BB D3 & A3FE CHARGING ISSUES

1. COMPLAINT OF OVERCHARGING CONDITIONS
    a. Determine duration and conditions of overcharging..
        i. Short duration- only a few seconds; 1-3 seconds, may go to 15-16 volts. This can be a normal condition of the electrical system from load dump situations. SAE has standards regarding voltage limitations that can be expected to be seen in the electrical system as components in the system open and close contacts, sometimes with very high electrical loads. Specifically SAE J1455 regarding normal expected voltage limitations and SAE J1113 regarding transient or 'spike' conditions also such as jump starts. These are industry standards set to assist the manufacturer of various components to know what to design their components to withstand, or limitations of what can be allowed in the electrical system, since all the components are interconnected and those will be affected by how well the components are assembled and routed within the system back to the battery and the battery condition. The battery acts as a huge electrical filter within the system to flatten out or reduce high electrical voltages introduced to the system. From the alternators perspective it can produce an internal transient (load dump) or see externally generated transients. Internal transients are clamped to a level of 1 times the avalanche diode value (up to 30 volts). Externally generated transients will be clamped at 2 times that diode value (up to 60 volts) because when they are introduced externally into the alternator the clamping diodes are in series with each other. The grid heaters, which are used to preheat the air going into the engine to control emissions and have been used since the government mandate of 2002, are some of the largest electrical loads on a vehicle today and may demand up to 250 amps. These loads are introduced immediately at start up of the vehicle to control emissions along with the electrical loads of the other components on the vehicle, which may be another 100 amps or more. Even more vehicle electrical loads are demanded also from ADA requirements to maintain a minimum and maximum interior temperature, which requires more a/c and heater systems. Most engine heaters used to control emissions are

thermostatically controlled so the duration and frequency of operation is determined by the ambient temperature and the engine inlet temperature. They may be engaged for only a short period of time and only come on one time or they may stay engaged up to 4 minutes, cycle off and remain off for a few minutes, and then turn on again for 4 minutes and so on depending on the ambient temperatures that the vehicle is operating in and they may also come on and go off during operation. On 2010 Cummins engines anytime the ground speed of the vehicle is below 30 m.p.h. the grid heaters may come on regardless of the ambient temperature to clean themselves for emission control. These conditions are prime to produce load switching 'voltage spikes' into the system because there is a large load placed on the alternator which will cause a high field current draw from the voltage regulator. Instantaneously removing a large load will cause an inductive current surge in the field and result in a load dump voltage spike in the system for a short period of time (milliseconds typically) before the regulator latches voltage back at regulated voltage levels which is a normal condition or occurrence in any electrical system and the severity is dependant on those conditions mentioned previously. The electrical components on these vehicles must be capable of sustaining these spikes for short periods and the alternator must also be able to replenish the battery levels in a timely manner.

ii. Long duration and may rise to 15-16 volts during end of route or late in the day after engine gets hot and once it cools down the voltage goes back to regulated voltage. Check ambient inlet air temperature going into the alternator. Indication would be the temperature threshold of the regulator has been exceeded which would allow the regulator to 'drift' voltage or allow it to exceed the regulated threshold. If these conditions continue for an extended period of time the regulator will fail. The regulator may fail in an open condition (most common) which would not allow the alternator to produce current at all or it may fail in the closed position (which is very seldom) and would cause the alternator to full field and produce all the voltage it can (approximately 18 volts). A remote regulator should be considered under these conditions.

iii. Erratic overvoltage- jumps above regulated voltage and fluctuates dramatically from regulated voltage to perhaps to 15-18 volts consistently. This could be a condition of a loose or high resistance connection within the electrical system or within the alternator itself.

1. Check all positive and negative connections for tightness and ensure for a clean connection as well as good crimps at each connection starting at the battery terminals first (most common) and then proceed all the way to the alternator and including the alternator connections.
2. If a sense lead is connected to the sense terminal of the alternator remove the sense wire and monitor voltage. If voltage stabilizes, unplug and reconnect plug at the alternator and reconnect sense wire. If this does not correct the fluctuating voltage locate the in line 5 amp fuse located at the starter hot stud and remove and check to ensure it is not blown. If the fuse is not blown, reinsert the fuse and recheck voltage. If this does not correct the

fluctuating voltage run a temporary wire directly from the sense terminal of the alternator back directly to the battery ensuring tight connections. If this stabilizes the voltage there is an issue with the sense lead.

3. If the vehicle has a remote regulator check the connection point of the red wire which may be in the left front power distribution box at the mega fuse location and also as it passes through the plug at the regulator. Some connections in the PDU have been found loose that causes high heat conditions which may be accompanied by darken terminations at the mega fuse and hot stud terminals causing the signal to the regulator to be erratic. The red wire is the sense lead for the remote regulator and if it has unstable voltage from a loose connection it will produce overvoltage or erratic voltage outputs.
4. If the vehicle has high mileage it may also be due to excessive brush wear which should be inspected and is a normal wear item and should be replaced normally every 2 years, but, could be sooner depending on the electrical loads and operating conditions.
5. If the above items do not correct the issue it can be determined that there is a loose connection internal to the alternator. If the alternator is within the 2 year warranty it should be returned for warranty.

iv. Steady overvoltage- (possibly 18 volts)

1. If a remote regulator is installed, temporarily run a replacement wire for the green wire that is connected between the regulator and the F- terminal at the alternator. If the voltage stabilizes at regulated voltage (14.2 – 14.5V) there is an issue with the green field wire going to ground. If this wire is grounded it will bypass the regulator and the alternator will go to a full field condition producing approximately 18 volts. If power is inadvertently applied to this circuit it will damage the regulator.
2. If the alternator has an internal regulator with out a remote sense feature a failed regulator is the most likely cause and should be returned for warranty if it is within the 2 year period.

2. COMPLAINT OF NOT CHARGING CODITIONS
   a. Determine if it was diagnosed as not charging due to the dash light indicating that the alternator is not charging OR if they have actually measured the voltage AND the current at the alternator or the cables from the alternator in the PDU. If the dash light is the only indicator that the alternator is not working compare the voltage reading on the volt gauge on the dash. If that reading is approximately 14 volts there is a problem with the dash light circuit. A purple wire connects to the 'W' terminal on the back of the AVI alternator or one of the three #10 a/c tap terminals on the back of the 4000 series alternators, which goes through the same 3 pin connector that the tan sense wire passes through, and connects to the coil of a relay that drives the dash 'alt not charging' light. Some relays have been found to be defective or loose connections have led to this light being illuminated.

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b. Low voltage reading at the back of the alternator. Measure the amperage reading on the positive cable at the alternator. If there is no amperage output and there is no 'I' or ignition terminal on the back of the alternator the alternator is defective. If there is an 'I' or ignition terminal on the alternator there has to be ignition power here for the alternator to produce current. If there is a high amperage reading it is an indication that there is more of an electrical demand from the vehicle than that particular alternator can produce at the speed it is being operated at. This can be verified by speeding the engine up to a higher r.p.m. range and monitor the voltage. If the voltage rises it indicates that more amperage has been required than can be produced and a higher amperage alternator should be considered.