### SPN 51

**Suspect Parameter Number (SPN) and Failure Mode Indicator (FMI) Description**

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**Circuit Description**

The throttle position sensor (TPS) is mounted in the throttle body assembly and is replaced as an assembly. The engine control module (ECM) supplies a 5 V reference and low reference to the throttle position sensor. The throttle position sensor supplies two output signals to the ECM through two separate signal circuits. The TPS1 signal circuit will supply a high value signal at idle and the TPS2 will supply a low value signal at idle. As the throttle angle increases, TPS1 signal will decrease and TPS2 signal will increase.

The Torque Security Module (TSM) also receives a signal from TPS1. The TSM and ECM compare TPS1 signals to verify proper operation.

The ECM performs a series of functions to learn the throttle position every time the ignition is turned ON. The throttle learn function is performed to verify that the throttle is working correctly. The throttle learn uses the average value of the TPS 1 and TPS 2 values when looking at throttle position as it moves through a series of pre-determined positions. If the ignition is turned off during the throttle learn process the process will be aborted.

The first sequence tests the throttle position neutral state. With ignition ON and 0% duty cycle the throttle must be in a pre-determined neutral position value range. In the second sequence the throttle moves to the closed position. The closed position is checked against a pre-determined value range.
In the third sequence the throttle then moves to the neutral position and its position is verified again against the predetermined neutral position range.

In the forth sequence the throttle moves to the wide open position. The wide open position is checked against a pre-determined value range.

In the fifth sequence the throttle then moves to the neutral position and its position is verified again against the pre-determined neutral position value range. At this point the throttle learn function is complete.

**Conditions to Run SPN**

**SPN 51–2 Throttle Position Sensor Conflict**

The SPN runs continuously while the ignition is ON and TPS1 and TPS2 are valid (e.g. no circuit errors are present).

**SPN 51–7 TPS1 Rationality Conflict between the ECM and TSM**

The SPN runs continuously while the ignition is ON.

**SPN 51–11 TPS Throttle Learn Error**

The SPN runs once per drive cycle during ignition ON with engine OFF.

**SPN 51–19 Throttle Position Sensor Invalid**

The SPN runs continuously while the ignition is ON.

**Conditions to Set SPN**

**SPN 51-2 Throttle Position Sensor Conflict**

The ECM detects the difference between TPS1 and TPS2 is greater than 6% for greater than 240ms.
SPN 51-7 TPS1 Rationality Conflict between the ECM and TSM

The difference between the ECM TPS1 input value and the TSM TPS1 input value is greater than the allowable amount for greater than 240ms.

SPN 51-11 TPS Throttle Learn Error

If at any point in the throttle learn function the throttle position is not in the predetermined value range specified for that position, or if the throttle position is in the value range but is not steady, the throttle position SPN will be set, the check engine and stop engine indicators will come on and the main power relay (MPR) will de-energize.

SPN 51–19 Throttle Position Sensor Invalid

The ECM detects both TPS1 and TPS2 signal circuits are open or shorted for greater than 240ms.

**Action Taken When SPN Sets**

**SPN 51–2 Throttle Position Sensor Conflict**

- The ECM will turn ON the malfunction indicator light (MIL)
- 51-2 is a Type B SPN

**SPN 51-7 TPS1 Rationality Conflict between the ECM and TSM**

- The ECM will turn ON the check engine lamp (CEL)
- The ECM will turn ON the stop engine lamp (SEL)
- 51-7 is a Type A SPN

**SPN 51-11 TPS Throttle Learn Error**

- The ECM will turn ON the check engine lamp (CEL)
- The ECM will turn ON the stop engine lamp (SEL)
- The ECM will de-energize the main power relay (MPR)
- 51-11 is a Type A SPN
SPN 51–19 Throttle Position Sensor Invalid

- The ECM will turn ON the malfunction indicator light (MIL)
- 51-19 is a Type B SPN

Diagnostic Reference

- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.
- Perform the Diagnostic System Check prior to using this diagnostic.
- Test for intermittent or poor connections.
- Review Schematics and Connector End Views to locate test points.
- Review the SPN Type, Indicator Lamp Definitions, and Conditions to Clear the SPN/Indicator Lamp.

Diagnostic Tips

- Test for intermittent or poor connections.

Required Tools

- Terminal Test Probe Kit
- Fused Jumper
- Digital Multi-meter
- High Impedance Test Lamp
- Electronic Service Tool

Circuit Diagnostics

WARNING! To prevent bodily injury or death, stay away from hot engine surfaces and rotating engine components.

1. Ignition OFF, disconnect the throttle body assembly harness connector, test for less than 10 Ω between the low reference circuit terminal C and ground.
If greater than 10 Ω, disconnect the ECM connector J1-A, test for less than 5 Ω between the low reference circuit terminal C and ECM connector J1-A terminal D4.

- If 5 Ω or greater, repair the open or high resistance in the circuit.
- If less than 5 Ω, replace the ECM.

✓ If 10 Ω or less, go to Step 2

2. Ignition ON, test for 4.8-5.2 V between the 5 V reference circuit terminal E and ground.

- If less than 4.8V, ignition OFF, disconnect the ECM connector J1-C, test for infinite resistance between the 5 V reference circuit terminal E and ground.
  - If not infinite resistance, repair the short to ground in the circuit.
  - If infinite resistance, test for less than 5 Ω between the 5 V reference circuit terminal E and the ECM connector J1-C terminal E4.
    - If greater than 5 Ω, repair the open or high resistance in the circuit.
    - If 5 Ω or less, replace the ECM.

- If greater than 5.2 V, ignition OFF, disconnect the ECM connector J1-C. Ignition ON, verify less than 1 V between the 5 V reference circuit terminal E and ground.
  - If 1 V or greater, repair the short to voltage on the circuit.
  - If less than 1 V, replace the ECM.

✓ If between 4.8-5.2 V, go to Step 3

3. Verify the Electronic Service Tool Throttle Position 1 parameter is less than 1 %.

- If the Throttle Position 1 parameter is 1% or greater, ignition OFF, disconnect the ECM connector J1-C. Ignition ON, verify less than 1 V between the TPS1 signal circuit terminal D and ground.
  - If 1 V or greater, ignition OFF, disconnect the TSM connect C4, ignition ON, verify less than 1V between TPS1 signal circuit terminal D and ground.
• If 1V or greater, repair the short to voltage on the circuit.
• If less than 1V, replace the TSM.

✓ If less than 1 V, replace the ECM.

✓ If the Position 1 parameter is 1% or less, go to Step 4

4. Verify the Electronic Service Tool Throttle Position 2 parameter is less than 1 %.

➢ If the Throttle Position 2 parameter is 1% or greater, ignition OFF, disconnect the ECM connector J1-C, ignition ON, verify less than 1 V between the TPS1 signal circuit terminal F and ground.

✓ If 1 V or greater, repair the short to voltage on the circuit.
✓ If less than 1 V, replace the ECM.

✓ If the Position 1 parameter is 1% or less, go to Step 5

5. Ignition OFF, install a 3 A fused jumper between the TPS1 signal circuit terminal D and the 5 V reference circuit terminal E, ignition ON, verify the Throttle Position 1 parameter is greater than 99 %.

➢ If the Throttle Position 1 parameter is less than 99 %, ignition OFF, remove fused jumper, disconnect the ECM connector J1-C, test for infinite resistance between the TPS1 signal circuit terminal D and ground.

✓ If not infinite resistance, disconnect the TSM connector C4, test for infinite resistance between the TPS1 signal circuit terminal D and ground.

• If not infinite resistance, repair the short to ground in the circuit.
• If infinite resistance, replace the TSM.

✓ If infinite resistance, test for less than 5 Ω between the TPS1 signal circuit terminal D and the ECM connector J1-C terminal A3.

• If greater than 5 Ω, repair the open or high resistance in the circuit.
- If 5 Ω or less, test for less than 5 Ω between the TPS1 signal circuit terminal D and the TSM connector C4 terminal 15.
  
  a) If greater than 5 Ω, repair the open/high resistance in the circuit.
  b) If less than 5 Ω, replace the ECM.

✔ If the Throttle Position 1 parameter is greater than 99 %, go to step 6

6. Ignition OFF, install a 3 A fused jumper between the TPS2 signal circuit terminal F and the 5 V reference circuit terminal E, ignition ON, verify the Throttle Position 2 parameter is greater than 99 %.

➢ If the Throttle Position 2 parameter is less than 99 %, ignition OFF, remove fused jumper, disconnect the ECM connector J1-C, test for infinite resistance between the TPS2 signal circuit terminal F and ground.
  
  ✓ If not infinite resistance, repair the short to ground in the circuit.
  ✓ If infinite resistance, test for less than 5 Ω between the TPS1 signal circuit terminal D and the ECM connector J1-C terminal E2.
  
  • If greater than 5 Ω, repair the open or high resistance in the circuit.
  • If 5 Ω or less, replace the ECM.

➢ If the Throttle Position 2 parameter is greater than 99 %, replace the throttle body assembly.