STANDARD PROCEDURE

ABS VERIFICATION TEST

DIAGNOSTIC TEST

ABS VERIFICATION TEST

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

1. Connect all previously disconnected components and connectors.
2. If any of the following components were replaced, use the following table below and perform the correct routines using the scan tool under "Miscellaneous Functions" in the Anti-lock Brake System (ABS) Module:

NOTE: **When performing the ABS Initialization routine, the vehicle temperature must be above 10B°C (50B°F).**

NOTE: **If the ABS is not initialized, the ABS indicator will flash continuously.**

NOTE: **The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).**

Component	Routines
Anti-lock Brake System (ABS) Module	ABS Initialization/Brake Pedal Calibration
Hydraulic Control Unit (HCU)	ABS Initialization/ABS Bleed Brakes/Brake Pedal Calibration
Integrated Control Unit (ICU)	ABS Initialization/ABS Bleed Brakes/Brake Pedal Calibration
Brake Pedal Sensor	Brake Pedal Calibration **NOTE:** **Where applicable the"Brake Pedal Learn" routine must also be performed through the Powertrain Control Module (PCM).**
Dynamics Sensor/ORC	ABS Initialization
Steering Column Control Module (SCCM)/Steering Angle Sensor (SAS)	ABS Initialization

NOTE: **If any of the Wheel Speed Sensors were repaired or replaced, test drive the vehicle at a speed above 40 km/h (25 mph) for several minutes.**

NOTE: **The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).**

NOTE: **If the ABS Module or the ORC was replaced, there may be a Dynamics Sensor DTCs active. To initialize the ABS Module and clear offsets have the vehicle parked on level ground and the wheels pointing straight ahead and follow the directions on the scan tool. If the ORC was replaced, test drive the vehicle by turning the vehicle in a left or right in a curving manner at a velocity between 10 and 25 km/h (6 and 15 mph).**

3. Turn the ignition off.
4. Verify all accessories are turned off and the battery is fully charged.
5. Turn the ignition on.
6. With the scan tool, erase all Diagnostic Trouble Codes (DTCs) from All modules. Start the engine and allow it to run for two minutes and fully operate the system that was indicating the failure.
7. Cycle the ignition off and to ignition on.
8. With the scan tool, read DTCs in the ABS Module.
9. If any DTCs are present, perform the appropriate diagnostic procedure. Refer to **DIAGNOSIS AND TESTING** .

   NOTE: **For Sensor Signal Plausibility and Pump Motor faults, the ABS Module must verify that the failure conditions are no longer present in the current ignition cycle before it can turn off the failure lamp(s). This may require the vehicle to be driven for several minutes above 15 k/mh (9 mph). Once it has been determined that the failure condition is no longer present the lamp(s) will be turned off.**

10. If there are no DTCs present after turning ignition on, road test the vehicle for at least five minutes.
    - Slowly turn the steering wheel from stop to stop.
    - Test drive the vehicle by turning the vehicle left or right in a curving manner at a speeds between 10 and 25 km/h (6 and 15 mph).
11. Again, with the scan tool read DTCs. If any DTCs are present, for the diagnostic procedure and troubleshoot the new or recurring DTC. Refer to **DIAGNOSIS AND TESTING** .
12. If there are no Diagnostic Trouble Codes (DTCs) present, and the customer's concern can no longer be duplicated, the repair is complete.

    Are any DTCs present or is the original concern still present?

    Yes

    - Repair is not complete, perform the appropriate diagnostic procedure. Refer to **DIAGNOSIS AND TESTING** .

    No

    - Repair is complete.

ABS INTERMITTENT CONDITION

DIAGNOSTIC TEST

PERFORM ABS INTERMITTENT CONDITION TEST

NOTE: **The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.**

1. Perform any Service Bulletins that may apply.
2. Review the scan tool Environmental Data (EV Data). If possible, try to duplicate the conditions under which the DTC set.
3. Turn the ignition off.
4. Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.
5. Wiggle the wires while checking for shorts and open circuits.
6. Perform a voltage drop test on the related circuits between the suspected inoperative component and the Anti-Lock Brake System (ABS) Module.
7. Inspect and clean all PCM, ABS, engine, and chassis grounds that are related to the most current DTC.
8. If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.
9. For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.
10. Use the scan tool to perform a System Test if one applies to failing component.
11. A co-pilot, data recorder, or lab scope should be used to help diagnose intermittent conditions.
12. Test drive the vehicle over 40 km/h (25 mph).

    Were any problems found during the above inspections?

    Yes

    - Perform the necessary repairs.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Test complete, the condition or conditions that originally set this DTC are not present at this time.

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
B1783-01	STOP LAMP CONTROL - GENERAL ELECTRICAL FAILURE
C0020-01	C0020-01 - ABS PUMP MOTOR CONTROL - GENERAL ELECTRICAL FAILURE
C0020-16	ABS PUMP MOTOR CONTROL - CIRCUIT VOLTAGE BELOW THRESHOLD
C0020-1C	ABS PUMP MOTOR CONTROL - CIRCUIT VOLTAGE OUT OF RANGE
C0020-35	ABS PUMP MOTOR CONTROL - SIGNAL HIGH TIME>MAXIMUM
C0021-02	BRAKE BOOSTER - GENERAL SIGNAL FAILURE
C0030-02	LEFT FRONT TONE WHEEL - GENERAL SIGNAL FAILURE
C0031-1D	LEFT FRONT WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE
C0031-2F	LEFT FRONT WHEEL SPEED SENSOR - SIGNAL ERRATIC
C0031-4A	LEFT FRONT WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED
C0031-62	LEFT FRONT WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE
C0033-02	RIGHT FRONT TONE WHEEL - GENERAL SIGNAL FAILURE
C0034-1D	RIGHT FRONT WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE
C0034-2F	RIGHT FRONT WHEEL SPEED SENSOR - SIGNAL ERRATIC
C0034-4A	RIGHT FRONT WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED
C0034-62	RIGHT FRONT WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE
C0036-02	LEFT REAR TONE WHEEL - GENERAL SIGNAL FAILURE
C0037-1D	LEFT REAR WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE
C0037-2F	LEFT REAR WHEEL SPEED SENSOR - SIGNAL ERRATIC
C0037-4A	LEFT REAR WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED
C0037-62	LEFT REAR WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE
C0039-02	RIGHT REAR TONE WHEEL - GENERAL SIGNAL FAILURE
C003A-1D	RIGHT REAR WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE
C003A-2F	RIGHT REAR WHEEL SPEED SENSOR - SIGNAL ERRATIC
C003A-4A	RIGHT REAR WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED
C003A-62	RIGHT REAR WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE
C0042-11	BRAKE PEDAL POSITION SENSOR - CIRCUIT SHORT TO GROUND
C0042-12	BRAKE PEDAL POSITION SENSOR - CIRCUIT SHORT TO BATTERY
C0042-1C	BRAKE PEDAL SENSOR - CIRCUIT VOLTAGE OUT OF RANGE
C0042-28	BRAKE PEDAL POSITION SENSOR - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE
C0042-2A	BRAKE PEDAL POSITION SENSOR - STUCK
C0042-54	BRAKE PEDAL POSITION SENSOR - MISSING CALIBRATION
C0042-62	BRAKE PEDAL POSITION SENSOR - SIGNAL COMPARE FAILURE
C0044-01	BRAKE PRESSURE SENSOR 1 - GENERAL ELECTRICAL FAILURE

DTC	Description
C0044-28	BRAKE PRESSURE SENSOR 1 - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE
C0044-49	BRAKE PRESSURE 1 - INTERNAL ELECTRONIC FAILURE
C0044-62	BRAKE PRESSURE SENSOR 1 - SIGNAL COMPARE FAILURE
C0044-64	BRAKE PRESSURE SENSOR 1 - SIGNAL PLAUSIBILITY FAILURE
C0051-22	STEERING WHEEL POSITION SENSOR - SIGNAL AMPLITUDE > MAXIMUM
C0051-28	STEERING WHEEL POSITION SENSOR - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE
C0051-49	STEERING WHEEL POSITION SENSOR - INTERNAL ELECTRONIC FAILURE
C0051-62	STEERING WHEEL POSITION SENSOR - SIGNAL COMPARE FAILURE
C006A-28	MULTI-AXIS ACCELERATION SENSOR - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE
C006A-49	MULTI-AXIS ACCELERATION SENSOR - INTERNAL ELECTRONIC FAILURE
C006A-54	MULTI-AXIS ACCELERATION SENSOR - MISSING CALIBRATION
C006A-62	MULTI-AXIS ACCELERATION SENSOR - SIGNAL COMPARE FAILURE
C006C-54	STABILITY SYSTEM - MISSING CALIBRATION
C006C-9A	STABILITY SYSTEM - COMPONENT OR SYSTEM OPERATING CONDITIONS
C0078-86	TIRE DIAMETER - SIGNAL INVALID
C1046-92	LEFT FRONT WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION
C1047-92	RIGHT FRONT WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION
C1048-92	LEFT REAR WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION
C1049-92	RIGHT REAR WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION
C1082-01	VACUUM PRESSURE SENSOR - GENERAL ELECTRICAL FAILURE
C1082-02	VACUUM PRESSURE SENSOR - GENERAL SIGNAL FAILURE
C1082-2F	VACUUM PRESSURE SENSOR - SIGNAL ERRATIC
C121A-09	C121A-09 - STEERING ANGLE SENSOR NOT INITIALIZED - COMPONENT FAILURES
C121C-00	TORQUE REQUEST SIGNAL DENIED
C1239-00	EMISSION ROLLS TEST ACTIVE
C123B-4B	ESP SYSTEM CONTROL TOO LONG - OVER TEMPERATURE
C1246-1C	VACUUM PRESSURE SENSOR SUPPLY - CIRCUIT VOLTAGE OUT OF RANGE
C1252-92	VACUUM PUMP CONTROL CIRCUIT - PERFORMANCE OR INCORRECT OPERATION
C2100-16	BATTERY VOLTAGE LOW - CIRCUIT VOLTAGE BELOW THRESHOLD
C2101-17	BATTERY VOLTAGE HIGH - CIRCUIT VOLTAGE ABOVE THRESHOLD
C211B-92	IGNITION RUN/START INPUT CIRCUIT - PERFORMANCE OR INCORRECT OPERATION
C212A-16	SYSTEM VOLTAGE LOW - CIRCUIT VOLTAGE BELOW THRESHOLD
C212A-17	SYSTEM VOLTAGE HIGH - CIRCUIT VOLTAGE ABOVE THRESHOLD
C2200-41	ANTI-LOCK BRAKE MODULE INTERNAL - GENERAL CHECKSUM FAILURE
C2200-44	ANTI-LOCK BRAKE MODULE INTERNAL - DATA MEMORY FAILURE

DTC	Description
C2200-45	ANTI-LOCK BRAKE MODULE INTERNAL - PROGRAM MEMORY FAILURE
C2200-46	ANTI-LOCK BRAKE MODULE INTERNAL - CALIBRATION / PARAMETER MEMORY FAILURE
C2200-47	ANTI-LOCK BRAKE MODULE INTERNAL - WATCHDOG / SAFTEY AuC FAILURE
C2200-48	ANTI-LOCK BRAKE MODULE INTERNAL - SUPERVISION SOFTWARE FAILURE
C2200-49	ANTI-LOCK BRAKE MODULE INTERNAL - INTERNAL ELECTRONIC FAILURE
C2202-00	ORIGINAL VIN MISMATCH / MISSING
C2206-00	VEHICLE CONFIGURATION MISMATCH
C220B-00	ABS ACC NOT CALIBRATED
C2212-00	ECU IN-PLANT MODE
P1DCB-72	REVERSE GEAR SWITCH - ACTUATOR STUCK OPEN
U0002-00	CAN C BUS OFF PERFORMANCE
U0100-00	LOST COMMUNICATION WITH ECM/PCM
U0101-00	LOST COMMUNICATION WITH TCM
U0102-00	LOST COMMUNICATION WITH TRANSFER CASE CONTROL MODULE / AWD
U0140-00	LOST COMMUNICATION WITH BODY CONTROL MODULE
U0151-00	LOST COMMUNICATION WITH RESTRAINTS CONTROL MODULE
U0229-00	LOST COMMUNICATION WITH STEERING COLUMN CONTROL MODULE
U0401-00	IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM
U0402-00	IMPLAUSIBLE DATA RECEIVED FROM TCM
U0403-00	IMPLAUSIBLE DATA RECEIVED FROM TCASE
U0422-00	IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE
U0429-00	IMPLAUSIBLE DATA RECEIVED FROM STEERING COLUMN CONTROL MODULE
U0432-00	INVALID DATA RECEIVED FROM MULTI-AXIS ACCELERATION SENSOR MODULE
U0452-00	U0452-00 - INVALID DATA RECEIVED FROM RESTRAINTS CONTROL MODULE
U140E-00	IMPLAUSIBLE VEHICLE CONFIGURATION DATA RECEIVED

DTC TROUBLESHOOTING

B1783-01-STOP LAMP CONTROL - GENERAL ELECTRICAL FAILURE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors the hardwired output signal of the Brake Pedal Position (BPP) sensor at the Body Control Module (BCM).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- No Brake Pedal Position (BPP) Sensor.

SET CONDITION

- Anti-lock Brake System (ABS) Module has detected an improper voltage level at the brake lamp signal in the Body Control Module (BCM).

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light is illuminated.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE BRAKE PEDAL POSITION (BPP) SENSOR RELATED DTCS
BRAKE SIGNAL 1 SHORTED TO VOLTAGE
BRAKE SIGNAL 1 SHORTED TO GROUND
BRAKE SIGNAL 1 OPEN OR HIGH RESISTANCE
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Turn the ignition on.
   2. With the scan tool, read ABS DTCs and record on the repair order.
   3. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
   4. With the scan tool, erase the DTCs.

5. Start the engine.
6. Press and release the brake pedal.
7. With the scan tool, read ABS DTCs.

Is the DTC active?

Yes

- Go To 2

No

- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR BRAKE PEDAL POSITION (BPP) SENSOR RELATED DTCS**
   1. Refer to the recorded DTCs.

   Are there any other BPP Sensor related DTCs active?

   Yes

   - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

   No

   - Go To 3

3. **ISOLATE AND CHECK THE (B15) BRAKE SIGNAL 1 CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Disconnect the Body Control Module (BCM) C4 harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Disconnect the Anti-lock Brake System (ABS) Module harness connector.
   4. Turn the ignition on.
   5. Using a DVOM, measure the voltage of the circuit being tested at the ABS Module harness connector.

   NOTE: **The voltage on the circuit should be 0.0 volts.**

   Is there any voltage present?

   Yes

   - Repair the (B15) Brake Signal circuit for a short to voltage.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **ISOLATE AND CHECK THE (B15) BRAKE SIGNAL 1 CIRCUIT FOR A SHORT TO GROUND**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Disconnect the Anti-lock Brake System (ABS) Module harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Disconnect the Body Control Module (BCM) C4/D harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.

4. Using a DVOM, check the continuity of the circuit being tested at the ABS Module harness connector and check for continuity between the circuit and ground.

NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the (B15) Brake Signal 1 circuit?

Yes

- Repair the (B15) Brake Signal 1 circuit for a short to ground.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B15) BRAKE SIGNAL 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Isolate the circuit by disconnecting the ABS Module harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Isolate the circuit by disconnecting the BCM C4/D harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   4. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
   5. Connect one lead of the DVOM to the circuit being tested at the ABS Module harness connector.
   6. Connect the other lead to the circuit being tested at the Body Control Module (BCM) harness connector and measure the resistance of the circuit.

NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

   1. Measure the resistance of the (B15) Brake Signal 1 circuit between the BCM harness connector and the ABS Module harness connector.

      Is the resistance below 3.0 Ohms?

      Yes

      - Go To 6

      No

      - Repair the (B15) Brake Signal 1 circuit for an open or high resistance.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **REPLACE THE BRAKE PEDAL POSITION (BPP) SENSOR AND TEST FOR DTCS**
   1. Replace the Brake Pedal Position (BPP) Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

3. Test drive the vehicle on mainly straight road conditions at a velocity above 20 km/h (12 mph).
4. With the scan tool, read the DTCs.

   Does the DTC remain active?

   Yes

   - Go To 7

   No

   - Test complete.

7. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0020-01 - ABS PUMP MOTOR CONTROL - GENERAL ELECTRICAL FAILURE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors the pump motor for voltage and current by verifying that it is within the threshold set values of the controller.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs set.

SET CONDITION

- Anti-lock Brake System (ABS) Module has detected improper voltage level internally when the motor is not running.
- Anti-lock Brake System (ABS) Module is not detecting the proper response when motor is running.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light is illuminated.
- Electronic Stability Control (ESC) System indicator light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
FUSE
FUSED B+ CIRCUIT SHORTED TO GROUND
FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
HYDRAULIC CONTROL UNIT (HCU)
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **VERIFY THE DTC IS ACTIVE**

NOTE: This DTC must be active for the results of this test to be valid.

1. Perform any Service Bulletins that may apply.
2. Ignition on.
3. With the scan tool, read and record the DTCs.
4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
5. With the scan tool, erase the ABS DTCs.
6. Start the engine.
7. Press the brake pedal and release.
8. With the scan tool, read the ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK THE F106 (50A) FUSE**
   1. Turn the ignition on.
   2. Using a 12-volt test light connected to ground, check the fuse F106 (50A) for power.

   Is the fuse good?

   Yes

   - Go To 4

   No

   - Go To 3

3. **ISOLATE AND CHECK THE (A107) FUSED B+ CIRCUIT FOR A SHORT TO GROUND**
   1. Turn the ignition off.
   2. Remove the Fuse.
   3. Disconnect the ABS Module harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   4. Using a DVOM, check the continuity of the circuit being tested at the ABS Module harness connector and check for continuity between the circuit and ground.

   NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

   NOTE: There should be no continuity between ground and the circuit being tested.

   Is there continuity between ground and the (A107) Fused B+ circuit?

   Yes

- Repair the (A107) Fused B+ circuit for a short to ground.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

4. **ABS PUMP MOTOR**
   1. Install the Fuse.
   2. Turn the ignition on.
   3. With the scan tool, read the ABS DTCs.
   4. With the scan tool, actuate the ABS pump motor.

   Did the Pump Motor operate correctly when actuated with out blowing the fuse?

   Yes

   - Go To 5

   No

   - Go To 6

5. **ISOLATE AND CHECK THE (A107) FUSED B+ PUMP CIRCUIT FOR AN OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
   1. Disconnect the ABS Module harness connector to isolate the (A107) Fused B+ circuit.
   2. Connect the positive lead of the load test tool to the (A107) Fused B+ circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
   3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
   4. Make sure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
   5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

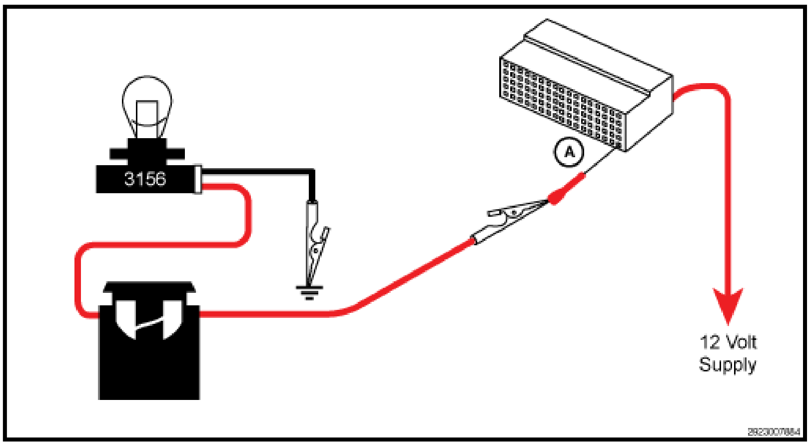
NOTE:	**Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

NOTE:	**A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE:	**Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 6

No

- Repair the (A107) Fused B+ Pump circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

6. **CHECK THE (Z907) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the ground circuit.
    2. Connect the positive lead of the load test tool to the positive side of the Battery.
    3. Connect the negative lead of the load test tool to the (Z907) Ground circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
    4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

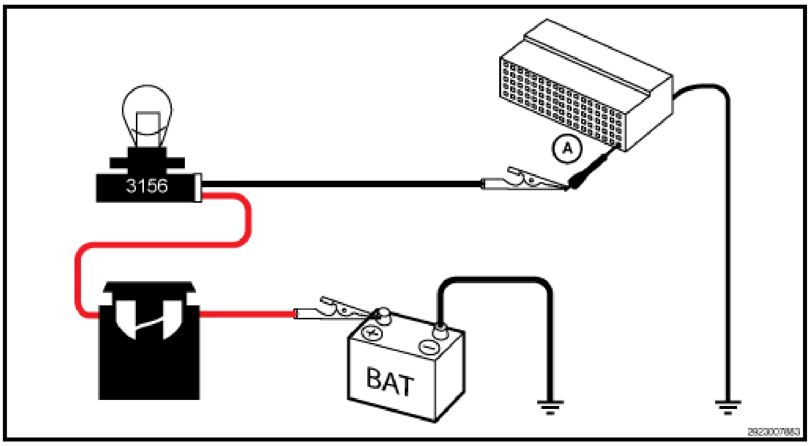
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 7

No

- Repair the (Z907) Ground circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

       NOTE: **For this failure it is necessary to replace both the ABS Module and the HCU as a complete unit.**

- Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0020-16-ABS PUMP MOTOR CONTROL - CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors the pump motor for voltage and current by verifying that it is within the threshold set values of the controller.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module has detected improper voltage level internally when the motor is not running.
- Anti-lock Brake System (ABS) Module is not detecting the proper response when motor is activated.

DEFAULT ACTION

- Anti-lock Brake System (ABS) light is illuminated.
- Electronic Stability Control (ESC) System light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
FUSE
FUSED B+ CIRCUIT SHORT TO GROUND
FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
HYDRAULIC CONTROL UNIT (HCU)
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **VERIFY THE DTC IS ACTIVE**

NOTE: **This DTC must be active for the results of this test to be valid.**

1. Perform any Service Bulletins that may apply.
2. Ignition on.
3. With the scan tool, read and record the DTCs.
4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
5. With the scan tool, erase the ABS DTCs.
6. Start the engine.
7. Press the brake pedal and release.
8. With the scan tool, read the ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK THE PUMP F106 (50A) FUSE**
   1. Turn the ignition on.
   2. Using a 12-volt test light connected to ground, check the fuse F106 (50A) for power.

   Is the fuse good?

   Yes

   - Go To 4

   No

   - Go To 3

3. **ISOLATE AND CHECK THE (A107) FUSED B+ CIRCUIT FOR A SHORT TO GROUND**
   1. Turn the ignition off.
   2. Remove the Fuse.
   3. Disconnect the ABS Module harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   4. Using a DVOM, check the continuity of the circuit being tested at the ABS Module harness connector and check for continuity between the circuit and ground.

   NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

   NOTE: **There should be no continuity between ground and the circuit being tested.**

   Is there continuity between ground and the (A107) Fused B+ circuit?

   Yes

   - Repair the (A107) Fused B+ circuit for a short to ground.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **ABS PUMP MOTOR**
    1. Install the Fuse.
    2. Turn the ignition on.
    3. With the scan tool, actuate the ABS pump motor.

    Did the Pump Motor operate correctly when actuated with out blowing the fuse?

    Yes

    - Go To 6

    No

    - Go To 5

5. **ISOLATE AND CHECK THE (A107) FUSED B+ CIRCUIT FOR AN OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the (A107) Fused B+ circuit.
    2. Connect the positive lead of the load test tool to the (A107) Fused B+ circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
    3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
    4. Make sure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
    5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE:	**Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

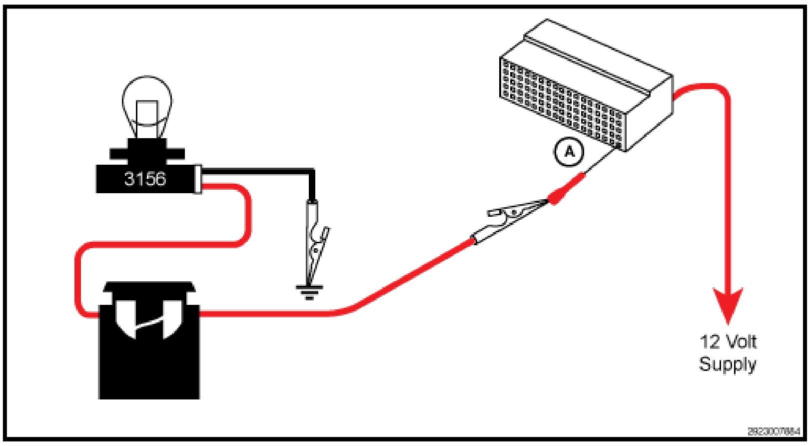
NOTE:	**A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE: **Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- **1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
- **2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**

- **3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 6

No

- Repair the (A107) Fused B+ circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **CHECK THE (Z907) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
   1. Disconnect the ABS Module harness connector to isolate the ground circuit.
   2. Connect the positive lead of the load test tool to the positive side of the Battery.
   3. Connect the negative lead of the load test tool to the (Z907) Ground circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
   4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of**

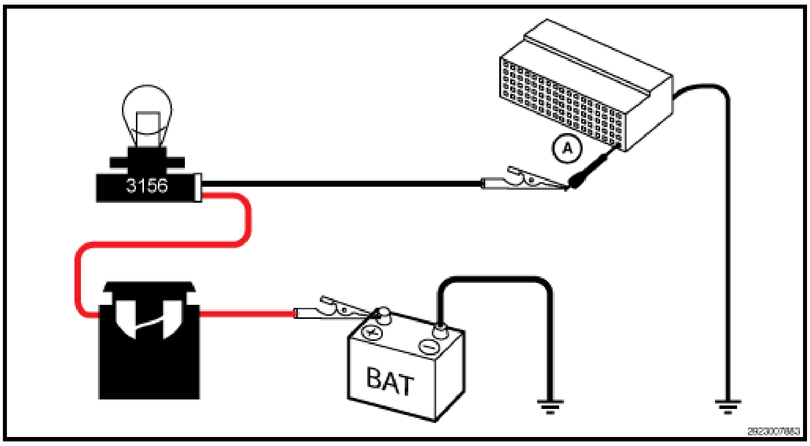
resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To 7

No

- Repair the (Z907) Ground circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - For this failure it is necessary to replace both the ABS Module and the HCU as a complete unit. Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C0020-1C-ABS PUMP MOTOR CONTROL - CIRCUIT VOLTAGE OUT OF RANGE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors the pump motor for voltage and current by verifying that it is within the threshold set values of the controller.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- ABS Module has detected improper voltage level when the motor is not running.
- ABS Module is not seeing the proper response when the motor is running.
- ABS has internal pump motor driver shorted.

DEFAULT ACTION

- Anti-lock Brake System (ABS) light is illuminated.
- Electronic Stability Control (ESC) System light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
FUSE
FUSED B+ CIRCUIT SHORT TO GROUND
FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
HYDRAULIC CONTROL UNIT (HCU)
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **VERIFY THE DTC IS ACTIVE**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Ignition on.
   3. With the scan tool, read and record the DTCs.

4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
5. With the scan tool, erase the ABS DTCs.
6. Start the engine.
7. Press the brake pedal and release.
8. With the scan tool, read the ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK THE F106 (50A) FUSE**
   1. Turn the ignition on.
   2. Using a 12-volt test light connected to ground, check the fuse F106 (50A) for power.

   Is the fuse good?

   Yes

   - Go To 4

   No

   - Go To 3

3. **ISOLATE AND CHECK THE (A107) FUSED B+ CIRCUIT FOR A SHORT TO GROUND**
   1. Turn the ignition off.
   2. Remove the Fuse.
   3. Disconnect the ABS Module harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   4. Using a DVOM, check the continuity of the circuit being tested at the ABS Module harness connector and check for continuity between the circuit and ground.

   NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

   NOTE: **There should be no continuity between ground and the circuit being tested.**

   Is there continuity between ground and the (A107) Fused B+ circuit?

   Yes

   - Repair the (A107) Fused B+ circuit for a short to ground.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **ABS PUMP MOTOR**
    1. Install the Fuse.
    2. Turn the ignition on.
    3. With the scan tool, actuate the ABS pump motor.

    Did the Pump Motor operate correctly when actuated with out blowing the fuse?

    Yes

    - Go To 6

    No

    - Go To 5
5. **ISOLATE AND CHECK THE (A107) FUSED B+ CIRCUIT FOR AN OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the (A107) Fused B+ circuit.
    2. Connect the positive lead of the load test tool to the (A107) Fused B+ circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
    3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
    4. Make sure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
    5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

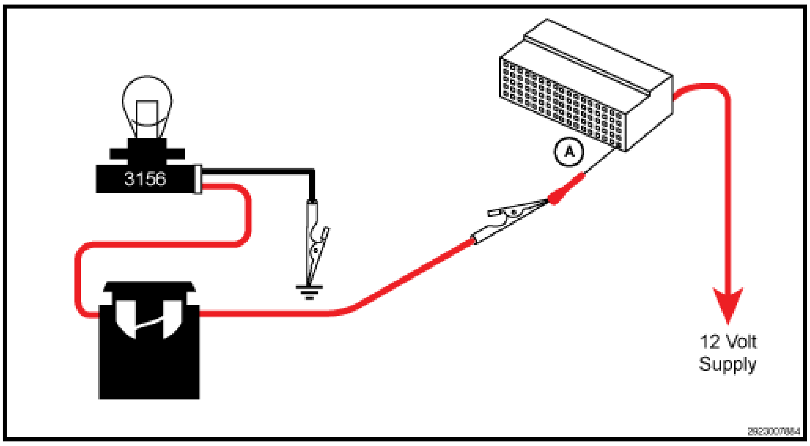
NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

NOTE: **A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE: **Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- **1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
- **2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**
- **3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 6

No

- Repair the (A107) Fused B+ circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

6. **CHECK THE (Z907) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
   1. Disconnect the ABS Module harness connector to isolate the ground circuit.
   2. Connect the positive lead of the load test tool to the positive side of the Battery.
   3. Connect the negative lead of the load test tool to the (Z907) Ground circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
   4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load**

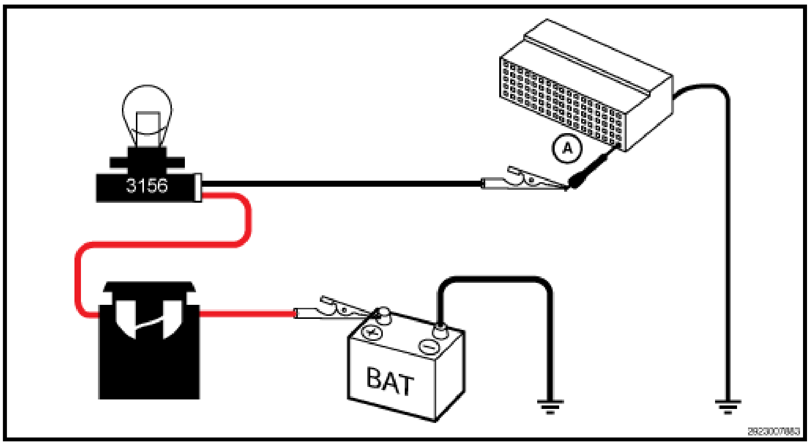
testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To 7

No

- Repair the (Z907) Ground circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - For this failure it is necessary to replace both the ABS Module and the HCU as a complete unit. Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
        - Test complete.

C0020-35-ABS PUMP MOTOR CONTROL - SIGNAL HIGH TIME>MAXIMUM

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors the pump motor for voltage and current by verifying that it is within the threshold set values of the controller.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module has detected an incorrect pump motor voltage after pump motor deactivation.

DEFAULT ACTION

- Anti-lock Brake System (ABS) light is illuminated.
- Electronic Stability Control (ESC) System light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
FUSE
FUSED B+ CIRCUIT SHORT TO GROUND
FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
HYDRAULIC CONTROL UNIT (HCU)
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **VERIFY THE DTC IS ACTIVE**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Ignition on.
   3. With the scan tool, read and record the DTCs.
   4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase the ABS DTCs.
   6. Start the engine.
   7. Press the brake pedal and release.
   8. With the scan tool, read the ABS DTCs.

Is the DTC active?

Yes

- Go To 2

No

- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK THE F106 (50A) FUSE**
   1. Turn the ignition on.
   2. Using a 12-volt test light connected to ground, check the F106 (50A) fuse for power.

   Is the fuse good?

   Yes

   - Go To 4

   No

   - Go To 3

3. **ISOLATE AND CHECK THE (A107) FUSED B+ CIRCUIT FOR A SHORT TO GROUND**
   1. Turn the ignition off.
   2. Remove the Fuse.
   3. Disconnect the ABS Module harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   4. Using a DVOM, check the continuity of the circuit being tested at the ABS Module harness connector and check for continuity between the circuit and ground.

   NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

   NOTE: **There should be no continuity between ground and the circuit being tested.**

   Is there continuity between ground and the (A107) Fused B+ circuit?

   Yes

   - Repair the (A107) Fused B+ circuit for a short to ground.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **ABS PUMP MOTOR**
   1. Install the Fuse.
   2. Turn the ignition on.
   3. With the scan tool, actuate the ABS pump motor.

      Did the Pump Motor operate correctly when actuated with out blowing the fuse?

Yes

- Go To 6

No

- Go To 5

5. **ISOLATE AND CHECK THE (A107) FUSED B+ CIRCUIT FOR AN OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the (A107) Fused B+ circuit.
    2. Connect the positive lead of the load test tool to the (A107) Fused B+ circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
    3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
    4. Make sure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
    5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

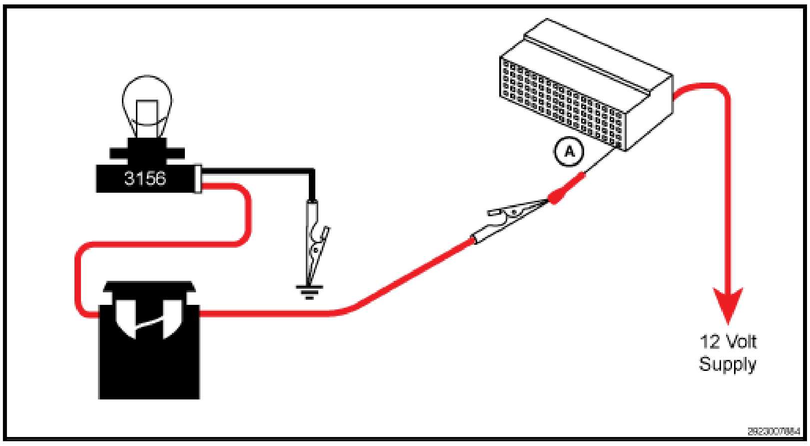
NOTE: **A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE: **Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- **1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
- **2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**
- **3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and

alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 6

No

- Repair the (A107) Fused B+ circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

6. **CHECK THE (Z907) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
   1. Disconnect the ABS Module harness connector to isolate the ground circuit.
   2. Connect the positive lead of the load test tool to the positive side of the Battery.
   3. Connect the negative lead of the load test tool to the (Z907) Ground circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
   4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

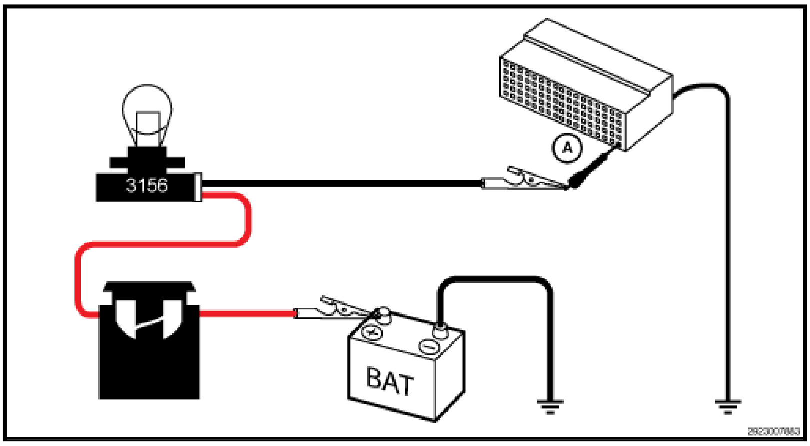
NOTE: **A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a**

circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: **Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- **1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
- **2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**
- **3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 7

No

- Repair the (Z907) Ground circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

7. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.

2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. 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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.
5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

    WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.
9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - For this failure it is necessary to replace both the ABS Module and the HCU as a complete unit. Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION .
    - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

    No

    - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
    - Test complete.

C0021-02-BRAKE BOOSTER - GENERAL SIGNAL FAILURE

THEORY OF OPERATION

When the Vacuum Pressure Sensor indicates a failure in the Vacuum Booster. After the cold start phase (i.e. 3 min after engine is running) and if the engine is running above 600 RPM there should be at least -135 mbar (-1.96 psi) of differential pressure in the vacuum-chamber for boosting the pedal force. If the pressure remains below this value for more than two minutes. Timer resets if the pressure remains above 220 mbar (3.19 psi) for 10 seconds or engine off vehicle speed present and low booster vacuum present.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No under voltage DTCs.
- Engine running longer than 3 minutes.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Vacuum Pressure Sensor indicates a failure in the Vacuum Booster.
- Low booster vacuum present.
- Vehicle speed above 3 km/h (2 mph).

DEFAULT ACTION

- Red Brake Warning indicator light illuminated.
- Hard Brake Pedal.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) DTCS
ANT-LOCK BRAKE SYSTEM (ABS) MODULE DTCS
ENGINE STALLED WHILE ROLLING IN NEUTRAL
PINCHED, CUT OR OPEN VACUUM SUPPLY LINE
VACUUM PRESSURE SENSOR
BRAKE BOOSTER
VACUUM PUMP

DIAGNOSTIC TEST

1. **VERIFY THE DTC IS ACTIVE**
    1. Turn the ignition on.
    2. With the scan tool, read and record the DTCs.
    3. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
    4. With the scan tool, erase the DTCs.
    5. Start the engine.
    6. Press and release the brake pedal three times.
    7. Wait five minutes or until red brake lamp illuminates.
    8. With the scan tool, read and record the DTCs.

    Is the DTC Active at this time?

    Yes

    - Go To 2

    No

- Check the vacuum supply line to brake booster for a pinched, cut, loose or cracked vacuum hose which could cause an intermittent condition.
- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR PCM OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any PCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

      No

      - Go To 3
3. **CHECK FOR OTHER ABS MODULE OR VACUUM RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any ABS Module or Vacuum related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 4
4. **CHECK VACUUM SUPPLY LINE**
   1. Turn the ignition off.
   2. Check the vacuum supply line to brake booster for a pinched, cut, loose or open vacuum hose.
   3. Disconnect the booster vacuum supply line and attach a vacuum pressure gauge.
   4. Start the engine.
   5. Raise the engine RPM above 600.

      Is the vacuum reading within this range 0 mbar (0 psi) to -135 mbar (2 psi)?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 5
5. **CHECK FOR VACUUM PRESSURE SIGNAL CHANGE**
   1. Turn the ignition on.
   2. Remove the Vacuum Pressure Sensor from the Booster.
   3. Block off the vacuum feed port.
   4. Connect a vacuum pump to the Vacuum Pressure Sensor.
   5. Apply vacuum to the Vacuum Pressure Sensor.
   6. Using the scan tool, and a pressure gauge watch for the signal change.

7. Using the scan tool, watch for signal change.

   Is the signal changing and does it compare to the pressure gauge reading?

   Yes

   - Go To 6

   No

   - Replace the Vacuum Pressure Sensor.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **CHECK BRAKE BOOSTER CHECK VALVE**
   1. Remove the Brake Booster Check Valve.
   2. Apply vacuum to the booster side of the check valve.

      Is the Brake Booster Check Valve holding vacuum?

      Yes

      - Replace the Power Brake Booster in accordance with the Service Information. Refer to **BOOSTER, POWER BRAKE, REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Replace the Power Brake Booster Check Valve.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C0030-02-LEFT FRONT TONE WHEEL - GENERAL SIGNAL FAILURE

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Vehicle speed above 16 km/h (10 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects periodic drops of a Wheel Speed Sensor (WSS) signal.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
WHEEL BEARING/TONE WHEEL DEBRIS OR DAMAGE
WHEEL BEARING/TONE WHEEL
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   8. Test drive the vehicle above 40 km/h (25 mph).

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any other WSS circuit related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

No

- Go To 3

3. **CHECK FOR IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES**
    1. Turn the ignition off.
    2. Check and adjust the Left Front Tire pressure.
    3. Check and adjust all other tire pressures.
    4. Inspect for mismatched tires on vehicle.

    Is the Left Front Tire improperly inflated or mismatched tires on vehicle?

    Yes

    - Repair as necessary.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 4

4. **CHECK THE LEFT FRONT WHEEL BEARING/TONE WHEEL AND WSS SENSOR FOR DEBRIS**

    NOTE: The Tone Wheel is internal to the Wheel Bearing.

    1. Inspect the Left Front Wheel Bearing/Tone Wheel and Sensor for debris.

    Was there debris on the Wheel Bearing/Tone Wheel or Sensor?

    Yes

    - Clean the Wheel Bearing/Tone Wheel and Sensor. Clear codes and retest.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 5

5. **CHECK THE LEFT FRONT WHEEL BEARING/TONE WHEEL FOR DAMAGE**

    NOTE: The Tone Wheel is internal to the Wheel Bearing.

    1. Check the Left Front Wheel Bearing/Tone Wheel for excessive runout, clearance or damage.

        NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

    Were there any problems found with the Wheel Bearing/Tone Wheel?

    Yes

    - Replace the Left Front Wheel Bearing/Tone Wheel in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 6

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Turn the ignition off.
    2. Disconnect the ABS Module harness connector.
    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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. Connect the 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.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    11. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - The wiring or poor connection problem has been repaired.
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C0031-1D-LEFT FRONT WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal current is continuously out of range, as compared to the thresholds of ABS Module sensor input values.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a Wheel Speed Sensor (WSS) circuit failure.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- Red Brake Warning indicator light flashing.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
CONNECTOR/TERMINAL DAMAGE
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO THE WHEEL SPEED SENSOR (-) CIRCUIT
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO GROUND
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (-) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (+) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (-) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (+) CIRCUIT FOR VOLTAGE
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. With the scan tool, read ABS DTCs.

Is the DTC active?

Yes

- Go To 2

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK CONNECTOR/TERMINAL FOR DAMAGE**
   1. Turn the ignition off.
   2. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

   NOTE: **Inspect connector installation and locks before disconnecting harness connectors.**

   3. Disconnect the Wheel Speed Sensor harness and connector.
   4. Disconnect the ABS Module harness connector.
   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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   Were any problems found?

   Yes

   - Repair as necessary in accordance with the Service Information.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

   No

   - Go To 3
3. **ISOLATE AND CHECK THE (B9) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO THE (B8) WHEEL SPEED SENSOR (-) CIRCUIT**
   1. The ignition must be off when checking for a short between circuits.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.

3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

NOTE: **There should be no continuity between the circuits being tested.**

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

No

- Go To 4

4. **ISOLATE AND CHECK THE (B9) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO GROUND**
   1. The ignition must be off when checking a circuit for continuity to ground.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Connect the negative lead of the DVOM to a known good ground.
   4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B9) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness and connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

No

- Go To 6

6. **ISOLATE AND CHECK THE (B8) WHEEL SPEED SENSOR (-) CIRCUIT FOR A SHORT TO VOLTAGE**
    1. Turn the ignition off.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Turn the ignition on.
    4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

    Is there any voltage present?

    Yes

    - Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

    No

    - Go To 7

7. **ISOLATE AND CHECK THE (B9) WHEEL SPEED SENSOR (+) CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the WSS harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

    Is the resistance below 3.0 Ohms?

    Yes

    - Go To 8

    No

    - Repair the circuit for an open/high resistance.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

8. **ISOLATE AND CHECK THE (B8) WHEEL SPEED SENSOR (-) CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the WSSr harness connector.

5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To 9

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

9. **CHECK THE (B9) WHEEL SPEED SENSOR (+) CIRCUIT FOR PROPER VOLTAGE AT THE WHEEL SPEED SENSOR (WSS) HARNESS CONNECTOR**
   1. Turn the ignition off.
   2. Connect the ABS Module harness connector.
   3. Disconnect the WSS harness connector.
   4. Turn the ignition on.
   5. Set the DVOM to measure DC voltage.
   6. Connect the negative lead of the DVOM to a known good ground.
   7. With the positive lead of the DVOM, measure the voltage of the circuit being tested at the WSS harness connector.

NOTE: **Normal operating voltage should be above 9.0 volts.**

Does the circuit have the proper voltage present?

Yes

- Go To 10

No

- Go To 11

10. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

CAUTION: **Make sure braking capability is available before road testing.**

1. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be meet.**

2. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 11

No

- The new Wheel Speed Sensor (WSS) repaired the problem.

11. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
        - Test complete.

C0031-2F-LEFT FRONT WHEEL SPEED SENSOR - SIGNAL ERRATIC

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage conditions.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects multiple changes in Wheel Speed Sensor (WSS) signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
CHECK WHEEL SPEED SENSOR (WSS) SIGNALS
CHECK WHEEL SPEED SENSOR (WSS) FOR DAMAGE
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
WHEEL BEARING/TONE WHEEL OR HUB DAMAGE
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

7. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) FOR CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any WSS circuit related DTCs present?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3

3. **CHECK THE WHEEL SPEED SENSOR (WSS) SIGNALS**
   1. Turn the ignition on.
   2. With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

      NOTE: **If graph shows periodic dropouts pay close attention to the encoder/tone wheel.**

   3. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

      Is the Left Front WSS speed showing 0 km/h (0 mph), not matching other wheels, or showing erratic behavior?

      Yes

      - Go To 4

      No

      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

4. **CHECK THE WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

1. Turn the ignition off.
2. Inspect the ABS Module harness connector and the WSS harness connector.
3. Check the WSS for looseness, excessive corrosion and not properly fastened.
4. Inspect the Left Front WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
5. Inspect the Left Front WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
6. Inspect the Wheel Speed Sensor for proper mounting.
7. Remove the Wheel Speed Sensor. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
8. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

   Were any problems found?

   Yes

   - Repair as necessary, refer to the appropriate service information, if necessary, for procedures or specifications.
   - Go To 6

   No

   - Go To 5

5. **CHECK THE WHEEL BEARING/TONE WHEEL OR HUB FOR DAMAGE**
   1. Inspect the Wheel Bearing/Tone Wheel and Hub for excessive runout, clearance, damage or debris.

   NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

   Is the Left Front Wheel Bearing/Tone Wheel or Hub Damaged?

   Yes

   - Replace the Wheel Bearing/Tone Wheel and Hub in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 6

6. **ASSEMBLE THE SYSTEM AND TEST FOR DTCS**
   1. Clean the Wheel Bearing/Tone Wheel and WSS and reassemble. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .

   WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   2. Road test the vehicle over 40 km/h (25 mph).

   NOTE: Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.

3. With the scan tool, erase ABS DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 7

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

7. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
   1. Replace the Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   4. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 8

   No

   - Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Turn the ignition off.
   2. Disconnect the ABS Module harness connector.
   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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Connect the 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 ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
11. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0031-4A-LEFT FRONT WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the wheel speed sensors of all four wheels. The wheel speed sensors on this system use a directional type wheel speed sensor. The front and rear wheel speed sensors are not interchangeable with one another, verify the correct part number is installed in the matching position on the vehicle.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects that the wrong component is installed.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
INCORRECT WHEEL SPEED SENSOR INSTALLED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION**
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any WSS circuit related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3

3. **REPLACE THE LEFT FRONT WHEEL SPEED SENSOR (WSS) AND RETEST FOR DTCS**

   NOTE: **Make sure the correct Wheel Speed Sensor is installed in the correct position with the correct part number.**

   1. Replace the Left Front Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .Perform the ABS VERIFICATION TEST. Refer to **ABS INTERMITTENT CONDITION** .
   2. With the scan tool, read DTCs.

      Does the DTC remain active?

      Yes

      - Go To 4

      No

      - Test complete.
4. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0031-62-LEFT FRONT WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal is periodically out of range as compared to other wheel speed sensors inputs.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects if the wheel speed signal is very low when compared to the other wheel speed signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) light is illuminated.
- Electronic Stability Control (ESC) System light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
CHECK WHEEL SPEED SENSOR FOR LOOSENESS
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
HUB AND WHEEL BEARING/TONE WHEEL
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition off.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
    5. With the scan tool, erase ABS DTCs.

    WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

    6. Road test the vehicle over 40 km/h (25 mph).
    7. With the scan tool, read ABS DTCs.

    Did the DTC return?

    Yes

    - Go To 2

    No

    - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
    - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

    Are there any WSS circuit related DTCs active?

    Yes

    - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

    No

    - Go To 3
3. **CHECK FOR IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES**
    1. Turn the ignition off.
    2. Check and adjust the Left Front Tire pressure.
    3. Check and adjust all other tire pressures.
    4. Inspect for mismatched tires on vehicle.

    Is the Left Front Tire improperly inflated or mismatched tires on vehicle?

    Yes

    - Repair as necessary
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

- Go To 4

4. **CHECK THE LEFT FRONT WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

   NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

   1. Turn the ignition off.
   2. Inspect the ABS Module harness connector and the Left Front WSS harness connector.
   3. Check the Left Front WSS for looseness, excessive corrosion and not properly fastened.
   4. Inspect the Left Front WSS circuits between the Left Front WSS and the Anti-lock Brake System (ABS) Module for damage.

      Is the Left Front WSS loose or any of the wiring/connectors/terminals damaged?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 5

5. **CHECK THE LEFT FRONT WHEEL SPEED SENSOR (WSS) FOR DAMAGE**
   1. Remove the Left Front Wheel Speed Sensor.
   2. Inspect the Wheel Speed Sensor for proper mounting.
   3. Inspect the Wheel Speed Sensor harness and connector.
   4. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

      Is the Left Front Wheel Speed Sensor (WSS) damaged?

      Yes

      - Replace the Left Front Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 6

6. **CHECK THE LEFT FRONT WHEEL BEARING/TONE WHEEL OR HUB FOR DAMAGE**
   1. Inspect the Left Front Wheel Bearing/Tone Wheel and Hub for excessive runout, clearance, damage or debris.

      NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

      Is the Left Front Wheel Bearing/Tone Wheel or Hub Damaged?

      Yes

      - Replace the Wheel Bearing/Tone Wheel and Hub in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

- Go To 7

7. **REPLACE THE LEFT FRONT WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Left Front Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    3. Road test the vehicle over 40 km/h (25 mph).

    NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

    4. With the scan tool, read ABS DTCs.

    Did the DTC return?

    Yes

    - Go To 8

    No

    - Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C0033-02-RIGHT FRONT TONE WHEEL - GENERAL SIGNAL FAILURE

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Vehicle speed above 16 km/h (10 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects periodic drops of a Wheel Speed Sensor (WSS) signal.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
WHEEL BEARING/TONE WHEEL DEBRIS OR DAMAGE
WHEEL BEARING/TONE WHEEL

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   8. Test drive the vehicle above 40 km/h (25 mph).

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any other WSS circuit related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3
3. **CHECK FOR IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES**
   1. Turn the ignition off.

2. Check and adjust the Right Front Tire pressure.
3. Check and adjust all other tire pressures.
4. Inspect for mismatched tires on vehicle.

   Is the Right Front Tire improperly inflated or mismatched tires on vehicle?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **CHECK THE RIGHT FRONT WHEEL BEARING/TONE WHEEL AND WSS SENSOR FOR DEBRIS**

   NOTE: The Tone Wheel is internal to the Wheel Bearing.

   1. Inspect the Right Front Wheel Bearing/Tone Wheel and Sensor for debris.

      Was there debris on the Wheel Bearing/Tone Wheel or Sensor?

      Yes

      - Clean the Wheel Bearing/Tone Wheel and Sensor. Clear codes and retest.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 5

5. **CHECK THE RIGHT FRONT WHEEL BEARING/TONE WHEEL FOR DAMAGE**

   NOTE: The Tone Wheel is internal to the Wheel Bearing.

   1. Check the Right Front Wheel Bearing/Tone Wheel for excessive runout, clearance or damage.

      NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

      Were there any problems found with the Wheel Bearing/Tone Wheel?

      Yes

      - Replace the Right Front Wheel Bearing/Tone Wheel in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 6

6. **CHECK RELATED HARNESS CONNECTIONS**
   1. Turn the ignition off.
   2. Disconnect the ABS Module harness connector.
   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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.
6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Connect the 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.

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
11. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - The wiring or poor connection problem has been repaired.
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C0034-1D-RIGHT FRONT WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal current is continuously out of range, as compared to the thresholds of ABS Module sensor input values.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a Wheel Speed Sensor (WSS) circuit failure.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- Red Brake Warning indicator light flashing.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
CONNECTOR/TERMINAL DAMAGE
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO THE WHEEL SPEED SENSOR (-) CIRCUIT
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO GROUND
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (-) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (+) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (-) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (+) CIRCUIT FOR VOLTAGE
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: Make sure the battery is fully charged.

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

- Go To 2

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK THE CONNECTOR/TERMINAL FOR DAMAGE**
    1. Turn the ignition off.
    2. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

    NOTE: **Inspect connector installation and locks before disconnecting harness connectors.**

    3. Disconnect the Wheel Speed Sensor harness and connector.
    4. Disconnect the ABS Module harness connector.
    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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.

    Were any problems found?

    Yes

    - Repair as necessary.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 3

3. **ISOLATE AND CHECK THE (B7) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO THE (B6) WHEEL SPEED SENSOR (-) CIRCUIT**
    1. The ignition must be off when checking for a short between circuits.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

    NOTE: **There should be no continuity between the circuits being tested.**

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **ISOLATE AND CHECK THE (B7) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO GROUND**
    1. The ignition must be off when checking a circuit for continuity to ground.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the negative lead of the DVOM to a known good ground.
    4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B7) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO VOLTAGE**
    1. Turn the ignition off.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness and connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Turn the ignition on.
    4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST**

No

- Go To 6

6. **ISOLATE AND CHECK THE (B6) WHEEL SPEED SENSOR (-) CIRCUIT FOR A SHORT TO VOLTAGE**
    1. Turn the ignition off.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Turn the ignition on.
    4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

    Is there any voltage present?

    Yes

    - Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 7
7. **ISOLATE AND CHECK THE (B7) WHEEL SPEED SENSOR (+) CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the WSS harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

    Is the resistance below 3.0 Ohms?

    Yes

    - Go To 8

    No

    - Repair the circuit for an open/high resistance.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST**
8. **ISOLATE AND CHECK THE (B6) WHEEL SPEED SENSOR (-) CIRCUIT FOR AN OPEN OR HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the WSSr harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To 9

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST**

9. **CHECK THE (B7) WHEEL SPEED SENSOR (+) CIRCUIT FOR PROPER VOLTAGE AT THE WHEEL SPEED SENSOR (WSS) HARNESS CONNECTOR**
   1. Turn the ignition off.
   2. Connect the ABS Module harness connector.
   3. Disconnect the WSS harness connector.
   4. Turn the ignition on.
   5. Set the DVOM to measure DC voltage.
   6. Connect the negative lead of the DVOM to a known good ground.
   7. With the positive lead of the DVOM, measure the voltage of the circuit being tested at the WSS harness connector.

NOTE: **Normal operating voltage should be above 9.0 volts.**

Is the voltage above 9.0 volts?

Yes

- Go To 10

No

- Go To 11

10. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

CAUTION: **Make sure braking capability is available before road testing.**

1. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be meet.**

2. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 11

   No

   - The new Wheel Speed Sensor (WSS) repaired the problem.

11. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
        - Test complete.

C0034-2F-RIGHT FRONT WHEEL SPEED SENSOR - SIGNAL ERRATIC

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage conditions.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects multiple changes in Wheel Speed Sensor (WSS) signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
CHECK WHEEL SPEED SENSOR (WSS) SIGNALS
CHECK WHEEL SPEED SENSOR (WSS) FOR DAMAGE
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
WHEEL BEARING/TONE WHEEL OR HUB DAMAGE
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase DTCs.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   6. Road test the vehicle over 40 km/h (25 mph).

NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

7. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) FOR CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any WSS circuit related DTCs present?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3

3. **CHECK THE WHEEL SPEED SENSOR (WSS) SIGNALS**
   1. Turn the ignition on.
   2. With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

      NOTE: **If graph shows periodic dropouts pay close attention to the encoder/tone wheel.**

   3. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

      Is the Right Front WSS speed showing 0 km/h (0 mph), not matching other wheels, or showing erratic behavior?

      Yes

      - Go To 4

      No

      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

4. **CHECK THE WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

   NOTE: **Check all terminals for broken, bent, pushed out, or corroded terminals.**

   1. Turn the ignition off.
   2. Inspect the ABS Module harness connector and the WSS harness connector.

3. Check the WSS for looseness, excessive corrosion and not properly fastened.
4. Inspect the Right Front WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
5. Inspect the Right Front WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
6. Inspect the Wheel Speed Sensor for proper mounting.
7. Remove the Wheel Speed Sensor. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
8. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

   Were any problems found?

   Yes

   - Repair as necessary, refer to the appropriate service information, if necessary, for procedures or specifications.
   - Go To 6

   No

   - Go To 5

5. **CHECK THE WHEEL BEARING/TONE WHEEL OR HUB FOR DAMAGE**
   1. Inspect the Wheel Bearing/Tone Wheel and Hub for excessive runout, clearance, damage or debris.

   NOTE: **Refer to the appropriate service information, if necessary, for procedures or specifications.**

   Is the Right Front Wheel Bearing/Tone Wheel or Hub Damaged?

   Yes

   - Replace the Wheel Bearing/Tone Wheel and Hub in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 6

6. **ASSEMBLE THE SYSTEM AND TEST FOR DTCS**
   1. Clean the Wheel Bearing/Tone Wheel and WSS and reassemble. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   2. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   3. With the scan tool, erase ABS DTCs.
   4. Turn the ignition off for a minimum of 10.0 seconds.
   5. Turn the ignition on.
   6. With the scan tool, read ABS DTCs.

Did the DTC return?

Yes

- Go To 7

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

7. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
   1. Replace the Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   4. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 8

   No

   - Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Turn the ignition off.
   2. Disconnect the ABS Module harness connector.
   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.

- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Connect the 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 ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
11. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0034-4A-RIGHT FRONT WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the wheel speed sensors of all four wheels. The wheel speed sensors on this system use a directional type wheel speed sensor. The front and rear wheel speed sensors are not interchangeable with one another, verify the correct part number is installed in the matching position on the vehicle.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects that the wrong component is installed.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.

- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
INCORRECT WHEEL SPEED SENSOR INSTALLED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any WSS circuit related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3
3. **REPLACE THE RIGHT FRONT WHEEL SPEED SENSOR (WSS) AND RETEST FOR DTCS**

   NOTE: **Make sure the correct Wheel Speed Sensor is installed in the correct position with the correct part number.**

1. Replace the Right Front Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
2. With the scan tool, read DTCs.

   Does the DTC remain active?

   Yes

   - Go To 4

   No

   - Test complete.

4. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0034-62-RIGHT FRONT WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal is periodically out of range as compared to other wheel speed sensors inputs.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects if the wheel speed signal is very low when compared to the other wheel speed signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) light is illuminated.
- Electronic Stability Control (ESC) System light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
CHECK WHEEL SPEED SENSOR FOR LOOSENESS
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
HUB AND WHEEL BEARING/TONE WHEEL
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

1. Perform any Service Bulletins that may apply.
2. Turn the ignition off.
3. With the scan tool, read ABS DTCs and record on the repair order.
4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
5. With the scan tool, erase ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Road test the vehicle over 40 km/h (25 mph).
7. With the scan tool, read ABS DTCs.

Did the DTC return?

Yes

- Go To 2

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

   Are there any WSS circuit related DTCs active?

   Yes

   - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

   No

   - Go To 3

3. **CHECK FOR IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES**
   1. Turn the ignition off.
   2. Check and adjust the Right Front Tire pressure.
   3. Check and adjust all other tire pressures.
   4. Inspect for mismatched tires on vehicle.

   Is the Right Front Tire improperly inflated or mismatched tires on vehicle?

   Yes

   - Repair as necessary
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **CHECK THE RIGHT FRONT WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

   NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

   1. Turn the ignition off.
   2. Inspect the ABS Module harness connector and the Right Front WSS harness connector.
   3. Check the Right Front WSS for looseness, excessive corrosion and not properly fastened.
   4. Inspect the Right Front WSS circuits between the Right Front WSS and the Anti-lock Brake System (ABS) Module for damage.

      Is the Right Front WSS loose or any of the wiring/connectors/terminals damaged?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 5

5. **CHECK THE RIGHT FRONT WHEEL SPEED SENSOR (WSS) FOR DAMAGE**
   1. Remove the Right Front Wheel Speed Sensor.
   2. Inspect the Wheel Speed Sensor for proper mounting.
   3. Inspect the Wheel Speed Sensor harness and connector.
   4. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

      Is the Right Front Wheel Speed Sensor (WSS) damaged?

      Yes

      - Replace the Right Front Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 6

6. **CHECK THE RIGHT FRONT WHEEL BEARING/TONE WHEEL OR HUB FOR DAMAGE**
   1. Inspect the Right Front Wheel Bearing/Tone Wheel and Hub for excessive runout, clearance, damage or debris.

      NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

      Is the Right Front Wheel Bearing/Tone Wheel or Hub Damaged?

      Yes

      - Replace the Wheel Bearing/Tone Wheel and Hub in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

- Go To 7

7. **REPLACE THE RIGHT FRONT WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
   1. Replace the Right Front Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   4. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 8

   No

   - Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

   Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C0036-02-LEFT REAR TONE WHEEL - GENERAL SIGNAL FAILURE

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Vehicle speed above 16 km/h (10 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects periodic drops of a Wheel Speed Sensor (WSS) signal.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
AXLE SHAFT/TONE WHEEL DEBRIS OR DAMAGE
AXLE SHAFT/TONE WHEEL

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   8. Test drive the vehicle above 40 km/h (25 mph).

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any other WSS circuit related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3

3. **CHECK FOR IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES**
   1. Turn the ignition off.

2. Check and adjust the Left Rear Tire pressure.
3. Check and adjust all other tire pressures.
4. Inspect for mismatched tires on vehicle.

Is the Left Rear Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **CHECK THE LEFT REAR TONE WHEEL AND WSS SENSOR FOR DEBRIS**

NOTE: The Tone Wheel is external and is part of the Axle Shaft.

1. Inspect the Left Rear Tone Wheel and Sensor for debris.

Was there debris on the Tone Wheel or Sensor?

Yes

- Clean the Tone Wheel and Sensor. Clear codes and retest.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **CHECK THE LEFT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**

NOTE: The Tone Wheel is external and is part of the Axle Shaft.

NOTE: Tone Wheel teeth should be perfectly square

1. Check the Left Rear Tone Wheel for missing, nicked, bent, cracked teeth.
2. Check the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

Were there any problems found with the Axle Shaft/Tone Wheel?

Yes

- Replace the Left Rear Axle Shaft/Tone Wheel in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **CHECK RELATED HARNESS CONNECTIONS**

1. Turn the ignition off.

2. Disconnect the ABS Module harness connector.
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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.

6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Connect the 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.

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
11. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - The wiring or poor connection problem has been repaired.
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C0037-1D-LEFT REAR WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal current is continuously out of range, as compared to the thresholds of ABS Module sensor input values.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a Wheel Speed Sensor (WSS) circuit failure.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- Red Brake Warning indicator light flashing.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
CONNECTOR/TERMINAL DAMAGE
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO THE WHEEL SPEED SENSOR (-) CIRCUIT
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO GROUND
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (-) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (+) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (-) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (+) CIRCUIT FOR VOLTAGE
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: Make sure the battery is fully charged.

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.

7. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK THE CONNECTOR/TERMINAL FOR DAMAGE**
   1. Turn the ignition off.
   2. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

      NOTE: **Inspect connector installation and locks before disconnecting harness connectors.**

   3. Disconnect the Wheel Speed Sensor harness and connector.
   4. Disconnect the ABS Module harness connector.
   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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 3

3. **ISOLATE AND CHECK THE (B4) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO THE (B3) WHEEL SPEED SENSOR (-) CIRCUIT**
   1. The ignition must be off when checking for a short between circuits.

2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

NOTE: **There should be no continuity between the circuits being tested.**

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **ISOLATE AND CHECK THE (B4) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO GROUND**
   1. The ignition must be off when checking a circuit for continuity to ground.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Connect the negative lead of the DVOM to a known good ground.
   4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B4) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness and connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **ISOLATE AND CHECK THE (B3) WHEEL SPEED SENSOR (-) CIRCUIT FOR A SHORT TO VOLTAGE**
    1. Turn the ignition off.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Turn the ignition on.
    4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

    Is there any voltage present?

    Yes

    - Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 7
7. **ISOLATE AND CHECK THE (B4) WHEEL SPEED SENSOR (+) CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the WSS harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

    Is the resistance below 3.0 Ohms?

    Yes

    - Go To 8

    No

    - Repair the circuit for an open/high resistance.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
8. **ISOLATE AND CHECK THE (B3) WHEEL SPEED SENSOR (-) CIRCUIT FOR AN OPEN OR HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow

the path of the circuit.

3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the WSSr harness connector.
5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To 9

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

9. **CHECK THE (B4) WHEEL SPEED SENSOR (+) CIRCUIT FOR PROPER VOLTAGE AT THE WHEEL SPEED SENSOR (WSS) HARNESS CONNECTOR**
    1. Turn the ignition off.
    2. Connect the ABS Module harness connector.
    3. Disconnect the WSS harness connector.
    4. Turn the ignition on.
    5. Set the DVOM to measure DC voltage.
    6. Connect the negative lead of the DVOM to a known good ground.
    7. With the positive lead of the DVOM, measure the voltage of the circuit being tested at the WSS harness connector.

NOTE: **Normal operating voltage should be above 9.0 volts.**

Is the voltage above 9.0 volts?

Yes

- Go To 10

No

- Go To 11

10. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

CAUTION: **Make sure braking capability is available before road testing.**

1. Road test the vehicle over 40 km/h (25 mph).

    NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be meet.**

2. With the scan tool, read ABS DTCs.

    Did the DTC return?

Yes

- Go To 11

No

- The new Wheel Speed Sensor (WSS) repaired the problem.

11. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

       - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

- Test complete.

C0037-2F-LEFT REAR WHEEL SPEED SENSOR - SIGNAL ERRATIC

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage conditions.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects multiple changes in Wheel Speed Sensor (WSS) signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
CHECK WHEEL SPEED SENSOR (WSS) SIGNALS
CHECK WHEEL SPEED SENSOR (WSS) FOR DAMAGE
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
WHEEL BEARING/TONE WHEEL OR AXLE SHAFT
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.

4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
5. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Road test the vehicle over 40 km/h (25 mph).

NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

7. With the scan tool, read ABS DTCs.

Did the DTC return?

Yes

- Go To 2

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) FOR CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

Are there any WSS circuit related DTCs present?

Yes

- Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

No

- Go To 3

3. **CHECK THE WHEEL SPEED SENSOR (WSS) SIGNALS**
   1. Turn the ignition on.
   2. With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: **If graph shows periodic dropouts pay close attention to the encoder/tone wheel.**

3. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Left Rear WSS speed showing 0 km/h (0 mph), not matching other wheels, or showing erratic behavior?

Yes

- Go To 4

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

4. **CHECK THE WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

   NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

   1. Turn the ignition off.
   2. Inspect the ABS Module harness connector and the WSS harness connector.
   3. Check the WSS for looseness, excessive corrosion and not properly fastened.
   4. Inspect the Left Rear WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
   5. Inspect the Left Rear WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
   6. Inspect the Wheel Speed Sensor for proper mounting.
   7. Remove the Wheel Speed Sensor. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
   8. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

   Were any problems found?

   Yes

   - Repair as necessary, refer to the appropriate service information, if necessary, for procedures or specifications.
   - Go To 6

   No

   - Go To 5

5. **CHECK THE LEFT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**

   NOTE: The Tone Wheel is external and is part of the Axle Shaft.

   NOTE: Tone Wheel teeth should be perfectly square

   1. Check the Left Rear Tone Wheel for missing, nicked, bent, cracked teeth.
   2. Check the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

      NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

   Were there any problems found with the Axle Shaft/Tone Wheel?

   Yes

   - Replace the Left Rear Axle Shaft/Tone Wheel in accordance with the Service Information.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 6

6. **ASSEMBLE THE SYSTEM AND TEST FOR DTCS**

1. Clean the WSS and Tone Wheel and reassemble. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

2. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

3. With the scan tool, erase ABS DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 7

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

7. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
   1. Replace the Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Road test the vehicle over 40 km/h (25 mph).

      NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   4. With the scan tool, read ABS DTCs.

      Did the DTC return?

      Yes

      - Go To 8

      No

      - Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Turn the ignition off.

2. Disconnect the ABS Module harness connector.
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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

   Repair any conditions that are found.

6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Connect the 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 ABS DTCs.

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
11. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C0037-4A-LEFT REAR WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the wheel speed sensors of all four wheels. The wheel speed sensors on this system use a directional type wheel speed sensor. The front and rear wheel speed sensors are not interchangeable with one another, verify the correct part number is installed in the matching position on the vehicle.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects that the wrong component is installed.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
INCORRECT WHEEL SPEED SENSOR INSTALLED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

- Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

        Are there any WSS circuit related DTCs active?

        Yes

        - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

        No

        - Go To 3

3. **REPLACE THE LEFT REAR WHEEL SPEED SENSOR (WSS) AND RETEST FOR DTCS**

    NOTE: **Make sure the correct Wheel Speed Sensor is installed in the correct position with the correct part number.**

    1. Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    2. With the scan tool, read DTCs.

        Does the DTC remain active?

        Yes

        - Go To 4

        No

        - Test complete.

4. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.

6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C0037-62-LEFT REAR WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal is periodically out of range as compared to other wheel speed sensors inputs.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects if the wheel speed signal is very low when compared to the other wheel speed signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) light is illuminated.
- Electronic Stability Control (ESC) System light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
CHECK WHEEL SPEED SENSOR FOR LOOSENESS
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
AXLE SHAFT/TONE WHEEL
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition off.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   6. Road test the vehicle over 40 km/h (25 mph).
   7. With the scan tool, read ABS DTCs.

      Did the DTC return?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any WSS circuit related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3
3. **CHECK FOR IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES**

1. Turn the ignition off.
2. Check and adjust the Left Rear Tire pressure.
3. Check and adjust all other tire pressures.
4. Inspect for mismatched tires on vehicle.

   Is the Left Rear Tire improperly inflated or mismatched tires on vehicle?

   Yes

   - Repair as necessary
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **CHECK THE LEFT REAR WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

   NOTE: **Check all terminals for broken, bent, pushed out, or corroded terminals.**

   1. Turn the ignition off.
   2. Inspect the ABS Module harness connector and the Left Rear WSS harness connector.
   3. Check the WSS for looseness, excessive corrosion and not properly fastened.
   4. Inspect the Left Rear WSS circuits between the Left Rear WSS and the Anti-lock Brake System (ABS) Module for damage.

   Is the Left Rear WSS loose or any of the wiring/connectors/terminals damaged?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 5

5. **CHECK THE LEFT REAR WHEEL SPEED SENSOR (WSS) FOR DAMAGE**
   1. Remove the Left Rear Wheel Speed Sensor.
   2. Inspect the Wheel Speed Sensor for proper mounting.
   3. Inspect the Wheel Speed Sensor harness and connector.
   4. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

   Is the Left Rear Wheel Speed Sensor (WSS) damaged?

   Yes

   - Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 6

6. **CHECK THE LEFT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**

NOTE: **The Tone Wheel is external and is part of the Axle Shaft.**

NOTE: **Tone Wheel teeth should be perfectly square**

1. Check the Tone Wheel for missing, nicked, bent, cracked teeth.
2. Check the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

   NOTE: **Refer to the appropriate service information, if necessary, for procedures or specifications.**

   Were there any problems found with the Axle Shaft/Tone Wheel?

   Yes

   - Replace the Left Rear Axle Shaft/Tone Wheel.
   - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

   No

   - Go To 7

7. **REPLACE THE LEFT REAR WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
   1. Replace the Left Front Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION .
   2. Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   4. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 8

   No

   - Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0039-02-RIGHT REAR TONE WHEEL - GENERAL SIGNAL FAILURE

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Vehicle speed above 16 km/h (10 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects periodic drops of a Wheel Speed Sensor (WSS) signal.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
AXLE SHAFT/TONE WHEEL DEBRIS OR DAMAGE
AXLE SHAFT/TONE WHEEL
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .**

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   8. Test drive the vehicle above 40 km/h (25 mph).

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

- Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

       Are there any other WSS circuit related DTCs active?

       Yes

       - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

       No

       - Go To 3
3. **CHECK FOR IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES**
    1. Turn the ignition off.
    2. Check and adjust the Right Rear Tire pressure.
    3. Check and adjust all other tire pressures.
    4. Inspect for mismatched tires on vehicle.

       Is the Right Rear Tire improperly inflated or mismatched tires on vehicle?

       Yes

       - Repair as necessary.
       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

       - Go To 4
4. **CHECK THE RIGHT REAR TONE WHEEL AND WSS SENSOR FOR DEBRIS**

   NOTE: The Tone Wheel is external and is part of the Axle Shaft.

    1. Inspect the Right Rear Tone Wheel and Sensor for debris.

       Was there debris on the Tone Wheel or Sensor?

       Yes

       - Clean the Tone Wheel and Sensor. Clear codes and retest.
       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

       - Go To 5
5. **CHECK THE RIGHT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**

   NOTE: The Tone Wheel is external and is part of the Axle Shaft.

   NOTE: Tone Wheel teeth should be perfectly square

    1. Check the Right Rear Tone Wheel for missing, nicked, bent, cracked teeth.
    2. Check the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

NOTE: **Refer to the appropriate service information, if necessary, for procedures or specifications.**

Were there any problems found with the Axle Shaft/Tone Wheel?

Yes

- Replace the Right Rear Axle Shaft/Tone Wheel in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Turn the ignition off.
    2. Disconnect the ABS Module harness connector.
    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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. Connect the 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.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    11. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- The wiring or poor connection problem has been repaired.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C003A-1D-RIGHT REAR WHEEL SPEED SENSOR - CIRCUIT CURRENT OUT OF RANGE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal current is continuously out of range, as compared to the thresholds of ABS Module sensor input values.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a Wheel Speed Sensor (WSS) circuit failure.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- Red Brake Warning indicator light flashing.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
CONNECTOR/TERMINAL DAMAGE
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO THE WHEEL SPEED SENSOR (-) CIRCUIT
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO GROUND
WHEEL SPEED SENSOR (+) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (-) CIRCUIT SHORTED TO VOLTAGE
WHEEL SPEED SENSOR (+) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (-) CIRCUIT OPEN OR HIGH RESISTANCE
WHEEL SPEED SENSOR (+) CIRCUIT FOR VOLTAGE
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK CONNECTOR/TERMINAL FOR DAMAGE**
   1. Turn the ignition off.
   2. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

      NOTE: Inspect connector installation and locks before disconnecting harness connectors.

   3. Disconnect the Wheel Speed Sensor harness and connector.
   4. Disconnect the ABS Module harness connector.
   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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   Were any problems found?

   Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 3

3. **ISOLATE AND CHECK THE (B2) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO THE (B1) WHEEL SPEED SENSOR (-) CIRCUIT**
    1. The ignition must be off when checking for a short between circuits.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

NOTE: **There should be no continuity between the circuits being tested.**

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **ISOLATE AND CHECK THE (B2) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO GROUND**
    1. The ignition must be off when checking a circuit for continuity to ground.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the negative lead of the DVOM to a known good ground.
    4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B2) WHEEL SPEED SENSOR (+) CIRCUIT FOR A SHORT TO VOLTAGE**
    1. Turn the ignition off.

2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness and connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Turn the ignition on.
4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **ISOLATE AND CHECK THE (B1) WHEEL SPEED SENSOR (-) CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

   Is there any voltage present?

   Yes

   - Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 7
7. **ISOLATE AND CHECK THE (B2) WHEEL SPEED SENSOR (+) CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
   4. Connect one lead of the DVOM to the circuit being tested at the WSS harness connector.
   5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

   Is the resistance below 3.0 Ohms?

   Yes

   - Go To 8

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

8. **ISOLATE AND CHECK THE (B1) WHEEL SPEED SENSOR (-) CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the WSS harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the WSSr harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

    Is the resistance below 3.0 Ohms?

    Yes

    - Go To 9

    No

    - Repair the circuit for an open/high resistance.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
9. **CHECK THE (B2) WHEEL SPEED SENSOR (+) CIRCUIT FOR PROPER VOLTAGE AT THE WHEEL SPEED SENSOR (WSS) HARNESS CONNECTOR**
    1. Turn the ignition off.
    2. Connect the ABS Module harness connector.
    3. Disconnect the WSS harness connector.
    4. Turn the ignition on.
    5. Set the DVOM to measure DC voltage.
    6. Connect the negative lead of the DVOM to a known good ground.
    7. With the positive lead of the DVOM, measure the voltage of the circuit being tested at the WSS harness connector.

    NOTE: **Normal operating voltage should be above 9.0 volts.**

    Does the circuit have the proper voltage present?

    Yes

    - Go To 10

    No

    - Go To 11
10. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

CAUTION: Make sure braking capability is available before road testing.

1. Road test the vehicle over 40 km/h (25 mph).

   NOTE: Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be meet.

2. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 11

   No

   - The new Wheel Speed Sensor (WSS) repaired the problem.

11. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
       - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C003A-2F-RIGHT REAR WHEEL SPEED SENSOR - SIGNAL ERRATIC

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the Wheel Speed Sensors (WSS) of all four wheels. The wheel speed sensors convert the wheel speed into a signal, sent to ABS Module. Each wheel has a wheel speed sensor and a tone wheel. The front tone wheel is internal to the wheel bearing. The rear tone wheel is external and is part of the rear axle shaft. The tone wheel is used to trigger the measuring mechanism for each wheel. There is no adjustment between the wheel speed sensor and the tone wheel.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage conditions.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects multiple changes in Wheel Speed Sensor (WSS) signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
CHECK WHEEL SPEED SENSOR (WSS) SIGNALS
CHECK WHEEL SPEED SENSOR (WSS) FOR DAMAGE
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
WHEEL BEARING/TONE WHEEL OR AXLE SHAFT
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase DTCs.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   6. Road test the vehicle over 40 km/h (25 mph).

      NOTE: Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.

   7. With the scan tool, read ABS DTCs.

      Did the DTC return?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) FOR CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any WSS circuit related DTCs present?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

      No

      - Go To 3
3. **CHECK THE WHEEL SPEED SENSOR (WSS) SIGNALS**
   1. Turn the ignition on.
   2. With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

      NOTE: If graph shows periodic dropouts pay close attention to the encoder/tone wheel.

   3. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Right Rear WSS speed showing 0 km/h (0 mph), not matching other wheels, or showing erratic behavior?

Yes

- Go To 4

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

4. **CHECK THE WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

   NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

   1. Turn the ignition off.
   2. Inspect the ABS Module harness connector and the WSS harness connector.
   3. Check the WSS for looseness, excessive corrosion and not properly fastened.
   4. Inspect the Right Rear WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
   5. Inspect the Right Rear WSS circuits between the WSS and the Anti-lock Brake System (ABS) Module for damage.
   6. Inspect the Wheel Speed Sensor for proper mounting.
   7. Remove the Wheel Speed Sensor. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
   8. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

   Were any problems found?

   Yes

   - Repair as necessary, refer to the appropriate service information, if necessary, for procedures or specifications.
   - Go To 6

   No

   - Go To 5

5. **CHECK THE RIGHT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**

   NOTE: The Tone Wheel is external and is part of the Axle Shaft.

   NOTE: Tone Wheel teeth should be perfectly square

   1. Check the Right Rear Tone Wheel for missing, nicked, bent, cracked teeth.
   2. Check the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

      NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

   Were there any problems found with the Axle Shaft/Tone Wheel?

   Yes

- Replace the Right Rear Axle Shaft/Tone Wheel in accordance with the Service Information.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **ASSEMBLE THE SYSTEM AND TEST FOR DTCS**
   1. Clean the WSS, Tone Wheel and reassemble. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   2. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   3. With the scan tool, erase ABS DTCs.
   4. Turn the ignition off for a minimum of 10.0 seconds.
   5. Turn the ignition on.
   6. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 7

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
7. **REPLACE THE WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
   1. Replace the Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Road test the vehicle over 40 km/h (25 mph).

   NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   4. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

- Go To 8

No

- Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**
    1. Turn the ignition off.
    2. Disconnect the ABS Module harness connector.
    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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.

    6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. Connect the 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 ABS DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    11. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

- Test complete.

C003A-4A-RIGHT REAR WHEEL SPEED SENSOR - INCORRECT COMPONENT INSTALLED

THEORY OF OPERATION

The Anti-Lock Brake System (ABS) Module receives signals from the wheel speed sensors of all four wheels. The wheel speed sensors on this system use a directional type wheel speed sensor. The front and rear wheel speed sensors are not interchangeable with one another, verify the correct part number is installed in the matching position on the vehicle.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects that the wrong component is installed.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
INCORRECT WHEEL SPEED SENSOR INSTALLED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

Is the DTC active?

Yes

- Go To 2

No

- Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

       Are there any WSS circuit related DTCs active?

       Yes

       - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

       No

       - Go To 3
3. **REPLACE THE RIGHT REAR WHEEL SPEED SENSOR (WSS) AND RETEST FOR DTCS**

   NOTE: **Make sure the correct Wheel Speed Sensor is installed in the correct position with the correct part number.**

    1. Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    2. With the scan tool, read DTCs.

       Does the DTC remain active?

       Yes

       - Go To 4

       No

       - Test complete.
4. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C003A-62-RIGHT REAR WHEEL SPEED SENSOR - SIGNAL COMPARE FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. A failure is detected, if the measured sensor signal is periodically out of range as compared to other wheel speed sensors inputs.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects if the wheel speed signal is very low when compared to the other wheel speed signals.

DEFAULT ACTION

- Anti-lock Brake System (ABS) light is illuminated.

- Electronic Stability Control (ESC) System light is illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
IMPROPER TIRE PRESSURE/MISMATCHED TIRES
CHECK WHEEL SPEED SENSOR FOR LOOSENESS
INSPECT CIRCUITS/CONNECTOR/TERMINALS FOR DAMAGE
AXLE SHAFT/TONE WHEEL
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition off.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   6. Road test the vehicle over 40 km/h (25 mph).
   7. With the scan tool, read ABS DTCs.

      Did the DTC return?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to ABS INTERMITTENT CONDITION .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any WSS circuit related DTCs active?

      Yes

- Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

No

- Go To 3

3. **CHECK FOR IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES**
    1. Turn the ignition off.
    2. Check and adjust the Right Rear Tire pressure.
    3. Check and adjust all other tire pressures.
    4. Inspect for mismatched tires on vehicle.

    Is the Right Rear Tire improperly inflated or mismatched tires on vehicle?

    Yes

    - Repair as necessary
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 4

4. **CHECK THE RIGHT REAR WSS FOR LOOSENESS, INSPECT CIRCUITS/CONNECTORS/TERMINALS FOR DAMAGE**

    NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

    1. Turn the ignition off.
    2. Inspect the ABS Module harness connector and the Right Rear WSS harness connector.
    3. Check the WSS for looseness, excessive corrosion and not properly fastened.
    4. Inspect the Right Rear WSS circuits between the Right Rear WSS and the Anti-lock Brake System (ABS) Module for damage.

    Is the Right Rear WSS loose or any of the wiring/connectors/terminals damaged?

    Yes

    - Repair as necessary.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 5

5. **CHECK THE RIGHT REAR WHEEL SPEED SENSOR (WSS) FOR DAMAGE**
    1. Remove the Right Rear Wheel Speed Sensor.
    2. Inspect the Wheel Speed Sensor for proper mounting.
    3. Inspect the Wheel Speed Sensor harness and connector.
    4. Inspect the Wheel Speed Sensor for excessive debris on the sensor.

    Is the Right Rear Wheel Speed Sensor (WSS) damaged?

    Yes

    - Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **CHECK THE RIGHT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**

   NOTE: **The Tone Wheel is external and is part of the Axle Shaft.**

   NOTE: **Tone Wheel teeth should be perfectly square**

   1. Check the Tone Wheel for missing, nicked, bent, cracked teeth.
   2. Check the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

      NOTE: **Refer to the appropriate service information, if necessary, for procedures or specifications.**

   Were there any problems found with the Axle Shaft/Tone Wheel?

   Yes

   - Replace the Right Rear Axle Shaft/Tone Wheel.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 7

7. **REPLACE THE RIGHT REAR WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**

   1. Replace the Right Front Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Road test the vehicle over 40 km/h (25 mph).

      NOTE: **Vehicle must be driven for several minutes above 40 km/h (25 mph) for set conditions to be met.**

   4. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 8

   No

   - Test Complete.

8. **CHECK RELATED HARNESS CONNECTIONS**

   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).

3. Disconnect the related component harness connectors.
4. 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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.
5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase ABS DTCs.

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C0042-11-BRAKE PEDAL POSITION SENSOR - CIRCUIT SHORT TO GROUND

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Brake Pedal Position (BPP) Sensor is hard wired to the Anti-lock Brake System (ABS) Module and is detecting an irregularity in voltage or signals.

The Anti-lock Brake System (ABS) Module broadcasts the BPP Sensor signal information, as well as the Master Cylinder Pressure Sensor signal information over the CAN Bus. The Master Cylinder Pressure Sensor is internal to the Hydraulic Control Unit (HCU).

The Master Cylinder Pressure (MCP) Sensor signal is utilized to support Brake Pedal Position Rationality and Brake Pedal Sensor Diagnostic. Autonomous braking systems such as Active Cruise Control (ACC) have the potential to defeat the Brake Pedal Position Rationality diagnostic as the vehicle can be brought to a complete stop without depressing the Brake Pedal, thus false failing the rationality. The Brake Pedal Position Rationality needs the MCP Sensor Signal to determine if any autonomous braking system is active. The MCP Sensor only measures the brake system pressure applied by the vehicle operator and is not affected by ABS, parking brake or autonomous braking systems.

The Brake Torque (BT) signal is a calculated measurement of braking force as determined by the ABS Module. The Brake Torque signal is used as a third correlating signal for BPP Rationality diagnostics and is accurate during both vehicle operator braking, as well as autonomous braking events.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a short from the Brake Pedal Position (BPP) Sensor.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE VACUUM PRESSURE SENSOR RELATED DTCS
BRAKE PEDAL POSITION (BPP) SENSOR IMPROPERLY INSTALLED, DAMAGE OR MECHANICAL FAILURE
BRAKE PEDAL POSITION SENSOR SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
BRAKE PEDAL POSITION SENSOR RETURN CIRCUIT OPEN OR HIGH RESISTANCE
BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT SHORTED TO BRAKE PEDAL POSITION SENSOR RETURN CIRCUIT
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.

3. With the scan tool, read ABS DTCs and record on the repair order.
4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
5. With the scan tool, erase the DTCs.
6. Start the engine.
7. Slowly press the brake pedal and release.
8. With the scan tool, read ABS DTCs and record on the repair order.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR VACUUM PRESSURE SENSOR RELATED DTCS**
   1. Refer to the recorded DTCs.

   Are there any other Vacuum related DTCs active?

   Yes

   - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING**.

   No

   - Go To 3

3. **INSPECT THE BRAKE PEDAL POSITION (BPP) SENSOR FOR INCORRECT INSTALLATION, DAMAGE OR MECHANICAL FAILURE**
   1. Turn the ignition off.
   2. Visually inspect the BPP Sensor for Improper installation, damage or mechanical failure. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **ISOLATE AND CHECK THE (B237) BPP SENSOR FEED CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Brake Pedal Position (BPP) Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.

4. Connect one lead of the DVOM to the circuit being tested at the Brake Pedal Position (BPP) Sensor harness connector.
5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

Is the resistance below 3.0 Ohms?

Yes

- Go To 5

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

5. **CHECK THE (B937) BPP SENSOR RETURN CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Brake Pedal Position (BPP) Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
   4. Connect one lead of the DVOM to the circuit being tested at the Brake Pedal Position (BPP) Sensor harness connector.
   5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

Is the resistance below 3.0 Ohms?

Yes

- Go To 6

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **ISOLATE AND CHECK THE (B137) BPP SENSOR SIGNAL CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Brake Pedal Position (BPP) Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.

4. Connect one lead of the DVOM to the circuit being tested at the Brake Pedal Position (BPP) Sensor harness connector.
5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

Is the resistance below 3.0 Ohms?

Yes

- Go To 7

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **ISOLATE AND CHECK THE (B137) BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND**
   1. The ignition must be off when checking a circuit for continuity to ground.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Brake Pedal Position Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Connect the negative lead of the DVOM to a known good ground.
   4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 8

8. **ISOLATE AND CHECK THE (B137) BPP SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE (B937) BPP SENSOR RETURN CIRCUIT**
   1. The ignition must be off when checking for a short between circuits.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

NOTE: **There should be no continuity between the circuits being tested.**

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 9

9. **CHECK THE BRAKE PEDAL POSITION (BPP) SENSOR FOR PROPER OPERATION**
    1. Turn the ignition off.
    2. Disconnect the harness connector at the component of the circuit being tested. Note: The ECU harness connector should still be connected during this test step.
    3. Turn the ignition on.
    4. Set the DVOM to measure DC voltage.
    5. Measure the voltage at the BPP Sensor harness connector between the (B237) Brake Pedal Position Sensor Feed and the (B937) Brake Pedal Position Sensor Return.

    NOTE: Normal operating voltage should be between 4.75 and 5.25 volts.

    1. Turn the ignition off.

        Does the circuit have the proper voltage present?

        Yes

        - Replace the Brake Pedal Position (BPP) Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Go To 10

10. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0042-12-BRAKE PEDAL POSITION SENSOR - CIRCUIT SHORT TO BATTERY

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Brake Pedal Position (BPP) Sensor is hard wired to the Anti-lock Brake System (ABS) Module and is detecting an irregularity in voltage or signals.

The Anti-lock Brake System (ABS) Module broadcasts the BPP Sensor signal information, as well as the Master Cylinder Pressure Sensor signal information over the CAN Bus. The Master Cylinder Pressure Sensor is internal to the Hydraulic Control Unit (HCU).

The Master Cylinder Pressure (MCP) Sensor signal is utilized to support Brake Pedal Position Rationality and Brake Pedal Sensor Diagnostic. Autonomous braking systems such as Active Cruise Control (ACC) have the potential to defeat the Brake Pedal Position Rationality diagnostic as the vehicle can be brought to a complete stop without depressing the Brake Pedal, thus false failing the rationality. The Brake Pedal Position Rationality needs the MCP Sensor Signal to determine if any autonomous braking system is active. The MCP Sensor only measures the brake system pressure applied by the vehicle operator and is not affected by ABS, parking brake or autonomous braking systems.

The Brake Torque (BT) signal is a calculated measurement of braking force as determined by the ABS Module. The Brake Torque signal is used as a third correlating signal for BPP Rationality diagnostics and is accurate during both vehicle operator braking, as well as autonomous braking events.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a short from the Brake Pedal Position (BPP) Sensor.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE VACUUM PRESSURE SENSOR RELATED DTCS
BRAKE PEDAL POSITION (BPP) SENSOR IMPROPERLY INSTALLED, DAMAGE OR MECHANICAL FAILURE
BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
BRAKE PEDAL POSITION SENSOR FEED CIRCUIT SHORTED TO VOLTAGE
BRAKE PEDAL POSITION SENSOR RETURN CIRCUIT SHORTED TO VOLTAGE
BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT SHORTED TO BRAKE PEDAL POSITION SENSOR FEED CIRCUIT
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record the Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase the DTCs.
   6. Start the engine.
   7. Slowly press the brake pedal and release.
   8. With the scan tool, read ABS DTCs and record on the repair order.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR VACUUM PRESSURE SENSOR RELATED DTCS**

1. Refer to the recorded DTCs.

   Are there any other Vacuum related DTCs active?

   Yes

   - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING**.

   No

   - Go To 3

3. **INSPECT THE BRAKE PEDAL POSITION (BPP) SENSOR FOR INCORRECT INSTALLATION, DAMAGE OR MECHANICAL FAILURE**
   1. Turn the ignition off.
   2. Visually inspect the BPP Sensor for Improper installation, damage or mechanical failure. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .

      Were any problems found?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 4

4. **ISOLATE AND CHECK THE (B137) BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the BPP Sensor harness and connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

   Is there any voltage present?

   Yes

   - Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 5

5. **ISOLATE AND CHECK THE (B237) BRAKE PEDAL POSITION SENSOR FEED CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the BPP Sensor harness and connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.

4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **ISOLATE AND CHECK THE (B937) BRAKE PEDAL POSITION SENSOR RETURN CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the BPP Sensor harness and connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 7

7. **ISOLATE AND CHECK THE (B137) BRAKE PEDAL POSITION SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE (B237) BRAKE PEDAL POSITION SENSOR FEED CIRCUIT**
   1. The ignition must be off when checking for a short between circuits.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

NOTE: **There should be no continuity between the circuits being tested.**

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 8

8. **CHECK THE BRAKE PEDAL POSITION (BPP) SENSOR FOR PROPER OPERATION**
    1. Turn the ignition off.
    2. Disconnect the harness connector at the component of the circuit being tested. Note: The ECU harness connector should still be connected during this test step.
    3. Turn the ignition on.
    4. Set the DVOM to measure DC voltage.
    5. Measure the voltage at the BPP Sensor harness connector between the (B237) Brake Pedal Position Sensor Feed and the (B937) Brake Pedal Position Sensor Return.

    NOTE: **Normal operating voltage should be between 4.75 and 5.25 volts.**

    1. Turn the ignition off.

        Does the circuit have the proper voltage present?

        Yes

        - Replace the Brake Pedal Position (BPP) Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Go To 9
9. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C0042-1C-BRAKE PEDAL SENSOR - CIRCUIT VOLTAGE OUT OF RANGE

THEORY OF OPERATION

The Brake Pedal Position (BPP) Sensor is hard wired to the Anti-lock Brake System (ABS) Module and is detecting an irregularity in voltage or signals.

The Anti-lock Brake System (ABS) Module broadcasts the BPP Sensor signal information, as well as the Master Cylinder Pressure Sensor signal information over the CAN Bus. The Master Cylinder Pressure Sensor is internal to the Hydraulic Control Unit (HCU).

The Master Cylinder Pressure (MCP) Sensor signal is utilized to support Brake Pedal Position Rationality and Brake Pedal Sensor Diagnostic. Autonomous braking systems such as Active Cruise Control (ACC) have the potential to defeat the Brake Pedal Position Rationality diagnostic as the vehicle can be brought to a complete stop without depressing the Brake Pedal, thus false failing the rationality. The Brake Pedal Position Rationality needs the MCP Sensor Signal to determine if any autonomous braking system is active. The MCP Sensor only measures the brake system pressure applied by the vehicle operator and is not affected by ABS, parking brake or autonomous braking systems.

The Brake Torque (BT) signal is a calculated measurement of braking force as determined by the ABS Module. The Brake Torque signal is used as a third correlating signal for BPP Rationality diagnostics and is accurate during both vehicle operator braking, as well as autonomous braking events.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module is sensing the Brake Pedal Position (BPP) Sensor voltage is outside of its allowable fixed range.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE OR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS
BRAKE PEDAL POSITION (BPP) SENSOR IMPROPERLY INSTALLED, DAMAGE OR MECHANICAL FAILURE
BRAKE PEDAL POSITION (BPP) SENSOR VOLTAGE
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, erase the DTCs.
    5. Start the Engine.
    6. Apply the brake pedal several times.
    7. With the scan tool, read the ABS DTCs.

    Is the DTC active?

    Yes

    - Go To 2

    No

    - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

    Are there any BPP Sensor circuit related DTCs active?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING**.

    No

    - Go To 3
3. **INSPECT THE BRAKE PEDAL POSITION (BPP) SENSOR FOR INCORRECT INSTALLATION, DAMAGE OR MECHANICAL FAILURE**
    1. Turn the ignition off.
    2. Visually inspect the BPP Sensor for Improper installation, damage or mechanical failure. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .

    Were any problems found?

Yes

- Repair as necessary.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **BRAKE PEDAL POSITION (BPP) SENSOR NOT APPLIED VOLTAGE**
    1. Start the engine.
    2. With the scan tool, under "Data Display" read the BPP voltage with brake pedal NOT pressed.
    3. Press the brake pedal several times.
    4. Lightly pull upward on the brake pedal.

    Was the brake pedal not applied BPP voltage change greater than 0.5 volt?

    Yes

    - Go To 6

    No

    - Go To 5
5. **INITIALIZE ANTI-LOCK BRAKES SYSTEM (ABS) MODULE**
    1. Turn the ignition on.

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    NOTE: **When performing the ABS Initialization routine, the vehicle temperature must be above 10Â°C (50Â°F).**

    2. Initialize the ABS Module, Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    3. Park the vehicle.

    Was the ABS Module initialization successful?

    Yes

    - Go To 6

    No

    - Perform the ABS Module Initialization routine again, if still unsuccessful.
    - Go To 7
6. **REPLACE THE BRAKE PEDAL POSITION (BPP) SENSOR**
    1. Turn the ignition off.
    2. Replace the Brake Pedal Position Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
    3. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    4. Start the engine.
    5. With the scan tool, under "Data Display" read the BPP voltage with brake pedal not pressed.
    6. Press the brake pedal several times.

7. Lightly pull upward on the brake pedal.

   Was the brake pedal not applied BPP voltage change greater than 0.3 volt?

   Yes

   - Replace the Brake Pedal Assembly in accordance with the Service Information. Refer to **PEDAL(S), BRAKE AND/OR ACCELERATOR, REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Test complete, the condition or conditions that originally set this DTC are not present at this time.

7. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0042-28-BRAKE PEDAL POSITION SENSOR - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE

THEORY OF OPERATION

The Brake Pedal Position (BPP) Sensor is hard wired to the Anti-lock Brake System (ABS) Module and is detecting an irregularity in voltage or signals.

The Anti-lock Brake System (ABS) Module broadcasts the BPP Sensor signal information, as well as the Master Cylinder Pressure Sensor signal information over the CAN Bus. The Master Cylinder Pressure Sensor is internal to the Hydraulic Control Unit (HCU).

The Master Cylinder Pressure (MCP) Sensor signal is utilized to support Brake Pedal Position Rationality and Brake Pedal Sensor Diagnostic. Autonomous braking systems such as Active Cruise Control (ACC) have the potential to defeat the Brake Pedal Position Rationality diagnostic as the vehicle can be brought to a complete stop without depressing the Brake Pedal, thus false failing the rationality. The Brake Pedal Position Rationality needs the MCP Sensor Signal to determine if any autonomous braking system is active. The MCP Sensor only measures the brake system pressure applied by the vehicle operator and is not affected by ABS, parking brake or autonomous braking systems.

The Brake Torque (BT) signal is a calculated measurement of braking force as determined by the ABS Module. The Brake Torque signal is used as a third correlating signal for BPP Rationality diagnostics and is accurate during both vehicle operator braking, as well as autonomous braking events.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- First brake apply after vehicle speed is above 20 km/h (12 mph)
- Anti-lock Brake System (ABS) Module is sensing the latest learned brake off voltage has changed by an amount too great from the original calibrated voltage.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE OR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS
BRAKE PEDAL POSITION (BPP) SENSOR NOT CALIBRATED

Possible Causes
BRAKE PEDAL POSITION (BPP) SENSOR IMPROPERLY INSTALLED, DAMAGE OR MECHANICAL FAILURE
BRAKE PEDAL POSITION (BPP) SENSOR VOLTAGE
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, erase the DTCs.
    5. Start the Engine.
    6. Apply the brake pedal several times.
    7. With the scan tool, read the ABS DTCs.

        Is the DTC active?

        Yes

        - Go To 2

        No

        - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

        Are there any BPP Sensor circuit related DTCs active?

        Yes

        - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING**.

        No

        - Go To 3
3. **PERFORM THE BRAKE PEDAL SENSOR ROUTINE(S)**
    1. Park the vehicle on level ground.

        NOTE: **When performing the Brake Pedal Sensor routine(s), make sure the brake pedal is NOT pressed.**

    2. With the scan tool under ABS in the "Miscellaneous Functions" menu, perform the Brake Pedal Calibration routine.

        NOTE: **This step only applies to applicable vehicles.**

3. With the scan tool under PCM in the "Miscellaneous Functions" menu, perform the Brake Pedal Learn routine (if available).

   Were the Brake Pedal routine(s) successful?

   Yes

   - Test complete.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Perform the Brake Pedal Sensor routine(s) again, if still unsuccessful.
   - Go To4

4. **INSPECT THE BRAKE PEDAL POSITION (BPP) SENSOR FOR INCORRECT INSTALLATION, DAMAGE OR MECHANICAL FAILURE**
   1. Turn the ignition off.
   2. Visually inspect the BPP Sensor for Improper installation, damage or mechanical failure. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .

      Were any problems found?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 5

5. **BRAKE PEDAL POSITION (BPP) SENSOR NOT APPLIED VOLTAGE**
   1. Start the engine.
   2. With the scan tool, under "Data Display" read the BPP voltage with brake pedal not pressed.
   3. Press the brake pedal several times.
   4. Lightly pull upward on the brake pedal.

      Was the brake pedal not applied BPP voltage change greater than 0.3 volt?

      Yes

      - Go To 7

      No

      - Go To 6

6. **PERFORM THE ABS INITIALIZATION ROUTINE**
   1. Turn the ignition on.

WARNING:	**To avoid possible serious or fatal injury, check brake capability is available before road testing.**
NOTE:	**When performing the ABS Initialization routine, the vehicle temperature must be above 10Â°C (50Â°F).**

2. Initialize the ABS Module, Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
3. Park the vehicle.

   Was the ABS Module initialization successful?

   Yes

   - Go To 7

   No

   - Perform the ABS Module Initialization routine again, if still unsuccessful.
   - Go To 8

7. **REPLACE THE BRAKE PEDAL POSITION (BPP) SENSOR**
   1. Turn the ignition off.
   2. Replace the Brake Pedal Position Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
   3. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
   4. Start the engine.
   5. With the scan tool, under "Data Display" read the BPP voltage with brake pedal not pressed.
   6. Press the brake pedal several times.
   7. Lightly pull upward on the brake pedal.

   Was the brake pedal not applied BPP voltage change greater than 0.3 volt?

   Yes

   - Replace the Brake Pedal Assembly in accordance with the Service Information. Refer to **PEDAL(S), BRAKE AND/OR ACCELERATOR, REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Test complete, the condition or conditions that originally set this DTC are not present at this time.

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0042-2A-BRAKE PEDAL POSITION SENSOR - STUCK

THEORY OF OPERATION

The Brake Pedal Position (BPP) Sensor is hard wired to the Anti-lock Brake System (ABS) Module and is detecting an irregularity in voltage or signals.

The Anti-lock Brake System (ABS) Module broadcasts the BPP Sensor signal information, as well as the Master Cylinder Pressure Sensor signal information over the CAN Bus. The Master Cylinder Pressure Sensor is internal to the Hydraulic Control Unit (HCU).

The Master Cylinder Pressure (MCP) Sensor signal is utilized to support Brake Pedal Position Rationality and Brake Pedal Sensor Diagnostic. Autonomous braking systems such as Active Cruise Control (ACC) have the potential to defeat the Brake Pedal Position Rationality diagnostic as the vehicle can be brought to a complete stop without depressing the Brake Pedal, thus false failing the rationality. The Brake Pedal Position Rationality needs the MCP Sensor Signal to determine if any autonomous braking system is active. The MCP Sensor only measures the brake system pressure applied by the vehicle operator and is not affected by ABS, parking brake or autonomous braking systems.

The Brake Torque (BT) signal is a calculated measurement of braking force as determined by the ABS Module. The Brake Torque signal is used as a third correlating signal for BPP Rationality diagnostics and is accurate during both vehicle operator braking, as well as autonomous braking events.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module performs rationality checks for failure modes of the Brake Pedal Position (BPP) Sensor.
- Anti-lock Brake System (ABS) Module detects Brake Pedal Position (BPP) Sensor stuck on with vehicle speed condition while the brake pedal is continually pressed.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
BRAKE PEDAL POSITION (BPP) SENSOR VOLTAGE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE OR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS BRAKE PEDAL POSITION (BPP) SENSOR NOT CALIBRATED
BRAKE PEDAL POSITION (BPP) SENSOR IMPROPERLY INSTALLED, DAMAGE OR MECHANICAL FAILURE
BRAKE PEDAL POSITION ASSEMBLY
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   8. Test drive the vehicle above 40 km/h (25 mph).

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

   9. Apply the brake pedal several times during drive test.

10. With the scan tool, read ABS DTCs.

    Is the DTC active?

    Yes

    - Go To 2

    No

    - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

       Are there any BPP Sensor circuit related DTCs active?

       Yes

       - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING**.

       No

       - Go To 3

3. **BRAKE PEDAL POSITION (BPP) SENSOR NOT APPLIED VOLTAGE**
    1. Start the engine.
    2. With the scan tool, under "Data Display" monitor the BPP voltage and Stoplamp Switch while pressing the brake pedal slowly.

       Does the voltage increase and the stoplamp switch status change when the BPP voltage changes by 0.5 volt while the brake pedal is being applied?

       Yes

       - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

       No

       - Go To 4

4. **PERFORM THE BRAKE PEDAL SENSOR ROUTINE(S)**
    1. Park the vehicle on level ground.

       NOTE: When performing the Brake Pedal Sensor routine(s), make sure the brake pedal is NOT pressed.

    2. With the scan tool under ABS in the "Miscellaneous Functions" menu, perform the Brake Pedal Calibration routine.

       NOTE: This step only applies to applicable vehicles.

    3. With the scan tool under PCM in the "Miscellaneous Functions" menu, perform the Brake Pedal Learn routine (if available).

       Were the Brake Pedal routine(s) successful?

Yes

- Test complete.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the Brake Pedal Sensor routine(s) again, if still unsuccessful.
- Go To5

5. **INSPECT THE BRAKE PEDAL POSITION (BPP) SENSOR FOR INCORRECT INSTALLATION, DAMAGE OR MECHANICAL FAILURE**
   1. Turn the ignition off.
   2. Visually inspect the BPP Sensor for Improper installation, damage or mechanical failure. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .

      Were any problems found?

      Yes

      - Repair as necessary and perform the "Brake Pedal Sensor Calibration" routine.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 6
6. **REPLACE THE BRAKE PEDAL POSITION (BPP) SENSOR AND TEST FOR DTCS**
   1. Replace the Brake Pedal Position (BPP) Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   3. Test drive the vehicle on mainly straight road conditions at a velocity above 20 km/h (12 mph).
   4. With the scan tool, read the DTCs.

      Does the DTC remain active?

      Yes

      - Go To 7

      No

      - Test complete.
7. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0042-54-BRAKE PEDAL POSITION SENSOR - MISSING CALIBRATION

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Brake Pedal Position (BPP) Sensor is hard wired to the Anti-lock Brake System (ABS) Module and is detecting an irregularity in voltage or signals.

The Anti-lock Brake System (ABS) Module broadcasts the BPP Sensor signal information, as well as the Master Cylinder Pressure Sensor signal information over the CAN Bus. The Master Cylinder Pressure Sensor is internal to the Hydraulic Control Unit (HCU).

The Master Cylinder Pressure (MCP) Sensor signal is utilized to support Brake Pedal Position Rationality and Brake Pedal Sensor Diagnostic. Autonomous braking systems such as Active Cruise Control (ACC) have the potential to defeat the Brake Pedal Position Rationality diagnostic as the vehicle can be brought to a complete stop without depressing the Brake Pedal, thus false failing the rationality. The Brake Pedal Position Rationality needs the MCP Sensor Signal to determine if any autonomous braking system is active. The MCP

Sensor only measures the brake system pressure applied by the vehicle operator and is not affected by ABS, parking brake or autonomous braking systems.

The Brake Torque (BT) signal is a calculated measurement of braking force as determined by the ABS Module. The Brake Torque signal is used as a third correlating signal for BPP Rationality diagnostics and is accurate during both vehicle operator braking, as well as autonomous braking events.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Brake Pedal Position (BPP) Sensor calibration.

SET CONDITION

- Brake Pedal Position (BPP) Sensor calibration performed, but voltage out of allowable range.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE OR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS BRAKE PEDAL POSITION (BPP) SENSOR IMPROPERLY INSTALLED, DAMAGE OR MECHANICAL FAILURE
BRAKE PEDAL POSITION (BPP) SENSOR NOT CALIBRATED
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.
   8. Press the brake pedal firmly and release.
   9. With the scan tool, read ABS DTCs.

Is the DTC active?

Yes

- Go To 2

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

    Are there any BPP Sensor circuit related DTCs active?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING**.

    No

    - Go To 3

3. **PERFORM THE BRAKE PEDAL CALIBRATION ROUTINE**
    1. Park the vehicle on level ground.

    NOTE: **When performing the Brake Pedal Sensor routine(s), make sure the brake pedal is NOT pressed.**

    2. With the scan tool under ABS in the "Miscellaneous Functions" menu, perform the Brake Pedal Calibration routine.

    NOTE: **This step only applies to applicable vehicles.**

    3. With the scan tool under PCM in the "Miscellaneous Functions" menu, perform the Brake Pedal Learn routine (if available).

    Were the Brake Pedal routine(s) successful?

    Yes

    - Test complete.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform the Brake Pedal Calibration routine(s) again, if still unsuccessful.
    - Go To 4

4. **INSPECT THE BRAKE PEDAL POSITION (BPP) SENSOR FOR INCORRECT INSTALLATION, DAMAGE OR MECHANICAL FAILURE**
    1. Turn the ignition off.
    2. Visually inspect the BPP Sensor for Improper installation, damage or mechanical failure. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .

Were any problems found?

Yes

- Repair as necessary.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **CHECK THE BRAKE PEDAL POSITION (BPP) SENSOR FOR PROPER OPERATION**
    1. Turn the ignition off.
    2. Disconnect the BPP Sensor harness connector.
    3. Turn the ignition on.
    1. Measure the voltage at the BPP Sensor harness connector between the (B237) BPP Sensor Feed and the (B937) BPP Sensor Return.

    Is the voltage above 4.75 volts?

    Yes

    - Replace the Brake Pedal Position (BPP) Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 6
6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION .
- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

No

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C0042-62-BRAKE PEDAL POSITION SENSOR - SIGNAL COMPARE FAILURE

THEORY OF OPERATION

The Brake Pedal Position (BPP) Sensor is hard wired to the Anti-lock Brake System (ABS) Module and is detecting an irregularity in voltage or signals.

The Anti-lock Brake System (ABS) Module broadcasts the BPP Sensor signal information, as well as the Master Cylinder Pressure Sensor signal information over the CAN Bus. The Master Cylinder Pressure Sensor is internal to the Hydraulic Control Unit (HCU).

The Master Cylinder Pressure (MCP) Sensor signal is utilized to support Brake Pedal Position Rationality and Brake Pedal Sensor Diagnostic. Autonomous braking systems such as Active Cruise Control (ACC) have the potential to defeat the Brake Pedal Position Rationality diagnostic as the vehicle can be brought to a complete stop without depressing the Brake Pedal, thus false failing the rationality. The Brake Pedal Position Rationality needs the MCP Sensor Signal to determine if any autonomous braking system is active. The MCP Sensor only measures the brake system pressure applied by the vehicle operator and is not affected by ABS, parking brake or autonomous braking systems.

The Brake Torque (BT) signal is a calculated measurement of braking force as determined by the ABS Module. The Brake Torque signal is used as a third correlating signal for BPP Rationality diagnostics and is accurate during both vehicle operator braking, as well as autonomous braking events.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- No Anti-lock Brake System (ABS) Module system activation.

SET CONDITION

- Anti-lock Brake System (ABS) Module sees brake pressure, but not corresponding with Brake Pedal Position (BPP) Sensor voltage for one second.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE OR BRAKE PEDAL POSITION (BPP) SENSOR CIRCUIT RELATED DTCS BRAKE PEDAL POSITION (BPP) SENSOR NOT CALIBRATED
BRAKE PEDAL POSITION (BPP) SENSOR IMPROPERLY INSTALLED, DAMAGE OR MECHANICAL FAILURE
BRAKE PEDAL POSITION (BPP) SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.
   8. Press the brake pedal firmly and hold for ten seconds.
   9. Release the brake pedal.
   10. With the scan tool, read ABS DTCs.

       Is the DTC active?

       Yes

       - Go To 2

       No

       - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
       - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **PERFORM THE BRAKE PEDAL SENSOR ROUTINE(S)**

1. Park the vehicle on level ground.

   NOTE: **When performing the Brake Pedal Sensor routine(s), make sure the brake pedal is NOT pressed.**

2. With the scan tool under ABS in the "Miscellaneous Functions" menu, perform the Brake Pedal Calibration routine.

   NOTE: **This step only applies to applicable vehicles.**

3. With the scan tool under PCM in the "Miscellaneous Functions" menu, perform the Brake Pedal Learn routine (if available).

   Were the Brake Pedal routine(s) successful?

   Yes

   - Test complete.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Perform the Brake Pedal Sensor routine(s) again, if still unsuccessful.
   - Go To3

3. **INSPECT THE BRAKE PEDAL POSITION (BPP) SENSOR FOR INCORRECT INSTALLATION, DAMAGE OR MECHANICAL FAILURE**
   1. Turn the ignition off.
   2. Visually inspect the BPP Sensor for Improper installation, damage or mechanical failure. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .

      Were any problems found?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 4

4. **REPLACE THE BRAKE PEDAL POSITION (BPP) SENSOR AND TEST FOR DTCS**
   1. Turn the ignition off.
   2. Replace the Brake Pedal Position (BPP) Sensor in accordance with the Service Information. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
   3. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
   4. Start the Vehicle.
   5. Press the brake pedal firmly and hold for ten seconds.
   6. Release the brake pedal.
   7. With the scan tool, read the DTCs.

      Did the DTC return?

      Yes

      - Go To 5

No

- Replacing the faulty component repaired the fault.
- Test Complete.

5. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
        - Test complete.

C0044-01-BRAKE PRESSURE SENSOR 1 - GENERAL ELECTRICAL FAILURE

THEORY OF OPERATION

The Brake Pressure Sensor is located internally in the Anti-lock Brake System (ABS) Hydraulic Control Unit (HCU). It interfaces directly with the ABS Module through spring loaded contacts. This is why it is imperative that at the end of the diagnostic procedure, if it is determined that the unit is to be replaced the entire unit needs to be replaced and not separated. This ensures the unit can be diagnosed as to a sensor failure or an internal connection failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module indicates that the Brake Pressure Sensor Signal is out of range.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Turn the ignition on.
   2. With the scan tool, read ABS DTCs and record on the repair order.
   3. With the scan tool, read and record Freeze Fame information.
   4. With the scan tool, erase DTCs.
   5. Start the engine.
   6. Press the brake pedal firmly and release.
   7. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present.
   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
        - Test complete.

C0044-28-BRAKE PRESSURE SENSOR 1 - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE

NOTE: **Repair all other DTC's before continuing with this diagnostic procedure.**

THEORY OF OPERATION

The Brake Pressure Sensor is located internally in the Anti-lock Brake System (ABS) Hydraulic Control Unit (HCU). It measures the zero level bias of the primary brake circuit when no brakes are applied and no ABS activation is in effect. The zero level bias can change due to residual brake pressure on the brake circuit or due to a bias on the pressure senor. A zero level bias on the pressure sensor is allowed and normal up to +/-16 bar (no actual pressure but the sensor reports some pressure). However an actual pressure buildup on the brake circuit is not allowed, not normal and must be repaired.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects brake pressure when the brake pedal has not been applied.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
BRAKE FLUID CONTAMINATION
PINCHED OR BENT BRAKE LINES
BRAKE PEDAL POSITION (BPP) SENSOR
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Turn the ignition on.
   2. With the scan tool, read ABS DTCs and record on the repair order.
   3. With the scan tool, read and record Freeze Frame information.
   4. With the scan tool, erase DTCs.
   5. Start the engine.
   6. Press the brake pedal firmly and release.
   7. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **MECHANICAL BRAKE SYSTEM INSPECTION**
    1. Turn the ignition off.
    2. Check the brake fluid for contaminants.
    3. Visually inspect all the brake lines for bent, damaged, or pinched restrictions.

    Where any problems found?

    Yes

    - Repair as necessary.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 3
3. **PERFORM THE ABS INITIALIZATION ROUTINE**
    1. Park the vehicle on level ground.
    2. Turn the ignition on.
    3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

    Was the ABS Initialization routine successful?

    Yes

    - Test complete.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform the ABS Initialization routine again, if still unsuccessful.
    - Go To 4
4. **BRAKE PEDAL INSPECTION**
    1. Turn the ignition off.
    2. Check the brake pedal for damage or restrictions not allowing it to fully return.

    Where any problems found?

    Yes

    - Repair as necessary.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 5
5. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

NOTE: **For this failure it is necessary to replace both the Anti-lock Brake System (ABS) Module and the Hydraulic Control Unit (HCU) as a complete unit. This is known as the Integrated Control Unit (ICU).**

- Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0044-49-BRAKE PRESSURE 1 - INTERNAL ELECTRONIC FAILURE

THEORY OF OPERATION

The Brake Pressure Sensor is located internally in the Anti-lock Brake System (ABS) Hydraulic Control Unit (HCU). It interfaces directly with the ABS Module through spring loaded contacts. This is why it is imperative that at the end of the diagnostic procedure, if it is determined that the unit is to be replaced the entire unit needs to be replaced and not separated. This ensures the unit can be diagnosed as to a sensor failure or an internal connection failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module indicates that the Brake Pressure Sensor Signal is out of range.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Turn the ignition on.
   2. With the scan tool, read ABS DTCs and record on the repair order.
   3. With the scan tool, read and record Freeze Fame information.
   4. With the scan tool, erase DTCs.
   5. Start the engine.
   6. Press the brake pedal firmly and release.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to ABS INTERMITTENT CONDITION .
2. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0044-62-BRAKE PRESSURE SENSOR 1 - SIGNAL COMPARE FAILURE

NOTE: **Repair all other DTCs first before continuing with this test.**

THEORY OF OPERATION

The Brake Pressure Sensor is located internally in the Anti-lock Brake System (ABS) Hydraulic Control Unit (HCU). It interfaces directly with the ABS Module through spring loaded contacts. This is why it is imperative that at the end of the diagnostic procedure, if it is determined that the unit is to be replaced the entire unit needs to be replaced and not separated. This ensures the unit can be diagnosed as to a sensor failure or an internal connection failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module indicates that the redundant brake pressure sensor elements do not agree.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
BASE BRAKE SYSTEM MECHANICAL OPERATION
INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Freeze Frame information.
   5. With the scan tool, erase DTCs.
   6. Start the engine.
   7. Press the brake pedal firmly and release.
   8. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to ABS INTERMITTENT CONDITION .
2. **MECHANICAL BRAKE SYSTEM INSPECTION**
   1. Turn the ignition off.
   2. Check the brake fluid level.
   3. Check for base brake issues.
   4. Check the brake fluid for contaminants.
   5. Visually inspect the Brake Master Cylinder and all brake line fittings.

6. Visually inspect the brake lines between the Brake Master Cylinder and the Integrated Control Unit (ICU) for bent, damaged, or pinched restrictions.

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 3

3. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

      Did the DTC return?

      Yes

      NOTE: **For this failure it is necessary to replace both the Anti-lock Brake System (ABS) Module and the Hydraulic Control Unit (HCU) as a**

complete unit. This is known as the Integrated Control Unit (ICU).

- Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0044-64-BRAKE PRESSURE SENSOR 1 - SIGNAL PLAUSIBILITY FAILURE

THEORY OF OPERATION

The Brake Pressure Sensor is located internally in the Anti-lock Brake System (ABS) Hydraulic Control Unit (HCU). It interfaces directly with the ABS Module through spring loaded contacts. This is why it is imperative that at the end of the diagnostic procedure, if it is determined that the unit is to be replaced the entire unit needs to be replaced and not separated. This ensures the unit can be diagnosed as to a sensor failure or an internal connection failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module has detected a moderate deceleration without a change in brake pressure.

DEFAULT ACTION

- Electronic Stability Control (ESC) System light is illuminated.
- ABS is partially disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
BRAKE FLUID LEVEL LOW OR CONTAMINATED
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
HYDRAULIC CONTROL UNIT (HCU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.

5. With the scan tool, erase ABS DTCs.
6. Start the engine.
7. Press the brake pedal firmly and release.
8. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **MECHANICAL BRAKE SYSTEM INSPECTION**
   1. Turn the ignition off.
   2. Check the brake fluid level.
   3. Check base brake issues.
   4. Check the brake fluid for contaminants.
   5. Visually inspect the master cylinder and all brake line fittings.
   6. Visually inspect the brake lines between the Brake Master Cylinder and the Integrated Control Unit (ICU) for bent, damaged, or pinched restrictions.

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 3

3. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

   Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

NOTE: For this failure it is necessary to replace both the Anti-lock Brake System (ABS) Module and the Hydraulic Control Unit (HCU) as a complete unit. This is known as the Integrated Control Unit (ICU).

- Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C0051-22-STEERING WHEEL POSITION SENSOR - SIGNAL AMPLITUDE > MAXIMUM

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module compares the steering wheel angle to vehicle inputs such as wheel speeds and acceleration to determine the steering wheel angle offset accuracy.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- No Communication Area Network (CAN) DTCs active in other modules.

SET CONDITION

- Anti-lock Brake System (ABS) Module is monitoring the Steering Angle Sensor for an overtravel range above Â±720Â°.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

NOTE: **The Steering Angle Sensor (SAS) is internal to the Steering Column Control Module (SCCM).**

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM) DTCS
STEERING WHEEL ALIGNMENT STEERING COLUMN OR INTERMEDIATE SHAFT IMPROPERLY INSTALLED OR DAMAGED STEERING ANGLE SENSOR (SAS) LOOSE
STEERING COLUMN CONTROL MODULE (SCCM)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE/INTEGRATED CONTROL UNIT (ICU)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. Start the engine.
   7. Slowly turn the steering wheel from stop to stop.
   8. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any SCCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3

3. **INSPECT THE WHEEL ALIGNMENT, STEERING COLUMN AND INTERMEDIATE SHAFT FOR INCORRECT INSTALLATION OR DAMAGE**

   NOTE: **If available, check the vehicle repair history for collision damage.**

   1. Turn the ignition off.
   2. Inspect the vehicle for proper wheel alignment.
   3. Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.
   4. Inspect the steering column and intermediate shaft for damage.

      Were any problems found?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 4
4. **CHECK THE STEERING ANGLE**
   1. Turn the steering wheel so that the wheels are pointing in a straight ahead position.
   2. With scan tool, read the steering angle.

      Is the Steering Angle reading within Â±15Â° of 0Â°?

      Yes

      - Go To 5

      No

      - Go To 6
5. **CHECK FOR STEERING ANGLE CHANGE**
   1. Turn steering wheel so wheels point in a straight ahead position.
   2. With scan tool, graph the steering angle sensor to see if the reading ever travels above the 720Â° while rotating the steering wheel from stop to stop.
   3. Rotate steering wheel to the right and the degrees will decrease and rotating steering wheel to the left the degrees will increase.

      Did the steering angle change accordingly with no irregularities and display lower than 720Â° from lock to lock?

      Yes

      - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Replace the Steering Control Module (SCCM) in accordance with the Service Information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **CHECK THE CLOCKSPRING (SAS) INSTALLATION**

NOTE: **The Clockspring (SAS) is internal to the SCCM.**

NOTE: **Proper Clockspring (SAS) installation is crucial for proper operation.**

WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Turn the ignition off.
2. Verify that the Clockspring (SAS) is properly installed.

Is the Clockspring (SAS) properly installed?

Yes

- Replace the Steering Control Module (SCCM) in accordance with the Service Information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Repair as necessary.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C0051-28-STEERING WHEEL POSITION SENSOR - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module compares the steering wheel angle to vehicle inputs such as wheel speeds and acceleration to determine the steering wheel angle offset for accuracy. When the ABS Initialization routine is performed, the ABS Module will reset the Steering Angle Sensor (SAS) data to a compensated value in the ABS Module until the vehicle drive test is completed. This DTC will set in the ABS Module when the actual steering angle data in the Steering Column Control Module (SCCM) compared to the ABS compensated steering angle data offsets differ by more than Â±8Â° between one another. This fault can only be cleared after performing the ABS initialization. The actual steering angle sensor value data is displayed in the SCCM.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Driving straight.
- Speeds above 15 km/h (9 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module detects the Steering Angle Sensor (SAS) signal is above than Â±15Â° of 0Â° while driving straight.

DEFAULT ACTION

- Electronic Stability Control (ESC) System light is illuminated.
- ESC is disabled.

NOTE: The Steering Angle Sensor (SAS) is internal to the Steering Column Control Module (SCCM).

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS
STEERING WHEEL ALIGNMENT
STEERING COLUMN OR INTERMEDIATE SHAFT IMPROPERLY INSTALLED OR DAMAGED
STEERING ANGLE SENSOR (SAS) LOOSE
STEERING COLUMN CONTROL MODULE (SCCM)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. Test drive the vehicle straight with speeds above 15 km/h (9 mph).
   7. Stop the vehicle.
   8. Slowly turn the steering wheel from stop to stop.
   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any SCCM or Communication related DTCs active?

Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

No

- Go To 3

3. **INSPECT THE WHEEL ALIGNMENT, STEERING COLUMN AND INTERMEDIATE SHAFT FOR INCORRECT INSTALLATION OR DAMAGE**

   NOTE: **If available, check the vehicle repair history for collision damage.**

   1. Turn the ignition off.
   2. Inspect the vehicle for proper wheel alignment.
   3. Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.
   4. Inspect the steering column and intermediate shaft for damage.

   Were any problems found?

   Yes

   - Repair as necessary. With the scan tool, perform the "ABS Initialization" routine.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **CHECK THE STEERING ANGLE**
   1. With the scan tool, perform the "ABS Initialization" routine.
   2. With the scan tool, erase ABS DTCs.
   3. Test drive the vehicle straight with speeds above 15 km/h (9 mph).
   4. With scan tool, monitor the steering angle in the SCCM.

   Is the Steering Angle reading within Â±8Â° of 0Â°?

   Yes

   - Test Complete.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 5

5. **CHECK THE CLOCKSPRING (SAS) INSTALLATION**

   NOTE: **The Clockspring (SAS) is internal to the SCCM.**

   NOTE: **Proper Clockspring (SAS) installation is crucial for proper operation.**

   WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system**

capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Turn the ignition off.
2. Verify that the Clockspring (SAS) is properly installed.

   Is the Clockspring (SAS) properly installed?

   Yes

   - Go To 6

   No

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the SCCM harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the SCCM harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

Yes

- Replace the Steering Control Module (SCCM) in accordance with the Service Information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- If the DTC returns, Go To 7

No

- Test complete.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

No

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C0051-49-STEERING WHEEL POSITION SENSOR - INTERNAL ELECTRONIC FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors the steering wheel angle for valid internal status.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects the Steering angle Sensor (SAS) has an internal failure status.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

NOTE: **The Steering Angle Sensor (SAS) is internal to the Steering Column Control Module (SCCM).**

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
ELECTRIC POWER STEERING (EPS) MODULE OR COMMUNICATION RELATED DTCS
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.

7. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any SCCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3

3. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the SCCM harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the SCCM harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.

8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Steering Control Module (SCCM) in accordance with the Service Information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- If the DTC returns, Go To

No

- Test complete.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C0051-62-STEERING WHEEL POSITION SENSOR - SIGNAL COMPARE FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module compares the steering wheel angle to vehicle inputs such as wheel speeds and acceleration to determine the steering wheel angle offset accuracy.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Vehicle speed is above 15 km/h (9 mph).
- Yaw rate, lateral acceleration, steering angle and vehicle-speed are all valid.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects the Electronic Stability Control (ESC) calculated Steering Angle does not match the sensor signal from the Steering Column Control Module (SCCM).

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC is disabled.

NOTE: **The Steering Angle Sensor (SAS) is internal to the Steering Column Control Module (SCCM).**

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM) DTCS

Possible Causes
TIRE PRESSURE RELATED DTCS STEERING WHEEL ALIGNMENT STEERING COLUMN OR INTERMEDIATE SHAFT IMPROPERLY INSTALLED OR DAMAGED STEERING ANGLE SENSOR (SAS) LOOSE
STEERING COLUMN CONTROL MODULE (SCCM)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. Start the engine.
   7. Slowly turn the steering wheel from stop to stop.
   8. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any SCCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3
3. **CHECK FOR RADIO FREQUENCY (RF) HUB OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any RF Hub or Communication related DTCs active?

      Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

No

- Go To 4

4. **INSPECT THE WHEEL ALIGNMENT, STEERING COLUMN AND INTERMEDIATE SHAFT FOR INCORRECT INSTALLATION OR DAMAGE**

   NOTE: If available, check the vehicle repair history for collision damage.

   1. Inspect the vehicle for proper wheel alignment.
   2. Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.
   3. Inspect the steering column and intermediate shaft for damage.

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 5

5. **CHECK THE STEERING ANGLE**
   1. Turn steering wheel so wheels point in a straight ahead position.
   2. With scan tool, read the steering angle.

   Is the Steering Angle reading within Â±8Â° of 0Â°?

   Yes

   - Go To 6

   No

   - Replace the Steering Column Control Module (SCCM) in accordance with the Service Information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **CHECK STEERING ANGLE CHANGE**
   1. Turn steering wheel so wheels point in a straight ahead position.
   2. With scan tool, graph the steering angle to see while rotating wheel from stop to stop.

      NOTE: Sensor damage can occur if wheel is turned over 720Â°.

   3. Rotate steering wheel to the right and the degrees will decrease and rotating steering wheel to the left the degrees will increase.

   Did the steering angle change accordingly and display lower then 720Â° from stop to stop with no erratic signal behavior?

   Yes

   - Go To 8

No

- Go To 7

7. **CHECK THE CLOCKSPRING (SAS) INSTALLATION**

NOTE: **The Steering Angle Sensor (SAS) is internal to the Steering Column Control Module (SCCM).**

WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

NOTE: **If available, check the vehicle repair history for collision damage.**

NOTE: **Proper Clockspring (SAS) installation is crucial for proper operation.**

1. Turn the ignition off.
2. Verify that the Clockspring (SAS) is properly installed. Refer to **CLOCKSPRING, REMOVAL AND INSTALLATION** .

   Is the Clockspring (SAS) properly installed?

   Yes

   - Replace the Steering Control Module (SCCM) in accordance with the Service Information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.

- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C006A-28-MULTI-AXIS ACCELERATION SENSOR - SIGNAL BIAS LEVEL OUT OF RANGE / ZERO ADJUSTMENT FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module compares the steering wheel angle to vehicle inputs such as wheel speeds and acceleration to determine the Dynamics Sensor offsets for accuracy. When the ABS Initialization routine is performed, the ABS Module will reset the Dynamics Sensor data to a compensated value in the ABS Module until the vehicle drive test is completed. This DTC will set in the ABS Module when the dynamics sensor offset data is out of range. This fault can only be cleared after performing the ABS initialization. The actual dynamics sensor value data is displayed in the Occupant Restraint Controller (ORC).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- 15 minute vehicle drive.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects that one of the Dynamic Sensors offset levels are above threshold limits.
- After 15 minute of vehicle drive time with vehicle speed above 15 km/h (9 mph).

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC disabled.

NOTE: The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).

POSSIBLE CAUSES

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC) DTCS
OCCUPANT RESTRAINT CONTROLLER (ORC) INSTALLATION
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE INITIALIZATION ROUTINE NOT PERFORMED
OCCUPANT RESTRAINT CONTROLLER (ORC)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Park the vehicle on level ground with the steering wheel pointed straight.
   3. Turn the ignition on.
   4. With the scan tool, read ABS DTCs and record on the repair order.
   5. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   6. With the scan tool, erase ABS DTCs.
   7. Turn the ignition off.
   8. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   9. Test drive the vehicle above 40 km/h (25 mph) for 15 minutes.

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

   10. With the scan tool, read ABS DTCs.

       Is the DTC active?

       Yes

       - Go To 2

       No

       - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to ABS INTERMITTENT CONDITION .

2. **CHECK FOR OCCUPANT RESTRAINT CONTROLLER (ORC) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

Are there any ORC or Communication related DTCs active?

Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

No

- Go To 3

3. **CHECK FOR ABS MODULE FOR DYNAMICS SENSOR RELATED DTCS**
   1. Refer to the recorded DTCs.

   Are there any other Dynamics Sensor related DTCs active?

   Yes

   - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING**.

   No

   - Go To 4

4. **CHECK THE OCCUPANT RESTRAINT CONTROLLER (ORC) INSTALLATION**

   NOTE: **ORC installation and mounting bolt torque is crucial for proper operation.**

   WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

   1. Check the ORC for damaged, modified, and bent mounting brackets.
   2. Check the ORC mounting bolts for a loose or over tightened condition.

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 5

5. **PERFORM THE ABS INITIALIZATION ROUTINE**
   1. Park the vehicle on level ground.
   2. Turn the ignition on.
   3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

   Was the ABS Initialization routine successful?

   Yes

- Test complete.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS Initialization routine again, if still unsuccessful.
- Go To 6

6. **REPLACE THE OCCUPANT RESTRAINT CONTROLLER (ORC) AND TEST FOR DTCS**

WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect the ORC harness connectors.
2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. 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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found. If no problems were found, Replace the Occupant Restraint Controller (ORC) in accordance with the Service Information. Refer to **CONTROLLER, OCCUPANT RESTRAINT (ORC), REMOVAL AND INSTALLATION** .

5. With the scan tool, erase DTCs.

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Test drive the vehicle at speeds above 40 k/mh (25 mph).
7. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Go to 7

    No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

7. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
        - Test complete.

C006A-49-MULTI-AXIS ACCELERATION SENSOR - INTERNAL ELECTRONIC FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is monitoring the outputs of the Dynamics Sensor information over the Controller Area Network (CAN) C bus. The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a Occupant Restraint Controller (ORC) internal failure.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC disabled.

NOTE: The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).

POSSIBLE CAUSES

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC) DTCS
OCCUPANT RESTRAINT CONTROLLER (ORC) INSTALLATION
OCCUPANT RESTRAINT CONTROLLER (ORC)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Park the vehicle on level ground with the steering wheel pointed straight.
   3. Turn the ignition on.
   4. With the scan tool, read ABS DTCs and record on the repair order.
   5. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   6. With the scan tool, erase ABS DTCs.
   7. Cycle the ignition from off to on.
   8. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

No

- Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR OCCUPANT RESTRAINT CONTROLLER (ORC) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

   Are there any ORC or Communication related DTCs active?

   Yes

   - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

   No

   - Go To 3

3. **CHECK THE OCCUPANT RESTRAINT CONTROLLER (ORC) INSTALLATION**

   NOTE: **ORC installation and mounting bolt torque is crucial for proper operation.**

   WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

   1. Check the ORC for damaged, modified, and bent mounting brackets.
   2. Check the ORC mounting bolts for a loose or over tightened condition.

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **REPLACE THE OCCUPANT RESTRAINT CONTROLLER (ORC) AND TEST FOR DTCS**

   WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

   1. Disconnect the ORC harness connectors.

2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. 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.
   - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

   Repair any conditions that are found. If no problems were found, Replace the Occupant Restraint Controller (ORC) in accordance with the Service Information. Refer to **CONTROLLER, OCCUPANT RESTRAINT (ORC), REMOVAL AND INSTALLATION** .

5. With the scan tool, erase DTCs.

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Test drive the vehicle at speeds above 40 k/mh (25 mph).
7. With the scan tool, read ABS Module DTCs.

   Did the DTC return?

   Yes

   - Go to 5

   No

   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
   - Test complete.

5. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C006A-54-MULTI-AXIS ACCELERATION SENSOR - MISSING CALIBRATION

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is monitoring the outputs of the Dynamics Sensor information over the Controller Area Network (CAN) C bus. The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage condition present.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a invalid signal from the Dynamics Sensor.
- Anti-lock Brake System (ABS) Module initialization routine not performed.

DEFAULT ACTION

- Electronic Stability Control (ESC) System light is illuminated.
- ESC is disabled.

NOTE: **The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).**

POSSIBLE CAUSES

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC) DTCS
OCCUPANT RESTRAINT CONTROLLER (ORC) IMPROPERLY INSTALLED/LOOSE OR WIRING HARNESS DAMAGE
ABS INITIALIZATION ROUTINE NOT PERFORMED
OCCUPANT RESTRAINT CONTROLLER (ORC)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Park the vehicle on level ground with the steering wheel pointed straight.
   3. Turn the ignition on.
   4. With the scan tool, read ABS DTCs and record on the repair order.
   5. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   6. With the scan tool, erase ABS DTCs.
   7. Cycle the ignition from off to on.
   8. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK THE OCCUPANT RESTRAINTS CONTROLLER (ORC) INSTALLED/LOOSE OR WIRING HARNESS DAMAGE**

   NOTE: **Occupant Restraints Controller (ORC) installation and mounting bolt torque is crucial for proper operation.**

   WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system**

capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Turn the ignition off.
2. Check the ORC for damaged, modified, and or bent mounting brackets.
3. Check the ORC mounting bolts for a loose or over tightened condition.
4. Verify the correct ORC part number matches the vehicle.
5. Check all related wiring for bruised, chafed, pierced, or partially broken wires.
6. Check all related connectors for broken, bent, pushed out, or corroded terminals.

   Were any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 3

3. **PERFORM THE ABS INITIALIZATION ROUTINE**
   1. Park the vehicle on level ground.
   2. Turn the ignition on.
   3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

   Was the ABS Initialization routine successful?

   Yes

   - Test complete.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Perform the ABS Initialization routine again, if still unsuccessful.
   - Go To 4

4. **REPLACE THE OCCUPANT RESTRAINT CONTROLLER (ORC) AND TEST FOR DTCS**

   WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

   1. Disconnect the ORC harness connectors.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found. If no problems were found, Replace the Occupant Restraint Controller (ORC) in accordance with the Service Information. Refer to **CONTROLLER, OCCUPANT RESTRAINT (ORC), REMOVAL AND INSTALLATION** .

5. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Test drive the vehicle at speeds above 40 k/mh (25 mph).
7. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Go to 5

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

5. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.

6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C006A-62-MULTI-AXIS ACCELERATION SENSOR - SIGNAL COMPARE FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module compares the steering wheel angle to vehicle inputs such as wheel speeds and acceleration to determine the Dynamics Sensor offsets for accuracy. When the ABS Initialization routine is performed, the ABS Module will reset the Dynamics Sensor data to a compensated value in the ABS Module until the vehicle drive test is completed. This DTC will set in the ABS Module when the dynamics sensor offset data is out of range. This fault can only be cleared after performing the ABS initialization. The actual dynamics sensor value data is displayed in the Occupant Restraint Controller (ORC).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage condition present.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects that one of the three Dynamic Sensor signals do not agree with the calculated value.
- Anti-lock Brake System (ABS) Module initialization routine not performed.

DEFAULT ACTION

- Electronic Stability Control (ESC) System light illuminated.
- ESC is disabled.

NOTE: **The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).**

POSSIBLE CAUSES

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC) DTCS
STEERING COLUMN CONTROL MODULE (SCCM) DTCS
STEERING WHEEL ALIGNMENT, STEERING COLUMN AND INTERMEDIATE SHAFT FOR INCORRECT INSTALLATION OR DAMAGE
ABS INITIALIZATION ROUTINE NOT PERFORMED
OCCUPANT RESTRAINT CONTROLLER (ORC)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   8. Test drive the vehicle above 40 km/h (25 mph).

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to ABS INTERMITTENT CONDITION .

2. **CHECK FOR OCCUPANT RESTRAINT CONTROLLER (ORC) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any ORC or Communication related DTCs active?

Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

No

- Go To 3

3. **CHECK FOR STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS**
    1. Refer to the recorded DTCs.

    Are there any SCCM or Communication related DTCs active?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

    No

    - Go To 4

4. **INSPECT THE WHEEL ALIGNMENT, STEERING COLUMN AND INTERMEDIATE SHAFT FOR INCORRECT INSTALLATION OR DAMAGE**

    NOTE: **If available, check the vehicle repair history for collision damage.**

    1. Turn the ignition off.
    2. Inspect the vehicle for proper wheel alignment.
    3. Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.
    4. Inspect the steering column and intermediate shaft for damage.

    Were any problems found?

    Yes

    - Repair as necessary.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 5

5. **PERFORM THE ABS INITIALIZATION ROUTINE**
    1. Park the vehicle on level ground.
    2. Turn the ignition on.
    3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

    Was the ABS Initialization routine successful?

    Yes

    - Test complete.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

- Perform the ABS Initialization routine again, if still unsuccessful.
- Go To 6

6. **REPLACE THE OCCUPANT RESTRAINT CONTROLLER (ORC) AND TEST FOR DTCS**

   WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

   1. Disconnect the ORC harness connectors.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found. If no problems were found, Replace the Occupant Restraint Controller (ORC) in accordance with the Service Information. Refer to **CONTROLLER, OCCUPANT RESTRAINT (ORC), REMOVAL AND INSTALLATION** .
   5. With the scan tool, erase DTCs.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.
   6. Test drive the vehicle at speeds above 40 k/mh (25 mph).
   7. With the scan tool, read ABS Module DTCs.

      Did the DTC return?

      Yes

      - Go to 7

      No

      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
      - Test complete.
7. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.

2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. 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.
   - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

   Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

   WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION .
    - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

    No

    - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
    - Test complete.

C006C-54-STABILITY SYSTEM - MISSING CALIBRATION

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module compares the steering wheel angle to vehicle inputs such as wheel speeds and acceleration to determine the Dynamics Sensor offsets for accuracy. When the ABS Initialization routine is performed, the ABS Module will reset the Dynamics Sensor data to a compensated value in the ABS Module until the vehicle drive test is completed. This DTC will set in the ABS Module when the dynamics sensor offset data is out of range. This fault can only be cleared after performing the ABS initialization. The actual dynamics sensor value data is displayed in the Occupant Restraint Controller (ORC).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage condition present.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a invalid signal from the Dynamics Sensor.

DEFAULT ACTION

- Electronic Stability Control (ESC) System light is illuminated.
- ESC is disabled.

NOTE: The Dynamics Sensor is internal to the Occupant Restraint Controller (ORC).

POSSIBLE CAUSES

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC) DTCS
OCCUPANT RESTRAINT CONTROLLER (ORC) IMPROPERLY INSTALLED/LOOSE OR WIRING HARNESS DAMAGE
ABS INITIALIZATION ROUTINE NOT PERFORMED
OCCUPANT RESTRAINT CONTROLLER (ORC)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

   8. Test drive the vehicle above 40 km/h (25 mph).

      NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.

9. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR OCCUPANT RESTRAINT CONTROLLER (ORC) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any ORC or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3

3. **CHECK THE OCCUPANT RESTRAINTS CONTROLLER (ORC) INSTALLED/LOOSE OR WIRING HARNESS DAMAGE**

   NOTE: **Occupant Restraints Controller (ORC) installation and mounting bolt torque is crucial for proper operation.**

   WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

   1. Turn the ignition off.
   2. Check the ORC for damaged, modified, and or bent mounting brackets.
   3. Check the ORC mounting bolts for a loose or over tightened condition.
   4. Verify the correct ORC part number matches the vehicle.
   5. Check all related wiring for bruised, chafed, pierced, or partially broken wires.
   6. Check all related connectors for broken, bent, pushed out, or corroded terminals.

      Were any problems found?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

- Go To 4

4. **PERFORM THE ABS INITIALIZATION ROUTINE**
    1. Park the vehicle on level ground.
    2. Turn the ignition on.
    3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

    Was the ABS Initialization routine successful?

    Yes

    - Test complete.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform the ABS Initialization routine again, if still unsuccessful.
    - Go To 5

5. **REPLACE THE OCCUPANT RESTRAINT CONTROLLER (ORC) AND TEST FOR DTCS**

    WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

    1. Disconnect the ORC harness connectors.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found. If no problems were found, Replace the Occupant Restraint Controller (ORC) in accordance with the Service Information. Refer to **CONTROLLER, OCCUPANT RESTRAINT (ORC), REMOVAL AND INSTALLATION** .

    5. With the scan tool, erase DTCs.

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Test drive the vehicle at speeds above 40 k/mh (25 mph).
7. With the scan tool, read ABS Module DTCs.

   Did the DTC return?

   Yes

   - Go To 6

   No

   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
   - Test complete.

6. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

       - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL**

AND INSTALLATION .

- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

No

- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C006C-9A-STABILITY SYSTEM - COMPONENT OR SYSTEM OPERATING CONDITIONS

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module has detected that the internal pump motor run time has exceeded the allowable threshold parameters set in the ABS Module or a defined Electronic Stability Control (ESC) system event number has been reached within the first two minutes of power up at speeds above 40 km/h (25 mph). The ABS Module perceives this as an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage condition present.
- First two minutes of driving with vehicle speed above 40 km/h (25 mph).

SET CONDITION

- Anti-lock Brake System (ABS) Module did not see the correct conditions to ensure proper system operation in the first two minutes of driving.

DEFAULT ACTION

- Electronic Stability Control (ESC) System light is illuminated.
- ESC is disabled.

NOTE: **The Dynamics Sensor is internal to the Occupant Restraints Controller (ORC)**

POSSIBLE CAUSES

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC) DTCS
ABS INITIALIZATION ROUTINE NOT PERFORMED
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Turn the ignition on.
    2. With the scan tool, read ABS DTCs and record on the repair order.

    WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    3. Road test the vehicle in a straight manner for two minutes over 40 km/h (25 mph).

NOTE: **Vehicle must be driven straight for several minutes above 40 km/h (25 mph) for set conditions to be met.**

4. With the scan tool, read ABS DTCs and record on the repair order.

   Did the DTC return?

   Yes

   - Go To 2

   No

   - Test complete, the condition or conditions that originally set this DTC are not present at this time.

2. **CHECK FOR OCCUPANT RESTRAINT CONTROLLER (ORC) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any ORC or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3

3. **PERFORM THE ABS INITIALIZATION ROUTINE**
   1. Park the vehicle on level ground.
   2. Turn the ignition on.
   3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

      Was the ABS Initialization routine successful?

      Yes

      - Test complete.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Perform the ABS Initialization routine again, if still unsuccessful.
      - Go To 4

4. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

DTC TROUBLESHOOTING

C0078-86-TIRE DIAMETER - SIGNAL INVALID

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is verifying internal tire diameter information to the information provided by the vehicle is within an acceptable range.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Stored tire size is out of range
- Tire size changed from the previous initialization.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
BODY CONTROL MODULE (BCM) DTCS
INCORRECT TIRE SIZE PROGRAMMED INTO BODY CONTROL MODULE (BCM)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE INITIALIZATION ROUTINE NOT PERFORMED
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

Is the DTC active?

Yes

- Go To 2

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR BODY CONTROL MODULE (BCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any BCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3

3. **INCORRECT TIRES PROGRAMMED INTO BCM**
   1. Inspect all four tires on the vehicle and note the size of each tire.

      NOTE: A non-production size tire cannot be programmed into the BCM. The production Powertrain, with the production size tires, is the only emissions certified configuration that is available for reprogramming.

   2. Verify the correct Tire/wheel information is programmed in the BCM.

      Is the correct value programmed in the BCM?

      Yes

      - Go To 4

      No

      - Program the correct Tire/Wheel information in the BCM.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

4. **PERFORM THE ABS INITIALIZATION ROUTINE**

   NOTE: When performing the ABS Initialization routine, the vehicle temperature must be above 10B°C (50B°F).

   1. Park the vehicle on level ground.
   2. Turn the ignition on.
   3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

      Was the ABS Initialization routine successful?

Yes

- Test complete.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS Initialization routine again, if still unsuccessful.
- Go To 5

5. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C1046-92-LEFT FRONT WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. This failure is detected, if the measured wheel speed sensor signal is out of the range of the ABS Module allowable threshold parameters, during an ABS event.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- During active ABS control.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a pressure reduction phase and the following pressure hold phase is too long.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
WHEEL BEARING/TONE WHEEL DAMAGED
WHEEL SPEED SIGNALS SWAPPED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Freeze Fame information.
    5. With the scan tool, erase DTCs.
    6. Cycle the ignition from off to on.
    7. With the scan tool, read ABS DTCs.

    Is the DTC active?

Yes

- Go To 2

No

- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

       Are there any other ABS WSS DTCs active or pending?

       Yes

       - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING** .

       No

       - Go To 3
3. **CHECK THE LEFT FRONT WHEEL BEARING/TONE WHEEL FOR DAMAGE**
    1. Turn the ignition off.
    2. Check the Left Front Wheel Bearing/Tone Wheel for excessive runout, clearance or damage.

       NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

       Were there any problems found with the Wheel Bearing/Tone Wheel?

       Yes

       - Replace the Left Front Wheel Bearing/Tone Wheel in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

       - Go To 4
4. **CHECK WHEEL SPEED SENSOR (WSS) WIRING**
    1. Check the ABS Module and WSS harness connectors for incorrectly wired connectors.

       Were any problems found?

       Yes

       - Repair as necessary.
       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

       - Go To 5
5. **REPLACE THE LEFT FRONT WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Left Front Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    3. With the scan tool, read ABS DTCs.

Did the DTC return?

Yes

- Go To 6

No

- Test Complete.

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C1047-92-RIGHT FRONT WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. This failure is detected, if the measured wheel speed sensor signal is out of the range of the ABS Module allowable threshold parameters, during an ABS event.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- During active ABS control.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a pressure reduction phase and the following pressure hold phase is too long.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
WHEEL BEARING/TONE WHEEL DAMAGED
WHEEL SPEED SIGNALS SWAPPED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Freeze Fame information.
    5. With the scan tool, erase DTCs.
    6. Cycle the ignition from off to on.
    7. With the scan tool, read ABS DTCs.

    Is the DTC active?

Yes

- Go To 2

No

- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any other ABS WSS DTCs active or pending?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3
3. **CHECK THE RIGHT FRONT WHEEL BEARING/TONE WHEEL FOR DAMAGE**
   1. Turn the ignition off.
   2. Check the Right Front Wheel Bearing/Tone Wheel for excessive runout, clearance or damage.

      NOTE: **Refer to the appropriate service information, if necessary, for procedures or specifications.**

      Were there any problems found with the Wheel Bearing/Tone Wheel?

      Yes

      - Replace the Right Front Wheel Bearing/Tone Wheel in accordance with the Service Information. Refer to **HUB AND BEARING, REMOVAL AND INSTALLATION** .
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 4
4. **CHECK WHEEL SPEED SENSOR (WSS) WIRING**
   1. Check the ABS Module and WSS harness connectors for incorrectly wired connectors.

      Were any problems found?

      Yes

      - Repair as necessary.
      - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

      No

      - Go To 5
5. **REPLACE THE RIGHT FRONT WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
   1. Replace the Right Front Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, FRONT, REMOVAL AND INSTALLATION** .
   2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
   3. With the scan tool, read ABS DTCs.

Did the DTC return?

Yes

- Go To 6

No

- Test Complete.

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C1048-92-LEFT REAR WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. This failure is detected, if the measured wheel speed sensor signal is out of the range of the ABS Module allowable threshold parameters, during an ABS event.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- During active ABS control.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a pressure reduction phase and the following pressure hold phase is too long.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
AXLE SHAFT/TONE WHEEL DAMAGED
WHEEL SPEED SIGNALS SWAPPED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Freeze Fame information.
    5. With the scan tool, erase DTCs.
    6. Cycle the ignition from off to on.
    7. With the scan tool, read ABS DTCs.

    Is the DTC active?

Yes

- Go To 2

No

- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

        Are there any other ABS WSS DTCs active or pending?

        Yes

        - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING** .

        No

        - Go To 3
3. **CHECK THE LEFT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**
    1. Turn the ignition off.
    2. Check the Left Rear Axle Shaft/Tone Wheel for excessive runout, clearance or damage.

        NOTE: **Refer to the appropriate service information, if necessary, for procedures or specifications.**

        Were there any problems found with the Axle Shaft/Tone Wheel?

        Yes

        - Replace the Left Rear Axle Shaft/Tone Wheel in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Go To 4
4. **CHECK WHEEL SPEED SENSOR (WSS) WIRING**
    1. Check the ABS Module and WSS harness connectors for incorrectly wired connectors.

        Were any problems found?

        Yes

        - Repair as necessary.
        - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Go To 5
5. **REPLACE THE LEFT REAR WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Left Rear Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    3. With the scan tool, read ABS DTCs.

Did the DTC return?

Yes

- Go To 6

No

- Test Complete.

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C1049-92-RIGHT REAR WHEEL PRESSURE PHASE MONITORING - PERFORMANCE OR INCORRECT OPERATION

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors each wheel speed sensor individually. This failure is detected, if the measured wheel speed sensor signal is out of the range of the ABS Module allowable threshold parameters, during an ABS event.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- During active ABS control.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects a pressure reduction phase and the following pressure hold phase is too long.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) System indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS
AXLE SHAFT/TONE WHEEL DAMAGED
WHEEL SPEED SIGNALS SWAPPED
WHEEL SPEED SENSOR (WSS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Freeze Fame information.
    5. With the scan tool, erase DTCs.
    6. Cycle the ignition from off to on.
    7. With the scan tool, read ABS DTCs.

    Is the DTC active?

Yes

- Go To 2

No

- Perform the ABS INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR WHEEL SPEED SENSOR (WSS) CIRCUIT RELATED DTCS**
    1. Refer to the recorded DTCs.

       Are there any other ABS WSS DTCs active or pending?

       Yes

       - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING** .

       No

       - Go To 3

3. **CHECK THE RIGHT REAR AXLE SHAFT/TONE WHEEL FOR DAMAGE**
    1. Turn the ignition off.
    2. Check the Right Rear Axle Shaft/Tone Wheel for excessive runout, clearance or damage.

       NOTE: **Refer to the appropriate service information, if necessary, for procedures or specifications.**

       Were there any problems found with the Axle Shaft/Tone Wheel?

       Yes

       - Replace the Right Rear Axle Shaft/Tone Wheel in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

       - Go To 4

4. **CHECK WHEEL SPEED SENSOR (WSS) WIRING**
    1. Check the ABS Module and WSS harness connectors for incorrectly wired connectors.

       Were any problems found?

       Yes

       - Repair as necessary.
       - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

       No

       - Go To 5

5. **REPLACE THE RIGHT REAR WHEEL SPEED SENSOR (WSS) AND TEST FOR DTCS**
    1. Replace the Right Rear Wheel Speed Sensor (WSS) in accordance with the Service Information. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION** .
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    3. With the scan tool, read ABS DTCs.

Did the DTC return?

Yes

- Go To 6

No

- Test Complete.

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C1082-01-VACUUM PRESSURE SENSOR - GENERAL ELECTRICAL FAILURE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives outputs from the vacuum pressure sensor which measures the differential pressure between the vacuum chamber and the atmosphere.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Vacuum Sensor Signal voltage level is below 0.1 volt for 100 msec.
- Vacuum Sensor Signal indicating voltage above 3.5 volts for 100 msec.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
VACUUM PRESSURE SENSOR SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
VACUUM PRESSURE SENSOR RETURN CIRCUIT OPEN OR HIGH RESISTANCE
VACUUM PRESSURE SENSOR SUPPLY CIRCUIT SHORTED TO VACUUM PRESSURE SENSOR SIGNAL CIRCUIT
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VACUUM PRESSURE SENSOR RETURN CIRCUIT
VACUUM PRESSURE SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.

5. With the scan tool, erase ABS DTCs.
6. Turn the ignition off.
7. Start the Vehicle.
8. Press the brake pedal firmly and release.
9. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **ISOLATE AND CHECK THE (B31) VACUUM PRESSURE SENSOR SUPPLY CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
   4. Connect one lead of the DVOM to the circuit being tested at the Vacuum Pressure Sensor harness connector.
   5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

   Is the resistance below 3.0 Ohms?

   Yes

   - Go To 3

   No

   - Repair the circuit for an open/high resistance.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

3. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

   Is there any voltage present?

   Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND**
    1. The ignition must be off when checking a circuit for continuity to ground.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the negative lead of the DVOM to a known good ground.
    4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the (B32) Vacuum Pressure Sensor Signal circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN OR HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the Vacuum Pressure Sensor harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To 6

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **ISOLATE AND CHECK THE (B33) VACUUM PRESSURE SENSOR RETURN CIRCUIT FOR AN OPEN OR HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the Vacuum Pressure Sensor harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

    Is the resistance below 3.0 Ohms?

    Yes

    - Go To 7

    No

    - Repair the circuit for an open/high resistance.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
7. **ISOLATE AND CHECK THE (B31) VACUUM PRESSURE SENSOR SUPPLY CIRCUIT FOR A SHORT TO THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT**
    1. The ignition must be off when checking for a short between circuits.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

    NOTE: There should be no continuity between the circuits being tested.

    Is there continuity between the circuits?

    Yes

    - Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 8
8. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (B33) VACUUM PRESSURE SENSOR RETURN CIRCUIT**
    1. The ignition must be off when checking for a short between circuits.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

    NOTE: There should be no continuity between the circuits being tested.

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 9

9. **REPLACE THE VACUUM PRESSURE SENSOR AND TEST FOR DTCS**
    1. Turn the ignition off.
    2. Replace the Vacuum Pressure Sensor.
    3. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    4. Turn the ignition on.
    5. With the scan tool, read the DTCs.

    Did the DTC return?

    Yes

    - Go To 10

    No

    - Test complete.
10. **CHECK RELATED HARNESS CONNECTIONS**
    1. Turn the ignition off.
    2. Disconnect the ABS Module harness connector.
    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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

8. Connect the 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.

WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
11. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- The wiring or poor connection problem has been repaired.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C1082-02-VACUUM PRESSURE SENSOR - GENERAL SIGNAL FAILURE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives outputs from the vacuum pressure sensor which measures the differential pressure between the vacuum chamber and the atmosphere.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Engine running for 5 minutes.

SET CONDITION

- Brake Pedal applied.
- Anti-Lock Brake System (ABS) Module detects that the Vacuum Sensor Signal is out of range based on other vehicle conditions.
- Vacuum Sensor Signal indicating no signal change.
- Vacuum Sensor Signal indicating signal rapid change.
- Vacuum Sensor Signal indicating unexpected change.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE VACUUM PRESSURE SENSOR BRAKE VACUUM BOOSTER
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.
   8. Press the brake pedal firmly and release three times, holding for two seconds each time.
   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK THE VACUUM PRESSURE SIGNAL**
   1. Start the engine.
   2. With the scan tool, under "Data Display" view and record the vacuum pressure signal with no brake applied.
   3. Turn the engine off.
   4. Turn the ignition on.
   5. With the scan tool, under "Data Display" view and record the vacuum pressure with no brake applied.

      Is the vacuum pressure signal staying consistent?

      Yes

      - Go To 3

No

- Go To 4

3. **MEASURE THE VACUUM PRESSURE SIGNAL**
    1. Start the engine.
    2. Measure the vacuum pressure while pressing the brake pedal rapidly several times.
    3. Turn the engine off.
    4. Turn the ignition on.

    Does the vacuum drop below 50 mbar (7 psi)?

    Yes

    - Go To 5

    No

    - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

4. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN OR HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the Vacuum Pressure Sensor harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

   Is the resistance below 3.0 Ohms?

   Yes

   - Go To 5

   No

   - Repair the circuit for an open/high resistance.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

5. **CHECK FOR A VACUUM PRESSURE SIGNAL CHANGE**
    1. Turn the ignition on.
    2. Remove the Vacuum Pressure Sensor from the Brake Booster.
    3. Connect a vacuum pump to the Vacuum Pressure Sensor.
    4. Apply vacuum to the Vacuum Pressure Sensor.
    5. With the scan tool, under "Data Display" view the vacuum pressure and watch for signal change.

    Is the vacuum pressure signal changing on the scan tool as vacuum is being applied?

    Yes

    - Go To 6

No

- Replace the Vacuum Pressure Sensor.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **CHECK THE BRAKE BOOSTER CHECK VALVE FOR CORRECT OPERATION**
    1. Remove the Brake Booster Check Valve.
    2. Apply vacuum to the booster side of the check valve.

    Is the Brake Booster Check Valve holding vacuum?

    Yes

    - Go To 7

    No

    - Replace the Brake Booster Check Valve.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
7. **CHECK THE POWER BRAKE BOOSTER FOR CORRECT OPERATION**
    1. Install the Brake Booster Check Valve.
    2. Connect a vacuum pump to the Brake Booster Check Valve.
    3. Using the vacuum pump, apply vacuum to the Brake Booster.

    Is the Power Brake Booster holding vacuum?

    Yes

    - Go To 8

    No

    - Replace the Power Brake Booster in accordance with the Service Information. Refer to **BOOSTER, POWER BRAKE, REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
8. **CHECK THE VEHICLE FOR AN ELECTRIC VACUUM PUMP**
    1. Verify the vehicle is equipped with an electric vacuum pump.

    Is the vehicle is equipped with a electric vacuum pump?

    Yes

    - Replace the Electric Vacuum Pump in accordance with the Service Information. Refer to **PUMP, ELECTRIC VACUUM, REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 9
9. **REPLACE THE VACUUM PRESSURE SENSOR AND TEST FOR DTCS**
    1. Turn the ignition off.
    2. Replace the Vacuum Pressure Sensor.
    3. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    4. With the scan tool, read the DTCs.

    Does the DTC remain active?

Yes

- Go To 10

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time.

10. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
       - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .
- Test complete.

C1082-2F-VACUUM PRESSURE SENSOR - SIGNAL ERRATIC

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives outputs from the vacuum pressure sensor which measures the differential pressure between the vacuum chamber and the atmosphere.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Vacuum Sensor Signal voltage level is below 0.1 volt for 100 msec.
- Vacuum Sensor Signal indicating voltage above 3.5 volts for 100 msec.

DEFAULT ACTION

- Electronic Stability Control (ESC) System indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
VACUUM PRESSURE SENSOR SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
VACUUM PRESSURE SENSOR RETURN CIRCUIT OPEN OR HIGH RESISTANCE
VACUUM PRESSURE SENSOR SUPPLY CIRCUIT SHORTED TO VACUUM PRESSURE SENSOR SIGNAL CIRCUIT
VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VACUUM PRESSURE SENSOR RETURN CIRCUIT
VACUUM PRESSURE SENSOR
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.

5. With the scan tool, erase ABS DTCs.
6. Turn the ignition off.
7. Start the Vehicle.
8. Press the brake pedal firmly and release.
9. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **ISOLATE AND CHECK THE (B31) VACUUM PRESSURE SENSOR SUPPLY CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
   1. The ignition must be off when checking the continuity of a circuit.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
   4. Connect one lead of the DVOM to the circuit being tested at the Vacuum Pressure Sensor harness connector.
   5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

   Is the resistance below 3.0 Ohms?

   Yes

   - Go To 3

   No

   - Repair the circuit for an open/high resistance.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

3. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

   Is there any voltage present?

   Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 4

4. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND**
    1. The ignition must be off when checking a circuit for continuity to ground.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the negative lead of the DVOM to a known good ground.
    4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the Vacuum Pressure Sensor harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To 6

No

- Repair the circuit for an open/high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **ISOLATE AND CHECK THE (B33) VACUUM PRESSURE SENSOR RETURN CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
    1. The ignition must be off when checking the continuity of a circuit.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
    4. Connect one lead of the DVOM to the circuit being tested at the Vacuum Pressure Sensor harness connector.
    5. Connect the other lead to the circuit being tested at the ABS Module harness connector and measure the resistance of the circuit.

    Is the resistance below 3.0 Ohms?

    Yes

    - Go To 7

    No

    - Repair the circuit for an open/high resistance.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
7. **ISOLATE AND CHECK THE (B31) VACUUM PRESSURE SENSOR SUPPLY CIRCUIT FOR A SHORT TO THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT**
    1. The ignition must be off when checking for a short between circuits.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

    NOTE: **There should be no continuity between the circuits being tested.**

    Is there continuity between the circuits?

    Yes

    - Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 8
8. **ISOLATE AND CHECK THE (B32) VACUUM PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (B33) VACUUM PRESSURE SENSOR RETURN CIRCUIT**
    1. The ignition must be off when checking for a short between circuits.
    2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
    3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

    NOTE: **There should be no continuity between the circuits being tested.**

Is there continuity between the circuits?

Yes

- Repair the short between the circuits. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 9

9. **REPLACE THE VACUUM PRESSURE SENSOR AND TEST FOR DTCS**
    1. Replace the Vacuum Pressure Sensor.
    2. Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    3. Turn the ignition on.
    4. With the scan tool, read the DTCs.

    Did the DTC return?

    Yes

    - Go To 10

    No

    - Test complete.
10. **CHECK RELATED HARNESS CONNECTIONS**
    1. Turn the ignition off.
    2. Disconnect the ABS Module harness connector.
    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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    6. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    7. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. Connect the 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.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

10. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
11. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- The wiring or poor connection problem has been repaired.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C121A-09 - STEERING ANGLE SENSOR NOT INITIALIZED - COMPONENT FAILURES

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module detects the Steering angle status from the Steering Column Control Module (SCCM) do not match.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under or over voltage conditions present.

SET CONDITION

- Anti-Lock Brake System (ABS) Module detects a incorrect voltage signal from the Steering Column Control Module (SCCM).
- Steering Angle Sensor (SAS) has not been properly initialized.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM) DTCS
TERMINAL/CONNECTOR/WIRING HARNESS DAMAGE
STEERING COLUMN CONTROL MODULE (SCCM)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   6. Test drive the vehicle by turning the vehicle left and right in a curving manner at a velocity above 50 km/h (30 mph).
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any SCCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3
3. **REPLACE THE STEERING ANGLE SENSOR (SAS) AND TEST FOR DTCS**

   NOTE: **The Steering Angle Sensor (SAS) is internal to the Steering Column Control Module (SCCM).**

   1. Replace the Steering Column Control Module (SCCM) in accordance with the Service Information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
      1. Connect the component and Electronic Control Unit (ECU) harness connectors.

    2. Turn the ignition on.
    3. With the scan tool, erase DTCs.
    4. Using the Environmental Data or When Monitored Conditions above, operate the vehicle within the conditions that set the DTC.

   WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

2. Test drive the vehicle by turning the vehicle left and right in a curving manner at a velocity above 50 km/h (30 mph).
3. With the scan tool, read the DTCs.

   Did the DTC return?

   Yes

   - Go To 4

   No

   - Replacing the faulty component repaired the fault.

4. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

       Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

       WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.

10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Test complete.

C121C-00-TORQUE REQUEST SIGNAL DENIED

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module monitors the Powertrain Control Module (PCM) and sets this DTC when the PCM indicates that torque request is not honored.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.
- Engine running.

SET CONDITION

- Powertrain Control Module (PCM) informed the Anti-lock Brake System (ABS) Module that it will not allow the engine torque increase or reduction requests.
- Engine is above 360 rpm.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) DTCS
EXCESSIVE LOAD ON ENGINE
POWERTRAIN CONTROL MODULE (PCM)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

    NOTE: **This DTC must be active for the results of this test to be valid and this DTC may set while driving under severe load conditions.**

1. Turn the ignition on.
2. With the scan tool, read ABS DTCs and record on the repair order.
3. With the scan tool, read and record Freeze Frame information.
4. With the scan tool, erase DTCs.
5. Cycle the ignition switch from off to on.
6. Start the engine and raise the engine RPM to 2500 for seven seconds.
7. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any PCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

      No

      - Go To 3
3. **CHECK ENGINE IDLE**
   1. Allow the engine to idle.

      Does the engine run rough at idle?

      Yes

      - Go To 4

      No

      - Go To 5
4. **REPLACE THE POWERTRAIN CONTROL MODULE (PCM) AND TEST FOR DTCS**
   1. Disconnect the PCM harness connectors.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found. If no problems were found, Replace the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .

5. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

6. Test drive the vehicle at speeds above 40 k/mh (25 mph).
7. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Go to 5

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

5. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.
   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C1239-00-EMISSION ROLLS TEST ACTIVE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module has been place in emission rolls mode.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module has been requested to activate the Emission Rolls Test.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator lamp illuminated.
- Electronic Stability Control (ESC) System indicator lamp illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
EMISSION ROLLS TEST ENABLED
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
BODY CONTROL MODULE (BCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

    NOTE: This DTC must be active for the results of this test to be valid.

    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
    5. With the scan tool, erase ABS DTCs.
    6. Cycle the ignition from off to on.
    7. Press the ESC switch from off to on.
    8. With the scan tool, read ABS DTCs.

        Is the DTC active?

        Yes

        - Go To 2

        No

        - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
        - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **EMISSION ROLLS TEST ENABLED**
    1. Turn the ignition on.
    2. Using the scan tool, under "Miscellaneous Functions" Perform the ABS Module Initialization routine.
    3. With the scan tool, erase the DTCs.
    4. Turn the ignition off and wait ten seconds.
    5. Cycle the ignition from off to on.
    6. Press the ESC switch from off to on.
    7. Using the scan tool, the read DTCs in ABS.

        Is the DTC active?

        Yes

        - Go To 3

        No

        - Test complete, the condition or conditions that originally set this DTC are not present at this time.
3. **REPLACE THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE AND TEST FOR DTCS**
    1. Disconnect the ABS Module harness connector.

2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. 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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found. If no problems were found, replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
5. With the scan tool, erase DTCs.
6. Cycle the ignition from off to on.
7. Press the ESC switch from off to on.
8. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Go to 4

    No

    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

4. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the Body Control Module (BCM) harness connectors.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the BCM harness connectors. Be certain that the harness connectors are fully seated and the connector locks are fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Body Control Module (BCM) in accordance with the Service Information. Refer to **MODULE, BODY CONTROL (BCM), REMOVAL AND INSTALLATION** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C123B-4B-ESP SYSTEM CONTROL TOO LONG - OVER TEMPERATURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) has been in control of the braking system for a longer time than the allowable threshold value causing the ABS Module internal and or external temperature to exceed the set values.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-Lock Brake System (ABS) Module indicates excessive valve control.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
AGGRESSIVE DRIVING MANEUVERS, MISMATCHED TIRES, FRONT END ALIGNMENT
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE WHEEL SPEED SENSOR (WSS) RELATED DTCS
OCCUPANT RESTRAINT CONTROLLER (ORC) DTCS
STEERING COLUMN CONTROL MODULE (SCCM) DTCS
TCS, ESP CONTROL TOO LONG OR TO FREQUENT

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **Check with customer for unusual driving terrain (e.g. mud, snow, ice) or aggressive driving maneuvers at the time of set condition.**

   NOTE: **Let the vehicle sit for ten minutes before proceeding with this diagnostic procedure.**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Turn the ignition off.
   7. Start the Vehicle.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   8. Test drive the vehicle above 40 km/h (25 mph) for ten minutes.

      NOTE: **Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.**

   9. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform ABS INTERMITTENT CONDITION diagnostic procedure. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR WHEEL SPEED SENSOR (WSS) RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any other WSS related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING** .

No

- Go To 3

3. **CHECK FOR OCCUPANT RESTRAINT CONTROLLER (ORC) OR COMMUNICATION RELATED DTCS**
    1. Refer to the recorded DTCs.

    Are there any ORC or Communication related DTCs active?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

    No

    - Go To 4

4. **CHECK FOR STEERING COLUMN CONTROL MODULE (SCCM) OR COMMUNICATION RELATED DTCS**
    1. Refer to the recorded DTCs.

    Are there any SCCM or Communication related DTCs active?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

    No

    - Go To 5

5. **INSPECT THE WHEEL ALIGNMENT, STEERING COLUMN AND INTERMEDIATE SHAFT FOR INCORRECT INSTALLATION OR DAMAGE**

    NOTE: **If available, check the vehicle repair history for collision damage.**

    1. Turn the ignition off.
    2. Check for mismatched tires.
    3. Inspect the vehicle for proper wheel alignment.
    4. Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.
    5. Inspect the steering column and intermediate shaft for damage.

    Were any problems found?

    Yes

    - Repair as necessary.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Go To 6

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).

3. Disconnect the related component harness connectors.
4. 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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

    WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C1246-1C-VACUUM PRESSURE SENSOR SUPPLY - CIRCUIT VOLTAGE OUT OF RANGE

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) monitors the supply voltage output to the Vacuum Pressure Sensor and the Brake Pedal Position (BPP) Sensor.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Vacuum Pressure Sensor Supply circuit voltage feedback level is below 4.85 volts for more than 50msec.
- Vacuum Pressure Sensor Supply circuit voltage feedback level is above 5.15 volts for more than 50msec.
- Brake Pedal Position Sensor Feed circuit voltage feedback level is below 4.85 volts for more than 50msec.
- Brake Pedal Position Sensor Feed circuit voltage feedback level is above 5.15 volts for more than 50msec.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
VACUUM PRESSURE SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
VACUUM PRESSURE SENSOR SUPPLY CIRCUIT SHORTED TO GROUND
BRAKE PEDAL POSITION SENSOR FEED CIRCUIT SHORTED TO VOLTAGE
BRAKE PEDAL POSITION SENSOR FEED CIRCUIT SHORTED TO GROUND
BRAKE PEDAL POSITION (BPP) SENSOR
VACUUM PRESSURE SENSOR (VPS)
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **This DTC must be active for the results of this test to be valid.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **ISOLATE AND CHECK THE (B31) VACUUM PRESSURE SENSOR SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Turn the ignition on.
   4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

   Is there any voltage present?

   Yes

   - Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 3

3. **ISOLATE AND CHECK THE (B31) VACUUM PRESSURE SENSOR SUPPLY CIRCUIT FOR A SHORT TO GROUND**
   1. The ignition must be off when checking a circuit for continuity to ground.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Vacuum Pressure Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Connect the negative lead of the DVOM to a known good ground.
   4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

   NOTE: **There should be no continuity between ground and the circuit being tested.**

   Is there continuity between ground and the circuit being tested?

   Yes

   - Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Go To 4

4. **ISOLATE AND CHECK THE (B237) BRAKE PEDAL POSITION SENSOR FEED CIRCUIT FOR A SHORT TO VOLTAGE**
   1. Turn the ignition off.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Brake Pedal Position Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.

3. Turn the ignition on.
4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 5

5. **ISOLATE AND CHECK THE (B237) BRAKE PEDAL POSITION SENSOR FEED CIRCUIT FOR A SHORT TO GROUND**
   1. The ignition must be off when checking a circuit for continuity to ground.
   2. Isolate the circuit by disconnecting the ABS Module harness connector and the Brake Pedal Position Sensor harness connector. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
   3. Connect the negative lead of the DVOM to a known good ground.
   4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: **There should be no continuity between ground and the circuit being tested.**

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **CHECK THE VACUUM PRESSURE SENSOR (VPS) AND TEST FOR DTCS**
   1. Turn the ignition off.
   2. Connect the Brake Pedal Position Sensor harness connector.
   3. Disconnect the Vacuum Pressure Sensor harness connector.
   4. Turn the ignition on.
   5. With the scan tool, erase the ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read the ABS DTCs.

   NOTE: **Discard all other ABS DTCs that may be active at this time**

   Did the DTC C1246-1C return?

   Yes

- Go To 7

No

- Replace the Vacuum Pressure Sensor.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **CHECK THE BRAKE PEDAL POSITION (BPP) SENSOR AND TEST FOR DTCS**
   1. Turn the ignition off.
   2. Connect the Vacuum Pressure Sensor harness connector.
   3. Disconnect the Brake Pedal Position Sensor harness connector.
   4. Turn the ignition on.
   5. With the scan tool, erase the ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read the ABS DTCs.

   NOTE: **Discard all other ABS DTCs that may be active at this time**

   Did the DTC C1246-1C return?

   Yes

   - Go To 8

   No

   - Replace the Brake Pedal Position (BPP) Sensor. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

8. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C1252-92-VACUUM PUMP CONTROL CIRCUIT - PERFORMANCE OR INCORRECT OPERATION

THEORY OF OPERATION

The electronically controlled Vacuum Pump system is installed to provide supplemental vacuum to the Brake Booster when the engine vacuum supply is low. This system maintains a consistent brake pedal feel under all driving conditions. The Vacuum Pump is connected to the engine and the Brake Booster through a series of hoses and one-way flow check valves. A Vacuum Pressure Sensor mounted in the Brake Booster is hard wired to the Anti-lock Brake System (ABS) Module. The Vacuum Pressure Sensor signal information is then sent to the Powertrain Control Module (PCM) over the CAN Bus. The PCM energizes the Vacuum Pump Relay with a Low Side Driver (LSD) to control the Vacuum Pump operation and maintain the Brake Booster vacuum.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Powertrain Control Module (PCM) has indicated there is a Vacuum Pump failure.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) DTCS
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE VACUUM PRESSURE SENSOR RELATED DTCS
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data.
   5. With the scan tool, erase ABS DTCs.
   6. Start the engine.
   7. Press the brake pedal firmly and release.
   8. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any PCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

      No

      - Go To 3
3. **CHECK FOR ABS VACUUM PRESSURE SENSOR RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any other ABS Vacuum related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 4
4. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).

3. Disconnect the related component harness connectors.
4. 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.
    - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

    WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C2100-16-BATTERY VOLTAGE LOW - CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives it's fused battery power and fused ignition feed input from the Power Distribution Center (PDC). These power inputs are used to power up the ABS Module Supply, Pump, and Valves of the controller. The ABS Module uses the chassis for its Ground. The ABS Module continuously monitors these inputs for voltage and ground.

WHEN MONITORED

- Continuously.

SET CONDITION

- Battery voltage below 9 volts with engine running for longer than five seconds.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) OR RELATED CHARGING SYSTEM DTCS
FUSE
POWER CIRCUITS OPEN OR HIGH RESISTANCE
GROUND CIRCUITS OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **If DTC C212A-16 is present, perform the diagnostic procedure for this DTC first before continuing.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Start the engine and allow it to idle for 5 minutes.
   7. With the scan tool, read ABS DTCs.

   Did the DTC return?

   Yes

   - Go To 2

   No

   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS**
    1. Refer to the recorded DTCs.

       Are there any PCM or related Charging System DTCs active or pending?

       Yes

       - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

       No

       - Go To 3
3. **CHECK THE F100 (30A) FUSE**
    1. Turn the ignition on.
    2. With a 12-volt test light connected to ground, check the F100 (30A) Fuse for power.

   Does the test light illuminate brightly?

   Yes

   - Go To 4

   No

   - If the related fuse is open, check the circuit for a short to ground
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
4. **CHECK THE (A200) FUSED (B+) CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the 12.0 volt supply circuit.
    2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
    3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
    4. Make sure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
    5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

   NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

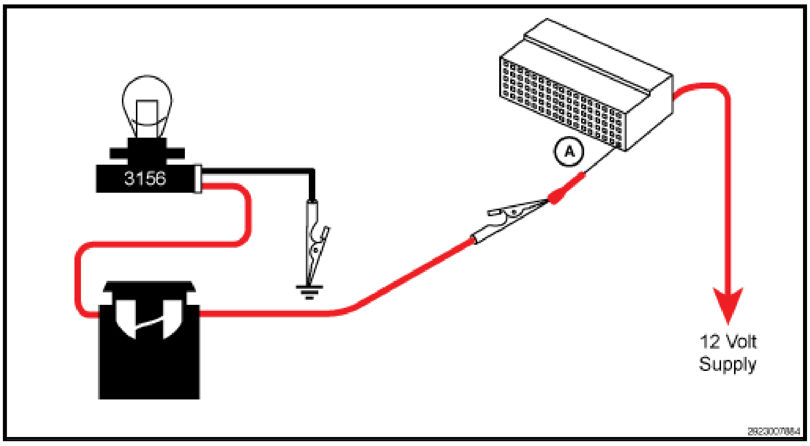
   NOTE: **A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a**

circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To 5

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

5. **CHECK THE (Z907) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**

1. Disconnect the ABS Module harness connector to isolate the ground circuit.
2. Connect the positive lead of the load test tool to the positive side of the Battery.
3. Connect the negative lead of the load test tool to the (Z907) ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

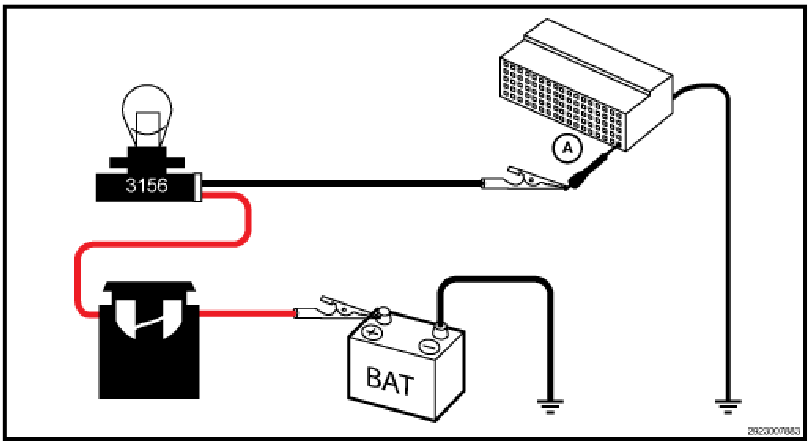
NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to** **CIRCUIT LOAD TESTING PROCEDURES .**

NOTE: **A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE: **Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- **1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
- **2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**
- **3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **CIRCUIT LOAD TESTING PROCEDURES .**



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 6

No

- Repair the (Z907) ground circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

6. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION .
    - Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

    No

    - The wiring or poor connection problem has been repaired.
    - Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

C2101-17-BATTERY VOLTAGE HIGH - CIRCUIT VOLTAGE ABOVE THRESHOLD

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives it's fused battery power and fused ignition feed input from the Power Distribution Center (PDC). These power inputs are used to power up the ABS Module Supply, Pump, and Valves of the controller. The ABS Module uses the chassis for its Ground. The ABS Module continuously monitors these inputs for voltage and ground.

WHEN MONITORED

- Continuously.

SET CONDITION

- Battery voltage is above 17.4 volts with ignition on.

DEFAULT ACTION

- Anti-lock Brake System (ABS) lamp illuminated.
- Electronic Stability Control (ESC) System lamp illuminated.
- Red Brake Warning indicator lamp illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) CHARGING SYSTEM DTCS PRESENT
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: **If DTC C212A-17 is present, perform the diagnostic procedure for this DTC first before continuing.**

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. With the scan tool, read ABS DTCs.

      Did the DTC return?

      Yes

      - Go To 2

      No

      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS**
   1. Refer to the recorded DTCs.

      Are there any PCM or Charging related DTCs active or pending?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

      No

      - Go To 3
3. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- The wiring or poor connection problem has been repaired.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C211B-92-IGNITION RUN/START INPUT CIRCUIT - PERFORMANCE OR INCORRECT OPERATION

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives it's fused battery power and fused ignition feed input from the Power Distribution Center (PDC). These power inputs are used to power up the ABS Module Supply, Pump, and Valves of the controller. The ABS Module uses the chassis for its Ground. The ABS Module continuously monitors these inputs for voltage and ground.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- The Anti-lock Brake System (ABS) Module Ignition Status does not match the state of the Ignition Input.

DEFAULT ACTION

- Anti-lock Brake System (ABS) Module indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) DTCS
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE DTCS
FUSE
FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT SHORT TO VOLTAGE
FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to ABS INTERMITTENT CONDITION .
2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any PCM or Communication related DTCs active?

      Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

No

- Go To 3

3. **CHECK FOR ANTI-LOCK BRAKE SYSTEM (ABS) MODULE OR VOLTAGE RELATED DTCS**
    1. Refer to the recorded DTCs.

    Are there any ABS Module or Voltage related DTCs active?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

    No

    - Go To 4

4. **CHECK THE F34 (10A) FUSE**
    1. Turn the ignition on.
    2. Using a 12-volt test light connected to ground, check the F34 (10A) fuse for power.

   Is the fuse good?

   Yes

   - Go To 5

   No

   - If the related fuse is open, check the (F941) Fused Ignition Switch Output (RUN/START) circuit for a short to ground.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

5. **CHECK THE (F941) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT FOR VOLTAGE AT THE ABS MODULE HARNESS CONNECTOR**
    1. Turn the ignition off.
    2. Disconnect the ABS Module harness connector
    3. Set the DVOM to measure DC voltage.
    4. Connect the negative lead of the DVOM to a known good ground.
    5. With the positive lead of the DVOM, measure the voltage on the (F941) Fused Ignition Switch Output (RUN/START) circuit at the ABS Module harness connector

   NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

   Is there any voltage present?

   Yes

   - Repair the (F941) Fused Ignition Switch Output (RUN/START) circuit for a short to voltage.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Go To 6

6. **CHECK THE (F941) FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the 12.0 volt supply circuit.
    2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
    3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
    4. Make sure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
    5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

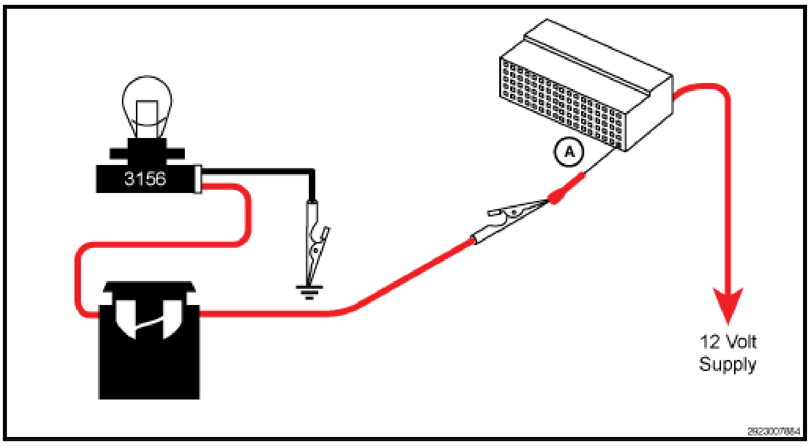
NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

NOTE: **A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE: **Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- **1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
- **2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**
- **3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 7

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C212A-16-SYSTEM VOLTAGE LOW - CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete BRAKE SYSTEM wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives it's fused battery power and fused ignition feed input from the Power Distribution Center (PDC). These power inputs are used to power up the ABS Module Supply, Pump, and Valves of the controller. The ABS Module uses the chassis for its Ground. The ABS Module continuously monitors these inputs for voltage and ground.

WHEN MONITORED

- Continuously.

SET CONDITION

- System voltage has dropped below 9.4 volts for more than five seconds.
- Body Control Module (BCM) system voltage CAN message indicates a low voltage condition.

DEFAULT ACTION

- Anti-lock Brake System (ABS) lamp illuminated.
- Electronic Stability Control (ESC) System lamp illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) OR RELATED CHARGING SYSTEM DTCS
BODY CONTROL MODULE (BCM) OR RELATED COMMUNICATION DTCS

Possible Causes
FUSES
BATTERY
POWER CIRCUITS OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
    5. With the scan tool, erase ABS DTCs.
    6. Start the engine and allow it to idle for 5 minutes.
    7. With the scan tool, read ABS DTCs.

        Did the DTC return?

        Yes

        - Go To 2

        No

        - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
        - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS**
    1. Refer to the recorded DTCs.

        Are there any PCM or related Charging System DTCs active or pending?

        Yes

        - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

        No

        - Go To 3
3. **CHECK FOR BODY CONTROL MODULE (BCM) DTCS**
    1. Refer to the recorded DTCs.

        Are there any BCM or related Communication DTCs active or pending?

        Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

No

- Go To 4

4. **CHECK THE CONDITION OF THE BATTERY**
    1. Use the (special tool #GR8-1220KIT-CHRY, AGM Battery Tester/Charger Station)or equivalent to load test the Battery.

    Did the Battery pass or fail?

    Passed

    - Go To 5

    Failed

    - Perform the appropriate repair according to the Battery tester.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
5. **CHECK THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE SUPPLY FUSES**
    1. Turn the ignition on.
    2. With a 12-volt test light connected to ground, check the F106 (40A), F100 (30A) and F34 (10A) Fuses for power.

    Does the test light illuminate brightly?

    Yes

    - Go To 6

    No

    - If the related fuse is open, check the circuit for a short to ground
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
6. **CHECK THE (A107) FUSED (B+), (A200) FUSED (B+) AND (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUITS FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the 12.0 volt supply circuit.
    2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the ABS Module harness connector (A). **Note:** refer to the diagram below.
    3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
    4. Make sure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
    5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for**

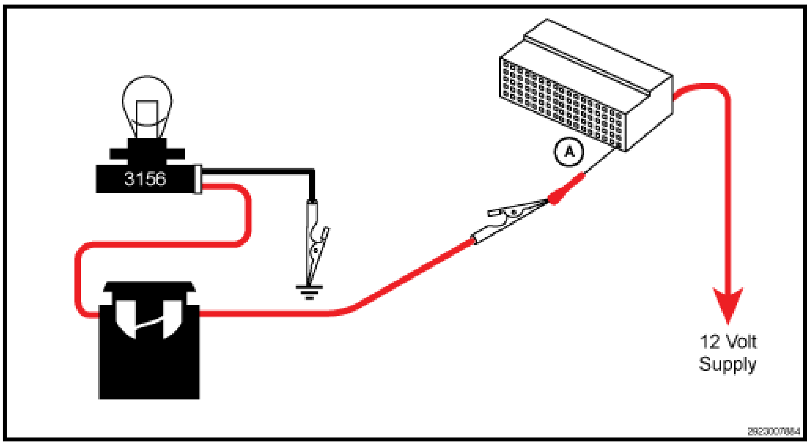
information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To 7

No

- Repair the 12.0 volt circuits for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

7. **CHECK THE (Z907) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the ABS Module harness connector to isolate the ground circuit.
    2. Connect the positive lead of the load test tool to the positive side of the Battery.
    3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
    4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

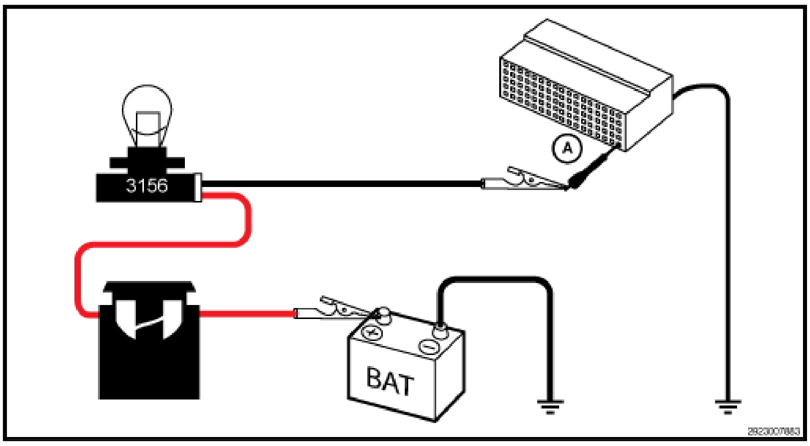
NOTE: **Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

NOTE: **A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE: **Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

- **1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
- **2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**
- **3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



NOTE: **When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.**

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Go To 8

No

- Repair the ground circuit for an open or high resistance.
- Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

8. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase ABS DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- The wiring or poor connection problem has been repaired.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C212A-17-SYSTEM VOLTAGE HIGH - CIRCUIT VOLTAGE ABOVE THRESHOLD

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module receives it's fused battery power and fused ignition feed input from the Power Distribution Center (PDC). These power inputs are used to power up the ABS Module Supply, Pump, and Valves of the controller. The ABS Module uses the chassis for its Ground. The ABS Module continuously monitors these inputs for voltage and ground.

WHEN MONITORED

- Continuously.

SET CONDITION

- System voltage is above 17.4 volts for more than 5 seconds.
- Body Control Module (BCM) system voltage CAN message indicates a high voltage condition.

DEFAULT ACTION

- Anti-lock Brake System (ABS) lamp illuminated.
- Electronic Stability Control (ESC) System lamp illuminated.
- Red Brake Warning indicator lamp illuminated.
- ABS is disabled.
- ESC is disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) OR RELATED CHARGING SYSTEM DTCS
BODY CONTROL MODULE (BCM) OR RELATED COMMUNICATION DTCS
BATTERY

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**
    1. Perform any Service Bulletins that may apply.
    2. Turn the ignition on.
    3. With the scan tool, read ABS DTCs and record on the repair order.
    4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
    5. With the scan tool, erase ABS DTCs.
    6. Start the engine and allow it to idle for 5 minutes.
    7. With the scan tool, read ABS DTCs.

    Did the DTC return?

    Yes

    - Go To 2

    No

    - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS**
    1. Refer to the recorded DTCs.

    Are there any PCM or related Charging System DTCs active or pending?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

    No

    - Go To 3
3. **CHECK FOR BODY CONTROL MODULE (BCM) DTCS**
    1. Refer to the recorded DTCs.

    Are there any BCM or related Communication DTCs active or pending?

    Yes

    - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

    No

    - Go To 4
4. **CHECK THE CONDITION OF THE BATTERY**

1. Use the (special tool #GR8-1220KIT-CHRY, AGM Battery Tester/Charger Station)or equivalent to load test the Battery.

   Did the Battery pass or fail?

   Passed

   - Go To 5

   Failed

   - Perform the appropriate repair according to the Battery tester.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

5. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase ABS DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

       - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL**

AND INSTALLATION .

- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

No

- The wiring or poor connection problem has been repaired.
- Perform ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

C2200-41-ANTI-LOCK BRAKE MODULE INTERNAL - GENERAL CHECKSUM FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is reporting an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detected an internal error.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- Red Brake Warning indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

1. Perform any Service Bulletins that may apply.
2. The Anti-lock Brake System (ABS) Module is reporting internal errors.

   NOTE: **Before continuing, check the Anti-lock Brake System (ABS) Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

3. Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

   Were there any problems found?

   Yes

- Repair as necessary.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C2200-44-ANTI-LOCK BRAKE MODULE INTERNAL - DATA MEMORY FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is reporting an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detected an internal error.

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

1. Perform any Service Bulletins that may apply.
2. The Anti-lock Brake System (ABS) Module is reporting internal errors.

   NOTE: **Before continuing, check the Anti-lock Brake System (ABS) Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

3. Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

   Were there any problems found?

   Yes

- Repair as necessary.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C2200-45-ANTI-LOCK BRAKE MODULE INTERNAL - PROGRAM MEMORY FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is reporting an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detected an internal error.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- Red Brake Warning indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

1. Perform any Service Bulletins that may apply.
2. The Anti-lock Brake System (ABS) Module is reporting internal errors.

NOTE: **Before continuing, check the Anti-lock Brake System (ABS) Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

3. Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C2200-46-ANTI-LOCK BRAKE MODULE INTERNAL - CALIBRATION / PARAMETER MEMORY FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is reporting an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detected an internal error.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- Red Brake Warning indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

1. Perform any Service Bulletins that may apply.
2. The Anti-lock Brake System (ABS) Module is reporting internal errors.

NOTE: **Before continuing, check the Anti-lock Brake System (ABS) Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

3. Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

   Were there any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C2200-47-ANTI-LOCK BRAKE MODULE INTERNAL - WATCHDOG / SAFTEY AUC FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is reporting an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detected an internal error.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- Red Brake Warning indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

1. Perform any Service Bulletins that may apply.
2. The Anti-lock Brake System (ABS) Module is reporting internal errors.

NOTE: Before continuing, check the Anti-lock Brake System (ABS) Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

3. Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

   Were there any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

C2200-48-ANTI-LOCK BRAKE MODULE INTERNAL - SUPERVISION SOFTWARE FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is reporting an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detected an internal error.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- Red Brake Warning indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

1. Perform any Service Bulletins that may apply.

2. The Anti-lock Brake System (ABS) Module is reporting internal errors.

NOTE: Before continuing, check the Anti-lock Brake System (ABS) Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

3. Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

   Were there any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

   No

   - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION .
   - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

C2200-49-ANTI-LOCK BRAKE MODULE INTERNAL - INTERNAL ELECTRONIC FAILURE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module is reporting an internal fault.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module detected an internal error.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- Red Brake Warning indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

1. Perform any Service Bulletins that may apply.
2. The Anti-lock Brake System (ABS) Module is reporting internal errors.

   NOTE: Before continuing, check the Anti-lock Brake System (ABS) Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

3. Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

   Were there any problems found?

   Yes

   - Repair as necessary.
   - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

   No

   - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION .
   - Perform the ABS VERIFICATION TEST. Refer to ABS VERIFICATION TEST .

C2202-00-ORIGINAL VIN MISMATCH / MISSING

THEORY OF OPERATION

The Anti-lock Brake System (ABS) is not detecting a Vehicle Identification Number (VIN) or the VIN being broadcast from the Powertrain Control Module (PCM) does not match what is programed in the ABS module.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Current Vehicle Identification Number (VIN) in Anti-lock Brake System (ABS) Module does not match the broadcast VIN.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE NOT INITIALIZED
POWERTRAIN CONTROL MODULE (PCM) VIN NOT PROGRAMMED

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any PCM or Communication related DTCs active?

      Yes

      - Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

      No

      - Go To 3
3. **WRONG VIN PROGRAMMED IN PCM**
   1. Turn the ignition on.
   2. With the scan tool, read the VIN in the PCM.
   3. Compare VIN in the PCM to the vehicle VIN.

      Is the correct VIN programmed in the PCM?

Yes

- Go To 4

No

- Program the correct VIN into the PCM. Follow the VIN programing procedure in the PCM/ECM reprogramming procedure. Refer to the appropriate service information .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

4. **INITIALIZE ABS MODULE**
    1. Perform any Service Bulletins that may apply.

    NOTE: **When performing the ABS Initialization routine, the vehicle temperature must be above 10B°C (50B°F).**

    2. With the scan tool, under "Miscellaneous Functions" run the ABS Initialization routine.
    3. Turn the ignition off.
    4. Cycle the ignition from off to on.
    5. Wait ten seconds.
    6. With the scan tool, read DTCs.

    Does the DTC remain active?

    Yes

    - Go To 5

    No

    - Test complete, the condition or conditions that originally set this DTC are not present at this time.

5. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

    Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.

6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: To avoid possible serious or fatal injury, check brake capability is available before road testing.

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C2206-00-VEHICLE CONFIGURATION MISMATCH

NOTE: If the BCM has been serviced make sure that the Restore Vehicle Configuration is performed before continuing with this diagnostic procedure.

THEORY OF OPERATION

The Anti-lock Brake System (ABS) is not matching the vehicle configuration information stored in the Powertrain Control Module (PCM).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- The vehicle configuration data has not been learned or has changed from the Powertrain Control Module (PCM) broadcast over the CAN C Bus.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE VEHICLE IDENTIFICATION NUMBER (VIN) RELATED DTCS
POWERTRAIN CONTROL MODULE (PCM) DTCS
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE NOT INITIALIZED
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.
   6. Cycle the ignition from off to on.
   7. With the scan tool, read ABS DTCs.

      Is the DTC active?

      Yes

      - Go To 2

      No

      - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR ABS VIN RELATED DTCS**
   1. Refer to the recorded DTCs.

      Are there any other ABS VIN related DTCs active?

      Yes

      - Perform the applicable diagnostic procedure(s). Refer to **DIAGNOSIS AND TESTING** .

      No

      - Go To 3
3. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR COMMUNICATION RELATED DTCS**
   1. Refer to the recorded DTCs.

Are there any PCM or Communication related DTCs active?

Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to the appropriate service information .

No

- Go To 4

4. **PERFORM THE ABS INITIALIZATION ROUTINE**
    1. Park the vehicle on level ground.
    2. Turn the ignition on.
    3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

    Was the ABS Initialization routine successful?

    Yes

    - Test complete.
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform the ABS Initialization routine again, if still unsuccessful.
    - Go To 5

5. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.

    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

    Did the DTC return?

    Yes

    - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

    No

    - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
    - Test complete.

C220B-00-ABS ACC NOT CALIBRATED

THEORY OF OPERATION

The Anti-lock Brake System (ABS) internal valves and pressure sensors have not been calibrated.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module and Hydraulic Control Unit (HCU) do not match.
- ABS analog valves and pressure sensors have not calibrated.

DEFAULT ACTION

- Anti-lock Brake System (ABS) indicator light illuminated.
- Electronic Stability Control (ESC) indicator light illuminated.
- ABS disabled.
- ESC disabled.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE INITIALIZATION NOT PERFORMED
INTEGRATED CONTROL UNIT (ICU)

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

NOTE: **This DTC must be active for the results of this test to be valid.**

1. Perform any Service Bulletins that may apply.
2. Turn the ignition on.
3. With the scan tool, read ABS DTCs and record on the repair order.
4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
5. With the scan tool, erase ABS DTCs.
6. Cycle the ignition from off to on.
7. With the scan tool, read ABS DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **PERFORM THE ABS INITIALIZATION ROUTINE**
   1. Park the vehicle on level ground.
   2. Turn the ignition on.
   3. With the scan tool, under "Miscellaneous Functions" perform the ABS Initialization routine.

   Was the ABS Initialization routine successful?

   Yes

   - Test complete.
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

   No

   - Perform the ABS Initialization routine again, if still unsuccessful.
   - Go To 3

3. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ABS Module DTCs.

Did the DTC return?

Yes

- Replace the Integrated Control Unit (ICU) in accordance with the Service Information. Refer to **INTEGRATED CONTROL UNIT (ICU), REMOVAL AND INSTALLATION** .
- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

C2212-00-ECU IN-PLANT MODE

THEORY OF OPERATION

The Anti-lock Brake System (ABS) Module has a special diagnostic mode called "in-plant mode" for the ABS Module and the Electric Parking Brake (EPB) portion in the ABS Module. Whenever any ABS Module diagnostic routine is run the ECU will stop normal operation and enter this mode. Partial EPB functions will be disabled while in this mode. This is so that the technician can work on the vehicle knowing that the parking brake will not automatically readjust itself. The Service Electric Parking Brake Message will be displayed on the cluster when this fault is first active.

The following table are the possible conditions present when "In-Plant-Mode":

Anti-lock Brake System (ABS) Module and Electric Park Brake (EPB) Portion of ABS Module are "In-Plant-Mode"	ABS Module is "In-Plant-Mode" and EPB Portion of ABS Module is not "In-Plant-Mode"	ABS Module is not "In-Plant-Mode" and EPB Portion of ABS Module is "In-Plant-Mode"
DTC C2212-00 is Active	DTC C2212-00 is Active	DTC C2212-00 is Active
ABS light flashing	ABS light illuminated	ABS light shows the actual status of the System
Service EPB light illuminated	EPB Warning light shows the actual status of the EPB System	EPB Warning light shows the actual status of the lamp

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- When an Anti-lock Brake System (ABS) Module diagnostic routine was performed.

DEFAULT ACTION

- Anti-lock Brake System (ABS) Module will remain "In-Plant-Mode" until disabled.

POSSIBLE CAUSES

Possible Causes
PLANT MODE ENABLED
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, run and save a vehicle Scan Report.
   4. With the scan tool, read ABS DTCs and record on the repair order.
   5. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   6. With the scan tool, erase ABS DTCs.
   7. Cycle the ignition from off to on.
   8. With the scan tool, read ABS DTCs.

      Did the DTC return?

      Yes

      - Go To 2

      No

      - The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
      - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **PERFORM THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE INITIALIZATION ROUTINE**
   1. Turn the ignition on.
   2. With the scan tool, under "Miscellaneous Function" perform the ABS Initialization routine.

3. With the scan tool, erase the DTCs.
4. Cycle the ignition from off to on.
5. With the scan tool, read ABS DTCs.

   Does the DTC remain active?

   Yes

   - Go To 3

   No

   - Test complete, the condition or conditions that originally set this DTC are not present at this time.
   - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

3. **CHECK RELATED HARNESS CONNECTIONS**
   1. Disconnect the ABS Module harness connector.
   2. Disconnect all related in-line harness connections (if equipped).
   3. Disconnect the related component harness connectors.
   4. 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.
      - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

      Repair any conditions that are found.

   5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
   6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
   7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
   8. With the scan tool, erase DTCs.

      WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

   9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
   10. With the scan tool, read ABS Module DTCs.

       Did the DTC return?

       Yes

- Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

No

- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
- Test complete.

P1DCB-72-REVERSE GEAR SWITCH - ACTUATOR STUCK OPEN

THEORY OF OPERATION

The plausibility of the reverse gear switch is compared to steering angle, yaw, and wheel speed sensor with an input of vehicle speed greater than 40 km/h (25 mph).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- Anti-lock Brake System (ABS) Module is receiving a signal that the reverse gear switch is indicating reverse for longer than 5 seconds while vehicle is moving forward in a curving motion at speeds above 15 km/h (9 mph).

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) DTCS
BODY CONTROL MODULE (BCM) DTCS
BACK UP LAMP SWITCH
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read DTCs and record on the repair order.
   4. With the scan tool, read and record Environmental Data to help identify the conditions in which the DTC was set.
   5. With the scan tool, erase ABS DTCs.

6. Cycle the ignition from off to on.

WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**

7. Test drive the vehicle above in a curving motion 40 km/h (25 mph).

NOTE: **Vehicle must be driven above 40 km/h (25 mph) for set conditions to be meet.**

8. With the scan tool, read ABS DTCs.

Is the DTC active?

Yes

- Go To 2

No

- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS**
    1. Refer to the recorded DTCs.

    Are there any PCM DTCs active or pending?

    Yes

    - Perform the appropriate diagnostic procedures. Refer to the appropriate service information .

    No

    - Go To 3

3. **CHECK FOR BODY CONTROL MODULE (BCM) DTCS**
    1. Refer to the recorded DTCs.

    Are there any BCM or Communication related DTCs active or pending?

    Yes

    - Perform the appropriate diagnostic procedure. Refer to **DIAGNOSIS AND TESTING** .

    No

    - Go To 4

4. **BACKUP LAMP SWITCH**
    1. Turn the ignition off.
    2. Replace the Backup Lamp Switch.
    3. Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .
    4. With the scan tool, read ABS DTCs.

    Does the DTC remain active?

    Yes

    - Go To 5

No

- Test complete.
- Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

5. **CHECK RELATED HARNESS CONNECTIONS**
    1. Disconnect the ABS Module harness connector.
    2. Disconnect all related in-line harness connections (if equipped).
    3. Disconnect the related component harness connectors.
    4. 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.
        - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

        Repair any conditions that are found.
    5. Connect the ABS Module harness connector. Be certain that the harness connector is fully seated and the connector lock is fully engaged.
    6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
    7. Connect the related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
    8. With the scan tool, erase DTCs.

        WARNING: **To avoid possible serious or fatal injury, check brake capability is available before road testing.**
    9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
    10. With the scan tool, read ABS Module DTCs.

        Did the DTC return?

        Yes

        - Replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

        No

        - Perform ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .
        - Test complete.

U0002-00-CAN C BUS OFF PERFORMANCE

NOTE: **This DTC may not be listed in the Body Control Module (BCM) diagnostic procedures. If this DTC is not found in the BCM diagnostic procedures, perform the comparable CAN C Bus diagnostic test, such as CAN C BUS-NO SIGNAL, CAN C BUS OFF PERFORMANCE or CAN C SIGNAL MISSING.**

Perform the comparable CAN C Bus diagnostic tests in the BCM. Refer to **DIAGNOSIS AND TESTING** .

U0100-00-LOST COMMUNICATION WITH ECM/PCM

NOTE: **Perform this diagnostic procedure ONLY when the DTC status is "Active". If the DTC status is "Stored" DO NOT proceed with this diagnostic procedure. A "Stored" DTC will not affect the performance of the vehicle.**

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0101-00-LOST COMMUNICATION WITH TCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0102-00-LOST COMMUNICATION WITH TRANSFER CASE CONTROL MODULE / AWD

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0140-00-LOST COMMUNICATION WITH BODY CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0151-00-LOST COMMUNICATION WITH RESTRAINTS CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0229-00-LOST COMMUNICATION WITH STEERING COLUMN CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0401-00-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0402-00-IMPLAUSIBLE DATA RECEIVED FROM TCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0403-00-IMPLAUSIBLE DATA RECEIVED FROM TCASE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0422-00-IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE

NOTE: **This DTC indicates a communication issue has occurred between the Sending control module (Body Control Module - BCM) and the Reporting control module(s) that set this DTC.**

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0429-00-IMPLAUSIBLE DATA RECEIVED FROM STEERING COLUMN CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0432-00-INVALID DATA RECEIVED FROM MULTI-AXIS ACCELERATION SENSOR MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage between 10.0 and 16.0 volts.
- One valid CAN message received at least once.
- No U0002-00-CAN C Bus Off Performance DTC present.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects an incorrect CAN message from the Occupant Restraint Controller (ORC).

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

NOTE: **The Dynamics Sensor is internal to Occupant Restraints Controller (ORC)**

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE CAN BUS DTCS
OCCUPANT RESTRAINT CONTROLLER (ORC) CAN BUS DTCS
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
OCCUPANT RESTRAINT CONTROLLER (ORC)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **VERIFY DTC IS ACTIVE**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. Cycle the ignition switch from off to on.
   5. With the scan tool, read the DTCs.

   Is the DTC active?

   Yes

   - Go To 2

   No

   - The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
   - Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .
2. **CHECK FOR OCCUPANT RESTRAINTS CONTROLLER (ORC) DTCS**
   1. Refer to the recorded DTCs.

   Are there any ORC DTCs active?

   Yes

   - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

   No

   - Go To 3
3. **CHECK OTHER MODULES FOR CAN BUS DTCS**
   1. Refer to the recorded DTCs.

   Are there any CAN BUS DTCs present?

   Yes

   - Using the schematics as a guide, check the Occupant Restraints Controller (ORC) pins, terminals, and connectors for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Occupant Restraints Controller (ORC) in accordance with the Service Information. Refer to **CONTROLLER, OCCUPANT RESTRAINT (ORC), REMOVAL AND INSTALLATION** .

   No

   - Using the schematics as a guide, check the Anti-lock Brake System (ABS) Module pins, terminals, and connectors for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Anti-lock

Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .

- Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST STANDARD PROCEDURE** .

U0452-00 - INVALID DATA RECEIVED FROM RESTRAINTS CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE STANDARD PROCEDURE** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage between 10.0 and 16.0 volts.
- One valid CAN message received at least once.
- No U0002-00-CAN C Bus Off Performance DTC present.

SET CONDITION

- Anti-lock Brake System (ABS) Module detects an incorrect CAN message from the Occupant Restraint Controller (ORC).

DEFAULT ACTION

- Electronic Stability Control (ESC) indicator light illuminated.

POSSIBLE CAUSES

Possible Causes
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE CAN BUS DTCS
OCCUPANT RESTRAINT CONTROLLER (ORC) CAN BUS DTCS
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
OCCUPANT RESTRAINT CONTROLLER (ORC)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .

DIAGNOSTIC TEST

1. **VERIFY DTC IS ACTIVE**

   NOTE: This DTC must be active for the results of this test to be valid.

   1. Perform any Service Bulletins that may apply.
   2. Turn the ignition on.
   3. With the scan tool, read ABS DTCs and record on the repair order.
   4. Cycle the ignition switch from off to on.
   5. With the scan tool, read the DTCs.

   Is the DTC active?

   Yes

- Go To 2

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform the ABS-INTERMITTENT CONDITION TEST. Refer to **ABS INTERMITTENT CONDITION** .

2. **CHECK FOR OCCUPANT RESTRAINTS CONTROLLER (ORC) DTCS**
   1. Refer to the recorded DTCs.

   Are there any ORC DTCs active?

   Yes

   - Perform the appropriate diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** .

   No

   - Go To 3
3. **CHECK OTHER MODULES FOR CAN BUS DTCS**
   1. Refer to the recorded DTCs.

   Are there any CAN BUS DTCs present?

   Yes

   - Using the schematics as a guide, check the Occupant Restraints Controller (ORC) pins, terminals, and connectors for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Occupant Restraints Controller (ORC) in accordance with the Service Information. Refer to **CONTROLLER, OCCUPANT RESTRAINT (ORC), REMOVAL AND INSTALLATION** .

   No

   - Using the schematics as a guide, check the Anti-lock Brake System (ABS) Module pins, terminals, and connectors for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Anti-lock Brake System (ABS) Module in accordance with the Service Information. Refer to **MODULE, ANTI-LOCK BRAKE SYSTEM (ABS), REMOVAL AND INSTALLATION** .
   - Perform the ABS VERIFICATION TEST. Refer to **ABS VERIFICATION TEST** .

U140E-00-IMPLAUSIBLE VEHICLE CONFIGURATION DATA RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

WARNING

WARNING: **All the operations should be carried out taking great care to avoid personal injury. The engine compartment contains many moving parts, components at high temperatures and live wires. Follow the warnings given below very carefully when working in the engine compartment: Turn off the engine and wait for it to cool down, do not smoke, do not use naked flames and ensure a fire extinguisher is available nearby. The use of special equipment is required for certain procedures. The use of these tools is vital for working safely. Follow the current workshop safety regulations. Where necessary, the Manual contains specific procedures to be followed to prevent dangerous situations from arising. When using chemical products, carefully follow the safety instructions on the safety card. The safety card must be provided to the consumer by the supplier. The electronic ignition system produces voltages of 20, 000 V and above which could be very hazardous to people especially if they are suffering from a heart condition. Therefore take great care when working on these systems or in the vicinity of their components.**

WARNING: **FCA US LLC does not manufacture any vehicles or replacement parts that contain asbestos. Aftermarket products may or may not contain asbestos. Refer to aftermarket product packaging for product information. Whether the product contains asbestos or not, dust and dirt can accumulate on brake parts during normal use. Follow practices prescribed by appropriate regulations for the handling, processing and disposing of dust and debris.**

CAUTION: **Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or MoparB® brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.**

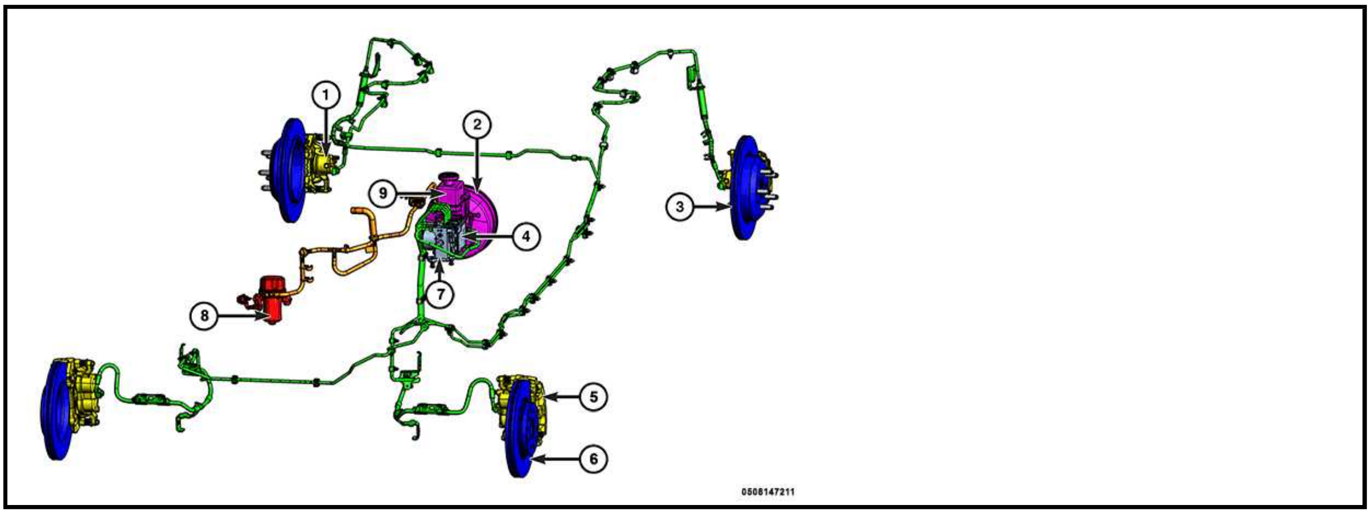
CAUTION: **Use MoparB® brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper antilock component operation.**

CAUTION: **Use MoparB® multi-mileage or high temperature grease to lubricate caliper slide surfaces, drum brake pivot pins, and shoe contact points on the backing plates. Use multi-mileage grease or GE 661 or Dow 111 silicone grease on caliper slide pins to ensure proper operation.**

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION



The base brake system consists of the following major components:

1. Rear single piston brake caliper
2. Brake booster
3. Rear solid brake rotor
4. Anti-lock Brake System (ABS) control module
5. Front dual piston brake caliper
6. Front vented brake rotor
7. Integrated Control Unit (ICU)
8. Electric vacuum pump
9. Master cylinder

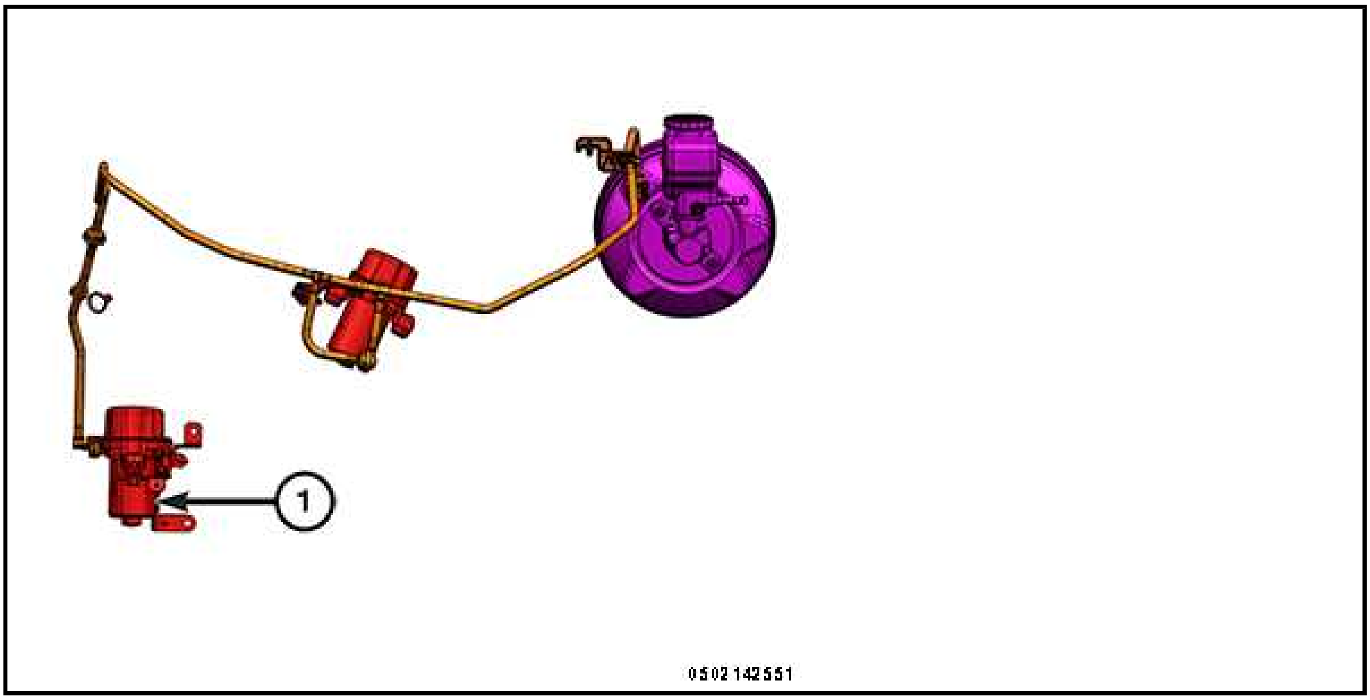
Power assist front disc and rear drum-in-hat disc brakes are standard equipment. Disc brake components consist of front dual piston brake calipers and ventilated rotors, and rear drum-in-hat style brakes with solid rear brake rotors and single piston rear brake rotors.

The parking brake mechanism is lever and cable operated. The cables are attached to actuators on the rear drum-in-hat park brake shoes. The parking brakes are operated by a hand lever.

A dual diaphragm vacuum power brake booster and electric vacuum pump are used for all applications.

All models have an aluminum master cylinder with plastic reservoir.

Factory brake lining on all models consists of an organic base material combined with metallic particles. The original equipment linings do not contain asbestos.



NOTE: **2.2L Diesel**

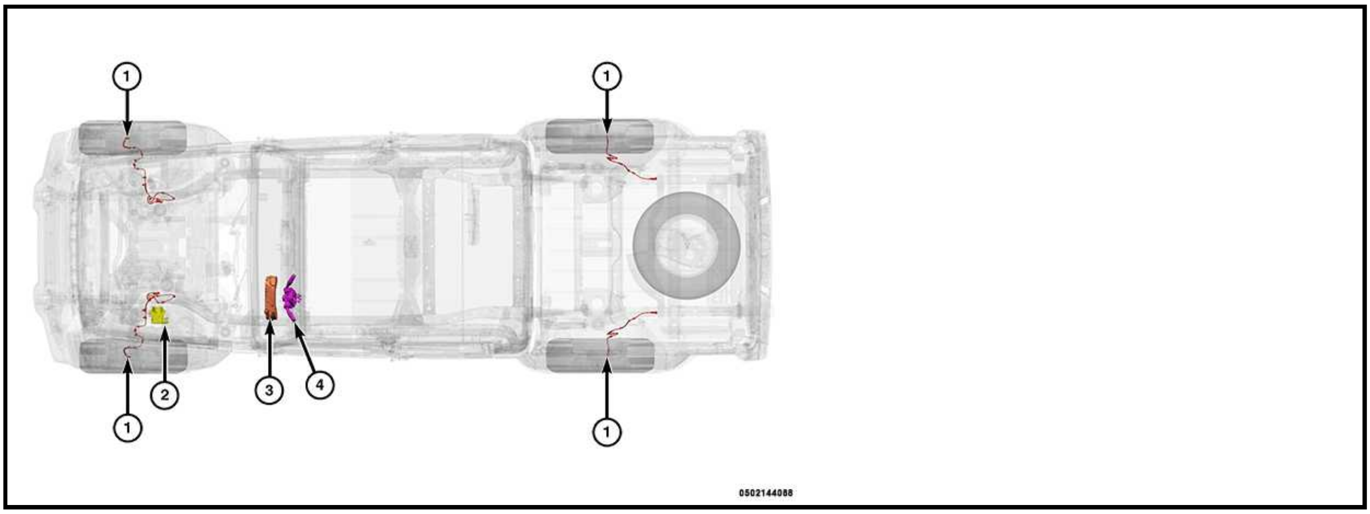
Diesel equipped vehicles also include:

1. Secondary electric vacuum pump

A secondary electric vacuum pump, located on the right side of the transmission bell housing is required on diesel engines where the engine is unable to create enough engine vacuum for use by the brake booster system.

NOTE: **Left Hand Drive (LHD) shown in graphics. The removal and installation procedures and torque specifications are the same for the Right Hand Drive (RHD).**

DESCRIPTION AND OPERATION - ABS



The Anti-Lock Brake System (ABS) includes the following components:

COMPONENT INDEX

1.	Refer to WHEEL SPEED SENSORS (WSS).
2.	Refer to INTEGRATED CONTROL UNIT (ICU).
3.	Refer to INSTRUMENT PANEL CLUSTER (IPC).
4.	Refer to STEERING COLUMN CONTROL MODULE (SCCM).

NOTE: **The Electronic Stability Control (ESC) may also be referred to as Electronic Stability Program (ESP) depending on the vehicle model year and configuration. Certain components may also reference ESP, ESC, or use the traction control symbol.**

OPERATION

The ABS module is mounted to the Hydraulic Control Unit (HCU) together forming the ICU. The ABS module is a micro-controller based device which monitors the anti-lock brake system during normal braking and controls it when the vehicle is in an ABS stop. The ABS function avoids wheel lock during braking maneuvers, maintaining the direction of the vehicle, and optimizing stopping distance.

The primary functions of the ABS are to:

- Monitor the anti-lock brake system for proper operation.
- Detect wheel locking or wheel slipping tendencies by monitoring the speed of all four wheels of the vehicle.
- Control fluid modulation to the wheel brakes while the system is in an ABS mode.
- Store diagnostic information.
- Provide communication to the scan tool while in diagnostic mode.
- Illuminate the ABS, Electronic Stability Control (ESC) or brake warning indicator lamp when the system is faulted.
- Illuminate the ESC function lamp when a vehicle dynamic event is occurring.
- Provide vehicle speed information, by monitoring the wheel speed sensors, to all modules on the Controller Area Network-Chassis (CAN-C) bus.

The ABS module constantly monitors the anti-lock brake system for proper operation. If the ABS module detects a fault, it will turn on a warning indicator lamp and disable the anti-lock braking system. The normal base braking system will remain operational.

NOTE: **If the vehicle is equipped with traction control, the ESC function lamp will illuminate anytime the amber ABS warning indicator lamp illuminates.**

The ABS module continuously monitors the speed of each wheel through the signals generated by the wheel speed sensors to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the ABS module commands the coils to actuate. The coils then open and close the valves in the HCU that modulate brake fluid pressure in some or all of the hydraulic circuits. The ABS module continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present. The ABS module contains a self-diagnostic program that monitors the anti-lock brake system for system faults. When a fault is detected, a warning indicator lamp is turned on and a Diagnostic Trouble Code (DTC) fault is then stored in a diagnostic program memory. A latched fault will disable certain system functionality for the current ignition cycle. An unlatched fault will disable certain system functionality until the fault condition disappears. These DTC's will remain in the ABS module memory even after the ignition has been turned off. The DTC's can be read and cleared from the ABS module memory by a technician using a scan tool. If not cleared with a scan tool, the fault occurrence and DTC will be automatically cleared from the ABS module memory after the identical fault has not been seen during the next 5633 km/h (3, 500 miles). Drive-off may be required for the amber ABS warning indicator lamp to go out on the next ignition cycle.

The ABS has multiple subsystems including, Traction Control System (TCS), Brake Assist System (BAS), Electronic Stability Control (ESC), Hill Start Assist (HSA), Electronic Roll Mitigation (ERM), Trailer Sway Control (TSC), and Hill Descent Control (HDC), Cornering Brake Control (CBC), Drag Torque Control [Motor Schleppmomenten Regelung] (MSR), and Off-Road ABS (ORA) ESC. All of these systems work together to enhance vehicle stability and control in various driving conditions.

A brief explanation of each subsystem follows:

TRACTION CONTROL

This system monitors the amount of wheel spin of each of the driven wheels. If wheel spin is detected, brake pressure is applied to the slipping wheel(s) to provide enhanced acceleration and stability.

BRAKE ASSIST SYSTEM

The BAS is designed to optimize the vehicle's braking capability during emergency braking maneuvers. The system detects an emergency braking situation by sensing the rate and amount of brake application and then applies optimum pressure to the brakes.

ELECTRONIC STABILITY CONTROL

The ESC system enhances directional control and stability of the vehicle using steering wheel angle, yaw (turning) rate and lateral acceleration sensors (combined into Dynamics Sensor). Using signals from these sensors, in addition to individual wheel speed sensor signals the ESC corrects for over/under steering of the vehicle by applying the brake of the appropriate wheel to assist in counteracting an over/under steer condition. Engine power may also be reduced to help the vehicle maintain the desired path. Certain components may also reference ESP, ESC, or use the traction control symbol.

HILL START ASSIST

NOTE: **The HSA system does not operate on an automatic transmission vehicle in the neutral position.**

The HSA system is designed to maintain the level of brake pressure for a short period of time after the brake pedal is released so that the vehicle does not roll on a hill between releasing the brake pedal and applying the accelerator pedal. The following must be true for HSA to activate:

- The vehicle must be stopped with the brake applied
- The vehicle must be at a eight percent or greater incline (three percent for manual transmissions)
- Gear selection must match uphill direction (forward gear for uphill, reverse for backing uphill)

ELECTRONIC ROLL MITIGATION

The ERM system monitors steering wheel input and the speed of the vehicle. When the rate of change of the steering wheel angle and vehicle's speed are sufficient to potentially cause wheel lift, the appropriate brake will apply, and engine power may be reduced to lessen the chance that wheel lift will occur. ERM will only intervene during very severe or evasive driving maneuvers.

TRAILER SWAY CONTROL

The TSC system uses sensors in the vehicle to recognize an excessively swaying trailer and will take the appropriate actions to attempt to stop the sway. The system may reduce engine power and apply the brake of the appropriate wheel(s) to counteract the sway of the trailer. TSC will become active automatically once an excessively swaying trailer is recognized.

HILL DESCENT CONTROL

The HDC system maintains vehicle speed while descending hills in off-road driving conditions by applying the brakes when necessary. HDC can only be enabled when the transfer case is in the "4WD LOW" position and the vehicle speed is less than 48 km/h (30 mph). If these conditions are not met while attempting to use the HDC feature, the HDC indicator light will flash on/off. The HDC indicator lamp will be on solid when HDC is enabled. When enabled, HDC senses the terrain and activates when the vehicle is descending a hill. HDC is only intended for low speed off-road driving. The accelerator pedal will override HDC at any time.

CORNERING BRAKE CONTROL

The CBC function reduces the over steer tendency of the vehicle during an ABS braking maneuver in a curve by providing an anti-yaw moment through reduction of front inner wheel pressure. The ESC shall pay attention to possible torque steering disturbance and noise actuations. CBC is active during braking in curve maneuvers or when ABS function is active. CBC is not active when ABS function is not active.

DRAG TORQUE CONTROL [MOTOR SCHLEPPMOMENTEN REGELUNG]

The MSR function tries to avoid locking of the driving axle during throttle-off maneuvers due to engine braking torque. MSR is active during throttle-off maneuvers. MSR activates when the locking tendency of a driving wheel exceeds the target value.

OFF-ROAD ABS (ORA) ESC

On deformable surfaces (gravel, sand, etc), a specific Off-Road ABS calibration with higher wheel slip targets may be used to improve the ABS stopping distance. A larger wheel slip will help take advantage of the wedge effect of the deformable surface in front of the tires. Off-road ABS shall be automatically enabled if the vehicle has terrain switch setting(s) for deformable surfaces, or it may be enabled if the transfer case is switched to low range. The ORA logic may also be used if the ESC detects a deformable surface based on information from the wheel speed sensors, longitudinal acceleration sensor, and brake torque model. The deeper wheel slip targets used in ORA shall be dependent on vehicle speed, steering wheel angle, and surface estimation. The ORA logic is not intended to be used on dry or wet asphalt, packed snow, or ice.

INSTRUMENT PANEL CLUSTER (IPC)

INSTRUMENT PANEL CLUSTER (IPC)

Refer to COMPONENT INDEX.

The IPC for this vehicle is located in the instrument panel above the steering column opening. The IPC gauges and indicators are visible through an opening in the cluster bezel and are protected by a clear plastic cluster lens that is secured to the cluster housing by integral latch formations. Several versions of the IPC are offered on this vehicle. These versions accommodate all of the variations of optional equipment and regulatory requirements for the various markets in which the vehicle is offered. The IPC utilizes integrated circuitry and information carried on the CAN-C and Controller Area Network-Interior High Speed (CAN-IHS) along with several hard-wired inputs to monitor other sensors and switches in the vehicle. In response to those inputs, the internal circuitry and programming of the IPC allow it to monitor many electronic functions and features of the vehicle. The IPC receives the following:

CAN-C Inputs

- ABS indication lamp ON request
- Key in ignition status
- Commanded ignition switch status

INTEGRATED CONTROL UNIT (ICU)

INTEGRATED CONTROL UNIT (ICU)

Refer to COMPONENT INDEX.

The ICU is located in the left rear corner of the engine compartment near the brake master cylinder. The HCU consists of the ABS module, valve body, pump motor, low pressure accumulators, inlet valves, outlet valves and noise attenuators. Accumulators in the valve body store extra fluid released from the calipers during ABS mode operation. The pump is used to clear the accumulator of brake fluid and is operated by a DC type motor. The motor is controlled by the ABS module. The valves modulate brake pressure during anti-lock braking and are controlled by the ABS module. The HCU provides individual pressure control to each front and rear brake. During anti-lock braking, the solenoid valves are opened and closed as needed. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration. Brake Traction Control and Electronic Stability Program modulate pressure on each wheel individually without any driver brake input.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system. The valves are all contained in the valve body portion of the HCU.

During anti-lock braking, solenoid valve pressure modulation occurs in three stages; pressure increase, pressure hold, or pressure decrease. A brief description of each pressure modulation is as follows:

PRESSURE INCREASE

- The inlet valve is open, and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to reapply the brakes. This cycle controls re-application of fluid apply pressure.

PRESSURE HOLD

- Both solenoid valves are closed in the pressure hold cycle but only the inlet valve is energized. Fluid apply pressure in the control channel is maintained at a constant rate. The ABS module maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

PRESSURE DECREASE

- The outlet valve is opened, and the inlet valve is closed during the pressure decrease cycle. A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the ABS module closes the inlet then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock. Once the period of high wheel slip has ended, the ABS module closes the outlet valve and begins a pressure increase or hold cycle as needed.

The ABS module is fused by the Power Distribution Center (PDC).

CAN-C Inputs

- Transfer case status
- Accelerator pedal position (Calculated)
- Static engine torque / Effective engine torque
- Steering wheel angle
- Commanded ignition switch status
- Vehicle speed

CAN-C Outputs

- ABS indication lamp ON request
- Status of any ABS brake event

STEERING COLUMN CONTROL MODULE (SCCM)

STEERING COLUMN CONTROL MODULE (SCCM)

Refer to COMPONENT INDEX.

The SCCM is located near the top of the steering column below the steering wheel. The SCCM includes the Steering Angle Sensor (SAS), the clockspring, lighting multifunction switch, and wiper multifunction switch. The SCCM is secured to the steering column by an integral band clamp on the bottom of the instrument panel side of the SCCM. The SCCM has a centering attachment screw located on the top of the instrument panel side of the SCCM to be certain the SCCM is centered properly on the steering column. The SCCM provides the following:

CAN-C Outputs

- Steering wheel angle

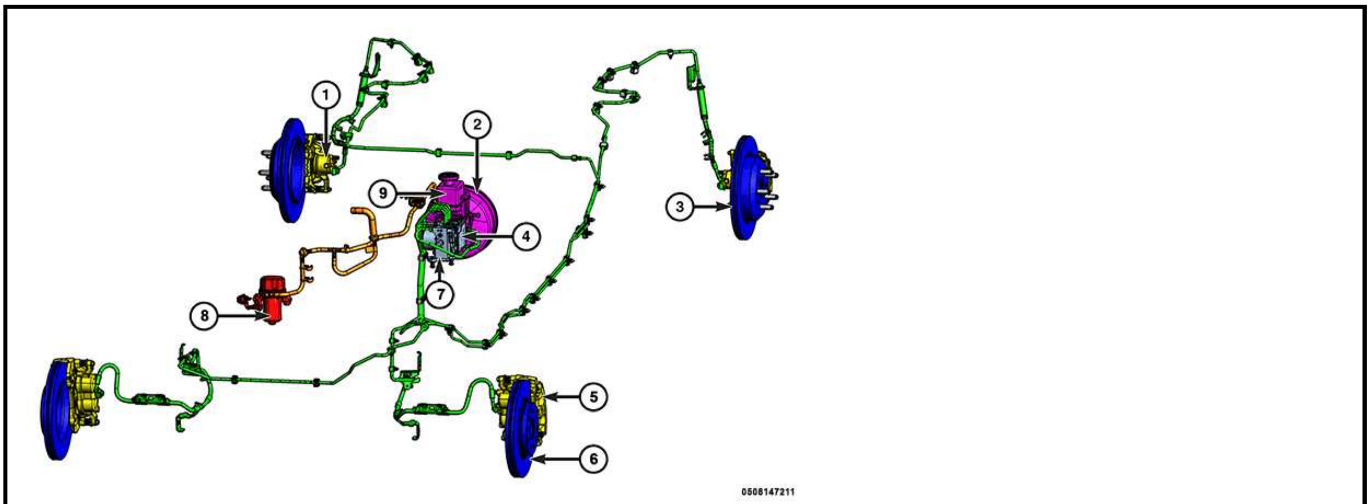
WHEEL SPEED SENSORS (WSS)

WHEEL SPEED SENSORS (WSS)
Refer to COMPONENT INDEX.

A wheel speed sensor is used at each wheel. The front sensors are mounted to the hub and bearings. The rear sensors are mounted to the park brake assembly. Tone wheels are mounted to the outboard ends of the front and rear axle shafts. The gear type tone wheel serves as the trigger mechanism for each sensor. The sensors convert wheel speed into small digital current signals in amperage. The ABS sends 12 volts to the sensors. The sensor is typically comprised of either a Hall Effect or a Magneto-Resistive element integrated with signal conditioning circuit. The sensor produces signals alternating between two constant levels with frequency proportional to the associated wheel speed. The sensor reads either a toothed ferrous tone wheel or a magnetically charged encoder for signal generation. The signal is sent to ABS module. The WSS provides the following:

CAN-C Outputs

- Wheel rpm for each wheel



The base brake system consists of the following major components:

1. Rear Single Piston Brake Caliper
2. Brake Booster
3. Rear Vented Brake Rotor
4. Anti-lock Brake System (ABS) Module
5. Front Dual Piston Brake Caliper
6. Front Vented Brake Rotor
7. Integrated Control Unit (ICU)
8. Electric Vacuum Pump
9. Master Cylinder

Power assist front disc and rear drum-in-hat disc brakes are standard equipment. Disc brake components consist of front dual piston brake calipers and ventilated rotors, and rear drum-in-hat style brakes with solid rear brake rotors and single piston rear brake rotors.

The parking brake mechanism is lever and cable operated. The cables are attached to actuators on the rear drum-in-hat park brake shoes. The parking brakes are operated by a hand lever.

A dual diaphragm vacuum power brake booster and electric vacuum pump are used for all applications.

All models have an aluminum master cylinder with plastic reservoir.

Factory brake lining on all models consists of an organic base material combined with metallic particles. The original equipment linings do not contain asbestos.

The Electric Vacuum Pump (EVP) system is installed to provide supplemental vacuum to the brake booster when the engine vacuum supply is low. The vacuum pump is connected to the engine and the brake booster through a series of hoses and one-way flow check valves. A vacuum pressure sensor, mounted in the brake booster, provides information to the Anti-lock Brake System (ABS) module, then the vacuum level is sent over the Controller Area Network (CAN) to the Powertrain Control Module (PCM). The PCM modulates the EVP operation to maintain the brake booster vacuum within a given range. This system ensures that the customer experiences a consistent brake pedal feel under all driving conditions.

An electrical connector is used to supply power and ground for the vacuum pump. Operating voltage is between 9V - 16V. Control of the vacuum pump is provided by the PCM using a low side driver to a normally open relay (coil side). The relay coil side power is from a fuse in the under hood Power Distribution Center (PDC). The switched power circuit to the vacuum pump relay is wired directly from the battery through an in-line fuse holder located below the remote battery post connection on the right side in the engine compartment. The relay is located on the left shock tower in the engine compartment.

The ABS module monitors the vacuum pressure sensor and when the signal indicates low engine vacuum the PCM will cycle the vacuum pump as necessary to add vacuum to the power brake booster. The vacuum hoses are connected between the vacuum pump, the engine manifold (for Manifold Absolute Pressure (MAP) sensor signal), and the vacuum pressure sensor (on the brake booster). When the PCM cycles the vacuum pump on, the PCM monitors the MAP sensor and if the vacuum signal does not indicate a rising vacuum then DTCs will be set. Additionally, the Anti-lock Brake System (ABS) module monitors the vacuum at the vacuum pressure sensor and Diagnostic Trouble Codes (DTC)s will also set in the ABS module.

STANDARD PROCEDURE

Always clean the master cylinder reservoir and cap before checking fluid level.

The fluid fill level is indicated on the side of the master cylinder reservoir.

The correct fluid level is to the MAX indicator on the side of the reservoir. If necessary, add fluid to the proper level.

PRESSURE BLEEDING

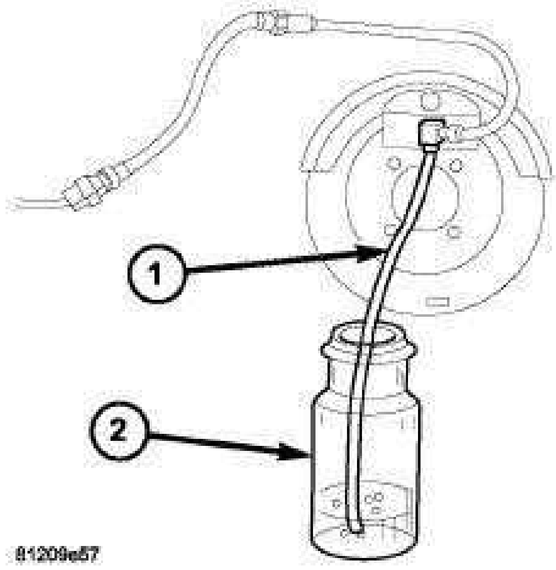
For brake fluid type. Refer to CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS .

Follow the manufacturer's instructions carefully when using pressure equipment. Do not exceed the tank manufacturer's pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system.

MANUAL BLEEDING



NOTE: **Pressure bleeding is recommended to bleed the base brake system to be sure all air is removed from system. Manual bleeding may also be used, but additional time is needed to remove all the air from the system.**

For brake fluid type. Refer to CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS .

1. Remove reservoir filler caps and fill reservoir.
2. If calipers were overhauled, open all caliper bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.
3. Attach one end of bleed hose (1) to bleed screw and insert opposite end in glass container (2) partially filled with brake fluid. Be sure end of bleed hose is immersed in fluid.

   NOTE: **Bleed procedure should be in this order: (1) Right rear, (2) Left rear, (3) Right front, and (4) Left front.**

4. Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down, hold the pedal down while closing the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.
5. Before moving the vehicle verify the pedal is firm and not soft.
6. Top off the brake fluid and install the reservoir cap.

STANDARD PROCEDURE - ANTILOCK BRAKE SYSTEM BLEEDING

For brake fluid type. Refer to CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS .

The base brake's hydraulic system must be bled anytime air enters the hydraulic system. The Antilock Brake System (ABS) must always be bled anytime it is suspected that the Hydraulic Control Unit (HCU) has ingested air.

Brake systems with ABS must be bled as two independent braking systems. The non-ABS portion of the brake system with ABS is to be bled the same as any non-ABS system.

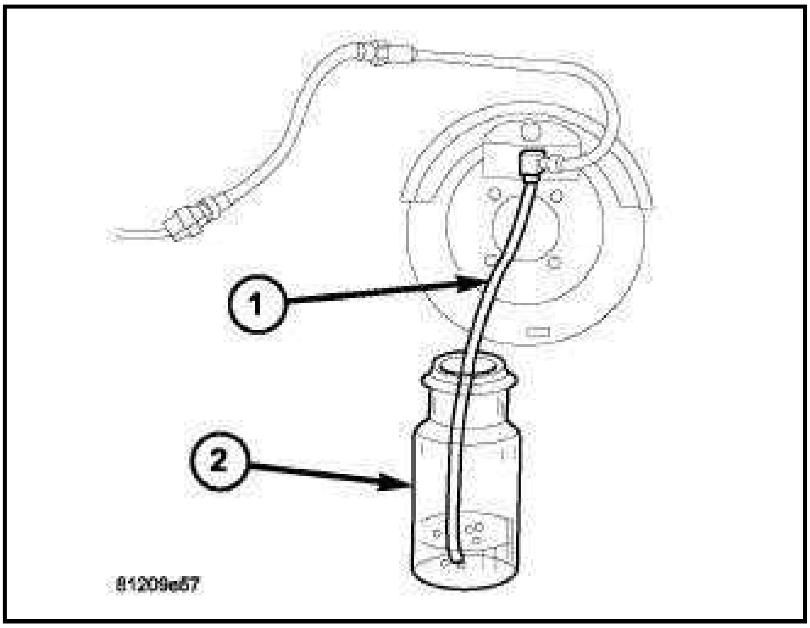
The ABS portion of the brake system must be bled separately. Use the following procedure to properly bleed the brake hydraulic system including the ABS.

NOTE: **During the brake bleeding procedure, be sure the brake fluid level remains close to the FULL level in the master cylinder fluid reservoir. Check the fluid level periodically during the bleeding procedure and add brake fluid as required.**

BLEEDING (ABS)

When bleeding the Anti-lock Brake System (ABS), the following bleeding sequence must be followed to insure complete and adequate bleeding.

1. Make sure all hydraulic fluid lines are installed and properly torqued.
2. Connect the scan tool to the diagnostics connector. The diagnostic connector is located under the lower steering column cover to the left of the steering column.
3. Using the scan tool, check to make sure the ABS does not have any fault codes stored. If it does, clear them.



WARNING: **When bleeding the brake system wear safety glasses. A clear bleed tube must be attached to the bleeder screws and submerged in a clear container filled part way with clean brake fluid. Direct the flow of brake fluid away from yourself and the painted surfaces of the vehicle. Brake fluid at high pressure may come out of the bleeder screws when opened.**

NOTE: **Pressure bleeding is recommended to bleed the base brake system to ensure all air is removed from system. Manual bleeding may also be used, but additional time is needed to remove all air from system.**

4. Bleed the base brake system. Refer to STANDARD PROCEDURE.
5. Using the scan tool, select ECU VIEW, followed by ABS MISCELLANEOUS FUNCTIONS to access bleeding. Follow the instructions displayed. When finished, disconnect the scan tool and proceed.
6. Bleed the base brake system a second time. Check brake fluid level in the reservoir periodically to prevent emptying, causing air to enter the hydraulic system.
7. Fill the master cylinder fluid reservoir to the FULL level.
8. Test drive the vehicle to be sure the brakes are operating correctly and that the brake pedal does not feel spongy.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, rear park brake drums/rotors, abutment clips, brake drum in hat rotor in the rear, front brake rotors, brake lines, master cylinder, booster, HCU and parking brake shoes.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, electrical or vacuum operated component.

The first diagnosis step is the preliminary check.

DIAGNOSIS AND TESTING - BRAKE ROTOR LOT ROT

If the vehicle has been on the lot for an extended period, the rotors may have a condition commonly referred to as lot rot. There may be a visible brake pad imprint on the friction surface, signs of corrosion, or both. This can lead to vibration or pulsation (judder) while braking. The amount of time required to cause this varies and some vehicles are more sensitive than others. It is not always possible to tell visually if the vehicle exhibits lot rot, in part because the inboard rotor surface is hidden. It is best to perform a test drive, per the following procedure.

1. Apply the brakes several times from 80-48 km/h (50-30 mph) to clean off the rotors.
2. Take the vehicle on a smooth highway and, at 97 km/h (60 mph), apply the brake lightly such as when slowing down to exit the highway. Do this several times noting any vibration, either felt through the seat/body or through the steering wheel.
3. If steering wheel nibble or oscillation exists, that indicates the front rotors are likely the issue. If vibration is only felt through the seat/body, the rear rotors are likely the issue and less likely the front. A combination might indicate both front and rear rotors are an issue. Smooth braking indicates no issue.
4. Resurface or replace the front or rear rotors as necessary, per test drive, to resolve the vibration/pulsation (judder) issue.

DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM DIAGNOSIS CHARTS

NOTE: **There are three diagnosis charts following that cover the red brake warning indicator, brake noise, and other brake conditions.**

RED BRAKE WARNING INDICATOR

CONDITION	POSSIBLE CAUSES	CORRECTION
RED BRAKE WARNING INDICATOR ON	1. Parking brake lever not fully released.	1. Release parking brake lever.
	2. Parking brake warning lamp switch on parking brake lever.	2. Inspect and replace switch as necessary.
	3. Brake fluid level low in the reservoir.	3. Fill reservoir. Check entire system for leaks. Repair or replace as required.
	4. Brake fluid level switch.	4. Disconnect switch wiring connector. If lamp goes out, replace the switch.
	5. Mechanical instrument cluster (MIC) problem.	5. Refer to appropriate diagnostic information.
	6. Amber Anti-lock Brake System (ABS) Warning Indicator Lamp also illuminated.	6. Refer to appropriate diagnostic information.
	7. Electric Vacuum Pump (EVP) malfunction.	7. Diagnose and repair the EVP.
	8. Park brake warning switch.	8. Inspect the park brake switch circuit.

THUMP/CLUNK NOISE

Thumping or clunk noises during braking are frequently not caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that blind on the slide surfaces can generate a thump or clunk noise.

OTHER BRAKE CONDITIONS

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKES CHATTER OR VIBRATION	1. Disc brake rotor has excessive thickness variation 2. Uneven tire wear or wheel - tire imbalance	1. Isolate condition as rear or front. Reface or replace brake rotors as necessary. 2. Inspect the tires and the wheels. Balance wheel weights.
BRAKES DRAG (FRONT OR ALL)	1. Contaminated brake fluid	1. Check for swollen seals. Replace all system components containing rubber.
	2. Binding caliper pins or bushings	2. Replace pins and bushings.
	3. Binding master cylinder (not fully returning)	3. Inspect and replace the master cylinder as necessary.
	4. Binding brake pedal	4. Replace the brake pedal bushings.
	5. The stop lamp sensor is not adjusted properly, or mounting bracket is bent	5. Straighten the mounting bracket and replace the stop lamp sensor. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
BRAKES DRAG (REAR ONLY)	1. Parking brake cables binding or froze up	1. Check cable routing. Replace cables as necessary.
	2. Parking brake cable return spring not returning shoes	2. Replace cables as necessary.
	3. Obstruction inside the center console preventing full return of the parking brake cables	3. Remove the console and remove obstruction.
	4. Operator error	4. Describe operation of the park brake.
BRAKES GRAB	1. Contaminated brake pad linings.	1. Inspect and clean, or replace pads and rotors. Repair the source of contamination.
	2. Improper power brake booster assist	2. Refer to power brake booster in this section.
	3. Damaged wheel or tire, or wheel imbalance	3. Inspect the wheels and tires. Balance the wheels.
EXCESSIVE PEDAL EFFORT	1. Obstruction of brake pedal	1. Remove the obstruction.
	2. Low power brake booster assist	2. Refer to the power brake booster in this section.
	3. Glazed brake linings	3. Reface or replace brake rotors as necessary. Replace brake shoes/pads.
	4. Brake pad lining transfer to brake rotor	4. Reface or replace brake rotors. Replace the brake pads.
EXCESSIVE PEDAL EFFORT (HARD PEDAL - CAN'T SKID WHEELS)	1. Power brake booster runout (vacuum assist)	1. Check booster vacuum hose and engine tune for adequate vacuum supply. Refer to Power Brake Booster.
EXCESSIVE PEDAL TRAVEL (VEHICLE STOPS OK)	1. Air in the brake lines 2. Brake fluid low in the reservoir	1. Bleed the brake system. 2. Fill the reservoir. Check the entire system for leaks, repair or replace as required.
EXCESSIVE PEDAL TRAVEL (ONE FRONT WHEEL LOCKS	1. One of the two hydraulic circuits is malfunctioning	1. Inspect the system for leaks. Check the master cylinder for internal

CONDITION	POSSIBLE CAUSES	CORRECTION
UP DURING HARD BRAKING)		malfunction.
PEDAL PULSATES/SURGES DURING BRAKING	1. Disc brake rotor has excessive thickness variation	1. Isolate condition as rear or front. Reface or replace brake rotors as necessary.
	2. Worn or damaged tires	2. Inspect the tires and wheels.
	3. Loose wheel bearings	3. Inspect the wheel bearings.
	4. Loose calipers	4. Inspect the calipers.
	5. Wheel imbalance	5. Balance the wheels.
PEDAL IS SPONGY	1. Air in the brake lines	1. Bleed the brakes.
	2. Power brake booster runout (vacuum assist)	2. Check the booster vacuum hose and engine tune for adequate vacuum supply. Refer to power brake booster diagnosis and testing.
	3. Electric Vacuum Pump (EVP) not functioning	3. Refer to the Anti-lock Brake System (ABS) section and appropriate diagnostic information.
PREMATURE REAR WHEEL LOCKUP	1. Contaminated brake linings	1. Inspect and clean, or replace the pads. Repair source of contamination.
	2.ABS function issue	2. Refer to the ABS section and appropriate diagnostic information.
STOP LAMPS STAY ON	1. Stop lamp sensor out of adjustment	1. Replace the stop lamp sensor. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .
	2. Brake pedal binding	2. Inspect and replace as necessary.
	3. Obstruction in pedal linkage	3. Remove the obstruction.
	4. Power brake booster not allowing pedal to return completely	4. Replace the power brake booster.
VEHICLE PULLS TO RIGHT OR LEFT ON BRAKING	1. Frozen brake caliper piston	1. Replace the frozen piston or caliper. Bleed the brakes.
	2. Contaminated brake pad lining (most likely front lining)	2. Inspect and clean or replace the pads. Repair the source of contamination.
	3. Pinched brake lines	3. Replace the pinched line.
	4. Leaking piston seal	4. Replace the piston seal or brake caliper.
	5. Suspension problem	5. Refer to the suspension section.
	6. Worn or damaged tires	6. Inspect the tires and wheels.
	7. Wheel imbalance	7. Balance the wheels.
PARKING BRAKE - EXCESSIVE LEVER/HANDLE TRAVEL	1. Park brake cable out of adjustment	1. Perform the park brake cable adjustment. Refer to **PARKING BRAKE, ADJUSTMENTS**.
	2. Park brake shoes out of adjustment or worn	2. Perform the park brake shoe adjustment. Refer to **SHOES, PARKING BRAKE, ADJUSTMENTS**.
	3. Broken or disconnected park brake cable	3. Replace the park brake cable. Refer to **CABLE, PARKING BRAKE, REMOVAL AND INSTALLATION**.

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Dislodged or miss-installed park brake shoe hardware	4. Properly install the park brake shoes and all hardware. Refer to **SHOES, PARKING BRAKE, REMOVAL AND INSTALLATION**.

VACUUM PUMP DIAGNOSTIC TESTS

KNOWN ISSUES - VACUUM PUMP SYSTEM

There are some concerns of unsecured connections:

- Vacuum hose to engine manifold connection.
- Vacuum hose to vacuum pump connection.
- Vacuum pump electrical connection resulting from housing damage, not fully seated, bent or damaged pins.
- Vacuum sensor electrical connection resulting from housing damage, not fully seated, bent or damaged pins.

DIAGNOSTICS - VACUUM SYSTEM LEAK TEST

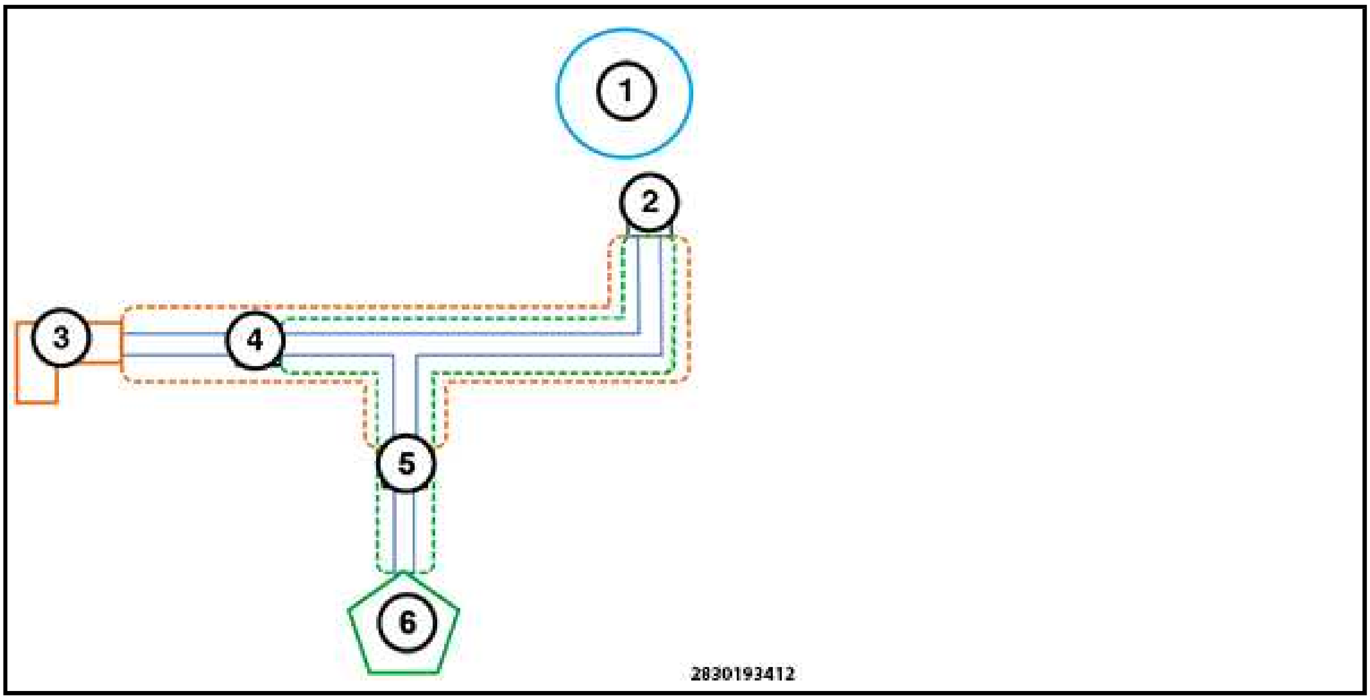
If any leaks are detected, replace the vacuum hose assembly.

Both of the procedures below should be performed in combination as part of any diagnostic for a brake vacuum system performance fault. The procedures should also be performed after any repairs are made to verify the system is not leaking. A leaky system can cause premature electric vacuum pump failure due to over operating the pump.

CHECK THE VACUUM HOSE ASSEMBLY FOR A LEAK:

Steps 1 and 2 require the vacuum hose assembly to be disconnected from the booster, engine, and Electric Vacuum Pump (EVP). If the sensor is not part of the vacuum hose assembly, remove the sensor from the booster and leave connected to the vacuum hose assembly. Once fully disconnected, the sensor must be plugged as to not allow leakage through the internal check valve. Plug method should be clean to prevent contamination into the sensor check valve.

1. Connect a hand vacuum pump to the EVP connection (6) and pull a vacuum of 8.0 kPa (23.5 In.Hg). Once vacuum is pulled to the correct level, measure vacuum loss over one minute. This will check for leakage in the engine check valve and all the vacuum hose assembly inside the green dashed line (4). The vacuum hose assembly should not leak more than 4.5 kPa (1.3 In.Hg) in one minute.
2. Next connect to the engine connection (3) and pull a vacuum of 8.0 kPa (23.5 In.Hg). Once vacuum is pulled to the correct level, measure vacuum loss over one minute. This will check for leakage in the EVP connection check valve and all the vacuum hose inside the orange dashed line (5). The vacuum hose assembly should not leak more than 4.5 kPa (1.3 In.Hg) in one minute.
3. Last, remove the plug from the sensor and pull a vacuum directly on the sensor (2) where it would be installed into the booster. Pull a vacuum of 8.0 kPa (23.5 In.Hg). Once vacuum is pulled to the correct level, measure vacuum loss over one minute. This will check leakage in the sensor check valve (2). The sensor check valve should not leak more than 4.5 kPa (1.3 In.Hg) in one minute.
   - If any of the above checks fail, the vacuum hose assembly should be replaced as an assembly. The check valves cannot be replaced separately.
   - If the above vacuum checks pass, continue to CHECKING THE BRAKE BOOSTER SIDE FOR A LEAK.



COMPONENT INDEX

1.	Brake Booster
2.	Check Valve/Vacuum Pressure Sensor
3.	Engine Connection
4.	Check Valve - Engine Path
5.	Check Valve - EVP Path
6.	Electric Vacuum Pump

CHECKING THE BRAKE BOOSTER SIDE FOR A LEAK: This procedure checks the brake booster for leakage. Securely install the vacuum hose assembly on the vehicle.

1. Turn the ignition on and monitor the brake pressure sensor data with the scan tool. **NOTE: The value is multiplied by (-1) so that the reading shows as a positive value. The value displayed in the scan tool may need to be converted to metric.**
2. Start and run the engine for at least 30 seconds while monitoring the brake pressure sensor data on the scan tool. Allow the value to stabilize, then immediately cycle the ignition off and back to ignition on engine not running. Monitor and record the pressure loss for the initial 15 seconds (the pressure should not drop more than 2.0 kPa (0.60 In.Hg) in the first 15 seconds). Monitor and record the pressure loss after an additional 45 seconds (the pressure should not drop more than 2.5 kPa (0.75 In.Hg) over the next 45 seconds).
    1. If the pressure drop was less than the thresholds listed above the brake booster and vacuum pressure sensor check valve are operating normally. If the P258B fault is present, perform the **VACUUM PUMP** diagnostic.
    2. If the pressure drop was more than the thresholds listed above there is a leak at the brake booster. Replace the brake booster and retest.

DIAGNOSTICS - VACUUM PUMP TEST

The following items must be performed before performing this diagnostic procedure:

- If the P258A-EVP Relay Control Circuit DTC or a vacuum pressure sensor circuit DTC is present, diagnose those DTCs before continuing.
- Perform the **VACUUM SYSTEM LEAK TEST** diagnostic before this diagnostic procedure to determine if the system is leaking, and if so which part of the system is leaking before performing the diagnostics below.

CHECKING THE OPERATION ON THE VACUUM PUMP: This diagnostic is being performed assuming that the VACUUM SYSTEM LEAK TEST was performed and passed both leak checks or that a repair was done and verified fixed.

NOTE: **The value is multiplied by (-1) so that the reading shows as a positive value. The value displayed in the scan tool may need to be converted to metric.**

1. Pump the brake pedal to lower the vacuum in the brake booster until pedal is hard. Start the engine and verify the Electric Vacuum Pump (EVP) is running. The vacuum pump will be commanded on by the PCM approximately 2 seconds after engine start. **If engine vacuum produces enough vacuum in the booster, the pump may not run.** If the EVP is operating, monitor the brake pressure sensor reading while the EVP is running. The pressure should steadily increase until the system reaches the maximum threshold or stabilizes and the EVP turns off. Max threshold should be 65% BARO in park, or 83% BARO while driving at 8 mph or above.

   NOTE: **If the EVP does not run after engine start, while in park, pump the brake pedal 8-10 times rapidly with the engine running. This will lower the vacuum and activate the vacuum pump. Do not monitor the scan tool at this time.**

   1. If the EVP is showing on in the PCM, but can not physically be seen running or the system cannot build vacuum pressure either the electric vacuum pump is failed or there is battery supply or ground circuit issue. **Continue to step 2.**
   2. If the EVP does run but cannot increase the vacuum supply either a gross leak is present, the vacuum pressure sensor is faulty, or the vacuum pump is faulty.
      - If the VACUUM SYSTEM LEAK TEST was performed prior to this test and passed, remove the vacuum hose assembly at the brake booster and use a hand vacuum pump to apply vacuum directly to the sensor to verify sensor value changes in the scan tool. If the sensor values do not change while using a hand vacuum pump directly attached to the sensor, replace the vacuum hose assembly with the vacuum pressure sensor. If the system still can not increase vacuum, replace the vacuum pump.
      - If the VACUUM SYSTEM LEAK TEST **was not** performed prior to this test, perform that procedure to check for a leak in the system before replacing the electric vacuum pump.
   3. If the EVP runs, increases the vacuum supply into a pass threshold and turns off the system is operating properly.
      - If there was a repair made during the VACUUM SYSTEM LEAK TEST the system is fixed.
      - If the system passed both leak checks in the VACUUM SYSTEM LEAK TEST then the issue is intermittent. Verify a good connection at the EVP, PDC, fuse, EVP relay (if removable) and ground location. If the DTC is still active, the PCM is faulty.
2. Disconnect the EVP harness connector. Load test the battery supply circuit and ground circuit at the EVP harness connector. Connect one lead of the load test tool to the Fused B+ circuit and the other lead of the load test tool to the ground circuit. With the ignition on, the load test bulb should be bright if both circuits are good. To verify that there is no resistance in the circuits being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. The voltage drop across the bulb should be equal to the voltage reading across the battery terminals if there is no resistance in either circuit. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **CIRCUIT LOAD TESTING PROCEDURES** .
   1. If the circuits fail the load test, remove the lead connected to the ground circuit and connect it to a good chassis ground. Check the voltage drop across the 3156 bulb of the load test tool again. If the voltage drop is still less than battery voltage, repair the battery supply circuit for an open or high resistance. If the voltage drop is now equal to battery voltage, repair the ground circuit for an open or high resistance.
   2. If the battery supply and ground circuits check good, replace the electric vacuum pump in accordance with the service information.

TECHNICAL SPECIFICATIONS

BASE BRAKES

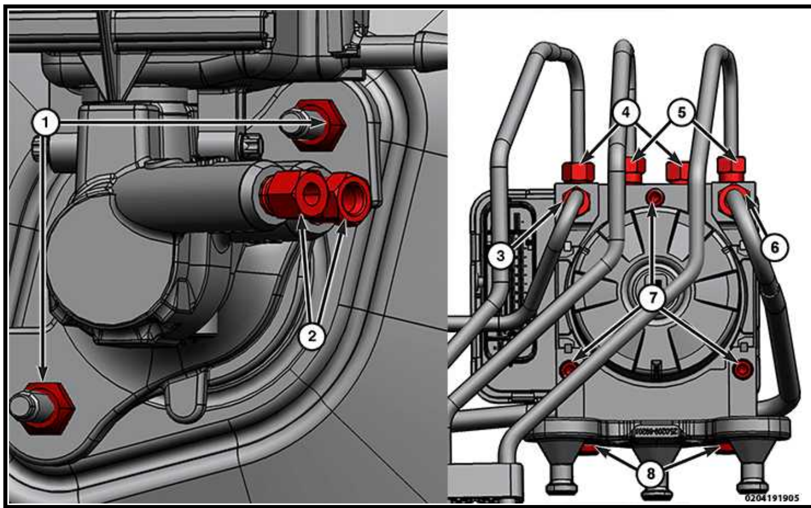
NOTE: **Rotor runout specifications are not to be used for diagnosing brake concerns. The values in the table are post turn measurements taken by an on-vehicle brake lathe.**

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Front Disc Brake Rotor Type	Ventilated
Rear Disc Brake Rotor Type	Ventilated
Rear Ventilated Disc Brake Rotor Max. Runout	0.020 mm (0.0008 in)
Front Ventilated Disc Brake Rotor Max. Runout	0.020 mm (0.0008 in)
Front Ventilated Disc Brake Rotor Min. Thickness	26.4 mm (1.039 in.)
Rear Ventilated Disc Brake Rotor Min. Thickness	20.0 mm (0.787 in.)
Front Disc Brake Calipers	Dual Piston Floating
Rear Disc Brake Calipers	Single Piston Floating
Rear Drum in Hat Diameter	206.1 mm (8.11 in.)
Rear Drum in Hat Cage Diameter	205.4 mm (8.08 in.) - 205.7 mm (8.09 in.)

TORQUE SPECIFICATIONS

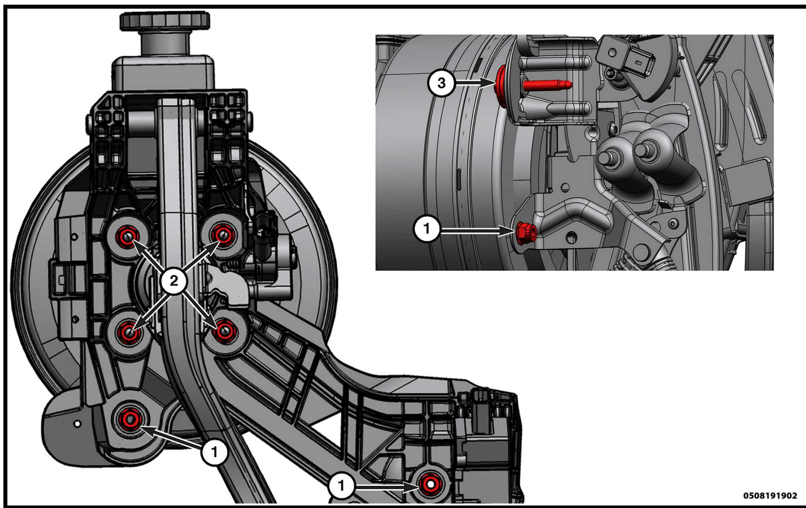
BRAKE BOOSTER AND MODULE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Master Cylinder Nuts	**18 N. m (13 Ft. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Master Cylinder Brake Lines	**23 N. m (17 Ft. Lbs.)**	-
3	Primary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**25 N. m (18 Ft. Lbs.)**	-
4	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
5	Hydraulic Control Unit (HCU) Brake Line Flare	**20 N. m (15 Ft. Lbs.)**	-

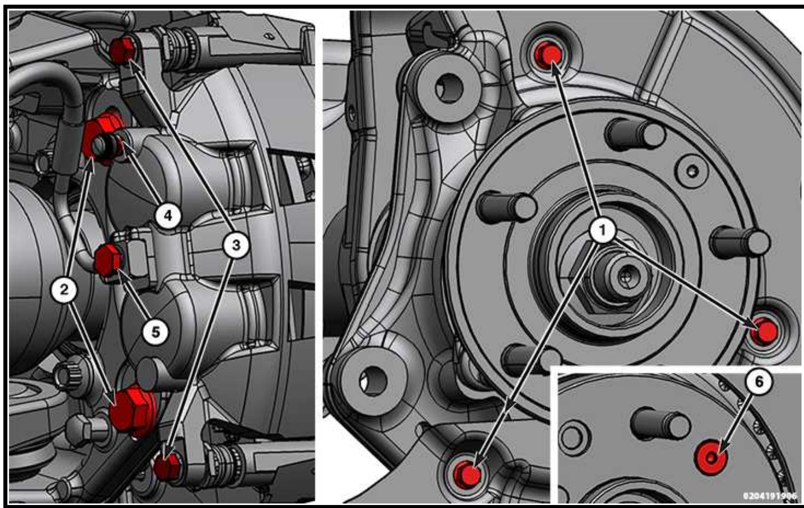
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
	Nuts		
6	Secondary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**23 N. m (17 Ft. Lbs.)**	-
7	Brake System Control Module (BSCM) Bolts	**8 N. m (70 In. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
8	Hydraulic Control Unit (HCU) Bracket Bolts	**5 N.m (44 In. Lbs.)**	-

BRAKE PEDAL



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pedal Sled Nut	**30 N. m (22 Ft. Lbs.)**	-
2	Brake Booster Nuts	**30 N. m (22 Ft. Lbs.)**	-
3	Clutch Pedal Bolt	**24 N. m (18 Ft. Lbs.)**	-

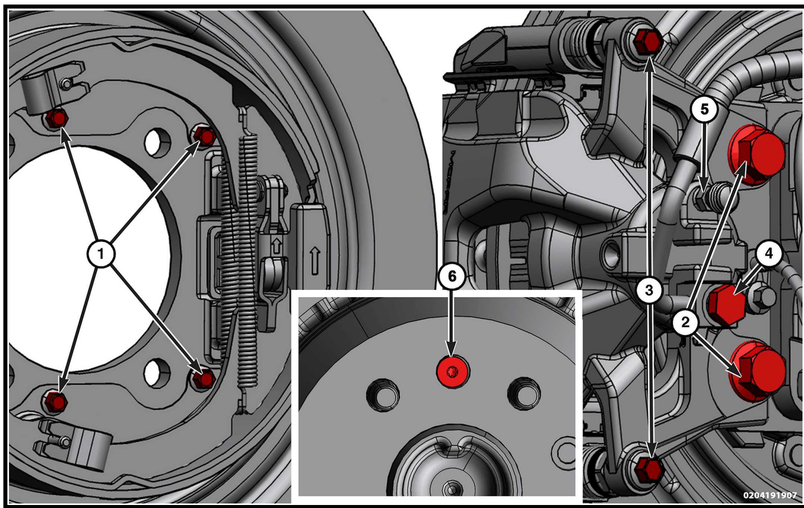
FRONT BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**10 N. m (7 Ft. Lbs.)**	-
2	Front Caliper Adapter Bolts	**195 N. m (144 Ft. Lbs.)**	-
3	Front Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-

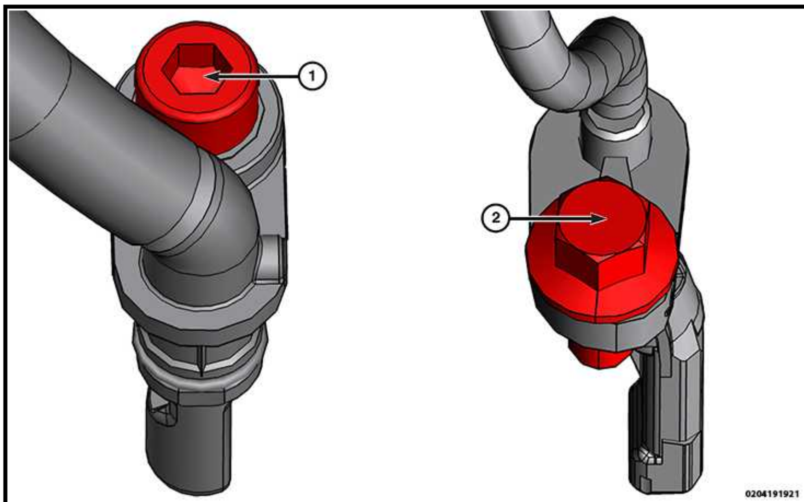
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
4	Front Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
5	Front Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
6	Front Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

REAR BRAKES



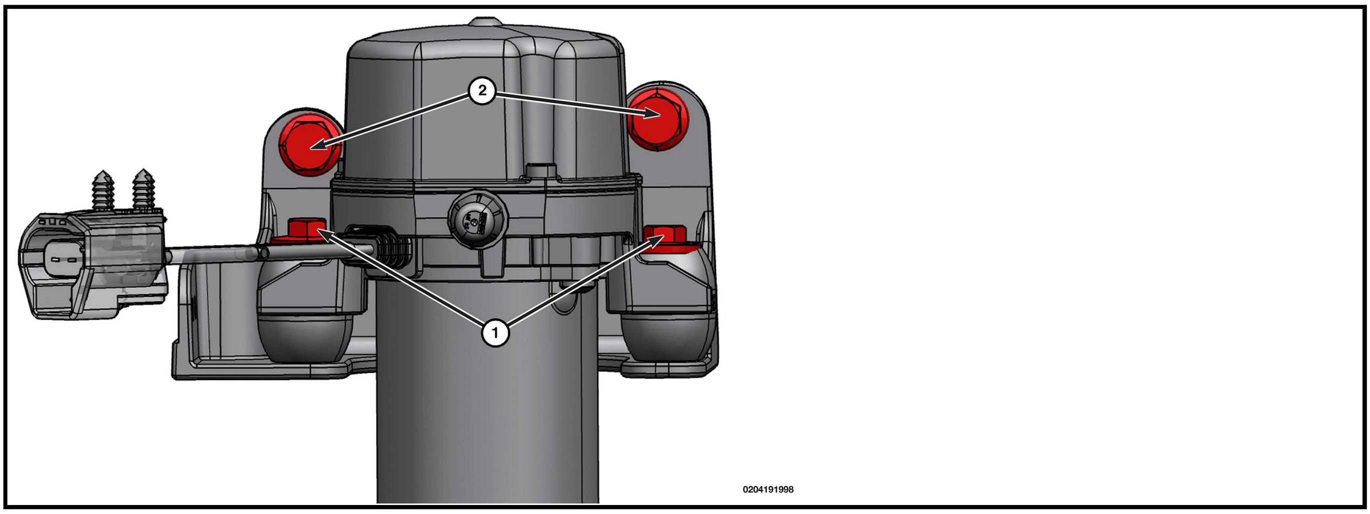
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**11 N. m (8 Ft. Lbs.)**	-
2	Rear Caliper Adapter Bolts	**125 N. m (92 Ft. Lbs.)**	-
3	Rear Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Rear Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
5	Rear Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
6	Rear Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

WHEEL SPEED SENSOR



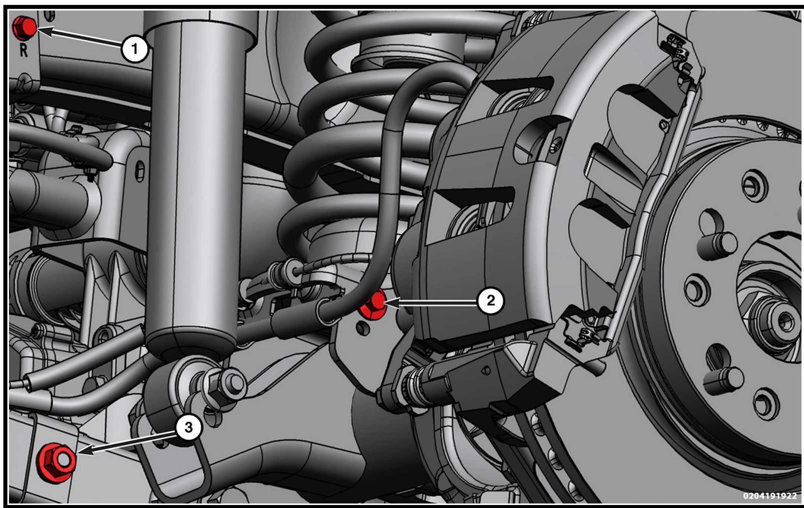
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Front Wheel Speed Sensor Bolt	**7 N. m (62 In. Lbs.)**	-
2	Rear Wheel Speed Sensor Bolt	**10 N. m (7 Ft. Lbs.)**	-

VACUUM PUMP

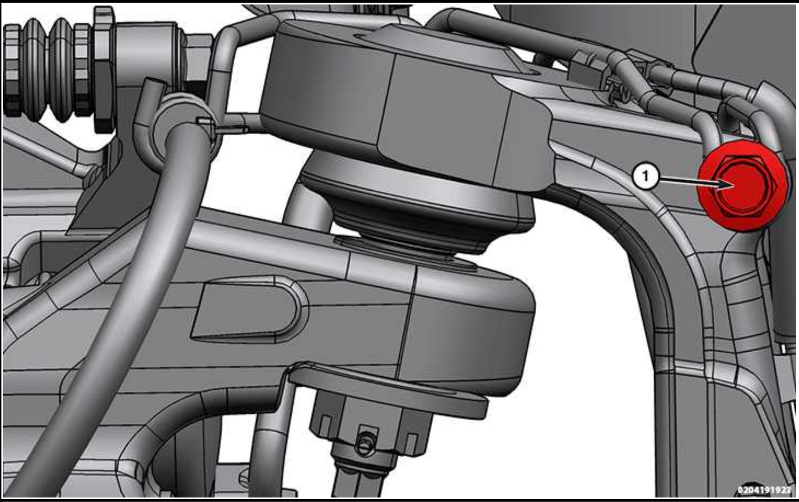


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Vacuum Pump Bolts	**8 N. m (71 In. Lbs.)**	-
2	Vacuum Pump Bracket Bolts	**25 N. m (18 In. Lbs.)**	-

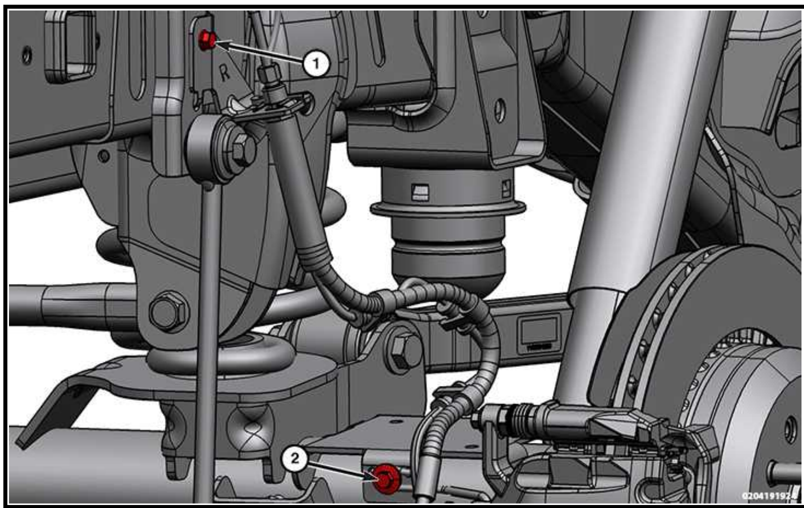
BRAKE LINES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Front Wheel Speed Sensor Bracket Bolt	**30 N. m (22 Ft. Lbs.)**	-
2	Front Brake Hose Axle Bolt	**8 N. m (71 Ft. Lbs.)**	-
3	Front Brake Hose Lower Control Arm Nut	**18 N. m (13 Ft. Lbs.)**	-



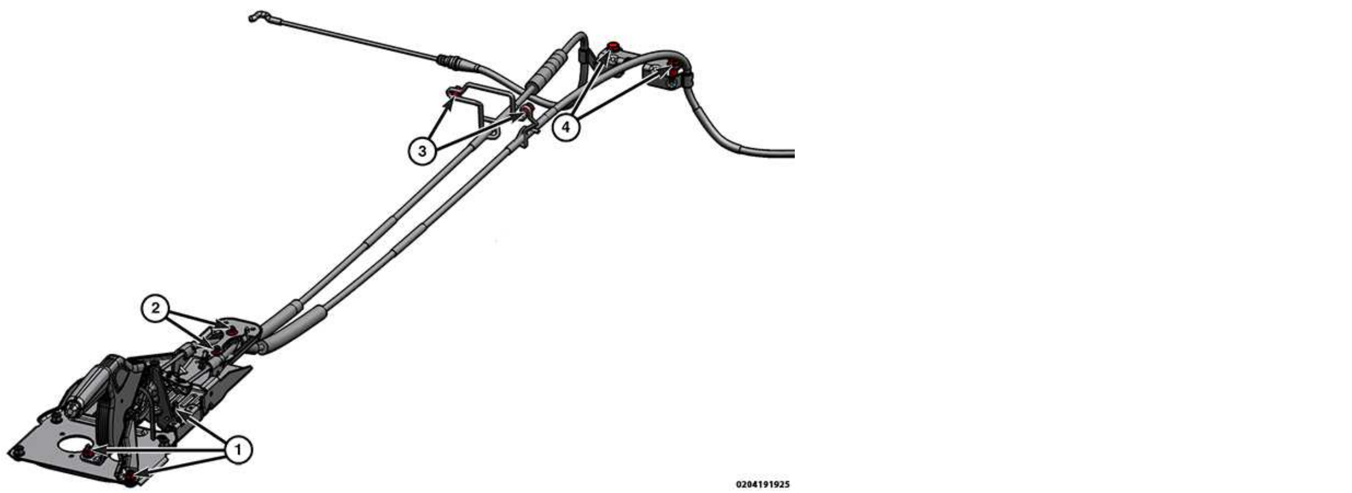
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Front Wheel Speed Sensor Support Bolt (Wire Form)	**25 N. m (18 Ft. Lbs.)**	-
B	Front Brake Line to Rear Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
B	Front Brake Hose to Axle	**11 N. m (8 In. Lbs.)**	-
B	Front Brake Hose Bracket Nut	**18 N. m (13 Ft. Lbs.)**	-
B	Front Brake Line to Hose Nut	**20 N. m (15 Ft. Lbs.)**	-
B	Front Brake Hose to Frame Bolt	**11 N. m (8 Ft. Lbs.)**	-
B	Rear Brake Line Junction Flare Nut	**18 N. m (13 Ft. Lbs.)**	-
B	Rear Brake Hose Bracket Nut	**7 N. m (62 In. Lbs.)**	-
B	Right Rear Brake Line Tube to Tube Connection	**35 N. m (26 Ft. Lbs.)**	-
B	Rear Brake Hose Axle Bolt	**28 N. m (21 Ft. Lbs.)**	-
B	Rear Brake Line to Hose Nut	**20 N. m (15 Ft. Lbs.)**	-



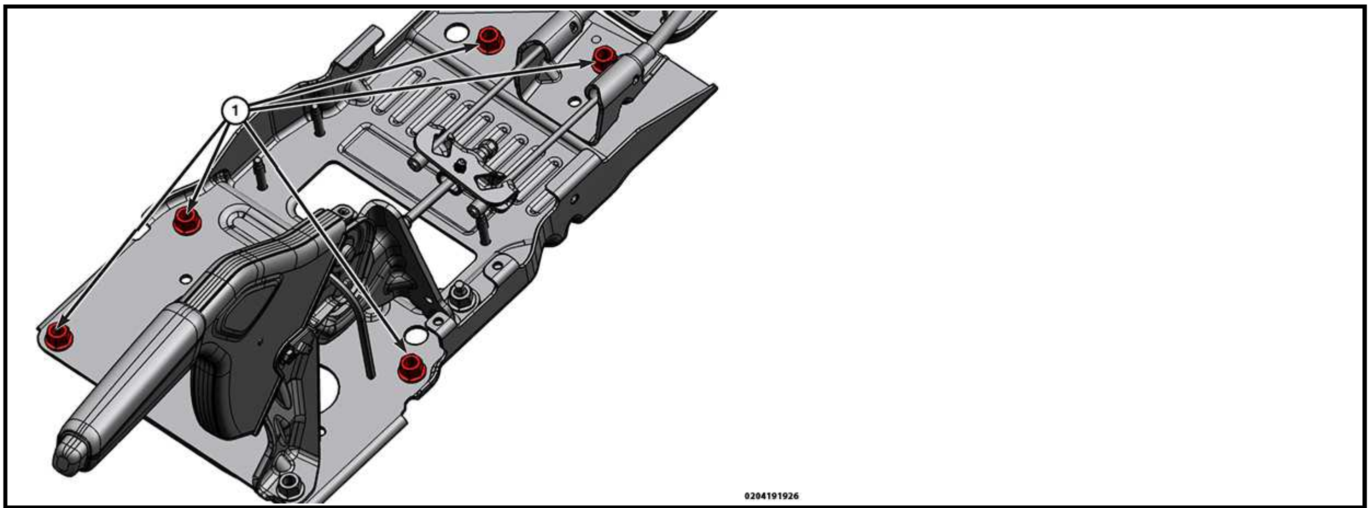
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Front Wheel Speed Sensor Bracket Bolt	**30 N. m (22 Ft. Lbs.)**	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
2	Brake Hose Frame Bolt	**11 N. m (8 Ft. Lbs.)**	-

PARK BRAKE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Parking Brake Lever Nuts	**22 N. m (16 Ft. Lbs.)**	-
2	Parking Brake Cable Bracket Nut	**8 N. m (71 In. Lbs.)**	-
3	Parking Brake Cable Frame Bracket Bolt	**28 N. m (21 Ft. Lbs.)**	-
4	Parking Brake Sled Nuts	**24 N. m (18 Ft. Lbs.)**	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Park Brake Lever Sled Nut	**24 N. m (18 Ft. Lbs.)**	-

ELECTRICAL

SENSOR, WHEEL SPEED, FRONT

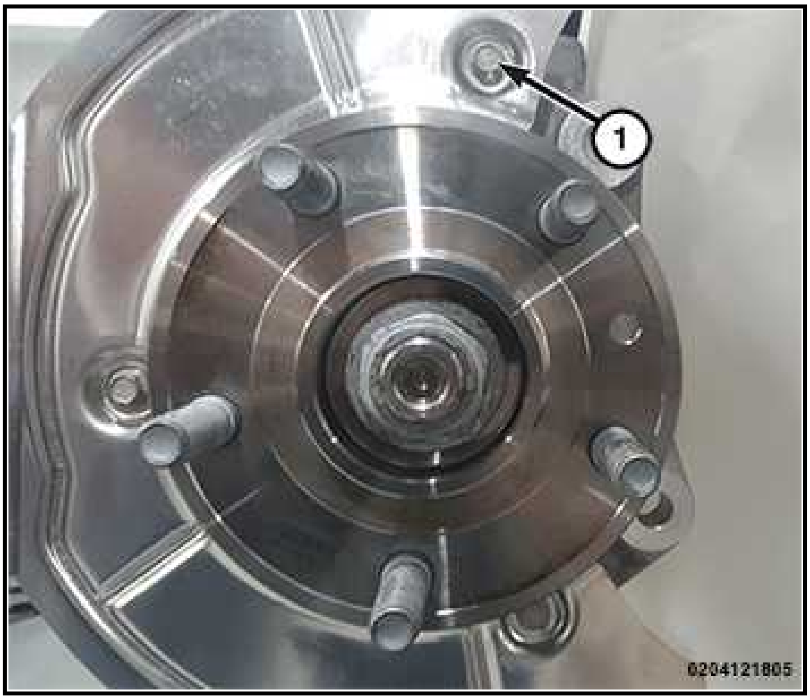
REMOVAL AND INSTALLATION

FRONT WHEEL SPEED SENSOR

REMOVAL

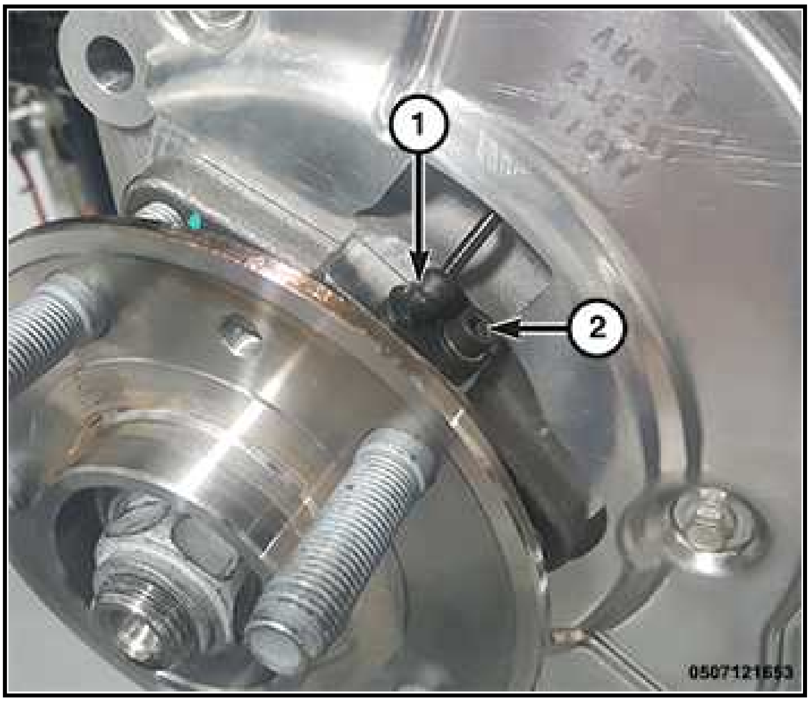
1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .

2. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
3. Remove the tire and wheel assembly. Refer to **REMOVAL AND INSTALLATION** .
4. Remove the disc brake rotor. Refer to **ROTOR, BRAKE, REMOVAL AND INSTALLATION**.



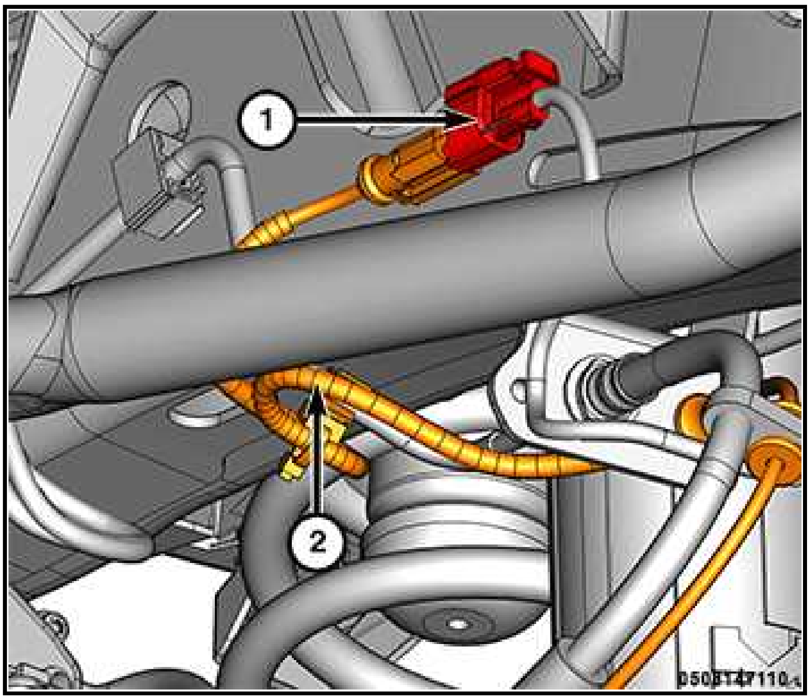
1 - Brake Rotor Splash Shield Bolts

5. Remove the three brake rotor splash shield bolts and remove the brake rotor splash shield.



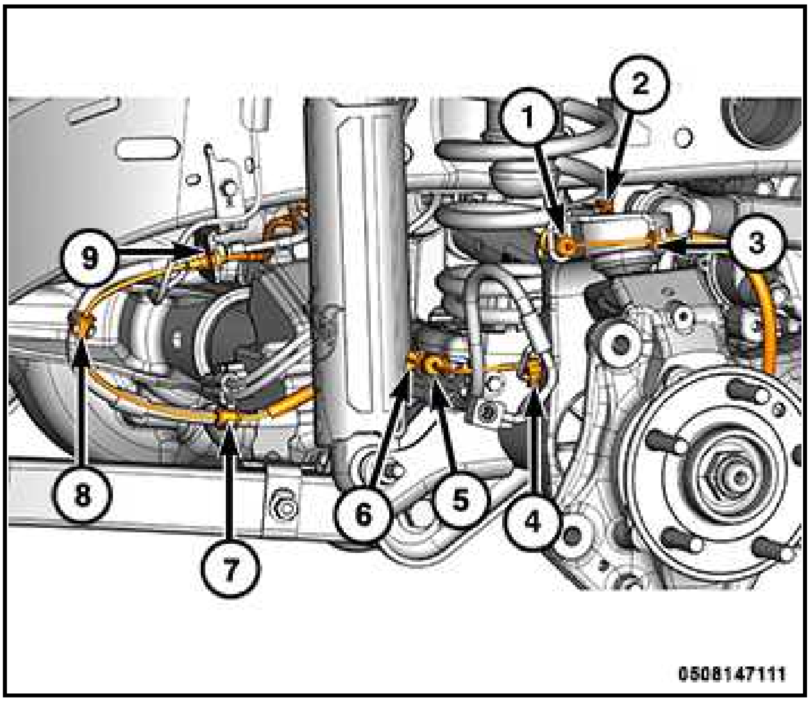
1 - Wheel Speed Sensor
2 - Front Wheel Speed Sensor Bolt

6. Clean the wheel speed sensor and surrounding area with shop towel before removal.
7. Remove the front wheel speed sensor bolt.
8. Remove the front wheel speed sensor from the hub and bearing.



1 - Wheel Speed Sensor Wire Harness Connector	
2 - Wheel Speed Sensor Wire Routing Retainer	

9. Disconnect the wheel speed sensor wire routing retainer (2) from the brake line.
10. Disconnect the front wheel speed sensor wire harness connector (1).



1 - 9 Routing Retainers

11. Disengage all of the wheel speed sensor wire routing retainers.
12. Remove the front wheel speed sensor.

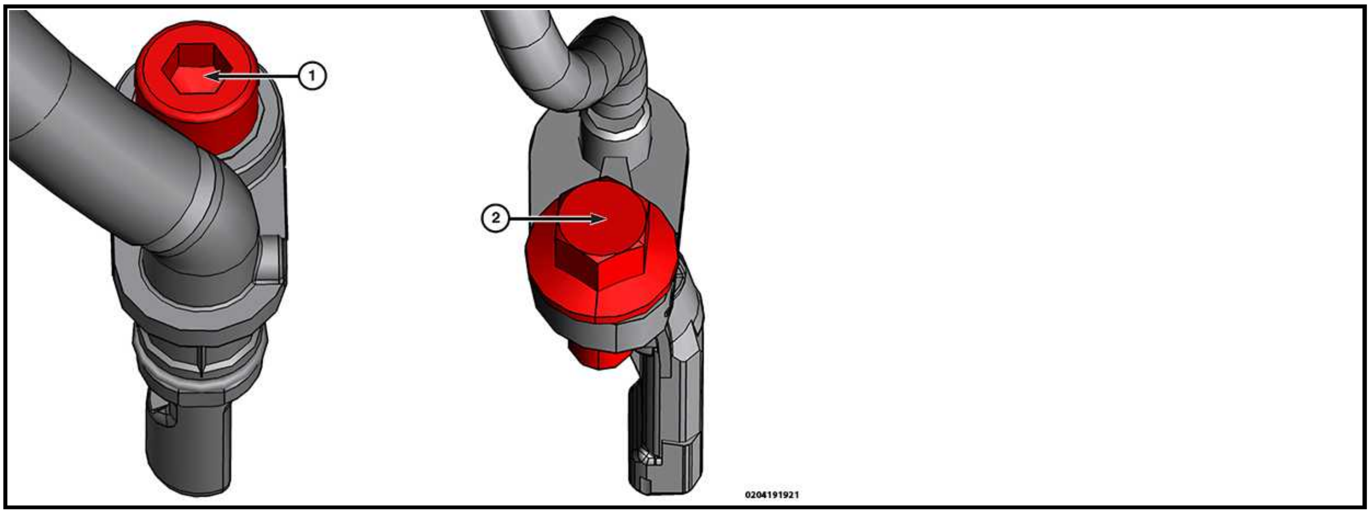
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

WHEEL SPEED SENSOR



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Front Wheel Speed Sensor Bolt	**7 N. m (62 In. Lbs.)**	-
2	Rear Wheel Speed Sensor Bolt	**10 N. m (7 Ft. Lbs.)**	-

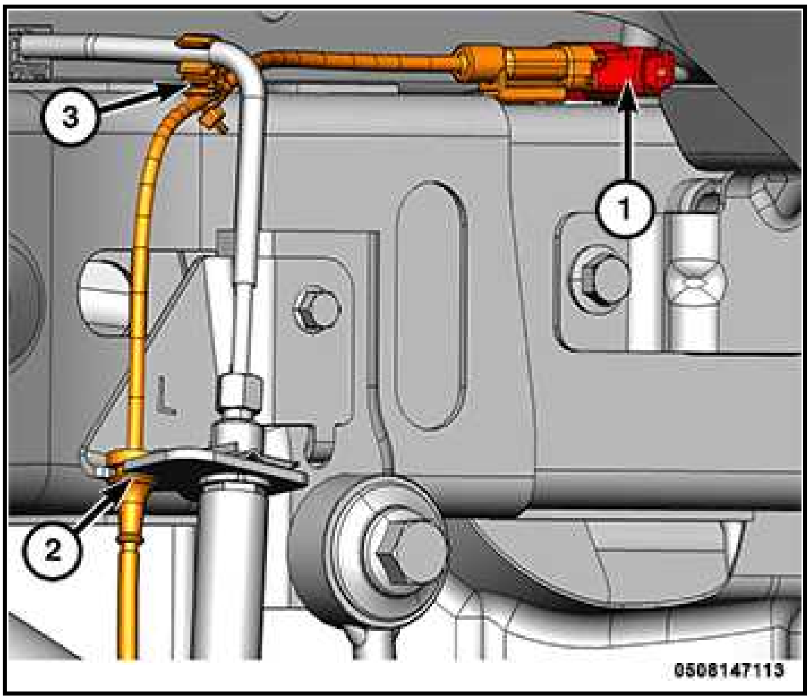
SENSOR, WHEEL SPEED, REAR

REMOVAL AND INSTALLATION

REAR WHEEL SPEED SENSOR

REMOVAL

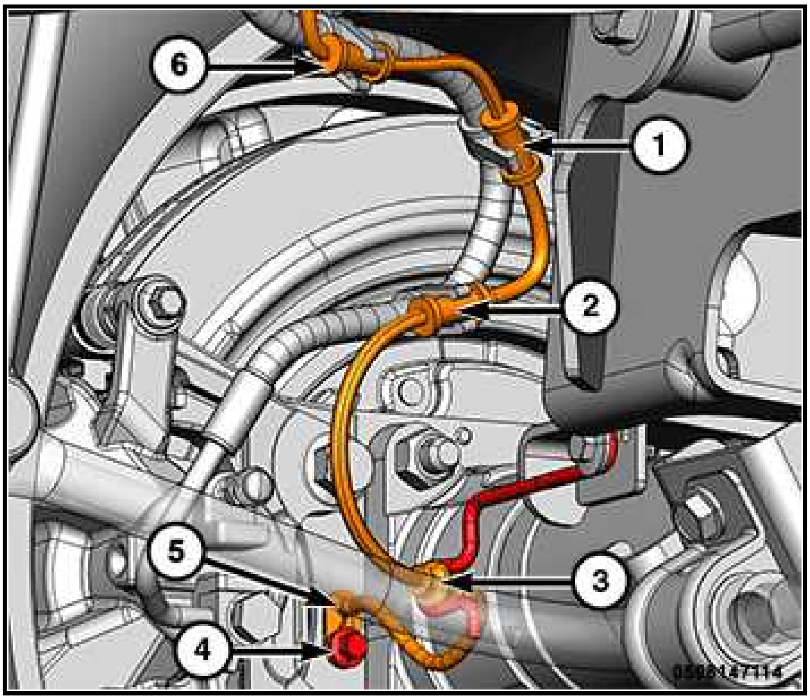
1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .



1 - Wheel Speed Sensor Wire Harness Connector	
2 - Routing Clips	

3 - Routing Clips

3. Disconnect the wheel speed sensor wire harness connector.
4. Disengage the wheel speed sensor wire harness from all of the routing clips.



1 - Wire Harness Retainer
2 - Wire Harness Retainer
3 - Wire Harness Retainer
4 - Rear Wheel Speed Sensor Bolt
5 - Wheel Speed Sensor
6 - Wire Harness Retainer

5. Disengage the wire harness retainer from the bracket.
6. Disengage the wire harness routing clips from the brake hose.
7. Remove the rear wheel speed sensor bolt.
8. Remove the wheel speed sensor.

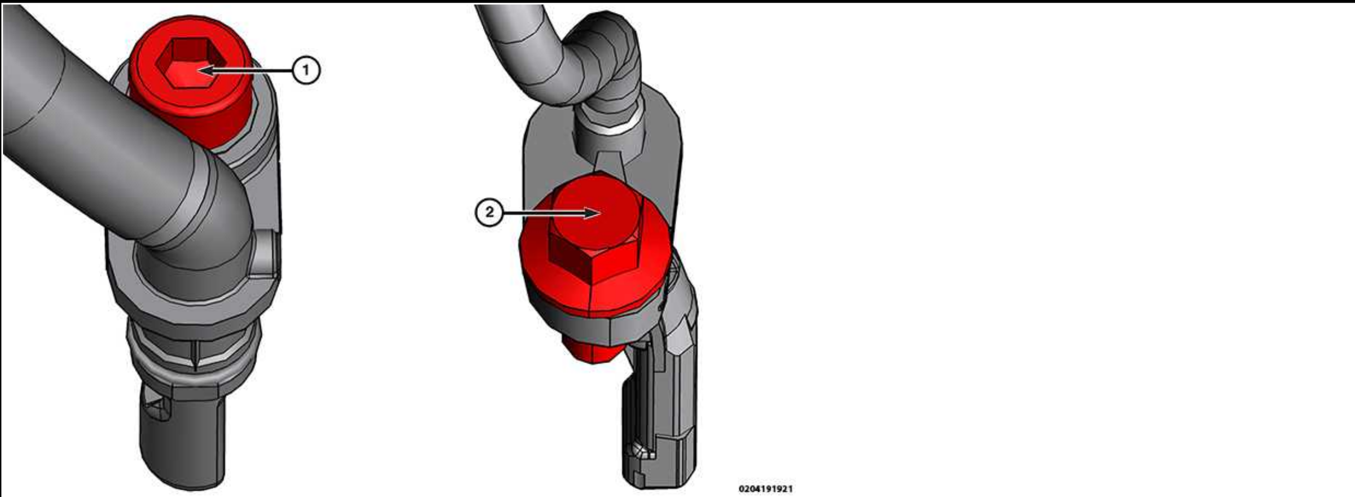
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

WHEEL SPEED SENSOR



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Front Wheel Speed Sensor Bolt	**7 N. m (62 In. Lbs.)**	-
2	Rear Wheel Speed Sensor Bolt	**10 N. m (7 Ft. Lbs.)**	-

SWITCH, ELECTRONIC STABILITY PROGRAM (ESP)

REMOVAL AND INSTALLATION

ELECTRONIC STABILITY PROGRAM (ESP) SWITCH

WARNING: **To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.**

The Electronic Stability Program (ESP) switch is integral to the Integrated Center Stack (ICS). The ESP switch must be serviced with the ICS. Refer to **MODULE, INTEGRATED CENTER STACK (ICSM), REMOVAL AND INSTALLATION** .

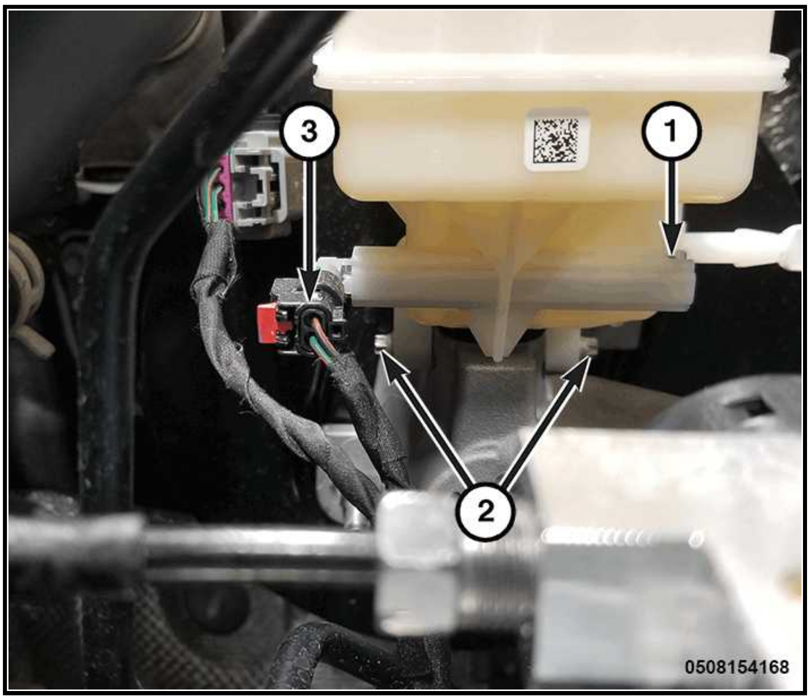
SWITCH, BRAKE FLUID LEVEL

REMOVAL AND INSTALLATION

BRAKE FLUID LEVEL SWITCH

REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .



1 - Brake Fluid Level Switch Tab	
2 - Brake Fluid Reservoir Bolts	
3 - Wire Harness Connector	

2. Disconnect the brake fluid level switch wire harness connector.
3. Release both brake fluid level switch tabs then grasp the connector end of brake fluid level switch and pull it out of brake fluid reservoir.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

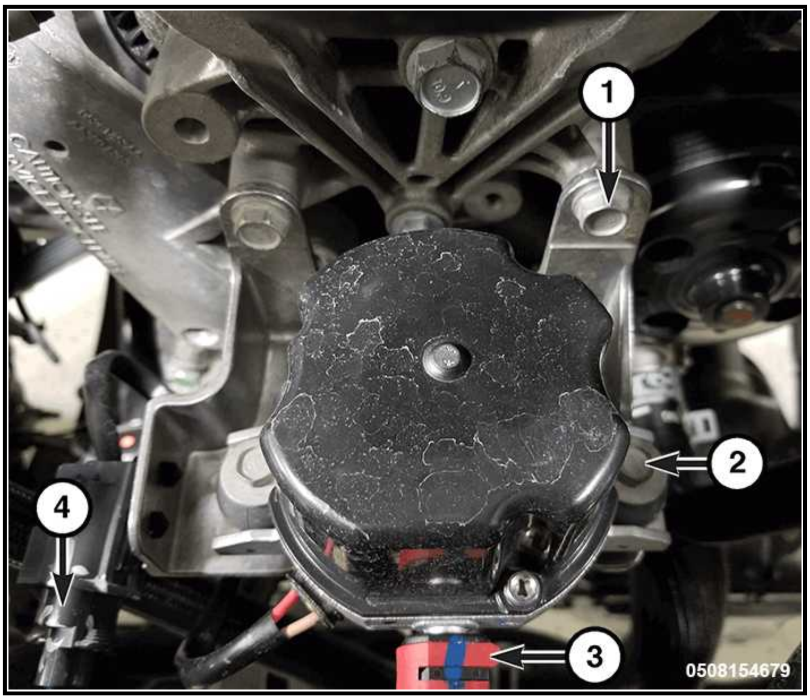
PUMP, ELECTRIC VACUUM

REMOVAL AND INSTALLATION

VACUUM PUMP

REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the air cleaner resonator. Refer to **RESONATOR, AIR CLEANER, REMOVAL AND INSTALLATION** .



1 - Vacuum Pump Bracket Bolts	
2 - Vacuum Pump Bolts	
3 - Vacuum Line	
4 - Wire Harness Connector	

3. Disconnect the electric vacuum pump wire harness connector and release the fasteners securing the vacuum pump harness.
4. Release the locking tab and disconnect the vacuum line from the vacuum pump.
5. Remove the two vacuum pump bolts and remove the vacuum pump.
6. Remove the two vacuum pump bracket bolts.
7. Remove the vacuum pump bracket.

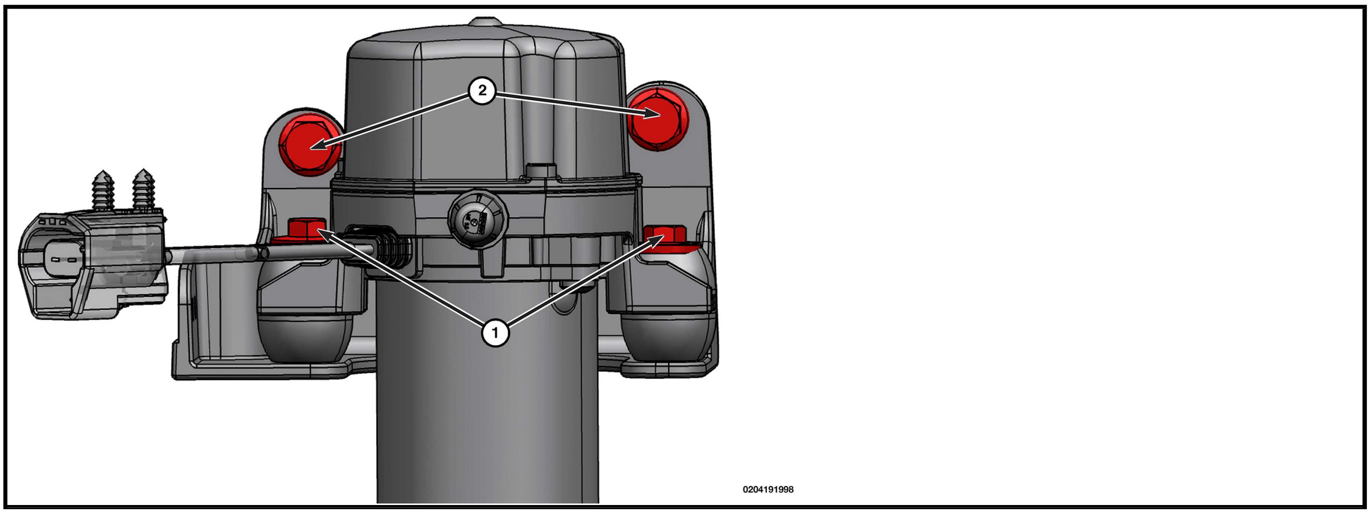
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

VACUUM PUMP



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Vacuum Pump Bolts	**8 N. m (71 In. Lbs.)**	-
2	Vacuum Pump Bracket Bolts	**25 N. m (18 In. Lbs.)**	-

HYDRAULIC/MECHANICAL

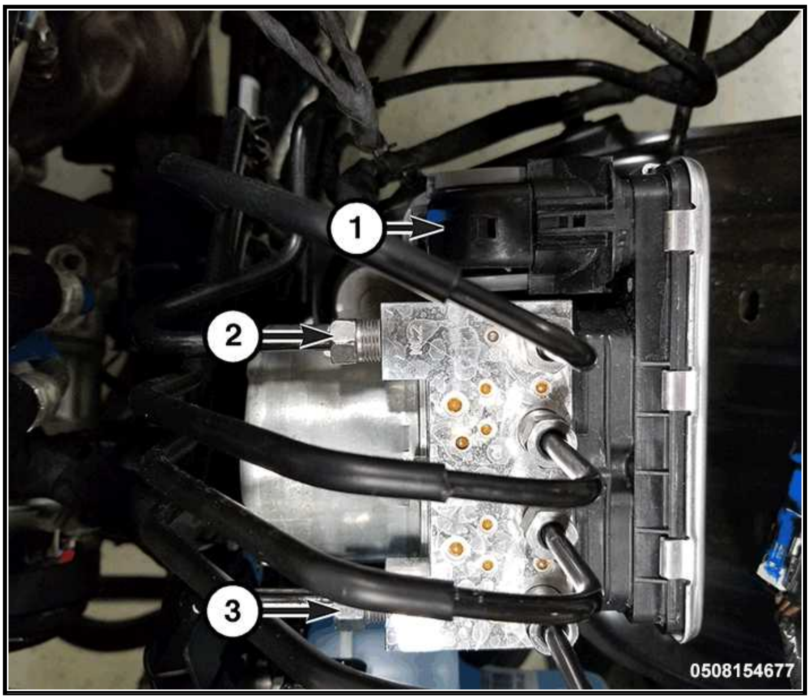
HYDRAULIC CONTROL UNIT (HCU)

REMOVAL AND INSTALLATION

HYDRAULIC CONTROL UNIT (HCU)

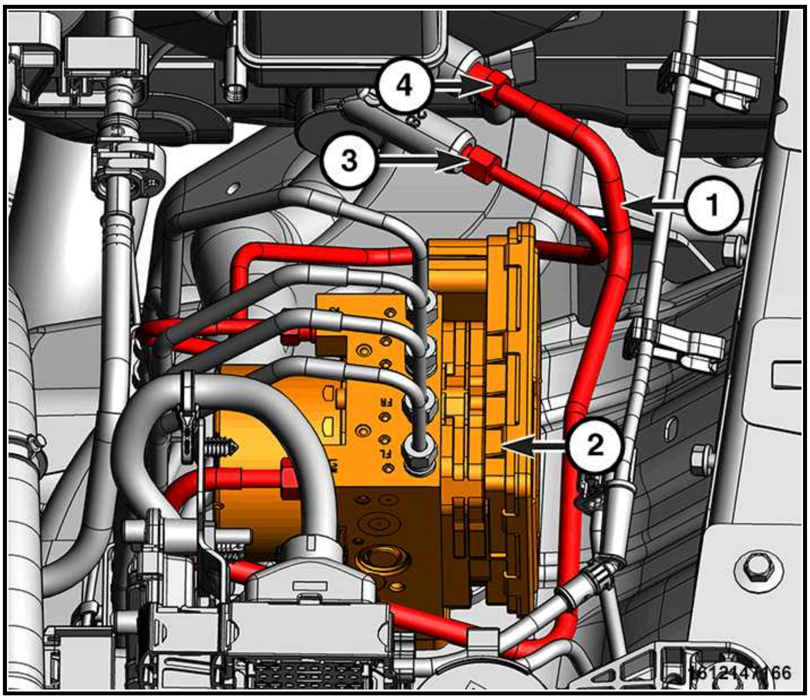
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Using a brake pedal holding tool, depress brake pedal past its first inch of travel and hold it in this position. Holding pedal in this position will isolate master cylinder from hydraulic brake system and will not allow brake fluid to drain out of brake fluid reservoir while brake lines are open.



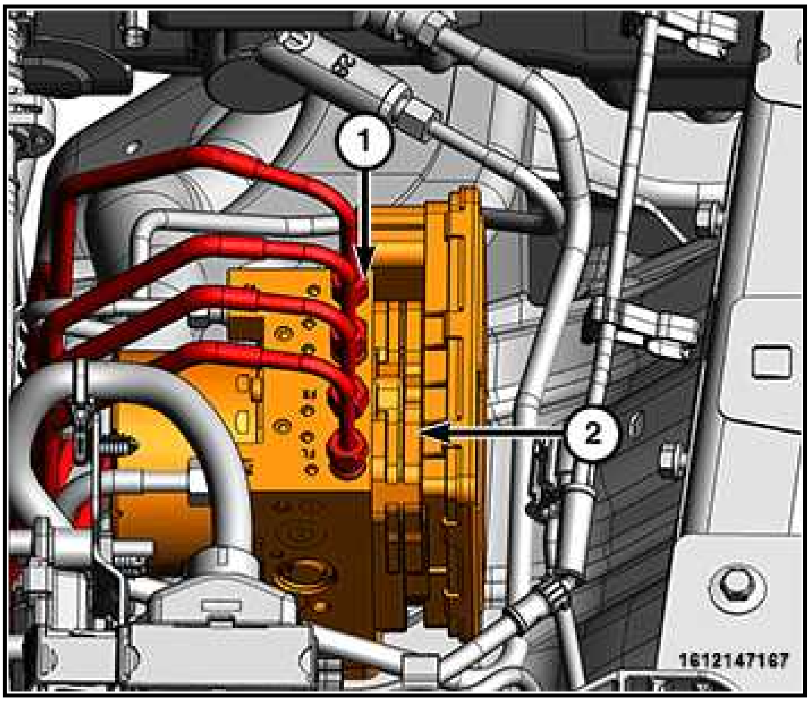
1 - Anti-lock Brake System (ABS) Module Wire Harness Connector	
2 - Primary Brake Line Flare Nut	
3 - Secondary Brake Line Flare Nut	

3. Disconnect the Anti-lock Brake System (ABS) module wire harness connector.
4. Remove the primary brake line flare nut at Hydraulic Control Unit (HCU) and the secondary brake line flare nut at Hydraulic Control Unit (HCU).



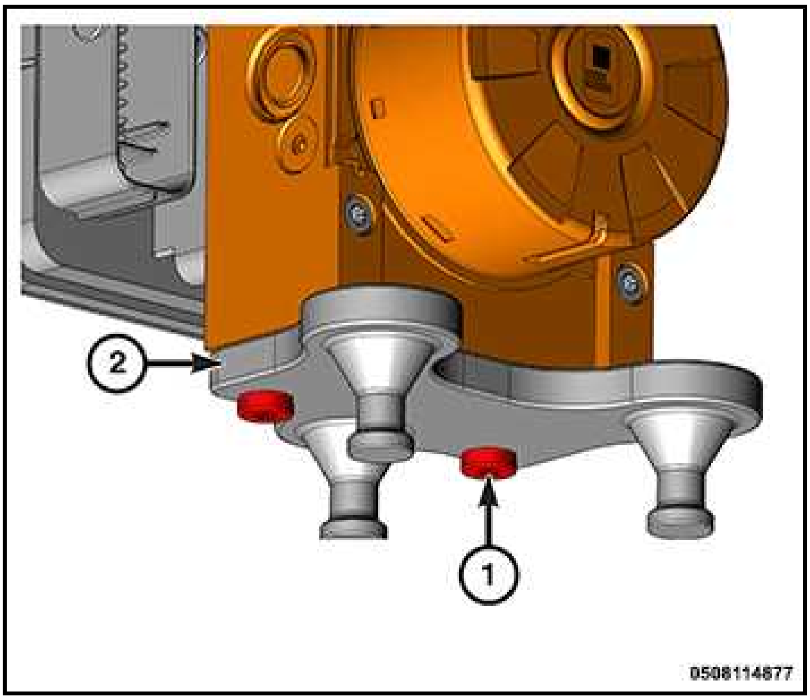
1 - Brake Fluid Supply Lines	
2 - Hydraulic Control Unit (HCU)	
3 - Master Cylinder Brake Line Flare Nuts	
4 - Master Cylinder Brake Line Flare Nuts	

5. Remove the two master cylinder brake line flare nuts.
6. Remove the two brake fluid supply lines.



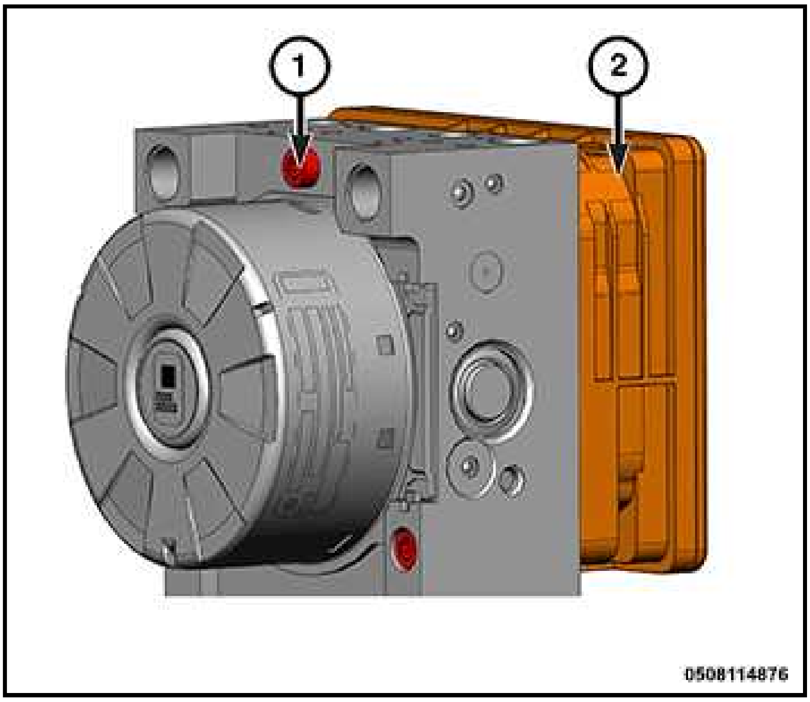
1 - Hydraulic Control Unit (HCU) Brake Lines Flare Nuts	
2 - HCU	

7. Remove the four Hydraulic Control Unit (HCU) brake lines flare nuts.
8. Remove the HCU.



1 - HCU Bracket Bolts	
2 - HCU Bracket	

9. Remove the two HCU bracket bolts and remove the HCU bracket.



1 - Anti-lock Brake System (ABS) Module Bolts	
2 - Anti-lock Brake System (ABS) Module	

10. Remove the three Anti-lock Brake System (ABS) module bolts and remove the ABS module.

INSTALLATION

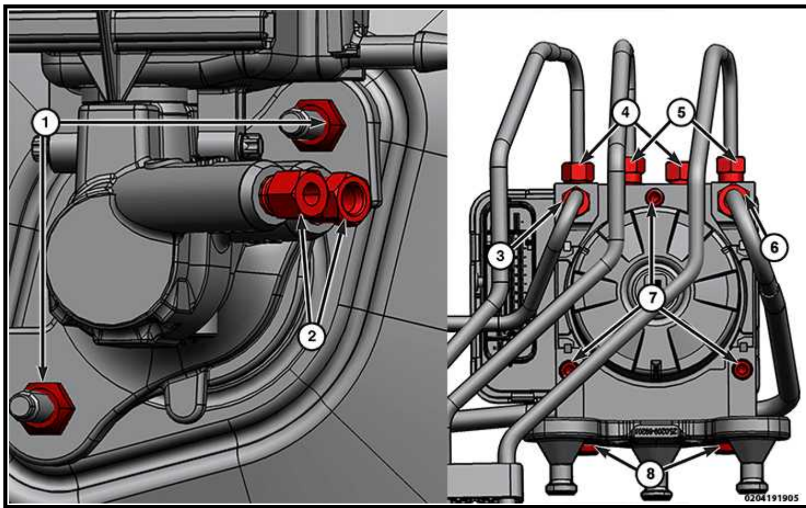
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Bleed the brake system. Refer to **STANDARD PROCEDURE**.

TORQUE SPECIFICATIONS

BRAKE BOOSTER AND MODULE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Master Cylinder Nuts	**18 N. m (13 Ft. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Master Cylinder Brake Lines	**23 N. m (17 Ft. Lbs.)**	-
3	Primary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**25 N. m (18 Ft. Lbs.)**	-
4	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
5	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
6	Secondary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**23 N. m (17 Ft. Lbs.)**	-
7	Brake System Control Module (BSCM) Bolts	**8 N. m (70 In. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
8	Hydraulic Control Unit (HCU) Bracket Bolts	**5 N.m (44 In. Lbs.)**	-

INTEGRATED CONTROL UNIT (ICU)

REMOVAL AND INSTALLATION

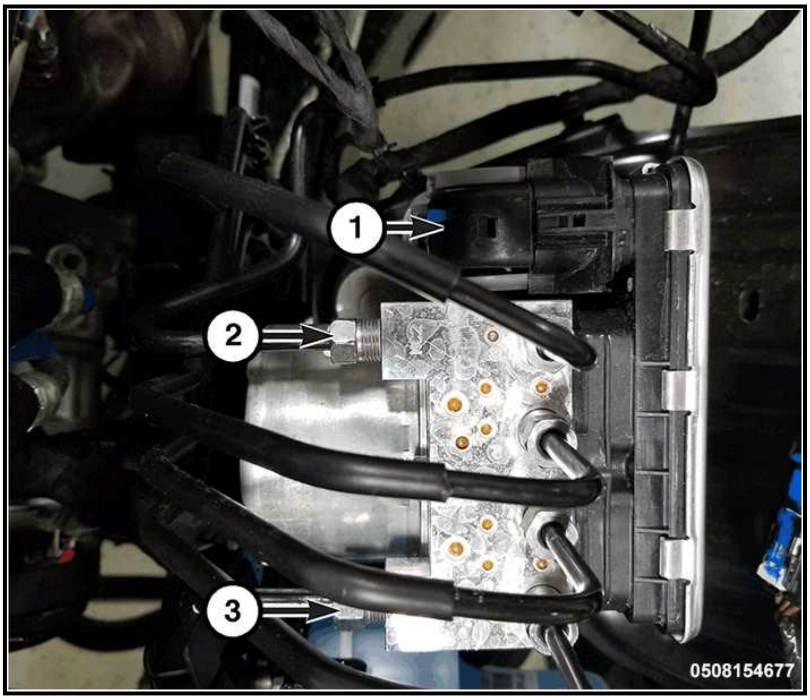
INTEGRATED CONTROL UNIT (ICU)

REMOVAL

NOTE: **The Integrated Control Unit (ICU) must be replaced as an assembly for certain DTCs. The ICU includes the Hydraulic Control Unit (HCU) and Anti-lock Brake System (ABS) module.**

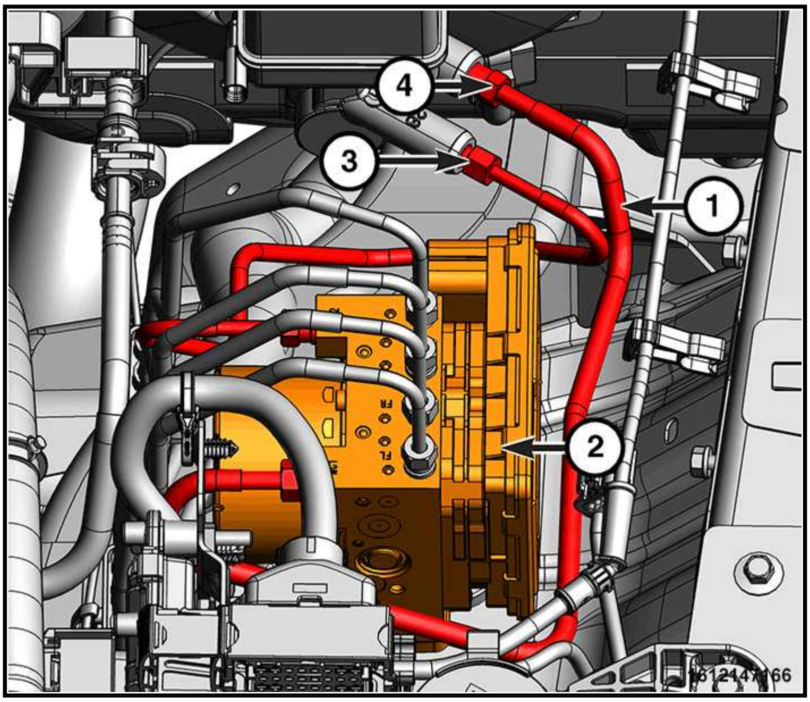
2. Using a brake pedal holding tool, depress brake pedal past its first inch of travel and hold it in this position. Holding pedal in this position will isolate master cylinder from hydraulic brake system and will not allow brake fluid to drain out of brake fluid reservoir while brake lines are open.

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Using a brake pedal holding tool, depress brake pedal past its first inch of travel and hold it in this position. Holding pedal in this position will isolate master cylinder from hydraulic brake system and will not allow brake fluid to drain out of brake fluid reservoir while brake lines are open.



1 - Anti-lock Brake System (ABS) Module Wire Harness Connector	
2 - Primary Brake Line Flare Nut	
3 - Secondary Brake Line Flare Nut	

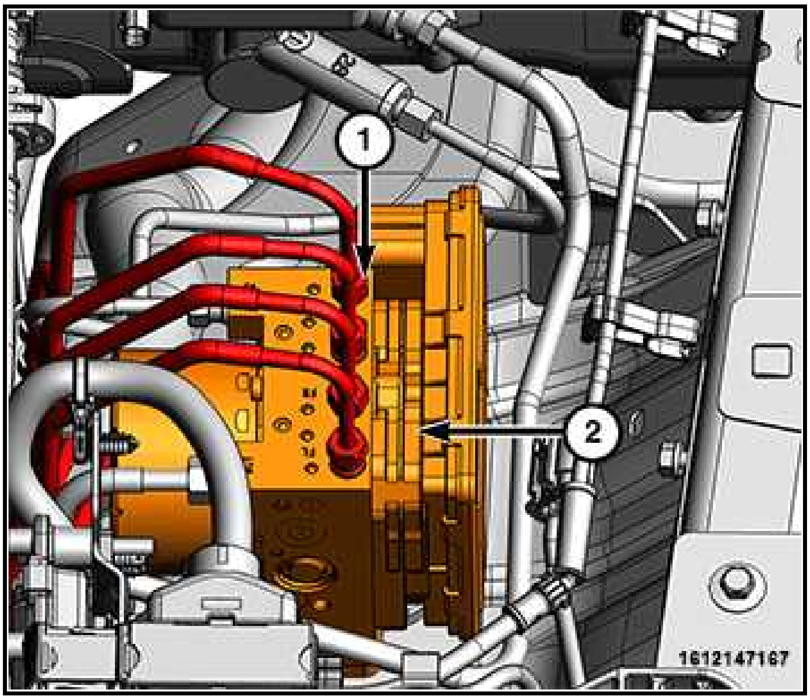
3. Disconnect the Anti-lock Brake System (ABS) module wire harness connector.
4. Remove the primary brake line flare nut at Hydraulic Control Unit (HCU) and the secondary brake line flare nut at Hydraulic Control Unit (HCU).



1 - Brake Fluid Supply Lines
2 - Hydraulic Control Unit (HCU)
3 - Master Cylinder Brake Line Flare Nuts

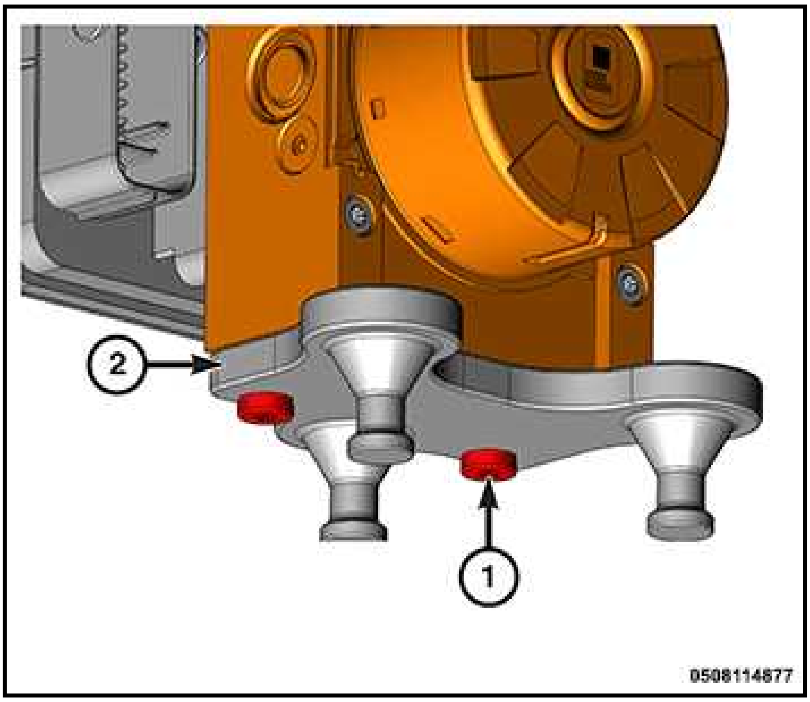
4 - Master Cylinder Brake Line Flare Nuts

5. Remove the two master cylinder brake line flare nuts.
6. Remove the two brake fluid supply lines.



1 - Hydraulic Control Unit (HCU) Brake Lines Flare Nuts
2 - HCU

7. Remove the four Hydraulic Control Unit (HCU) brake lines flare nuts.
8. Remove the HCU.



1 - HCU Bracket Bolts
2 - HCU Bracket

9. Remove the two HCU bracket bolts and remove the HCU bracket.

INSTALLATION

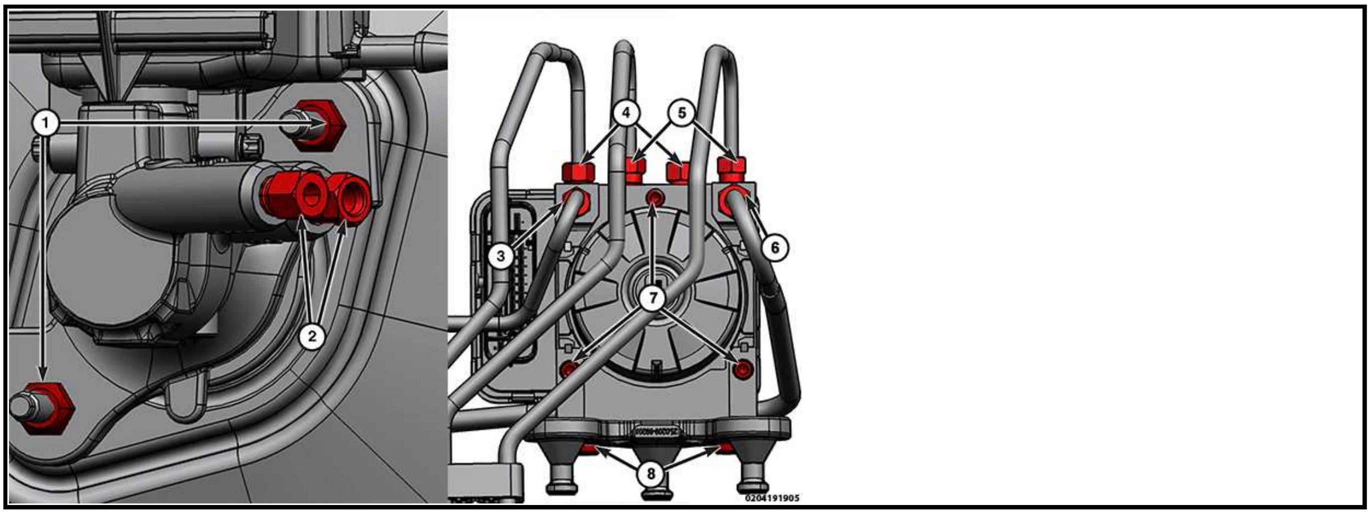
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Bleed the brake system. Refer to **STANDARD PROCEDURE**.

TORQUE SPECIFICATIONS

BRAKE BOOSTER AND MODULE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Master Cylinder Nuts	**18 N. m (13 Ft. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Master Cylinder Brake Lines	**23 N. m (17 Ft. Lbs.)**	-
3	Primary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**25 N. m (18 Ft. Lbs.)**	-
4	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
5	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
6	Secondary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**23 N. m (17 Ft. Lbs.)**	-
7	Brake System Control Module (BSCM) Bolts	**8 N. m (70 In. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
8	Hydraulic Control Unit (HCU) Bracket Bolts	**5 N.m (44 In. Lbs.)**	-

ADAPTER, DISC BRAKE CALIPER

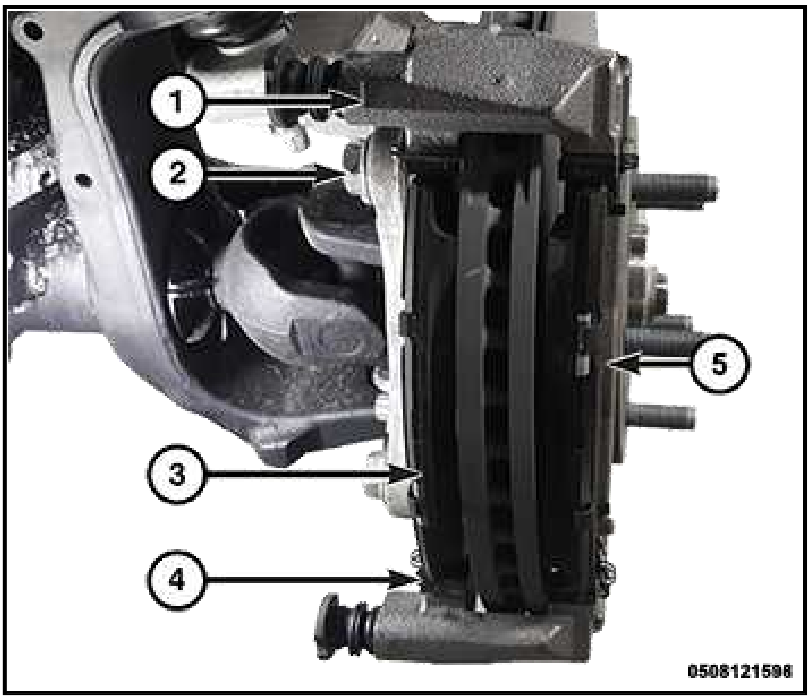
REMOVAL AND INSTALLATION

FRONT

REMOVAL

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the tire and wheel assembly. Refer to **REMOVAL AND INSTALLATION** .
3. Separate the brake caliper from the caliper adapter. Refer to **CALIPER, DISC BRAKE, FRONT, REMOVAL AND INSTALLATION** .

CAUTION: **Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**



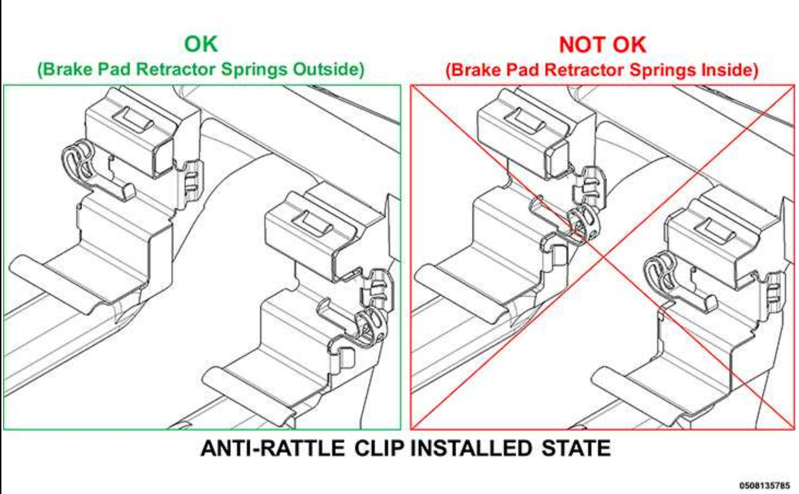
1 - Caliper Adapter	
2 - Caliper Adapter Bolts	
3 - Inboard Brake Pads	
4 - Anti-Rattle Clips	
5 - Outboard Brake Pads	

4. Remove the inboard and outboard brake pads. Refer to **PADS, BRAKE, FRONT, REMOVAL AND INSTALLATION** .
5. Remove the two caliper adapter bolts.
6. Remove the caliper adapter.
7. Remove and **DISCARD** the four anti-rattle clips.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.



- Using a suitable tool press both caliper pistons fully into the caliper bores.

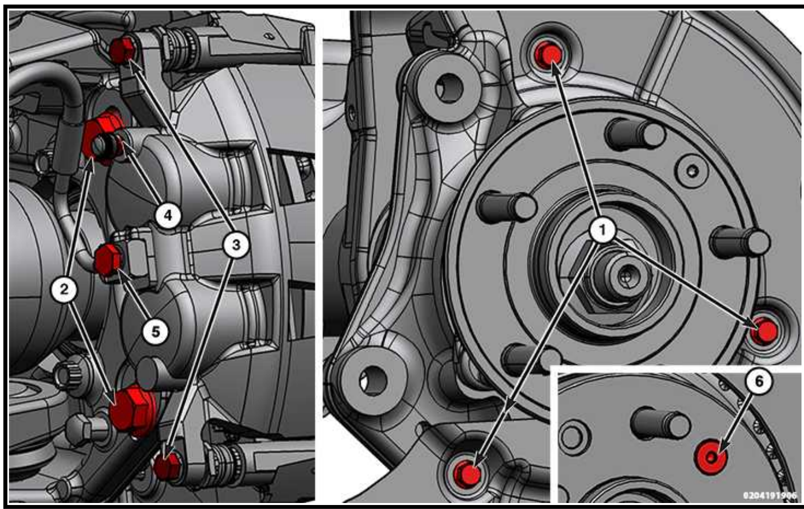
NOTE: **Be certain that the anti-rattle clip mounting surfaces of the caliper adapter are free from rust and debris.**

NOTE: **The four NEW anti-rattle clips must be installed as shown.**

- Install the four **NEW** anti-rattle clips.
- Pump brake pedal until caliper pistons and brake pads are seated and a **firm** brake pedal is obtained.
- Verify proper brake fluid level.
- Road test vehicle making several stops to wear off any foreign material on brakes and to seat brake pads.

TORQUE SPECIFICATIONS

FRONT BRAKES



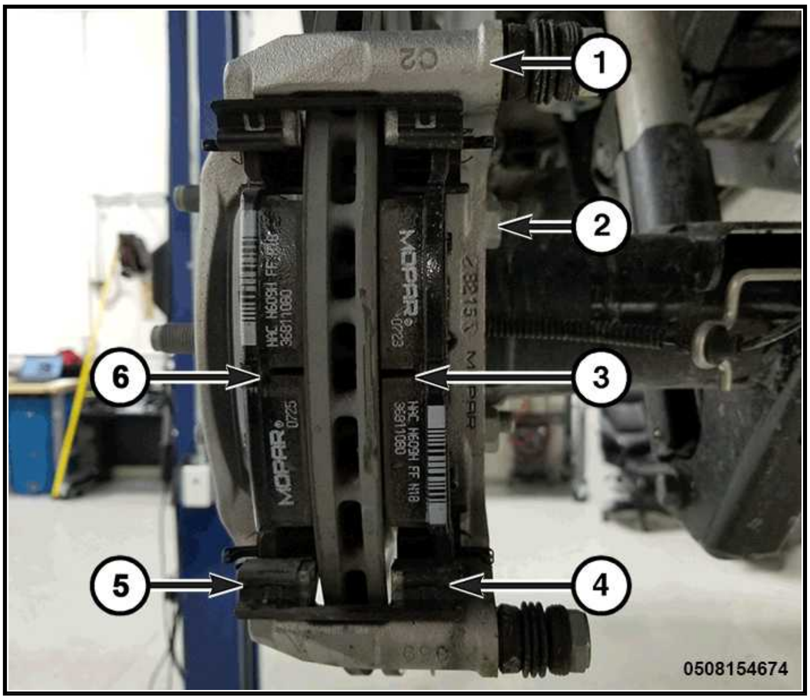
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**10 N. m (7 Ft. Lbs.)**	-
2	Front Caliper Adapter Bolts	**195 N. m (144 Ft. Lbs.)**	-
3	Front Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Front Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
5	Front Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
6	Front Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

REAR

REMOVAL

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the tire and wheel assembly. Refer to **REMOVAL AND INSTALLATION** .
3. Separate the rear brake caliper from the caliper adapter. Refer to **CALIPER, DISC BRAKE, REAR, REMOVAL AND INSTALLATION**.

CAUTION: **Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**



1 - Caliper Adapter	
2 - Caliper Adapter Bolts	
3 - Inboard Brake Pads	
4 - Anti-Rattle Clips	
5 - Anti-Rattle Clips	
6 - Outboard Brake Pads	

4. Remove the inboard and outboard brake pads. Refer to **PADS, BRAKE, REAR, REMOVAL AND INSTALLATION**.
5. Remove the caliper adapter mounting bolts.
6. Remove the rear caliper adapter.
7. Remove and **DISCARD** both anti-rattle clips.

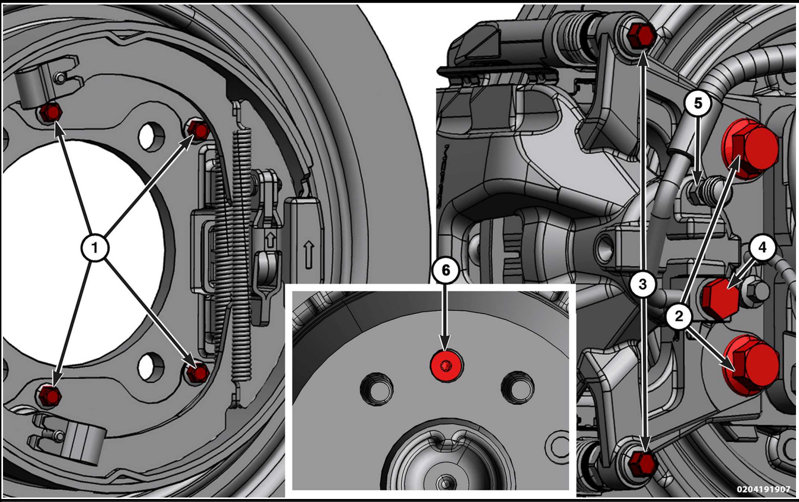
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

REAR BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**11 N. m (8 Ft. Lbs.)**	-
2	Rear Caliper Adapter Bolts	**125 N. m (92 Ft. Lbs.)**	-
3	Rear Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Rear Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
5	Rear Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
6	Rear Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

BOOSTER, POWER BRAKE

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING

Check for Diagnostic Trouble Codes (DTC)s and refer to the appropriate diagnosis and testing in the appropriate service information and. Refer to **DIAGNOSIS AND TESTING** . .

DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER

1. Start the engine and check the booster vacuum hose connections. A hissing noise indicates a vacuum leak. Correct any vacuum leaks before proceeding.
2. Stop the engine and pump the brake pedal until all vacuum reserve in the booster is depleted.
3. Press and hold the brake pedal under light foot pressure. The pedal should hold firm. If the pedal falls away, there may be an external leak or the master cylinder is faulty (internal leakage).
4. Start the engine and note pedal action. It should fall away slightly under light foot pressure, then hold firm. If no pedal action is discernible, the power booster, vacuum supply or vacuum check valve is faulty, proceed to the POWER BOOSTER VACUUM TEST.
5. If the POWER BOOSTER VACUUM TEST passes, rebuild the booster vacuum reserve as follows: Release the brake pedal. Increase engine speed to 1500 RPM, close the throttle and immediately turn off the ignition to stop the engine.
6. Wait a minimum of 90 seconds and try brake action again. The booster should provide two or more vacuum assisted pedal applications. If the vacuum assist is not provided, the booster is faulty.

POWER BOOSTER VACUUM TEST

1. Remove the vacuum pressure sensor from the brake booster and connect a vacuum gauge to the vacuum pressure sensor.
2. Start and run the engine at idle for one minute.

3. Observe the vacuum supply. If the vacuum supply is less than 12 inches HG (406 millibars), repair the vacuum supply.
4. If the vehicle had a symptom such as a hard pedal, and the vacuum gauge reading is within the specified range, replace the brake booster. Refer to **BOOSTER, POWER BRAKE, REMOVAL AND INSTALLATION**.

POWER BOOSTER CHECK VALVE TEST

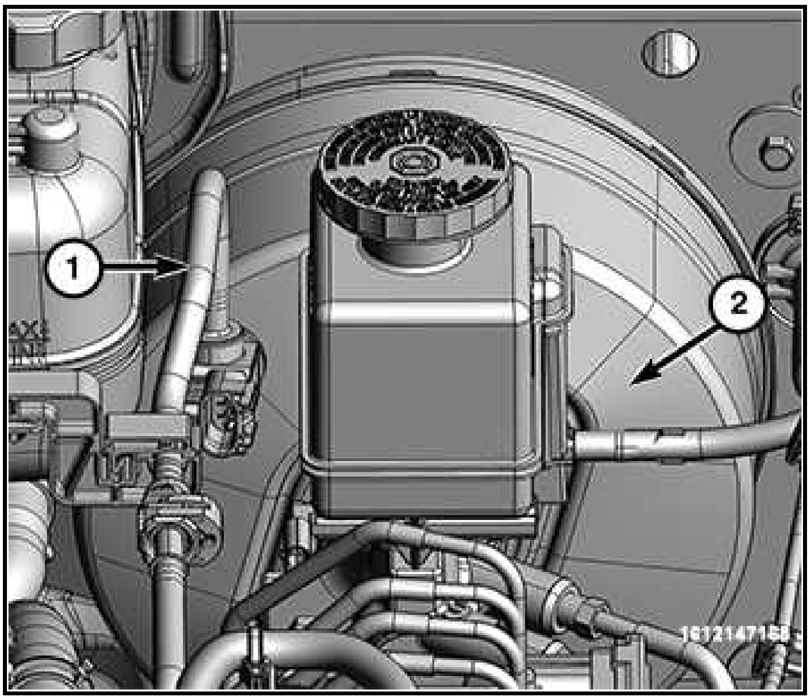
1. Remove the power booster check valve from the power booster.
2. Using a hand operated vacuum pump, apply 15-20 inches HG (508-677 millibars) vacuum at the booster side of the check valve.
3. The vacuum should hold steady. If the gauge on the pump indicates vacuum loss, the check valve is faulty and should be replaced.

REMOVAL AND INSTALLATION

LEFT HAND DRIVE

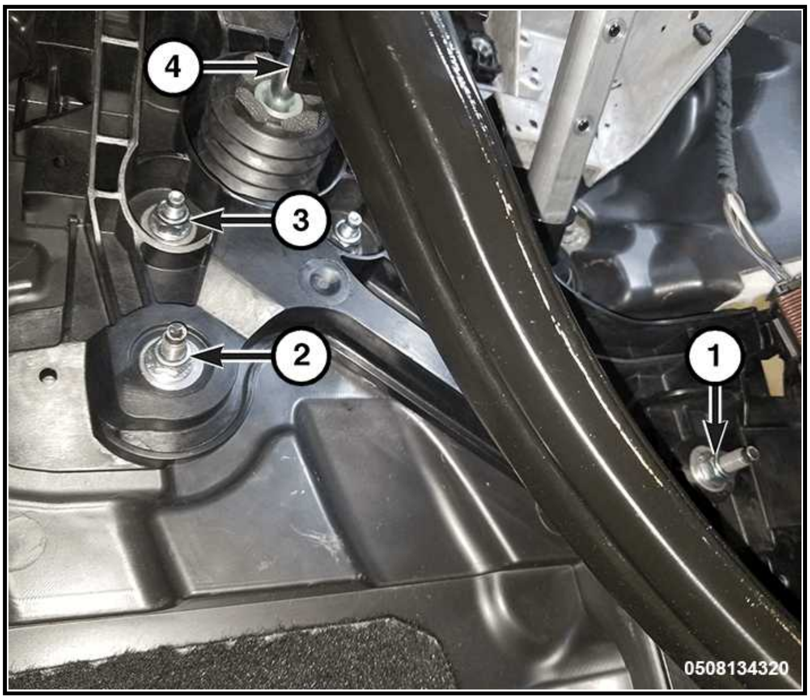
REMOVAL

1. Remove the master cylinder. Refer to **MASTER CYLINDER, BRAKE, REMOVAL AND INSTALLATION**.



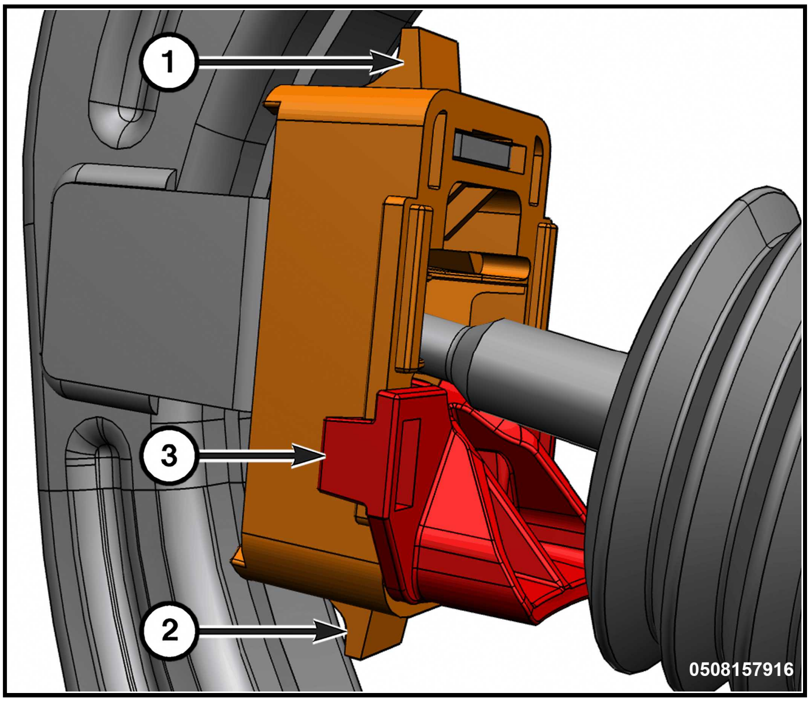
1 - Vacuum Hose	
2 - Brake Booster	

2. Disconnect vacuum hose from the brake booster.
3. Remove the steering column opening cover. Refer to **COVER, STEERING COLUMN OPENING, REMOVAL AND INSTALLATION** .
4. Remove the power inverter module. Refer to **MODULE, POWER INVERTER, REMOVAL AND INSTALLATION** .
5. Remove the comfort seat and wheel module. Refer to **MODULE, COMFORT SEAT AND WHEEL (CSWM), REMOVAL AND INSTALLATION** .



1 - Brake Pedal Nut	
2 - Brake Pedal Nut	
3 - Brake Booster Nuts	
4 - Brake Booster Pushrod Retainer	

6. Remove the four brake booster nuts.



1 - Brake Booster Pushrod Retainer Tabs	
2 - Brake Booster Pushrod Retainer Tab	
3 - Brake Booster Pushrod Locking Tabs	

7. Remove and **DISCARD** the brake booster push rod locking tab by disengaging the two tangs from the brake booster push rod clip.
8. Pull rearward both brake booster push rod retainer tabs and pull up the brake pedal to disengage the both brake booster push rod retainer from the brake pedal.

9. Slide the brake booster push rod retainer up then remove the brake booster push rod retainer from the brake booster push rod and **DISCARD** the brake booster push rod retainer.
10. Remove the brake booster.

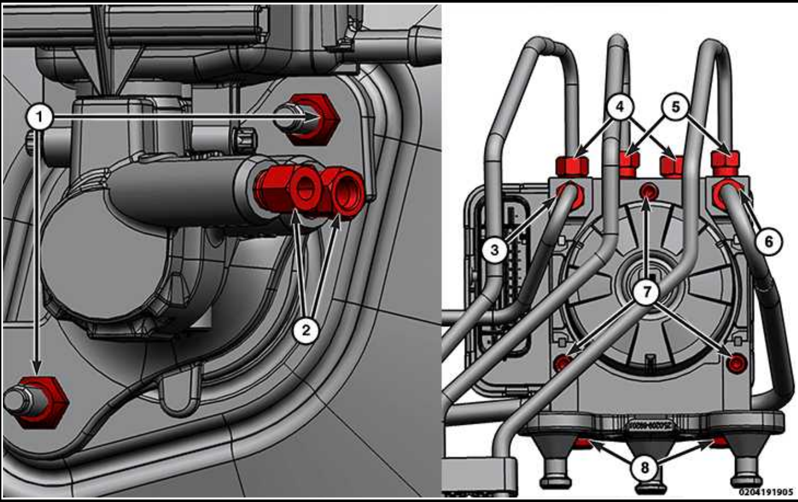
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

BRAKE BOOSTER AND MODULE

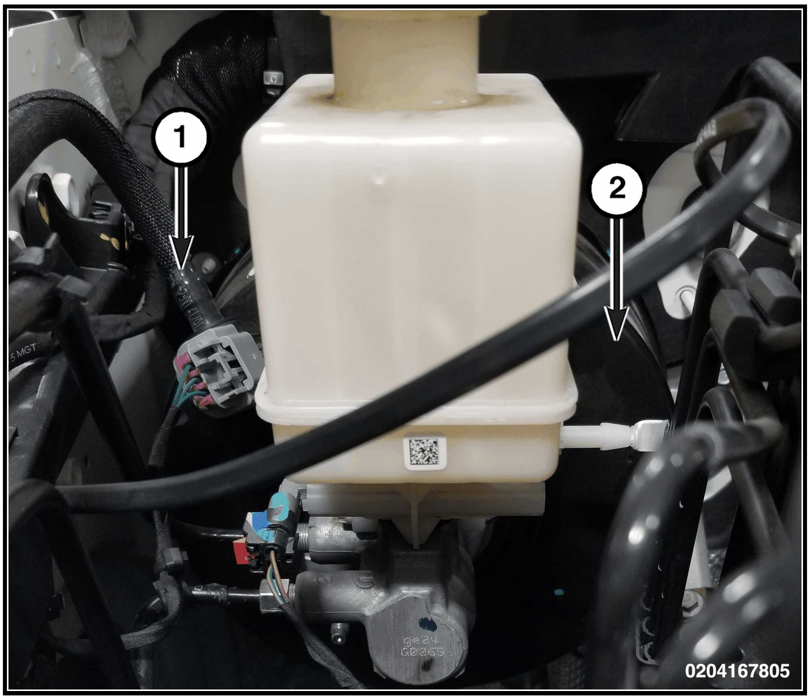


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Master Cylinder Nuts	**18 N. m (13 Ft. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Master Cylinder Brake Lines	**23 N. m (17 Ft. Lbs.)**	-
3	Primary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**25 N. m (18 Ft. Lbs.)**	-
4	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
5	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
6	Secondary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**23 N. m (17 Ft. Lbs.)**	-
7	Brake System Control Module (BSCM) Bolts	**8 N. m (70 In. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
8	Hydraulic Control Unit (HCU) Bracket Bolts	**5 N.m (44 In. Lbs.)**	-

RIGHT HAND DRIVE

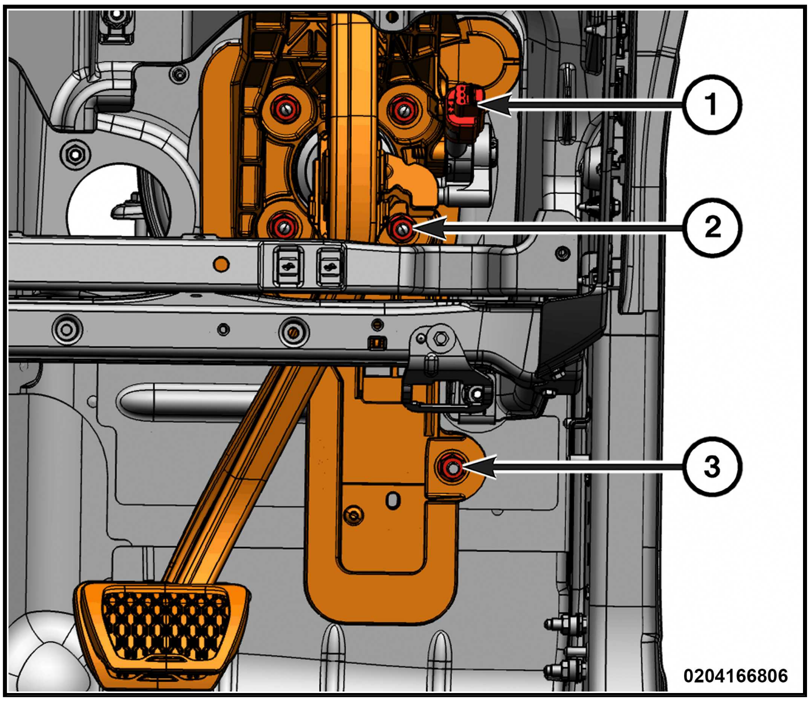
REMOVAL

1. Remove the master cylinder. Refer to **MASTER CYLINDER, BRAKE, REMOVAL AND INSTALLATION**.



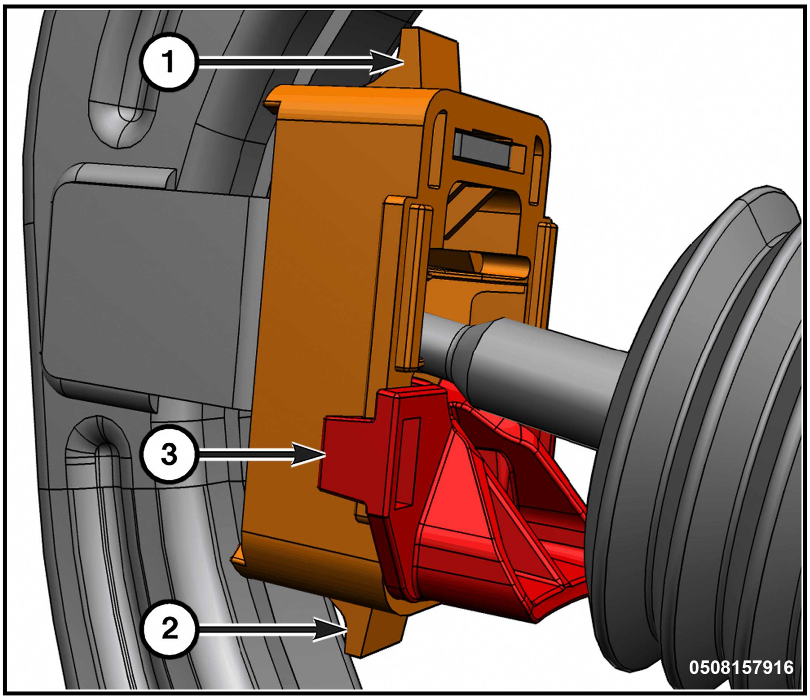
1 - Vacuum Hose	
2 - Brake Booster	

2. Disconnect vacuum hose from the brake booster.
3. Remove the steering column opening cover. Refer to **COVER, STEERING COLUMN OPENING, REMOVAL AND INSTALLATION** .
4. Remove the power inverter module. Refer to **MODULE, POWER INVERTER, REMOVAL AND INSTALLATION** .
5. Remove the comfort seat and wheel module. Refer to **MODULE, COMFORT SEAT AND WHEEL (CSWM), REMOVAL AND INSTALLATION** .



1 - Wire Harness Connector	
2 - Brake Booster Nuts	
3 - Pedal Sled Nut	

6. Remove the four brake booster nuts.



1 - Brake Booster Push Rod Retainer Tab
2 - Brake Booster Push Rod Retainer Tab
3 - Brake Booster Push Rod Locking Tab

7. Remove and **DISCARD** the brake booster push rod locking tab by disengaging the two tangs from the brake booster push rod clip.
8. Pull rearward both brake booster push rod retainer tabs and pull up the brake pedal to disengage the both brake booster push rod retainer from the brake pedal.
9. Slide the brake booster push rod retainer up then remove the brake booster push rod retainer from the brake booster push rod and **DISCARD** the brake booster push rod retainer.
10. Remove the brake booster.

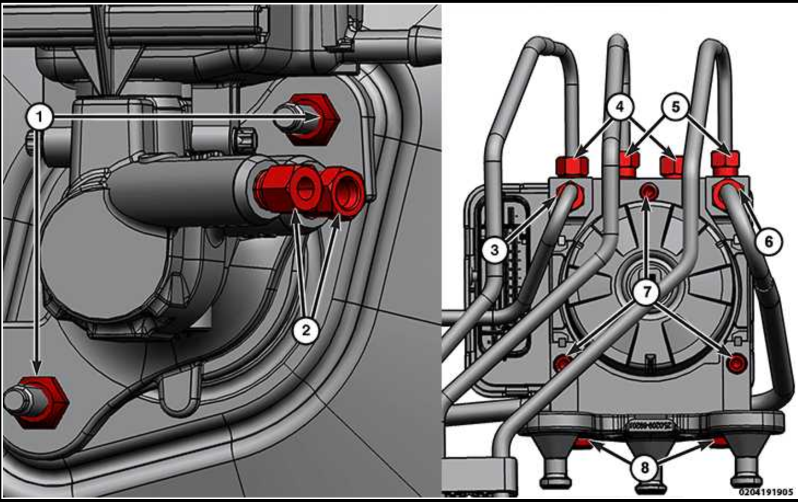
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

BRAKE BOOSTER AND MODULE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Master Cylinder Nuts	**18 N. m (13 Ft. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Master Cylinder Brake Lines	**23 N. m (17 Ft. Lbs.)**	-
3	Primary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**25 N. m (18 Ft. Lbs.)**	-
4	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
5	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
6	Secondary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**23 N. m (17 Ft. Lbs.)**	-
7	Brake System Control Module (BSCM) Bolts	**8 N. m (70 In. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
8	Hydraulic Control Unit (HCU) Bracket Bolts	**5 N.m (44 In. Lbs.)**	-

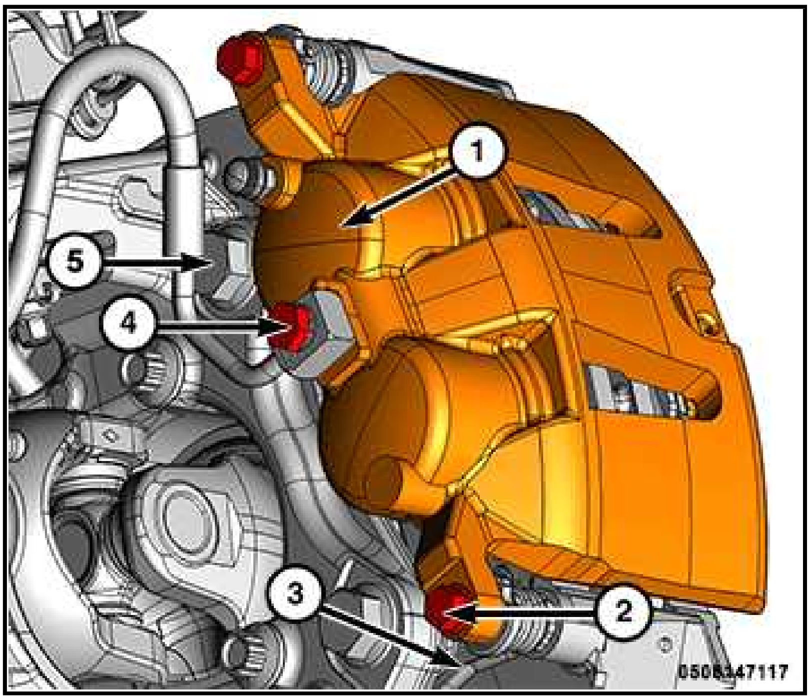
CALIPER, DISC BRAKE, FRONT

REMOVAL AND INSTALLATION

FRONT

REMOVAL

1. Using a brake pedal holding tool, depress brake pedal past its first inch of travel and hold it in this position. Holding pedal in this position will isolate master cylinder from hydraulic brake system and will not allow brake fluid to drain out of brake fluid reservoir while brake lines are open.
2. Raise and support vehicle. Refer to HOISTING, STANDARD PROCEDURE .
3. Remove the tire and wheel assembly. Refer to REMOVAL AND INSTALLATION .



1 - Brake Caliper	
2 - Caliper Bolts	
3 - Caliper Adapter	
4 - Brake Hose Banjo Bolt	
5 - Caliper Adapter Bolt	

4. Remove the brake hose banjo bolt and **DISCARD** two copper gaskets.
5. Remove the two caliper bolts.

NOTE: **For light duty sport models only. Prior to removing the caliper, use a suitable clamp tool to press the outboard brake pad away from the brake caliper to break the adhesive bond between the brake pad and the brake caliper.**

6. Remove the caliper.

NOTE: **For light duty sport models only, brake pads and anti-rattle clips must be removed and discarded. Refer to PADS, BRAKE, FRONT, REMOVAL AND INSTALLATION .**

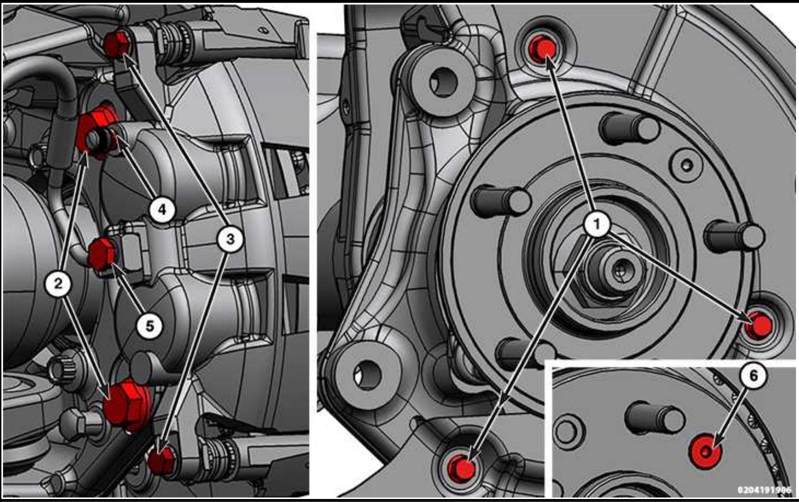
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

FRONT BRAKES



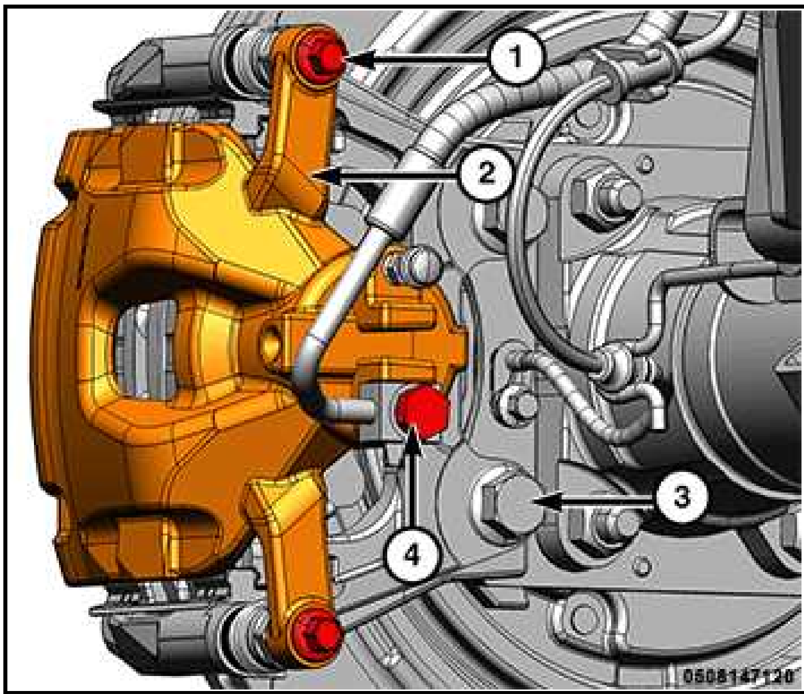
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**10 N. m (7 Ft. Lbs.)**	-
2	Front Caliper Adapter Bolts	**195 N. m (144 Ft. Lbs.)**	-
3	Front Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Front Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
5	Front Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
6	Front Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

CALIPER, DISC BRAKE, REAR

REMOVAL AND INSTALLATION

REAR

REMOVAL



1 - Caliper Bolts	
2 - Brake Caliper	
3 - Caliper Adapter Bolt	
4 - Brake Hose Banjo Bolt	

1. Using a brake pedal holding tool, depress brake pedal past its first inch of travel and hold it in this position. Holding pedal in this position will isolate master cylinder from hydraulic brake system and will not allow brake fluid to drain out of brake fluid reservoir while brake lines are open.
2. Raise and support vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
3. Remove the tire and wheel assembly. Refer to **REMOVAL AND INSTALLATION** .
4. Remove brake hose banjo bolt and **DISCARD** the two copper gaskets.
5. Remove the two caliper bolts.
6. Remove the caliper.

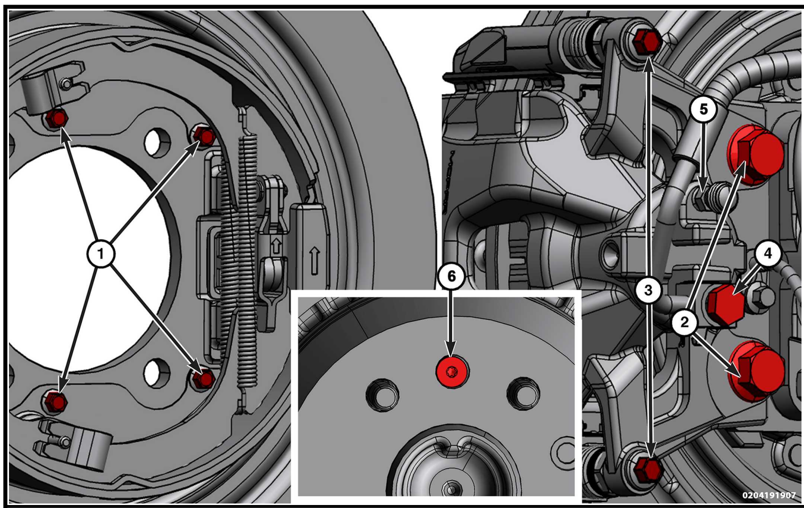
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

REAR BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**11 N. m (8 Ft. Lbs.)**	-
2	Rear Caliper Adapter Bolts	**125 N. m (92 Ft. Lbs.)**	-
3	Rear Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Rear Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
5	Rear Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
6	Rear Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

FLUID

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, caliper seals, Anti-lock Brake System (ABS) hydraulic unit and all hydraulic fluid hoses.

SPECIFICATIONS

For brake fluid type. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .

CAUTION: **Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.**

CAUTION: **Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.**

MASTER CYLINDER, BRAKE

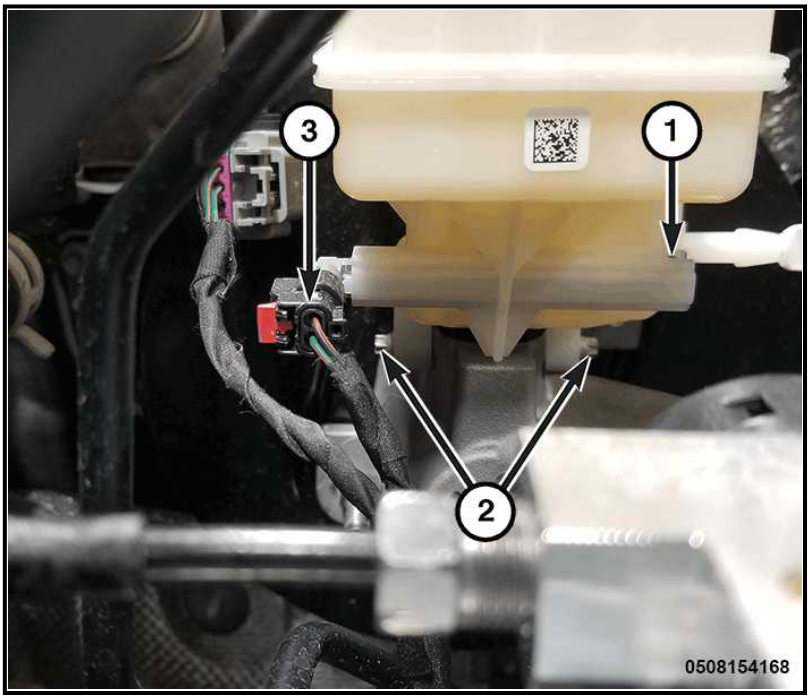
REMOVAL AND INSTALLATION

MASTER CYLINDER - LHD

REMOVAL

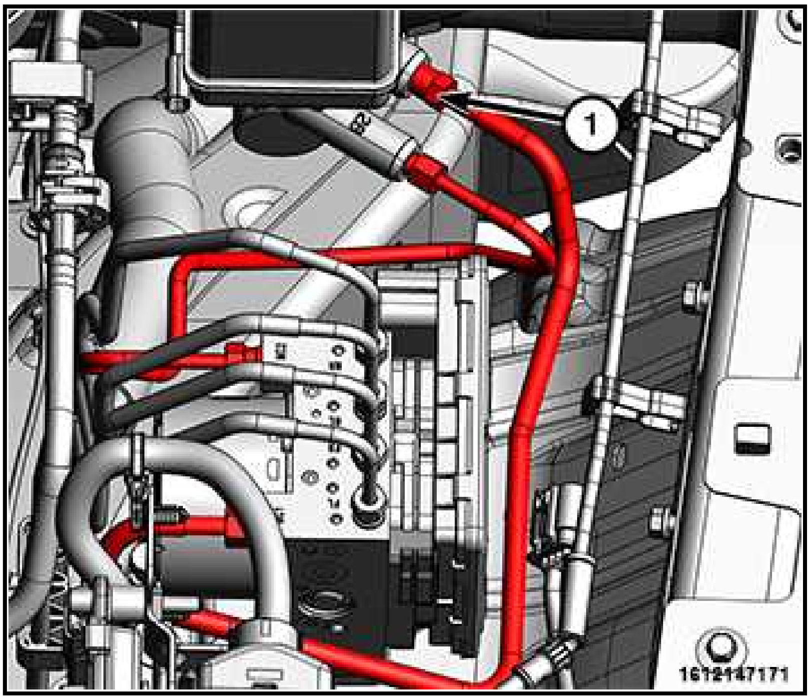
CAUTION: **The vacuum in the power brake booster must be depleted before removing the master cylinder to avoid damaging the master cylinder and to prevent inhalation of the o-ring or any other contamination into the booster. The preferred method is to pump the brake pedal while the engine is not running until the brake pedal becomes firm. An alternative method is to remove and immediately reinstall the check valve located on the booster. If the check valve is removed, special care should be taken to ensure that the grommet is not damaged and remains seated, the check valve is dry and free of debris, and that contaminates cannot be ingested during removal.**

1. With the engine off, depress the brake pedal five times to deplete any vacuum that may remain in the booster unit.
2. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
3. Siphon and drain the fluid from the reservoir.



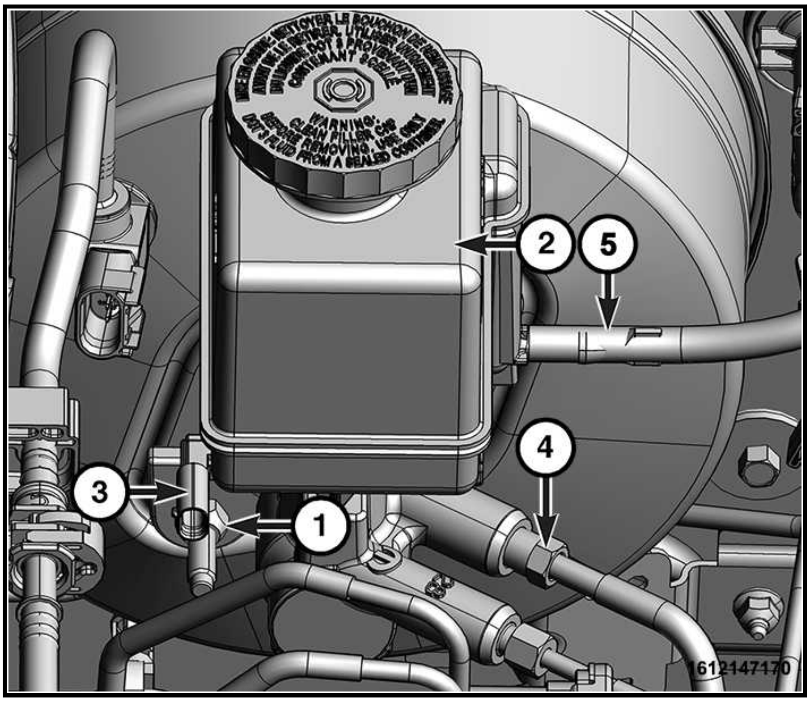
1 - Brake Fluid Level Switch Tab	
2 - Brake Fluid Reservoir Bolts	
3 - Wire Harness Connector	

4. Disconnect the brake fluid level sensor wire harness connector.



1 - Brake Lines

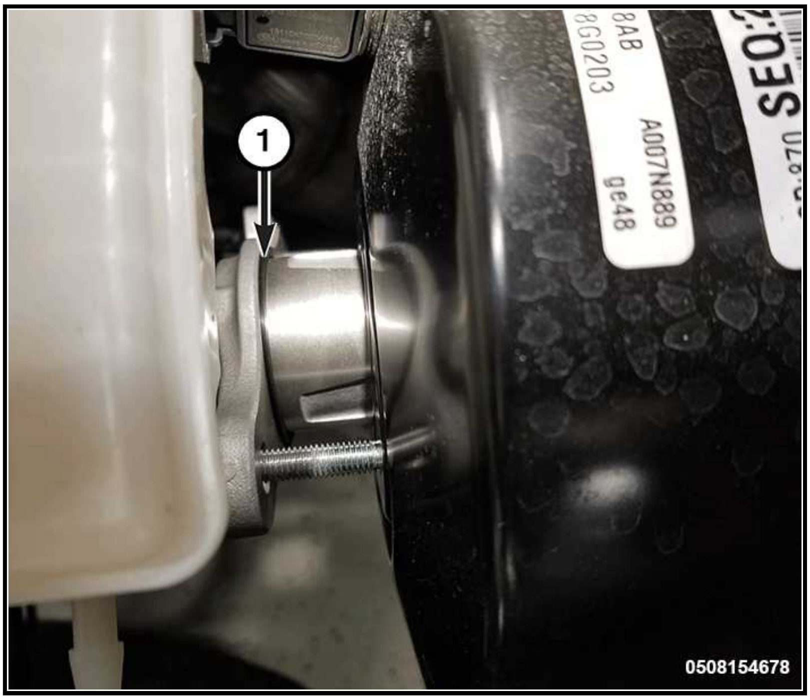
5. Remove the brake lines.



1 - Master Cylinder Nuts
2 - Master Cylinder
3 - Brake Fluid Level Sensor Wire Harness Connector
4 - Brake Line Flare Nuts
5 - Brake Fluid Level Hose

6. If equipped, disconnect the brake fluid hose from the master cylinder.

7. Remove the two master cylinder nuts.
8. Remove the master cylinder.
9. Remove cylinder cap and drain the rest of the fluid.



1 - Seal

10. Make sure the seal stays on the master cylinder.

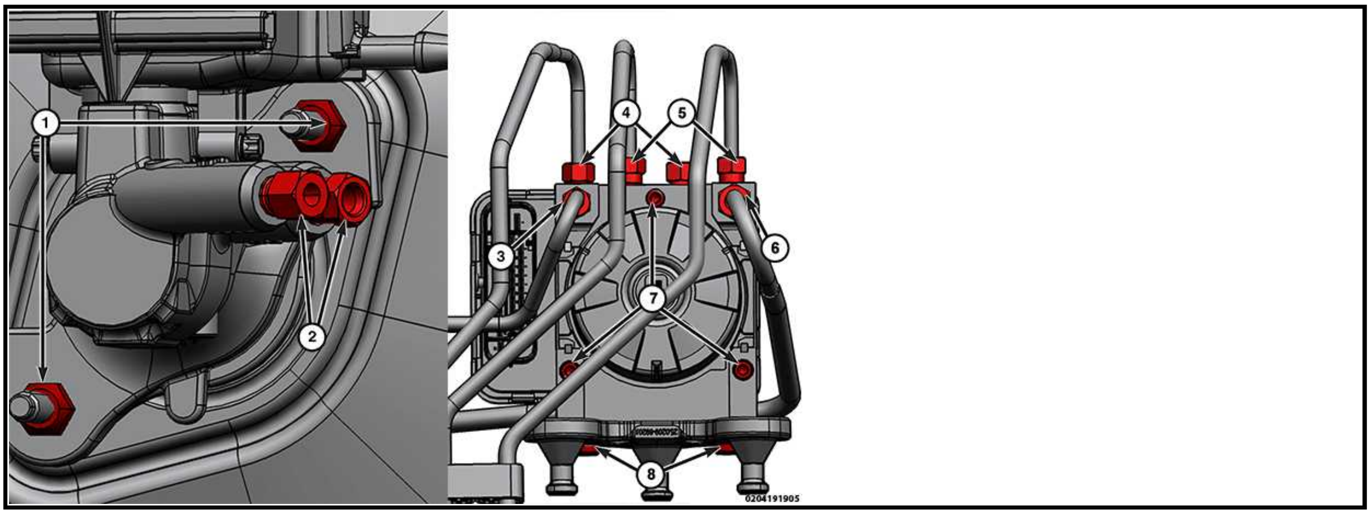
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

BRAKE BOOSTER AND MODULE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Master Cylinder Nuts	**18 N. m (13 Ft. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must

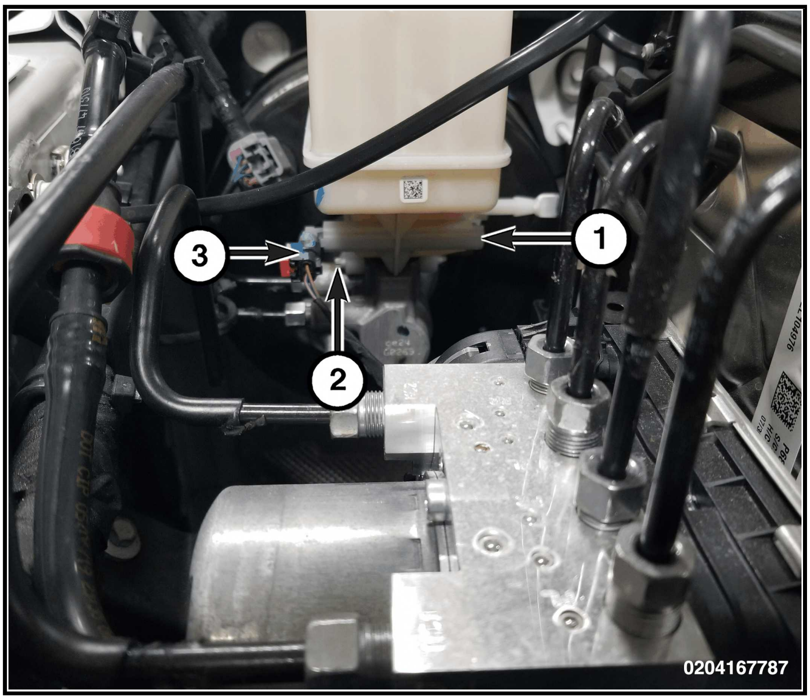
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
			be installed and tightened to specifications.
2	Master Cylinder Brake Lines	**23 N. m (17 Ft. Lbs.)**	-
3	Primary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**25 N. m (18 Ft. Lbs.)**	-
4	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
5	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
6	Secondary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**23 N. m (17 Ft. Lbs.)**	-
7	Brake System Control Module (BSCM) Bolts	**8 N. m (70 In. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
8	Hydraulic Control Unit (HCU) Bracket Bolts	**5 N.m (44 In. Lbs.)**	-

MASTER CYLINDER - RHD

REMOVAL

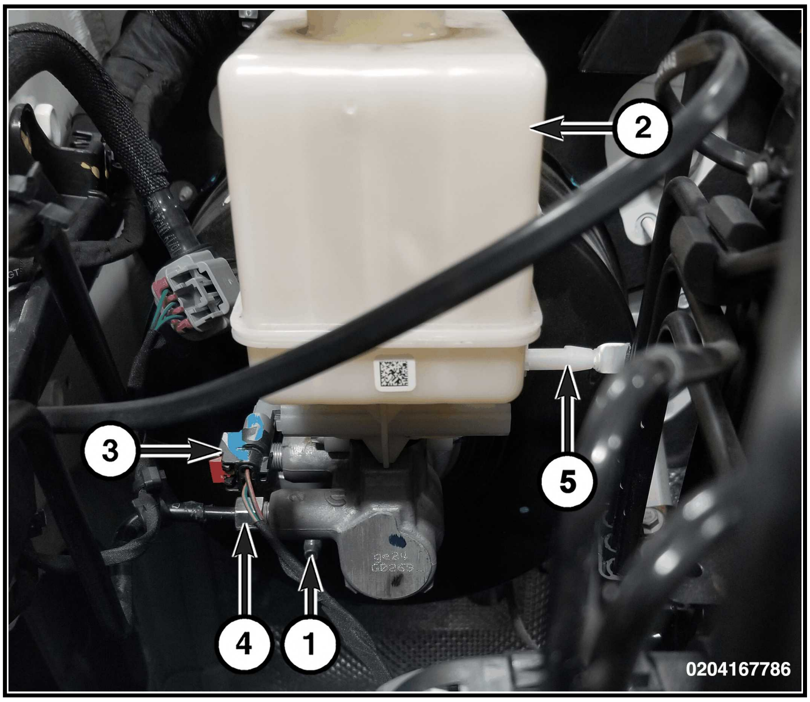
CAUTION: **The vacuum in the power brake booster must be depleted before removing the master cylinder to avoid damaging the master cylinder and to prevent inhalation of the o-ring or any other contamination into the booster. The preferred method is to pump the brake pedal while the engine is not running until the brake pedal becomes firm. An alternative method is to remove and immediately reinstall the check valve located on the booster. If the check valve is removed, special care should be taken to ensure that the grommet is not damaged and remains seated, the check valve is dry and free of debris, and that contaminates cannot be ingested during removal.**

1. With the engine off, depress the brake pedal five times to deplete any vacuum that may remain in the booster unit.
2. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
3. Siphon and drain the fluid from the reservoir.



1 - Brake Fluid Reservoir	
2 - Master Cylinder	
3 - Wire Harness Connector	

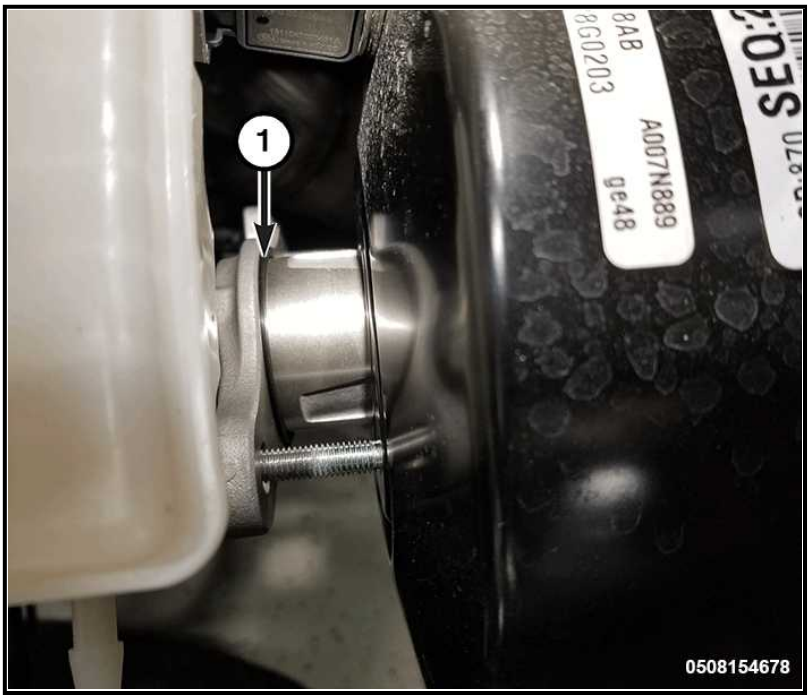
4. Disconnect the brake fluid level sensor wire harness connector.



1 - Master Cylinder Nuts	
2 - Master Cylinder	
3 - Wire Harness Connector	
4 - Brake Line Flare Nuts	
5 - Brake Fluid Hose Connection	

5. Remove the brake lines.
6. If equipped, disconnect the brake fluid hose from the master cylinder.
7. Remove the two master cylinder nuts.
8. Remove the master cylinder.

9. Remove cylinder cap and drain the rest of the fluid.



1 - Seal

10. Make sure the seal stays on the master cylinder.

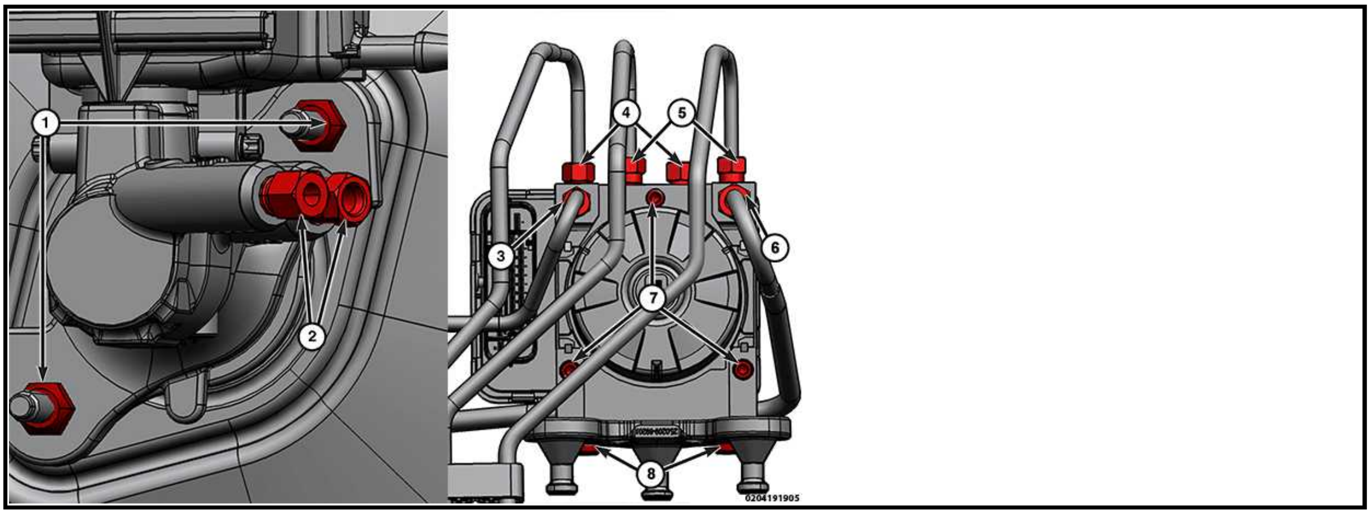
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

BRAKE BOOSTER AND MODULE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Master Cylinder Nuts	**18 N. m (13 Ft. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
2	Master Cylinder Brake Lines	**23 N. m (17 Ft. Lbs.)**	-
3	Primary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**25 N. m (18 Ft. Lbs.)**	-
4	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
5	Hydraulic Control Unit (HCU) Brake Line Flare Nuts	**20 N. m (15 Ft. Lbs.)**	-
6	Secondary Brake Line Flare Nut at Hydraulic Control Unit (HCU)	**23 N. m (17 Ft. Lbs.)**	-
7	Brake System Control Module (BSCM) Bolts	**8 N. m (70 In. Lbs.)**	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
8	Hydraulic Control Unit (HCU) Bracket Bolts	**5 N.m (44 In. Lbs.)**	-

PADS, BRAKE, FRONT

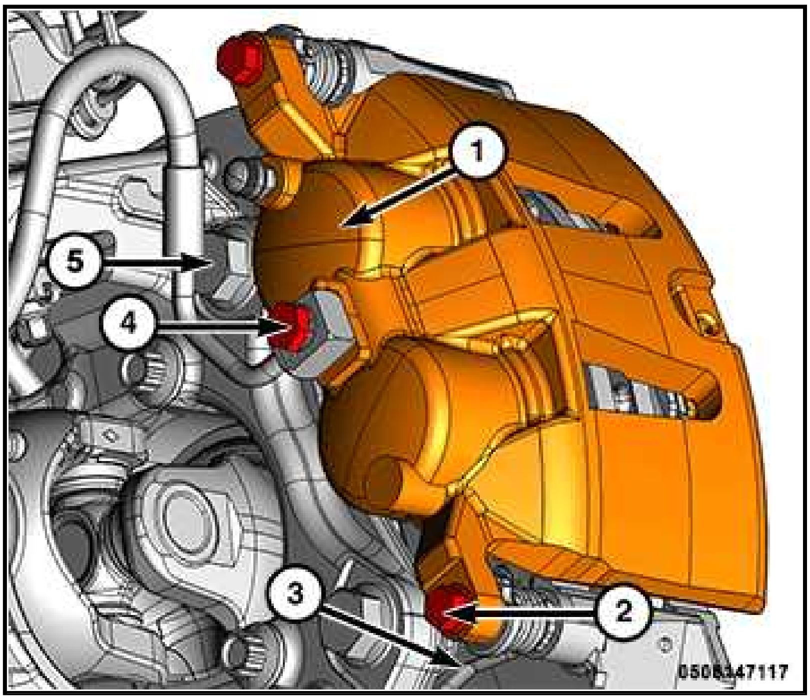
REMOVAL AND INSTALLATION

FRONT

REMOVAL

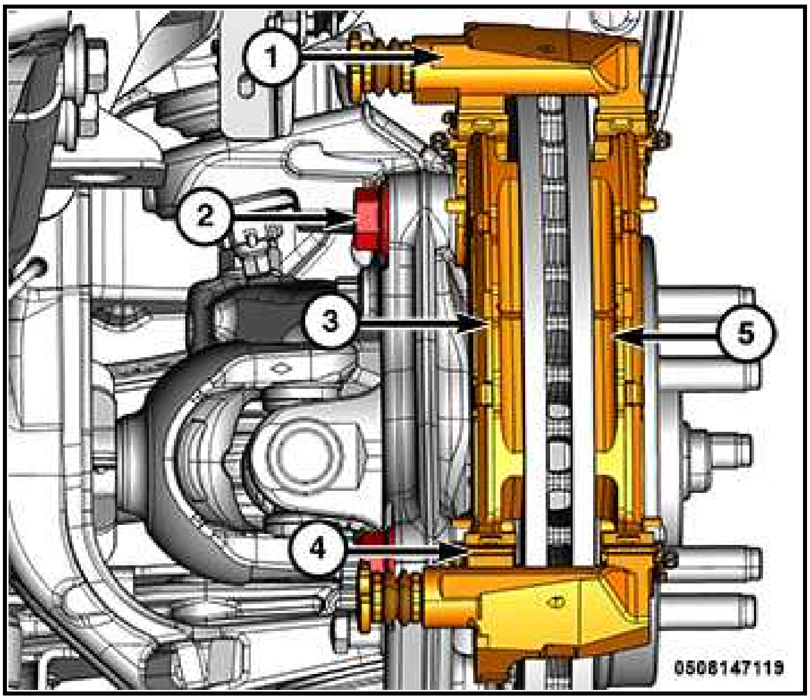
1. Raise and support vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the tire and wheel assembly. Refer to **REMOVAL AND INSTALLATION** .

NOTE: **In some cases, it may be necessary to retract the caliper pistons into their bores a small amount in order to provide sufficient clearance between the pads and the rotor to easily remove the caliper from the adapter. Never push on pistons directly as it may get damaged.**



1 - Brake Caliper
2 - Caliper Bolts
3 - Caliper Adapter
4 - Brake Hose Banjo Bolt
5 - Caliper Adapter Bolt

3. Remove the two caliper bolts.
4. Separate the caliper from the adapter then position the caliper aside and ensure that it is securely supported. Refer to CALIPER, DISC BRAKE, FRONT, REMOVAL AND INSTALLATION . **Do not allow brake hose to support caliper weight.**



1 - Caliper Adapter
2 - Caliper Adapter Bolts
3 - Inboard Brake Pad
4 - Anti-Rattle Clips
5 - Outboard Brake Pad

5. Remove the inboard and outboard brake pads from the caliper adapter.
6. Remove and **DISCARD** the four anti-rattle clips from the brake caliper adapter.

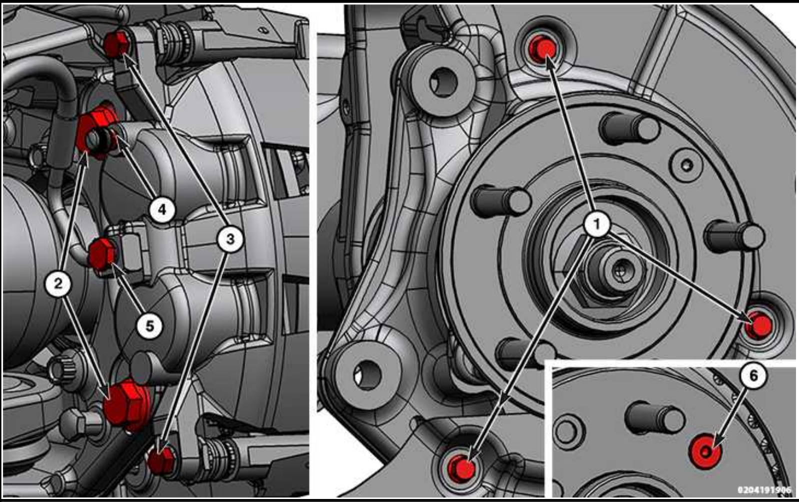
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

FRONT BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**10 N. m (7 Ft. Lbs.)**	-
2	Front Caliper Adapter Bolts	**195 N. m (144 Ft. Lbs.)**	-
3	Front Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Front Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
5	Front Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
6	Front Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

PADS, BRAKE, REAR

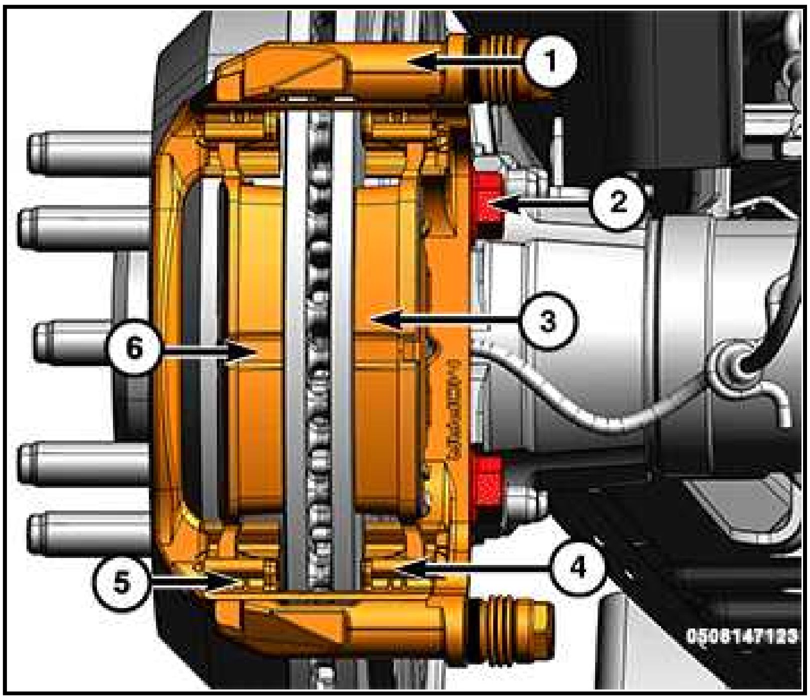
REMOVAL AND INSTALLATION

REAR

REMOVAL

1. Raise and support vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the tire and wheel assembly. Refer to **REMOVAL AND INSTALLATION** .

NOTE: **In some cases, it may be necessary to retract the caliper pistons into their bores a small amount in order to provide sufficient clearance between the pads and the rotor to easily remove caliper from the adapter. Never push on pistons directly as it may get damaged.**



1 - Caliper Adapter	
2 - Caliper Adapter Bolts	
3 - Inboard Brake Pad	
4 - Anti-Rattle Clips	
5 - Anti-Rattle Clips	
6 - Outboard Brake Pad	

3. Separate the caliper from the adapter then position the caliper aside. Refer to CALIPER, DISC BRAKE, REAR, REMOVAL AND INSTALLATION. **Do not allow brake hose to support caliper weight** .
4. Remove the inboard brake pad from the caliper adapter.
5. Remove the outboard brake pad from the caliper adapter.
6. Remove all four anti-rattle clips.

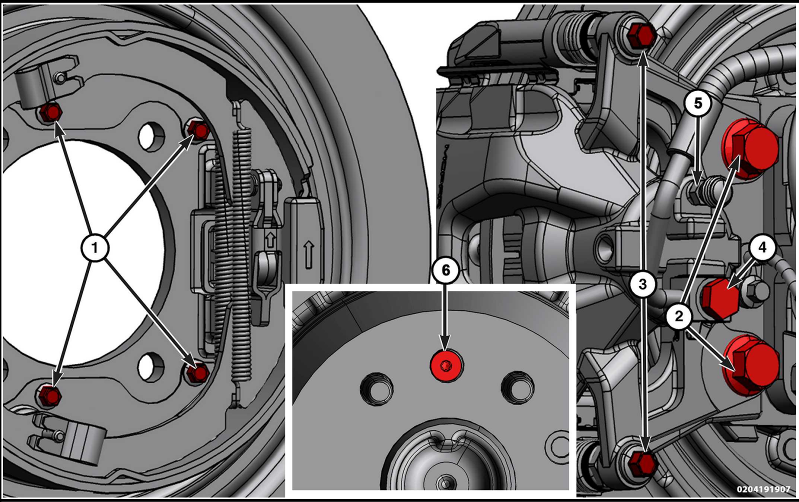
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

REAR BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**11 N. m (8 Ft. Lbs.)**	-
2	Rear Caliper Adapter Bolts	**125 N. m (92 Ft. Lbs.)**	-
3	Rear Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Rear Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
5	Rear Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
6	Rear Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

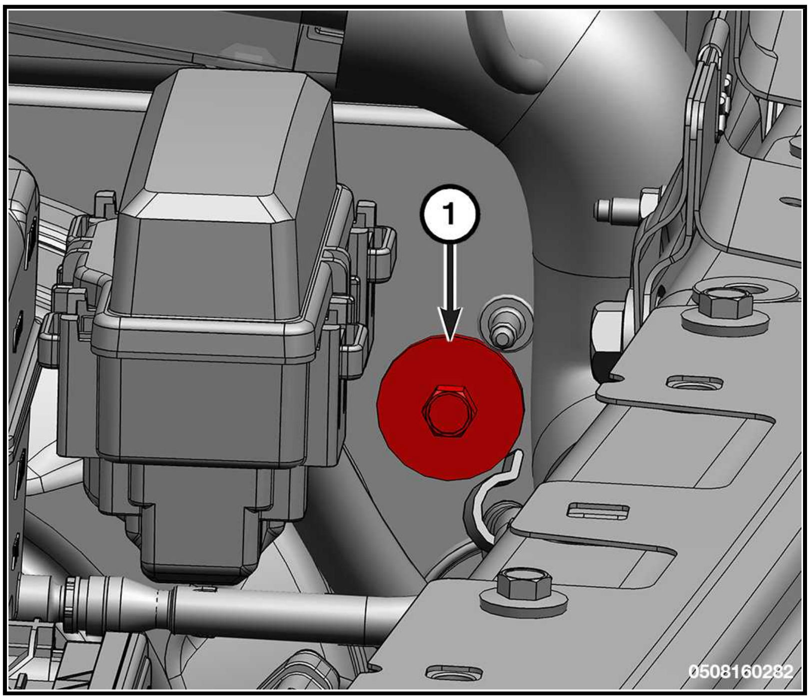
PEDAL(S), BRAKE AND/OR ACCELERATOR

REMOVAL AND INSTALLATION

LEFT HAND DRIVE

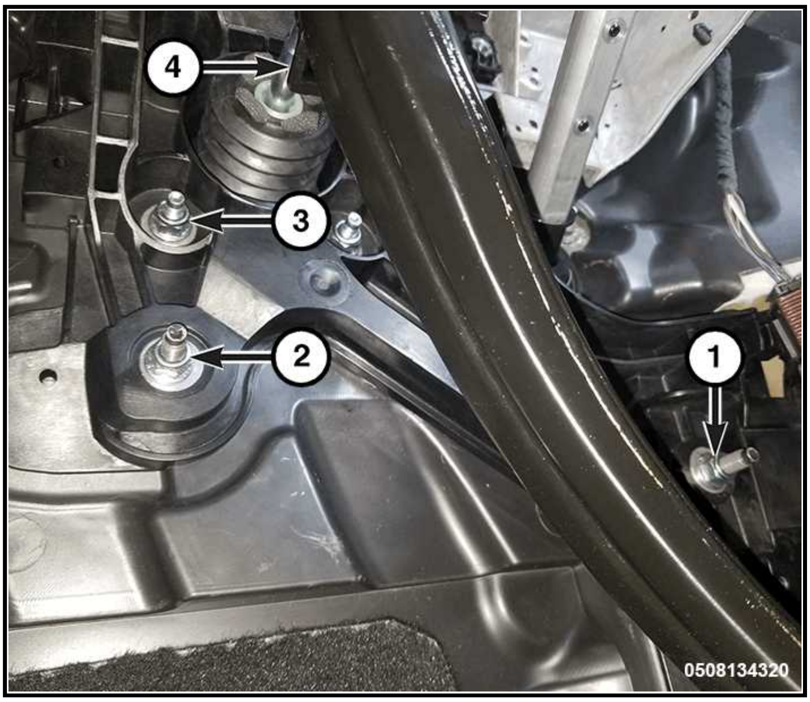
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the instrument panel. Refer to **PANEL, INSTRUMENT, REMOVAL AND INSTALLATION** .
3. Remove the accelerator pedal. Refer to **PEDAL, ACCELERATOR, REMOVAL AND INSTALLATION** .
4. Remove the stop lamp sensor. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .



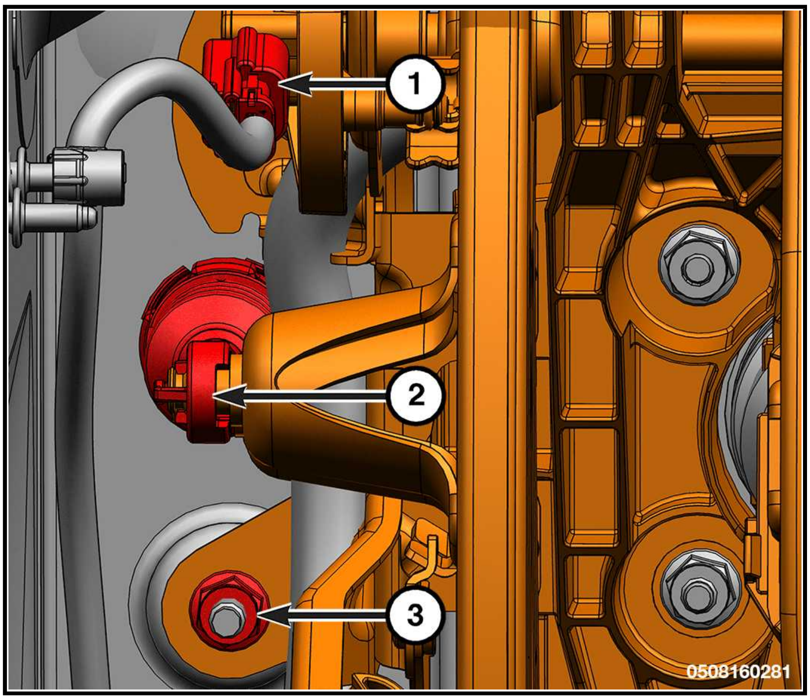
1 - Clutch Pedal Bolt

5. If equipped, remove the clutch pedal bolt.



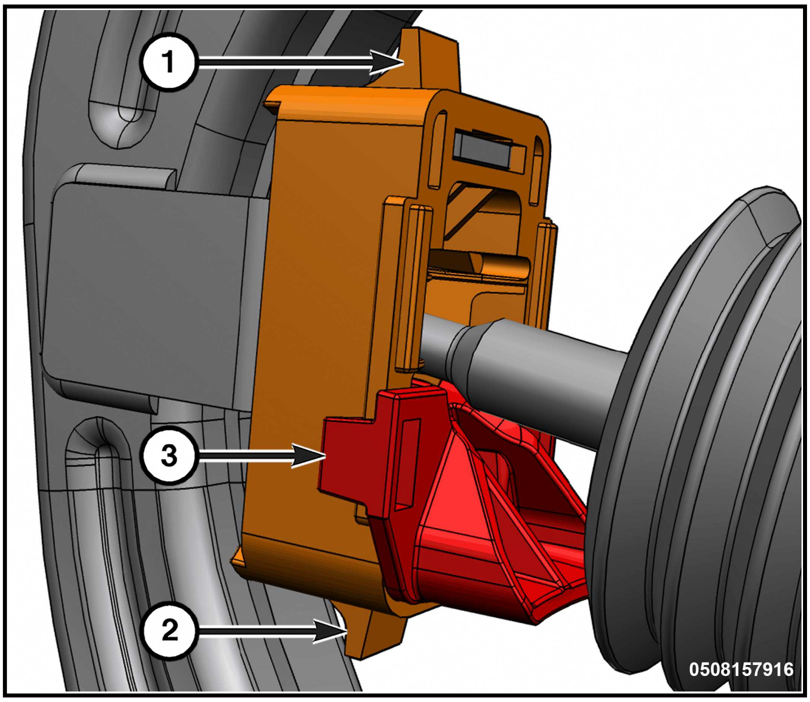
1 - Pedal Sled Nut
2 - Pedal Sled Nut
3 - Brake Booster Nuts
4 - Brake Booster Pushrod Retainer

6. Remove the four brake booster nuts.
7. Remove the two pedal sled nuts.



1 - Clutch Pedal Position Sensor Wire Harness Connector	
2 - Clutch Master Cylinder Rod	
3 - Pedal Sled Nut	

8. If equipped, disconnect the clutch pedal position sensor wire harness connector.
9. If equipped, disengage the clutch master cylinder rod from the clutch pedal.
10. If equipped, remove the pedal sled nut.



1 - Brake Booster Pushrod Retainer Tabs
2 - Brake Booster Pushrod Retainer Tab
3 - Brake Booster Pushrod Locking Tabs

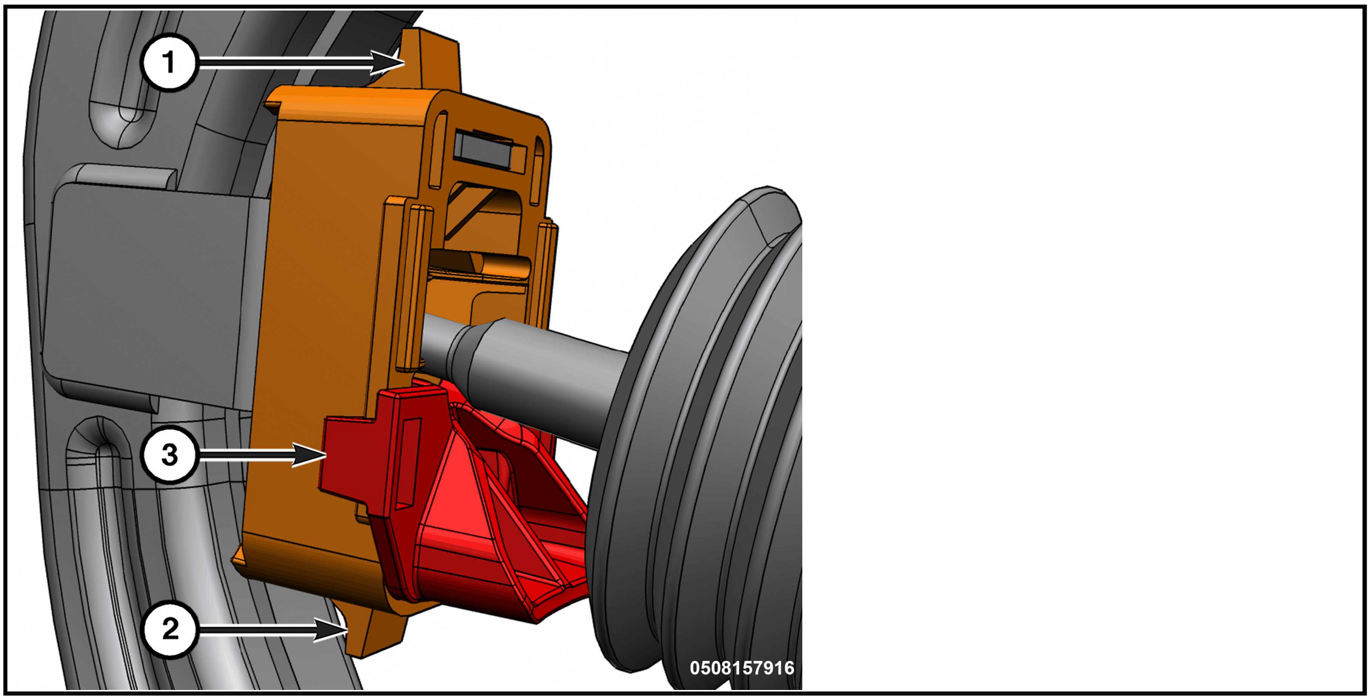
11. Remove and **DISCARD** the brake booster push rod locking tab (3) by disengaging the two tangs from the brake booster push rod clip.
12. Pull rearward both brake booster push rod retainer tabs and pull up the brake pedal to disengage the both brake booster push rod retainer from the brake pedal.

13. Slide the brake booster push rod retainer up then remove the brake booster push rod retainer from the brake booster push rod and **DISCARD** the brake booster push rod retainer.
14. Remove the pedal sled and brake pedal as an assembly.
15. If equipped, remove the clutch pedal position sensor. Refer to **SENSOR, CLUTCH PEDAL POSITION, REMOVAL AND INSTALLATION** .

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

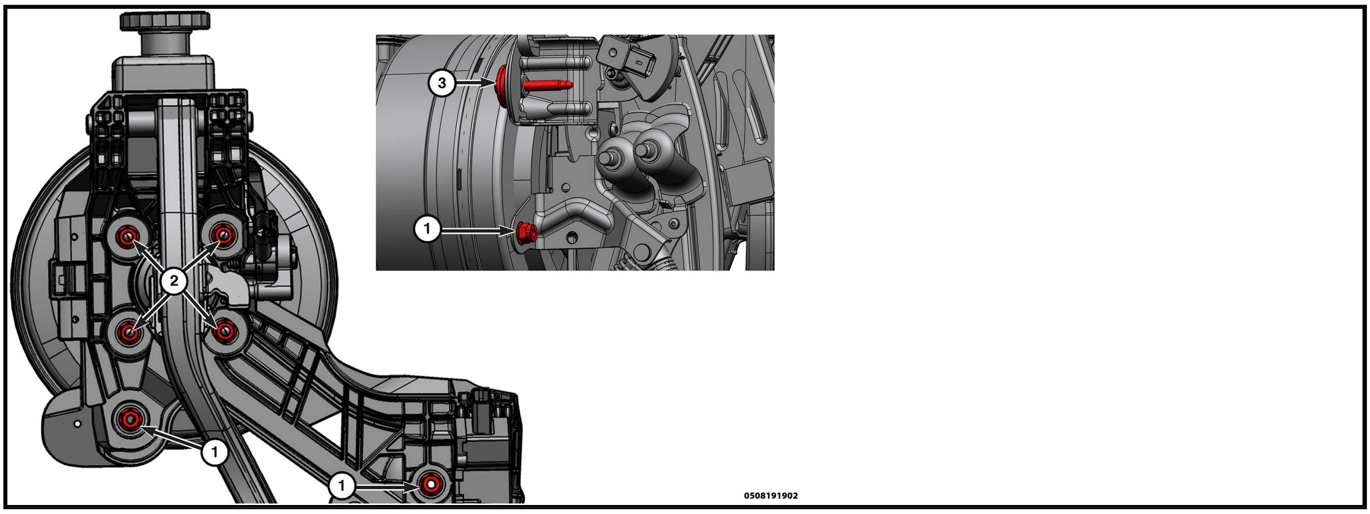


1 - Brake Booster Pushrod Retainer Tabs	
2 - Brake Booster Pushrod Retainer Tab	
3 - Brake Booster Pushrod Locking Tabs	

- Install a **NEW** brake booster push rod clip to the brake pedal by pressing brake booster push rod clip onto the brake pedal while listening for the click of the tabs and to confirm engagement.
- Align the brake booster push rod to the brake pedal cup then press the brake pedal until the brake booster push rod ball drops in to the brake pedal cup and fully engages the brake booster push rod retaining clip, gently pull up on the brake pedal to verify engagement.

TORQUE SPECIFICATIONS

BRAKE PEDAL

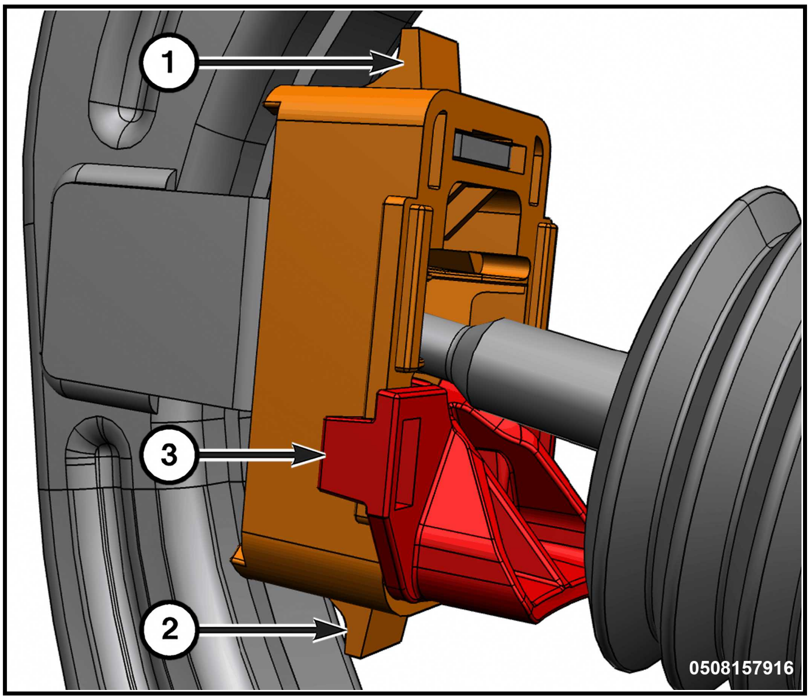


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pedal Sled Nut	**30 N. m (22 Ft. Lbs.)**	-
2	Brake Booster Nuts	**30 N. m (22 Ft. Lbs.)**	-
3	Clutch Pedal Bolt	**24 N. m (18 Ft. Lbs.)**	-

RIGHT HAND DRIVE

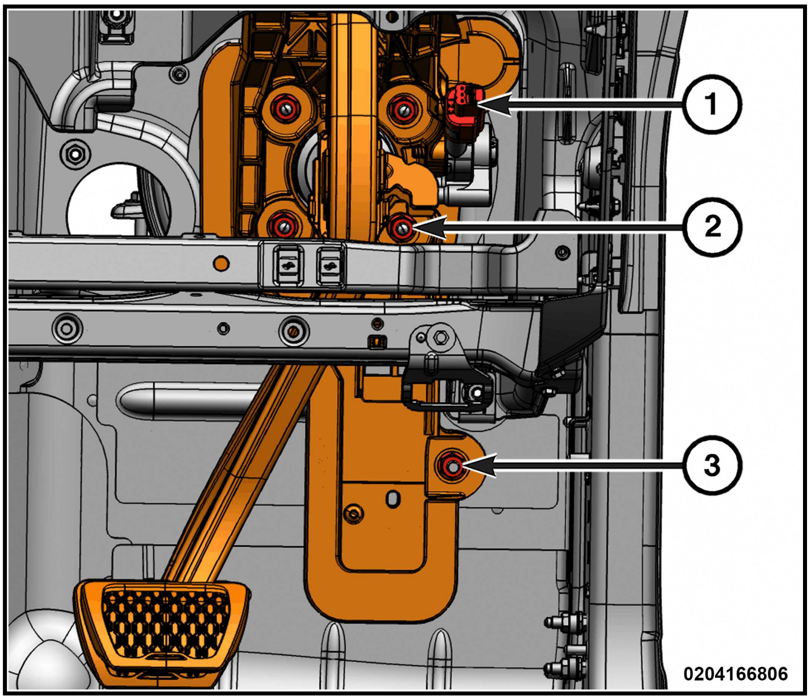
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the instrument panel. Refer to **PANEL, INSTRUMENT, REMOVAL AND INSTALLATION** .
3. Remove the accelerator pedal. Refer to **PEDAL, ACCELERATOR, REMOVAL AND INSTALLATION** .
4. Remove the stop lamp sensor. Refer to **SENSOR, STOP LAMP, REMOVAL AND INSTALLATION** .



1 - Brake Booster Push Rod Retainer Tab	
2 - Brake Booster Push Rod Retainer Tab	
3 - Brake Booster Push Rod Locking Tab	

5. Remove and **DISCARD** the brake booster push rod locking tab by disengaging the two tangs from the brake booster push rod clip.
6. Release the tabs and pull up the brake pedal to disengage the both brake booster push rod retainer from the brake pedal.
7. Slide the brake booster push rod retainer up then remove the brake booster push rod retainer from the brake booster push rod and **DISCARD** the brake booster push rod retainer.



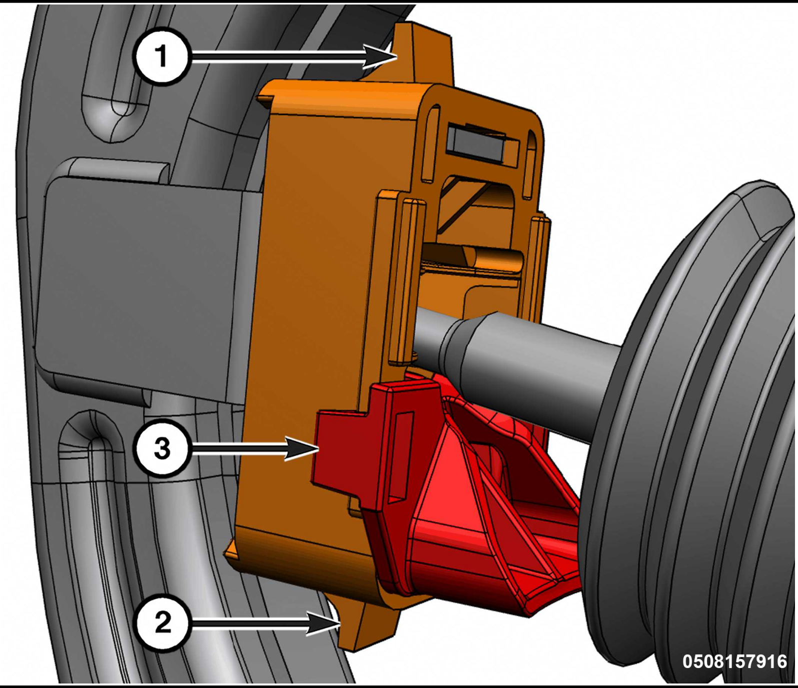
1 - Wire Harness Connector	
2 - Brake Booster Nuts	
3 - Pedal Sled Nut	

8. Remove the four brake booster nuts.
9. Remove the pedal sled nut.
10. Remove the pedal sled and brake pedal as an assembly.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

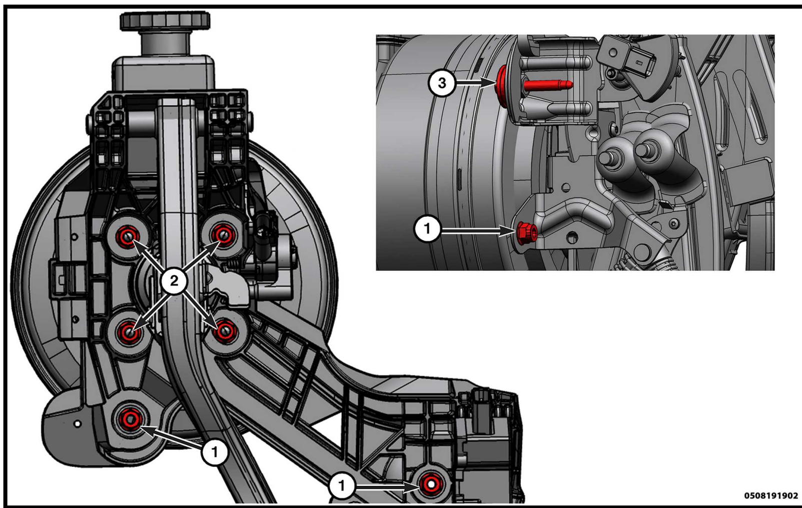


1 - Brake Booster Pushrod Retainer Tabs	
2 - Brake Booster Pushrod Retainer Tab	
3 - Brake Booster Pushrod Locking Tabs	

- Install a **NEW** brake booster push rod clip to the brake pedal by pressing brake booster push rod clip onto the brake pedal while listening for the click of the tabs and to confirm engagement.
- Align the brake booster push rod to the brake pedal cup then press the brake pedal until the brake booster push rod ball drops in to the brake pedal cup and fully engages the brake booster push rod retaining clip, gently pull up on the brake pedal to verify engagement.

TORQUE SPECIFICATIONS

BRAKE PEDAL



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pedal Sled Nut	**30 N. m (22 Ft. Lbs.)**	-
2	Brake Booster Nuts	**30 N. m (22 Ft. Lbs.)**	-
3	Clutch Pedal Bolt	**24 N. m (18 Ft. Lbs.)**	-

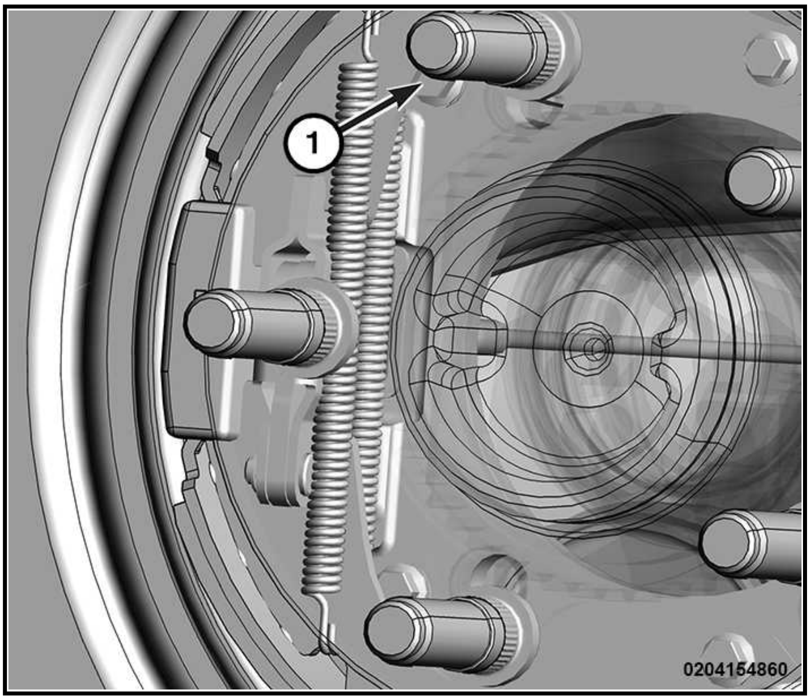
PLATE, BRAKE BACKING

REMOVAL AND INSTALLATION

BRAKE BACKING PLATE

REMOVAL

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the rear axle shaft. Refer to **REMOVAL AND INSTALLATION** .
3. Remove the park brake shoes. Refer to **SHOES, PARKING BRAKE, REMOVAL AND INSTALLATION**.



1 - Backing Plate Bolts

4. Remove the four backing plate bolts.
5. Remove the backing plate from the axle seal plate.

INSTALLATION

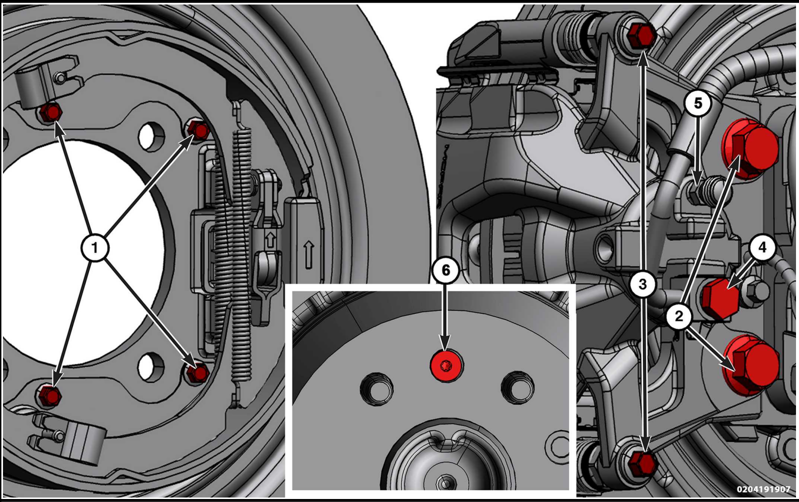
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Check and fill the rear axle fluid.

TORQUE SPECIFICATIONS

REAR BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**11 N. m (8 Ft. Lbs.)**	-
2	Rear Caliper Adapter Bolts	**125 N. m (92 Ft. Lbs.)**	-
3	Rear Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Rear Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
5	Rear Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
6	Rear Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

ROTOR, BRAKE

DIAGNOSIS AND TESTING

DISC BRAKE ROTOR

The rotor braking surfaces should not be refinished unless necessary.

Light surface rust and scale can be removed with a lathe equipped with dual sanding discs. The rotor surfaces can be restored by machining in a disc brake lathe if surface scoring and wear are light.

Replace the rotor under the following conditions:

- Severely Scored
- Tapered
- Hard Spots
- Cracked
- Below Minimum Thickness. Refer to **TORQUE SPECIFICATIONS** .

ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if worn below minimum thickness, or if machining would reduce thickness below the allowable minimum.

Rotor minimum thickness is usually specified on the rotor hub. The specification is either stamped or cast into the hub surface.

BRAKE DRUM IN HAT ROTOR

The maximum allowable diameter of the drum braking surface is indicated on the drum outer edge. Always replace the drum if machining would cause drum diameter to exceed the size limit indicated on the drum in hat.

BRAKE DRUM RUNOUT

Measure drum diameter and runout with an accurate gauge. The most accurate method of measurement involves mounting the drum in a brake lathe and checking variation and runout with a dial indicator.

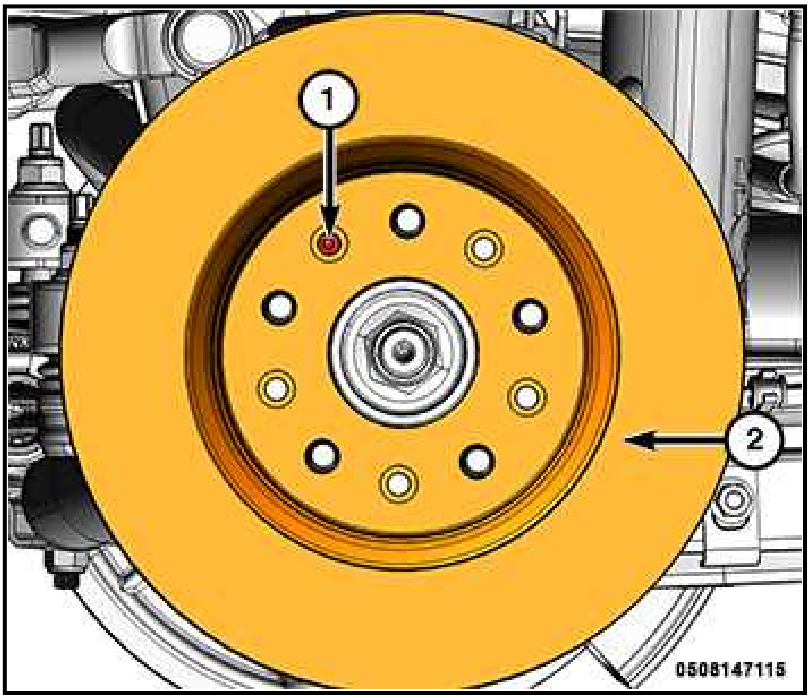
Machine the drum if runout or variation exceed values. Replace the drum in hat rotor if machining causes the drum in hat rotor to exceed the maximum allowable diameter.

REMOVAL AND INSTALLATION

FRONT

REMOVAL

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the front caliper adapter and front caliper as an assembly. Refer to **ADAPTER, DISC BRAKE CALIPER, REMOVAL AND INSTALLATION**.



1 - Front Rotor Screw	
2 - Brake Rotor	

3. Remove the front rotor screw.
4. Remove rotor.

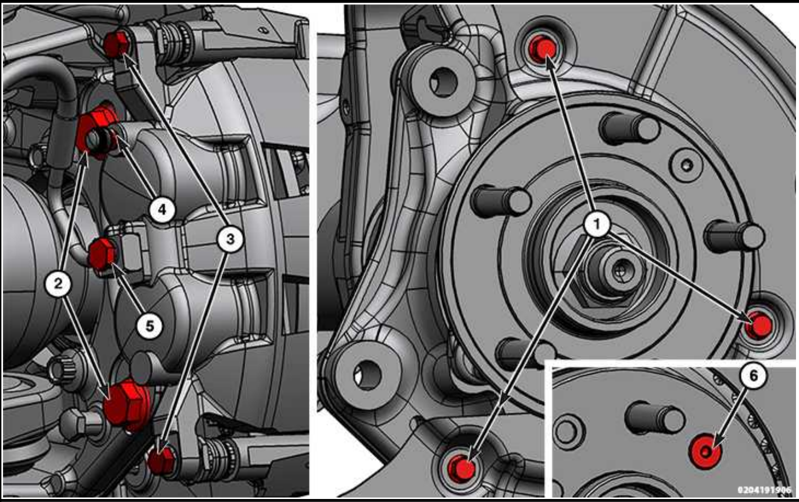
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

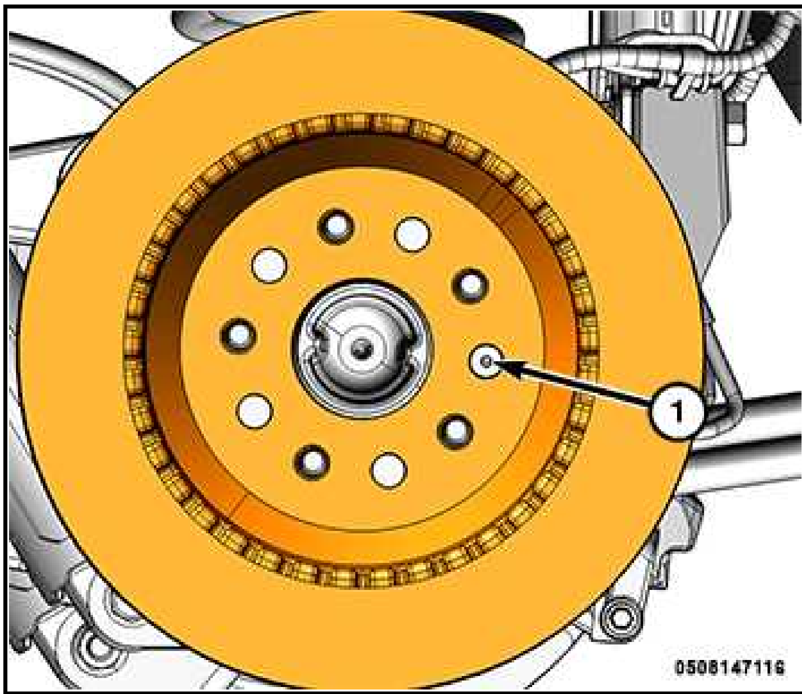
FRONT BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**10 N. m (7 Ft. Lbs.)**	-
2	Front Caliper Adapter Bolts	**195 N. m (144 Ft. Lbs.)**	-
3	Front Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Front Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
5	Front Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
6	Front Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

REAR

REMOVAL



1 - Rear Rotor Screw

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .

CAUTION: **Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**

2. Remove the rear caliper adapter and rear caliper as an assembly. Refer to **ADAPTER, DISC BRAKE CALIPER, REMOVAL AND INSTALLATION**.
3. Remove the rear rotor screw.
4. Remove the rotor.

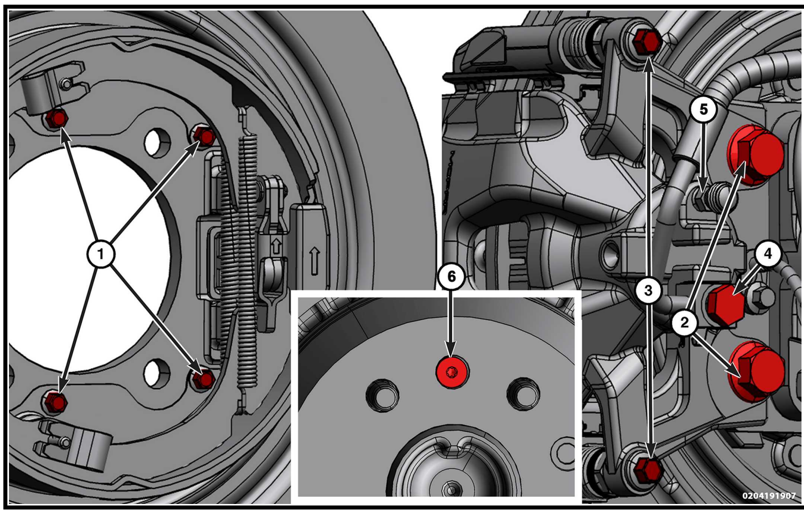
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

REAR BRAKES



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Brake Rotor Splash Shield Bolts	**11 N. m (8 Ft. Lbs.)**	-
2	Rear Caliper Adapter Bolts	**125 N. m (92 Ft. Lbs.)**	-
3	Rear Caliper Bolts	**37 N. m (27 Ft. Lbs.)**	-
4	Rear Caliper Brake Hose Banjo Bolt	**35 N. m (26 Ft. Lbs.)**	-
5	Rear Caliper Bleed Screw	**10 N. m (7 Ft. Lbs.)**	-
6	Rear Rotor Screw	**20 N. m (15 Ft. Lbs.)**	-

PARKING BRAKE

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION

The parking brake is a hand lever and cable operated system used to apply the park brake shoes. The park brake system is a drum-in-hat arrangement which houses the park brake shoes in a drum which is integral to the rear rotor.

OPERATION

A hand operated lever is located in the center floor console.

The cables are connected to the rear actuators which contact each brake shoe.

To apply the parking brakes, the hand lever is pulled upward. This pulls the rear park brake shoe actuators, by means of cables.

A parking brake switch is mounted on the parking brake lever and is closed by upward movement of the lever. The switch, which is in circuit with the red brake warning light in the dash, will illuminate the red brake warning light whenever the parking brake is applied.

The parking brake system has two adjustments that can be made; cable adjustment and rear parking brake shoe adjustment. A loose cable system is characterized by the park brake lever being loose at the beginning of travel. Under adjustment of the rear parking brake shoes is characterized by excessive park brake lever travel.

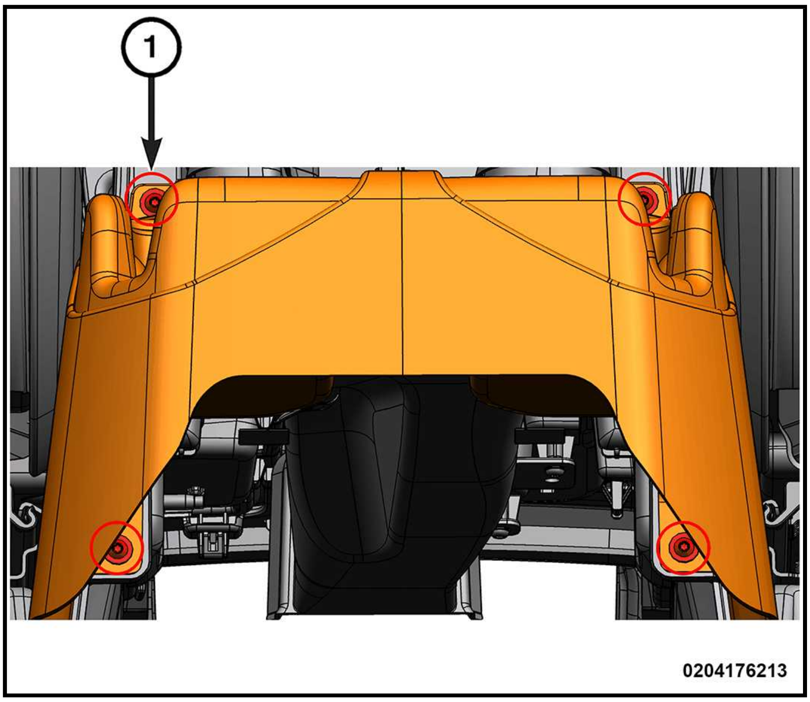
The park brake cables are adjusted with a nut at the end of the output rod of the parking brake lever. The initial adjustment is made at the factory, and under normal circumstances, no further adjustment should be necessary. Before adjusting the rear brake shoes, verify the parking brake cables are properly adjusted, or adjust as required.

ADJUSTMENTS

PARK BRAKE ADJUSTMENT

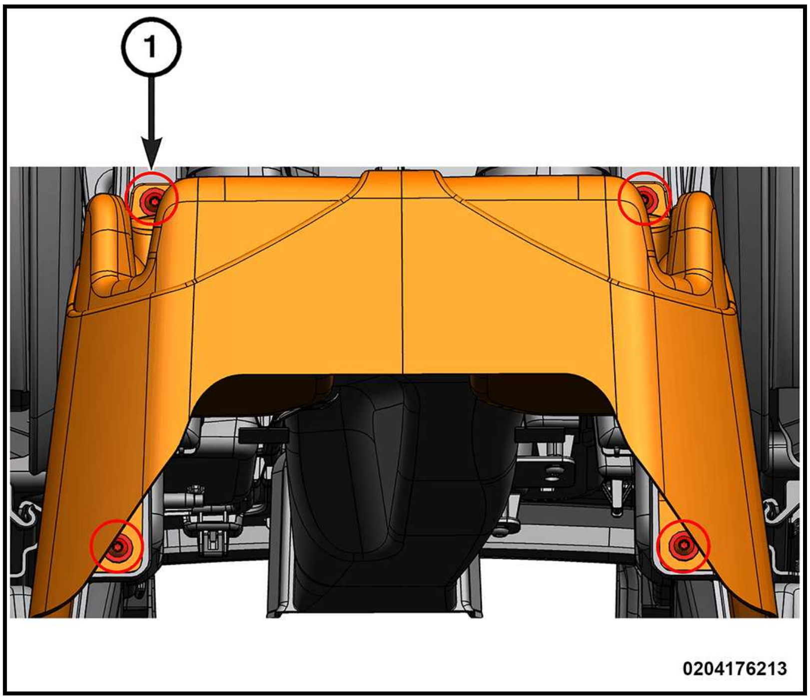
1. Remove the front bolt covers and the bolts (1) on both sides of the console.
2. Move the front seats to the full forward position.

3. Remove the rear bolt covers and the bolts (1) on both sides of the console.
4. Remove the floor console end cap. Refer to **CONSOLE, FLOOR, REMOVAL AND INSTALLATION CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION** .



5. Lift the center floor console slightly then remove the cup holder screws (1) and remove the cup holder.
6. Release the parking brake handle and place in the completely lowered position.
7. Turn the adjuster nut counterclockwise (loosening direction) until there is clear slack in the cable system.
8. Pull the parking brake handle gently with virtually no effort in order to evaluate the slack in the cable system. At no time in the adjustment process should you be applying the park brake lever with any significant input or travel, with the exception of Step 6. You are simply looking for looseness or slack at the very beginning of lever travel with essentially zero input force.
9. Turn the adjuster nut in the clockwise direction (tightening) while continuing to wiggle the handle up and down gently to assess the slack in the cable system. Continue turning the nut in the clockwise (tightening) direction, while at the same time wiggling the park bake lever, until slack is perceived to be gone.
10. Apply the parking brake lever at a minimum of 9 clicks and let sit for one minute.

11. Release the parking brake and check for any new slack that may have appeared. Readjust as necessary according to step 5 above.
12. Tighten the adjuster nut an additional one full turn.
13. Pull on the parking brake handle and set the parking brake to ensure it functions properly.
14. Release the parking brake handle and place in the completely lowered position.



15. Position the cup holder to the center floor console then install and tighten the cup holder screws (1).
16. Lower the floor console to the floor.
17. Install the floor console end cap. Refer to **CONSOLE, FLOOR, REMOVAL AND INSTALLATION CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION** .

18. Install the bolts (1) and tighten securely.
19. Install the rear bolt covers on both sides of the console.
20. Move the front seats to the full rearward position.

21. Install the bolts (1) and tighten securely.
22. Install the front bolt covers on both sides of the console.

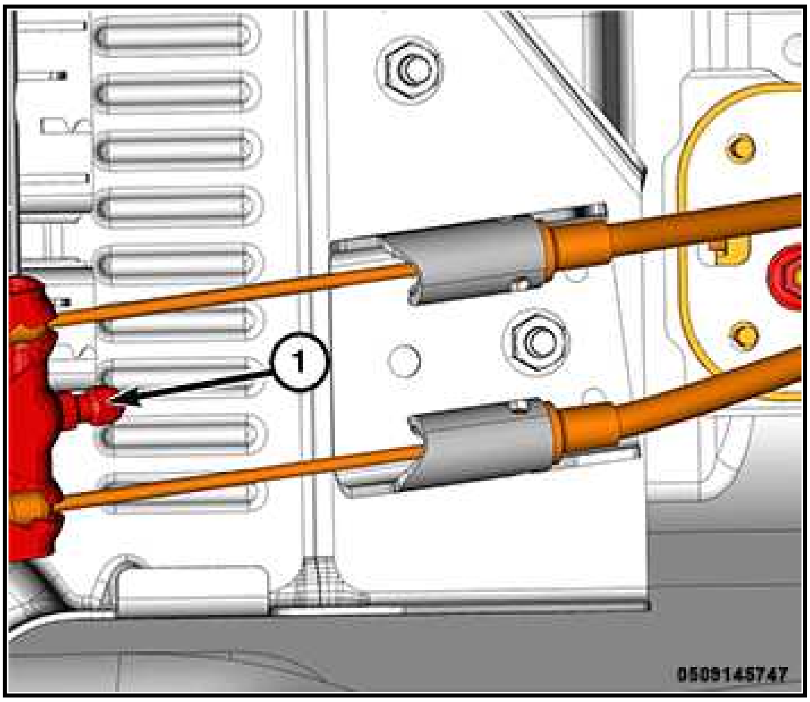
CABLE, PARKING BRAKE

REMOVAL AND INSTALLATION

CABLE

REMOVAL

1. Remove the floor console. Refer to CONSOLE, FLOOR, REMOVAL AND INSTALLATION CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION .

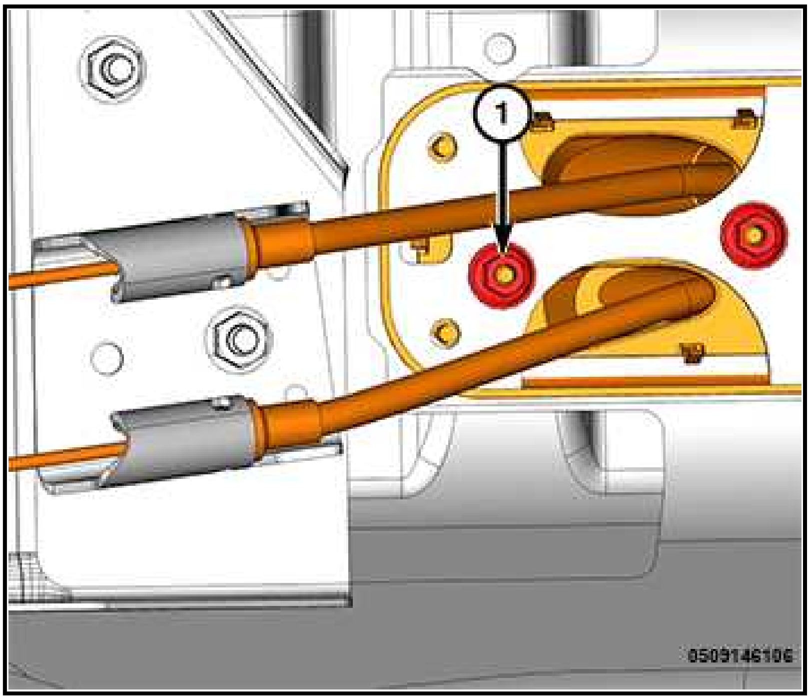


1 - Adjuster Nut

2. Loosen the adjuster nut then disconnect both cable buttons from the equalizer.

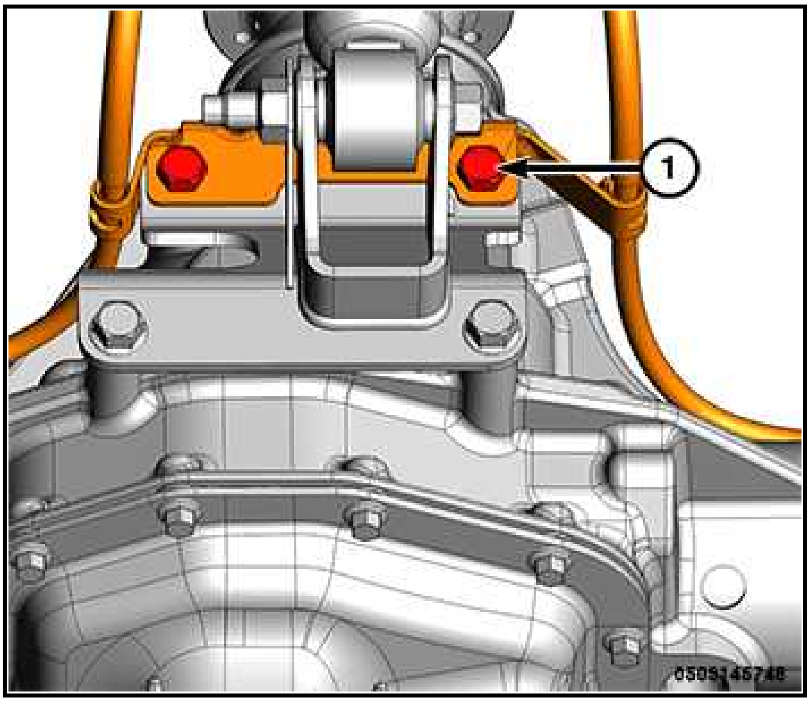
NOTE: **The park brake cable tabs can be accessed through the reaction bracket windows.**

3. Using a suitable tool, release the park brake cable tabs.
4. Pull the park brake cable out of the reaction bracket.



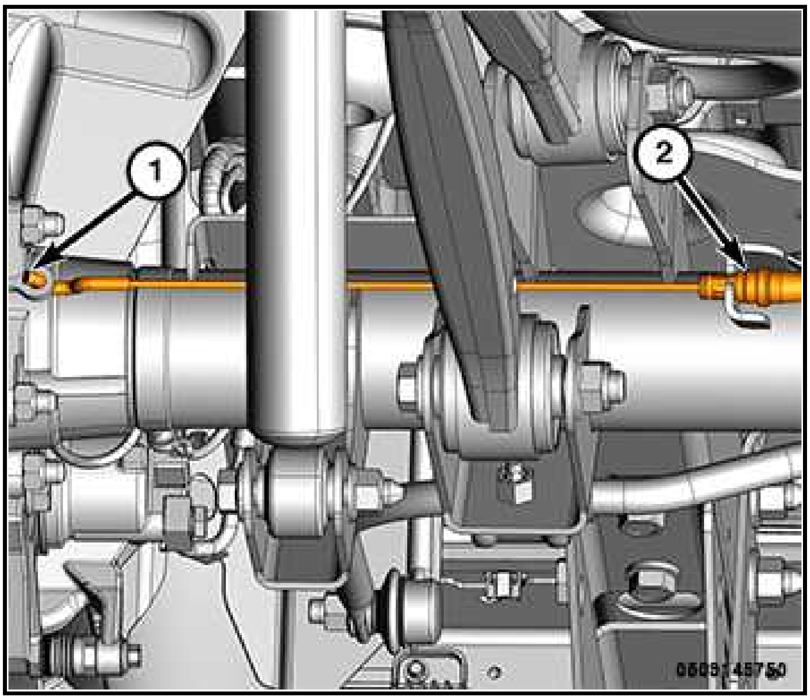
1 - Park Brake Cable Boot Nuts

5. Remove the two park brake cable boot nuts.
6. Remove the cable boot from the floor pan.



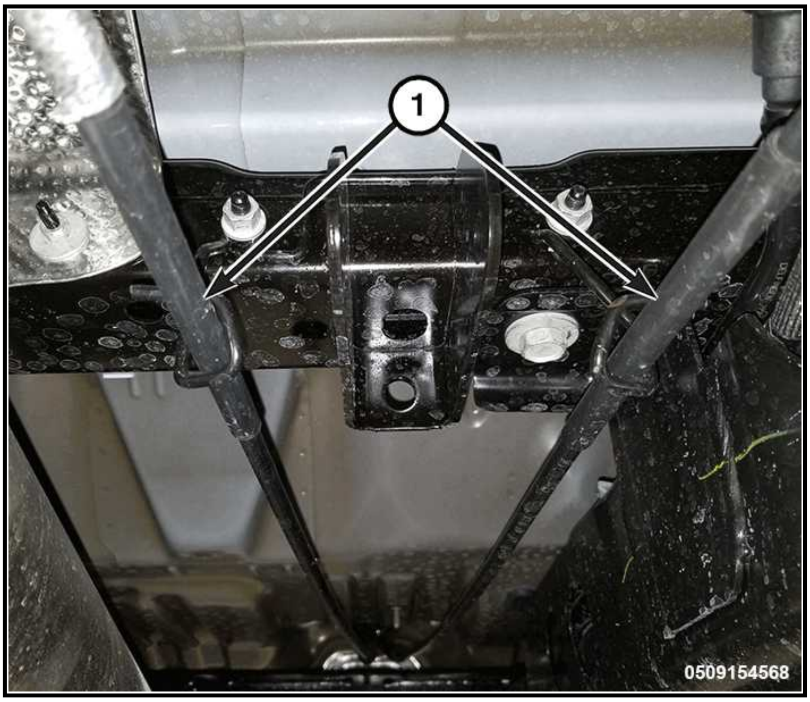
1 - Park Brake Cable Bracket Bolts

7. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
8. Remove the two power hop damper axle bracket bolts (1), or the two park brake cable bracket bolts.



1 - Park Brake Cable End	
2 - Park Brake Cable	

9. Remove the brake cable end from the brake actuator.
10. Depress the park brake cable tabs and remove the cable from the axle bracket.



1 - Park Brake Cable

11. Pull the park brake cable through the routing bracket and remove the park brake cable.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

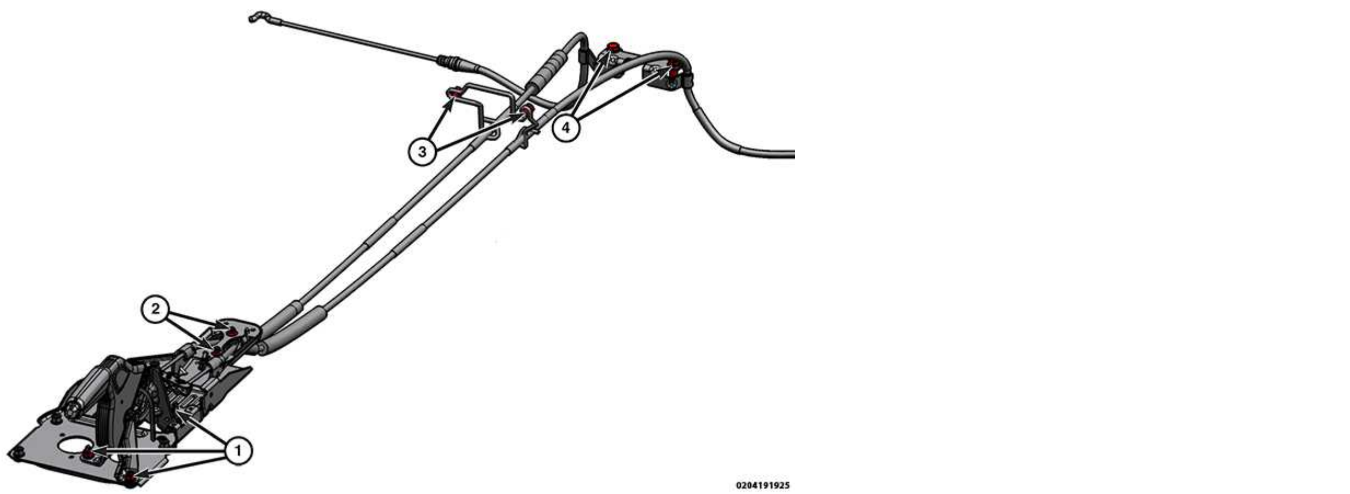
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Perform the park brake adjustment procedure. Refer to **PARKING BRAKE, ADJUSTMENTS**.

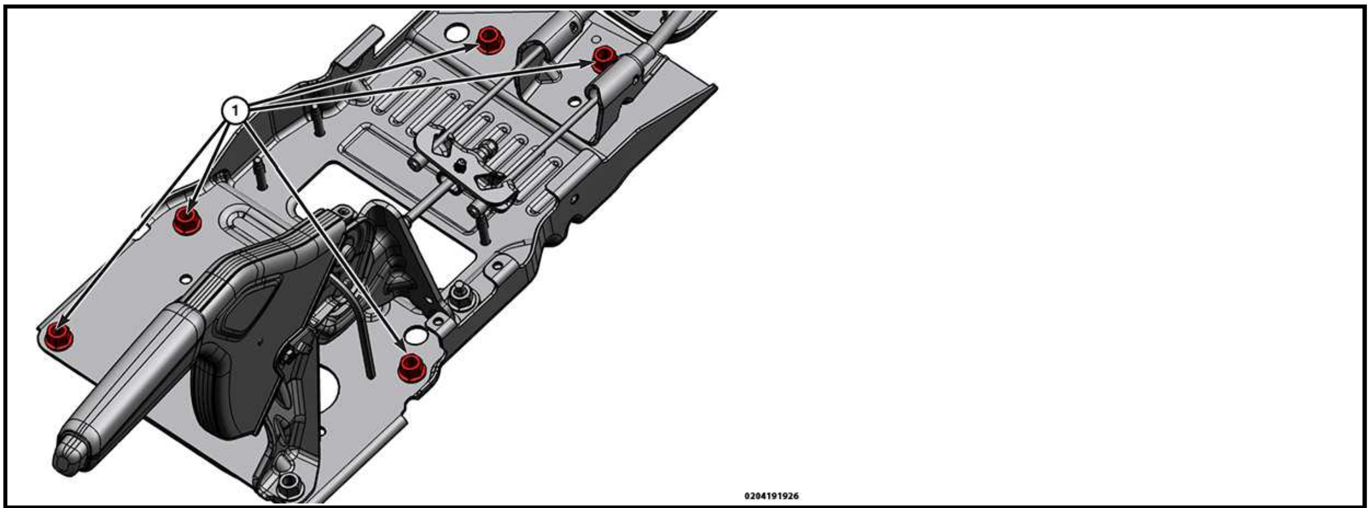
- Verify proper park brake system operation and repeat adjustment procedure as needed.

TORQUE SPECIFICATIONS

PARK BRAKE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Parking Brake Lever Nuts	**22 N. m (16 Ft. Lbs.)**	-
2	Parking Brake Cable Bracket Nut	**8 N. m (71 In. Lbs.)**	-
3	Parking Brake Cable Frame Bracket Bolt	**28 N. m (21 Ft. Lbs.)**	-
4	Parking Brake Sled Nuts	**24 N. m (18 Ft. Lbs.)**	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Park Brake Lever Sled Nut	**24 N. m (18 Ft. Lbs.)**	-

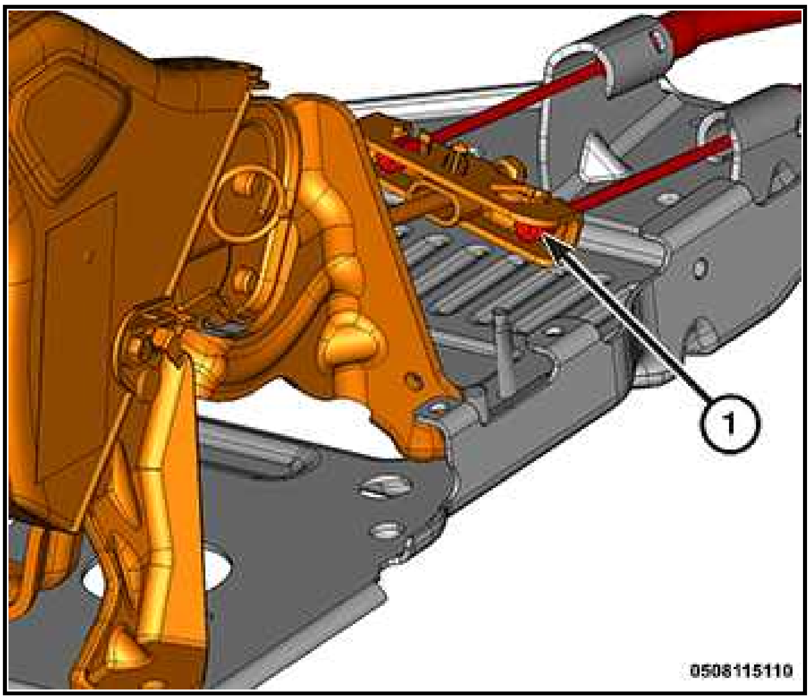
LEVER, PARKING BRAKE

REMOVAL AND INSTALLATION

PARK BRAKE LEVER

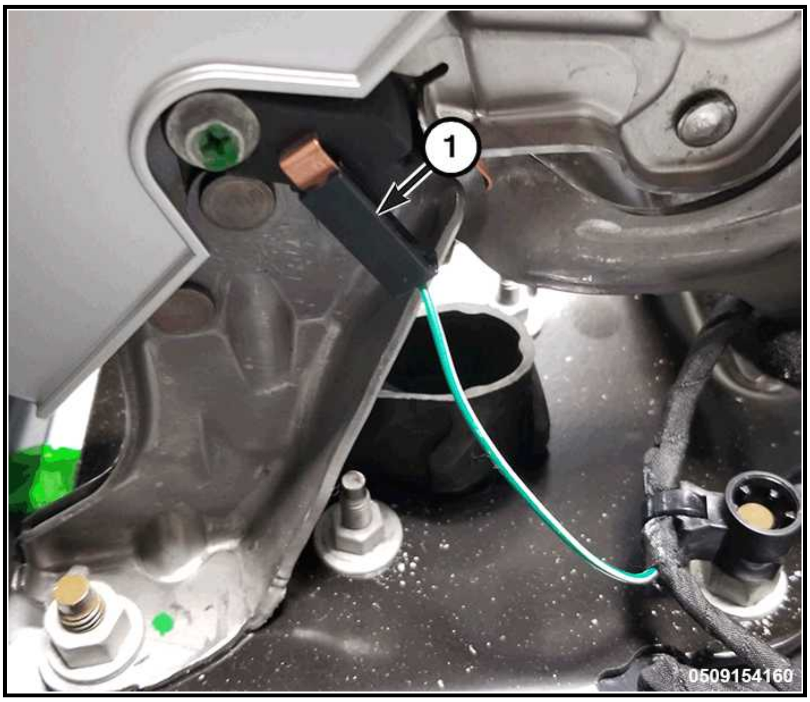
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the floor console. Refer to **CONSOLE, FLOOR, REMOVAL AND INSTALLATION CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION** .



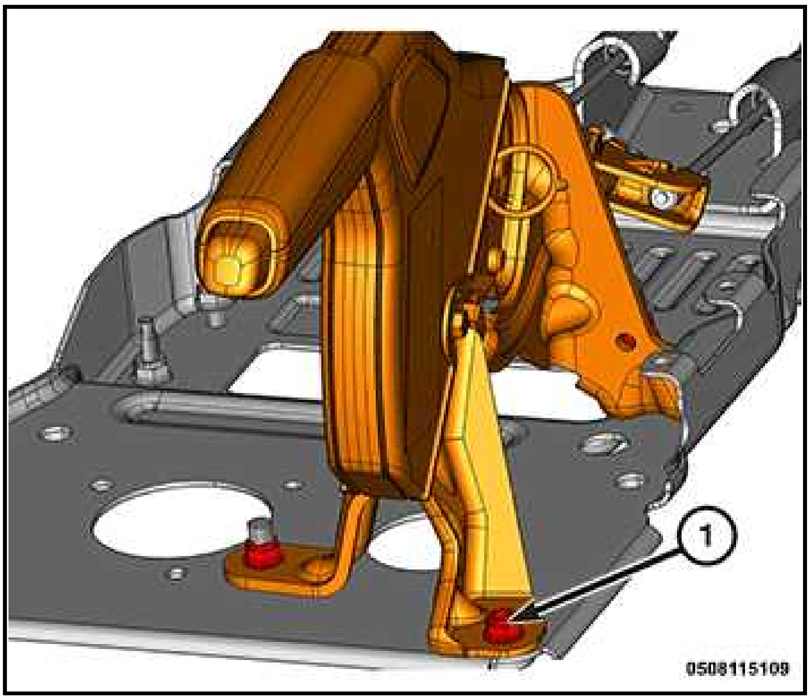
1 - Park Brake Cables

3. Loosen the adjuster nut then disconnect both cables from the equalizer.



1 - Wire Harness Connector

4. Disconnect the park brake switch wire harness connector.



1 - Park Brake Lever Nuts

5. Remove the three park brake lever nuts.
6. Remove the park brake lever assembly.

INSTALLATION

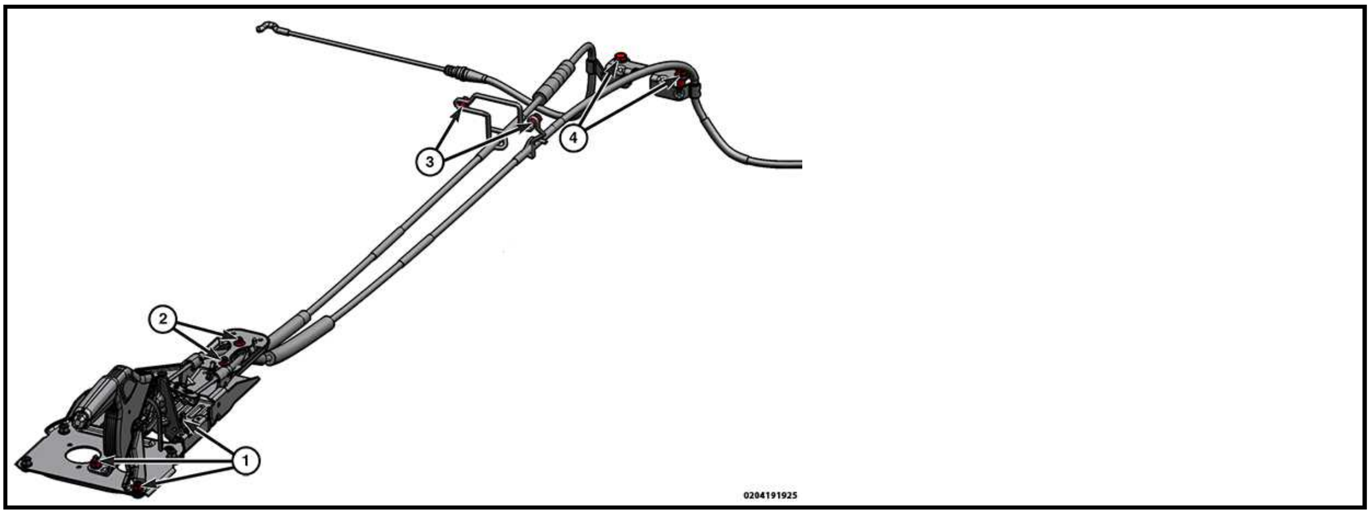
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Perform the park brake adjustment procedure. Refer to **PARKING BRAKE, ADJUSTMENTS**.
- Verify proper park brake system operation and repeat adjustment procedure as needed.

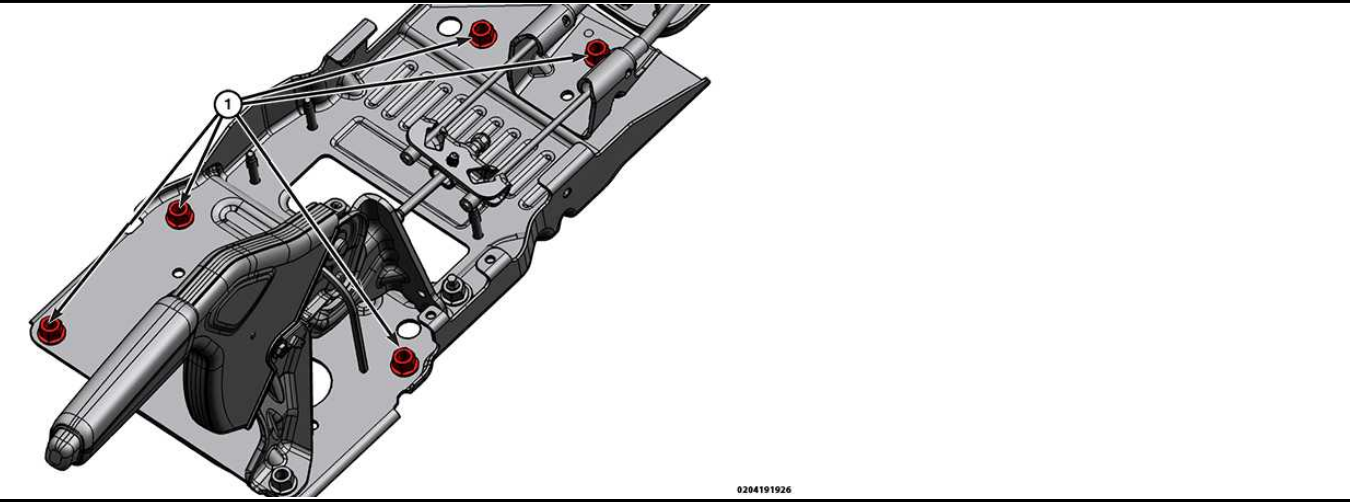
TORQUE SPECIFICATIONS

PARK BRAKE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Parking Brake Lever Nuts	**22 N. m (16 Ft. Lbs.)**	-
2	Parking Brake Cable Bracket Nut	**8 N. m (71 In. Lbs.)**	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
3	Parking Brake Cable Frame Bracket Bolt	**28 N. m (21 Ft. Lbs.)**	-
4	Parking Brake Sled Nuts	**24 N. m (18 Ft. Lbs.)**	-



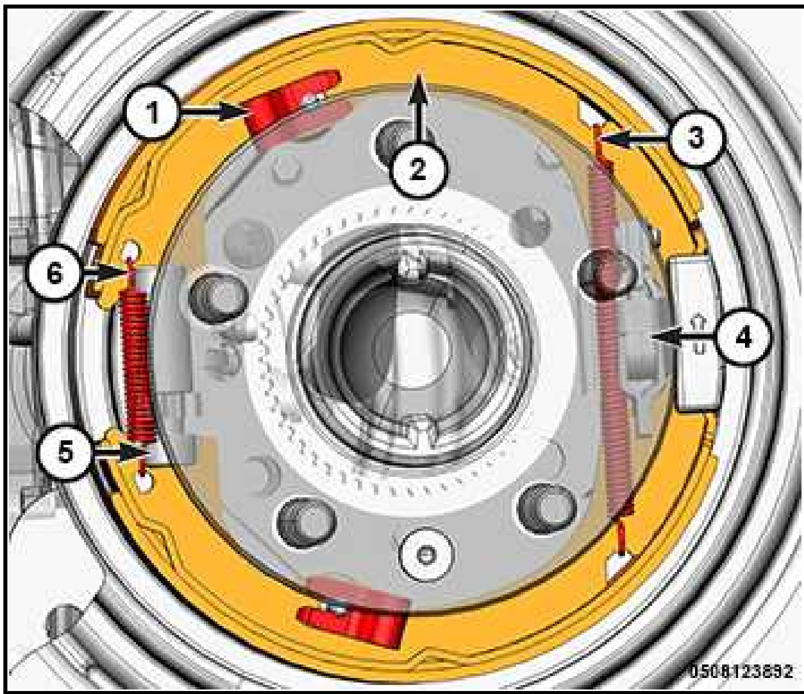
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Park Brake Lever Sled Nut	**24 N. m (18 Ft. Lbs.)**	-

SHOES, PARKING BRAKE

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION



Drum in hat park brakes are dual shoe, internal expanding units with an adjuster mechanism and consist of the following major components:

1. Park brake shoe retainers
2. Park brake shoes
3. Park brake shoe return spring

4. Park brake shoe actuator
5. Park brake shoe adjuster
6. Park brake shoe spring

OPERATION

When the parking brake lever is pulled up the brake cable pulls the actuator which applies the park brake shoes outward against the brake drum-in-hat. When the brake lever is released, the return springs attached to the brake shoes pull the shoes back to their released position.

CLEANING

Clean the individual brake components, including the support plate exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

ADJUSTMENTS

ROTOR REMOVED

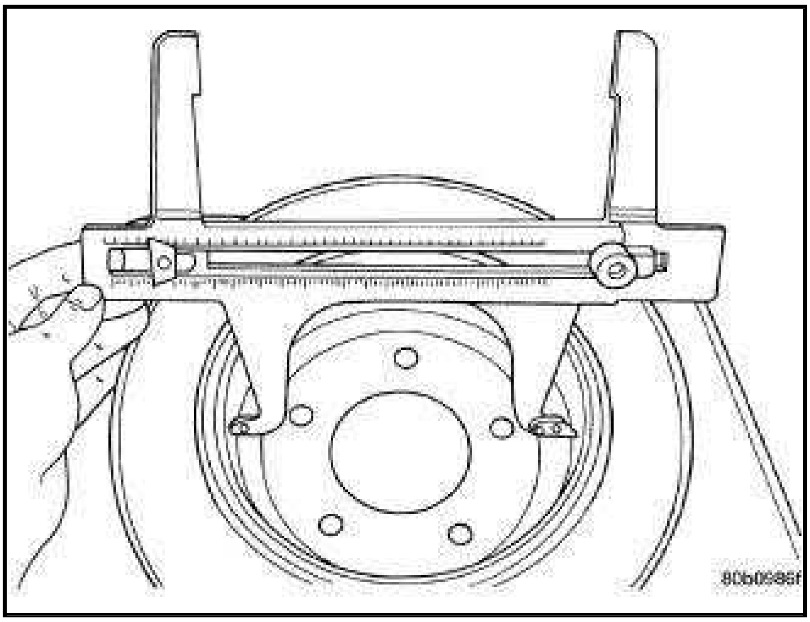
Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

CAUTION: Before adjusting the park brake shoes be sure that the park brake lever is in the fully released position. If the park brake lever is not in the fully released position, the park brake shoes can not be accurately adjusted.

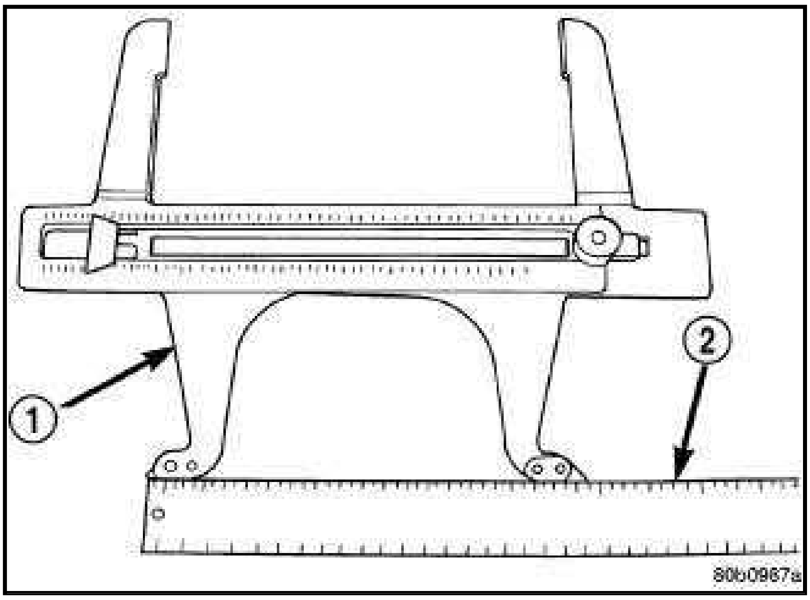
1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the tire and wheel. Refer to **REMOVAL AND INSTALLATION** .
3. Remove the disc brake caliper from the caliper adapter. Refer to **CALIPER, DISC BRAKE, FRONT, REMOVAL AND INSTALLATIONCALIPER, DISC BRAKE, REAR, REMOVAL AND INSTALLATION**.
4. Remove the rotor from the axle shaft. Refer to **ROTOR, BRAKE, REMOVAL AND INSTALLATION**.

   NOTE: When measuring the brake drum diameter, the diameter should be measured at the center of the area in which the park brake shoes contact the surface of the brake drum.

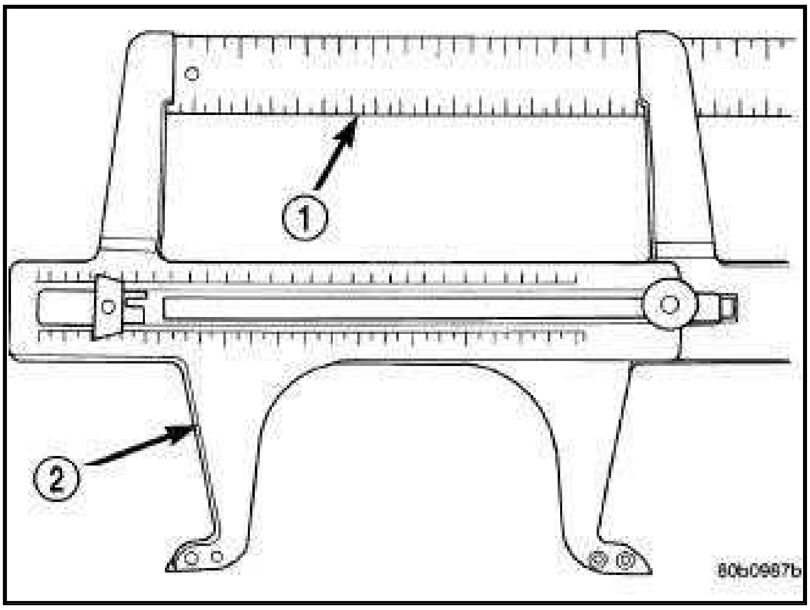
5. Using (special tool #C-3919, Gauge, Brake Shoes), or equivalent, **accurately** measure the inside diameter of the park brake drum portion of the rotor.



6. Using a ruler that reads in 64th of an inch, accurately read the measurement of the inside diameter of the park brake drum from the special tool.



7. Reduce the inside diameter measurement of the brake drum that was taken using (special tool #C-3919, Gauge, Brake Shoes) by 1/64 of an inch. Reset (special tool #C-3919, Gauge, Brake Shoes) or the equivalent used, so that the outside measurement jaws are set to the reduced measurement.



8. Place (special tool #C-3919, Gauge, Brake Shoes), or equivalent over the park brake shoes. The special tool must be located diagonally across at the top of one shoe and bottom of opposite shoe (widest point) of the park brake shoes.
9. Using the star wheel adjuster, adjust the park brake shoes until the lining on the park brake shoes just touches the jaws on the special tool.
10. Repeat step 8 above and measure shoes in both directions.
11. Install the brake rotor on the axle shaft. Refer to **ROTOR, BRAKE, REMOVAL AND INSTALLATION**.
12. Rotate the rotor to verify that the park brake shoes are not dragging on the brake drum. If park brake shoes are dragging, remove rotor and back off star wheel adjuster one notch and recheck for brake shoe drag against drum. Continue with the previous step until brake shoes are not dragging on brake drum.
13. Install the disc brake caliper on the caliper adapter. Refer to **CALIPER, DISC BRAKE, FRONT, REMOVAL AND INSTALLATIONCALIPER, DISC BRAKE, REAR, REMOVAL AND INSTALLATION**.
14. Install the wheel and tire. Refer to **REMOVAL AND INSTALLATION** .
15. Remove the support and lower the vehicle.

CAUTION: **Before moving vehicle, pump brake pedal several times to ensure the vehicle has a firm enough pedal to stop the vehicle.**

NOTE: **After park brake lining replacement, it is recommended that the park brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the park brake lever.**

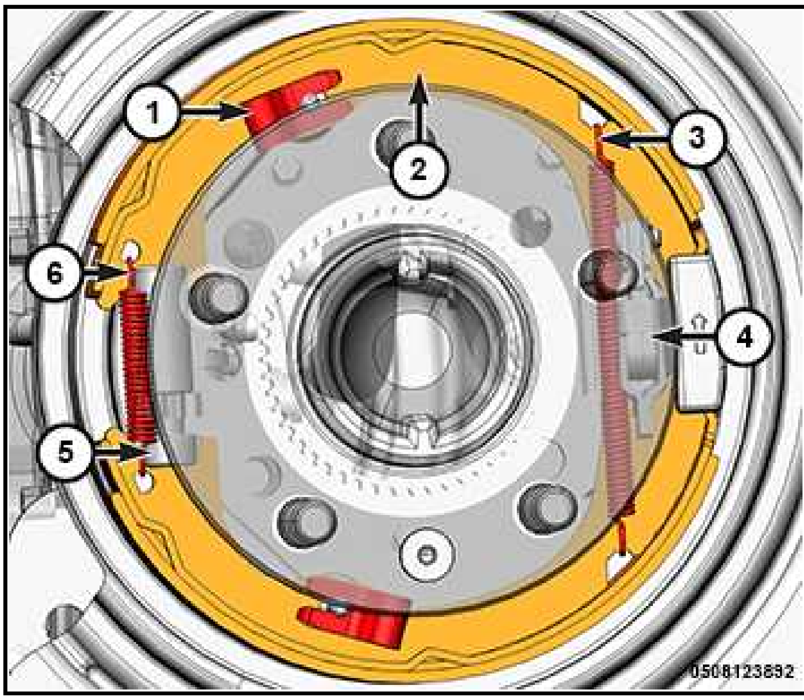
16. Road test the vehicle to ensure proper function of the vehicle's brake system.

ROTOR INSTALLED

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

1. Be sure parking brake lever is fully released.
2. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
3. Remove the plug from each access hole in brake support plates.
4. Remove the floor console. Refer to **CONSOLE, FLOOR, REMOVAL AND INSTALLATION CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION** .
5. Loosen the park brake cable adjustment nut until there is slack in the front cable.
6. Insert the adjusting tool through the support plate access hole and engage the tool in the teeth of the adjusting screw star wheel.
7. Rotate the adjuster screw star wheel (move the tool handle upward) until slight drag can be felt when the wheel is rotated.
8. Back off the adjuster screw star wheel until brake drag is eliminated.
9. Repeat the adjustment at the opposite wheel. Be sure the adjustment is equal at both wheels.
10. Install the support plate access hole plugs.
11. Adjust the park brake cable. Refer to **PARKING BRAKE, ADJUSTMENTS**.
12. Remove the support and lower the vehicle.
13. Apply the park brake lever and make sure the park brakes hold the vehicle stationary.
14. Release park brake lever.

INSPECTION



As a general rule, riveted brake shoes (2) should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be replaced and the drum checked for runout or taper.

Inspect the adjuster screw assembly (5). Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded.

Discard the brake springs (3 and 6) and retainer components (1) if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

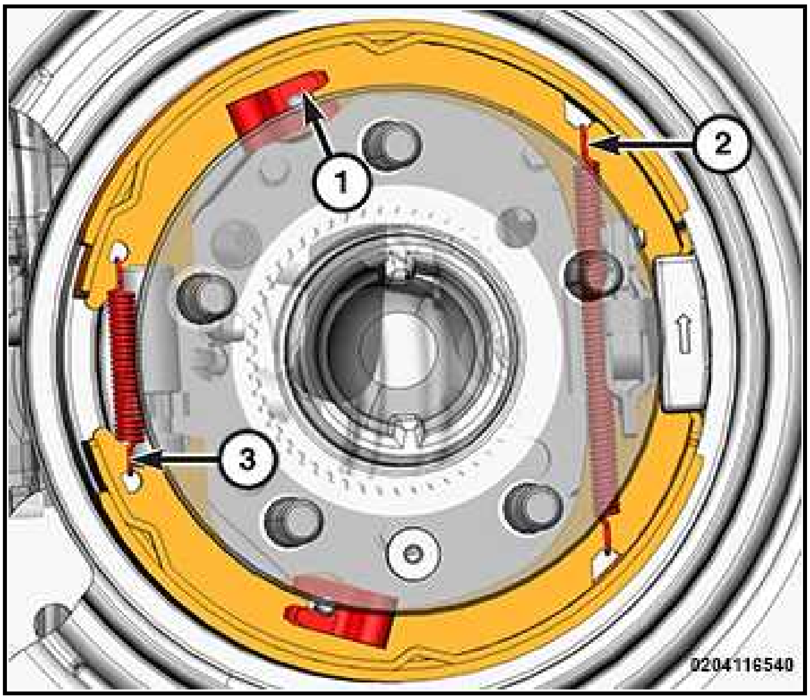
Inspect the brake shoe contact pads on the support plate, replace the support plate if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted.

REMOVAL AND INSTALLATION

PARK BRAKE SHOES

REMOVAL

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the rear wheel speed sensor from the brake backing plate. Refer to **SENSOR, WHEEL SPEED, REAR, REMOVAL AND INSTALLATION**.
3. Remove the rear axle shaft. Refer to **REMOVAL AND INSTALLATION** .



1 - Brake Shoe Hold Down Springs
2 - Spring
3 - Spring

4. Remove both springs from the brake shoes.
5. Remove the two brake shoe hold down springs.
6. Remove both brake shoes taking care to retain all hardware such as the hold down pins and springs, the adjuster assembly, and the actuator assembly.

INSTALLATION

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Check and fill the rear axle fluid.
- Perform the park brake adjustment procedure. Refer to **PARKING BRAKE, ADJUSTMENTS**.
- Verify proper park brake system operation and repeat adjustment procedure as needed.