Mack Models

Mack Model	CH , RB , DM , CHN , CL , CT , CV , CX , CXM , LE , MR , RD

** SOLUTION **

Title	V-MAC III - Severe Engine Stumble
Cause	V-MAC III Severe Engine Stumble Due to Intermittent Electrical Power Failure.

Solution

1. INTRODUCTION

Recently, Service Engineering has seen a V-MAC III intermittent stumble due to a severe power failure condition that does not register any fault codes. This condition may result if any of the following clean (battery) power components are intermittently shorted low:

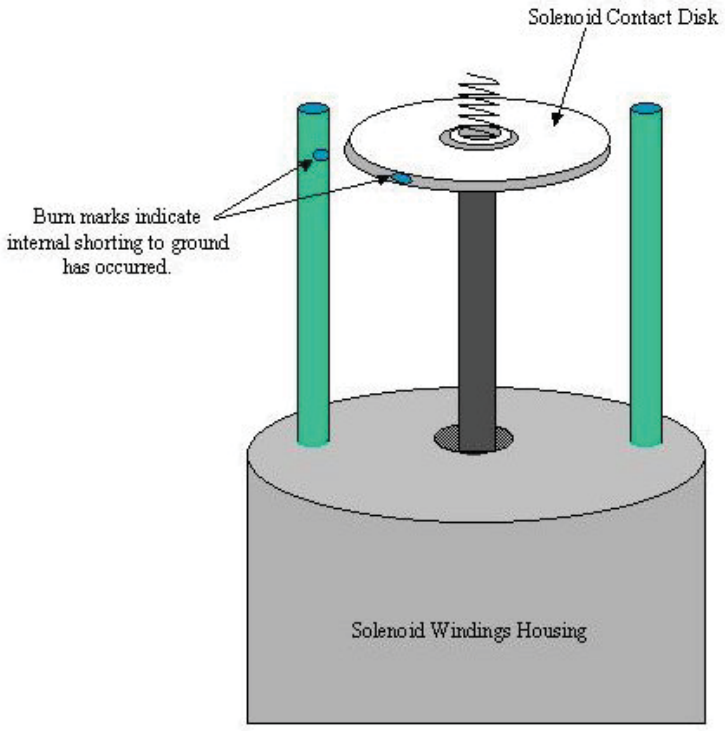
1. Battery Cables (linking battery to starter solenoid, starter solenoid to alternator and starter relay)
2. Battery (internally or externally)
3. Starter Solenoid Battery Terminal (internally or externally)
4. Alternator Output Terminal (internally or externally)
5. Starter Relay Battery Terminal (internally or externally)
6. VECU (internally or externally)
7. EECU (internally or externally)
8. Electrical Equipment Panel (internally or externally)
9. Cab Harness (battery and switched power wiring)
10. Engine Power Distribution Module (internally or externally)
11. Engine Power Distribution Module Harness (switched power wiring)
12. Engine Harness (switched power wiring)

When this condition occurs, momentarily the tachometer will drop 200 RPM, the torque will go to zero, the engine stumbles and then the tachometer and torque are restored. The electrical transient is very fast and can not be easily detected. A digital voltmeter will not be able to see this very fast electrical disturbance. This engine or torque cutout is violent and the vehicle will jerk excessively when under a load with the engine speed between 1400 to 1600 rpms. It is even possible for this condition to cause the V-MAC to go into limp mode. When a step 4 V-MAC III system goes into limp mode, the engine power will be limited to approximately 45% after recovering. When a step 5 V-MAC system goes into limp mode, the engine power will be limited to approximately 85%. Also, for step 5, it is possible for a PID S151 MID 128 FMI 4 or 3 (8-9) fault code to be logged on the EECU. This condition has been experienced both at idle no load and at 1400 to 1600 rpms in 9th or 10th gear with a load present.

2. PRELIMINARY DIAGNOSTICS

It is possible to observe a jumping tachometer and a surging engine if the EUPS are unable to control the fuel delivery. Before proceeding with the following diagnostic procedures, verify that the symptoms are not the result of a mechanical or an ECU output failure by doing the following:

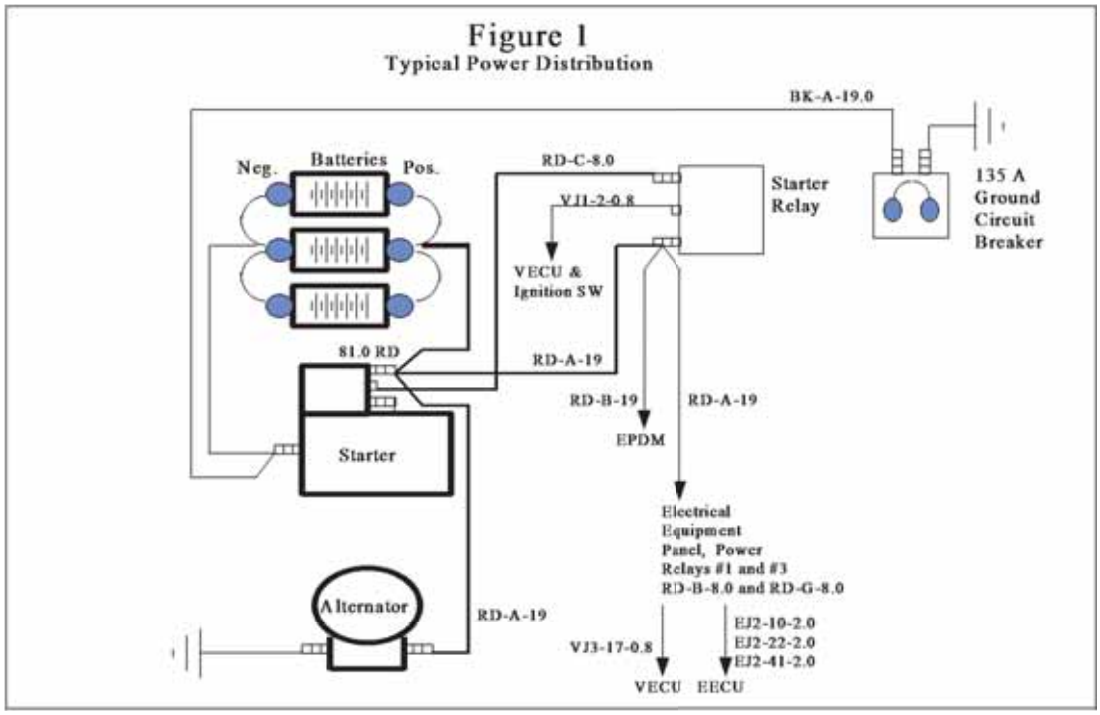
- Check all positive and negative battery cables for corrosion or looseness. If necessary clean and tighten terminals.
- Check each of the Power relays and fuses on the electrical equipment panel. Remove each one and look for deep score marks on each terminal and check that the electrical terminals in the electrical equipment panel are securely locked in place. Deep score marks indicate a tight electrical connection is being made between the relay and fuse terminals and the electrical equipment panel terminals. Intermittent or poor contact between the relay and fuse terminals will result in evident arching on the terminal.
- Check all V-MAC connections (EJ1, EJ2, VJ1, VJ2, VJ3, Engine/Trans interface [transition], EPDM interface, Bulkhead interface) for corrosion. Check the grip of each female terminal by inserting the correct male terminal and evaluate the amount of "drag" the female terminal applies as the male terminal is withdrawn. Insufficient drag will allow intermittent contact to occur. Replace any terminal that has loose drag or has corrosion.
- Check if the EUP wiring stud terminals are painted black. If necessary, detach the terminals, then remove the black paint from the terminals and attach and re-tighten terminals 9 lb-in (1 N-m).
- Check the fuel pressure at the secondary fuel filter outlet. This test should be performed during the road test. The fuel pressure should maintain approximately 100 psi.
- Re-enter the EUP calibration codes.
- Remove the alternator from the engine and shake, listening for any rattling sound. Any loose metal objects in the alternator can create momentary shorts to ground.
- If a 42MT starter motor is fitted to the engine, remove the solenoid from the starter motor (do not remove complete starter motor). Remove the end cover of the solenoid. Look for burn marks on the circumference of the contact disk that align with a similar burn mark on the solenoid cover mounting pin.



3. DIAGNOSTICS

To diagnose this severe and fast electrical power failure, each clean battery power electrical component must

be isolated (excluded) from clean battery power circuitry. Then, the vehicle should be road tested to see if the conditions has been eliminated. One component assembly should be tested per road test and the components close to the batteries should be tested first. See Figure 1, for a typical battery power circuit arrangement.



3.1 Isolating The Batteries

To exclude the batteries do the following:

If a sister truck (that is performing with no problems) is available, switch batteries with the sister truck and road test to see if the cutout condition follows the batteries.

Otherwise, load test each battery as follows:

- Inspect each battery for visual damage.
- With the battery fully charged, apply a 300 amp load (with a carbon pile) to the battery for 15 seconds. Then, turn the load off. This will stabilize the battery.
- With the battery fully charged (open circuit voltage above 12.4 Volts), apply a test load (with a carbon pile) of 1/2 the CCA rating @ 0 degrees F in amps.
- After 15 seconds with the load on, measure and record the battery terminal voltage. Turn the load off.
- Check the recorded voltage against the following load test voltage to electrolyte temperature table (estimate the temperature [ambient]).

Minimum Voltage	Temperature Degrees Fahrenheit
9.6	70
9.5	60
9.4	50

9.3	40
9.1	30
8.9	20
8.7	10
8.5	0

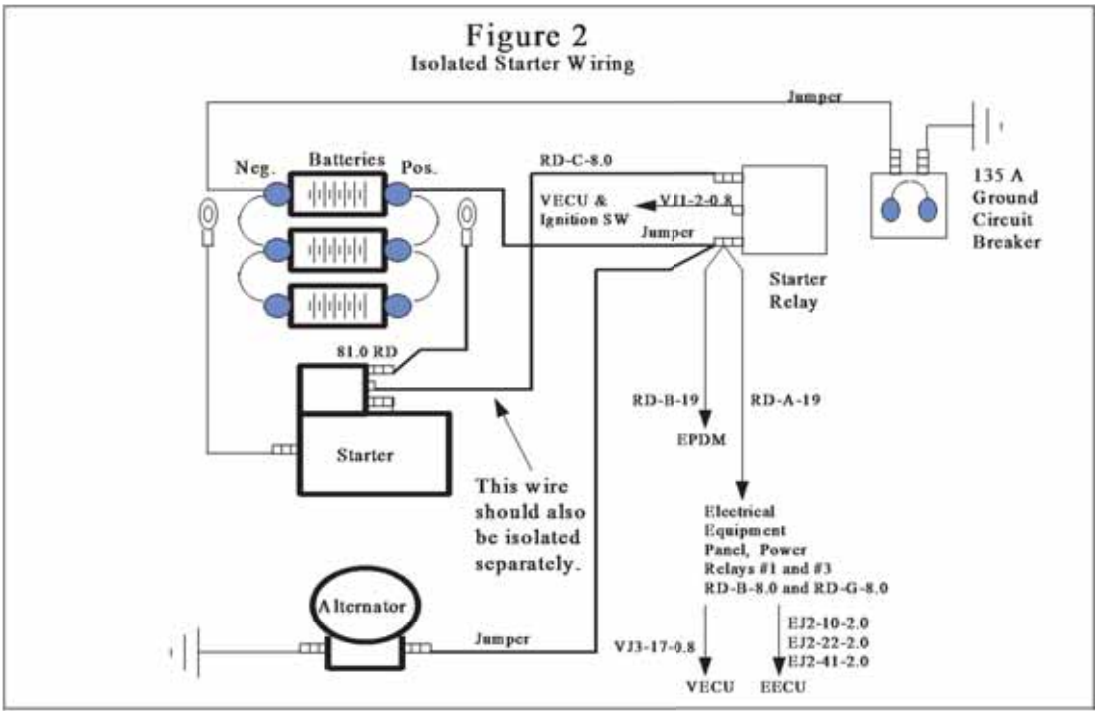
- If the recorded voltage does not meet or exceed the value in the table, replace the battery. Otherwise the battery is okay.

3.2 Isolating The Starter

To exclude the starter from the clean battery power circuitry, do the following:

- Disconnect the negative battery cable from the negative terminal on the battery;
- Disconnect the negative (BK-A-19.0) wire between the starter and the ground circuit breaker;
- Attach a 4 AWG jumper wire between an unused negative battery terminal and the ground circuit breaker;
- Disconnect the positive (RD-A-19.0) wire between the starter solenoid and the starter relay;
- Disconnect the positive (RD-A-19.0) wire between the starter solenoid and the alternator (both ring terminals);
- Connect a 4 AWG jumper wire between the starter relay battery post and an unused positive battery terminal;
- Connect a 4 AWG jumper wire between the starter relay battery post and alternator output terminal;
- Connect the negative battery cable to the negative terminal on the battery;
- Start the vehicle and disconnect both battery cables at the battery terminals;
- The starter is now isolated from the clean power circuitry;
- Road test the vehicle to see if the condition is still present;
- Also isolate the RD-C-8.0 wire from between the starter solenoid and the starter relay and road test vehicle to see if condition is still present.

See Figure 2, for the isolated starter wiring.

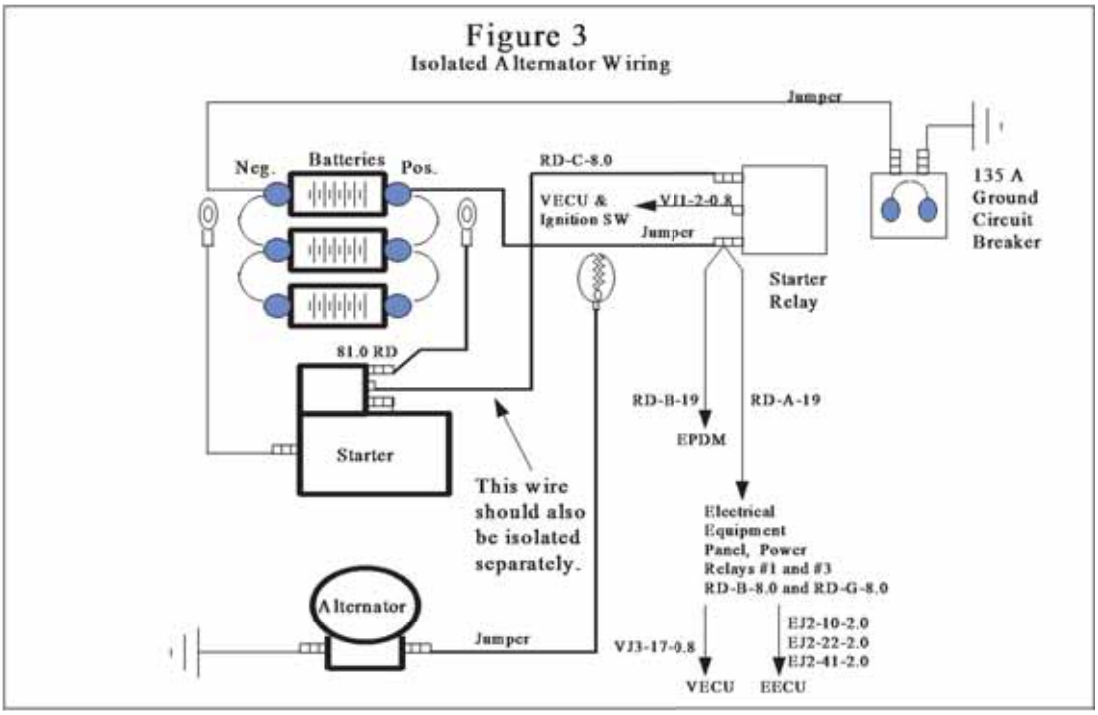


3.3 Isolating The Alternator

To exclude the alternator from the clean battery power circuitry, do the following:

- Check that the batteries are fully charged. The vehicle must not be operated if the batteries are below 60 percent state of charge (11 volts open circuit voltage). While performing the test, if the voltage falls below 11 volts, stop the vehicle and reconnect the alternator output jumper. This test can be conducted for approximately 30 minutes (engine running without lighting) before the fully charged battery needs to be recharged;
- With the engine running, and with the isolated started wiring arrangement intact, disconnect the alternator output terminal jumper;
- Road test the vehicle to see if the condition is still present.

See Figure 3, for the isolated alternator wiring.



3.4 Isolating The Starter Relay

To exclude the starter relay from the clean battery power circuitry, do the following:

- Restore all the wiring to the original arrangement. See Figure 1;
- Disconnect the negative battery cable from the battery terminal;
- Disconnect the two RD-A-19.0 and RD-B-19.0 ring terminals from the starter relay battery stud;
- Attach the two RD-A-19.0 and RD-B-19.0 ring terminals to one end of a jumper wire, then attach the other end of the jumper wire to the starter relay battery stud;
- Start the vehicle;
- Disconnect the jumper wire from the starter relay battery stud. Make sure this jumper will not short low during the road test;
- The starter relay is now isolated from the clean power circuitry;
- Road test the vehicle to see if the condition is still present.
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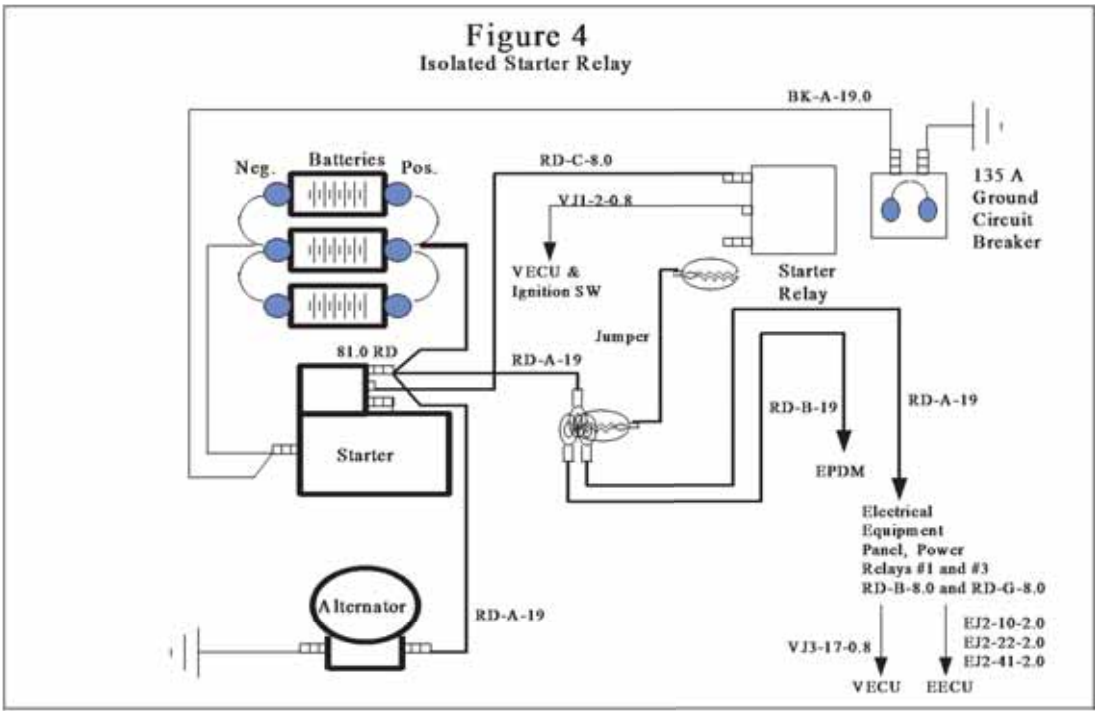
See Figure 4, for the isolated starter relay wiring.



3.5 Isolating The VECU & EECU

To isolate the ECUs, switch each ECU with a known good ECU and road test the vehicle to see if the cutout (stumble) is still present.

3.6 Isolating The Cab (Electrical Equipment Panel), EPDM, and Engine Harness

If isolating the battery, starter solenoid, alternator, starter relay, EECU, and VECU does not cause the severe clean electrical power failure condition to disappear, then a conductor in one of the harnesses must be shorting low. Service Engineering has developed a diagnostic jumper harness that can isolate the cab, EPDM, and engine harnesses. To get more information concerning the jumper harness, contact Marc Murray at 610 709-2448. The harness and instructions will be shipped upon request.

NOTE: The diagnostic jumper will only test intermittent shorts in the wiring (the harness component). If the other clean power components have not been isolated correctly as dictated above, the diagnostic jumper harness will be of no assistance.

4. REPAIR

Once the circuit component assembly has been identified as the cause of the cutout (stumble), disassemble the component assembly if possible. Then, look for any signs of extreme heat, bluing, and or metal transfer to validate that this is the failed component. Replace the failed component.

Solution visibility	Dealer distribution

Function(s)/component(s) affected

Function affected	VMAC

Function Group

Function Group	3 electric power supply; lighting; instruments; software; warning and information system

Administration

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