**Pinpoint Test B: Incorrect Fuel Gauge Indication**

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. Refer to Diagnostic Methods in Diagnostic Methods in Section 100-00 for information regarding these diagnostic practices.

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

The fuel tank is a saddle tank design with 2 variable resistance senders, driven by floats, that provide resistances related to fuel level in each side of the fuel tank to the Instrument Panel Cluster (IPC). The fuel level is determined using variable resistance fuel sender units, with an approximate resistance range between 180 ohms ± 4 ohms at empty (E) and 10 ohms ± 2 ohms at full (F). The IPC provides a reference voltage to the fuel level sender (part of the fuel pump module [LH side]) and the fuel level sensor (RH side) through individual signal circuits and receives a return through the signal return circuits from both the fuel level sender (part of the fuel pump module [LH side]) and fuel level sensor. As the fuel level changes, a float actuates a variable resistor on the fuel pump module and the fuel level sensor, raising or lowering the fuel level signal voltage depending on the resistance of the fuel level sender (float and card) or fuel level sensor. The IPC monitors the changes in voltage from both senders and commands the fuel gauge with a corresponding movement of the pointer. If the IPC detects the fuel level sensor circuitry is open, the fuel gauge defaults to the fuel level sender (part of the fuel pump module [LH side]) value only and the fuel gauge displays between 1/2 and empty (E) indicating the fuel level in the LH side of the fuel tank. If the IPC detects the fuel pump module circuitry is open, the fuel gauge defaults to the empty (E) position.

The IPC uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Ignition OFF fueling
- Ignition ON fueling
- Recovery

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

The default fuel gauge mode is called the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sensor readings caused by fuel moving around in the tank), the fuel gauge takes approximately 55 minutes to go from empty (E) to full (F).

The ignition OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The ignition must be in the OFF mode when refueling the vehicle.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.
- The IPC must receive a valid ignition ON fuel sensor reading within one second of the ignition being put into the RUN mode. The key ON sample readings are considered valid if the fuel sensor reading is between 10 ohms ± 2 ohms and 180 ohms ± 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

The ignition ON fueling mode (approximately 90 seconds to read empty [E] to full [F]) requires the following conditions be met:

- Engine speed is greater than 0 rpm.
- The transmission is in PARK (P).
- The ignition is in the RUN mode.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.

In ignition ON fueling mode, a 30-second timer activates after the transmission is put into the PARK (P) position. When the 30-second time has elapsed and at least 15% of the vehicle's fuel capacity has been added, the fuel gauge response time is 60 seconds to read from empty (E) to full (F). When the transmission is shifted out of PARK (P), the fuel gauge strategy reverts to the anti-slosh mode. The ignition ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the ignition in the RUN mode.

Recovery mode is incorporated into the IPC strategy to recover from a missing fuel level input after a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sensor or its circuits. Recovery mode (empty [E] to full [F] approximately 20 minutes) is initiated when the following 2 conditions are met:

- The IPC is in the anti-slosh (default) mode.

- The actual fuel level in the tank is greater than what is being displayed by the fuel gauge.

**Instrument Panel Cluster (IPC) DTCs**

| DTC Description | Fault Trigger Conditions |
|---|---|
| • B1A75:11 — Fuel Sender No. 1: Circuit Short to Ground | A continuous and on-demand DTC that sets in the IPC if the IPC detects that the fuel level sender (part of the fuel pump module [LH side]) is out of range on the input circuit with a short to ground for 33 seconds. The IPC defaults the fuel gauge to empty (E) once the IPC detects a fault and sets DTC B1A75:11. |
| • B1A75:15 — Fuel Sender No. 1: Circuit Short to Battery or Open | A continuous and on-demand DTC that sets in the IPC if the IPC detects that the fuel level sender (part of the fuel pump module [LH side]) is out of range on the input circuit with an open or short to voltage on circuit VMC11 (YE/VT) or circuit RMC32 (GN/BU) for 33 seconds. The IPC defaults the fuel gauge to empty (E) once the IPC detects a fault and sets DTC B1A75:15. |
| • B1A76:11 — Fuel Sender No. 2: Circuit Short to Ground | A continuous and on-demand DTC that sets in the IPC if the IPC detects that the fuel level sensor (RH side) is out of range on the input circuit with a short to ground for 33 seconds. Once the IPC detects a fault, the IPC sets DTC B1A76:11 and the gauge displays between 1/2 and empty (E), indicating the fuel level in the LH side of the tank. |
| • B1A76:15 — Fuel Sender No. 2: Circuit Short to Battery or Open | A continuous and on-demand DTC that sets in the IPC if the IPC detects that the fuel level sensor (RH side) is out of range on the input circuit with an open or short to voltage on circuit RMC33 (WH/VT) for 33 seconds. Once the IPC detects a fault, the IPC sets DTC B1A76:15 and the gauge displays between 1/2 and empty (E), indicating the fuel level in the LH side of the tank. |
| • P1243:06 — Second Fuel Pump Fault or Ground Fault: Algorithm Based Failure | **NOTE:** Normal operation of the fuel delivery system uses fuel from the fuel level sensor side of the fuel tank (RH side) prior to using fuel from the fuel level sender side of the fuel tank (LH side).<br><br>Once the IPC detects a large discrepancy in the amount of fuel (based on input from both fuel sensors) between both sides of the fuel tank, with the fuel level sensor side (RH) having more fuel than the fuel level sender side (RH), the IPC sets DTC P1243:06. |

**PCM DTCs**

| DTC Description | Fault Trigger Conditions |
|---|---|
| • P0460 — Fuel Level Sensor A Circuit | Sets when the PCM determines the value of the fuel level input signal is stuck, that the fuel level input signal does not change or does not correspond with the calculated fuel usage. |
| • P0461 — Fuel Level Sensor A Circuit Range/Performance | Sets when the PCM determines the fuel level input signal repeatedly moves in and out of range, exceeding the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank. |
| • P0462 — Fuel Level Sensor A Circuit Low | Sets in the PCM when the PCM detects a short to ground on the fuel pump module signal circuit based on the messaged input received from the IPC. |
| • P0463 — Fuel Level Sensor A Circuit High | Sets in the PCM when the PCM detects an open or a short to voltage on the fuel pump module signal circuit based on the messaged input received from the IPC. |
| • P2065 — Fuel Level Sensor B Circuit | Sets when the PCM determines the value of the fuel level sensor input signal is stuck, that the fuel level input signal does not change or does not correspond with the calculated fuel usage. |
| • P2066 — Fuel Level Sensor B Circuit Range/Performance | Sets when the PCM determines the fuel level sensor input signal repeatedly moves in and out of range, exceeding the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank. |
| • P2067 — Fuel Level Sensor B | Sets in the PCM when the PCM detects a short to ground on the fuel level sensor |

| | |
|---|---|
| Circuit Low | signal circuit based on the messaged input received from the IPC. |
| • P2068 — Fuel Level Sensor B Circuit High | Sets in the PCM when the PCM detects an open or short to voltage on the fuel level sensor signal circuit on the messaged input received from the IPC. |

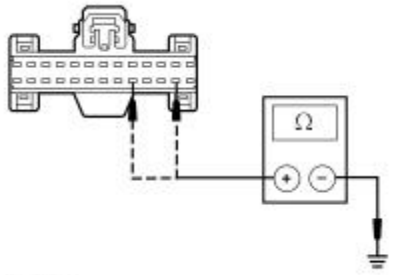
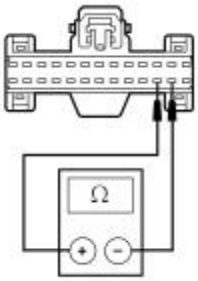
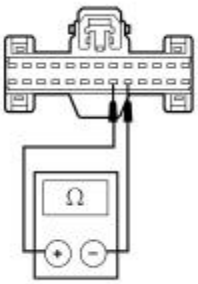
**This pinpoint test is intended to diagnose the following:**

- Wiring, terminals or connectors
- Fuel pump module (LH side)
- Fuel level sensor (RH side)
- Fuel level sender (float and card) (LH side)
- Fuel tank transfer tube
- Fuel tank
- IPC

**PINPOINT TEST B: INCORRECT FUEL GAUGE INDICATION**

***NOTICE:*** **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

| Test Step | Result / Action to Take |
|---|---|
| **B1 RETRIEVE THE RECORDED DTCs FROM THE IPC SELF-TEST** | **Yes**<br>For DTC B1A75:11 or DTC B1A76:11, GO to B3. For DTC B1A75:15, GO to B7. For DTC B1A76:15, GO to B12. For DTC P1243:06, GO to B16.<br><br>**No**<br>GO to B2. |
| • Ignition OFF.<br>• Check for recorded DTCs from the IPC self-test.<br>• **Are any DTCs recorded?** | |
| **B2 CARRY OUT THE IPC FUEL GAUGE ACTIVE COMMAND USING THE SCAN TOOL** | **Yes**<br>GO to B16.<br><br>**No**<br>INSTALL a new IPC. REFER to Instrument Panel Cluster (IPC) in this section. TEST the system for normal operation. |
| • Ignition ON.<br>• Enter the following diagnostic mode on the scan tool: IPC DataLogger.<br>• Select the IPC fuel gauge (FuelLevel) active command. Command the fuel gauge from 0% to 25%, 50%, 75% and 100% while observing the fuel gauge.<br>• **Does the fuel gauge begin at (E) empty, move to approximately 1/4, 1/2, 3/4 and F (full)?** | |
| **B3 CHECK THE FUEL SENDER FOR A SHORT TO GROUND** | **Yes**<br>INSTALL a new fuel pump module (DTC B1A75:11) or fuel level sensor (DTC B1A76:11). REFER to Section 310-01. CLEAR the DTCs. REPEAT the self-test.<br><br>**No**<br>GO to B4. |
| • Disconnect: Fuel Pump Module C433 (3.7L or 5.0L) or C4331 (5.8L) (DTC B1A75:11).<br>• Disconnect: Fuel Level Sensor C4374 (DTC B1A76:11).<br>• Ignition ON.<br>• Wait one minute.<br>• Enter the following diagnostic mode on the scan tool: IPC Self-Test.<br>• **NOTE:** DTC B1A75:11 or DTC B1A76:11 may also be present.<br>• Repeat the IPC on-demand self-test.<br>• **Is DTC B1A75:15 or DTC B1A76:15 retrieved?** | |
| **B4 CHECK THE FUEL LEVEL SIGNAL CIRCUITS FOR A SHORT TO GROUND** | |

| | |
|---|---|
| • Ignition OFF.<br>• Disconnect: IPC C220.<br>• Measure the resistance between the IPC C220-15 (DTC B1A75:11), circuit VMC11 (YE/VT), harness side and ground; or between the IPC C220-18 (DTC B1A76:11), circuit VMC23 (GN/OG), harness side and ground.<br>  <br>N0099733<br>• **Is the resistance greater than 10,000 ohms?** | **Yes**<br>For DTC B1A75:11, GO to B5.<br><br>For DTC B1A76:11, GO to B6.<br><br>**No**<br>REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. |
| **B5 CHECK THE FUEL PUMP MODULE SIGNAL AND RETURN CIRCUITS FOR A SHORT TOGETHER** | |
| • Measure the resistance between the IPC C220-16, circuit RMC32 (GN/BU), harness side and between the IPC C220-15, circuit VMC11 (YE/VT), harness side.<br>  <br>N0099734<br>• **Is the resistance greater than 10,000 ohms?** | **Yes**<br>GO to B20.<br><br>**No**<br>REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. |
| **B6 CHECK THE FUEL LEVEL SENSOR SIGNAL AND RETURN CIRCUITS FOR A SHORT TOGETHER** | |
| • Measure the resistance between the IPC C220-18, circuit VMC23 (GN/OG), harness side and the IPC C220-19, circuit RMC33 (WH/VT), harness side.<br>  <br>N0099737<br>• **Is the resistance greater than 10,000 ohms?** | **Yes**<br>GO to B20.<br><br>**No**<br>REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. |
| **B7 CHECK THE FUEL PUMP MODULE CIRCUITRY FOR A SHORT TO VOLTAGE** | |
| • Disconnect: IPC C220.<br>• Ignition ON.<br>• Measure the voltage between the IPC C220-15, circuit VMC11 (YE/VT), harness side and ground; and between the IPC C220-16, circuit RMC23 | **Yes**<br>GO to B8.<br><br>**No** |

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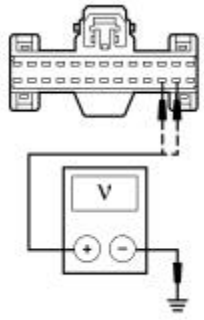
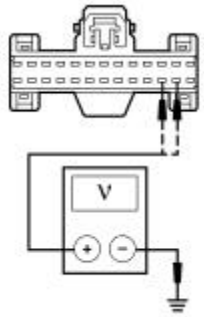
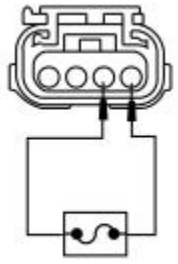
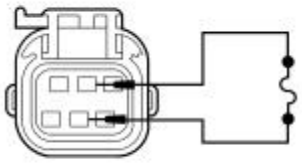
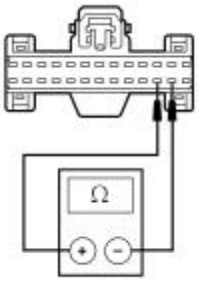
| (GN/BU), harness side and ground.<br>  <br>N0099736<br>• **Is any voltage present?** | GO to B9. |
| **B8 CHECK THE FUEL PUMP MODULE FOR A SHORT TO VOLTAGE**<br>• Ignition OFF.<br>• Disconnect: Fuel Pump Module C433 (3.7L and 5.0L) or C4331 (5.8L).<br>• Ignition ON.<br>• Measure the voltage between the IPC C220-15, circuit VMC11 (YE/VT), harness side and ground; and between the IPC C220-16, circuit RMC32 (GN/BU), harness side and ground.<br>  <br>N0099736<br>• **Is any voltage present?** | **Yes**<br>REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.<br><br>**No**<br>INSTALL a new fuel pump module. REFER to Section 310-01. CLEAR the DTCs. REPEAT the self-test. |
| **B9 CHECK THE FUEL PUMP MODULE CIRCUITRY FOR AN OPEN**<br>• Ignition OFF.<br>• Disconnect: Fuel Pump Module C433 (3.7L and 5.0L) or C4331 (5.8L).<br>• For 3.7L and 5.0L engines, connect a fused jumper wire between the fuel pump module C433-1, circuit RMC32 (GN/BU), harness side and the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side.<br>  <br>N0125074<br>• For 5.8L engine, connect a fused jumper wire between the fuel pump module C4331-5, circuit VMC11 (YE/VT), harness side and the fuel pump module C4331-2, circuit RMC32 (GN/BU), harness side. | **Yes**<br>REMOVE the jumper wire. GO to B10.<br><br>**No**<br>REMOVE the jumper wire. GO to B11. |



N0082050

- Measure the resistance between the IPC C220-16, circuit RMC32 (GN/BU), harness side and the IPC C220-15, circuit VMC11 (YE/VT), harness side.



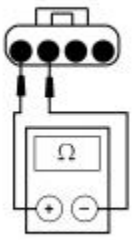

N0099734

- **Is the resistance less than 5 ohms?**

**B10 CHECK THE FUEL PUMP MODULE FOR AN OPEN**

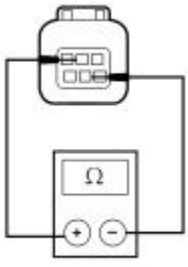
**NOTE:** The fuel level sensor resistance varies from 180 ± 4 ohms when empty (E) to 10 ± 2 ohms when full (F).

- For 3.7L and 5.0L engines, measure the resistance between the fuel pump module C433-1, component side and the fuel pump module C433-2, component side.




N0125075

- For 5.8L engine, measure the resistance between the fuel pump module C4331-2, component side and the fuel pump module C4331-5, component side.

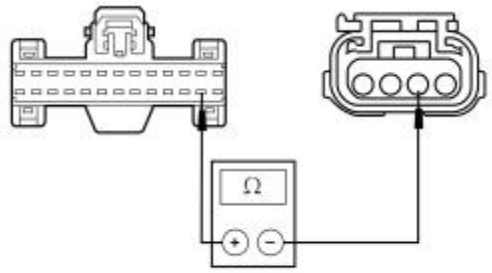
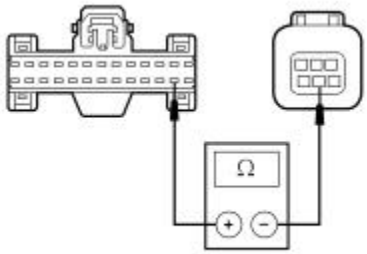
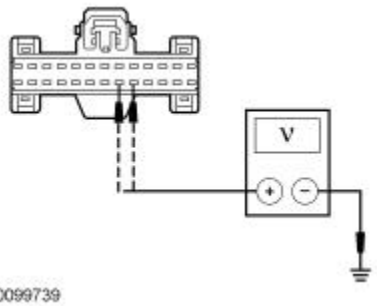


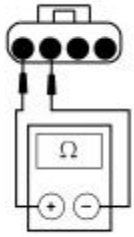

N0084252

- **Is the resistance between 10 and 180 ohms?**

**Yes**
GO to B20.

**No**
GO to B19.

| B11 CHECK THE FUEL LEVEL SIGNAL CIRCUIT FOR AN OPEN | |
|---|---|
| • For 3.7L and 5.0L engines, measure the resistance between the IPC C220-15, circuit VMC11 (YE/VT), harness side and the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side.<br>  <br><br>N0125072<br>• For 5.8L engine, measure the resistance between the IPC C220-15, circuit VMC11 (YE/VT), harness side and the fuel pump module C4331-5, circuit VMC11 (YE/VT), harness side.<br>  <br><br>N0099738<br>• **Is the resistance less than 5 ohms?** | **Yes**<br>REPAIR circuit RMC32 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test.<br><br>**No**<br>REPAIR circuit VMC11 (YE/VT). CLEAR the DTCs. REPEAT the self-test. |
| **B12 CHECK THE FUEL LEVEL SENSOR CIRCUITRY FOR A SHORT TO VOLTAGE** | |
| • Disconnect: IPC C220.<br>• Disconnect: Fuel Level Sensor C434.<br>• Ignition ON.<br>• Measure the voltage between the IPC C220-18, circuit VMC23 (GN/OG), harness side and ground; and between the IPC C220-19, circuit RMC33 (WH/VT), harness side and ground.<br>  <br><br>N0099739<br>• **Is any voltage present?** | **Yes**<br>REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.<br><br>**No**<br>GO to B13. |
| **B13 CHECK THE FUEL LEVEL SENSOR FOR AN OPEN** | |
| **NOTE:** The fuel level sensor resistance varies from 180 ± 4 ohms when empty (E) to 10 ± 2 ohms when full (F).<br><br>• Ignition OFF.<br>• Measure the resistance between the fuel level sensor C4374-1, component side and the fuel level sensor C4374-2, component side. | **Yes**<br>GO to B14.<br><br>**No**<br>INSTALL a new fuel level sensor. REFER to Section 310-01. CLEAR the DTCs. REPEAT the self-test. |

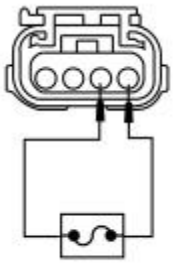


N0125075

- **Is the resistance between 10 and 180 ohms?**

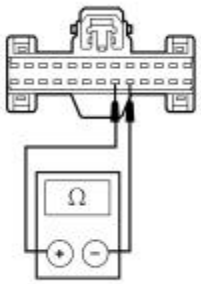
**B14 CHECK THE FUEL LEVEL SENSOR CIRCUITRY FOR AN OPEN**

- Connect a fused jumper wire between the fuel level sensor C4374-2, circuit VMC23 (GN/OG), harness side and the fuel level sensor C4374-1, circuit RMC33 (WH/VT), harness side.



N0125074

- Measure the resistance between the IPC C220-18, circuit VMC23 (GN/OG), harness side and the IPC C220-19, circuit RMC33 (WH/VT), harness side.



N0099737

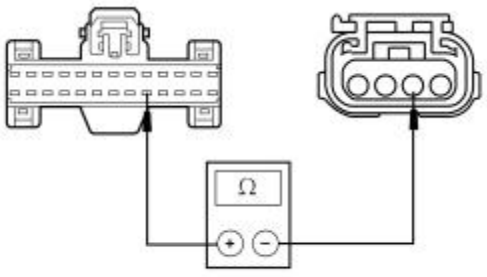
- **Is the resistance less than 5 ohms?**

**Yes**
REMOVE the jumper wire. GO to B20.

**No**
REMOVE the jumper wire. GO to B15.

**B15 CHECK THE FUEL LEVEL SENSOR SIGNAL FOR AN OPEN**

- Measure the resistance between the IPC C220-18, circuit VMC23 (GN/OG), harness side and the fuel level sensor C4374-2, circuit VMC23 (GN/OG), harness side.

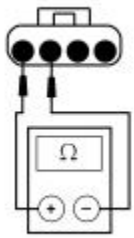
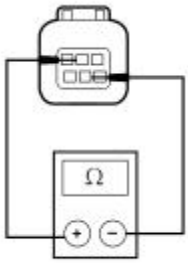


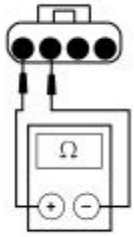
N0125204

- **Is the resistance less than 5 ohms?**

**Yes**
REPAIR circuit RMC33 (WH/VT) for an open. CLEAR the DTCs. REPEAT the self-test.

**No**
REPAIR circuit VMC23 (GN/OG). CLEAR the DTCs. REPEAT the self-test.

| | |
|---|---|
| **B16 INSPECT THE FUEL TANK** | |
| • Visually inspect the fuel tank for any damage or deformation.<br>• **Is the fuel tank OK?** | **Yes**<br>GO to B17.<br><br>**No**<br>INSTALL a new fuel tank. REFER to Section 310-01. CLEAR the DTCs. REPEAT the self test. |
| **B17 INSPECT THE FUEL TANK TRANSFER TUBE CONNECTIONS** | |
| • Remove the fuel pump module and the fuel level sensor. Refer to Section 310-01.<br>• Inspect the fuel tank transfer tube, connections, the fuel pump module and the fuel level sensor for any damage or deformation.<br>• **Are the fuel tank transfer tube, connections, the fuel pump module and the fuel level sensor OK?** | **Yes**<br>GO to B18.<br><br>**No**<br>INSTALL a new fuel tank transfer tube, fuel pump module or fuel level sensor as necessary. REFER to Section 310-01. CLEAR the DTCs. REPEAT the self test. |
| **B18 CHECK THE FUEL PUMP MODULE AND FUEL LEVEL SENSOR RESISTANCE READINGS** | |
| **NOTE:** The fuel pump module and fuel level sensor resistance varies from 180 ± 4 ohms when empty (E) to 10 ± 2 ohms when full (F).<br><br>• For 3.7L and 5.0L engines, measure the resistance between the fuel pump module C433-1, component side and the fuel pump module C433-2, component side while slowly moving the float from the bottom of the travel to the top.<br><br>  <br><br>N0125075<br><br>• For 5.8L engine, measure the resistance between the fuel pump module C4331-2, component side and the fuel pump module C4331-5, component side while slowly moving the float from the bottom of the travel to the top.<br><br>  <br><br>N0084252<br><br>• For all engines, measure the resistance between the fuel level sensor C4374-2, component side and the fuel level sensor C4374-1, component side, while slowly moving the float from the bottom of the travel to the top. | **Yes**<br>INSTALL a new fuel tank. REFER to Section 310-01. CLEAR the DTCs. REPEAT the self-test.<br><br>**No**<br>For the fuel pump module, GO to B19.<br><br>For the fuel level sensor, INSTALL a new fuel level sensor. REFER to Section 310-01. CLEAR the DTCs. REPEAT the self-test. |



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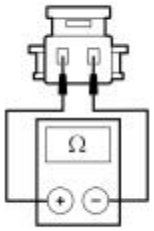
- **Does the resistance of both senders start at approximately 180 ohms with the float at the bottom of the travel and slowly decrease to approximately 10 ohms with the float at the top of the travel?**

| | |
|---|---|
| **B19 CHECK THE FUEL LEVEL SENDER (FLOAT AND CARD)** | |
| **NOTE:** The fuel level sender (float and card) resistance measures between 180 ± 4 ohms at the lower stop position and 10 ± 2 ohms at the upper stop position.<br><br>• Remove the fuel pump module. Refer to Section 310-01.<br>• Disconnect the fuel level sender input wire from the fuel pump module.<br>• Measure the resistance between the fuel level sender connector pin 1, harness side and the fuel level sender connector pin 2, harness side while slowly moving the float arm between the lower and upper stop position.<br><br>  <br>N0112563<br><br>• **Does the resistance slowly decrease from approximately 180 ohms at the lower stop to 10 ohms at the upper stop?** | **Yes**<br>INSTALL a new fuel pump module. REFER to Section 310-01. CLEAR the DTCs. REPEAT the self-test.<br><br>**No**<br>INSTALL a new fuel level sender (float and card). REFER to Section 310-01. CLEAR the DTCs. REPEAT the self-test. |
| **B20 CHECK FOR CORRECT IPC OPERATION** | |
| • Disconnect the IPC connector.<br>• Check for:<br>  ▪ corrosion<br>  ▪ damaged pins<br>  ▪ pushed-out pins<br>• Connect the IPC connector and make sure it seats correctly.<br>• Operate the system and verify the concern is still present.<br>• **Is the concern still present?** | **Yes**<br>INSTALL a new IPC. REFER to Instrument Panel Cluster (IPC) in this section. TEST the system for normal operation.<br><br>**No**<br>The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. |