

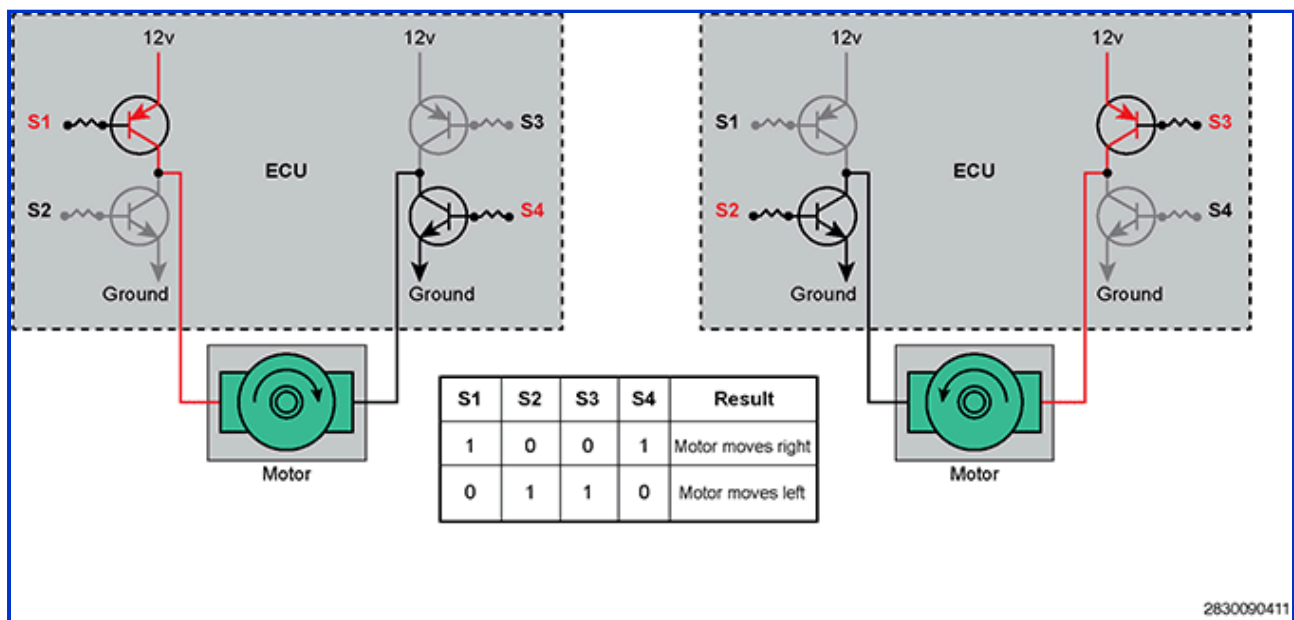
## P2B93-00-WASTEGATE POSITION SENSOR A EXCEEDED LEARNING LIMIT

### Theory of Operation

**GENERAL WASTEGATE OPERATION:** The base Turbocharger boost pressure is managed by the Wastegate. The primary function of the Wastegate is to regulate the maximum boost pressure in a Turbocharged engine. The Wastegate Motor is electrically controlled by an internal H-Bridge Driver circuit inside the Powertrain Control Module (PCM). When the PCM determines boost is required, it energizes the Wastegate Motor to move the Wastegate toward the closed position. When less boost is needed the PCM energizes the Wastegate Motor to move the Wastegate toward the open position allowing the exhaust gases to bypass the turbine inside the Turbocharger. When not energized the Wastegate is in the open position. The PCM monitors the signal from the Wastegate internal position sensor to determine when the Wastegate has reached the commanded position.

**WASTEGATE POSITION SENSOR:** The PCM detects the position of the Wastegate Valve from feedback provided by the Wastegate Position Sensor. The Wastegate Position Sensor is integrated as part of the Wastegate Valve and operates like a typical three wire sensor. The PCM provides a 5-Volt Supply and Sensor Return circuit to the Wastegate Position Sensor and receives the feedback voltage on the signal circuit.

**GENERAL H-BRIDGE OPERATION:** An H-Bridge is an electronic circuit that enables a voltage to be applied across a load in either direction. The H-Bridge arrangement is generally used to reverse the polarity/direction of the DC motor which allows the DC motor to run forward and backwards. A DC Motor is typically controlled using an H-Bridge circuit inside the Powertrain Control Module (PCM). **See the figure below for a general configuration and operation of an H-Bridge:**



### DIAGNOSTICS:

- The PCM performs diagnostics on the DC Motor and circuits. If the PCM detects that the current draw or Pulse Width Modulation (PWM) to the DC Motor is too high or low for a calibrated amount of time, then the PCM determines that the motor or circuitry is faulted and not operating properly.
- During operation the PCM performs a rationality diagnostic. The rationality diagnostic uses the feedback from the integrated Wastegate Position Sensor to monitor the difference between the desired position and the actual position of the Wastegate Valve.
- The PCM also performs diagnostics on the integrated Wastegate Position Sensor **separately** to monitor the circuits for an open, shorted to voltage, or shorted to ground condition,

**NOTE:** The PCM can detect a circuit high or circuit low fault during operation of the component, whereas open circuit detection can only occur when the component is not being commanded on. If an open occurs in the

component or circuits during operation, the PCM will normally detect the failure during the performance diagnostic for the system that component is being used to control.

## When Monitored and Set Conditions

**When Monitored:** This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Engine is off.
- No Wastegate DTC active.

### Set Conditions:

- The Powertrain Control Module (PCM) detects the voltage of Wastegate Sensor 1 at the lower mechanical stop position during permanent learning is less than 0.4 volts or greater than 2.0 volts.

### Default Actions:

- The MIL is illuminated.

| Possible Causes                                                                       |
|---------------------------------------------------------------------------------------|
| WASTEGATE ACTUATOR LINKAGE DISCONNECTED OR DAMAGED<br>POWERTRAIN CONTROL MODULE (PCM) |

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. ([Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control \(PCM\) - Standard Procedure](#)) .

## TURBOCHARGER IDENTIFICATION

### Diagnostic Test

#### 1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR THE DTC TO RETURN

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1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

### Did the DTC return?

**Yes**

- Go To Next Step

## No

- Perform the INTERMITTENT CONDITION diagnostic procedure. ([Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control \(PCM\) - Standard Procedure](#)). .

## 2. REPLACE THE WASTEGATE LINKAGE AND RETEST FOR DTCS

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1. Turn the ignition off.
2. Replace the Wastegate Linkage in accordance with the Service Information.
3. Connect the component and Electronic Control Unit (ECU) harness connectors.
4. Turn the ignition on.
5. With the scan tool, erase all DTCs.
6. Turn the ignition off for a minimum of 10.0 seconds.
7. Turn the ignition on.
8. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
9. With the scan tool, read DTCs.

### Did the DTC return?

## Yes

- Go To Next Step

## No

- Replacing the faulty component repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. ([Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control \(PCM\) - Standard Procedure](#)). .

## 3. CHECK RELATED PCM AND COMPONENT CONNECTIONS

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1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
  - Proper connector installation.
  - Damaged connector locks.
  - Corrosion.
  - Other signs of water intrusion.
  - Weather seal damage (if equipped).
  - Bent terminals.
  - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
  - Terminals that have been pushed back into the connector cavity.
  - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

### **Did the DTC return?**

#### **Yes**

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. ([Refer to 08 - Electrical/8E - Electronic Control Modules/MODULE, Powertrain Control/Removal and Installation](#)).
- Perform the POWERTRAIN VERIFICATION TEST. ([Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control \(PCM\) - Standard Procedure](#)) .

#### **No**

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. ([Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control \(PCM\) - Standard Procedure](#)) .