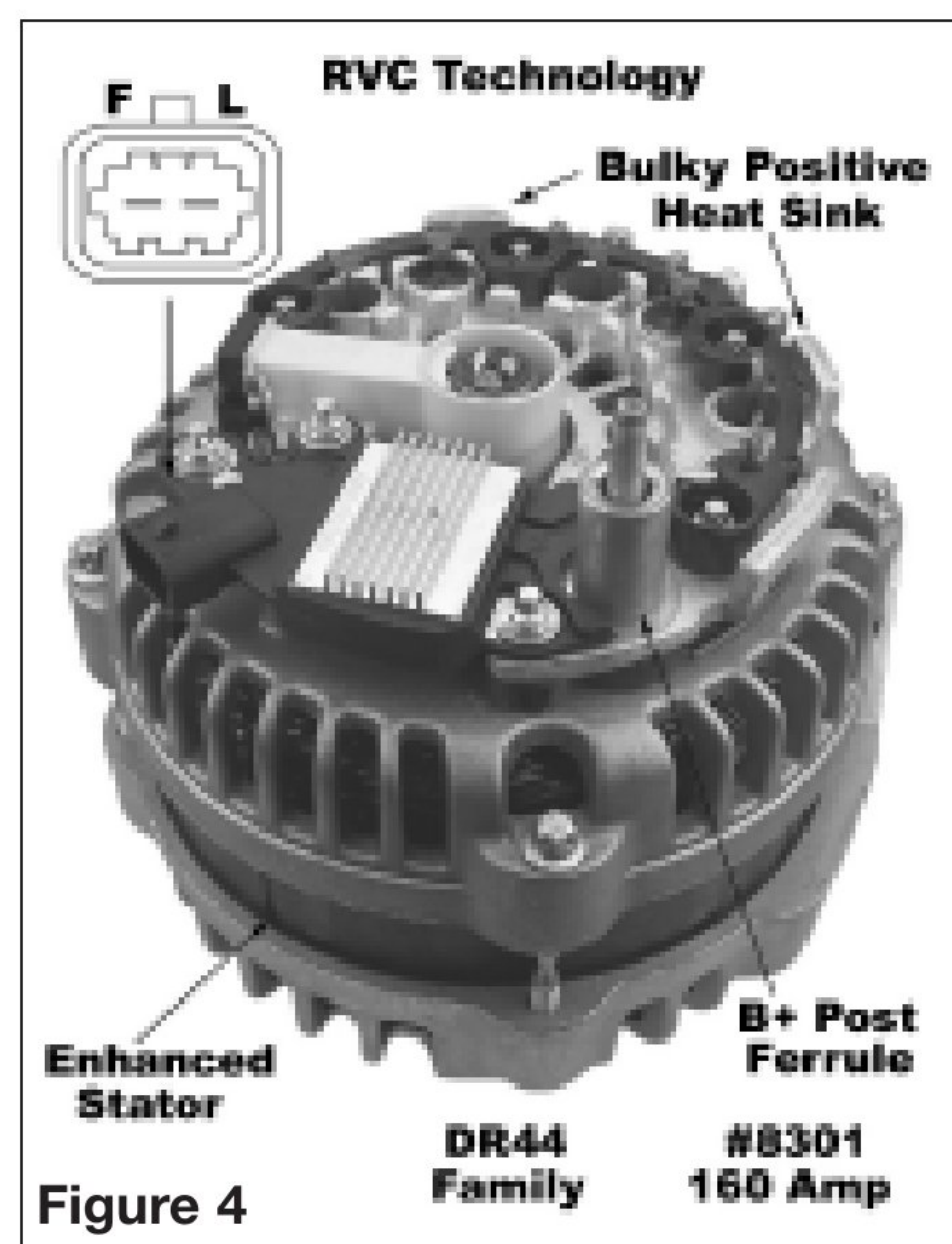
a new era of performance-handling alternators. The CS130 had a particular sound to it; in fact some people liked the magnetic whine while others hated it. The CS130D was introduced to eliminate this annoying whine, thus the reason to have the stator encapsulated into the DE housing. The magnetic noise stems from the stator stack laminations rubbing together, like crickets rubbing their legs together. The DR44 families have combated this magnetic noise problem even more. Their rotors have special contoured segments and the stator stack has been enhanced by using very thin laminations.

The 145-amp versions use a rotor with red windings and the 160-amp rotor has natural colored windings. These rotors have an amp draw of 7.5 amps at 12 volts. The 145-amp version uses a stator with green windings and the 160-amp stator uses brown colored windings. These units use press fit avalanche diodes which are marked blue for the 145-amp and yellow on the 160-amp. The brush holders can be a white or light brown color.

The units are very rebuild friendly other than a couple areas such as the SRE bearing removal and the fact the negative diodes are pressed into the SRE frame. In the previously used Delphi AD244 the regulator B+ connection was prone to cause problems. In the DR44(G), this problem has been eliminated through a redesign of this connection. The B+ post now has a ferrule pressed onto it applying pressure to the B+ regulator connector (see Figure 4). Do not twist the ferrule when attempting to remove it, pull straight up.

The DR44 no. 8301 160-amp alternator has some unique features as compared to the 145-amp versions. While they both use a stator with the same ID and OD, the 160-amp stator is 5 mm wider. The 160-amp rotor is also thicker and also has a slightly larger OD thus reducing the rotor to stator air gap. The 160-amp rotor as seen in Figure 1 utilizes a different plastic fan. The positive heat sink shown in Figure 4 is more bulky than the 145-amp version and requires a different rear cover to clear the larger heat sink.

To properly test the RVC units, a special test lead or box that contains the correct simulated signal, is needed. Although these units may self excite and default at 13.8 volts, one cannot be assured the regulator will respond to incoming signals (request for output voltage change) to the “L” terminal when installed in the



vehicle. Also, relying on the self exciting test may lead to grief. When the unit is disassembled and the rotor is tested then reassembled with the pulley being tightened down with an impact wrench, there is a good chance the residual magnetism will be lost. Without this residual magnetism the unit will not self excite. Flashing DC to the stator terminal of the regulator won't work here as the regulator is looking for the correct AC signal. The “F” terminal can be verified on the test bench by connecting a voltmeter to it and ground. The voltage should increase as the output amps increase.

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