

Diagnostic Tips for Fuel Systems: Engine Cranks / Won't Start / Stalls (Intermittent)

1. Make the “fork in the road” decision WHILE problem (crank / won't start) is present.
 - a. Spray starting fluid or carb cleaner into intake just prior to cranking the engine.
 - b. Did the engine start and run momentarily?
 - I. Engine DID Start? Its fuel delivery related. Could be a bad fuel pump / clogged fuel filter / poor electrical supply to fuel pump, or the PCM not pulsing the injectors). Also verify adequate fuel pressure by connecting a fuel pressure gauge between in coming line and fuel rail (if there's no handy test port). Fuel pressure should at specs. 2-5 % higher or lower shouldn't cause a no start on “most” fuel systems. NOTE: GM “Spider” (Sequential Central Port Injection) must be at or above published pressure specifications due to the nature of these systems' fuel injectors.
 - II. Engine Did NOT Start? Problem is likely spark related or a combination of fuel and spark (PCM fuse, PCM's power relay (powers lots of things) or ground problem. While an airflow issue could be the problem (low compression, incorrect valve timing, etc.) these conditions are rarely intermittent.
 - c. Keep in mind that its not only the complicated things that make diagnostics difficult (immobilizers, newer 3-phase brushless fuel pumps, dual fuel tanks with switching valves) but also the simply things we are ALL capable of overlooking (clogged fuel filter, lack of fuel, battery / ground problem).
2. If fuel delivery related, intermittent problems are usually electrical. Start by taking a digital voltmeter and checking the voltage between the power feed (i.e., pink/black tracer wire) and ground feed (i.e., black wire) at the fuel pump harness connector. Should be within 0.5 volts of battery voltage. i.e., the battery reads 12.6 volts across the posts, the pump should have at least 12.1 volts right after the key is turned to run or engine cranked.
3. Electrical problems can often be due to voltage drops. If the pump won't run but appears to have good power and ground running to it, disconnect it and connect a known good electrical load (a headlight that works) with some jumper wires to the vehicle harness. Turn the key to run / crank to power up fuel pump circuit. If the headlight glows, connect your voltmeter across the power and ground feeds to verify that you have the full 12-volts. **NOTE:** All meter testing should be performed by “back probing” the connections. Refer to page in this handout that describes proper back probing techniques. A known good load used in a powered-up circuit is the **ONLY** way to perform a voltage drop test properly. A reading that is over 0.5 (1/2) volts LOWER than the battery voltage (measured at battery) indicates the need to go further with voltage drop testing on either / both the power or the ground circuits to pinpoint where the voltage is being lost.
4. Measuring from the ground source (good chassis ground) to the ground feed (black wire to fuel pump) WHILE there is a working fuel pump / lighted headlight (substitute load) should read nothing (0-volts) in the ideal world of no voltage drops. In the real world, you may see up to 0.5 (a half a volt) at most. Do the same thing with your meter on the power side of the circuit. One lead to a known good battery feed connection and the other voltmeter lead to the pink wire feeding the fuel pump connector. See illustration drawings and notes on subsequent page in this document.

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Every vehicle has a “system pressure” specification. www.delphiautoparts.com has those specifications for each fuel pump we list.

Use an approved **fuel pressure** test kit (gauge) to verify pressure is at specs.

Fuel pump current draw is also important. A simple inductive ammeter (amp clamp) can be used to test current draw.

Pressure low & current low?

- Voltage drop to pump
- Restricted pump inlet strainer / low on fuel

Pressure low & current high?

- Restricted filter (inline or internal to pump) or pinched plastic fuel line
- Faulty (binding) fuel pump armature / turbine

IMAGES PART INFO. BUYER'S GUIDE

HP10089

Product Information

Product Line: Fuel Pump Hanger Assembly

Part Number: HP10089

Status: Available

UPC: 00689604194485

Package Contents: Fuel Pump Hanger Assembly w/Float Arm, (2) Retainer Clips, Instruction Sheet

System Pressure: 44 psi

Application Specific: Y

Description: 100 years of OE experience, supplier to the world's top automakers, OE Heritage and knowledge built into every aftermarket part, comprehensive portfolio for a wide range of vehicles and model years.

Remanufactured: N

Warranty Special: Limited Lifetime

California Proposition 65:  **WARNING:** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or reproductive harm. For more information go to www.P65Warnings.ca.gov.

Features and Benefits: Meets or Exceeds Original Equipment Manufacture Specifications



Fuel pressure test kit either already in your toolbox or available to 'rent' (\$150 refundable deposit) at many auto parts stores.

Product Attributes

Average Current Draw: 6 A

Average Flow Rating: 29 gph

Fuel Type: Gas

Gasket Or Seal Included: Yes

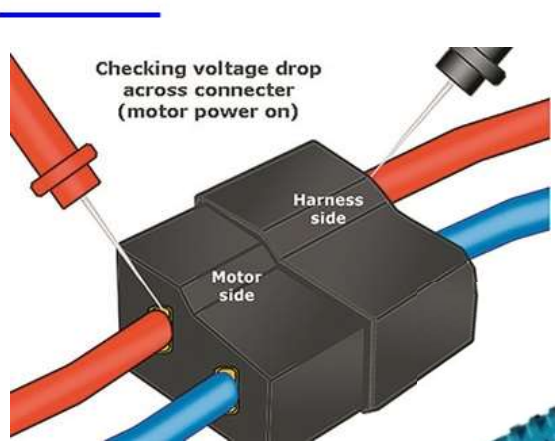
In Tank or External: In Tank

Inlet Type: Strainer

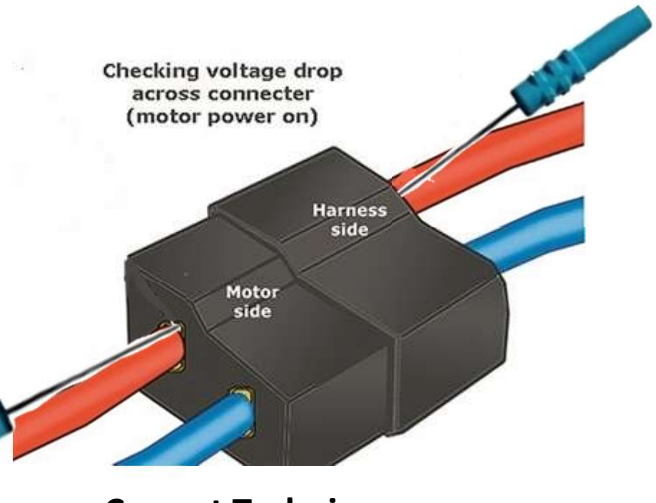


60-amp inductive “amp clamp” either already in your toolbox or available for < \$100 from most tool suppliers. Connects to voltmeter (turn setting to mV) and in order to read out current draw.

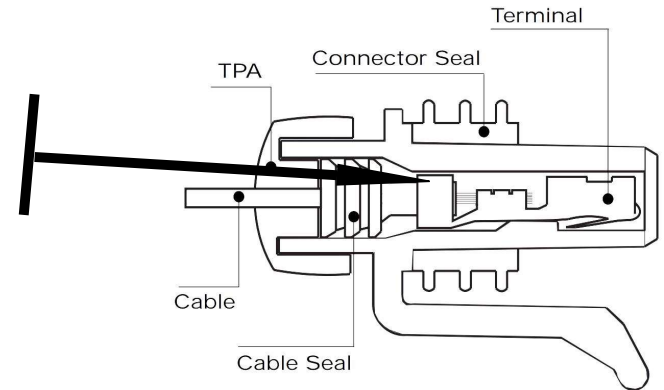
Tech Tip: Back Probing Effectively and Safely!



Incorrect Technique
(probes won't stay in place)



Correct Technique
(probes will stay in place)



Female Connector Assembly

Close-Up of Correct Technique
(be cautious NOT to force the probe TOO deep into connector cavity. Damage to terminal may result and cause ANOTHER problem!)



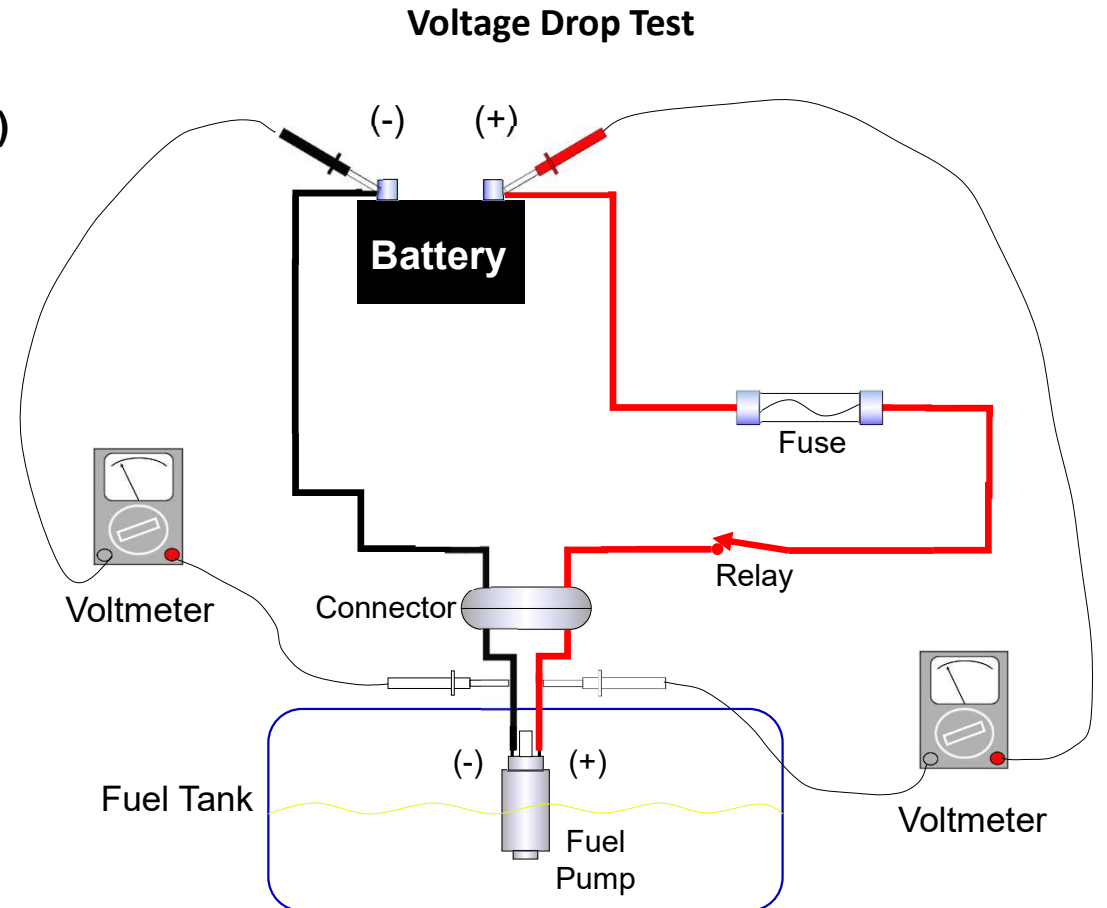
Back Probing Kit (superior to fabric store "T" pins or sharpened paper clips)

We've yet to find a technician who didn't LOVE these. www.aeswave.com at under \$40

Voltage Drop Testing - Concept

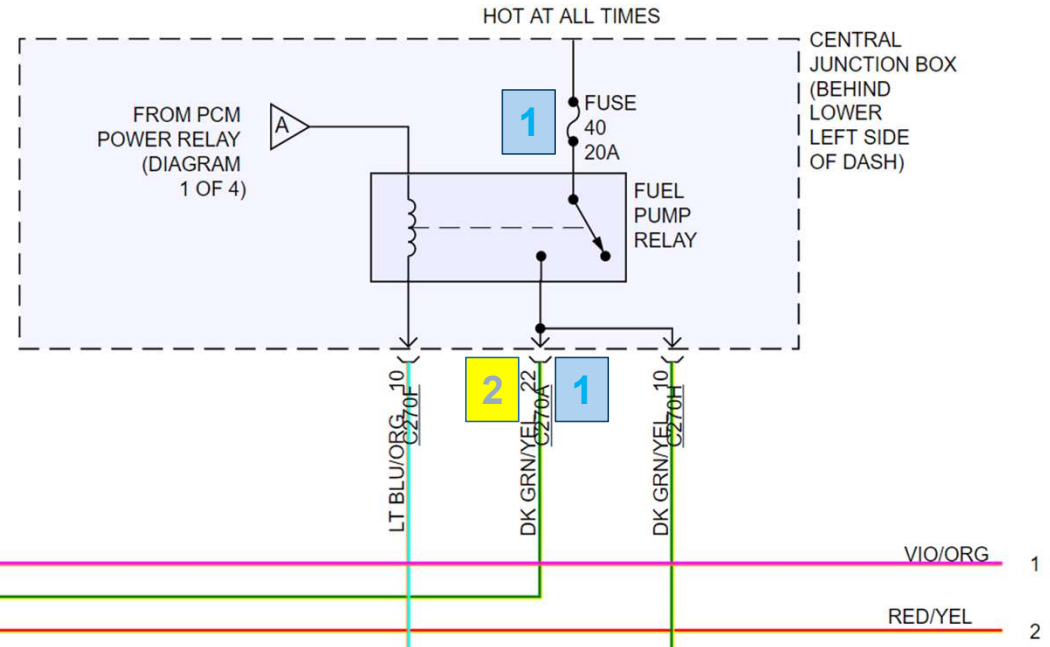
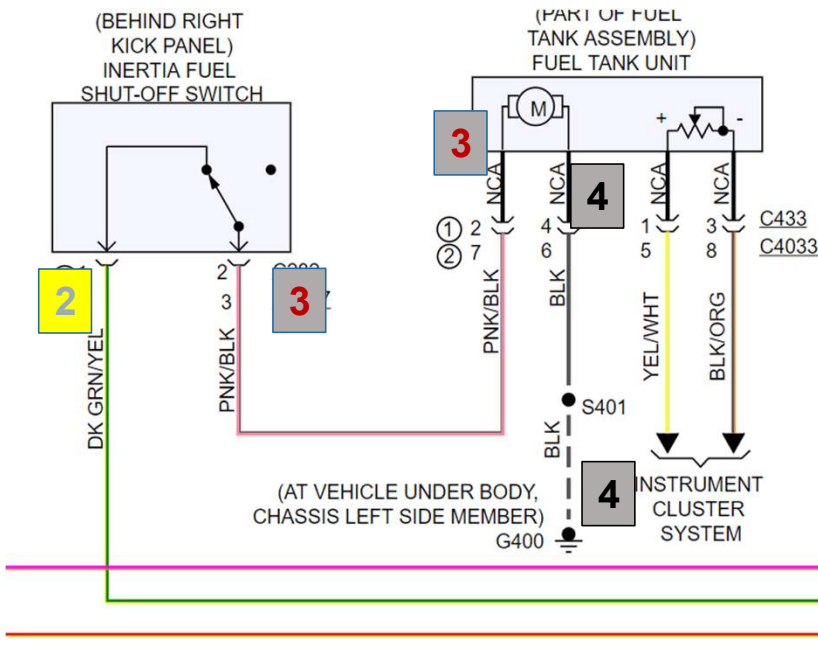
1st – Check for voltage level (between the power and the ground to any electrical device)

It should NOT be over 0.5 volts lower than the actual battery voltage measured at the battery. (keeping the key on / engine running to make it a “apples and apples” test. If the voltage to the device is more than 0.5 volts LOWER than battery voltage, you’ll need to perform a voltage drop test on both the power and the ground circuits to determine which if those circuits is robbing power to the device under test. Since you are measuring voltage from one end of the same circuit to the other, there should be little or no voltage (a.k.a. potential difference) on that circuit. 0.1 volts per connection is the rule of thumb with a total of 0.5 volts being allowable. Rusty / burnt / corroded terminals, splices and ground connections are the “usual suspects.”



Voltage Drop Testing - Schematic

Battery Volts	12.44 Volts
- <u>Fuel Pump Volts</u>	<u>12.04 Volts</u>
Fuel System Voltage Drop	00.40 Volts



Rules for Voltage Drop Testing;

1. Only test with electrical load in place and powered (working fuel pump or substitute load)
2. Measure across battery 1st, then across the working load while (back probing). Compare voltages.
3. Over 0.5 volts difference? Check between points (same number to same number) as shown above.

"PCM power relay" (in under hood fuse/relay center) provides 12-volts for fuel pump relay winding

EXAMPLE: 1997 Ford F-150 4.6-liter VIN W (factory diagram with Delphi notes)

PCM provides ground for fuel pump relay winding

PCM gets 12-volts from fuel pump relay to tell it that the relay is working. A code (DTC) "should" set if the voltage isn't seen here. A scan tool might even have a PID (parameter ID) showing the voltage of the relay's output.

A safety device that cuts power to Electric Fuel Pump if a collision occurs. Switch must be reset manually.

If inertia switch was 'open' the cluster "should" indicate this. These rarely are intermittent.

G104 located at the left front radiator support

