

Background: When the 7.5 amp fuse labeled "ALT.S" (in the fuse block near the battery) is connected, and I put a multimeter between the battery's negative post and its cable connector, I record a current draw of about 330 mA and the car never goes to sleep. However, if I remove the 7.5 amp fuse labeled "ALT.S" I start off with about 72 mA and after a short delay the system goes into sleep mode with less than 5 mA of current. The same thing happens if I keep the ALT.S fuse in place but pull the plastic wire connector from the S terminal of the alternator.

We agreed that I would perform some tests using a new wire to the S terminal, to rule out shorts or other defects in the existing S terminal wire. All of the following tests were performed with the starter disconnected, the key off and out of the ignition switch. Also, I had disconnected all of the equipment in the trunk, plus the audio system and all other equipment in that part of the dash.

Test A. I connected the negative cable to its post, then I disconnected the positive cable from the positive battery post; then I ran a new wire directly from the positive battery post to the S terminal on the alternator. The car's entire ground system was still working, but the only "hot" source was the positive post (not the fuse block) and the only circuit in operation went from the positive post to the alternator's S terminal then to ground then to my multimeter and then to the negative battery terminal. When I completely isolated the new S Terminal wire in that way, it pulled only 2.7 mA through the S terminal.

Test B. I reconnected the cable to the battery's positive post, and I ran the new wire directly from a "hot" 12 volt source in the fuse block to the alternator's S terminal... BUT I disconnected the wire that ran from the alternator's B terminal (the main output) to the fuse block. Then I measured the draw between the negative cable and the negative post, and it was again only 2.7 mA, and it was flowing only through the S terminal, not the B terminal.

Test C. I connected the battery's positive and negative cables to their posts, and I connected the new wire to the S terminal starting with a "hot" 12 volt source in the fuse block. Then I disconnected the large wire that ran from the alternator's B terminal to the fuse block (the 120 amp fusible link) and measured the current across that gap with the multimeter.

1. With the new wire to the S terminal connected to a "hot" 12 volt source in the fuse block, I recorded 270 mA across the gap between the B terminal charge wire and the 120 amp fusible link
2. With the new wire to the S terminal disconnected from the fuse block, I recorded only 0.13 mA flowing across that gap.

In other words, under these test conditions:

- when the car is shut off and the S Terminal is connected to power, there is ALWAYS a current draw of about 270 mA through terminal B – the main charge wire terminal
- even with the S Terminal disconnected, there is ALWAYS a 0.13 mA current draw through terminal B. It's very low, but knowing it might help to diagnose the problem

- when Terminal S is connected to power, there is ALWAYS a 2.7 mA current draw through Terminal S regardless of what's happening to terminal B

Having determined what happens when the L Terminal wire is not in the picture, I ran a wire between the L Terminal prong on the alternator and the L Terminal position in the plastic connector. There was no significant change in the test results.

**Results when old “ALT.S” wire not connected to charger –
New wire used as a substitute bringing power to the charger’s S Terminal**

| S and L Terminals Setup | Initial Current at Neg. Battery Gap | Initial Current at Fuse Block Gap (B Terminal Wire) | Go To Sleep Mode? |
|--|-------------------------------------|---|-------------------|
| S Terminal On (powered) | | | |
| L Terminal Connected | 350 mA | | NO |
| L Terminal Connected | | 260 mA | NO |
| L Terminal Disconnected | 330 mA | | NO |
| L Terminal Disconnected | | 270 mA | NO |
| S Terminal Off (disconnected) | | | |
| L Terminal Connected | 72 mA | | YES |
| L Terminal Connected | | 0.13 mA | No Reading |
| L Terminal Disconnected | 72 mA | | YES |
| L Terminal Disconnected | | 0.13 mA | No Reading |
| Note: current through <u>isolated</u> S Terminal was tested to be 2.7 mA | | | |

In the chart, “No Reading” of sleep mode when testing across the fuse block gap simply means that with only one multimeter I could not test both the “fuse block gap” and the “negative battery terminal gap” at the same time. However, because we know the system does go into sleep mode when the S Terminal is disconnected, we know that “No Reading” really means “YES.”

Readings were taken over two days. The slight differences in readings with the S Terminal Connected (350 v 330, and 260 v 270) might be merely a function of the differences in ambient temperature and the state of charge of the battery.

What have we learned?

The B Terminal will draw excessive current WHEN THE S TERMINAL IS CONNECTED TO POWER. When the S terminal is disconnected, the alternator seems to draw about 2.8 mA. With the alternator drawing 2.8 mA, the system’s initial 72 mA standby current draw is fine and it quickly goes into sleep mode.

We have learned that the excessive current draw we see is not merely associated with the alternator but is actually flowing through the B terminal. That's a pretty important element to know. This is not a case where the state of the S terminal (powered or not powered) is causing some other device(s) to leak a lot of current. This is a case where the state of the S Terminal is causing the alternator itself to leak current through the B Terminal. Unfortunately, the S Terminal wire at the fuse box is intended to be connected to power at all times.

We know that current leaks through the B Terminal even when the L Terminal is disconnected; so we know that none of the leakage is going upstream via the L Terminal. Is it possible that when the S Terminal wire is powered, the CURRENT STATE of the L Terminal wire causes an internal switch to close allowing current to flow through the B Terminal, but if we CHANGED THE STATE OF THE L TERMINAL WIRE then the internal circuitry would not cause current to flow through the B Terminal? I don't know. I doubt it. The FSM indicates that the L Terminal merely supplies ground to the Combination Meter. It would be crazy to construct a system whereby any fault in the "idiot light" ground circuit CAUSES the B Terminal to leak current.

I know that when the S Terminal is connected to power about 270 mA of current – an unacceptably excessive amount -- leaks through the B Terminal. I don't know why. I know it's not a wiring problem, because it happens when only two wires are connected: a new clean wire to the S Terminal, and the main charging wire to the B Terminal. Just to make sure the main charging wire was not shorted, I disconnected it and substituted a new 4 gauge wire – but the results were the same. With two new wires making direct connections, there is a proven current leak through the B Terminal of the alternator – only when the S Terminal is connected to power.

Suggestion:

Checking whether this is (another) alternator defect, or an obscure system defect, ought to be simple. The alternator leakage can be seen and measured when the car is not running. If you have a known good alternator – one that you know for a fact is free of fault – we could test it on my car without actually installing it. All we need to do is connect its body to my car's ground – any ground -- and connect its Terminals to my car's Terminal wires. We could just lay it in the engine bay and wire it up temporarily. We don't need to turn anything on. If a known good alternator also shows the current leak we will have to look outside my existing alternator for a cause. If a known good alternator does NOT exhibit the same current leak, we will know that the alternator that was installed in my car is defective.