

2021 STEERING

(Electro-Hydraulic Power Steering (EHPS) Module - Electrical Diagnostics) - Gladiator

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
C1587-16	POWER STEERING MOTOR INVERTER POWER SUPPLY - CIRCUIT VOLTAGE BELOW THRESHOLD
C1587-17	POWER STEERING MOTOR INVERTER POWER SUPPLY - CIRCUIT VOLTAGE ABOVE THRESHOLD
C15A4-00	POWER STEERING ASSIST INHIBITED-VEHICLE SPEED TOO HIGH
C211B-00	IGNITION RUN/START INPUT
C211B-11	IGNITION RUN/START INPUT - CIRCUIT SHORT TO GROUND
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C2128-00	ECU RESET/RECOVERY OCCURED
C2129-16	BATTERY VOLTAGE - CIRCUIT VOLTAGE BELOW THRESHOLD
C2129-17	BATTERY VOLTAGE-CIRCUIT VOLTAGE ABOVE THRESHOLD
C212A-16	SYSTEM VOLTAGE - CIRCUIT VOLTAGE BELOW THRESHOLD
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C212A-84	SYSTEM VOLTAGE - SIGNAL BELOW ALLOWABLE RANGE
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C2206-00	VEHICLE CONFIGURATION MISMATCH
C220D-00	ELECTRICAL POWERED HYDRAULIC STEERING MODULE INTERNAL
C2210-00	ECU OVERTEMPERATURE
C221F-00	ECU NOT INITIALIZED
U0002-00	CAN C BUS OFF PERFORMANCE
U0100-00	LOST COMMUNICATION WITH ECM/PCM
U0100-00	LOST COMMUNICATION WITH ECM/PCM
U0121-00	LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE
U0126-00	LOST COMMUNICATION WITH STEERING ANGLE SENSOR
U0140-00	LOST COMMUNICATION WITH BODY CONTROL MODULE
U0155-00	LOST COMMUNICATION WITH CLUSTER-CCN
U0401-00	IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM
U0415-00	IMPLAUSIBLE DATA RECEIVED FROM ABS
U0428-00	IMPLAUSIBLE DATA RECEIVED FROM STEERING ANGLE SENSOR MODULE
U1601-00	ECU APPLICATION SOFTWARE CODE 1 MISSING OR CORRUPTED
U160B-00	ECU BOOT SOFTWARE 1 MISSING OR CORRUPTED

DIAGNOSIS AND TESTING

C1587-16-POWER STEERING MOTOR INVERTER POWER SUPPLY - CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- The Electro-Hydraulic Power Steering (EHPS) Module detects that the voltage is under 10 volts and can not operate the motor safely.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM VOLTAGE LOW
FUSES
RUN/START RELAY
IGNITION RUN/START CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUSED B(+) CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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.

5. With the scan tool, erase EHPS DTCs.
1. Park the vehicle on level ground.
2. Start the engine.
3. Turn the steering wheel from stop to stop.
4. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#)

2. CHECK FOR PCM OR RELATED CHARGING DTCS

1. Refer to the recorded DTCs.

Are there any PCM or related Charging DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#) , or [3.6L \(GPEC 2A\) - DIAGNOSTIC CODE INDEX](#) .

No

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3. CHECK THE N6 (125A) AND F34 (10A) FUSES

1. Turn the ignition on.
2. Using a 12-volt test light connected to ground, check the Fuses N6 (125A) and F34 (10A) for power.

Are the fuses good?

Yes

- Go To [4](#)

No

- If the related fuse(s) are open, check the EHPS Module Power circuits for a short to ground.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

4. CHECK THE (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS C2 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 EHPS C2 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.

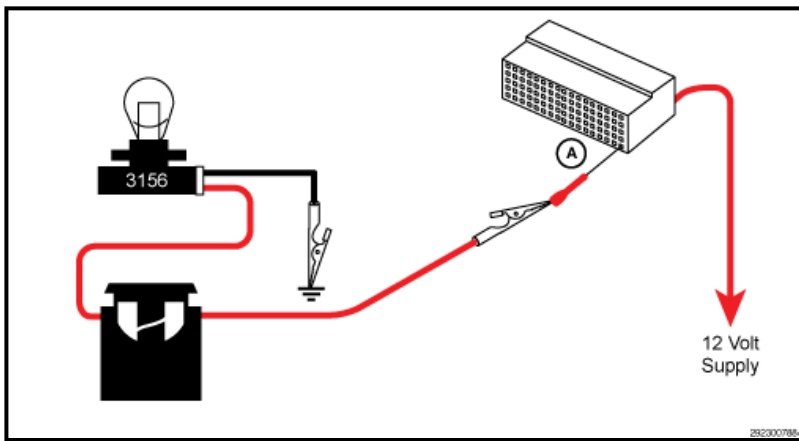
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 (F941) Ignition RUN/START Control Output circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

5. CHECK THE (A10) FUSED B(+) CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS C1 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 EHPS C1 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.

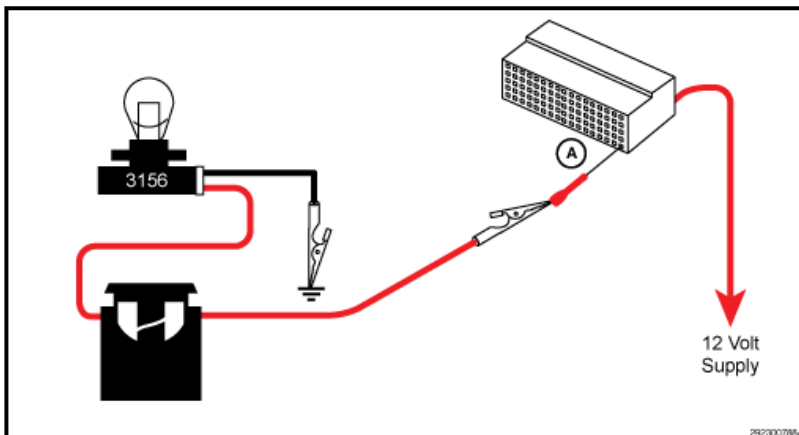
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 (A10) Fused B(+) circuit for an open or high resistance.

- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

6. CHECK THE (Z908) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS C1 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 EHPS C1 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.

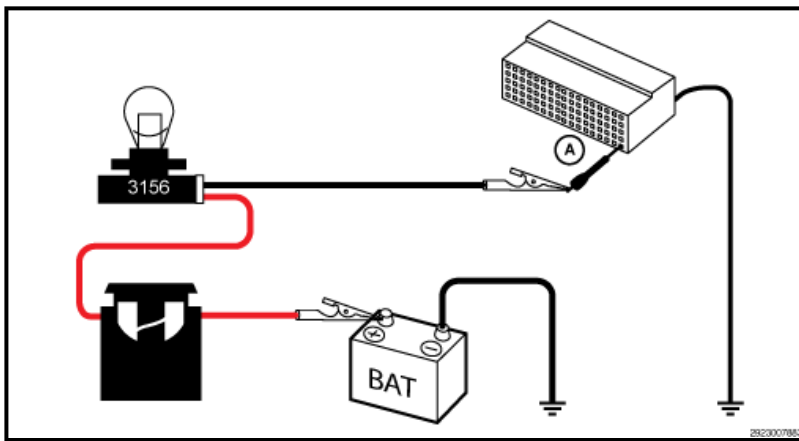
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 (Z908) Ground circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

7. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C1587-17-POWER STEERING MOTOR INVERTER POWER SUPPLY - CIRCUIT VOLTAGE ABOVE THRESHOLD

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- The Electro-Hydraulic Power Steering (EHPS) Module detects voltage over 16 volts.

DEFAULT ACTION

- EHPS indicator light illuminated.

- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes

CHARGING SYSTEM VOLTAGE HIGH
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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.
5. With the scan tool, erase EHPS DTCs.
1. Park the vehicle on level ground.
2. Start the engine.
3. Turn the steering wheel from stop to stop.
4. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

2. CHECK FOR PCM OR RELATED CHARGING DTCS

1. Refer to the recorded DTCs.

Are there any PCM or related Charging DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to **3.0L DIESEL - DIAGNOSTIC CODE INDEX** , or **3.6L (GPEC 2A) - DIAGNOSTIC CODE INDEX** .

No

- Go To [3](#)

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION**.
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C15A4-00-POWER STEERING ASSIST INHIBITED-VEHICLE SPEED TOO HIGH

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power

steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- The Electro-Hydraulic Power Steering (EHPS) Module detects that the voltage is under 10 volts and can not operate the motor safely.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes

ELECTRO-HYDRAULIC POWER STEERING (EHPS) MODULE OR COMMUNICATION DTCS
ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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.
5. With the scan tool, erase EHPS DTCs.
1. Park the vehicle on level ground.
2. Start the engine.
3. Turn the steering wheel from stop to stop.
4. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

2. CHECK FOR ELECTRO-HYDRAULIC POWER STEERING (EHPS) MODULE OR COMMUNICATION RELATED DTCS

1. Refer to the recorded DTCs.

Are there any EHPS Module or Communication related DTCs active?

Yes

- Perform the appropriate diagnostic procedures before continuing with this test. Refer to [ANTILOCK BRAKE SYSTEM \(ABS\) - DIAGNOSTIC CODE INDEX](#) .

No

- Go To [3](#)

3. EHPS PUMP MOTOR

1. Turn the steering wheel left and right.

Is there power steering assist?

Yes

- Go To [4](#)

No

- Replace the Electro-Hydraulic Power Steering (EHPS) Pump in accordance with the Service Information. Refer to [PUMP, REMOVAL AND INSTALLATION](#) .
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

4. POWER STEERING SYSTEM

1. Inspect the Power Steering System for mechanical problems.

Were any problems found?

Yes

- Repair as necessary.
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Go To [5](#)

5. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C211B-00-IGNITION RUN/START INPUT

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power

steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- No ignition voltage sensed at the Electro-Hydraulic Power Steering (EHPS) Module while the vehicle is running.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes

IGNITION (RUN-START) CONTROL OUTPUT CIRCUIT SHORTED TO GROUND
IGNITION (RUN-START) CONTROL OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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.
5. With the scan tool, erase EHPS DTCs.
1. Park the vehicle on level ground.
2. Start the engine.
3. Turn the steering wheel from stop to stop.
4. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

2. ISOLATE AND CHECK THE (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUIT FOR A SHORT TO GROUND

1. Remove Fuse 34 from Front Power Distribution Center (PDC).
2. The ignition must be off when checking a circuit for continuity to ground.
3. Isolate the (F941) Ignition RUN/START Control Output circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested.
Note: Use the wiring diagram as a guide to follow the path of the circuit.
4. Connect the negative lead of the DVOM to a known good ground.
5. With the positive lead of the DVOM, probe the circuit being tested at the EHPS C1 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 circuit being tested?

Yes

- Repair the (F941) Ignition RUN/START Control Output 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 EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Go To [3](#)

3. CHECK THE (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component 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.

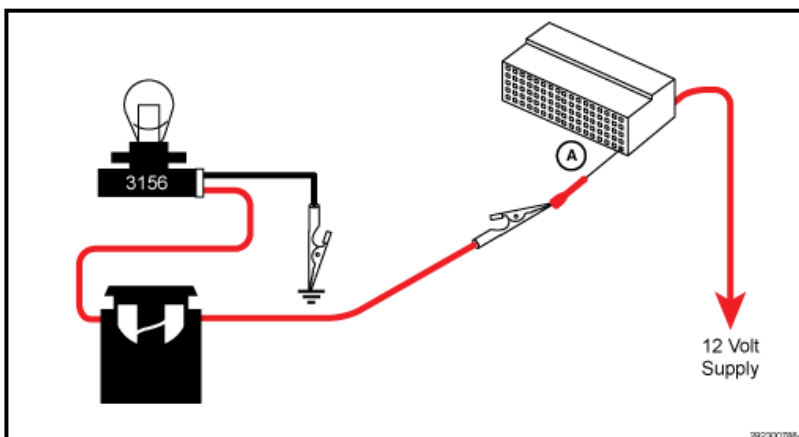
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 [4](#)

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

4. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION**.

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C211B-11-IGNITION RUN/START INPUT - CIRCUIT SHORT TO GROUND

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- The ignition signal at the Electro-Hydraulic Power Steering (EHPS) Module harness connector is less than 2.5 Volts while the vehicle is running.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes

IGNITION RUN/START CONTROL OUTPUT CIRCUIT SHORTED TO GROUND
ELECTRO-HYDRAULIC POWER STEERING (EHPS) MODULE

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. 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.
5. With the scan tool, erase EHPS DTCs.
1. Cycle the ignition from off to on.
2. With the scan tool, read EHPS DTCs.

Is the DTC active at this time?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

2. ISOLATE AND CHECK THE (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUIT FOR A SHORT TO GROUND

1. Remove Fuse 34 from Front Power Distribution Center (PDC).
2. The ignition must be off when checking a circuit for continuity to ground.
3. Isolate the (F941) Ignition RUN/START Control Output circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested.
Note: Use the wiring diagram as a guide to follow the path of the circuit.
4. Connect the negative lead of the DVOM to a known good ground.
5. 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: 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 (F941) Ignition RUN/START Control Output circuit being tested?

Yes

- Repair the (F941) Ignition RUN/START Control Output 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 EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Go To [3](#)

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to [MODULE, ELECTRO-HYDRAULIC POWER STEERING \(EHPS\), REMOVAL AND INSTALLATION](#).
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).
- Test complete.

C211B-12-IGNITION RUN/START INPUT - CIRCUIT SHORT TO BATTERY

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- The Electro-Hydraulic Power Steering (EHPS) Module receives ignition signal while ignition is off.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes
IGNITION RUN/START CONTROL OUTPUT CIRCUIT SHORTED TO BATTERY
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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.
5. With the scan tool, erase EHPS DTCs.
1. Cycle the ignition from off to on.
2. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

2. ISOLATE AND CHECK THE (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. Disconnect the EHPS C2 harness connector at the EHPS Module. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Using a DVOM, measure the voltage of the (F941) Ignition RUN/START Control Output circuit being tested at the EHPS C2 harness connector.

Is there any voltage present?

Yes

- Repair the (F941) Ignition RUN/START Control Output 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 EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Go To [3](#)

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C2128-00-ECU RESET/RECOVERY OCCURED

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Once, at each ignition cycle.
- No under voltage DTCs.

SET CONDITION

- The ignition is turned on, the Electro-Hydraulic Power Steering (EHPS) Module checks to see if the last shutdown occurred correctly. If it did not, this DTC will be set active for the remainder of the current key cycle. The EHPS Pump will run normally even if this DTC is active.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).

POSSIBLE CAUSES

Possible Causes
(A951) FUSED B(+) CIRCUIT OPEN OR HIGH RESISTANCE
(Z908) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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 12-volt battery is fully charged before proceeding.

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.
5. With the scan tool, erase EHPS DTCs.
1. Park the vehicle on level ground.
2. Start the engine.
3. Turn the steering wheel from stop to stop.
4. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

2. CHECK THE (A10) FUSED B(+) CIRCUIT FOR AN OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS C1 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 EHPS C1 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.

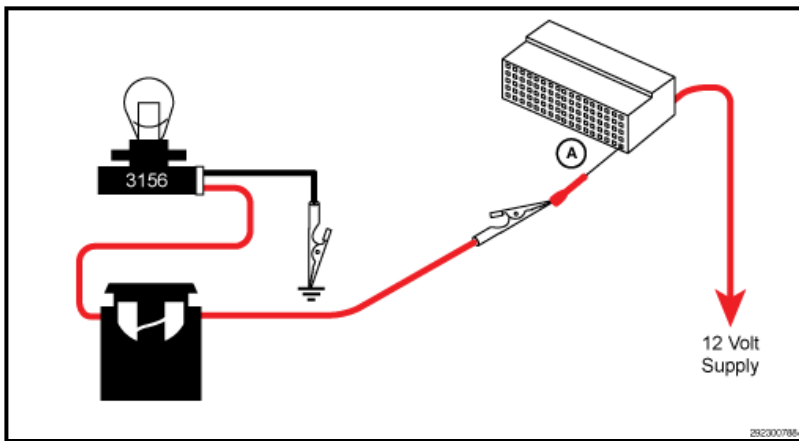
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 [3](#)

No

- Repair the (A951) Fused B(+) circuit for an open or high resistance.
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

3. CHECK THE (Z908) GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS C1 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](#).

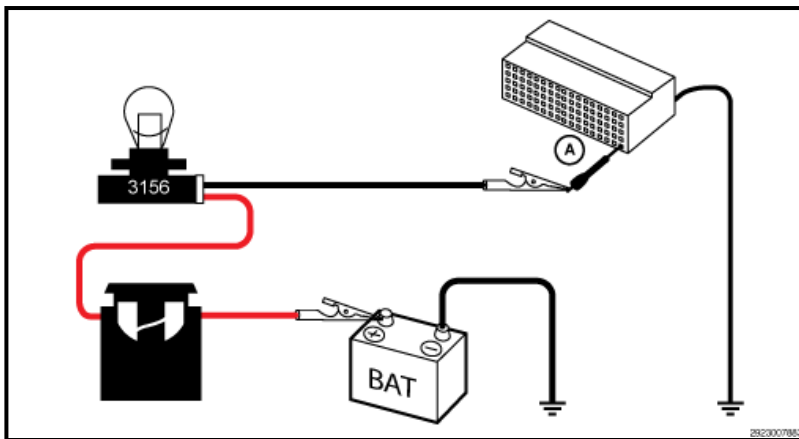
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load 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 [4](#)

No

- Repair the (Z908) Ground circuit for an open or high resistance.
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

4. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C2129-16-BATTERY VOLTAGE - CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Module monitors the battery voltage level at the EHPS supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low

If the EHPS supply voltage is below the System Voltage Low or the Excessively Low threshold, the EHPS will not supply power to the steering gear motor. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage between 10.0 and 16.0 volts.

SET CONDITION

- Electro-Hydraulic Power Steering (EHPS) Module supply voltage below 10.0 volts for longer than 15 seconds.

DEFAULT ACTION

- EHPS Module supply voltage below 10.0 volts:
 - Power Steering assist reduced.
- EHPS Module supply voltage below 9.0 volts:
 - No Power Steering assist.

POSSIBLE CAUSES

Possible Causes
FUSED IGNITION OPEN OR HIGH RESISTANCE
FUSED B(+) CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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. Park the vehicle on level ground.
2. Perform any Service Bulletins that may apply.
3. Turn the ignition on.
4. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
5. With the scan tool, read DTCs and record on the repair order.
6. With the scan tool, erase all DTCs.
7. Start the engine and run for two minutes.
8. Turn the steering wheel from stop to stop.
9. With the scan tool, read the EHPS DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension and repair as necessary. If no problems are found, test complete.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

2. ISOLATE AND CHECK THE (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUIT FOR AN OPEN/HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS Module C2 harness connector to isolate the (F941) Ignition RUN/START Control Output circuit.
2. Connect the positive lead of the load test tool to the (F941) Ignition RUN/START Control Output circuit at the EHPS Module C1 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 ((F941) Ignition RUN/START Control Output 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.

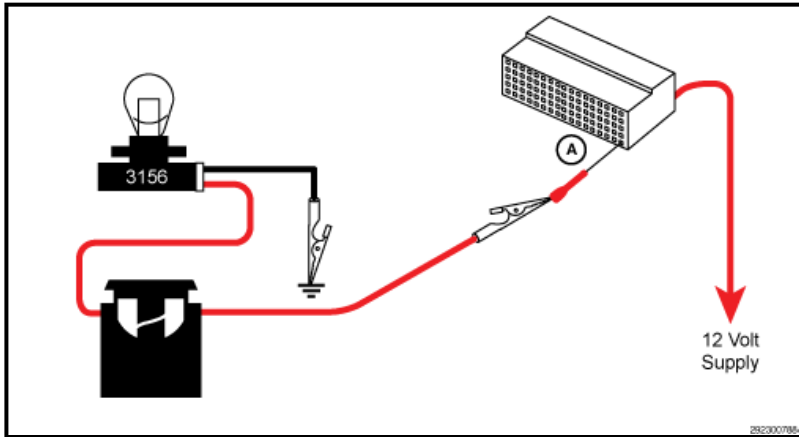
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 [3](#)

No

- Repair the (F941) Ignition RUN/START Control Output circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST** .

3. ISOLATE AND CHECK THE (A10) FUSED (B+) CIRCUIT FOR AN OPEN/HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS Module C1 harness connector to isolate the (A10) Fused (B+) circuit.
2. Connect the positive lead of the load test tool to the (A10) Fused (B+) circuit at the EHPS Module C1 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 (A10) Fused (B+) 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

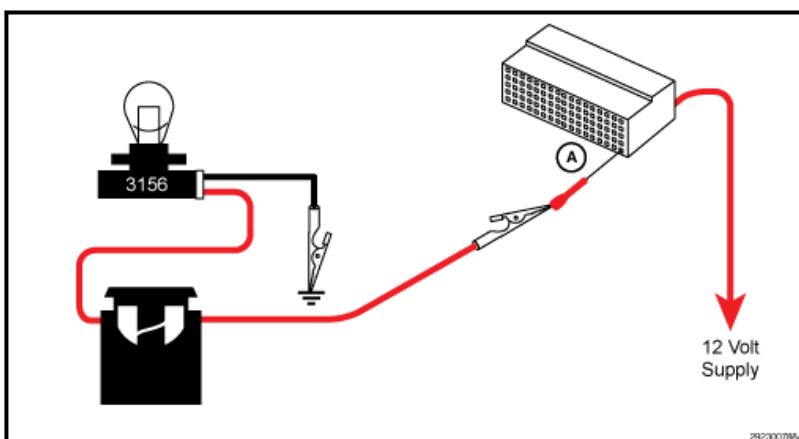
circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative 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 [4](#)

No

- Repair the (A10) Fused (B+) circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

4. ISOLATE AND CHECK THE (Z908) GROUND CIRCUIT FOR AN OPEN/HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS Module C1 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 EHPS Module C1 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.

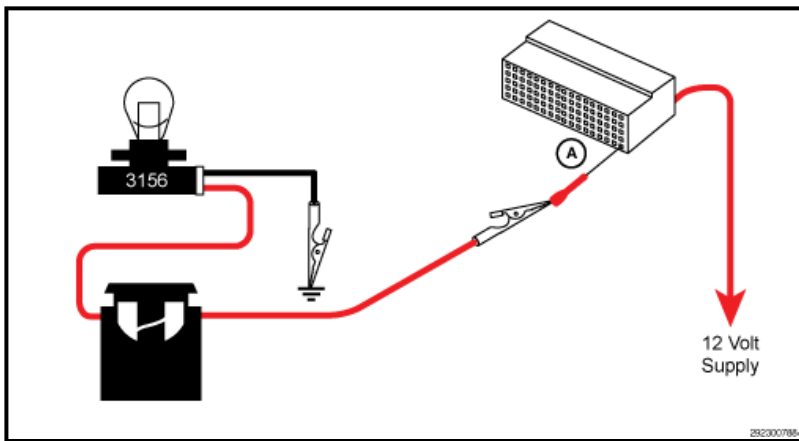
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 [5](#)

No

- Repair the (Z908) Ground circuit for an open circuit or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

5. CHECK THE EHPS MODULE RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module C1 and C2 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C2129-17-BATTERY VOLTAGE-CIRCUIT VOLTAGE ABOVE THRESHOLD

THEORY OF OPERATION

The Electric Hydraulic Power Steering (EHPS) Module monitors the battery voltage level at the EHPS supply voltage terminal for the following failure conditions:

- System Voltage High

If the EHPS supply voltage is above the System Voltage High threshold, the EHPS will not supply power to the steering gear motor. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- Electro-Hydraulic Power Steering (EHPS) Module detects the battery voltage has increased above 16.5 volts for more than 1 second.

DEFAULT ACTION

- EHPS is disabled.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM DTCS PRESENT
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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 DTCs and record on vehicle work order.
3. With the scan tool, erase DTCs.
4. Start the engine.
5. With the scan tool, read EPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time.
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR CHARGING SYSTEM RELATED DTCS

1. Turn the ignition on.
2. With the scan tool, read DTCs in the PCM.

Are there any PCM or Charging System related DTCs present?

Yes

- Perform the appropriate Charging System DTC diagnostic procedures before continuing with this test. Refer to **3.0L DIESEL - DIAGNOSTIC CODE INDEX** , or **3.6L (GPEC 2A) - DIAGNOSTIC CODE INDEX** .

No

- Go To [3](#)

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to [MODULE, ELECTRO-HYDRAULIC POWER STEERING \(EHPS\), REMOVAL AND INSTALLATION](#) .
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).
- Test complete.

C212A-16-SYSTEM VOLTAGE - CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Module monitors the battery voltage level at the EHPS supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low

If the EHPS supply voltage is below the System Voltage Low or the Excessively Low threshold, the EHPS will not supply power to the steering gear motor. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

- System voltage between 10.0 and 16.0 volts.

SET CONDITION

- Electro-Hydraulic Power Steering (EHPS) Module supply voltage below 10.0 volts for longer than 15 seconds.

DEFAULT ACTION

- EHPS Module supply voltage below 10.0 volts:
 - Power Steering assist reduced.
 - EPS lamp not illuminated.
- EHPS Module supply voltage below 9.0 volts:
 - No Power Steering assist.
 - EPS lamp illuminated.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM
FUSED IGNITION CIRCUIT OPEN OR HIGH RESISTANCE
FUSED B(+) CIRCUITS OPEN OR HIGH RESISTANCE
GROUND CIRCUITS OPEN OR HIGH RESISTANCE
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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. Park the vehicle on level ground.
2. Perform any Service Bulletins that may apply.
3. Turn the ignition on.
4. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
5. With the scan tool, read DTCs and record on the repair order.
6. With the scan tool, erase all DTCs.
7. Start the engine and run for two minutes.
8. Turn the steering wheel from stop to stop.
9. With the scan tool, read the EHPS DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension and repair as necessary. If no problems are found, test complete.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR COMMUNICATION RELATED DTCS

1. Refer to the recorded DTCs.

Are there any PCM DTCs present?

Yes

- Perform the applicable diagnostic procedure(s). Refer to [ANTILOCK BRAKE SYSTEM \(ABS\) - DIAGNOSTIC CODE INDEX](#).

No

- Go To [3](#)

3. ISOLATE AND CHECK THE (F941) IGNITION RUN/START CONTROL OUTPUT CIRCUIT FOR AN OPEN/HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS Module C2 harness connector to isolate the (F941) Ignition RUN/START Control Output circuit.
2. Connect the positive lead of the load test tool to the (F941) Ignition RUN/START Control Output circuit at the EHPS Module C1 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 ((F941) Ignition RUN/START Control Output 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.

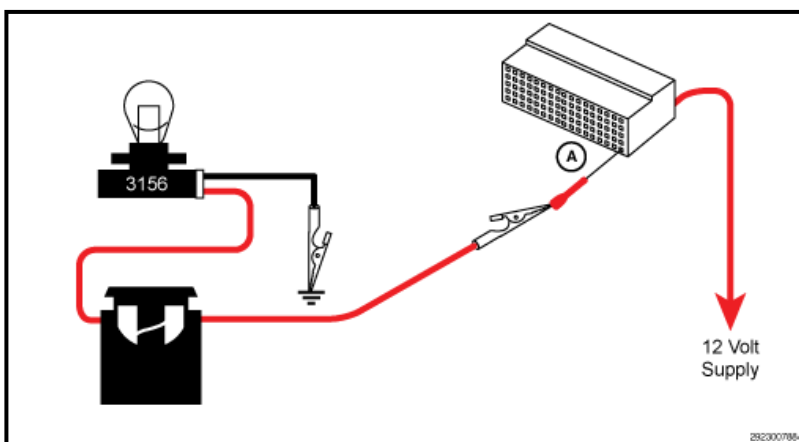
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NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable 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 [4](#)

No

- Repair the (F941) Ignition RUN/START Control Output circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

4. ISOLATE AND CHECK THE (A10) FUSED (B+) CIRCUIT FOR AN OPEN/HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS Module C1 harness connector to isolate the (A10) Fused (B+) circuit.
2. Connect the positive lead of the load test tool to the (A10) Fused (B+) circuit at the EHPS Module C1 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 (A10) Fused (B+) 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.

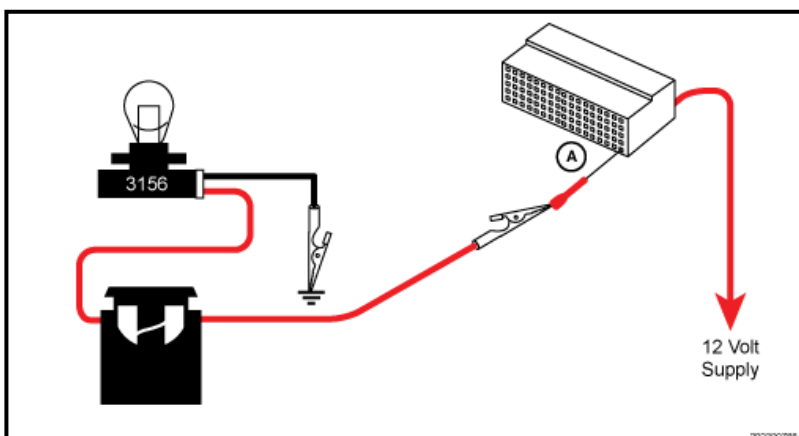
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 (A10) Fused (B+) circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

5. ISOLATE AND CHECK THE (Z908) GROUND CIRCUIT FOR AN OPEN/HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the EHPS Module C1 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 EHPS Module C1 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.

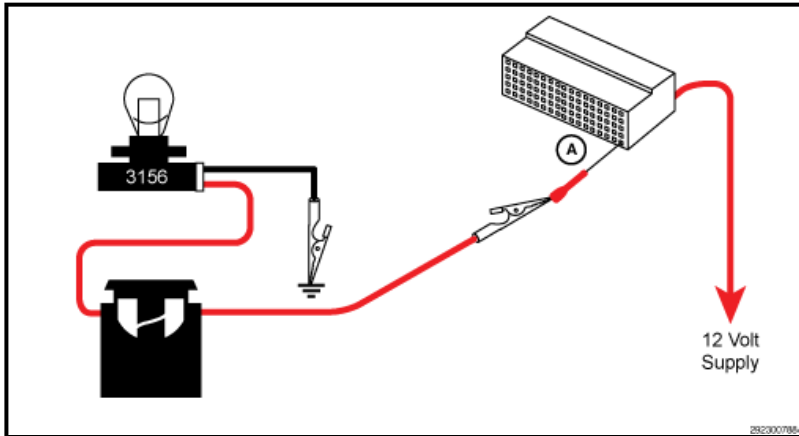
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance 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 (Z908) Ground circuit for an open circuit or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

6. CHECK THE EHPS MODULE RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module C1 and C2 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C212A-17-SYSTEM VOLTAGE - CIRCUIT VOLTAGE ABOVE THRESHOLD

THEORY OF OPERATION

The Electric Hydraulic Power Steering (EHPS) Module monitors the battery voltage level at the EHPS supply voltage terminal for the following failure conditions:

- System Voltage High

If the EHPS supply voltage is above the System Voltage High threshold, the EHPS will not supply power to the steering gear motor. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- Electro-Hydraulic Power Steering (EHPS) Module detects the battery voltage has increased above 16.5 volts for more than 1 second.

DEFAULT ACTION

- EHPS is disabled.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM DTCS PRESENT
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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 DTCs and record on vehicle work order.
3. With the scan tool, erase DTCs.
4. Start the engine.
5. With the scan tool, read EPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time.
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) OR CHARGING SYSTEM RELATED DTCS

1. Turn the ignition on.
2. With the scan tool, read DTCs in the PCM.

Are there any PCM or Charging System related DTCs present?

Yes

- Perform the appropriate Charging System DTC diagnostic procedures before continuing with this test. Refer to **DIAGNOSIS AND TESTING** , or **DIAGNOSIS AND TESTING** .

No

- Go To [3](#)

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION**.
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C212A-84-SYSTEM VOLTAGE - SIGNAL BELOW ALLOWABLE RANGE

For a complete ELECTRO HYDRAULIC POWER STEERING EHPS SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result,

steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Once, at each ignition cycle.
- No under voltage DTCs.

SET CONDITION

- The Electro-Hydraulic Power Steering (EHPS) Module receives a low charging system voltage message over the CAN C bus or detects voltage under 10 volts.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) OR RELATED CHARGING SYSTEM DTCs
FUSED B(+) CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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 DTCs and record on the repair order.
4. With the scan tool, read and record Environmental Data.
5. With the scan tool, erase EHPS DTCs.
1. Park the vehicle on level ground.
2. Start the engine.
3. Turn the steering wheel from stop to stop.
4. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and

connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

- Perform the EHPS VERIFICATION TEST. Refer to [**STANDARD PROCEDURE - EHPS VERIFICATION TEST**](#).

2. CHECK FOR PCM OR RELATED CHARGING DTCS

1. Refer to the recorded DTCS.

Are there any PCM or related Charging DTCS active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to [**3.0L DIESEL - DIAGNOSTIC CODE INDEX**](#) , or [**3.6L \(GPEC 2A\) - DIAGNOSTIC CODE INDEX**](#) .

No

- Go To [**3**](#)

3. CHECK THE (A951) FUSED B(+) CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component 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**](#) .

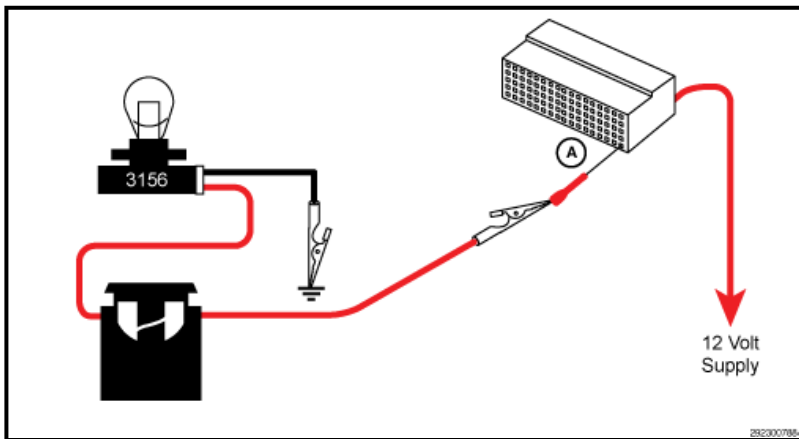
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load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

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [**STANDARD PROCEDURE - EHPS VERIFICATION TEST**](#).

4. CHECK THE (Z907) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component 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

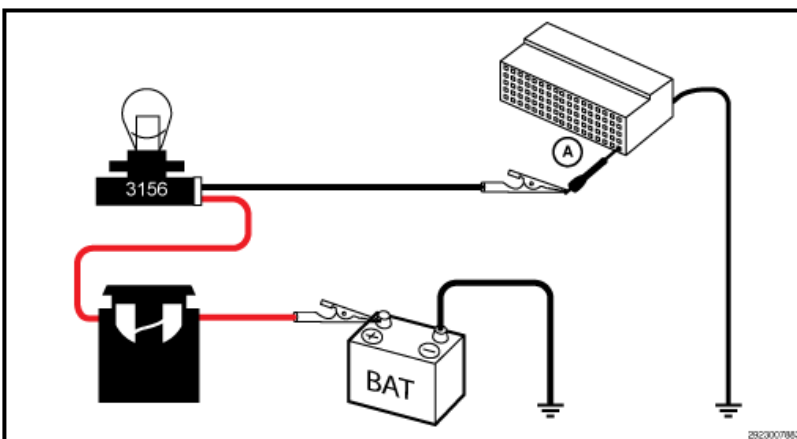
circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative 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 [5](#)

No

- Repair the ground circuit for an open or high resistance.
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

5. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to [MODULE, ELECTRO-HYDRAULIC POWER STEERING \(EHPS\), REMOVAL AND INSTALLATION](#).
- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Perform the EHPS VERIFICATION TEST. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

- Test complete.

C212A-85-SYSTEM VOLTAGE - SIGNAL ABOVE ALLOWABLE RANGE

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Once, at each ignition cycle.
- No under voltage DTCs.

SET CONDITION

- The Electro-Hydraulic Power Steering (EHPS) Module receives a high charging system voltage message over the CAN C bus or detects voltage over 16 volts.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) OR RELATED CHARGING SYSTEM DTCs
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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 DTCs and record on the repair order.
4. With the scan tool, read and record Environmental Data.
5. With the scan tool, erase EHPS DTCs.
1. Cycle the ignition from off to on.
2. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

2. CHECK FOR PCM OR RELATED CHARGING SYSTEM DTCS

1. Refer to the recorded DTCs.

Are there any PCM or related Charging System DTCs ?

Yes

- Perform the Charging System diagnostic procedure. Refer to [DIAGNOSIS AND TESTING](#) , or [DIAGNOSIS AND TESTING](#) .

No

- Go To [3](#)

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C2206-00-VEHICLE CONFIGURATION MISMATCH

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Once, at each ignition cycle.
- No under voltage DTCs.

SET CONDITION

- This DTC will set if the vehicle type is not identified or incorrectly identified in the Electro-Hydraulic Power Steering (EHPS) Module.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).

POSSIBLE CAUSES

Possible Causes
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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 DTCs and record on the repair order.
4. With the scan tool, read and record Environmental Data.
5. With the scan tool, erase EHPS DTCs.
1. Cycle the ignition from off to on.
2. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete, the condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.
- Perform the BODY VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

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 **3.0L DIESEL - DIAGNOSTIC CODE INDEX** , or **3.6L (GPEC 2A) - DIAGNOSTIC CODE INDEX** .

No

- Go To [3](#)

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION**.
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C220D-00-ELECTRICAL POWERED HYDRAULIC STEERING MODULE INTERNAL

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the

EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- If the Electro-Hydraulic Power Steering (EPS) Module detects an internal fault, this DTC will set. Most of internal faults that can set this DTC will result in the EPS Pump not operating for the remainder of the current key cycle.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes
ELECTRO-HYDRAULIC POWER STEERING (EPS) 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.
5. With the scan tool, erase EHPS DTCs.
1. Park the vehicle on level ground.
2. Start the engine and run for two minutes.
3. Turn the steering wheel from stop to stop.
4. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring harness and electrical connectors.
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

2. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION**.
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- The Electro-Hydraulic Power Steering (EHPS) Module detects an over temperature at the Electro-Hydraulic Power Steering (EHPS) Pump.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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.
5. With the scan tool, erase EHPS DTCs.
1. Cycle the ignition from off to on.
2. With the scan tool, read EHPS DTCs.

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. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

2. CHECK THE EHPS PUMP FOR OVER TEMPERATURE

1. Turn the ignition off.
2. Let vehicle sit for 30 minutes.
3. Turn the ignition on.
4. With the scan tool, erase EHPS DTCs.
5. Test drive vehicle performing parking maneuvers.
6. Cycle the ignition switch from off to on.
7. With the scan tool, read EHPS Module 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. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

3. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION**.
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.
- Test complete.

C221F-00-ECU NOT INITIALIZED

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle Speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No under voltage DTCs.

SET CONDITION

- The Body Control Module (BCM) detects that the Electro-Hydraulic Power Steering (EHPS) Module has not been initialized.

DEFAULT ACTION

- EHPS indicator light illuminated.
- EHPS message displayed in Electronic Vehicle Information Center (EVIC).
- EHPS assist disabled.

POSSIBLE CAUSES

Possible Causes
ELECTRO-HYDRAULIC POWER STEERING (EHPS) 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.
 5. With the scan tool, erase EHPS DTCs.
1. Cycle the ignition switch from off to on several times then leave the key in the run position.
 2. With the scan tool, read EHPS DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

2. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect the EHPS Module 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 EHPS Module 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 EHPS Module DTCs.

Did the DTC return?

Yes

- Replace the Electro-Hydraulic Power Steering (EHPS) Module in accordance with the Service Information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION**.
- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Perform the EHPS Verification Test. Refer to **STANDARD PROCEDURE - EHPS 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 **BODY CONTROL MODULE (BCM) - DIAGNOSTIC CODE INDEX**.

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**.

U0100-00-LOST COMMUNICATION WITH 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** .

U0121-00-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) 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** .

U0126-00-LOST COMMUNICATION WITH STEERING ANGLE SENSOR

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** .

U0155-00-LOST COMMUNICATION WITH CLUSTER-CCN

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

WHEN MONITORED

- Continuously, with the ignition on.
- One valid CAN message received at least once.
- No U0002-00-CAN C Bus Off Performance DTC present.

SET CONDITION

- When the Electro-Hydraulic Power Steering (EHPS) Pump detects an incorrect CAN C buss message from the Powertrain Control Module (PCM).

POSSIBLE CAUSES

Possible Causes
EHPS CAN C BUS DTCS
PCM DTCS
ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP

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 EHPS Module DTCS and record on the repair order.
3. Cycle the ignition switch from off to on.

4. With the scan tool, read EHPS Module DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

2. CHECK IF BCM CAN C BUS DTCS ARE PRESENT

1. With the scan tool, read BCM DTCs.

Are there any BCM CAN C BUS DTCs present?

Yes

- Perform the appropriate diagnostic procedure. Refer to [BODY CONTROL MODULE \(BCM\) - DIAGNOSTIC CODE INDEX](#) .

No

- Go To [3](#)

3. CHECK IF ENGINE DTCS ARE PRESENT

1. With the scan tool, read PCM DTCs.

Are there any PCM DTCs present?

Yes

- Perform the appropriate diagnostic procedure. Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#) , or [3.6L \(GPEC 2A\) - DIAGNOSTIC CODE INDEX](#) .

No

- Using the schematics as a guide, check the Electro-Hydraulic Power Steering 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 Electro-Hydraulic Power Steering (EHPS) Pump in accordance with the Service Information. Refer to [MODULE, ELECTRO-HYDRAULIC POWER STEERING \(EHPS\), REMOVAL AND INSTALLATION](#) .
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

U0415-00-IMPLAUSIBLE DATA RECEIVED FROM ABS

For a complete wiring diagram, refer to appropriate **SYSTEM WIRING DIAGRAMS** article .

WHEN MONITORED

Continuously, while the system is active.

SET CONDITION

An error message has been received over the CAN C bus from the Anti-lock Brake System (ABS) Module.

POSSIBLE CAUSES

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE DTC

NOTE: Diagnose all CAN C bus communication DTCs before continuing.

1. Turn the ignition on.
2. With a scan tool, read EHPS Module DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

2. ABS CAN C BUSS COMMUNICATION RELATED DTCS IN OTHER MODULES

1. With a scan tool check for ABS communication related DTCs in other modules on the CAN C Bus.

Are there any ABS communication related DTCs in other modules on the CAN C Bus at this time?

Yes

- Replace and program the Anti-lock Brake System (ABS) in accordance with the Service Information. Refer to [MODULE, ANTI-LOCK BRAKE SYSTEM \(ABS\), REMOVAL AND INSTALLATION](#).
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

No

- Replace and program the Electro-Hydraulic Power Steering (EHPS) Pump in accordance with the Service Information. Refer to [MODULE, ELECTRO-HYDRAULIC POWER STEERING \(EHPS\), REMOVAL AND INSTALLATION](#).
- Perform the EHPS Verification Test. Refer to [STANDARD PROCEDURE - EHPS VERIFICATION TEST](#).

U0428-00-IMPLAUSIBLE DATA RECEIVED FROM STEERING ANGLE SENSOR MODULE

For a complete wiring diagram, refer to appropriate **SYSTEM WIRING DIAGRAMS** article .

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Assembly draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering

independent of the gasoline engine. The EHPS Assembly requires communication over the CAN C bus to function properly. The output flow of the EHPS Assembly is varied as a function of Steering Wheel Rate (received from SAS Module) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The pump will start to provide steering assist when a hybrid active (vehicle started) or a Vehicle Speed message greater than 5 kph (3 mph) is received on CAN C bus. If both the Vehicle Speed and Hybrid Active messages are missing at vehicle startup, the EHPS Assembly will not operate. If the Vehicle Speed message is lost during operation the EHPS Module will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Module will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS Assembly will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

Continuously, while the system is active.

SET CONDITION

An error message has been received over the bus from the Steering Angle Sensor (SAS).

POSSIBLE CAUSES

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
STEERING ANGLE SENSOR (SAS)
STEERING COLUMN CONTROL MODULE (SCCM)
ELECTRO-HYDRAULIC POWER STEERING (EHPS) MODULE

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE DTC

NOTE: Diagnose all communication DTCs before continuing.

1. Turn the ignition on.
2. With a scan tool, read EHPS Module DTCs.

Is the DTC active?

Yes

- Go To [2](#)

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

2. SAS COMMUNICATION RELATED DTCs IN OTHER MODULES

1. With a scan tool check for SAS communication related DTCs in other modules on the CAN C Bus.

Are there any SAS communication related DTCs in other modules on the CAN C Bus at this time?

Yes

- Replace the SAS in accordance with the service information. Refer to **MODULE, STEERING COLUMN CONTROL (SCCM), REMOVAL AND INSTALLATION** .
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

No

- Replace the Electro-Hydraulic Power Steering (EHPS) Assembly in accordance with service information. Refer to **MODULE, ELECTRO-HYDRAULIC POWER STEERING (EHPS), REMOVAL AND INSTALLATION** .
- Perform the EHPS VERIFICATION TEST. Refer to **STANDARD PROCEDURE - EHPS VERIFICATION TEST**.

U1601-00-ECU APPLICATION SOFTWARE CODE 1 MISSING OR CORRUPTED

THEORY OF OPERATION

The Electro-Hydraulic Power Steering (EHPS) Pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS Pump draws power from the 12-volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The EHPS Pump requires communication over the CAN C bus to function properly. The output flow of the EHPS Pump is varied as a function of Steering Wheel Rate (received from SAS) and Vehicle Speed (received from ABS Module) in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS Pump will start to provide steering assist when the Vehicle speed message greater than 5 km/h (3 mph) is received on CAN C bus. If the Vehicle Speed message is missing at vehicle startup, the EHPS Pump will not operate. If the Vehicle Speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the Steering Wheel Position message is lost the EHPS Pump will use a default steering wheel rate of 230B° per second to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

WHEN MONITORED

Continuously, with the ignition on.

SET CONDITION

When the Electro-Hydraulic Power Steering (EHPS) Pump detects that its software has been corrupted or is missing.

POSSIBLE CAUSES

Possible Causes
BODY CONTROL MODULE (BCM) FLASHED INCORRECTLY
ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP

DIAGNOSTIC TEST

CHECK FOR AN ACTIVE DTC

NOTE: This DTC must be active for the results of this test to be valid. Check for a loose scan tool connection. Verify battery charger is installed and charge rate provides approximately 13.5 volts.

1. Turn the ignition on.
2. With the scan tool, read the DTCs.

3. With the scan tool, follow the reprogramming procedure and flash the Electro-Hydraulic Power Steering (EHPS) Pump while maintaining voltage as noted above.
4. With the scan tool, read the EHPS Module DTCs.

Is the DTC active?

Yes

- Replace and program the Electro-Hydraulic Power Steering (EHPS) Pump in accordance with the service information. Refer to [**MODULE, ELECTRO-HYDRAULIC POWER STEERING \(EHPS\), REMOVAL AND INSTALLATION**](#) .
- Perform EHPS VERIFICATION TEST. Refer to [**STANDARD PROCEDURE - EHPS VERIFICATION TEST**](#).

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring harness and connectors.
- Perform the EHPS VERIFICATION TEST. Refer to [**STANDARD PROCEDURE - EHPS VERIFICATION TEST**](#).

U160B-00-ECU BOOT SOFTWARE 1 MISSING OR CORRUPTED

For a complete wiring diagram, refer to appropriate **SYSTEM WIRING DIAGRAMS** article .

WHEN MONITORED

With the ignition on.

SET CONDITION

The Electro-Hydraulic Power Steering (EHPS) Pump detects an internal failure.

POSSIBLE CAUSES

Possible Causes
ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP

DIAGNOSTIC TEST

CHECK FOR AN ACTIVE DTC

1. Turn the ignition on.
2. With a scan tool, read EHPS Module DTCs.

Is the DTC active?

Yes

- Replace and program the Electro-Hydraulic Power Steering (EHPS) Pump in accordance with the Service Information. Refer to [**MODULE, ELECTRO-HYDRAULIC POWER STEERING \(EHPS\), REMOVAL AND INSTALLATION**](#) .
- Perform the EHPS VERIFICATION TEST. Refer to [**STANDARD PROCEDURE - EHPS VERIFICATION TEST**](#).

No

- Test complete. The condition or conditions that originally set this DTC are not present at this time. Using the appropriate wiring diagrams as a guide, check all related splices and connectors for signs

of water intrusion, corrosion, pushed out or bent terminals, and correct pin tension.

STANDARD PROCEDURE

STANDARD PROCEDURE - EHPS VERIFICATION TEST

For a complete wiring diagram, refer to **Wiring Information** .

EHPS VERIFICATION TEST

EHPS VERIFICATION TEST

1. Turn the ignition off.
2. Remove all test equipment.
3. Connect all previously disconnected components and connectors.
4. Verify all accessories are turned off and the battery is fully charged.
5. Turn the ignition on.
6. With the scan tool, record and erase all 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.

NOTE: Turn the steering wheel from stop to stop, holding at each lock position for one second.

7. Turn the ignition off and wait five seconds. Turn the ignition on and using the scan tool, read Diagnostic Trouble Codes (DTCs) from all modules.
8. If there are no DTCs present after turning ignition on, road test the vehicle for at least five minutes.
9. With the scan tool read DTCs. If any DTCs are present, refer to the Table of Contents in the applicable information for the Diagnostic procedure and troubleshoot the new or recurring symptom.
10. If there are no 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

- Perform the appropriate diagnostic procedure.

No

- Repair is complete.
-

2021 GENERAL INFORMATION

(Steering Column Control Module (SCCM) - Electrical Diagnostics) - Gladiator

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
P0815-2A	UPSHIFT SWITCH - STUCK
P0816-2A	DOWNSHIFT SWITCH-STUCK
P0826-11	UP/DOWN SHIFT SWITCH-CIRCUIT SHORT TO GROUND
P0826-13	UP/DOWN SHIFT SWITCH-CIRCUIT OPEN
P0826-15	UP/DOWN SHIFT SWITCH-CIRCUIT SHORT TO BATTERY OR OPEN
B1D9C-00	STEERING COLUMN TILT SWITCH
B1D9C-2A	STEERING COLUMN TILT SWITCH-STUCK
B2225-00	(SCM) STEERING COLUMN MODULE INTERNAL
B2306-2A	FRONT WASHER SWITCH-STUCK
B232E-00	REAR WASHER SWITCH STUCK
B23A1-2A	FLASH TO PASS/OPTICAL HORN SWITCH-STUCK
C1240-76	STEERING ANGLE SENSOR ANGLE OVERTRAVEL PERFORMANCE- WRONG MOUNTING POSITION
C2129-16	BATTERY VOLTAGE-CIRCUIT VOLTAGE BELOW THRESHOLD
C2129-17	BATTERY VOLTAGE-CIRCUIT VOLTAGE ABOVE THRESHOLD
C212A-16	SYSTEM VOLTAGE-CIRCUIT VOLTAGE BELOW THRESHOLD
C212A-17	SYSTEM VOLTAGE-CIRCUIT VOLTAGE ABOVE THRESHOLD
C2205-00	STEERING ANGLE SENSOR INTERNAL
C2205-29	STEERING ANGLE SENSOR INTERNAL-SIGNAL INVALID
C2205-2F	STEERING ANGLE SENSOR INTERNAL-SIGNAL ERRATIC
C2205-41	STEERING ANGLE SENSOR INTERNAL-GENERAL CHECKSUM FAILURE
C2205-96	STEERING ANGLE SENSOR INTERNAL-COMPONENT INTERNAL FAILURE
U0001-00	CAN C BUS
U0002-00	CAN C BUS OFF PERFORMANCE
U0140-00	LOST COMMUNICATION WITH BODY CONTROL MODULE
U0401-00	IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM
U0422-00	IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE
U0423-00	IMPLAUSIBLE DATA RECEIVED FROM CLUSTER-CCN
U1008-00	LIN 1 BUS
U121E-00	LOST COMMUNICATION WITH STEERING WHEEL CRUISE CONTROL SWITCH

DIAGNOSIS AND TESTING

P0815-2A-UPSHIFT SWITCH - STUCK

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information .**

THEORY OF OPERATION

The Paddle Shifters are integral to the Remote Radio Switches. The Paddle Shifters in the two Remote Radio Switch units are normally open MUX switches that are hard wired to the Right Steering Wheel Switch (Speed Control Switch). The Right Steering Wheel Switch (Speed Control Switch) provides a 5 volt signal and return

circuit to the switches. Both switches share the signal and return circuits. The Right Steering Wheel Switch senses the status of the switches by reading the voltage drop of the signal circuit.

When the Right Steering Wheel Switch senses an input (voltage drop) from any one of the Paddle Shifters, it communicates the switch status message to the Steering Column Control Module (SCCM) through the LIN Bus (through the Clockspring). The SCCM then broadcasts the switch status information over the CAN Bus to the Transmission Control Module (TCM) communicating the request for Transmission upshift or downshift.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Upshift Paddle Shift Switch has been active for greater than 45 seconds.

DEFAULT ACTION

- The Upshift Paddle Shift Switch will be inactive.

POSSIBLE CAUSES

Possible Causes
UPSHIFT PADDLE SHIFT SWITCH STUCK
UPSHIFT PADDLE SHIFT SWITCH
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK IF DTC RETURNS**
1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.

3. With the scan tool, erase all DTCS.

4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read Steering Column Control Module (SCCM) DTCS.

Did the DTC return?

Yes

- Visually and physically inspect the Upshift Paddle Shift Switch for any debris or foreign material that may contribute to a sticking or stuck switch. If no problem is found, Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK THE UPSHIFT PADDLE SHIFT SWITCH STATUS VIA THE SCAN TOOL

1. With the scan tool, view the Upshift Paddle Shift Switch status.
2. While monitoring the Upshift Paddle Shift Switch status, actuate the switch multiple times.

Does the scan tool display the correct status of the switch in the data display?

Yes

- Go To [3](#)

No

- Verify all connections between the Downshift Paddle Shift Switch and the SCCM are properly made, properly seated and verify proper terminal tension. If no problems are found, replace the Upshift Paddle Shift Switch in accordance with the Service Information. Refer to **SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION** .
- Perform the BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

3. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

P0816-2A-DOWNSHIFT SWITCH-STUCK

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Paddle Shifters are integral to the Remote Radio Switches. The Paddle Shifters in the two Remote Radio Switch units are normally open MUX switches that are hard wired to the Right Steering Wheel Switch (Speed Control Switch). The Right Steering Wheel Switch (Speed Control Switch) provides a 5 volt signal and return circuit to the switches. Both switches share the signal and return circuits. The Right Steering Wheel Switch senses the status of the switches by reading the voltage drop of the signal circuit.

When the Right Steering Wheel Switch senses an input (voltage drop) from any one of the Paddle Shifters, it communicates the switch status message to the Steering Column Control Module (SCCM) through the LIN Bus (through the Clockspring). The SCCM then broadcasts the switch status information over the CAN Bus to the Transmission Control Module (TCM) communicating the request for Transmission upshift or downshift.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Downshift Paddle Shift Switch has been active for greater than 45 seconds.

DEFAULT ACTION

- The Downshift Paddle Shift Switch will be inactive.

POSSIBLE CAUSES

Possible Causes
DOWNSHIFT PADDLE SHIFT SWITCH STUCK
DOWNSHIFT PADDLE SHIFT SWITCH
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK IF DTC RETURNS**

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Visually and physically inspect the Downshift Paddle Shift Switch for any debris or foreign material that may contribute to a sticking or stuck switch. If no problem is found, Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK THE DOWNSHIFT PADDLE SHIFT SWITCH STATUS VIA THE SCAN TOOL

1. With the scan tool, view the Downshift Paddle Shift Switch status.
2. While monitoring the Downshift Paddle Shift Switch status, actuate the switch multiple times.

Does the scan tool display the correct status of the switch in the data display?

Yes

- Go To [3](#)

No

- Verify all connections between the Downshift Paddle Shift Switch and the SCCM are properly made, properly seated and verify proper terminal tension. If no problems are found, replace the Downshift Paddle Shift Switch in accordance with the Service Information. Refer to [SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION](#) .
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

3. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

P0826-11-UP/DOWN SHIFT SWITCH-CIRCUIT SHORT TO GROUND

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Paddle Shifters are integral to the Remote Radio Switches. The Paddle Shifters in the two Remote Radio Switch units are normally open MUX switches that are hard wired to the Right Steering Wheel Switch (Speed Control Switch). The Right Steering Wheel Switch (Speed Control Switch) provides a 5 volt signal and return circuit to the switches. Both switches share the signal and return circuits. The Right Steering Wheel Switch senses the status of the switches by reading the voltage drop of the signal circuit.

When the Right Steering Wheel Switch senses an input (voltage drop) from any one of the Paddle Shifters, it communicates the switch status message to the Steering Column Control Module (SCCM) through the LIN Bus (through the Clockspring). The SCCM then broadcasts the switch status information over the CAN Bus to the Transmission Control Module (TCM) communicating the request for Transmission upshift or downshift.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects one of the Paddle Shift Switch Signal circuits is shorted to ground for greater than 40 milliseconds.

DEFAULT ACTION

- The Paddle Shift Switches will be inactive.

POSSIBLE CAUSES

Possible Causes
PADDLE SHIFT SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
LEFT OR RIGHT PADDLE SHIFT SWITCH
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK IF DTC RETURNS

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. DISCONNECT THE DOWNSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTOR - ERASE DTCS AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Disconnect the component harness connector(s) containing the circuit being tested.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Replace the Downshift Paddle Shift Switch in accordance with the Service Information. Refer to **SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION** .
- Perform the BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

3. DISCONNECT THE UPSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTOR - ERASE DTCS AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Disconnect the component harness connector(s) containing the circuit being tested.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- Go To [4](#)

No

- Replace the Upshift Paddle Shift Switch in accordance with the Service Information. Refer to **SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION** .
- Perform the BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

4. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

P0826-13-UP/DOWN SHIFT SWITCH-CIRCUIT OPEN

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Paddle Shifters are integral to the Remote Radio Switches. The Paddle Shifters in the two Remote Radio Switch units are normally open MUX switches that are hard wired to the Right Steering Wheel Switch (Speed Control Switch). The Right Steering Wheel Switch (Speed Control Switch) provides a 5 volt signal and return circuit to the switches. Both switches share the signal and return circuits. The Right Steering Wheel Switch senses the status of the switches by reading the voltage drop of the signal circuit.

When the Right Steering Wheel Switch senses an input (voltage drop) from any one of the Paddle Shifters, it communicates the switch status message to the Steering Column Control Module (SCCM) through the LIN Bus (through the Clockspring). The SCCM then broadcasts the switch status information over the CAN Bus to the Transmission Control Module (TCM) communicating the request for Transmission upshift or downshift.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects one of the Paddle Shift Switch Signal circuits is open for greater than 40 milliseconds.

DEFAULT ACTION

- The Paddle Shift Switches will be inactive.

POSSIBLE CAUSES

Possible Causes
PADDLE SHIFT SWITCH SIGNAL CIRCUIT OPEN LEFT OR RIGHT PADDLE SHIFT SWITCH STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK IF DTC RETURNS

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. DISCONNECT THE UPSHIFT AND DOWNSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTORS - INSPECT THE WIRING AND CONNECTORS

1. Turn the ignition off.
2. Disconnect the component harness connector(s) containing the circuit being tested.
3. Inspect the wiring harness between the component harness connector(s) containing the circuit being tested and the ECU harness connector for any damaged wires, connectors, and open/spread terminals.

Were any problems found?

Yes

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

No

- Go To [3](#)

3. CONNECT THE UPSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTOR - ERASE DTCS AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Connect the indicated component harness connector.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read SCCM DTCs.

NOTE: Additional DTCs may set in the SCCM and the Radio. Disregard any other DTCs that may set.

Did the DTC return?

Yes

- Go To [4](#)

No

- Replace the Upshift Paddle Shift Switch in accordance with the Service Information. Refer to [SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION](#) .
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

4. DISCONNECT THE UPSHIFT AND CONNECT THE DOWNSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTORS - ERASE DTCS AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Connect the indicated component harness connector.
3. Disconnect the indicated component harness connector.
4. With the scan tool, erase all DTCs.
5. Turn the ignition off for a minimum of 10.0 seconds.
6. Turn the ignition on.
7. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
8. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- Go To [5](#)

No

- Replace the Downshift Paddle Shift Switch in accordance with the Service Information. Refer to [SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION](#) .
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

5. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

P0826-15-UP/DOWN SHIFT SWITCH-CIRCUIT SHORT TO BATTERY OR OPEN

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Paddle Shifters are integral to the Remote Radio Switches. The Paddle Shifters in the two Remote Radio Switch units are normally open MUX switches that are hard wired to the Right Steering Wheel Switch (Speed Control Switch). The Right Steering Wheel Switch (Speed Control Switch) provides a 5 volt signal and return circuit to the switches. Both switches share the signal and return circuits. The Right Steering Wheel Switch senses the status of the switches by reading the voltage drop of the signal circuit.

When the Right Steering Wheel Switch senses an input (voltage drop) from any one of the Paddle Shifters, it communicates the switch status message to the Steering Column Control Module (SCCM) through the LIN Bus

(through the Clockspring). The SCCM then broadcasts the switch status information over the CAN Bus to the Transmission Control Module (TCM) communicating the request for Transmission upshift or downshift.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects one of the Paddle Shift Switch Signal circuits is shorted to voltage or both Left & Right Paddle Shift Switches are open for greater than 40 milliseconds.

DEFAULT ACTION

- The Paddle Shift Switches will be inactive.

POSSIBLE CAUSES

Possible Causes
PADDLE SHIFT SWITCH SIGNAL CIRCUIT OPEN PADDLE SHIFT SWITCH STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK IF DTC RETURNS

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. DISCONNECT THE UPSHIFT AND DOWNSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTORS - INSPECT THE WIRING AND CONNECTORS

1. Turn the ignition off.

2. Disconnect the component harness connector(s) containing the circuit being tested.
3. Inspect the wiring harness between the component harness connector(s) containing the circuit being tested and the ECU harness connector for any damaged wires, connectors, and open/spread terminals.

Were any problems found?

Yes

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

No

- Go To **3**

3. CONNECT THE UPSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTOR - ERASE DTCs AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Connect the indicated component harness connector.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read SCCM DTCs.

NOTE: Additional DTCs may set in the SCCM and the Radio. Disregard any other DTCs that may set.

Did the DTC return?

Yes

- Go To **4**

No

- Replace the Upshift Paddle Shift Switch in accordance with the Service Information. Refer to **SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION** .
- Perform the BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

4. DISCONNECT THE UPSHIFT AND CONNECT THE DOWNSHIFT PADDLE SHIFT SWITCH HARNESS CONNECTORS - ERASE DTCs AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Connect the indicated component harness connector.
3. Disconnect the indicated component harness connector.
4. With the scan tool, erase all DTCs.
5. Turn the ignition off for a minimum of 10.0 seconds.
6. Turn the ignition on.
7. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
8. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- Go To [5](#)

No

- Replace the Downshift Paddle Shift Switch in accordance with the Service Information. Refer to [SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION](#) .
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

5. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

No

- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

- Test complete.

B1D9C-00-STEERING COLUMN TILT SWITCH

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information .**

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located at the end of the Steering Column, beneath the Steering Wheel. The SCCM includes the Clockspring, the Multifunction Switch and a LIN/CAN C Gateway. LIN Bus messages received by the SCCM are sent over the CAN C Bus to the appropriate modules.

The Steering Column Tilt Switch, if equipped, provides switch signals to the Steering Column Control Module (SCCM) in order to control the movement of the Steering Column.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects a Steering Column Power Tilt Switch failure for greater than 50 milliseconds.

DEFAULT ACTION

- The Steering Column Power Tilt function will be inoperative.

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN TILT SWITCH CONTROL CIRCUIT SHORTED TO GROUND OR VOLTAGE
STEERING COLUMN TILT SWITCH
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK IF DTC RETURNS

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. DISCONNECT THE STEERING COLUMN TILT SWITCH HARNESS CONNECTOR - ERASE DTCS AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Disconnect the component harness connector(s) containing the circuit being tested. **Note:** Use the appropriate wiring diagram as a guide to follow the path of the circuit.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Replace the Steering Column Tilt Switch in accordance to the Service Information.
- Perform the BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

3. ISOLATE AND CHECK THE (A92) FUSED B(+) CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. If currently connected, disconnect the component harness connector for the circuit being tested. **Note:** Use the appropriate wiring diagram as a guide to follow the path of the circuit.
3. Turn the ignition on.
4. Using a DVOM, measure the voltage on the circuit being tested at the component harness connector.

NOTE: When probing a circuit at any harness connector, always use an appropriate probing tool to prevent any possible damage to the harness connector pins.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

- Go To [4](#)

4. ISOLATE AND CHECK THE (A92) FUSED B(+) 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 all Electronic Control Unit (ECU) and component harness connectors containing the circuit being tested. **Note:** Use the appropriate 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. Connect the positive lead of the DVOM to the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: When probing a circuit at any harness connector, always use an appropriate probing tool to prevent any possible damage to the harness connector pins.

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 appropriate 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

- Go To [5](#)

5. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

B1D9C-2A-STEERING COLUMN TILT SWITCH-STUCK

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located at the end of the Steering Column, beneath the Steering Wheel. The SCCM includes the Clockspring, the Multifunction Switch and a LIN/CAN C Gateway. LIN Bus messages received by the SCCM are sent over the CAN C Bus to the appropriate modules.

The Steering Column Tilt Switch, if equipped, provides switch signals to the Steering Column Control Module (SCCM) in order to control the movement of the Steering Column.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Steering Column Power Tilt and Telescope Switch has been active for greater than 50 seconds.

DEFAULT ACTION

- The Tilt and Telescope Switches will be inactive.

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN TILT SWITCH STUCK
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK IF DTC RETURNS

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Visually and physically inspect the Steering Column Tilt Switch for any debris or foreign material that may cause a sticking or stuck switch. If no problem is found, Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

2. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

B2225-00-(SCM) STEERING COLUMN MODULE INTERNAL

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects an internal failure.

DEFAULT ACTION

- The Rear Wiper will be inoperative.
- The Front Wipers will default to Low setting
- Cruise control set to implausible
- Shift By Wire or Steering Angle Sensor set to idle

POSSIBLE CAUSES

Possible Causes
LOW BATTERY VOLTAGE
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR CHARGING OR VOLTAGE RELATED DTC(S) PRESENT IN THE POWERTRAIN CONTROL MODULE (PCM)

3. Make sure the Battery and Generator Drive Belt are in good condition.

Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

Inspect the fuses in the Power Distribution Center (PDC) Assembly. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

1. Start the Engine.
2. With the scan tool, read PCM DTCs and record on the repair order.

Are there any charging system or battery voltage related DTCs present?

Yes

- Repair the Powertrain Control Module (PCM) DTCs before continuing with this test. Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#) , or [3.6L\(GPEC 2A\) - DIAGNOSTIC CODE INDEX](#) .

No

- Go To [2](#)
- **CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS**

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

B2306-2A-FRONT WASHER SWITCH-STUCK

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Right Hand (RH) Multifunction Switch provides a Front Wiper Washer Switch signal to the Steering Column Control Module (SCCM). The SCCM sends the Front Wiper Washer Switch signal to the Body Control Module (BCM) through the CAN-C Bus circuit. When the BCM receives the Front Wiper Washer Switch signal from the SCCM, the BCM activates the Front Wiper Washer Pump.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.

- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Front Washer Switch has been active for greater than 20 seconds.

DEFAULT ACTION

- The Front Washer Switch will be inactive.

POSSIBLE CAUSES

Possible Causes
FRONT WASHER SWITCH STUCK
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Visually and physically inspect the Front Washer Switch for any debris or foreign material that may contribute to a sticking or stuck switch. If no problem is found, Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

B232E-00-REAR WASHER SWITCH STUCK

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Right Hand (RH) Multifunction switch provides a Rear Wiper Washer Switch signal to the Steering Column Control Module (SCCM). The SCCM sends the Rear Wiper Washer Switch signal to the Body Control Module (BCM) through the LIN 3 Bus circuit. When the BCM receives the Rear Wiper Washer Switch signal from the SCCM, the BCM activates the Rear Wiper Washer Pump.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Rear Washer Switch has been active for greater than 20 seconds.

DEFAULT ACTION

- The Rear Washer Switch will be inactive.

POSSIBLE CAUSES

Possible Causes
REAR WASHER SWITCH STUCK
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Visually and physically inspect the Rear Washer Switch for any debris or foreign material that may contribute to a sticking or stuck switch. If no problem is found, Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to [**BODY VERIFICATION TEST**](#).

No

- Perform the BODY VERIFICATION TEST. Refer to [**BODY VERIFICATION TEST**](#).
- Test complete.

B23A1-2A-FLASH TO PASS/OPTICAL HORN SWITCH-STUCK

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The LH Multifunction Switch provides Flash to Pass/Optical Horn Switch signals to the Steering Column Control Module (SCCM). The SCCM sends the requested signal to the Body Control Module (BCM) through the LIN 3 Bus circuit.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 7 and 17 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Flash To Pass/Optical Horn Switch has been active for greater than 20 seconds.

DEFAULT ACTION

- The Flash To Pass/Optical Horn Switch will be inactive.

POSSIBLE CAUSES

Possible Causes
FLASH TO PASS/OPTICAL HORN SWITCH STUCK
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Visually and physically inspect the Left Hand (LH) Multifunction Switch for any debris or foreign material that may contribute to a sticking or stuck switch. If no problem is found, Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

C1240-76-STEERING ANGLE SENSOR ANGLE OVERTRAVEL PERFORMANCE-WRONG MOUNTING POSITION

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Steering Angle Sensor (SAS) for this vehicle is integral to the Steering Column Control Module (SCCM).

WHEN MONITORED

- With Ignition on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects an incorrect installation of the Steering Angle Sensor (SAS).

DEFAULT ACTION

- The SAS will be inactive.
- ESP is off

POSSIBLE CAUSES

Possible Causes
STEERING ANGLE SENSOR (SAS) NOT ALIGNED CORRECTLY
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

NOTE: This DTC will set the when the Steering Angle Sensor (SAS) has been installed incorrectly. Before proceeding with this test, if any steering system service was recently performed, refer to the Service Information to verify the repairs have been performed correctly.

1. Confirm the steering wheel and front tires are straight ahead.
2. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
3. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
4. With the scan tool, erase all DTCs.
5. Turn the ignition off for a minimum of 10.0 seconds.
6. Turn the ignition on.
7. Rotate steering wheel to the right steering lock, then to the left steering lock.
8. Repeat Step 7, and then center the steering wheel.
9. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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. Confirm the steering wheel and front tires are straight ahead.
6. Connect all SCCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are 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 all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Rotate the steering wheel to the right steering lock and the left steering lock.
11. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

C2129-16-BATTERY VOLTAGE-CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the voltage is below 5.9 volts for greater than 15 seconds.

DEFAULT ACTION

- All switch outputs will be inactive.

POSSIBLE CAUSES

Possible Causes
CHARGING OR VOLTAGE DTCS PRESENT
LOW BATTERY VOLTAGE
FUSED B(+) CIRCUIT HIGH RESISTANCE
GROUND CIRCUIT HIGH RESISTANCE
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK FOR CHARGING OR VOLTAGE RELATED DTC(S) PRESENT IN THE POWERTRAIN CONTROL MODULE (PCM)

3. Make sure the Battery and Generator Drive Belt are in good condition.

Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

Inspect the fuses in the Power Distribution Center (PDC) Assembly. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

1. Start the Engine.
2. With the scan tool, read PCM DTCS and record on the repair order.

Are there any charging system or battery voltage related DTCS present?

Yes

- Repair the Powertrain Control Module (PCM) DTCs before continuing with this test. Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#) , or [3.6L \(GPEC 2A\) - DIAGNOSTIC CODE INDEX](#) .

No

- Go To [2](#)
- **CHECK THE (A238) FUSED B(+) CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
 1. Disconnect the component 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. Ensure 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](#) .

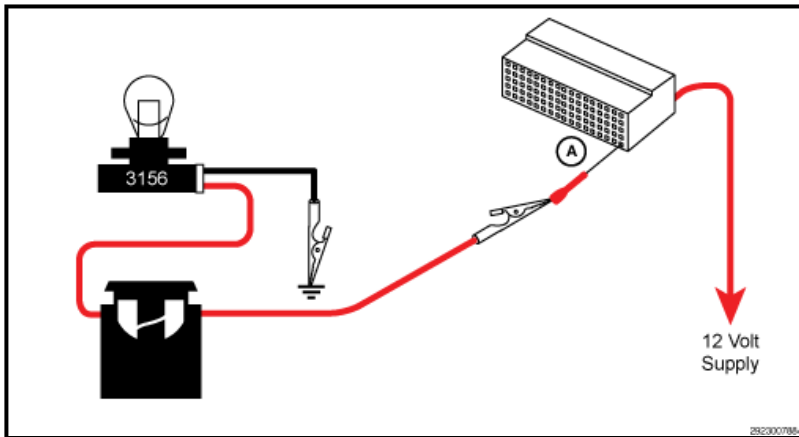
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load 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 [3](#)

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the SCCM VERIFICATION TEST. Refer to the appropriate information.
- **CHECK THE (Z911) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
 1. Disconnect the component 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

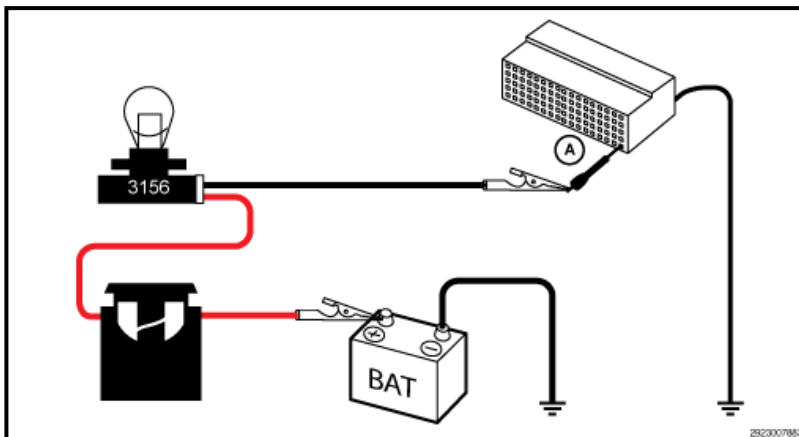
circuit, the tool being used should draw more than approximately 0.75 amps.

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 [4](#)

No

- Repair the ground circuit for an open or high resistance.
- Perform the SCCM VERIFICATION TEST. Refer to the appropriate information.
- **CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -**
 1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

C2129-17-BATTERY VOLTAGE-CIRCUIT VOLTAGE ABOVE THRESHOLD

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

WHEN MONITORED

- This diagnostic runs continuously when the Engine is on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the voltage is above 16 volts for greater than 15 seconds.

DEFAULT ACTION

- All switch outputs will be inactive.

POSSIBLE CAUSES

Possible Causes
CHARGING OR VOLTAGE DTCS PRESENT
HIGH BATTERY VOLTAGE
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK FOR CHARGING OR VOLTAGE RELATED DTC(S) PRESENT IN THE POWERTRAIN CONTROL MODULE (PCM)

3. Make sure the Battery and Generator Drive Belt are in good condition.

Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

Inspect the fuses in the Power Distribution Center (PDC) Assembly. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

1. Start the Engine.

2. With the scan tool, read PCM DTCs and record on the repair order.

Are there any charging system or battery voltage related DTCs present?

Yes

- Repair the Powertrain Control Module (PCM) DTCs before continuing with this test. Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#) , or [3.6L\(GPEC 2A\) - DIAGNOSTIC CODE INDEX](#) .

No

- Go To [2](#)
- **CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -**
 1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

No

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

C212A-16-SYSTEM VOLTAGE-CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Steering Column Control Module (SCCM) internal power supply is below 10 volts for more than 15 seconds.

DEFAULT ACTION

- All switch outputs will be inactive.

POSSIBLE CAUSES

Possible Causes
CHARGING OR VOLTAGE DTCS PRESENT
LOW BATTERY VOLTAGE
FUSED B(+) CIRCUIT OPEN OR EXCESSIVE RESISTANCE
GROUND CIRCUIT OPEN OR EXCESSIVE RESISTANCE
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR CHARGING OR VOLTAGE RELATED DTC(S) PRESENT IN THE POWERTRAIN CONTROL MODULE (PCM)

3. Make sure the Battery and Generator Drive Belt are in good condition.

Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

Inspect the fuses in the Power Distribution Center (PDC) Assembly. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

1. Start the Engine.
2. With the scan tool, read PCM DTCs and record on the repair order.

Are there any charging system or battery voltage related DTCs present?

Yes

- Repair the Powertrain Control Module (PCM) DTCs before continuing with this test. Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#) , or [3.6L \(GPEC 2A\) - DIAGNOSTIC CODE INDEX](#) .

No

- Go To [2](#)
- **CHECK THE (A238) FUSED B(+) CIRCUIT FOR OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
 1. Disconnect the component harness connector to isolate the Fused B(+) circuit.
 2. Connect the positive lead of the load test tool to the Fused B(+) 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. Ensure that the circuit being tested is being powered on. If the 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: **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: **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**

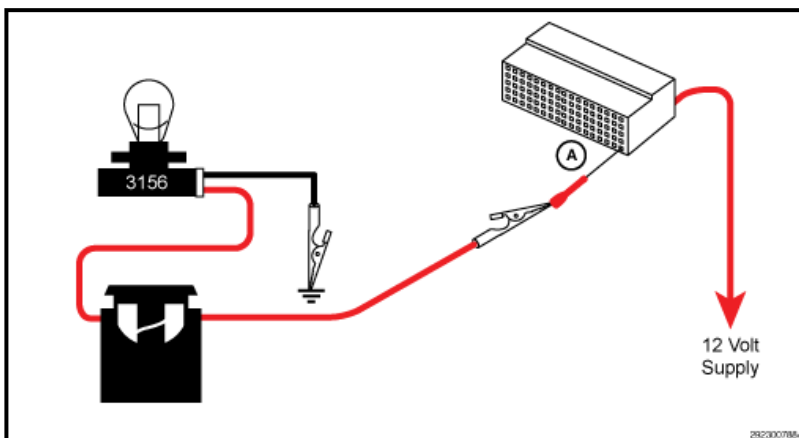
test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE:

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 any harness connector, always use an appropriate probing tool to prevent any possible damage to the harness connector pins.

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 the appropriate information

No

- Repair the Fused B(+) circuit for an open or high resistance.
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#).

- **CHECK THE (Z911) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**

1. Disconnect the component 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**](#) .

5. Connect all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

C212A-17-SYSTEM VOLTAGE-CIRCUIT VOLTAGE ABOVE THRESHOLD

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

WHEN MONITORED

- This diagnostic runs continuously when the Engine is on.

SET CONDITION

- The Steering Column Control Module (SCCM) internal power supply is above 16 volts for more than 15 seconds.

DEFAULT ACTION

- All switch outputs will be inactive.

POSSIBLE CAUSES

Possible Causes
CHARGING OR VOLTAGE DTCS PRESENT
HIGH BATTERY VOLTAGE
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

2. CHECK FOR CHARGING OR VOLTAGE RELATED DTC(S) PRESENT IN THE POWERTRAIN CONTROL MODULE (PCM)

3. Make sure the Battery and Generator Drive Belt are in good condition.

Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

Inspect the fuses in the Power Distribution Center (PDC) Assembly. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

1. Start the Engine.
2. With the scan tool, read PCM DTCs and record on the repair order.

Are there any charging system or battery voltage related DTCs present?

Yes

- Repair the Powertrain Control Module (PCM) DTCs before continuing with this test. Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#), or [3.6L \(GPEC 2A\) - DIAGNOSTIC CODE INDEX](#).

No

- Go To [2](#)
- **CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -**
 1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

C2205-00-STEERING ANGLE SENSOR INTERNAL

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Steering Angle Sensor (SAS) for this vehicle is integral to the Steering Column Control Module (SCCM).

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Steering Angle Sensor (SAS) has set an internal failure.

DEFAULT ACTION

- The SAS will be inactive.

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. DISCONNECT RELATED MODULE HARNESS CONNECTIONS - INSPECT FOR PROBLEMS - CONNECT RELATED MODULE HARNESS CONNECTIONS - ERASE DTCS AND CHECK IF DTC TO RETURNS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

C2205-29-STEERING ANGLE SENSOR INTERNAL-SIGNAL INVALID

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Steering Angle Sensor (SAS) for this vehicle is integral to the Steering Column Control Module (SCCM).

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Steering Angle Sensor (SAS) has set an internal failure.

DEFAULT ACTION

- The SAS will be inactive.
- ESP is turned off

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

C2205-2F-STEERING ANGLE SENSOR INTERNAL-SIGNAL ERRATIC

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Steering Angle Sensor (SAS) for this vehicle is integral to the Steering Column Control Module (SCCM).

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Steering Angle Sensor (SAS) has set an internal failure.

DEFAULT ACTION

- The SAS will be inactive.

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

C2205-41-STEERING ANGLE SENSOR INTERNAL-GENERAL CHECKSUM FAILURE

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Steering Angle Sensor (SAS) for this vehicle is integral to the Steering Column Control Module (SCCM).

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Steering Angle Sensor (SAS) has set an internal failure.

DEFAULT ACTION

- The SAS will be inactive.
- ESP will be off

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.

3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

C2205-96-STEERING ANGLE SENSOR INTERNAL-COMPONENT INTERNAL FAILURE

For a complete SPEED CONTROL SYSTEM wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Steering Angle Sensor (SAS) for this vehicle is integral to the Steering Column Control Module (SCCM).

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Steering Column Control Module (SCCM) detects the Steering Angle Sensor (SAS) has set an internal failure.

DEFAULT ACTION

- The SAS will be inactive.
- ESP will be off

POSSIBLE CAUSES

Possible Causes
STEERING COLUMN CONTROL MODULE (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

No

- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .
- Test complete.

U0001-00-CAN C BUS

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 [BODY CONTROL MODULE \(BCM\) - DIAGNOSTIC CODE INDEX](#) .

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 [BODY CONTROL MODULE \(BCM\) - DIAGNOSTIC CODE INDEX](#) .

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](#) .

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](#) .

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](#) .

U0423-00-IMPLAUSIBLE DATA RECEIVED FROM CLUSTER-CCN

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](#) .

U1008-00-LIN 1 BUS

For a complete SPEED CONTROL SYSTEM wiring diagram, refer to the appropriate wiring information .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 10 and 16 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) detects a short on the LIN Bus circuit for greater than five seconds.

DEFAULT ACTION

- The Left Steering Wheel Switches will be inactive.

POSSIBLE CAUSES

Possible Causes
LIN BUS CIRCUIT SHORTED TO VOLTAGE
LIN BUS CIRCUIT SHORTED TO GROUND
LEFT STEERING WHEEL SWITCH
STEERING COLUMN CONTROL SWITCH (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. DISCONNECT THE LEFT STEERING WHEEL SWITCH HARNESS CONNECTOR - ERASE DTCS AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Disconnect the component harness connector(s) containing the circuit being tested. **Note:** Use the appropriate wiring diagram as a guide to follow the path of the circuit.

3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Replace the Left Steering Wheel Switch in accordance to the Service Information. Refer to [SWITCH, REMOTE RADIO, REMOVAL AND INSTALLATION](#) .
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

3. ISOLATE AND CHECK THE (D594) LIN BUS CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. If not currently disconnected, disconnect the component harness connector for the circuit being tested. **Note:** Use the appropriate 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.

NOTE: When probing a circuit at any harness connector, always use an appropriate probing tool to prevent any possible damage to the harness connector pins.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

No

- Go To [4](#)

4. ISOLATE AND CHECK THE (D594) LIN BUS 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 all Electronic Control Unit (ECU) and component harness connectors containing the circuit being tested. **Note:** Use the appropriate 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. Connect the positive lead of the DVOM to the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: When probing a circuit at any harness connector, always use an appropriate probing tool to prevent any possible damage to the harness connector pins.

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 appropriate 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

- Go To [5](#)

5. ISOLATE AND CHECK THE (A92) FUSED B(+) 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 Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the appropriate 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 component harness connector.
5. Connect the other lead to the circuit being tested at the ECU 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 or high resistance.
- Perform the BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

6. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS -

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST** .

No

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

U121E-00-LOST COMMUNICATION WITH STEERING WHEEL CRUISE CONTROL SWITCH

For a complete SPEED CONTROL SYSTEM wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Steering Column Control Module (SCCM) is located near the top of the Steering Column underneath the Steering Wheel. The SCCM includes the Clockspring, the Multi-Function Switch and a LIN/CAN C Gateway. LIN Bus messages received by the LIN/CAN C Gateway are broadcast over the CAN C Bus to the appropriate modules.

The Right Steering Wheel Switch (Speed Control Switch) communicates with the Steering Column Control Module (SCCM) through a dedicated LIN Bus. When the SCCM receives a LIN Bus message from the Right Steering Wheel Switch, the SCCM will send a message over the CAN C Bus to the appropriate modules.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- The ignition is on.
- The Battery voltage is between 10 and 16 volts.

SET CONDITION

- The Steering Column Control Module (SCCM) does not detect any communication with the Right Steering Wheel Switch (Speed Control) for greater than five seconds.

DEFAULT ACTION

- The Speed Control Switch will be inactive.

POSSIBLE CAUSES

Possible Causes
LIN BUS CIRCUIT SHORTED TO VOLTAGE
LIN BUS CIRCUIT SHORTED TO GROUND
RIGHT STEERING WHEEL SWITCH (SPEED CONTROL)
STEERING COLUMN CONTROL SWITCH (SCCM)

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

DIAGNOSTIC TEST

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

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read Steering Column Control Module (SCCM) DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the appropriate INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. DISCONNECT THE RIGHT STEERING WHEEL SWITCH HARNESS CONNECTOR - ERASE DTCS AND CHECK IF DTC RETURNS

1. Turn the ignition off.
2. Disconnect the component harness connector(s) containing the circuit being tested. **Note:** Use the appropriate wiring diagram as a guide to follow the path of the circuit.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read SCCM DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Replace the Right Steering Wheel Switch (Speed Control) in accordance to the Service Information. Refer to [SWITCH, SPEED CONTROL, REMOVAL AND INSTALLATION](#) .
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

3. ISOLATE AND CHECK THE (D592) LIN BUS CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. If not currently disconnected, disconnect the component harness connector for the circuit being tested. **Note:** Use the appropriate 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.

NOTE: When probing a circuit at any harness connector, always use an appropriate probing tool to prevent any possible damage to the harness connector pins.

Is there any voltage present?

Yes

- Repair the circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

No

- Go To [4](#)

4. ISOLATE AND CHECK THE (D592) LIN BUS 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 all Electronic Control Unit (ECU) and component harness connectors containing the circuit being tested. **Note:** Use the appropriate 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. Connect the positive lead of the DVOM to the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: When probing a circuit at any harness connector, always use an appropriate probing tool to prevent any possible damage to the harness connector pins.

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 appropriate 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 BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#) .

No

- Go To [5](#)

5. ISOLATE AND CHECK THE (A92) FUSED B(+) 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 Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the appropriate 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 component harness connector.
5. Connect the other lead to the circuit being tested at the ECU 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 or high resistance.
- Perform the BODY VERIFICATION TEST. Refer to [BODY VERIFICATION TEST](#).

6. CHECK SCCM AND RELATED MODULE HARNESS CONNECTIONS

1. Disconnect all SCCM 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 all SCCM harness connectors. Be certain that all 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 all 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 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 SCCM DTCs.

Did the DTC return?

Yes

- 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 BODY VERIFICATION TEST. Refer to **BODY VERIFICATION TEST**.

No

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

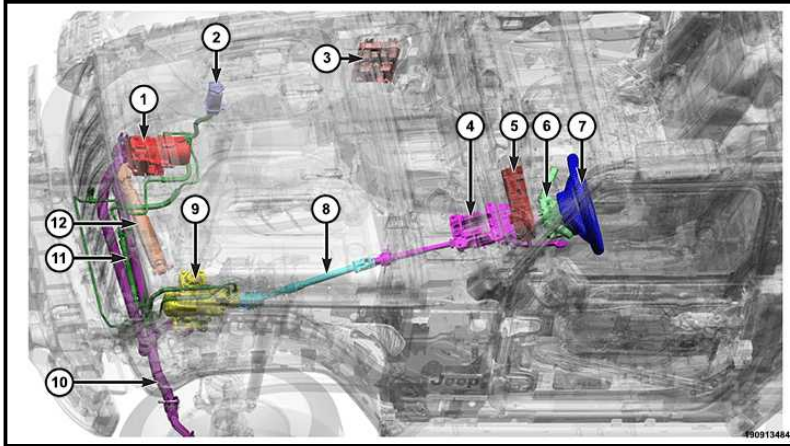
2021 STEERING

Steering System - Gladiator

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION



The electric hydraulic power steering system is made up of the following components:

COMPONENT INDEX

1.	Refer to <u>ELECTRIC HYDRAULIC POWER STEERING (EHPS) PUMP.</u>
2.	Fluid Reservoir
3.	Refer to <u>BODY CONTROL MODULE (BCM).</u>
4.	Steering Column
5.	Refer to <u>INSTRUMENT PANEL CLUSTER (IPC).</u>
6.	Refer to <u>STEERING COLUMN CONTROL MODULE (SCCM).</u>
7.	Steering Wheel
8.	Intermediate Shaft
9.	Steering Gear
10.	Steering Linkage
11.	Fluid Lines
12.	Steering Damper

OPERATION

Multiple modules work together to improve vehicle steering assist at different rates at different speeds. At slow speeds, such as parking maneuvers, more assist is available and at high speeds less assist is available. The EHPS module uses the Controller Area Network-Chassis (CAN-C) and Controller Area Network-Interior High Speed (CAN-IHS) data bus for inputs and outputs of the information necessary for operation. The use of a scan tool is necessary for diagnostics. EHPS module faults are stored in a diagnostic program memory and are accessible with the scan tool. Faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are not erased if the battery is disconnected.

The EHPS pump assembly contains a control module, brushless electric motor, and hydraulic pump integrated into a single unit. The EHPS pump draws power from the 12 volt electrical system and provides the necessary flow and pressure to the steering gear to provide normal power steering. The output flow of the EHPS pump is varied as a function of steering wheel rate and vehicle speed in order to provide the optimum flow of power steering fluid to the steering gear under all operating conditions. The EHPS pump will start to provide steering assist when the vehicle speed message showing greater than 5 km/h (3 mph) is received on CAN-C. If the

vehicle speed message is missing at vehicle startup, the EHPS pump will not operate. If the vehicle speed message is lost during operation the EHPS pump will use a default vehicle speed of 85 km/h (59 mph) to calculate desired flow and as a result, steering effort will no longer be speed sensitive. If the steering wheel position message is lost the EHPS pump will use a default steering wheel rate of 230B°/sec to calculate desired flow and as a result, steering effort may be higher on evasive steering maneuvers. The EHPS pump will resume normal operation automatically once any missing message or out of range condition noted above is restored to normal.

The EHPS warning lamp is used to visually indicate the fault/fail status of the EHPS system. The EHPS system is capable of controlling hydraulic output flow as a calibrated function of Engine Stop Start (ESS) status.

BODY CONTROL MODULE (BCM)

BODY CONTROL MODULE (BCM)

Refer to [**COMPONENT INDEX**](#).

The BCM separates the branches of the bus networking systems, the BCM must act as a gateway module to allow communication between the different bus networks. The BCM will translate and share messages among all modules on the following bus networks. The BCM is the configuration master for the vehicle. As the configuration master, the BCM broadcasts configuration data over the bus whenever the ignition is in the RUN state.

CAN-C Inputs

- Power steering system type
- Steering wheel angle
- Steering wheel angle sensor status

CAN-IHS Outputs

- Steering wheel angle
- Steering wheel angle sensor status
- Power steering system type

ELECTRIC HYDRAULIC POWER STEERING (EHPS) PUMP

ELECTRIC HYDRAULIC POWER STEERING (EHPS) PUMP

Refer to [**COMPONENT INDEX**](#).

Power assist is provided by the EHPS pump mounted above the right front frame rail forward of the engine. The EHPS pump is an electrically operated hydraulic pump which supplies variable hydraulic fluid flow and pressure to the steering gear. The EHPS pump replaces the conventional belted power steering pump. The EHPS pump has an EHPS module attached (not replaceable separately). There are two electrical connectors on the EHPS pump assembly. One connector is a 12 volt low amperage module connector, and the other is a 12 volt higher amperage pump connector containing larger gauge wire for motor operation. The power steering hoses and steering gear are substantially unchanged in function from a conventional system. However, there are unique components for this system, such as hoses for routing and the gear for valve tuning.

The EHPS provides the following signals:

CAN-C Inputs

- Vehicle speed
- System voltage
- Commanded ignition switch status
- Propulsion system active
- Stop start feature present

- Engine Stop Start (ESS) engine state
- Steering module configuration
- Delta steering wheel angle
- Steering wheel angle
- Steering wheel angle precision
- Network configuration status
- Electric power steering configuration
- BCM Present / Not Present
- PCM Present / Not Present
- Anti-lock brake system module Present / Not Present
- IPC Present / Not Present
- SCCM Present / Not Present
- Hybrid control processor Present / Not Present

CAN-C Outputs

- Electric power steering assistance status
- Electric power steering warning display request
- Power steering system type
- Electric power steering current
- Power steering system type
- Engine fan activation request for cooling

INSTRUMENT PANEL CLUSTER (IPC)

INSTRUMENT PANEL CLUSTER (IPC)

Refer to <u>COMPONENT INDEX</u> .
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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. The instrument cluster assembly houses four analog gauges and has provisions for up to 25 international control and display symbol icon indicators that are all controlled by the IPC and standard on all models. The gauge graphics are white and gray against a black field except for a single red graduation at the high end of the gauge scale on both the engine temperature and fuel level gauges, and several red graduations at the high end of the gauge scale on the tachometer that designate the red line area, making them clearly visible within the instrument cluster in daylight. When illuminated by the cluster illumination lighting, the white and gray text and graphics as well as the red graphics still appear the same, the red gauge needles have internal optical illumination. Gauge illumination is provided by dimmer controlled Light Emitting Diode (LED) units soldered onto the IPC circuit board. The Gauge set and indicators shown above are an integrated part of the IPC, therefore are only serviced as a unit with the instrument cluster. The cluster lens and the cluster hood and mask unit are the only components of the instrument cluster assembly that can be serviced separately.

The IPC function for this system is to display a warning light for the EHPS system and receives the following signals:

CAN-C INPUTS

- Vehicle configuration data
- Electric power steering warning display request

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, the left (lighting) multifunction switch, and the right (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 EHPS system with the following signals:

CAN-C Inputs

- Vehicle configuration information
- System voltage
- Commanded ignition switch status

CAN-C Outputs

- Steering wheel angle
- Steering wheel angle sensor status
- Steering angle polarity
- Steering wheel angle precision
- Delta steering wheel angle

DIAGNOSIS AND TESTING

STEERING SYSTEM DIAGNOSIS CHARTS

NOTE: There are four diagnosis charts following that cover VIBRATION (SHIMMY) ABOVE 50 MPH (80 KMH), NOISE, VIBRATION AND HARSHNESS (NVH) ISSUES, PERFORMANCE ISSUES, and FLUID ISSUES.

VIBRATION (SHIMMY) ABOVE 50 MPH (80 KMH)

Vehicles equipped with a solid front axle can be susceptible to steering shimmy. Often this condition is due to modifications to the vehicle that may involve aftermarket equipment that may not be compatible with the vehicle architecture or is not intended for on-road use. For original equipment, this condition can be corrected with routine inspection for properly maintained wheels and tires and replacement of damaged or worn components.

NOTE: This Diagnosis and Testing covers a self-sustaining vibration (shimmy) of the vehicle and steering wheel while driving at speeds typically above 50 MPH (80 KMH)

NOTE: This applies to vehicles equipped with a solid front axle only.

1. Test drive the vehicle to verify customer complaint.

NOTE: It may be necessary to drive the vehicle in the environment (i.e., same type of terrain, such as uneven pavement, railroad tracks, etc.) that the customer experienced the condition in order to properly diagnose the condition and confirm that the repairs corrected the concern.

2. Is the vehicle equipped with aftermarket components or other modifications (e.g. lift kits, wheels, suspension components or tires) that can affect the performance of or wear upon steering components?
 1. Yes: notify the owner and document in the repair order that: i. the express limited warranties do not cover conditions or damage caused by the use of aftermarket components, improper maintenance, or impact damage; and the use of aftermarket components, improper maintenance, and impact damage can cause steering shimmy or otherwise accelerate the wear of steering components that cause steering shimmy; and iii. the dealership will inspect steering components that were supplied by the manufacturer for defects in material, workmanship and factory preparation and determine if necessary repairs are covered under the terms of the warranties applicable to the vehicle. With customer authorization, proceed to Step #3.
 2. No: Proceed to Step #3.
3. Inspect the vehicle steering components for any damage.
4. Was any visible damage present?
 1. Yes: Recommend the replacement of all damaged components
 2. No: Proceed to Step #5.
5. Are the tires on the vehicle properly inflated to the correct pressure?
 1. Yes: Proceed to Step #6.
 2. No: Refer to the tire placard on the inside of the driver's door and inflate the tires to the specified pressure and proceed to Step #6.
6. Do the tires exhibit a condition of excessive wear, cupping or damage?
 1. Yes: Recommend replacement if required or perform tire rotation to locate the best tires onto the front axle.
 2. No: Proceed to Step #7.

NOTE: **Refer to the proper diagnosing and testing procedures indicated in the service information**

7. Verify proper wheel and tire balance.

Refer to **TIRE AND WHEEL BALANCE** .

8. Does the vehicle still exhibit the condition?
 1. Yes: Proceed to Step #9.
 2. No: Return the vehicle to the customer.
9. Recommend the replacement of the steering damper. Refer to steering damper in the appropriate service information.
10. Does the vehicle still exhibit the condition?
 1. Yes: Proceed to Step #11.
 2. No: Return the vehicle to the customer.
11. Does the track bar show signs of excessive wear or damage?
 1. Yes: Proceed to Step #12.
 2. No: Proceed to Step #14.

NOTE: **Refer to the proper diagnosing and testing procedures indicated in the service information.**

12. Recommend the replacement of the track bar. Refer to the service procedures in the appropriate service information.
13. Does the vehicle still exhibit the condition?
 1. Yes: Proceed to Step #14.
 2. No: Return the vehicle to the customer.

14. Do the tie rods show signs of excessive wear or damage?

1. Yes: Proceed to Step #15.
2. No: Proceed to Step #16.

NOTE: Refer to the proper diagnosing and testing procedures indicated in the service information.

15. Recommend the replacement of worn tie rods. Refer to the service procedures in the appropriate service information.

16. Does the drag link show signs of excessive wear or damage?

1. Yes: Proceed to Step #17.
2. No: Proceed to Step #18.

NOTE: Refer to the proper diagnosing and testing procedures indicated in the service information.

17. Recommend the replacement of the worn drag link. Refer to the service procedures in the appropriate service information.

18. Verify vehicle wheel alignment is within specification and adjust accordingly. Refer to the appropriate service information.

19. Does the vehicle still exhibit the condition?

1. Yes: Proceed to Step #20.
2. No: Return the vehicle to the customer.

20. Do the ball joints show signs of excessive wear or damage?

1. Yes: Proceed to Step #21.
2. No further diagnosis required.

NOTE: Refer to the proper diagnosing and testing procedures indicated in the service information.

21. Recommend the replacement of worn ball joints. Refer to the service procedures in the appropriate service information.

22. Does the vehicle still exhibit the condition?

1. Yes: Further diagnosis is required.
2. No: Return the vehicle to the customer.

NOISE, VIBRATION AND HARSHNESS (NVH) ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
OBJECTIONABLE HISS OR WHISTLE WHILE TURNING STEERING WHEEL WHEN STATIONARY OR MOVING SLOWLY*	1. Damaged or mispositioned steering column shaft/coupling dash boot seal.	1. Check to ensure boot is properly installed and seals against sheet metal. Reposition or replace steering column shaft/coupling dash boot seal as necessary.
B	2. Mis-routed power steering hose.	2. Check routing of power steering hoses. Ensure hoses do not come in unwanted contact with other components and objects.
B	3. Restriction in pressure or return hose.	3. Using an electronic listening tool, determine if noise is coming from either pressure or return hose. Replace hose that noise is present within.

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
B	4. Noisy valve in power steering gear.	4. For evaluation and correction. Refer to <u>END, TIE ROD, DIAGNOSIS AND TESTING.</u>
RATTLE OR EXCESSIVE CLUNK**	1. Power steering gear loose on engine cradle/crossmember.	1. Check fastener torque and tighten to specifications. Replace as necessary. Check steering wheel center following repair.
B	2. Loose strut assembly mounting fasteners at tower or knuckle.	2. Check fastener torque and tighten to specifications.
B	3. Damaged engine cradle/crossmember.	3. Inspect the cradle/crossmember for cracks or other damage. Replace as necessary.
B	4. Engine cradle/crossmember mounting fasteners loose at frame or bushings worn.	4. Check fastener torque and tighten to specifications. Inspect bushings and repair as necessary.
B	5. Wheel Mounting (Lug) nuts loose.	5. Inspect wheel mounting (Lug) nuts and studs and repair as necessary. Tighten nuts to specifications.
B	6. Power steering hose touching the body or frame of vehicle.	6. For evaluation and correction. Refer to <u>PUMP, DIAGNOSIS AND TESTING.</u>
B	7. Loose inner tie rod.	7. For evaluation and correction. Refer to <u>END, TIE ROD, DIAGNOSIS AND TESTING.</u>
B	8. Loose lower control arm mounting bolts at engine cradle, frame or crossmember (occurs with steering input only when moving, not stationary).	8. Check control arm mounting bolts and tighten to specified torque.
B	9. Loose intermediate shaft or column.	9. Rotate intermediate (steering) shaft in relationship to gear, checking for free-play. Check column fasteners and tighten to specifications as necessary.
B	10. Lower control arm pivot bushing worn (occurs with steering input only when moving, not stationary).	10. Inspect bushings for wear and replace lower control arm as necessary.
B	11. Internal power steering gear noise.	11. Drive vehicle on rough road, then steer rapidly back and forth when stopped. Replace power steering gear as necessary.
B	12. Stabilizer bar link joints worn (occurs with steering input only when moving, not stationary).	12. At park, jounce only one side of vehicle front to exercise stabilizer bar. Replace stabilizer bar link.
B	13. Excessive play in outer tie rod.	13. For evaluation and correction. Refer to <u>END, TIE ROD, DIAGNOSIS AND TESTING.</u>
POPPING NOISE	1. Loose steering gear mounting fasteners.	1. Check fasteners for proper torque and retighten as necessary.
B	2. Loose outer tie rod mounting nut or jam nut.	2. Check fastener torque. Replace nuts as necessary and tighten to specifications.
B	3. Loose intermediate (steering) shaft coupling at gear input shaft.	3. Make sure coupling is fully seated on gear input shaft. Retighten or re-seat as necessary.
B	4. Worn tie rod (outer or	4. For evaluation and correction. Refer to <u>END,</u>

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
	inner).	<u>TIE ROD, DIAGNOSIS AND TESTING.</u>
B	5. Worn axle shaft.	5. For evaluation and correction refer to the diagnosis and testing section for the appropriate front axle.
CHIRP OR SQUEAL (POWER STEERING PUMP)	1. Loose power steering pump drive belt.	1. Inspect belt. Replace belt if worn or glazed. Tighten/adjust power steering pump drive belt if equipped with a manual tensioner.
B	2. Pulley alignment incorrect.	2. Realign accessory drives.
B	3. Malfunctioning belt auto-tensioner	3. Verify belt tension. Replace belt auto-tensioner.
B	4. Power steering pump noisy (worn bearing/bushing noise).	4. Using an electronic listening tool, determine if noise is coming from pump. Replace power steering pump as required.
B	5. Generator or water pump noisy.	5. Using an electronic listening tool, determine if noise is coming from Generator or water pump. Replace faulty component.
WHINE, GROWL, MOAN OR GROAN (POWER STEERING PUMP)***	1. Low power steering fluid level.	1. Fill power steering fluid reservoir to proper level and check for leaks (make sure all air is bled from the system fluid).
B	2. Air in power steering fluid.	2. Inspect for excessive air bubbles in fluid (fluid will appear foamy and lighter in color). Inspect hoses for leaks and replace as necessary. Bleed air from fluid Refer to <u>STANDARD PROCEDURE.</u>
B	3. Power steering hose touching body or frame of vehicle.	3. For evaluation and correction. Refer to <u>PUMP, DIAGNOSIS AND TESTING.</u>
B	4. Wear of power steering pump internal components.	4. For evaluation and correction. Refer to <u>PUMP, DIAGNOSIS AND TESTING.</u>
COLD START WHINE OR MOAN (POWER STEERING PUMP)***	1. Low power steering fluid level.	1. Fill power steering fluid reservoir to proper level and check for leaks (make sure all air is bled from the system fluid).
B	2. Extremely low ambient temperature (near 0 FB° (-18 CB°) or below)	2. Some noise is expected as pump attempts to pull cold, thick fluid. Noise should go away as vehicle warms up. Acceptable levels of excessive noise are one second at 0 FB° (-18 CB°) and 15 seconds at -20 FB° (-29 CB°). If noise is excessive, look for poor sealing on the return hose or a possible fluid leak.
SQUEAKING OR RUBBING SOUND	1. Steering column shroud or shaft rubbing.	1. While turning the steering wheel, listen down column to locate. Check interference between moving components. Move or realign shrouds or shaft as necessary. Replace components if this does not correct problem.
B	2. Clockspring inside steering column noisy.	2. Remove clockspring and reinstall steering wheel for testing. If noise is gone, replace clockspring.
B	3. Boot/dash seal lubrication inadequate.	3. Remove boot seal and recheck for noise. Lubricate seal as necessary.
B	4. Steering gear outer tie rod noisy.	4. While a helper turns the steering wheel, use an electronic listening tool to determine if noise is

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
		coming from either outer tie rod. Replace outer tie rods as necessary.
B	5. Steering gear internally noisy.	5. Remove dash seal boot, then exercise the steering wheel. If noise is still present at gear, replace steering gear.
SCRUBBING OR KNOCKING SOUND.	1. Incorrect tire or wheel size.	1. Replace incorrect size tire or wheel with original equipment size.
B	2. Worn motor or transmission mount.	2. Drive vehicle, moving accelerator pedal rapidly up and down attempting to locate noise. Try in both forward and reverse. Replace mounts as necessary.
B	3. Tires contacting wheel well.	3. Make sure wheel house is properly positioned. If not, reposition as necessary. If steering wheel is properly centered, check steering gear travel left to right by rotating the steering wheel to each stop. Steering wheel should rotate the same amount in both directions from center. If not, replace steering gear.
B	4. Interference between moving steering components and other components.	4. Check for bent or misaligned components. Correct or replace as necessary.
B	5. Accessory drive pulley rubbing against another component.	5. Check pulleys for wear. Check for worn engine or transmission mount. Reposition components or replace mounts as necessary.

NOTE: * There is some noise in all power steering systems. One of the most common is a hissing sound evident when turning the steering wheel when at a standstill or when parking and the steering wheel is at the end of its travel. Hiss is a very high frequency noise similar to that experienced while slowly closing a water tap. The noise is present in every valve and results when high velocity fluid passes valve orifice edges. There is no relationship between this noise and the performance of the steering system.

NOTE: ** A light clunk may be felt or heard during steering wheel reversal while vehicle is stationary. This results from internal steering gear rack movement at the bushings and in no way affects the performance of the steering system. This movement may be felt in the steering components during steering wheel reversal.

NOTE: *** Power steering pump growl/moan/groan results from the development of high pressure fluid flow. Normally this noise level should not be high enough to be objectionable.

PERFORMANCE ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
STEERING WHEEL OR COLUMN HAS FREEPLAY/LASH/LOOSENESS (CLUNKING OR RATTLING)	1. Loose coupling pinch bolt at gear input shaft.	1. Check pinch bolt torque. Replace pinch bolt if equipped with thread locker patch and tighten to specifications.
B	2. Power steering gear loose on cradle/crossmember.	2. Inspect gear mounting bolts. Replace if necessary and tighten to specifications.

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
B	3. Excessive freeplay or noise from steering column bearings.	3. Replace steering column.
B	4. Excessive intermediate (steering) shaft coupling u-joint free-play.	4. Rotate steering wheel back-and-forth while watching coupling. Observe for free-play. Replace intermediate shaft as necessary.
B	5. Loose or worn outer tie rod.	5. For evaluation and correction. Refer to <u>END, TIE ROD, DIAGNOSIS AND TESTING.</u>
B	6. Lack of lubrication in lower ball joint or ball joint is damaged.	6. Lubricate ball joint if equipped with a zerk fitting and check for function. If not equipped with a zerk fitting, test and replace ball joint as necessary.
B	7. Excessive lash inside steering gear.	7. Disconnect intermediate shaft and turn steering gear input shaft. Observe for any movement without a corresponding tire movement. Replace steering gear as necessary.
STEERING WHEEL HAS FORE AND AFT LOOSENESS.	1. Steering wheel retaining bolt loose.	1. Check steering wheel retaining bolt torque and tighten to specifications as necessary.
B	2. Loose steering column to instrument panel fasteners.	2. Check steering column to instrument panel fastener torque and tighten to specifications as necessary.
B	3. Steering column lower bearing spring retainer slipped on steering column shaft.	3. Pull steering wheel fore-and-aft while observing movement. Replace steering column as necessary.
STEERING WHEEL, DASH OR VEHICLE VIBRATES DURING STEERING MANEUVERS (ESPECIALLY AT LOW SPEED OR STANDSTILL).	1. Air in power steering fluid.	1. Inspect for excessive air bubbles in fluid (fluid will appear foamy and lighter in color). Inspect hoses for leaks and replace as necessary. Bleed air from fluid Refer to <u>POWER STEERING SYSTEM BLEEDING</u> .
B	2. Tire(s) not properly inflated.	2. Check and inflate tires to the specified pressure.
B	3. Excessive engine vibration.	3. Ensure that the engine is tuned properly.
B	4. Loose tie rod end jam nut.	4. Check torque and tighten the inner to outer tie rod jam nut to specifications.
B	5. Overcharged air conditioning (A/C) system.	5. Turn A/C off and verify issue goes away. Repair A/C as necessary.
B	6. Grounded, damaged or loose engine mount.	6. Visually inspect for damaged or misaligned mounts. Check fastener torque. Replace, realign or retighten as necessary.
B	7. Loose or worn outer tie rod.	7. For evaluation and correction. Refer to <u>END, TIE ROD, DIAGNOSIS AND TESTING.</u>
B	8. Steering gear noisy.	8. During a parking event at 0 mph, verify there is vibration only with steering. Steer in both directions and

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
		verify that the noise follows the steering input. Check TSB's for any known issues. Replace steering gear as necessary.
STEERING CATCHES, SURGES OR STICKS IN CERTAIN POSITIONS OR IS DIFFICULT TO TURN.	1. Low power steering fluid level.	1. Check fluid level and fill to proper level as necessary. Check for leaks. Make sure all air is bled from system.
B	2. Tire(s) not properly inflated.	2. Check and inflate tires to the specified pressure.
B	3. Lack of lubrication in lower ball joint or ball joint is damaged.	3. Lubricate ball joint if equipped with a zerk fitting and check for function. If not equipped with a zerk fitting, test and replace ball joint as necessary.
B	4. Lack of lubrication in steering gear outer tie rod end(s).	4. For evaluation and correction. Refer to <u>END, TIE ROD, DIAGNOSIS AND TESTING.</u>
B	5. Faulty power steering pump.	5. Perform Power Steering Flow and Pressure Test. Refer to <u>DIAGNOSIS AND TESTING.</u> Look for low or erratic flow or pressure. Replace power steering pump as necessary.
B	6. Excessive friction in intermediate shaft/coupler joint.	6. Disconnect intermediate shaft/coupler at steering gear and check joint for smooth operation in all directions. Replace intermediate shaft/coupler joint.
B	7. Excessive friction in steering column.	7. Disconnect intermediate shaft/coupler at steering gear. Turn steering wheel two revolutions in either direction from on center and check for smooth operation. DO NOT turn past two revolutions. Damage to the clockspring may occur. Replace steering column as necessary.
B	8. Worn or binding seat and bearing in front strut assembly.	8. Disconnect outer tie rod ends from knuckles, then turn tire and wheel assembly checking for smooth operation. Replace front strut assembly seat and bearing.
B	9. Faulty steering gear.	9. With vehicle on hoist, tires unsupported and engine off, steer gear throughout travel and check for smooth operation. Replace steering gear (only after all previous components have been checked).
STEERING WHEEL DOES NOT RETURN TO CENTER POSITION.	1. Tire(s) not properly inflated.	1. Check and inflate tires to the specified pressure.
B	2. Improper front wheel alignment.	2. Check and adjust wheel alignment as necessary.
B	3. Lack of lubrication in lower ball joint or ball joint is damaged.	3. Lubricate ball joint if equipped with a zerk fitting and check for function. If not equipped with a zerk fitting, test and replace ball joint as necessary.

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
B	4. Excessive friction in intermediate shaft/coupler joint.	4. Disconnect intermediate shaft/coupler at steering gear and check joint for smooth operation in all directions. Replace intermediate shaft/coupler joint.
B	5. Excessive friction in steering column.	5. Disconnect intermediate shaft/coupler at steering gear. Turn steering wheel two revolutions in either direction from on center and check for smooth operation. DO NOT turn past two revolutions. Damage to the clockspring may occur. Replace steering column as necessary.
B	6. Worn or binding seat and bearing in front strut assembly.	6. Disconnect steering gear outer tie rod ends at knuckles, then turn tire and wheel assembly in and out checking for smooth operation. Replace seat and bearing as necessary.
B	7. Excessive friction in power steering gear.	7. With vehicle on hoist, tires unsupported and engine off, steer gear throughout travel and check for smooth operation. Replace steering gear (only after all previous components have been checked).
EXCESSIVE STEERING WHEEL KICKBACK FROM ROAD INPUTS	1. Air in power steering fluid.	1. Inspect for excessive air bubbles in fluid (fluid will appear foamy and lighter in color). Inspect hoses for leaks and replace as necessary. Bleed air from fluid Refer to <u>POWER STEERING SYSTEM BLEEDING</u> .
B	2. Power steering gear loose on cradle/crossmember.	2. Inspect gear mounting bolts. Replace if necessary and tighten to specifications.
B	3. Steering column, coupling or intermediate shaft worn or loose.	3. Rotate steering wheel back-and-forth while inspecting intermediate shaft going into steering gear. Look for excessive free-play. Retighten if loose bolt is found. Replace steering column, coupling or intermediate shaft if necessary.
B	4. Power steering pump flow is too low.	4. Perform Power Steering Flow and Pressure Test. Refer to <u>DIAGNOSIS AND TESTING</u> . Look for low or erratic flow or pressure. Replace power steering pump as necessary.

FLUID ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
LOW FLUID LEVEL WITH VISIBLE LEAK.	1. Loose power steering hose fittings or connections.	1. Check torque on all tube nuts (at gear and pump). Inspect clamps at all rubber hose connections for correct position, damage and tension. Tighten tube nuts as required. Reposition or replace clamps at hose connections. Clean joints and reinspect for leaks.
B	2. Damaged or missing O-ring at power steering hose	2. Remove tube nut and inspect O-ring. If damaged or missing, replace O-ring. Clean

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
	tube nuts.	joints and reinspect for leaks.
B	3. Power steering line or hose failure.	3. Clean fluid from around suspect areas. Run vehicle and inspect for leaks. Look inside reservoir to see if air is being ingested. Replace hoses as necessary.
B	4. Power steering component leaking (reservoir, pump, gear).	4. Clean fluid from around suspect areas. Run vehicle and inspect for leaks. Look inside reservoir to see if air is being ingested. Replace power steering component as necessary.
AERATED FLUID.*	1. Low power steering fluid level.	1. Check fluid level and fill to proper level as necessary. Check for leaks. Make sure all air is bled from system.
B	2. Air leak at power steering supply hose, reservoir or pump.	2. Inspect components. Put a hand vacuum pump on the reservoir and verify that the system can keep a vacuum. System should not lose more than 1 psi in 2 minutes (make sure vacuum pump is sealed well to the reservoir).
B	3. Air leak at power steering supply hose, reservoir or pump.	3. Inspect components. Place a hand vacuum pump with Adapter 9688 on reservoir and verify that system can sustain vacuum. System should not lose more than 1 psi in 2 minutes (make sure vacuum pump is sealed well to the reservoir). Replace steering component as necessary.
RESERVOIR FLUID OVERFLOW OR FLUID THAT IS MILKY IN COLOR	1. Water contamination of power steering fluid.	1. Inspect fluid for milky appearance. Completely drain power steering fluid. Refill and bleed system. Refer to <u>POWER STEERING SYSTEM BLEEDING</u> .

NOTE: Extremely cold temperatures may cause power steering fluid aeration. The air should work its way out of the system as the fluid warms.

POWER STEERING FLOW AND PRESSURE - ELECTRO-HYDRAULIC POWER STEERING (EHPS)

The following procedure is used to test the operation of the power steering system on the vehicle equipped with EHPS. This test provides the Gallons Per Minute (GPM) or the flow rate of the power steering pump along with the maximum relief pressure. Perform this test any time a power steering system problem is present. This test determines if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Kit. (special tool #6815, Kit, Power Steering), Hose (special tool #6905, Assembly, Hose) from Power Steering Analyzer Adapter Kit (special tool #6893A, Kit, Power Steering), Hose (special tool #6959, Assembly, Hose), and Power Steering Analyzer Adapter.

FLOW AND PRESSURE TEST

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the front skid plate. Refer to **PLATE, SKID, REMOVAL AND INSTALLATION** .
3. Assemble Power Steering Analyzer as follows:
 - a. Gauge end (inlet) of Flow Meter And Gauge (special tool #6800, Analyzer, Power Steering) - Hose (special tool #6905, Assembly, Hose) (3), Adapter (special tool #10250-2, Adapters, Power Steering) (2).
 - b. Valve end (outlet) of Flow Meter And Gauge (special tool #6800, Analyzer, Power Steering) - Hose (special tool #6959, Assembly, Hose) (6), Adapter (special tool #10250-1, Adapters, Power Steering) (5).

4. Remove power steering pressure line retaining bolt from power steering pump. Separate pressure line fitting from power steering pump.
5. Connect Adapter (special tool #10250-2, Adapters, Power Steering) (2) to pressure fitting on power steering pump. Tighten retaining bolt to 10 N.m (89 in. lbs.).
6. Connect power steering pressure hose to Adapter Fitting (special tool #10250-1, Adapters, Power Steering) (5). Tighten retaining bolt to 10 N.m (89 in. lbs.).
7. Open the test valve completely.
8. Start the engine and idle long enough to circulate power steering fluid through the flow/pressure test gauge and to get air out of the fluid. Then shut off engine.
9. Check the fluid level, add fluid as necessary. Start the vehicle and allow it to idle.
10. The gauge should read below 517 kPa (75 psi), if above, inspect the hoses for restrictions and repair as necessary.

NOTE: Always test for and repair Diagnostic Trouble Codes (DTCs) prior to replacement of the EHPS pump. The EHPS pump will not vary output if there are communication DTCs.

11. Record the flow meter reading GPM at idle with no steering wheel movement, and again while turning the wheel as fast as possible. The readings should be within specifications. If the readings are below specifications, replace the power steering pump.

CAUTION: The following test procedure involves testing maximum pump pressure output and flow control valve operation. Do not leave the valve closed for more than three seconds as the pump could be damaged.

12. Close the valve fully three times and record the highest pressure indicated each time. All three readings must be above specifications.

CAUTION: Do not force the pump to operate against the stops for more than 2 to 3 seconds at a time because, pump damage will result.

13. Open the test valve and turn the steering wheel to the extreme left and right positions three times against the stops. Record the highest pressure reading at each position. Compare the readings and if the pressure readings are not within 690 kPa (100 psi) of each other, the gear is leaking internally and must be replaced.

PUMP SPECIFICATION

SYSTEM	RELIEF PRESSURE B± 150	FLOW RATE (GPM)
EHPS	11, 030 kPa (1600 psi) turning steering wheel to wheel stops.	Momentarily raise to between 0.5 - 2.8 GPM at idle with rapid steering wheel rotation.

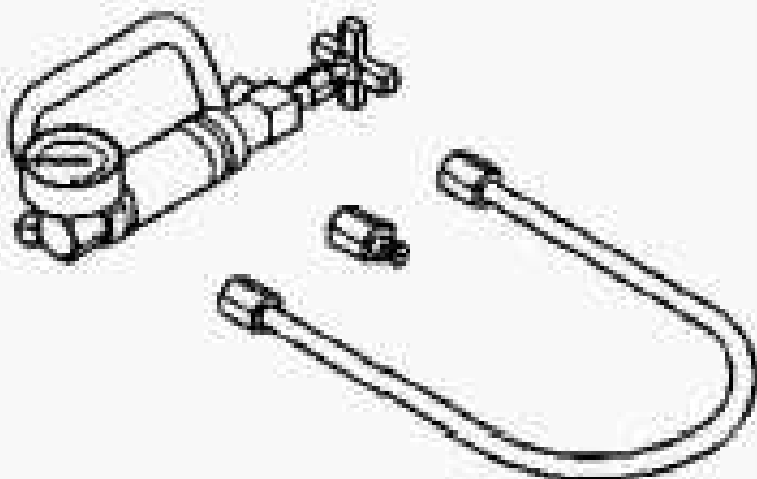
NOISE, VIBRATION AND HARSHNESS (NVH) DIAGNOSTIC SHEET

Diagnosis And Testing may be aided by using the Noise, Vibration and Harshness (NVH) diagnostic sheet. The NVH diagnostic sheet can be found by opening DealerCONNECT, select the SERVICE tab, look under REPAIR INFORMATION, then under Warranty Diagnostic Check Sheets, expand Other, and then select NVH Diagnostic Sheet.

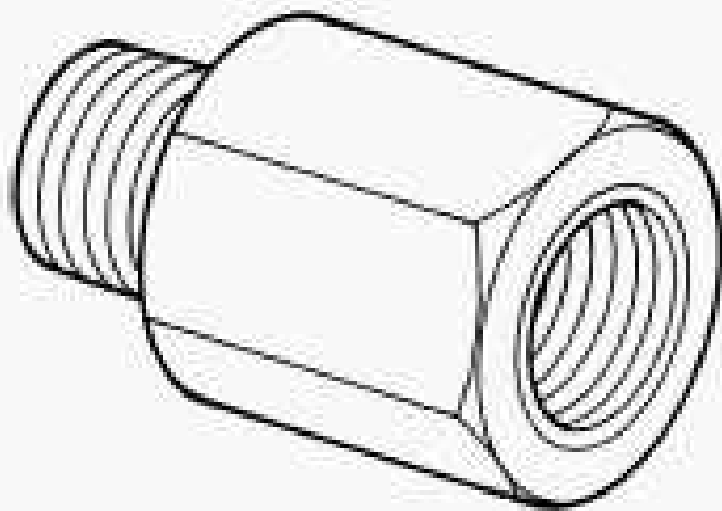
SPECIAL TOOLS



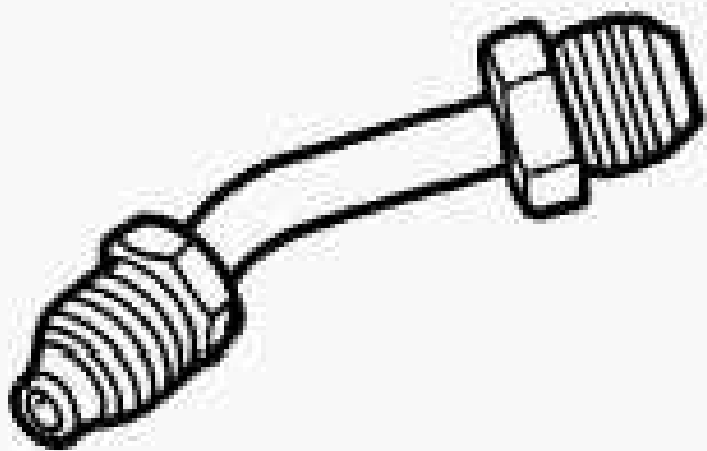
9615A - Remover, Pitman Arm



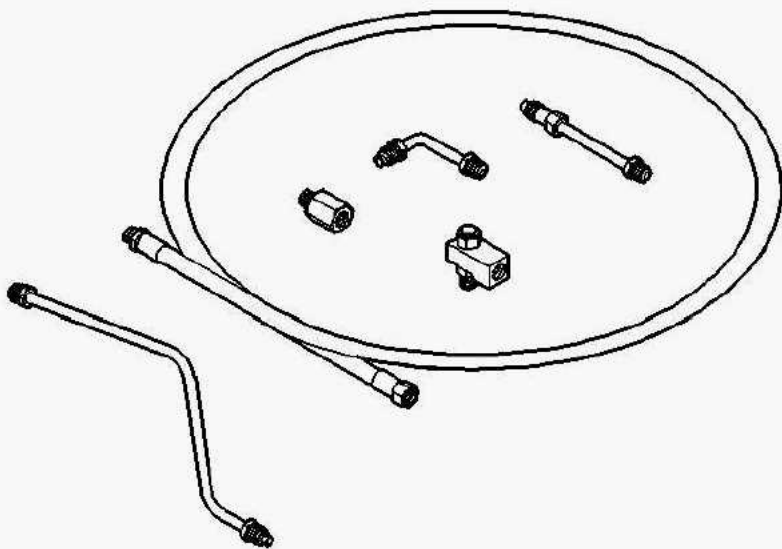
6815 - Kit, Power Steering
(Originally Shipped In Kit Number(s)
6784, 6809, 6898.)



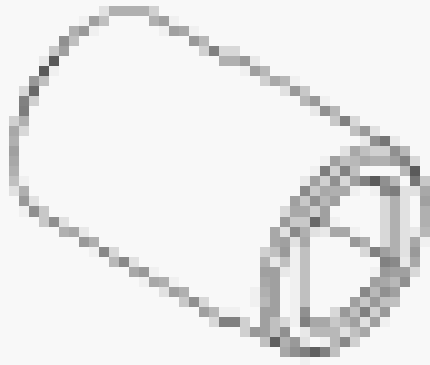
6826 - Adapter, LH P/S Tester
(Originally Shipped In Kit Number(s)
6893A, 6894, 6895, 6897, 6898.)



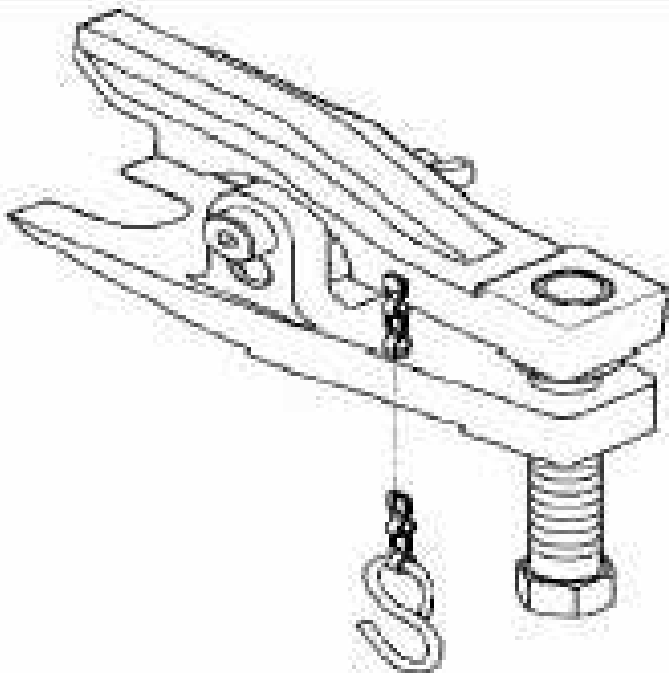
6844 - Adapter, Power Steering (Truck)
(Originally Shipped In Kit Number(s)
6896.)



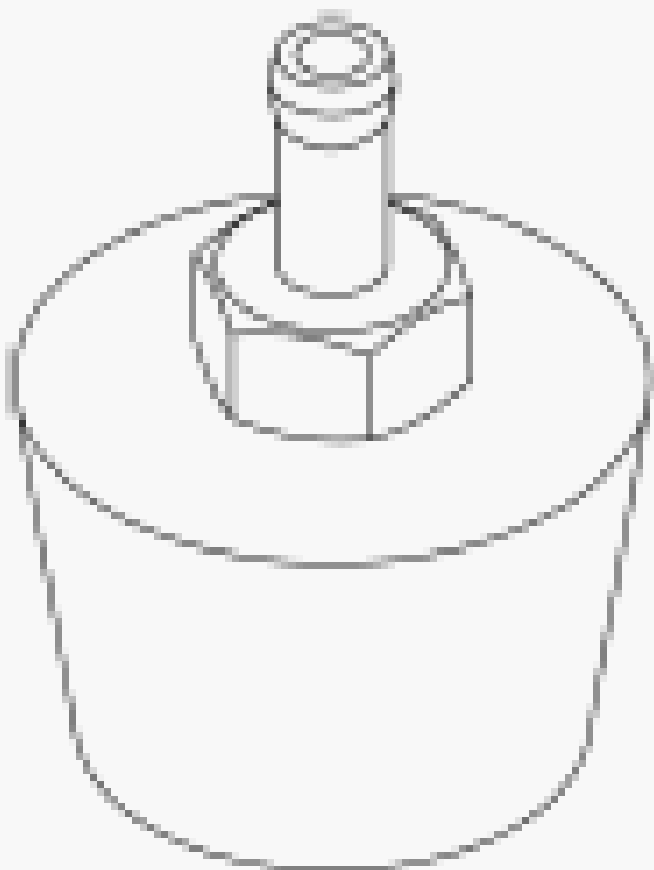
6893A - Kit, Power Steering
(Originally Shipped In Kit Number(s)
6896.)



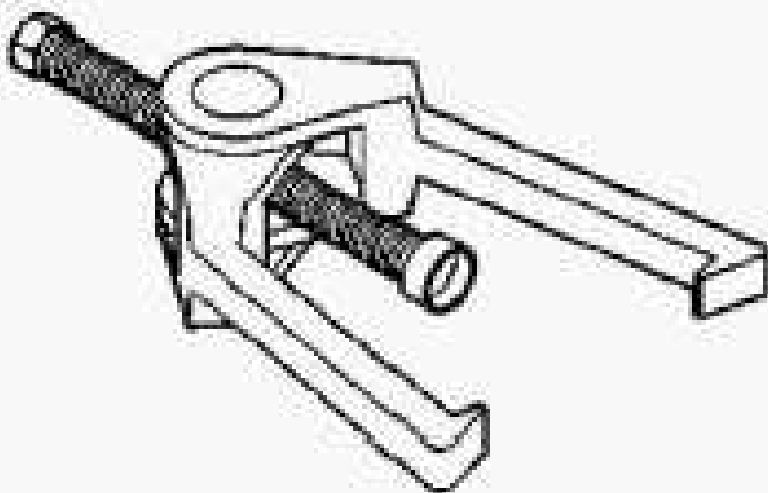
8343 - Wrench
(Originally Shipped In Kit Number(s)
8283, 8283CC, 8527, 8527CC.)



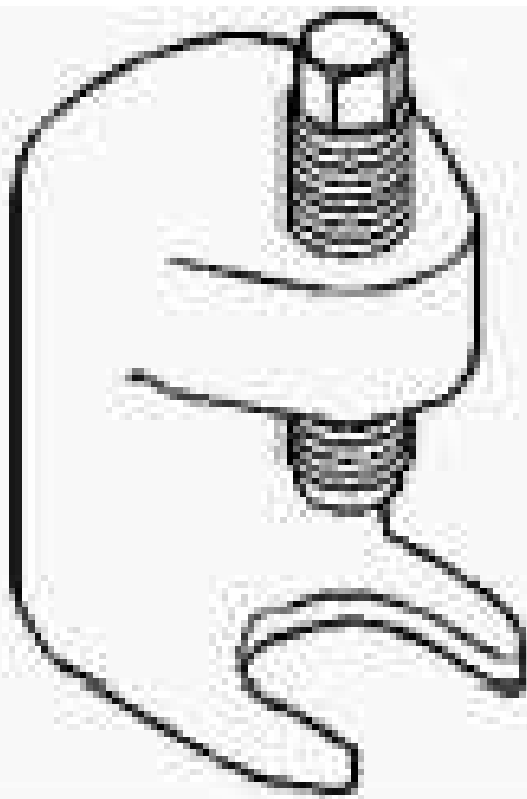
9360 - Remover, Ball Joint
(Originally Shipped In Kit Number(s)
9329, 9515, 9516, 9516-CAN, 9517,
9517-CAN, 9518, 9519, 9540, 9541.)



9688A - Cap Adapter, Power Steering Pump
(Originally Shipped In Kit Number(s)
10075A-DOD, 10075-CHRYSLER,
10075-DODGE.)



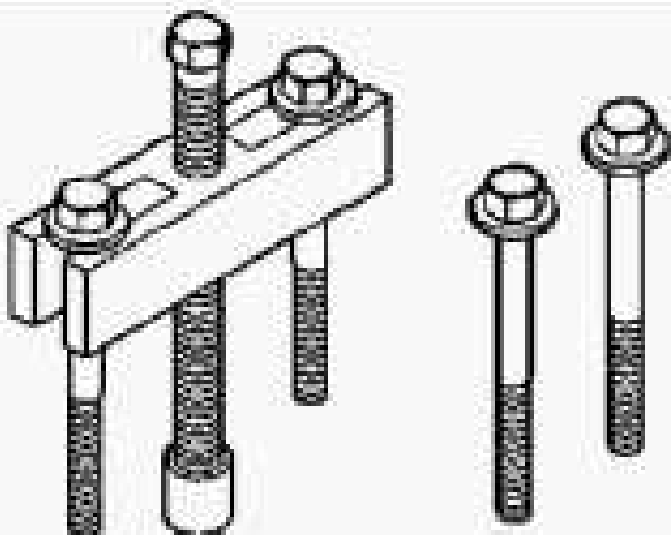
C-3894-A - Puller, Tie Rod
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



C-4150A - Press, Ball Joint
(Originally Shipped In Kit Number(s)
6672, 6745.)



C-4207-A - Vacuum Pump, Hand



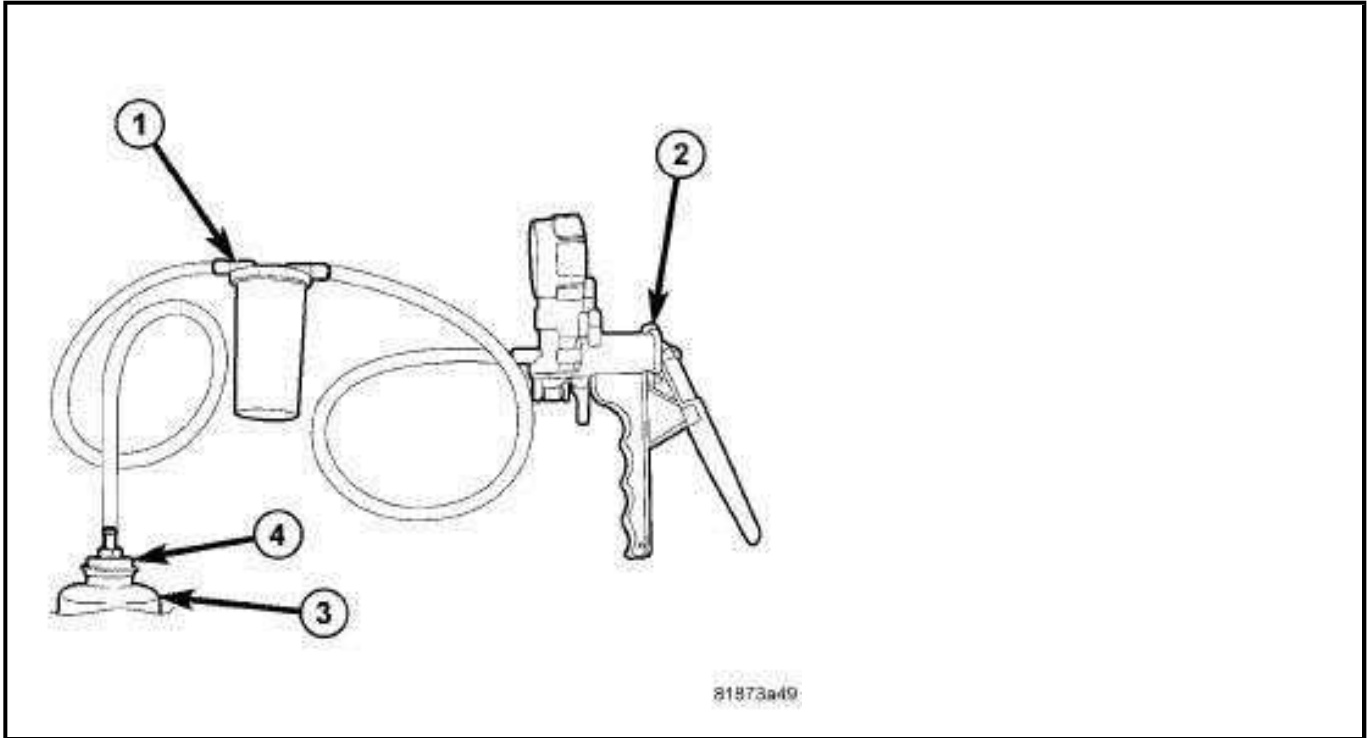
L-4407A - Puller, Gear

STANDARD PROCEDURE

POWER STEERING SYSTEM BLEEDING

WARNING: The fluid level should be checked with engine off to prevent injury from moving components.

CAUTION: If the air is not purged from the power steering system correctly, pump failure could result.



NOTE: Be sure the vacuum tool used in the following procedure is clean and free of any fluids.

1. Check the fluid level. As measured on the side of the reservoir, the level should indicate between "ADD" and "FULL COLD" when the fluid is at normal ambient temperature. Adjust the fluid level as necessary. Refer to **FLUID, STANDARD PROCEDURE**.
2. Tightly insert (special tool #9688A, Cap Adapter, Power Steering Pump) (4) into the mouth of the reservoir.

CAUTION: Failure to use a the vacuum pump reservoir (1) may allow power steering fluid to be sucked into the hand vacuum pump.

3. Attach (special tool #C-4207-A, Vacuum Pump, Hand) (2) or equivalent, with the reservoir (1) attached to the power steering cap adapter (4).

CAUTION: Do not run the engine while vacuum is applied to the power steering system. Damage to the power steering pump can occur.

NOTE: When performing the following step make sure the vacuum level is maintained during the entire time period.

4. Using the hand vacuum pump (2), apply 68-85 kPa (20-25 in. Hg) of vacuum to the system for three minutes.
5. Slowly release the vacuum and remove the special tools.

6. Adjust the fluid level as necessary.
7. Start the engine and cycle the steering wheel lock-to-lock three times.

NOTE: Do not hold the steering wheel at the stops.

8. Stop the engine and check for leaks at all connections.
9. Check for any signs of air in the reservoir and check the fluid level. If air is present, repeat the procedure as necessary.

COLUMN

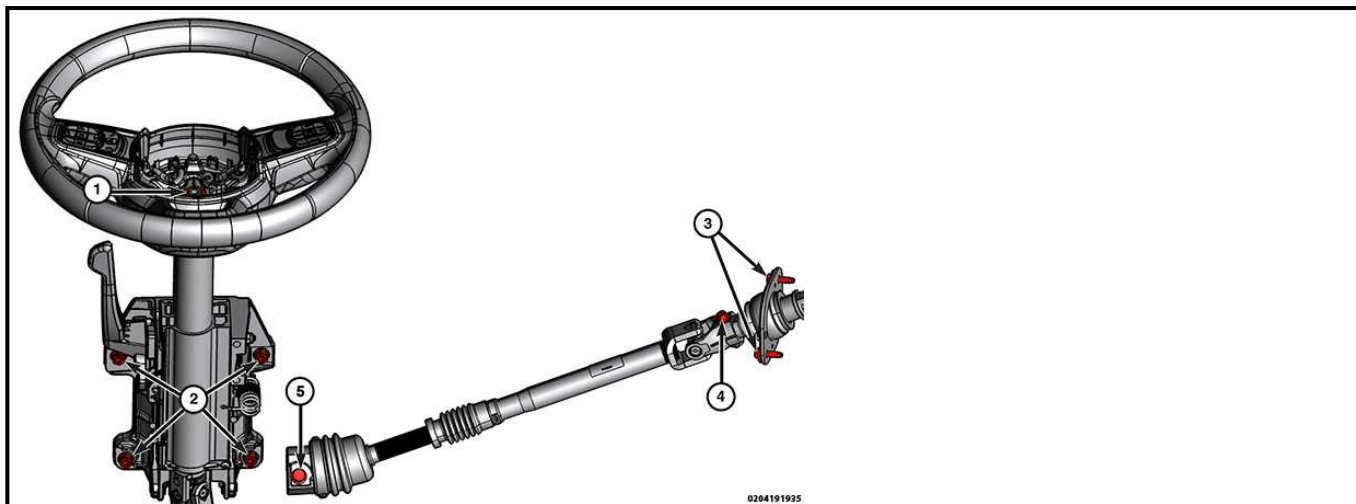
DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING

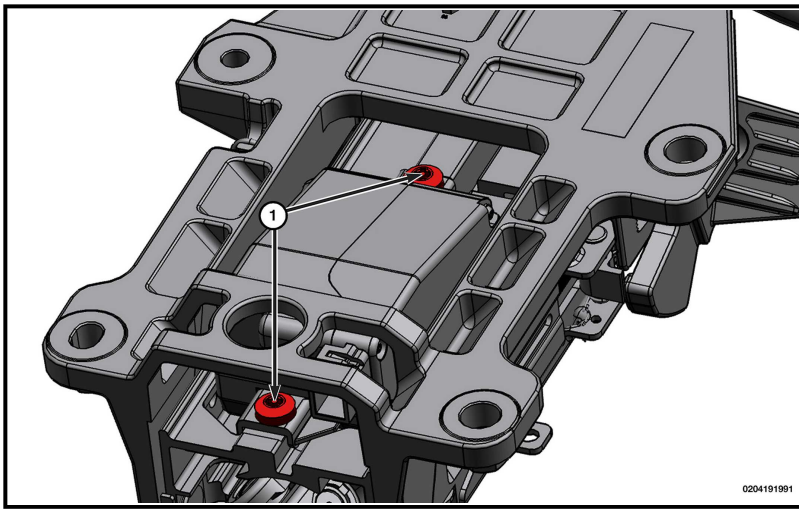
NOTE: If the vehicle is involved in a collision where the airbag has been deployed or the steering wheel deformed, then steering column replacement is required.

TORQUE SPECIFICATIONS

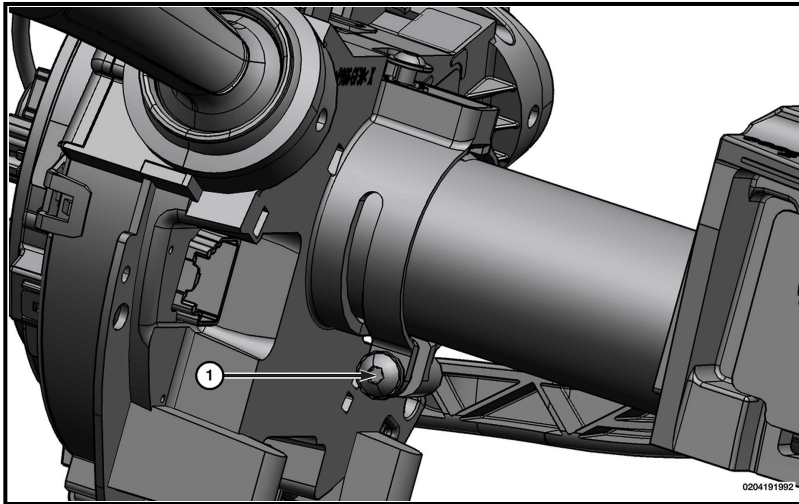
STEERING COLUMN



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Wheel Nut	50 N. m (37 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Steering Column Nuts	27 N. m (20 Ft. Lbs.)	-
3	Bulkhead Bearing Bolt	9 N. m (7 Ft. Lbs.)	-
4	Intermediate Shaft Coupler Upper Pinch Bolts	34 N. m (25 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Intermediate Shaft Coupler Lower Pinch Bolts	55 N. m (41 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Electronic Steering Lock (ESL) Module Bolts	8 N. m (71 In. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Column Control Module (SCCM) Band Clamp Fastener	6 N. m (53 In. Lbs.)	-

REMOVAL AND INSTALLATION

LEFT HAND DRIVE

REMOVAL

1. Position front wheels **straight ahead**.

CAUTION: Steering column module is centered to the vehicles steering system. Failure to keep the system and steering column module centered and locked/inhibited from rotating can result in steering column module damage.

NOTE: Some vehicles may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

2. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .

3. Disconnect the upper end of the steering intermediate shaft from the steering column shaft. Refer to [SHAFT, INTERMEDIATE, REMOVAL AND INSTALLATION](#).
4. Remove the steering wheel. Refer to [WHEEL, STEERING, REMOVAL AND INSTALLATION](#).
5. Remove the gap hider. Refer to [GAP HIDER, STEERING COLUMN SHROUD, REMOVAL AND INSTALLATION](#).



- | |
|-------------------------------|
| 1 - Steering Column Nuts |
| 2 - Wire Harness Routing Clip |

6. Remove the wiring harness routing clip from the steering column.
7. Remove the four steering column nuts.



- | |
|--|
| 1 - Steering Column Lock Module Wire Harness Connector |
|--|

8. Lower the steering column slightly and disconnect the steering column lock module wire harness connector if equipped.

9. Carefully guide the steering column shaft through the bulkhead and remove the steering column.

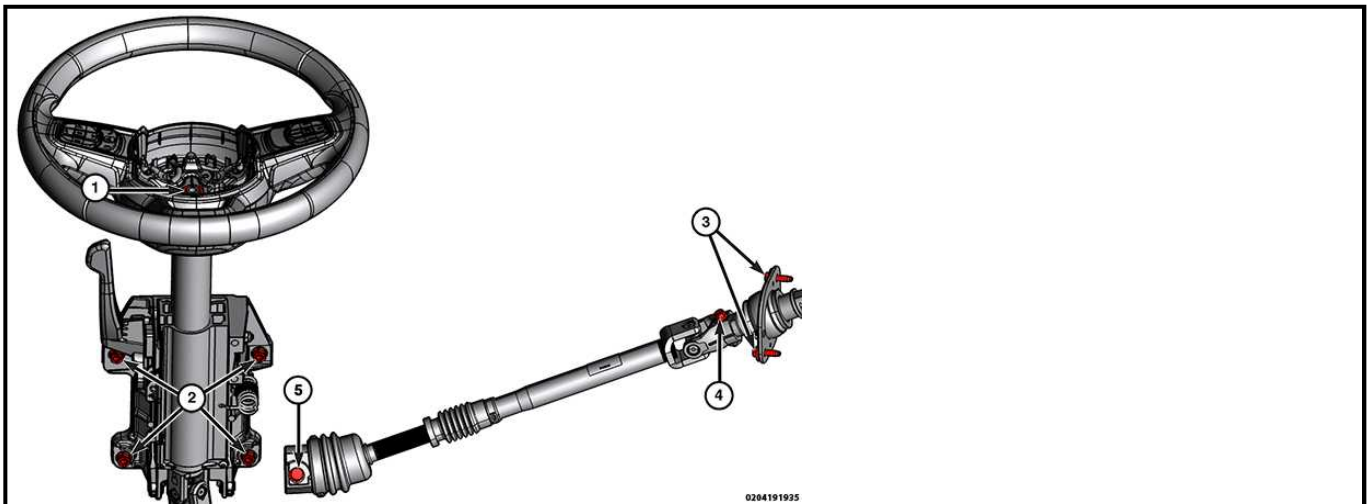
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

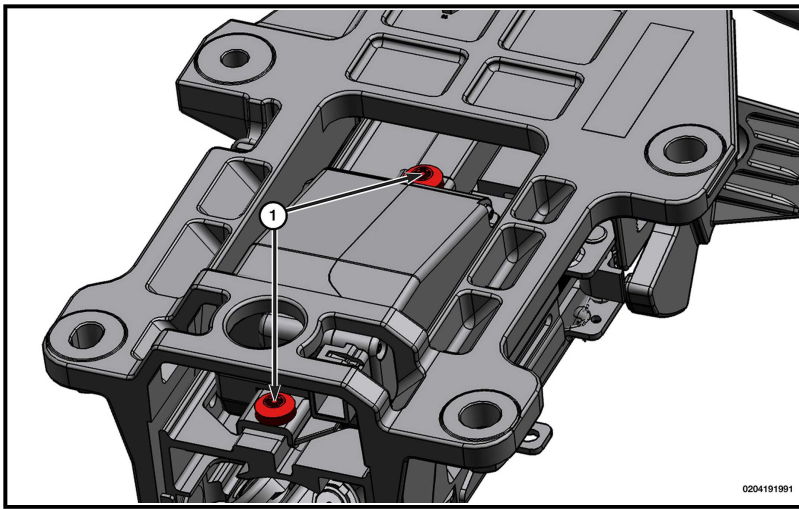
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

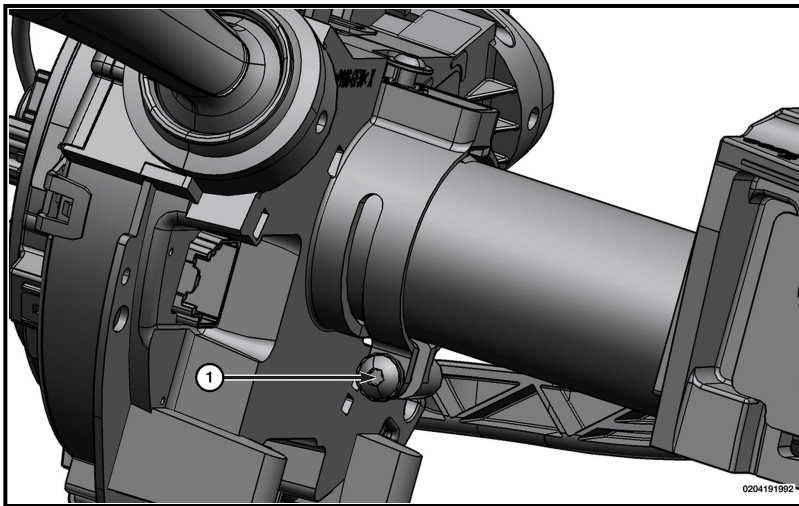
STEERING COLUMN



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Wheel Nut	50 N. m (37 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Steering Column Nuts	27 N. m (20 Ft. Lbs.)	-
3	Bulkhead Bearing Bolt	9 N. m (7 Ft. Lbs.)	-
4	Intermediate Shaft Coupler Upper Pinch Bolts	34 N. m (25 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Intermediate Shaft Coupler Lower Pinch Bolts	55 N. m (41 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Electronic Steering Lock (ESL) Module Bolts	8 N. m (71 In. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Column Control Module (SCCM) Band Clamp Fastener	6 N. m (53 In. Lbs.)	-

RIGHT HAND DRIVE

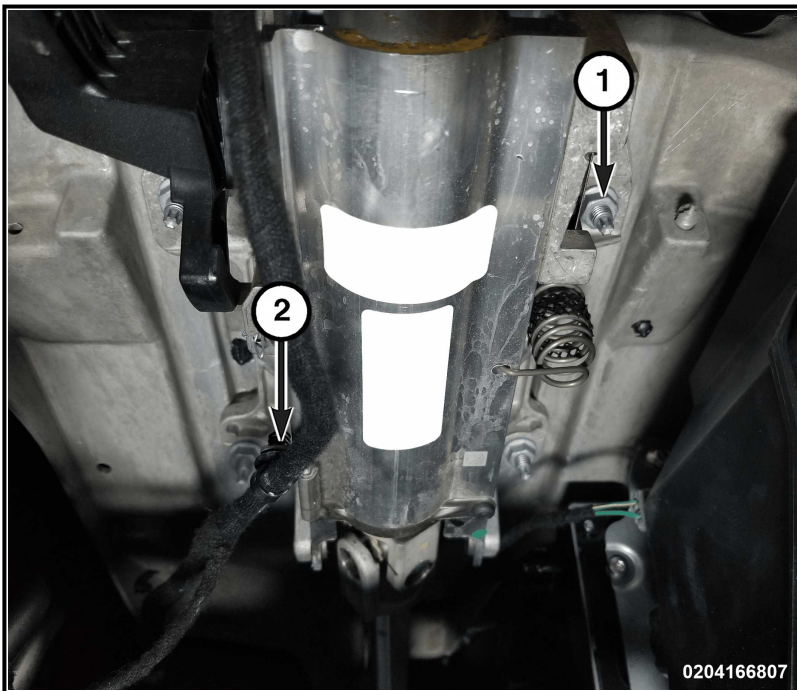
REMOVAL

CAUTION: Steering column module is centered to the vehicles steering system. Failure to keep the system and steering column module centered and locked/inhibited from rotating can result in steering column module damage.

NOTE: Some vehicles may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

1. Position the front wheels straight ahead.
2. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
3. Remove the steering wheel. Refer to [WHEEL, STEERING, REMOVAL AND INSTALLATION](#).
4. Remove the Steering Column Control Module (SCCM). Refer to [MODULE, STEERING COLUMN CONTROL \(SCCM\), REMOVAL AND INSTALLATION](#) .

5. Remove the gap hider. Refer to [GAP HIDER, STEERING COLUMN SHROUD, REMOVAL AND INSTALLATION](#).
6. Disconnect the upper end of the steering intermediate shaft from the steering column shaft. Refer to [SHAFT, INTERMEDIATE, REMOVAL AND INSTALLATION](#).



- | |
|-------------------------------|
| 1 - Steering Column Nuts |
| 2 - Wire Harness Routing Clip |

7. Remove the wiring harness routing clip from the steering column.
8. Remove the four steering column nuts.



- | |
|--|
| 1 - Steering Column Lock Module Wire Harness Connector |
|--|

9. Lower the steering column slightly and disconnect the steering column lock module wire harness connector if equipped.
10. Carefully guide the steering column shaft out of the bulkhead and remove the steering column.

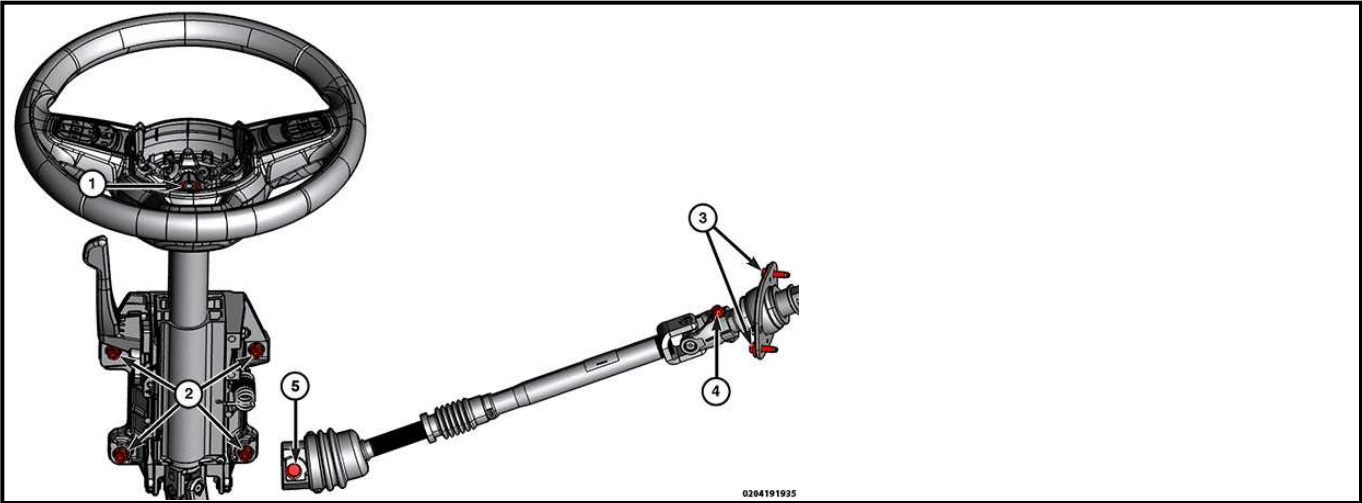
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

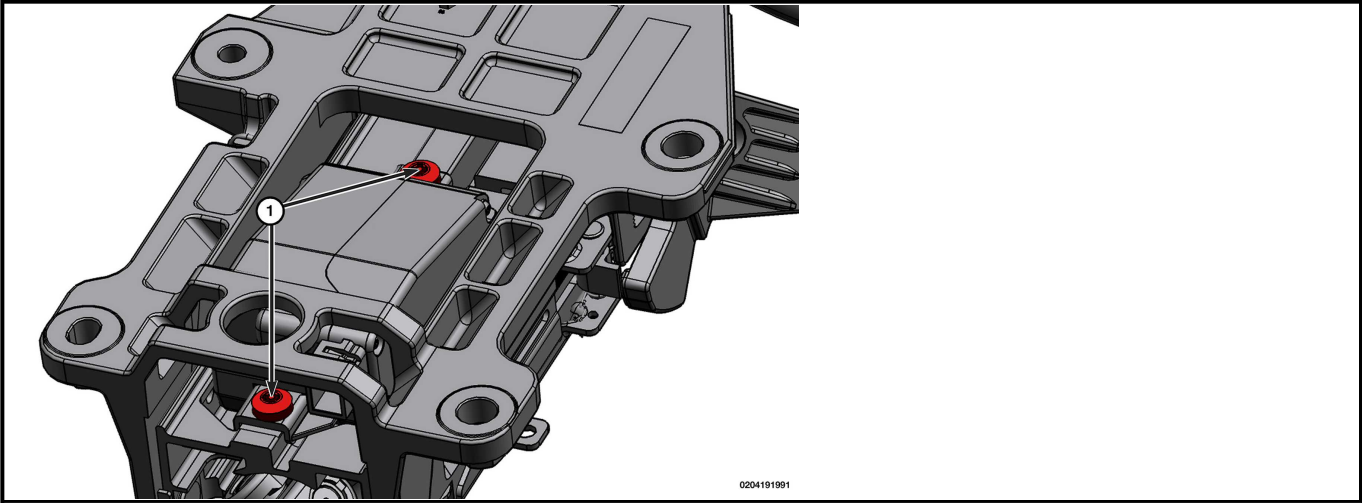
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

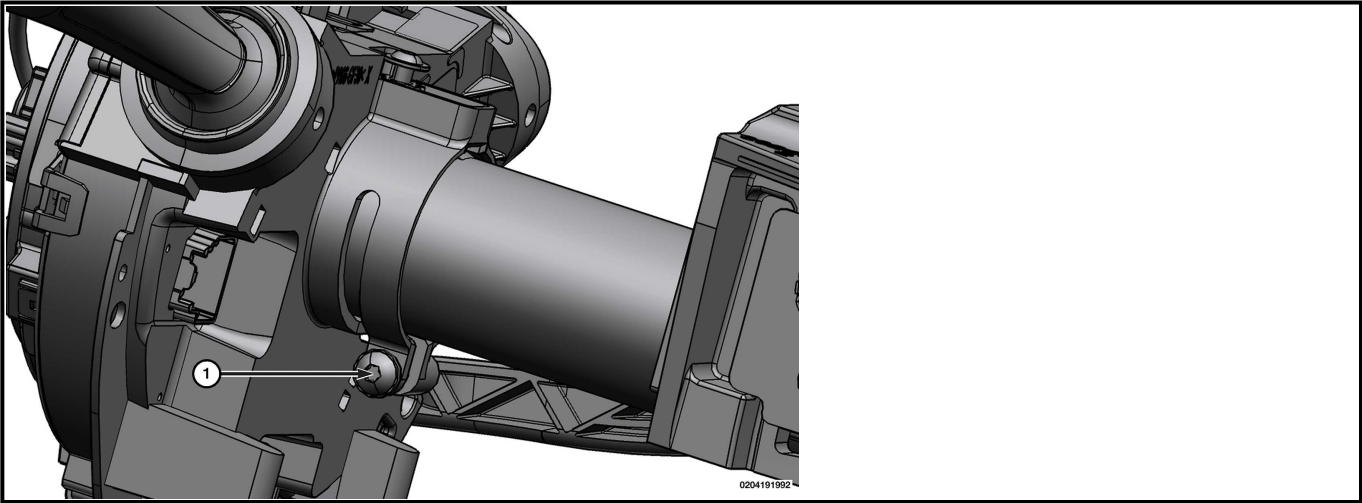
STEERING COLUMN



CalloUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Wheel Nut	50 N. m (37 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Steering Column Nuts	27 N. m (20 Ft. Lbs.)	-
3	Bulkhead Bearing Bolt	9 N. m (7 Ft. Lbs.)	-
4	Intermediate Shaft Coupler Upper Pinch Bolts	34 N. m (25 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Intermediate Shaft Coupler Lower Pinch Bolts	55 N. m (41 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Electronic Steering Lock (ESL) Module Bolts	8 N. m (71 In. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Column Control Module (SCCM) Band Clamp Fastener	6 N. m (53 In. Lbs.)	-

BEARING, STEERING COLUMN INTERMEDIATE SHAFT

REMOVAL AND INSTALLATION

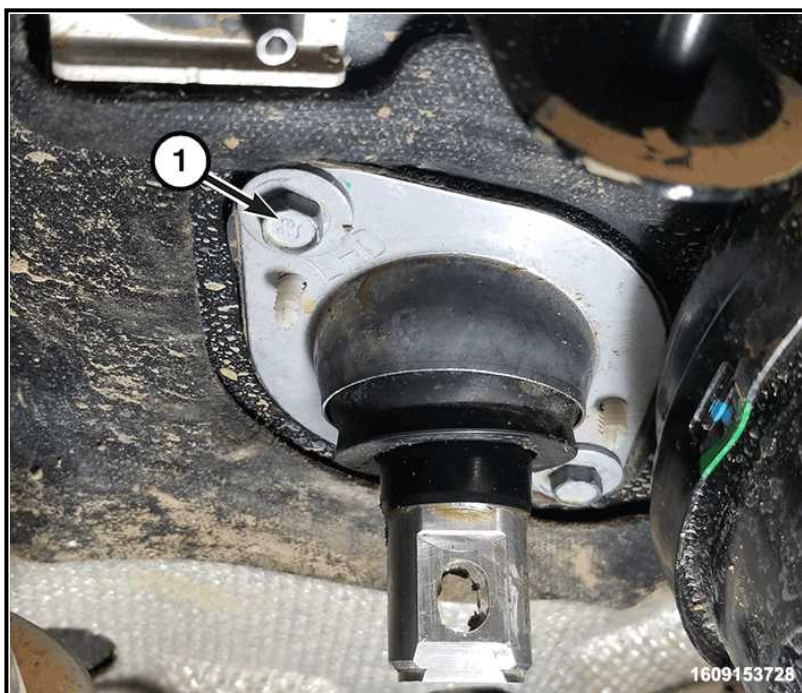
STEERING COLUMN INTERMEDIATE SHAFT BEARING

REMOVAL

CAUTION: Anytime the Steering Column Control Module (SCCM) is mounted on the steering column the steering shaft must be kept from turning or else SCCM damage will occur. Some vehicles do not have an internal lock mechanisms, so the steering column shaft must be preventing from rotating through use of a suitable tool.

LHD as shown in illustration, RHD similar.

1. Disconnect the intermediate shaft from the steering column shaft. Refer to **SHAFT, INTERMEDIATE, REMOVAL AND INSTALLATION.**



1 - Bulkhead Bearing Bolts

2. Remove the two intermediate shaft bulkhead bearing bolts and slide the steering column intermediate shaft bearing off of the upper steering column shaft.

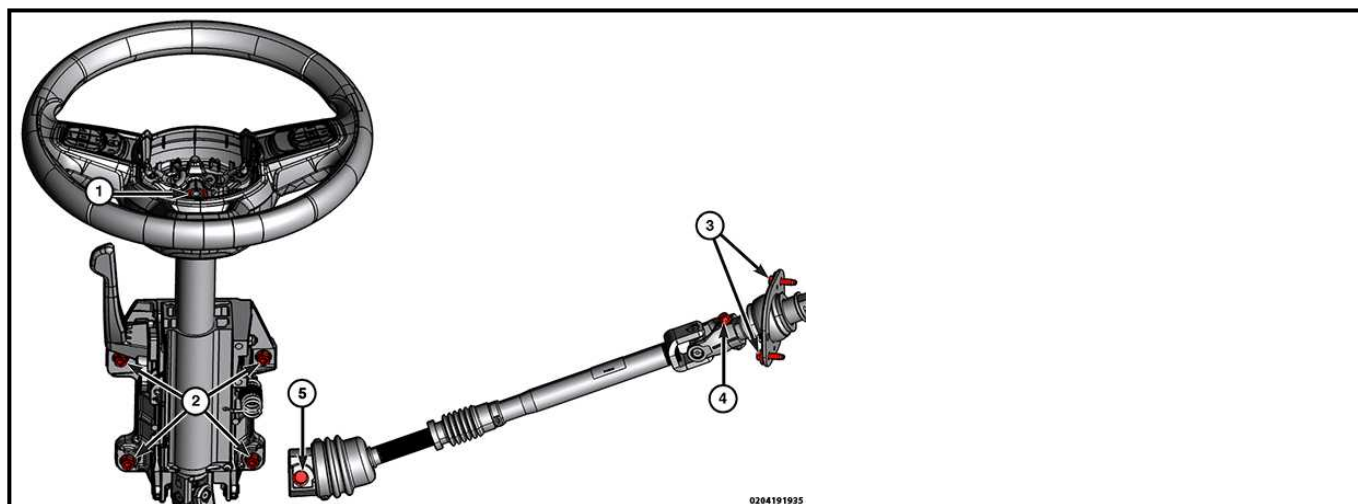
INSTALLATION

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.

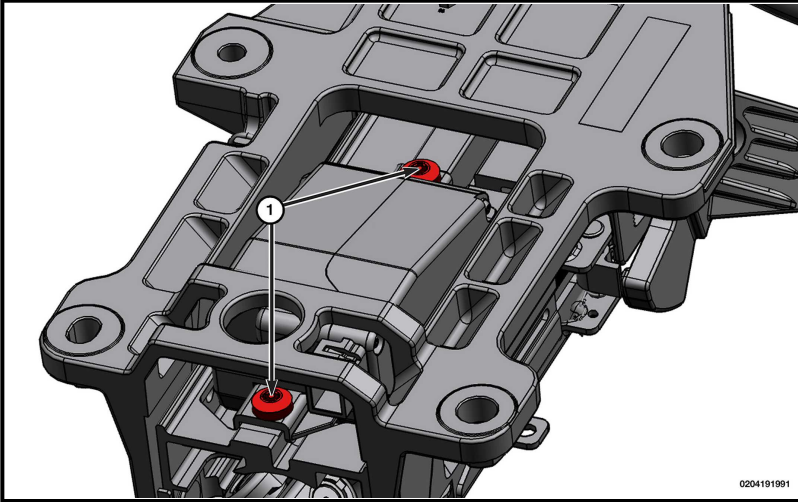
TORQUE SPECIFICATIONS

STEERING COLUMN

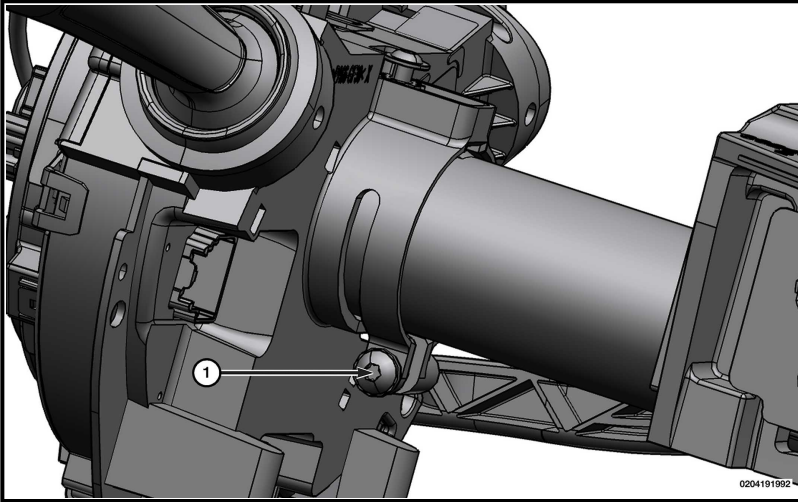


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Wheel Nut	50 N. m (37 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Steering Column Nuts	27 N. m (20 Ft. Lbs.)	-
3	Bulkhead Bearing Bolt	9 N. m (7 Ft. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
4	Intermediate Shaft Coupler Upper Pinch Bolts	34 N. m (25 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Intermediate Shaft Coupler Lower Pinch Bolts	55 N. m (41 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Electronic Steering Lock (ESL) Module Bolts	8 N. m (71 In. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Column Control Module (SCCM) Band Clamp Fastener	6 N. m (53 In. Lbs.)	-

SHAFT, INTERMEDIATE

REMOVAL AND INSTALLATION

INTERMEDIATE SHAFT

REMOVAL

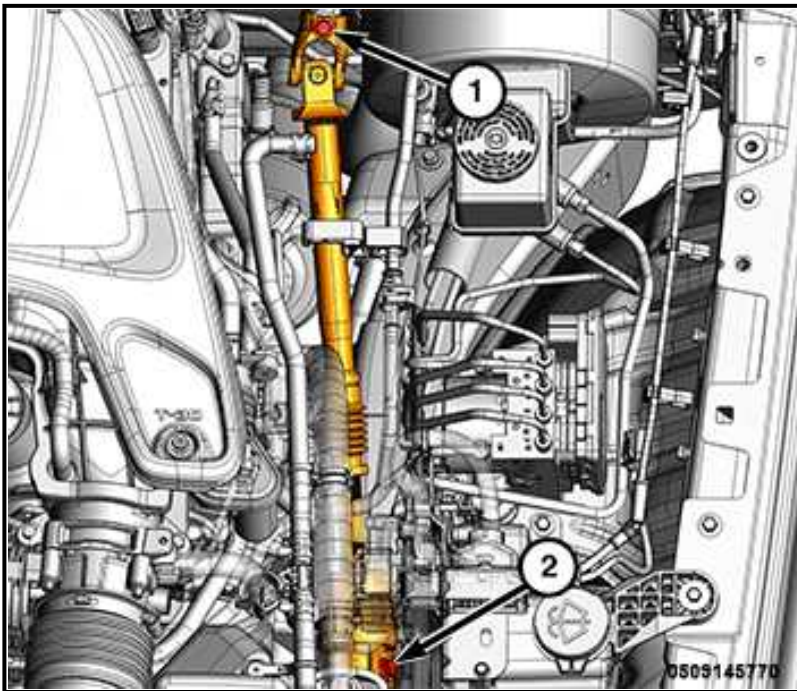
LHD as shown in illustration, RHD similar.

1. Secure the steering wheel with the tires in the **straight ahead position** .

NOTE: Some vehicles may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

CAUTION: Steering column module is centered to the vehicles steering system. Failure to keep the system and steering column module centered and locked/inhibited from rotating can result in steering column module damage.

2. Remove the pressurized coolant bottle and bracket as an assembly and position it aside. Refer to **BOTTLE, PRESSURIZED COOLANT, REMOVAL AND INSTALLATION BOTTLE, PRESSURIZED COOLANT, REMOVAL AND INSTALLATION** .



1 - Intermediate Shaft Coupler Upper Pinch Bolt
2 - Intermediate Shaft Coupler Lower Pinch Bolt

3. Remove and **DISCARD** the intermediate shaft coupler lower pinch bolt from the steering gear end of the shaft.
4. Slide the intermediate shaft coupler off of the steering gear.
5. Remove and **DISCARD** the intermediate shaft coupler upper pinch bolt from the steering column end of the shaft.
6. Slide the intermediate shaft coupler off of the steering column.
7. Remove the intermediate shaft.

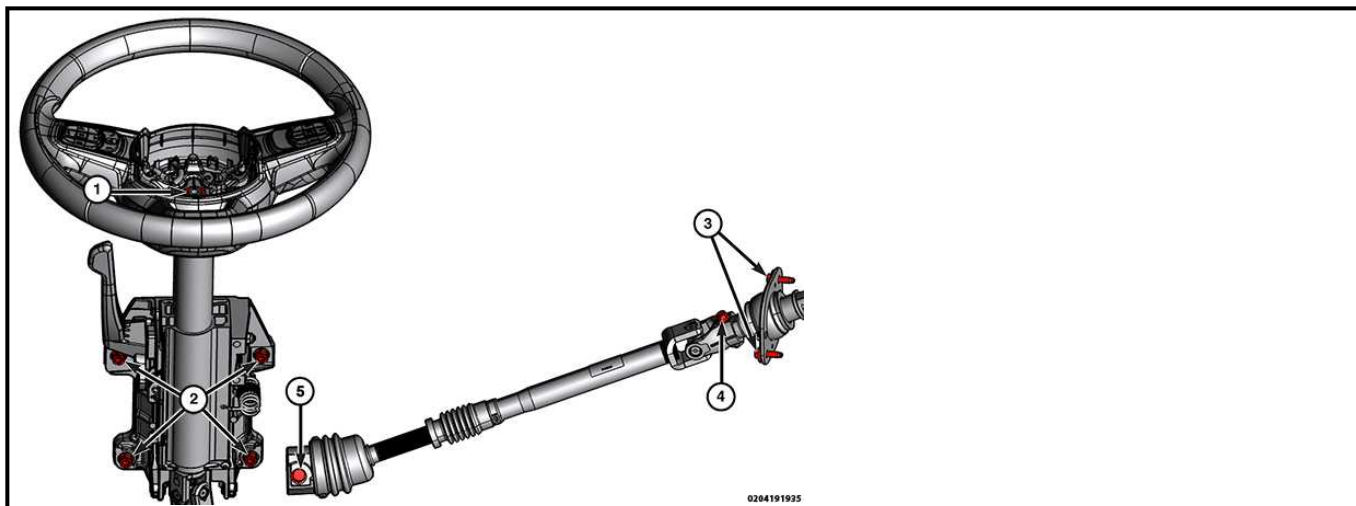
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

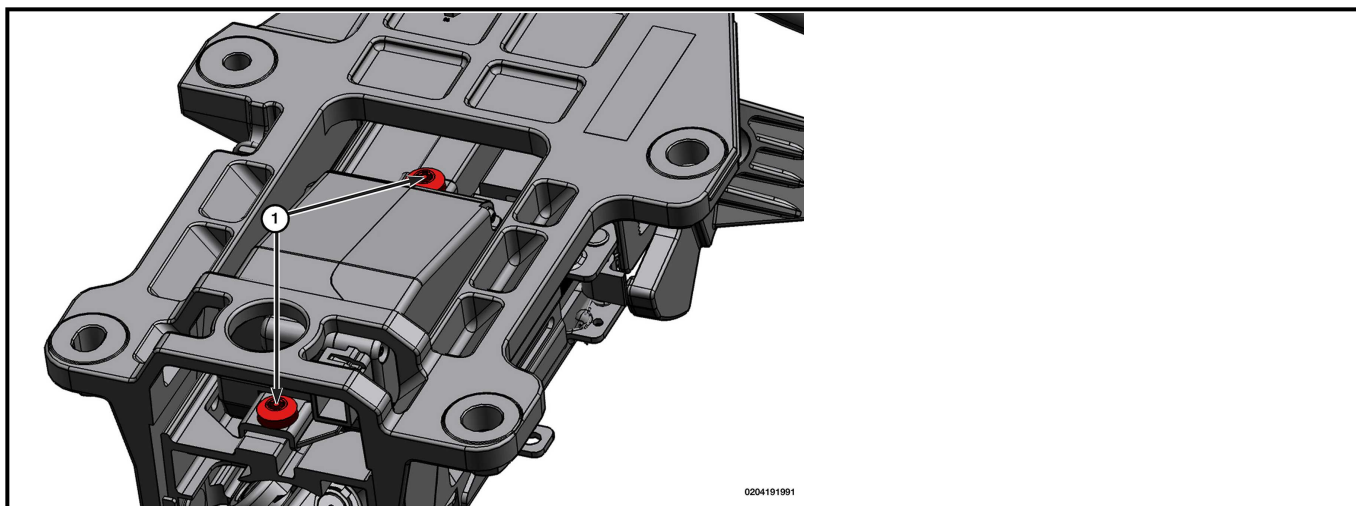
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

TORQUE SPECIFICATIONS

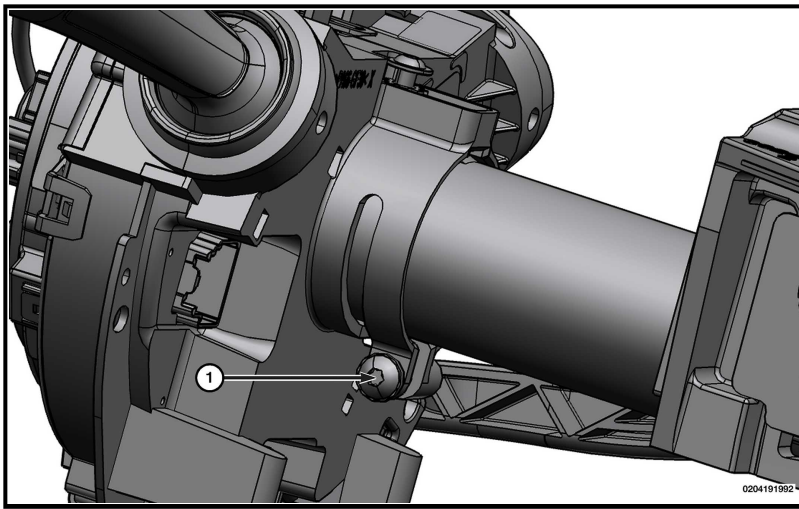
STEERING COLUMN



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Wheel Nut	50 N. m (37 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Steering Column Nuts	27 N. m (20 Ft. Lbs.)	-
3	Bulkhead Bearing Bolt	9 N. m (7 Ft. Lbs.)	-
4	Intermediate Shaft Coupler Upper Pinch Bolts	34 N. m (25 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Intermediate Shaft Coupler Lower Pinch Bolts	55 N. m (41 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Electronic Steering Lock (ESL) Module Bolts	8 N. m (71 In. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Column Control Module (SCCM) Band Clamp Fastener	6 N. m (53 In. Lbs.)	-

SHROUD, STEERING COLUMN

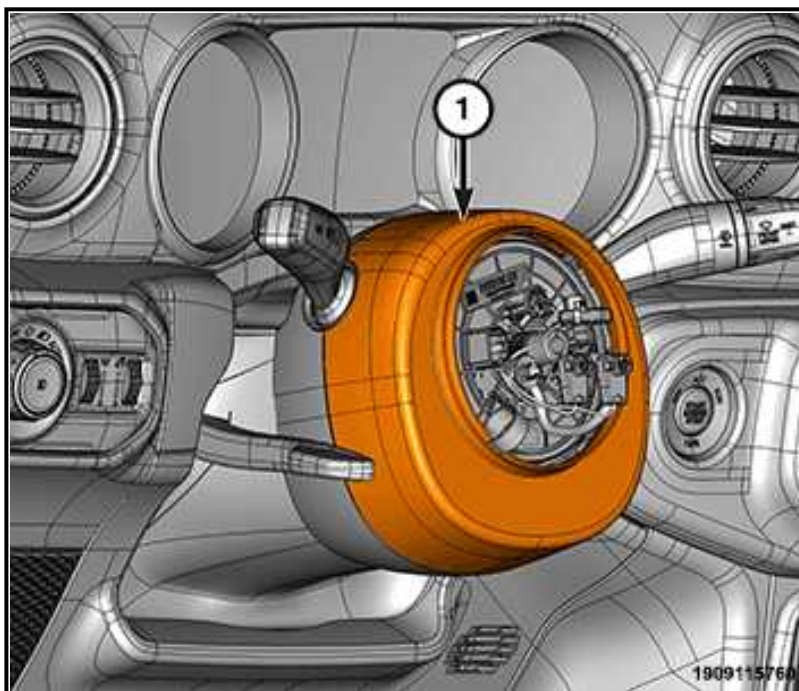
REMOVAL AND INSTALLATION

SHROUD

REMOVAL

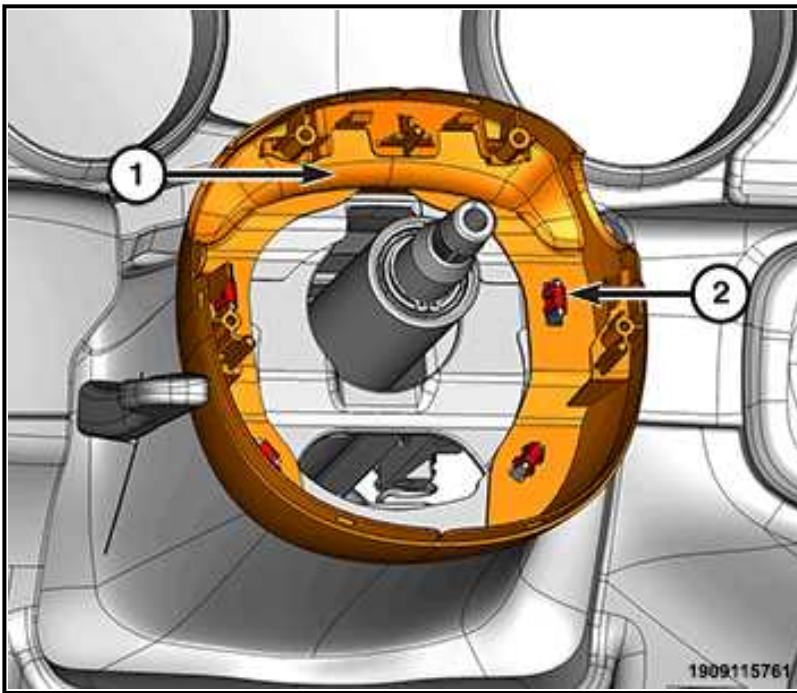
LHD as shown in illustration, RHD similar.

1. Remove the steering wheel. Refer to [WHEEL, STEERING, REMOVAL AND INSTALLATION](#).



1 - Outer Steering Column Shroud

2. Separate the outer steering column shroud from the inner steering column shroud and remove the outer steering column shroud.
3. Remove the steering column control module (SCCM). Refer to [MODULE, STEERING COLUMN CONTROL \(SCCM\), REMOVAL AND INSTALLATION](#).



1 - Inner Steering Column Shroud

4. Separate the inner steering column shroud from the steering column opening cover and remove the inner steering column shroud.

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.

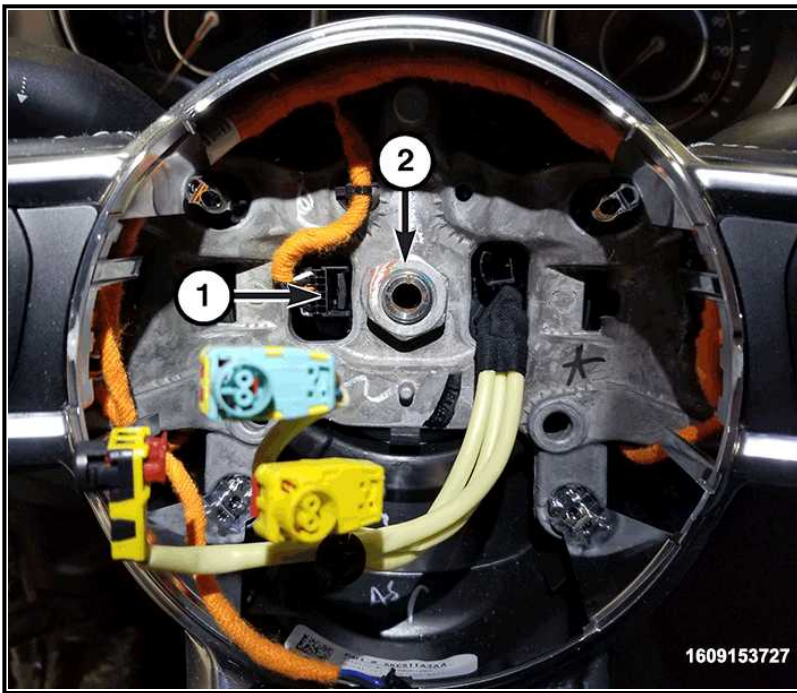
WHEEL, STEERING

REMOVAL AND INSTALLATION

STEERING WHEEL

REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the driver airbag. Refer to [AIR BAG, DRIVER, REMOVAL AND INSTALLATION](#) .



1 - Wire Harness Connectors
2 - Steering Wheel Nut

3. Remove and **DISCARD** the steering wheel nut.
4. Disconnect the wire harness connector(s).
5. Remove the steering wheel.
6. Remove the Electronic Vehicle Information System (EVIC) switches. Refer to [SWITCH, EVIC CONTROL, REMOVAL AND INSTALLATION](#) .

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

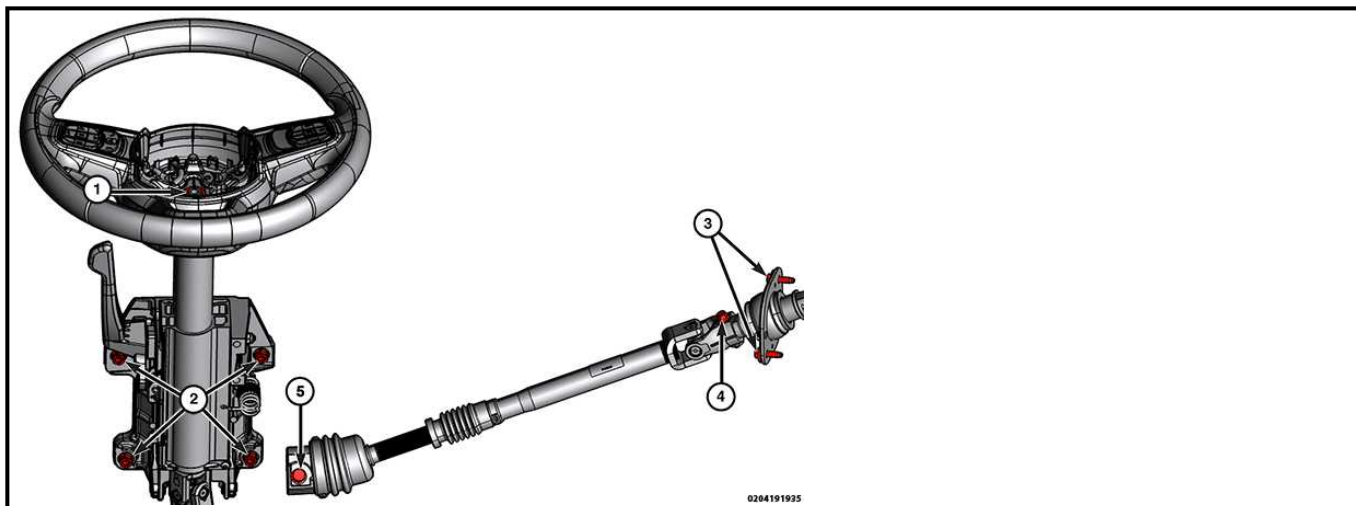
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

NOTE: Be certain that the steering wheel nut is tightened to the proper torque specification to ensure proper clockspring operation.

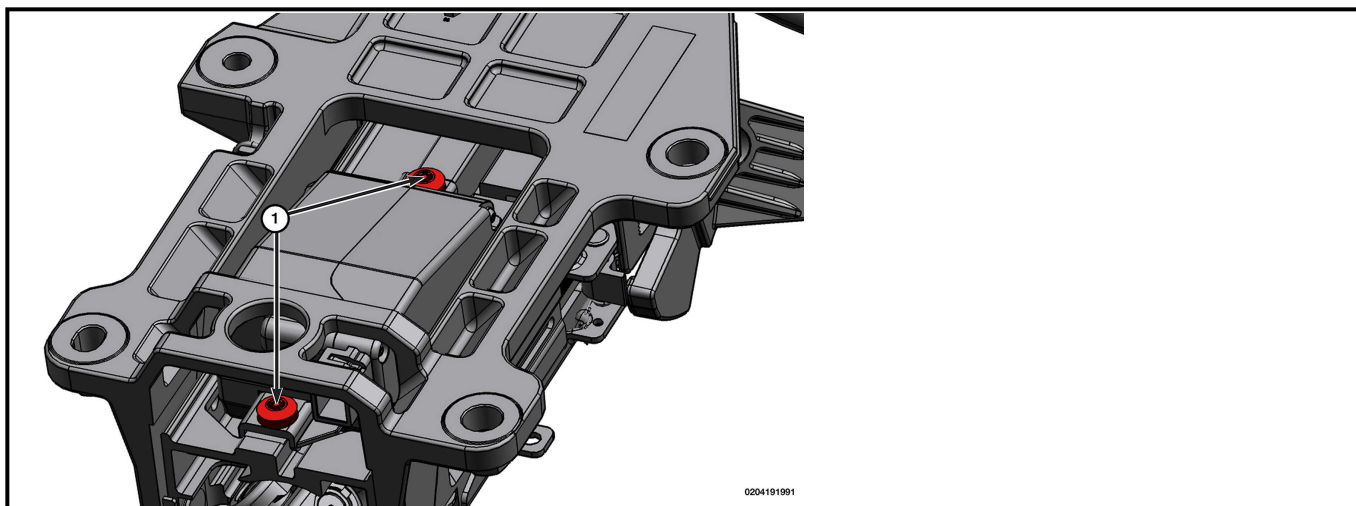
- Install a **NEW** steering wheel nut.

TORQUE SPECIFICATIONS

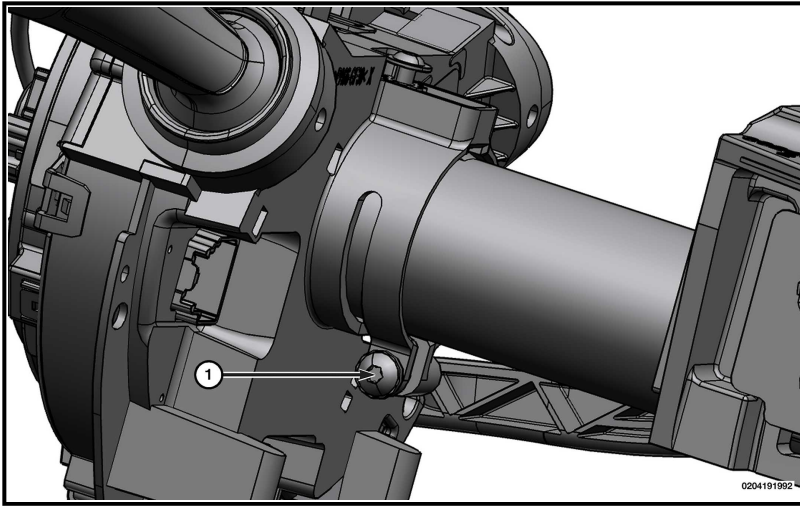
STEERING COLUMN



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Wheel Nut	50 N. m (37 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Steering Column Nuts	27 N. m (20 Ft. Lbs.)	-
3	Bulkhead Bearing Bolt	9 N. m (7 Ft. Lbs.)	-
4	Intermediate Shaft Coupler Upper Pinch Bolts	34 N. m (25 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Intermediate Shaft Coupler Lower Pinch Bolts	55 N. m (41 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Electronic Steering Lock (ESL) Module Bolts	8 N. m (71 In. Lbs.)	-

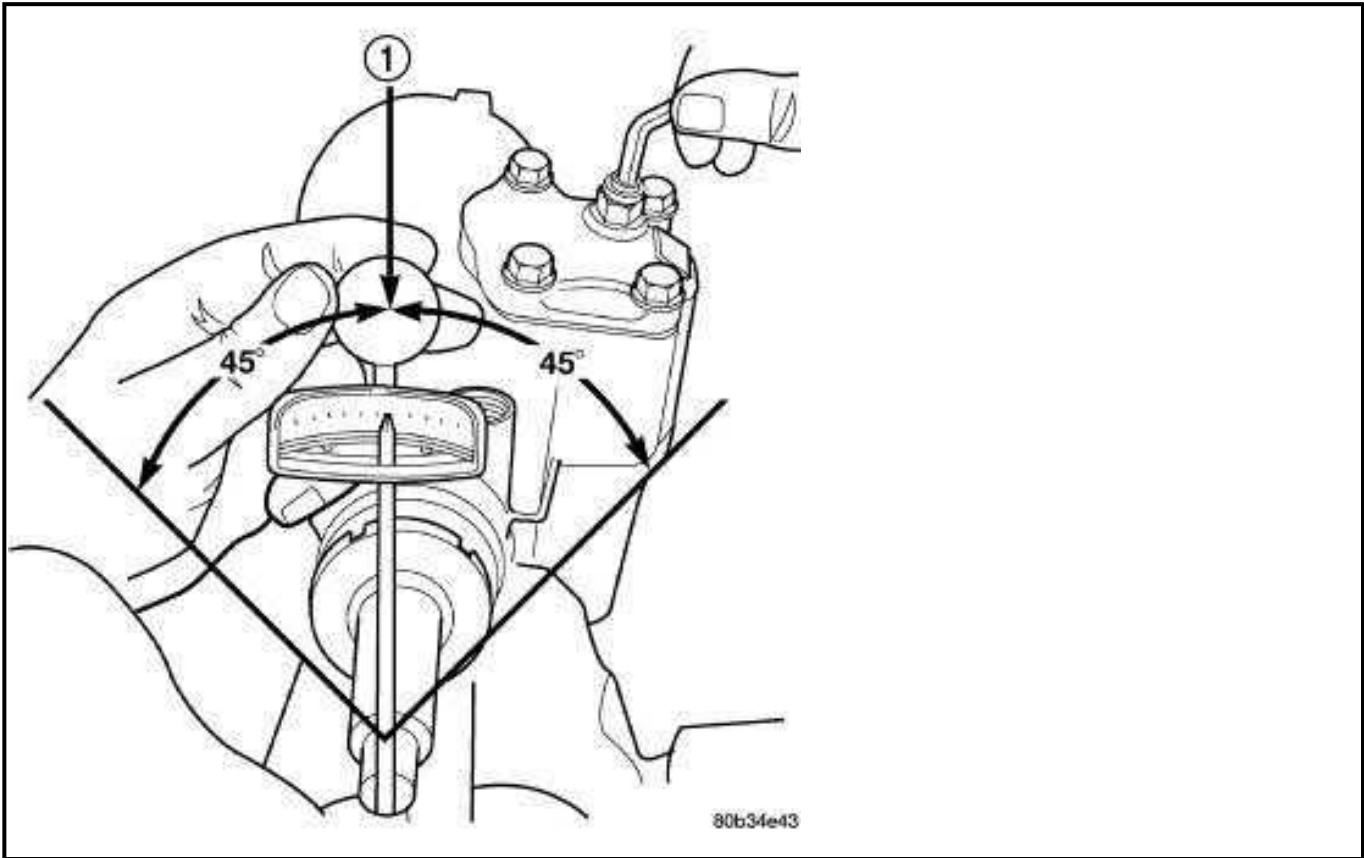


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Column Control Module (SCCM) Band Clamp Fastener	6 N. m (53 In. Lbs.)	-

GEAR

ADJUSTMENTS

CHECKING OVER-CENTER



1 - Center

1. Remove the steering gear. Refer to [GEAR, REMOVAL AND INSTALLATION](#).
2. Drain the fluid from the steering gear.

NOTE: Any fluid remaining in the gear provides some back pressure which will change your torque readings.

3. Rotate the input shaft with (special tool #8343, Wrench) from stop to stop and count the number of turns.
4. Center the input shaft by rotating it from the stop 1/2 of the total amount of turns.
5. Place a torque wrench and (special tool #8343, Wrench) in a vertical position on the input shaft. Rotate the wrench 45 degrees each side of the center and record the highest rotational torque in this range. This is the On-Center Rotating Torque.

NOTE: The input shaft must rotate smoothly without sticking or binding.

6. Rotate the input shaft between 90B° and 180B° to the left of center and record the left off-center preload. Repeat this to the right of center and record the right off-center preload. The average of these two recorded readings is the Off-Center Rotating Torque.
7. The On-Center Rotating Torque should be 0.15-0.65 N.m (1.3-5.8 in. lbs.) **higher** than the Off-Center Rotating Torque. Adjustment to the On-Center Rotating Torque is not possible. If lash or torque are out of specification, the gear must be replaced.

TECHNICAL SPECIFICATIONS

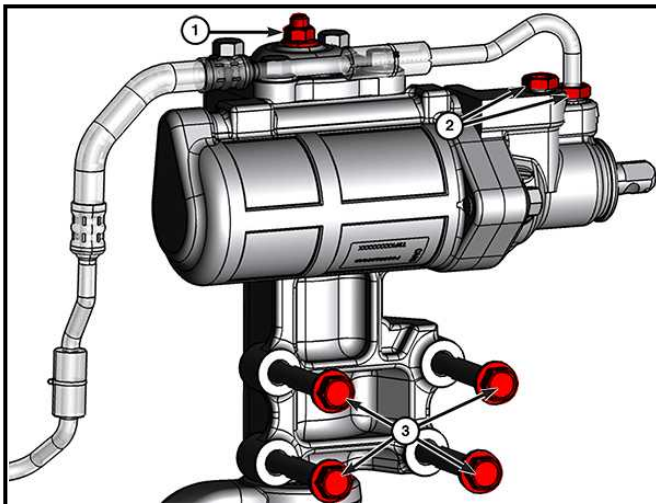
SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Steering Gear Type	Recirculating Ball
Steering Gear Overall Ratio	14:1 LWB or 16:1 SWB

TORQUE SPECIFICATION

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.	Comments
Pitman Shaft Overcenter Drag	0.45-0.80 + Worm Shaft Preload	-	4-7 + Worm Shaft Preload	B

TORQUE SPECIFICATION



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Adjuster Screw Lock Nut	45 N. m (33 Ft. Lbs.)	-
2	Steering Gear Fluid Line Nut	28 N. m (21 Ft. Lbs.)	-
3	Steering Gear Bolts (Long, Alloy Gear)	60 N. m + 170B° (44 Ft. Lbs. + 170B°)	Apply threadlocker to the steering gear bolts.
3	Steering Gear Bolts (Short, Alloy Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
3	Steering Gear Bolts (Iron Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.

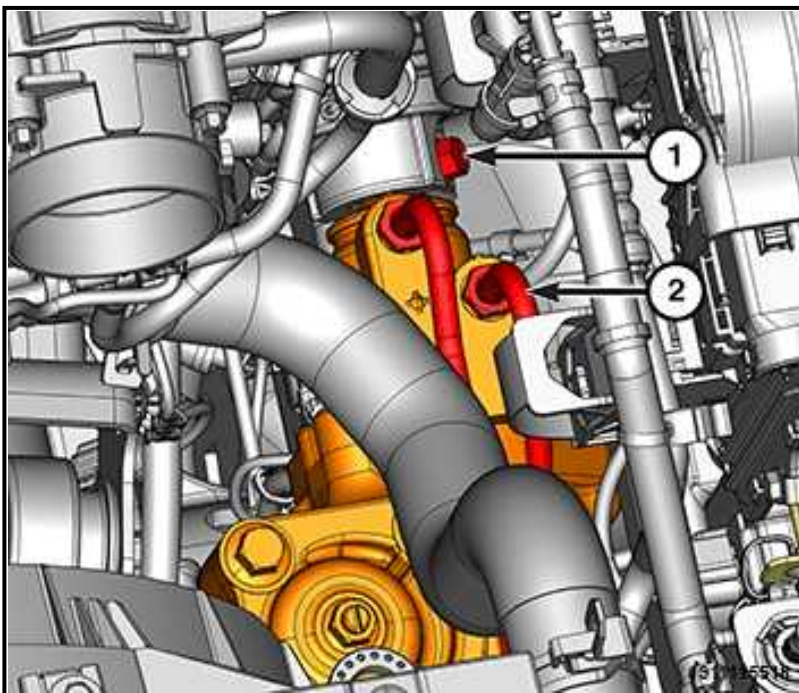
REMOVAL AND INSTALLATION

LEFT HAND DRIVE

REMOVAL

NOTE: The steering column on some vehicles may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service should be used.

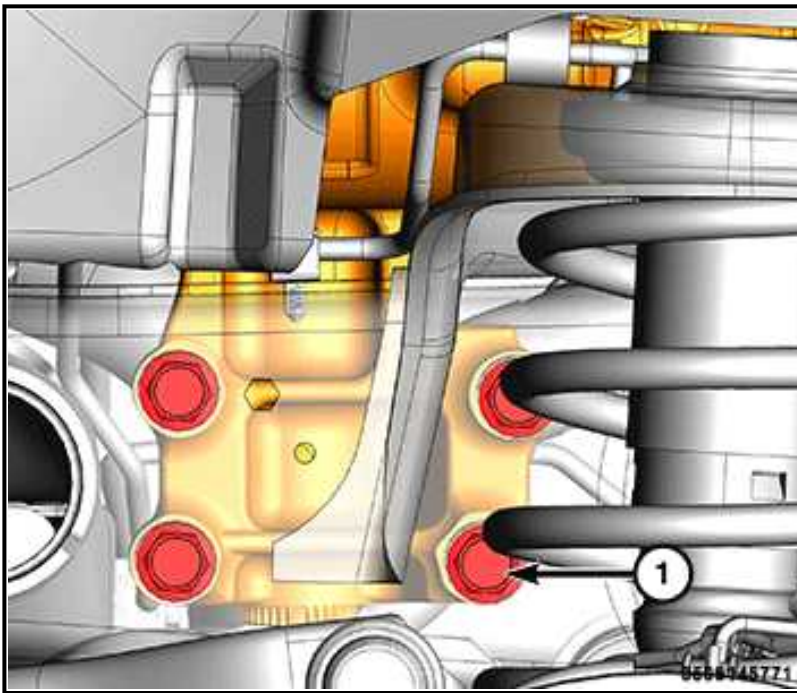
1. Place the front wheels in the straight ahead position with the steering wheel centered and secured.
2. Remove the air cleaner body. Refer to [RESONATOR, AIR CLEANER, REMOVAL AND INSTALLATION](#) .



1 - Shaft Nut

2 - Power Steering Lines

3. Remove the two power steering lines from the steering gear.
4. Disconnect the intermediate shaft from the steering gear. Refer to [SHAFT, INTERMEDIATE, REMOVAL AND INSTALLATION](#) .
5. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
6. Disconnect the pitman arm from the steering gear. Refer to [ARM, PITMAN, REMOVAL AND INSTALLATION](#) .



1 - Steering Gear Bolts

7. Remove the four steering gear bolts.
8. Remove the steering gear.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

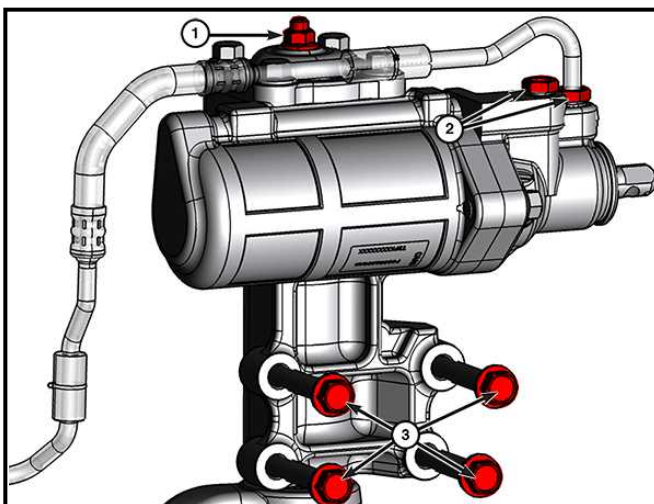
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

NOTE: The two long bolts go to the front and the two shorter bolts go to the rear.

- Apply threadlocker to the steering gear bolts.
- Perform the wheel alignment procedure. Refer to [WHEEL ALIGNMENT, STANDARD PROCEDURE](#).

TORQUE SPECIFICATIONS

STEERING GEAR



0204191942

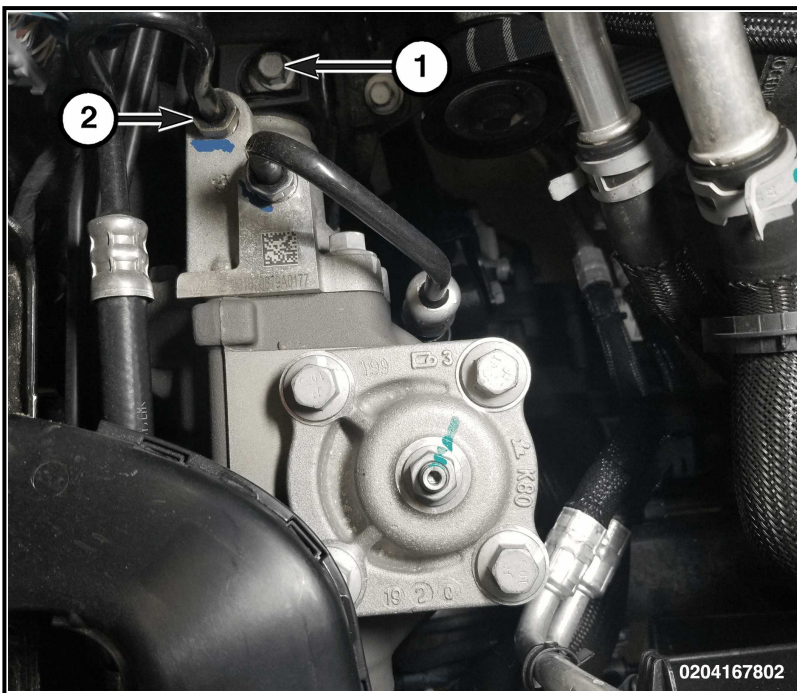
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Adjuster Screw Lock Nut	45 N. m (33 Ft. Lbs.)	-
2	Steering Gear Fluid Line Nut	28 N. m (21 Ft. Lbs.)	-
3	Steering Gear Bolts (Long, Alloy Gear)	60 N. m + 170B° (44 Ft. Lbs. + 170B°)	Apply threadlocker to the steering gear bolts.
3	Steering Gear Bolts (Short, Alloy Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.
3	Steering Gear Bolts (Iron Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.

RIGHT HAND DRIVE

REMOVAL

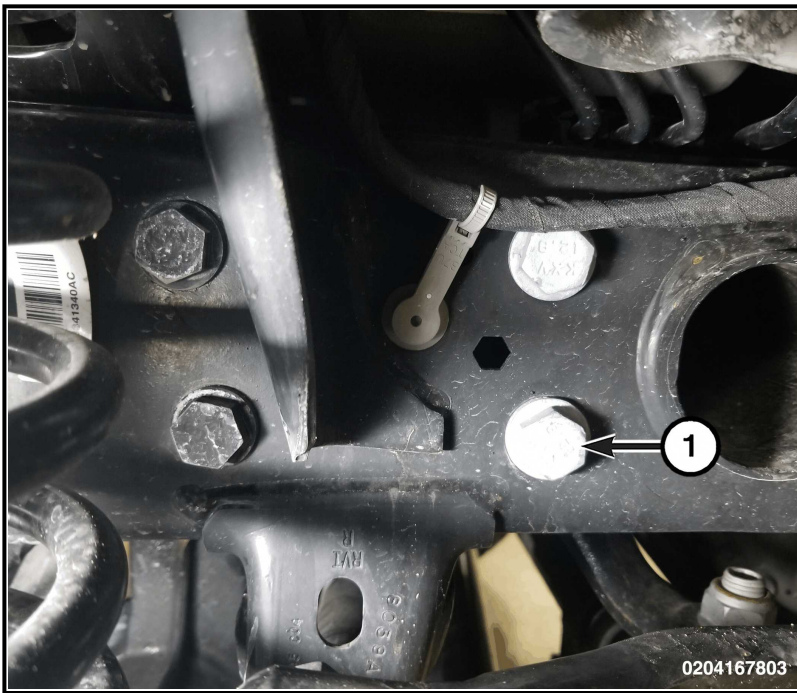
NOTE: The steering column on some vehicles may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service should be used.

1. Place the front wheels in the straight ahead position with the steering wheel centered and secured.
2. Remove the air cleaner body. Refer to [RESONATOR, AIR CLEANER, REMOVAL AND INSTALLATION](#) .



1 - Power Steering Lines
1 - Intermediate Shaft Coupler Pinch Bolt

3. Remove the two power steering lines from the steering gear.
4. Disconnect the intermediate shaft from the steering gear. Refer to [SHAFT, INTERMEDIATE, REMOVAL AND INSTALLATION](#).
5. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
6. Disconnect the pitman arm from the steering gear. Refer to [ARM, PITMAN, REMOVAL AND INSTALLATION](#).



1 - Steering Gear Bolts

7. Remove the four steering gear bolts.
8. Remove the steering gear.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

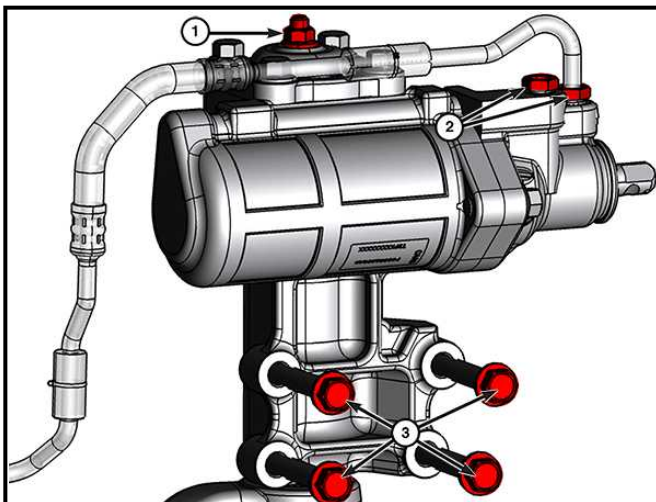
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

NOTE: The two long bolts go to the front and the two shorter bolts go to the rear.

- Apply threadlocker to the steering gear bolts.
- Perform the wheel alignment procedure. Refer to [WHEEL ALIGNMENT, STANDARD PROCEDURE](#).

TORQUE SPECIFICATIONS

STEERING GEAR



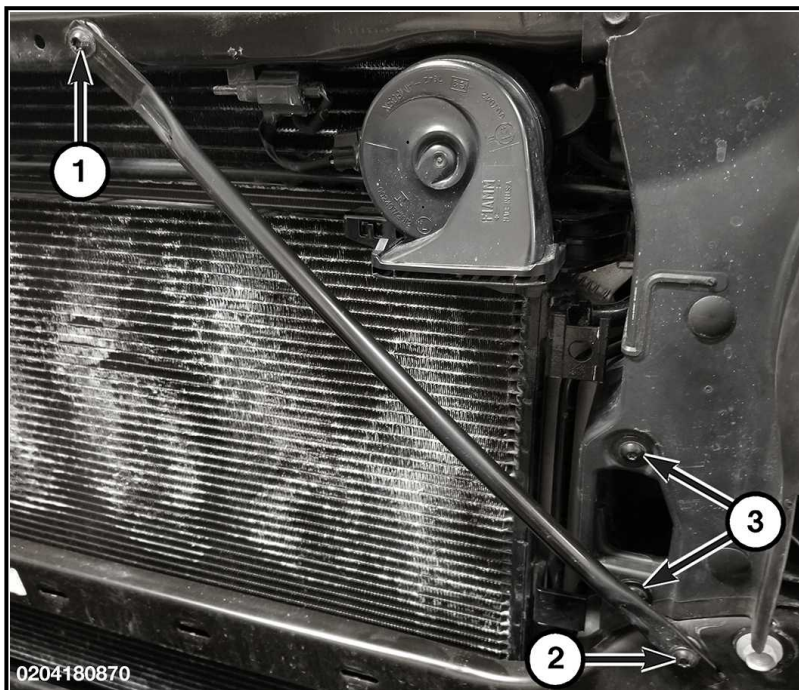
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Adjuster Screw Lock Nut	45 N. m (33 Ft. Lbs.)	-
2	Steering Gear Fluid Line Nut	28 N. m (21 Ft. Lbs.)	-
3	Steering Gear Bolts (Long, Alloy Gear)	60 N. m + 170B° (44 Ft. Lbs. + 170B°)	Apply threadlocker to the steering gear bolts.
3	Steering Gear Bolts (Short, Alloy Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.
3	Steering Gear Bolts (Iron Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.

3.0L

REMOVAL

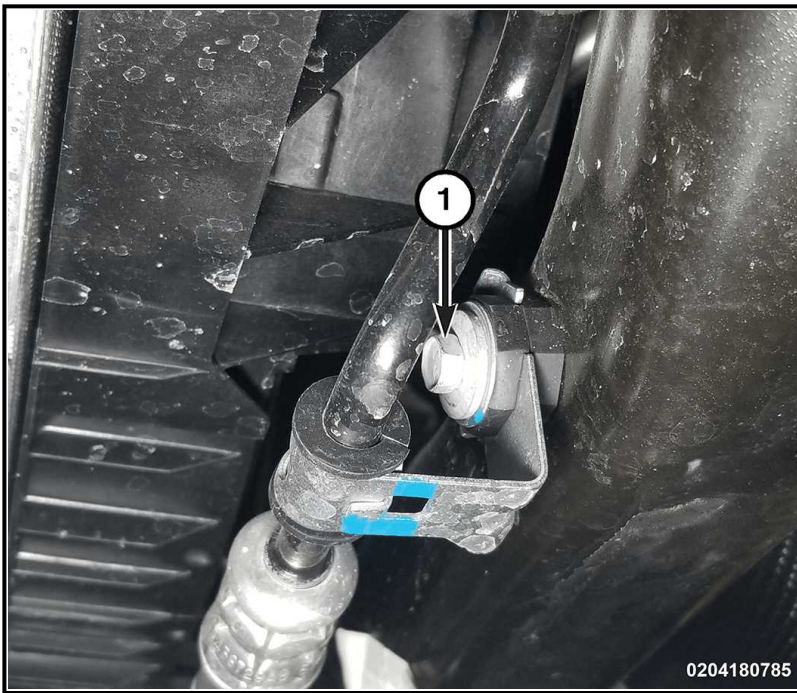
NOTE: The steering column on some vehicles may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service should be used.

1. Place the front wheels in the **straight ahead position** with the steering wheel centered and secured.
2. Remove the air cleaner body. Refer to [RESONATOR, AIR CLEANER, REMOVAL AND INSTALLATION](#) .
3. Remove the left front wheelhouse splash shield. Refer to [SHIELD, SPLASH, FRONT WHEELHOUSE, REMOVAL AND INSTALLATION](#) .
4. Remove the grille. Refer to [GRILLE, REMOVAL AND INSTALLATION](#) .



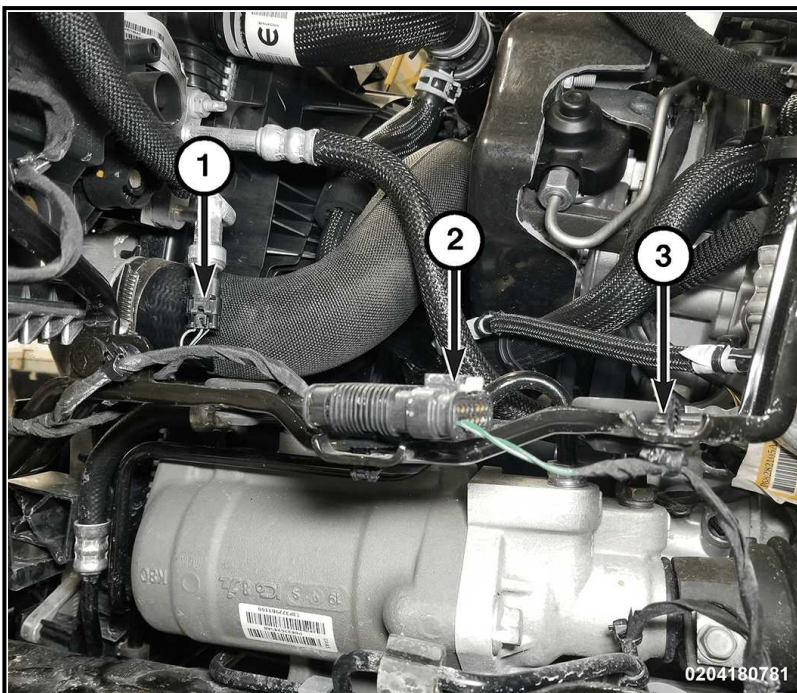
1 - Radiator Crossmember Brace Bolts
2 - Radiator Crossmember Brace Bolts
3 - Air Duct Bolts

5. Remove the radiator crossmember brace bolts and remove the brace.
6. Remove the air duct bolts and remove the duct.



1 - Power Steering Hose Routing Bracket Bolt
--

7. Remove the power steering hose routing bracket bolt.



1 - Pressure Sensor Wire Harness Connector
--

2 - Wire Harness Connector

3 - Wire Harness Routing Clip

8. Disconnect the pressure sensor wire harness connector.

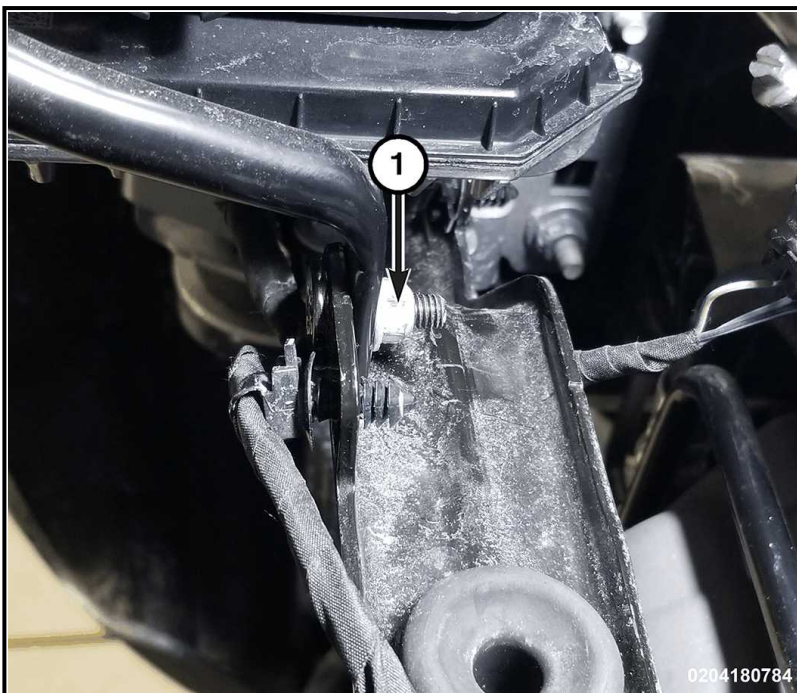
9. Disconnect the wire harness connector.

10. Disengage the wire harness routing clip.



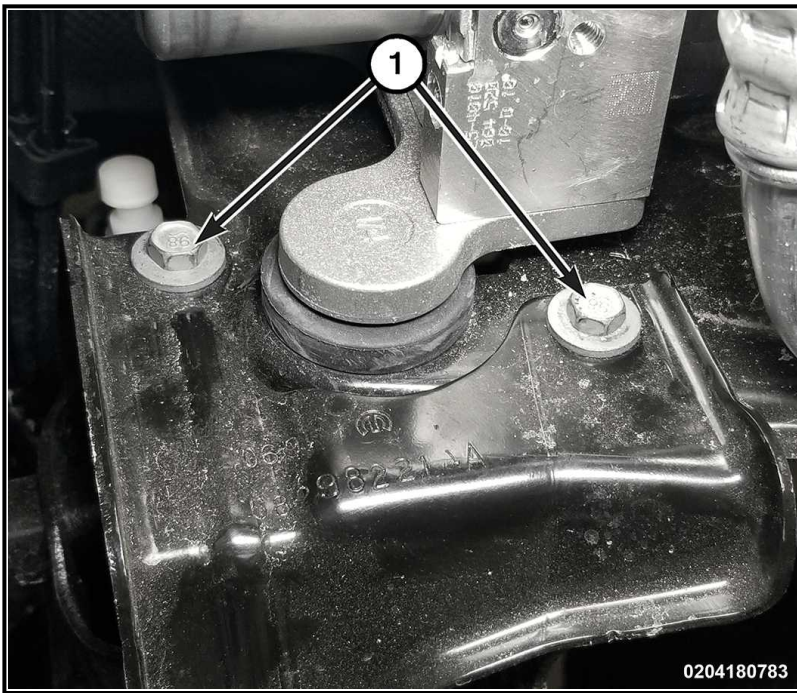
1 - Air Cleaner Bracket Bolt

11. Remove the air cleaner bracket bolt.



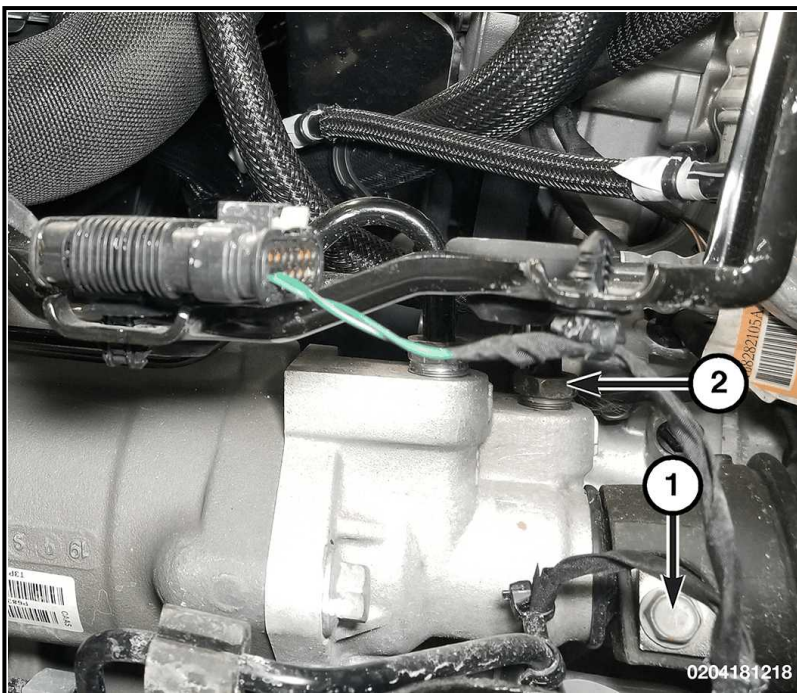
1 - Air Cleaner Bracket Nut

12. Remove the air cleaner bracket nut.



1 - Air Cleaner Bracket Bolts

13. Remove the air cleaner bracket bolts and position the bracket aside.



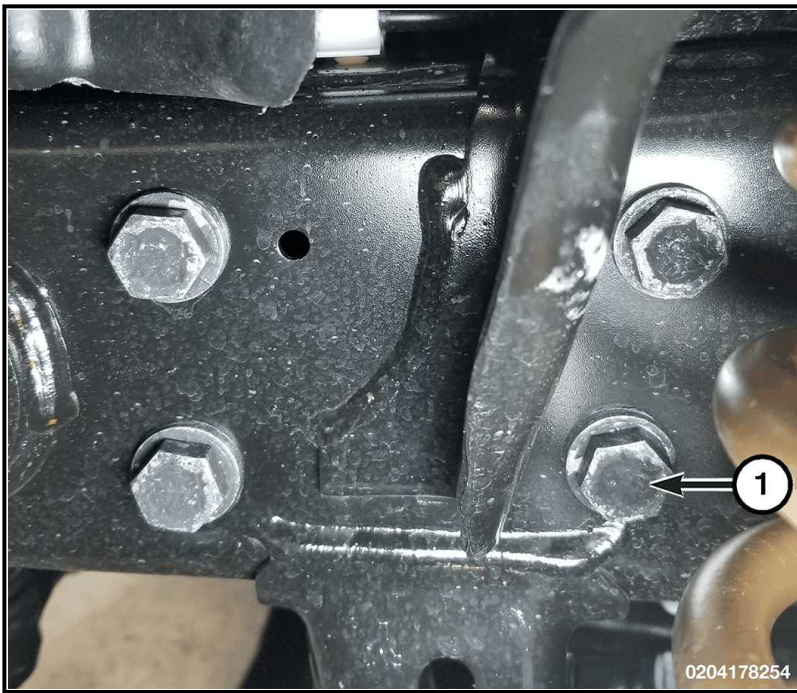
1 - Power Steering Lines

1 - Intermediate Shaft Coupler Pinch Bolt

14. Remove the two power steering lines from the steering gear.

15. Remove and **DISCARD** the intermediate shaft coupler pinch bolt, then disconnect the intermediate shaft from the steering gear.

16. Disconnect the pitman arm from the steering gear. Refer to [ARM, PITMAN, REMOVAL AND INSTALLATION](#).



1 - Steering Gear Bolts

17. Remove the four steering gear bolts.
18. Remove the steering gear.

INSTALLATION

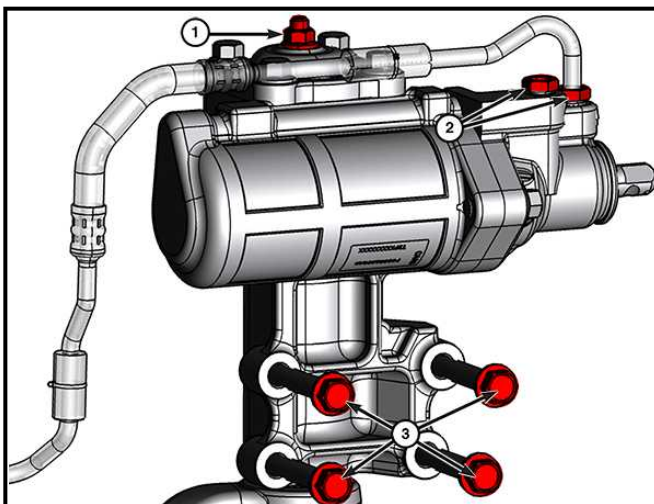
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Apply threadlocker to the steering gear bolts.
- Install a **NEW** intermediate shaft coupler lower pinch bolt.
- Fill the power steering system to the proper level. Refer to [**STANDARD PROCEDURE**](#).
- Perform the wheel alignment procedure. Refer to [**WHEEL ALIGNMENT, STANDARD PROCEDURE**](#).

TORQUE SPECIFICATIONS

STEERING GEAR

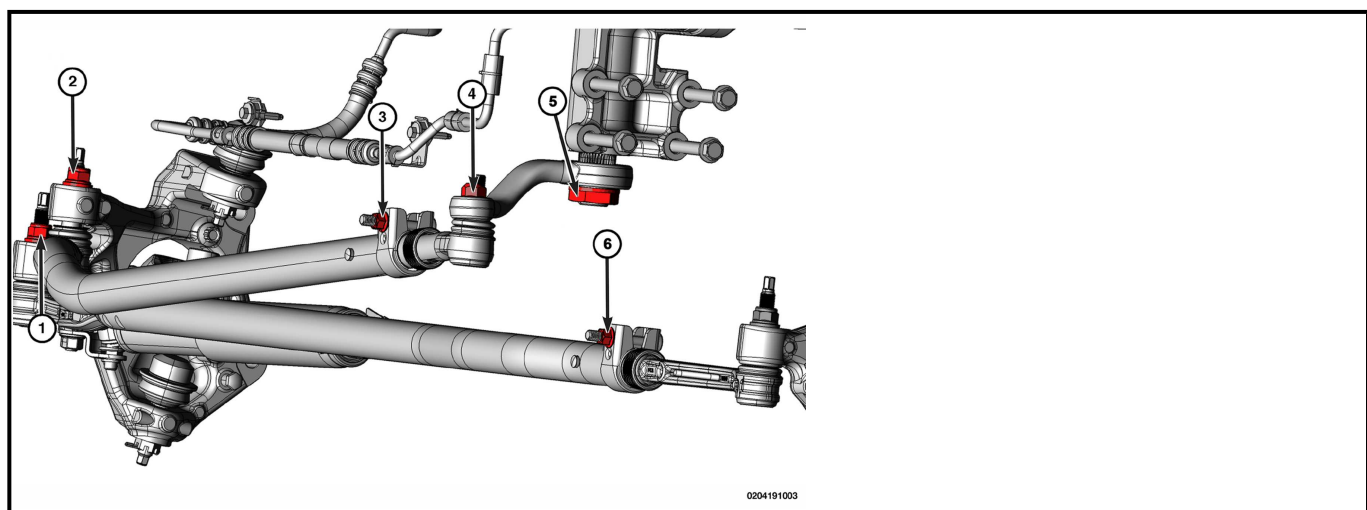


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Adjuster Screw Lock Nut	45 N. m (33 Ft. Lbs.)	-
2	Steering Gear Fluid Line Nut	28 N. m (21 Ft. Lbs.)	-
3	Steering Gear Bolts (Long, Alloy Gear)	60 N. m + 170B° (44 Ft. Lbs. + 170B°)	Apply threadlocker to the steering gear bolts.
3	Steering Gear Bolts (Short, Alloy Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.
3	Steering Gear Bolts (Iron Gear)	60 N. m + 135B° (44 Ft. Lbs. + 135B°)	Apply threadlocker to the steering gear bolts.

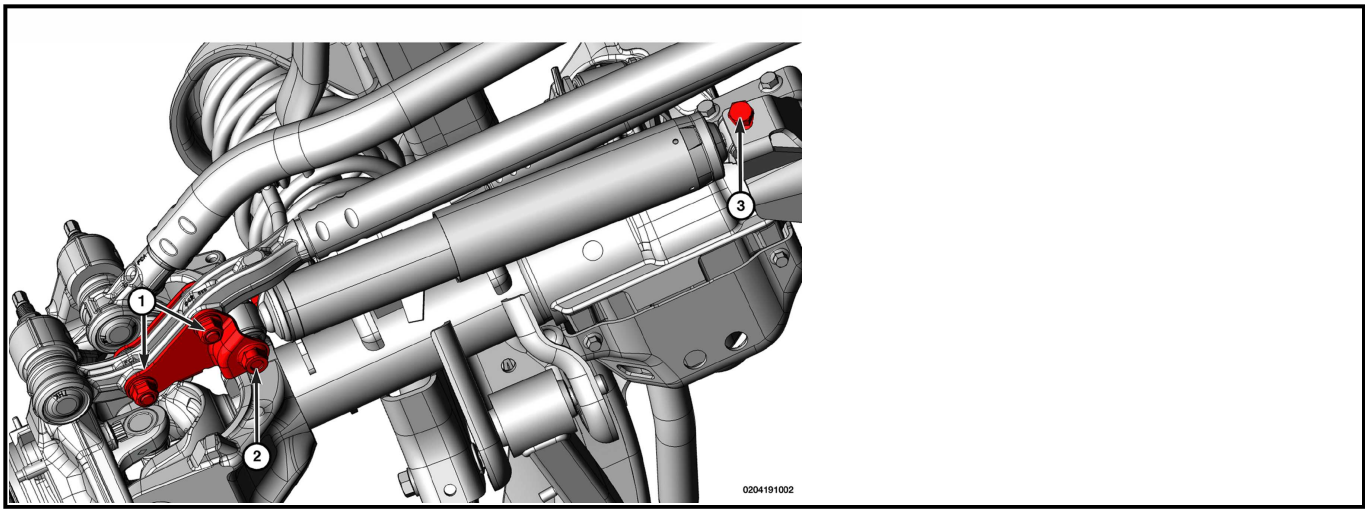
LINKAGE

TECHNICAL SPECIFICATIONS

TORQUE SPECIFICATION



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Tie Rod End Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Drag Link Outer Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
3	Drag Link Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-
4	Drag Link Inner Nut	39 N. m + 125B° (29 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Pitman Arm Nut	250 N. m (185 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
6	Tie Rod End Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Damper Bracket Nut	75 N. m (55 Ft. Lbs.)	-
2	Steering Damper Nut	75 N. m (55 Ft. Lbs.)	-
3	Steering Damper Bolt	68 N. m (50 Ft. Lbs.)	-

ARM, PITMAN

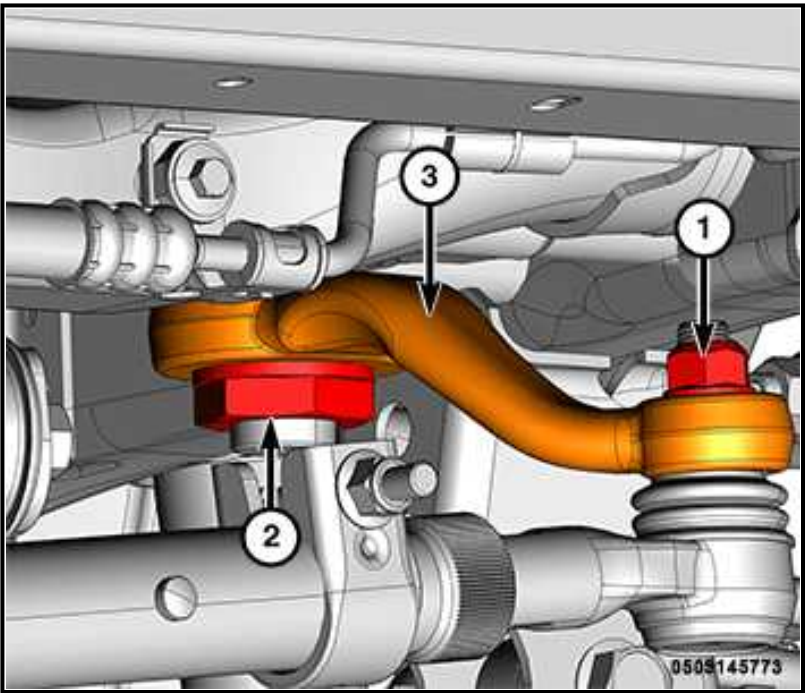
REMOVAL AND INSTALLATION

PITMAN ARM

REMOVAL

NOTE: LHD as shown in illustration, RHD similar.

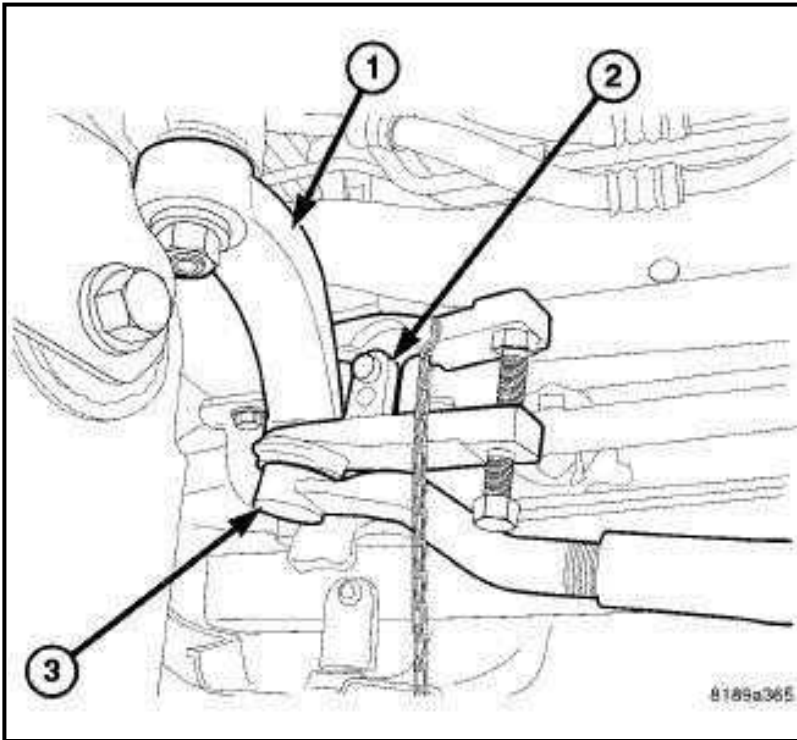
1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Disconnect the track bar from the frame. Refer to [TRACK BAR, FRONT, REMOVAL AND INSTALLATION](#) .



1 - Drag Link Inner Nut
2 - Pitman Arm Nut

NOTE: Hold the end of the ball stud with a suitable tool while removing or installing the nuts to prevent damage to the tie rod.

3. Remove the drag link inner nut.

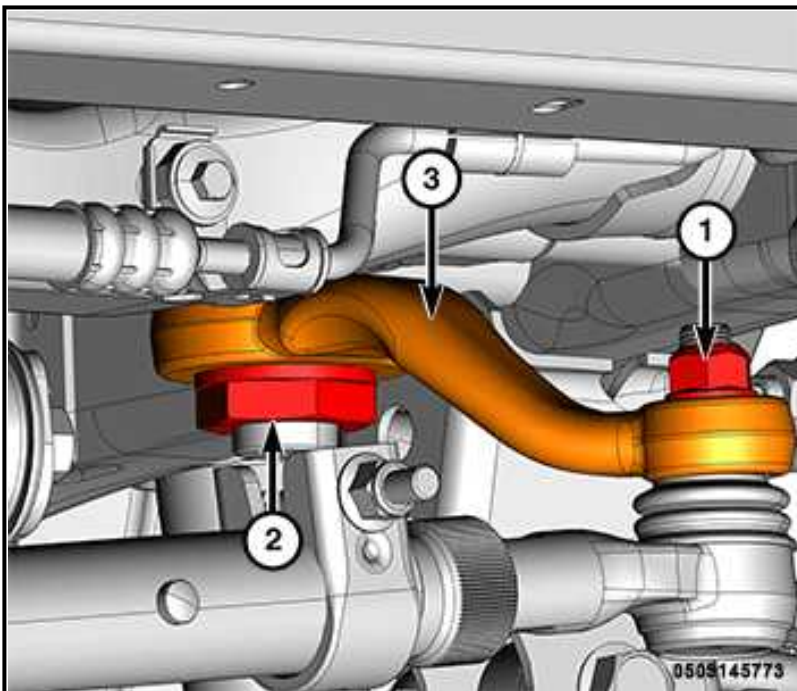


1 - Pitman Arm

2 - Remover, Ball Joint 9360

3 - Drag Link

4. Using the Ball Joint Remover (special tool #9360, Remover, Ball Joint) or equivalent, separate the drag link from the pitman arm.

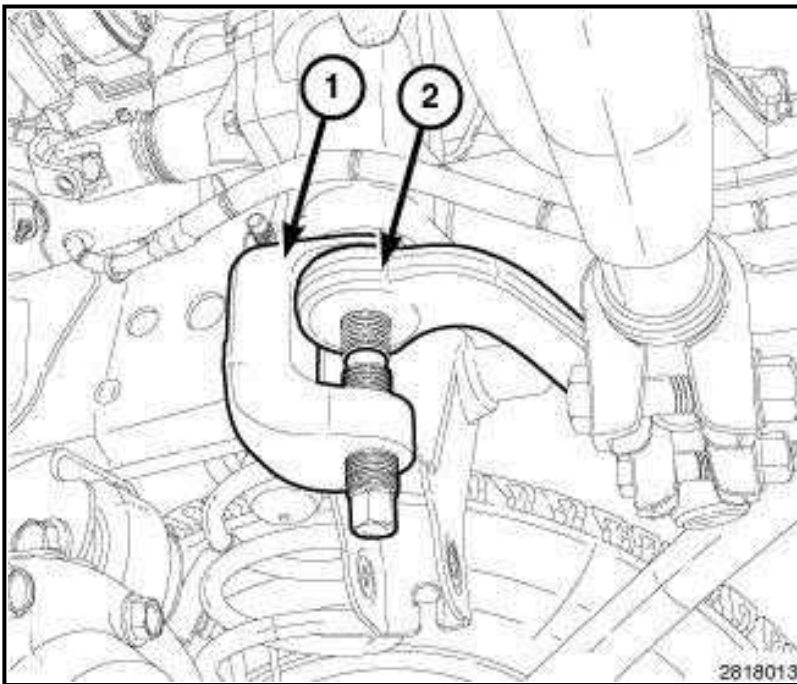


1 - Drag Link Inner Nut

2 - Pitman Arm Nut

3 - Pitman Arm

5. Mark the steering gear shaft and pitman arm for installation reference.
6. Remove and **DISCARD** the pitman arm nut.



1 - Remover, Pitman Arm 9615A

2 - Pitman Arm

7. Using (special tool #9615A, Remover, Pitman Arm) or equivalent, remove the pitman arm from the steering gear.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

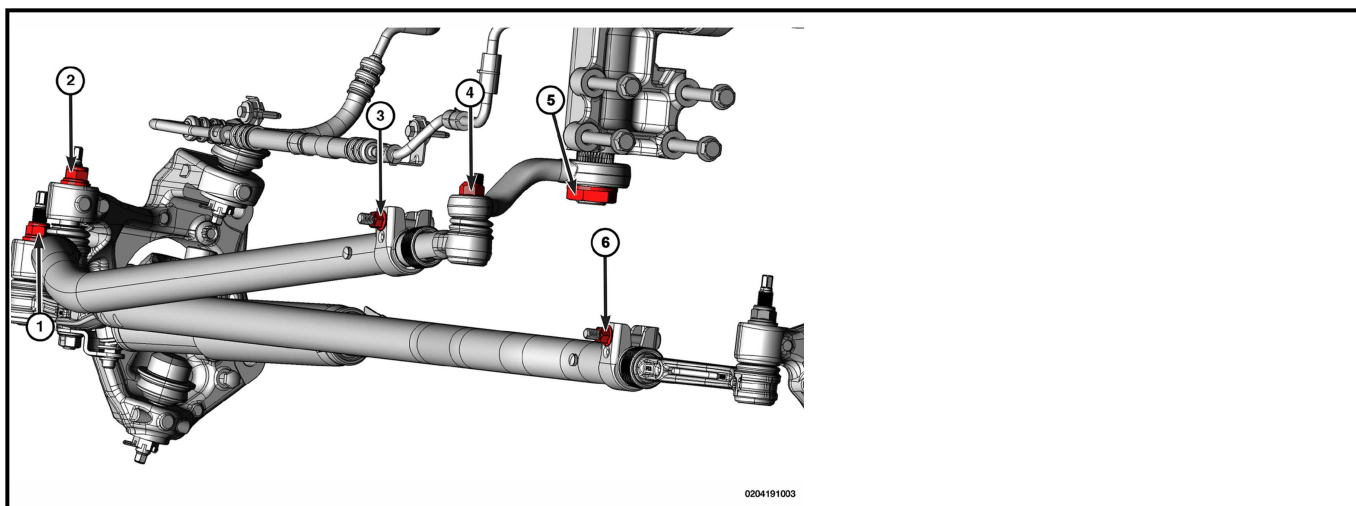
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

NOTE: Hold the end of the drag link ball stud with a suitable tool while removing or installing the nuts to prevent damage to the tie rod.

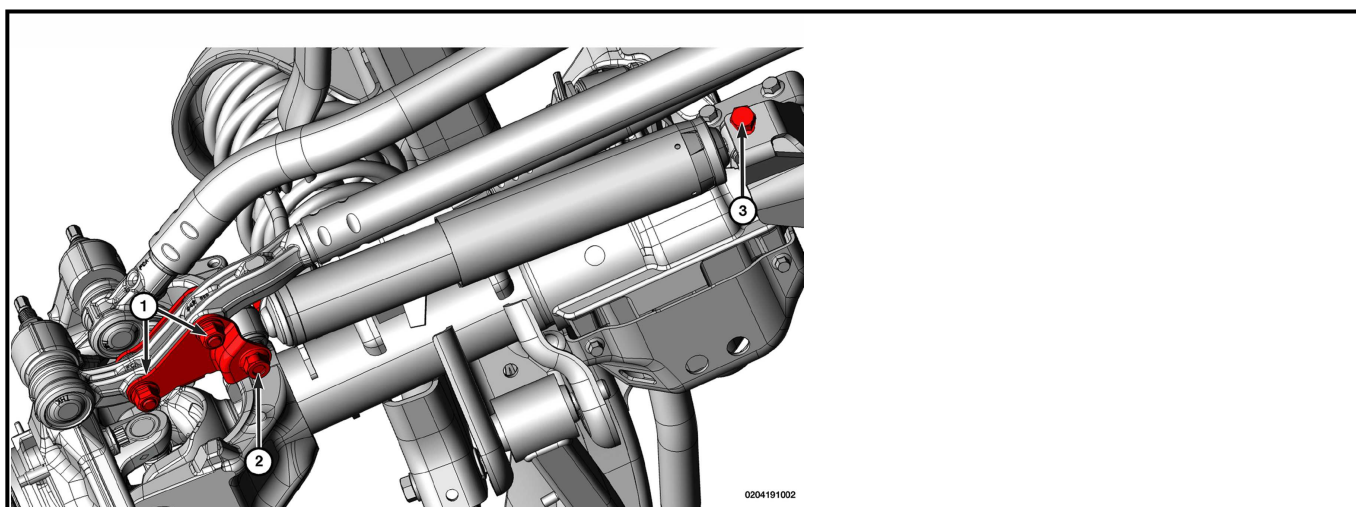
- Install a **NEW** pitman arm nut with washer.
- Perform the toe set procedure. Refer to [WHEEL ALIGNMENT, STANDARD PROCEDURE](#) .

TORQUE SPECIFICATIONS

LINKAGE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Tie Rod End Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Drag Link Outer Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
3	Drag Link Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-
4	Drag Link Inner Nut	39 N. m + 125B° (29 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Pitman Arm Nut	250 N. m (185 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
6	Tie Rod End Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Damper Bracket Nut	75 N. m (55 Ft. Lbs.)	-
2	Steering Damper Nut	75 N. m (55 Ft. Lbs.)	-
3	Steering Damper Bolt	68 N. m (50 Ft. Lbs.)	-

DAMPER, STEERING

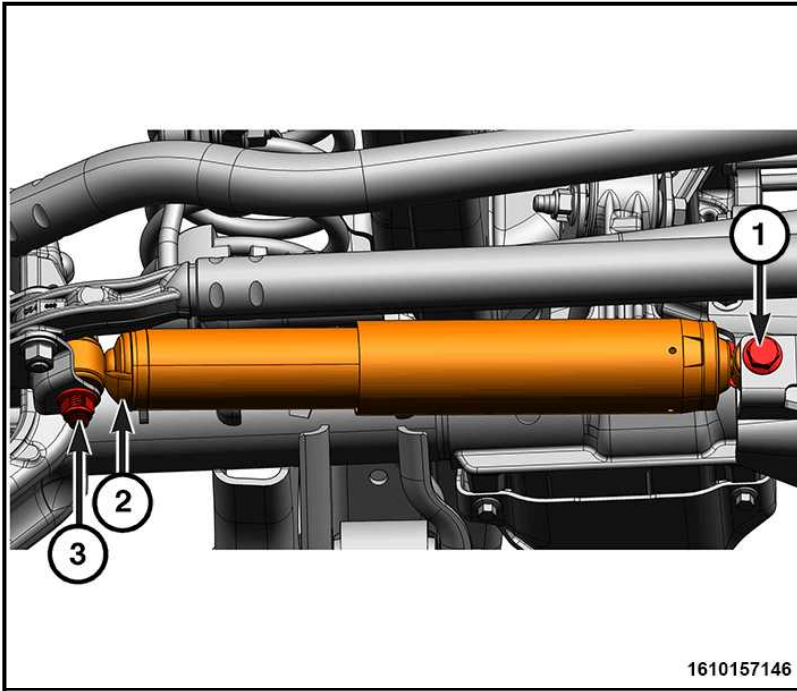
REMOVAL AND INSTALLATION

STEERING DAMPER

REMOVAL

NOTE: LHD as shown in illustration, RHD similar.

1. Place the front wheels in a **straight ahead position** .
2. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .

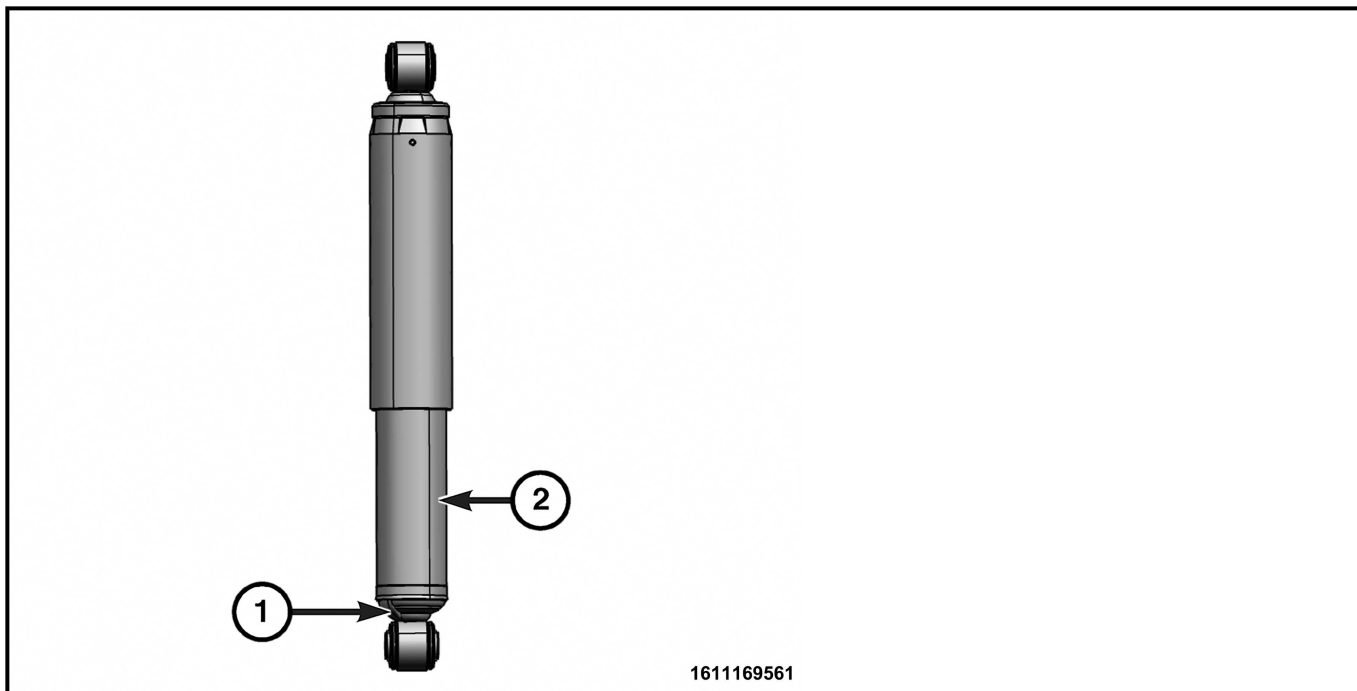


1 - Steering Damper Bolt
2 - Intake Bump
3 - Steering Damper Nut

3. Remove and **DISCARD** the steering damper nut.
4. Remove and **DISCARD** the steering damper bolt from the tie rod bracket.
5. Remove and **DISCARD** the steering damper bolt.
6. Remove and **DISCARD** the flag nut.
7. Remove the steering damper.

INSTALLATION

NOTE: The "Front/Rear" stickers may or may not be installed correctly on the steering damper based on part number level.



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1 - Base Cup

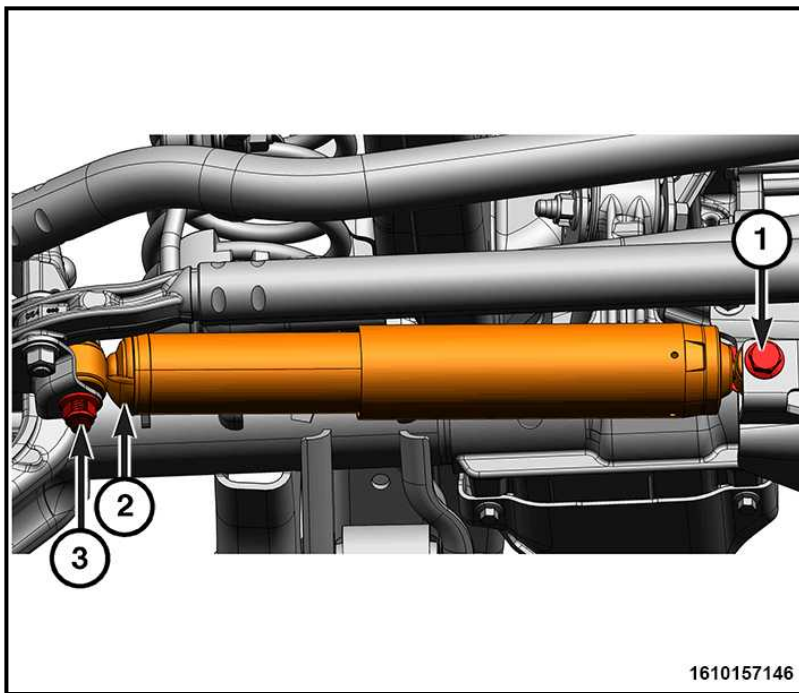
2 - Damper Body End

1. Place suitable tools such as screwdrivers through the bushings at each end of the steering damper.
2. Place the damper in a vertical orientation with the damper body end and base cup down.
3. Hold the lower end of the steering damper to the floor.
4. Fully compress and fully extend the steering damper five times as quickly as possible without stopping.



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5. The steering damper must be installed with the larger bushing diameter up, on tie rod end.



1 - Steering Damper Bolt

2 - Intake Bump

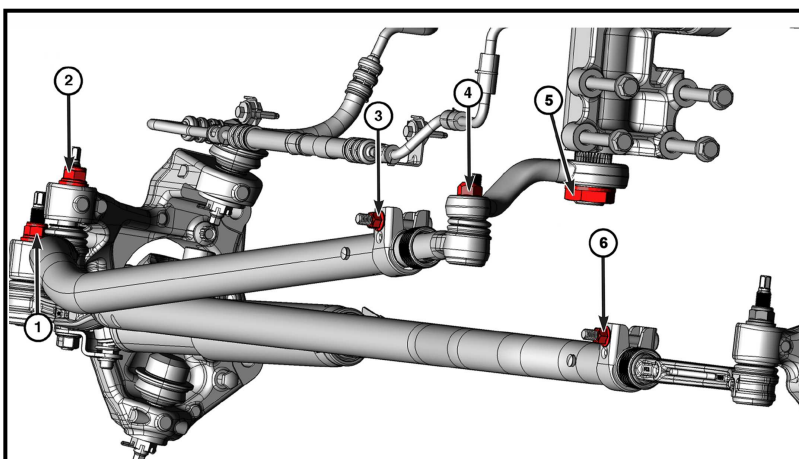
3 - Steering Damper Nut

6. Install the steering damper with the intake bump down, as shown.
7. Install a **NEW** steering damper bolt through the axle bracket and start it a few threads into the **NEW** flag nut.
8. Install a **NEW** bolt through the steering damper bracket at the tie rod and start a **NEW** steering damper nut a few threads.
9. Tighten the steering damper bolt to the proper torque specifications.
10. Tighten the steering damper nut to the proper torque specifications.
11. Remove the support and lower the vehicle.
12. Turn the steering wheel five full lock to lock turns at one rotation per second to prime the steering damper and purge any air.

NOTE: It is important to prime the new damper by rotating the steering wheel five full lock to lock turns to purge any trapped air.

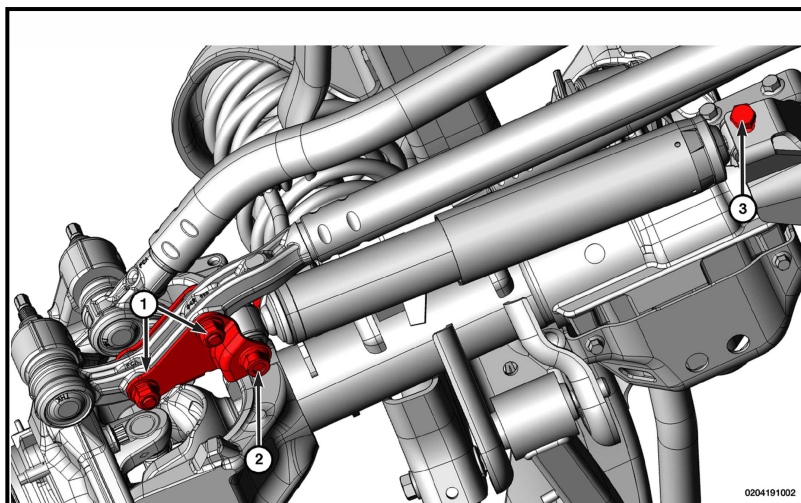
TORQUE SPECIFICATIONS

LINKAGE



0204191003

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Tie Rod End Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Drag Link Outer Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
3	Drag Link Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-
4	Drag Link Inner Nut	39 N. m + 125B° (29 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Pitman Arm Nut	250 N. m (185 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
6	Tie Rod End Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Damper Bracket Nut	75 N. m (55 Ft. Lbs.)	-
2	Steering Damper Nut	75 N. m (55 Ft. Lbs.)	-
3	Steering Damper Bolt	68 N. m (50 Ft. Lbs.)	-

DRAG LINK, STEERING

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING

Tie rod free-play can be measured using the following method:

NOTE: Always check and repair (if necessary) outer tie rod free-play before checking inner tie rod free-play. False results can otherwise be obtained.

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. If necessary, remove the front wheel and install two standard wheel mounting nuts, flat side to rotor, diagonally opposite to each on the rotor.

NOTE: At curb height, verify the tie rod is straight (90B°) in relation to the knuckle. There is a misalignment pin inside the linkage tube that contains this and prevents ball joint misalignment during toe set. If misalignment is noted, verify the alignment pin is intact, replace the linkage as necessary.

3. Attach a magnetic dial indicator to the inside or outside of the brake rotor, then align the dial indicator's contact pointer with the direction of the stud axis and touch the outer tie rod.
4. Zero the dial indicator.

NOTE: When checking free-play DO NOT expect the tie rod to rotate it's about access. The tie rod assembly is constrained at one end by a reverse pin. (Passenger side linkage ball joints are slotted and not oval).

5. Grasp the outer tie rod near the ball stud and attempt to move the tie rod straight up and down using light hand pressure (less than 10 lbs. of force).

NOTE: Due to the pin feature, if the tie rod or drag link are rocked fore and aft, there will be a noise as the stud contacts the pin feature, this is normal and is not indicative of a failed part.

6. Measure and record any tie rod free-play movement.
7. Remove the magnetic dial indicator.
8. Remove the standard wheel mounting nuts from the two studs.
9. If the free-play in the tie rod exceeds 1.15 mm (.045 in.), replace the tie rod end. Refer to [END, TIE ROD, REMOVAL AND INSTALLATION](#).
10. Install the wheel. Refer to [REMOVAL AND INSTALLATION](#).
11. Remove the supports and lower the vehicle.

NOTE: All four ball joints can be checked with the same procedure. One at the pitman arm, two at the passenger side knuckle, and one at the driver side knuckle.

REMOVAL AND INSTALLATION

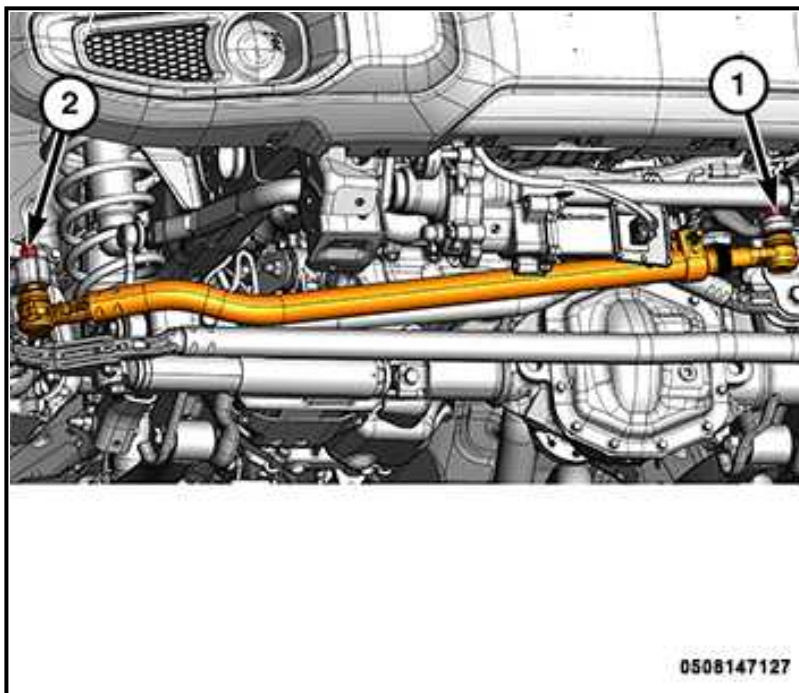
DRAG LINK

REMOVAL

NOTE: LHD as shown in illustration, RHD similar.

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#).
2. Remove the tire and wheel assembly. Refer to [REMOVAL AND INSTALLATION](#).

NOTE: Hold the end of the ball stud with a wrench when removing or installing the nuts to prevent damage to the tie rod.



1 - Drag Link Inner Nut
2 - Drag Link Outer Nut

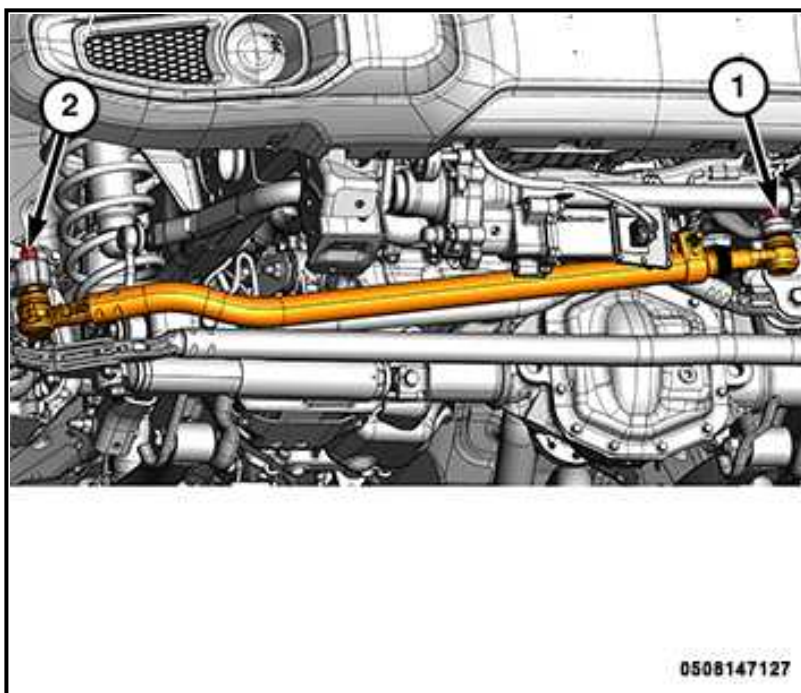
NOTE: Hold the end of the ball stud with a wrench when removing or installing the nuts to prevent damage to the tie rod.

3. Remove and **DISCARD** the drag link outer nut.
4. Separate the drag link from the steering knuckle using special tool (special tool #9360, Remover, Ball Joint) separator.
5. Remove and **DISCARD** the drag link inner nut.
6. Separate the drag link from the pitman arm using special tool (special tool #9360, Remover, Ball Joint) separator.
7. Remove the drag link.

INSTALLATION

1. Position the drag link to the pitman arm.

NOTE: Hold the end of the ball stud with a wrench when removing or installing the nuts to prevent damage to the tie rod.

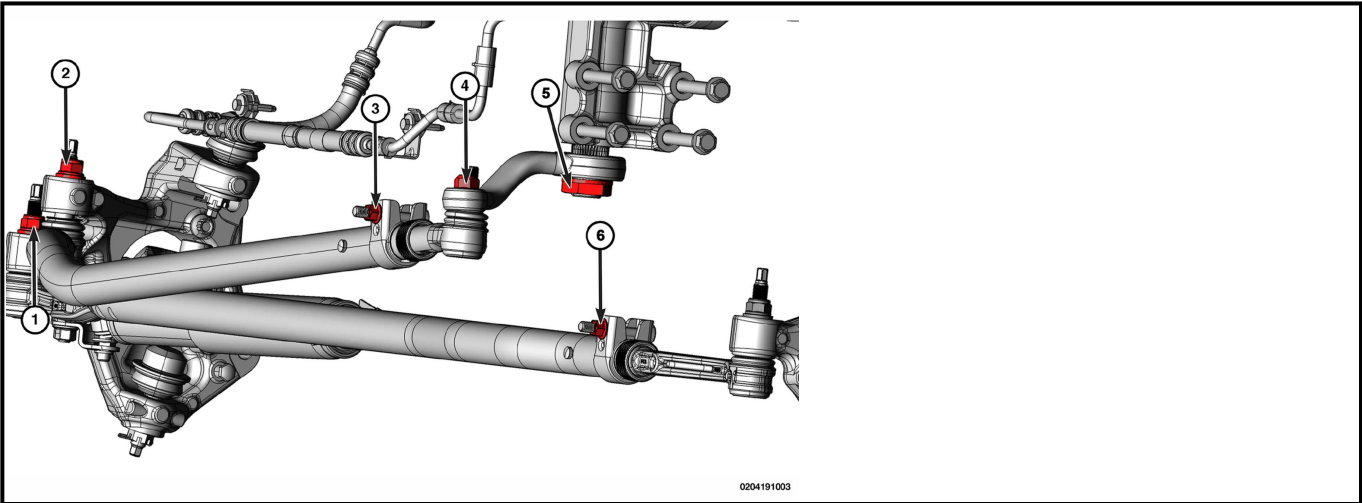


1 - Drag Link Inner Nut
2 - Drag Link Outer Nut

2. Install a **NEW** drag link inner nut and tighten to the proper torque specifications.
3. Position the drag link to the steering knuckle.
4. Install a **NEW** drag link outer nut and tighten to the proper torque specifications.
5. Install the tire and wheel assembly. Refer to [REMOVAL AND INSTALLATION](#) .
6. Remove the support and lower the vehicle.
7. Set the toe. Refer to [WHEEL ALIGNMENT, STANDARD PROCEDURE](#) .

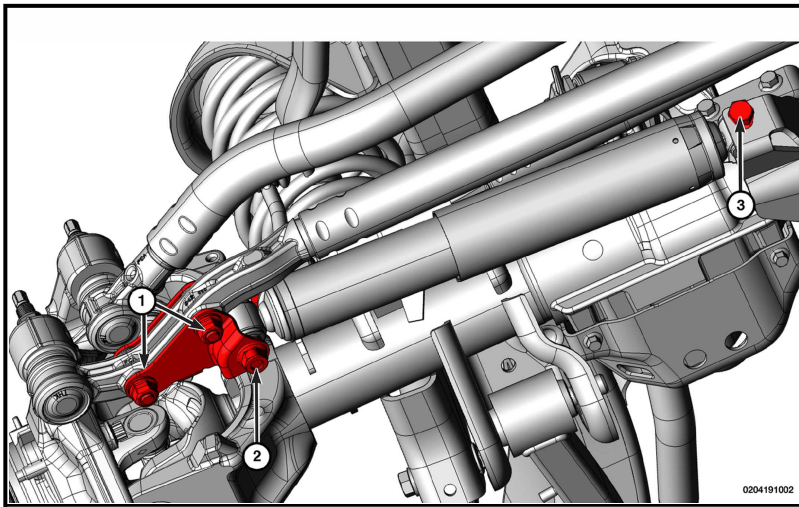
TORQUE SPECIFICATIONS

LINKAGE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Tie Rod End Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Drag Link Outer Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
			be installed and tightened to specifications.
3	Drag Link Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-
4	Drag Link Inner Nut	39 N. m + 125B° (29 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Pitman Arm Nut	250 N. m (185 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
6	Tie Rod End Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Damper Bracket Nut	75 N. m (55 Ft. Lbs.)	-
2	Steering Damper Nut	75 N. m (55 Ft. Lbs.)	-
3	Steering Damper Bolt	68 N. m (50 Ft. Lbs.)	-

END, TIE ROD

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING

Tie rod free-play can be measured using the following method:

NOTE: Always check and repair (if necessary) outer tie rod free-play before checking inner tie rod free-play. False results can otherwise be obtained.

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#).
2. If necessary, remove the front wheel and install two standard wheel mounting nuts, flat side to rotor, diagonally opposite to each on the rotor.

NOTE: At curb height, verify the tie rod is straight (90B°) in relation to the knuckle. There is a misalignment pin inside the linkage tube that contains this and prevents ball joint misalignment during toe set. If misalignment is noted, verify the alignment pin is intact, replace the linkage as necessary.

3. Attach a magnetic dial indicator to the inside or outside of the brake rotor, then align the dial indicator's contact pointer with the direction of the stud axis and touch the outer tie rod.
4. Zero the dial indicator.

NOTE: When checking free-play DO NOT expect the tie rod to rotate it's about access. The tie rod assembly is constrained at one end by a reverse pin. (Passenger side linkage ball joints are slotted and not oval).

5. Grasp the outer tie rod near the ball stud and attempt to move the tie rod straight up and down using light hand pressure (less than 10 lbs. of force).

NOTE: Due to the pin feature, if the tie rod or drag link are rocked fore and aft, there will be a noise as the stud contacts the pin feature, this is normal and is not indicative of a failed part.

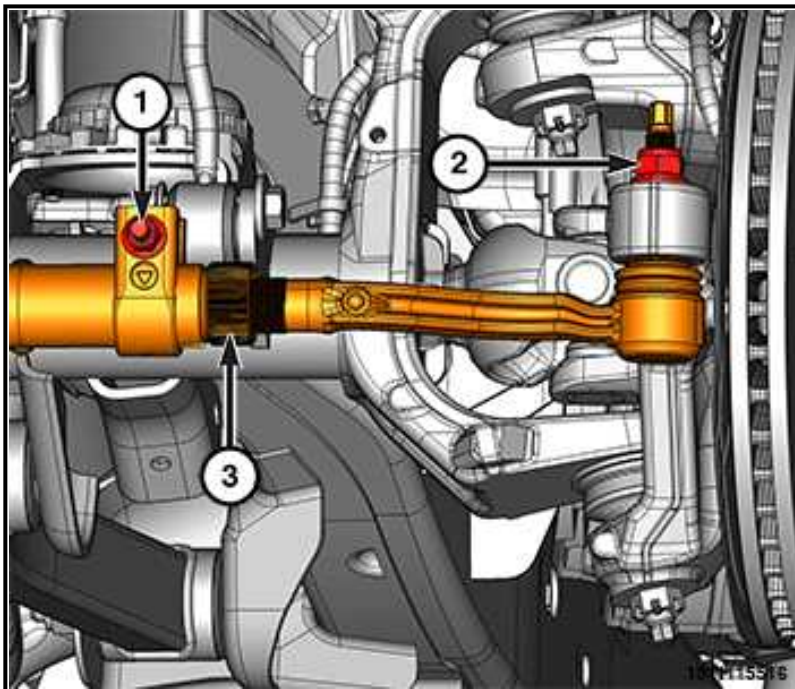
6. Measure and record any tie rod free-play movement.
7. Remove the magnetic dial indicator.
8. Remove the standard wheel mounting nuts from the two studs.
9. If the free-play in the tie rod exceeds 1.15 mm (.045 in.), replace the tie rod end. Refer to **END, TIE ROD, REMOVAL AND INSTALLATION**.
10. Install the wheel. Refer to **REMOVAL AND INSTALLATION**.
11. Remove the supports and lower the vehicle.

NOTE: All four ball joints can be checked with the same procedure. One at the pitman arm, two at the passenger side knuckle, and one at the driver side knuckle.

REMOVAL AND INSTALLATION

LEFT

REMOVAL



- | |
|--------------------------------|
| 1 - Tie Rod End Adjuster Clamp |
| 2 - Tie Rod End Nut |
| 3 - Tie Rod Adjuster Sleeve |

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the tire and wheel assembly. Refer to [REMOVAL AND INSTALLATION](#) .
3. Hold the end of the ball stud with a wrench then remove and **DISCARD** the tie rod end nut.
4. Loosen the tie rod end adjuster clamp.
5. Separate the tie rod from the knuckle using special tool (special tool #9360, Remover, Ball Joint) separator.

NOTE: Count the number of turns when removing the tie rod end, This will give a good starting point when reassembling and toe adjustment.

6. Unthread the left tie rod end from the tie rod adjuster sleeve.

INSTALLATION

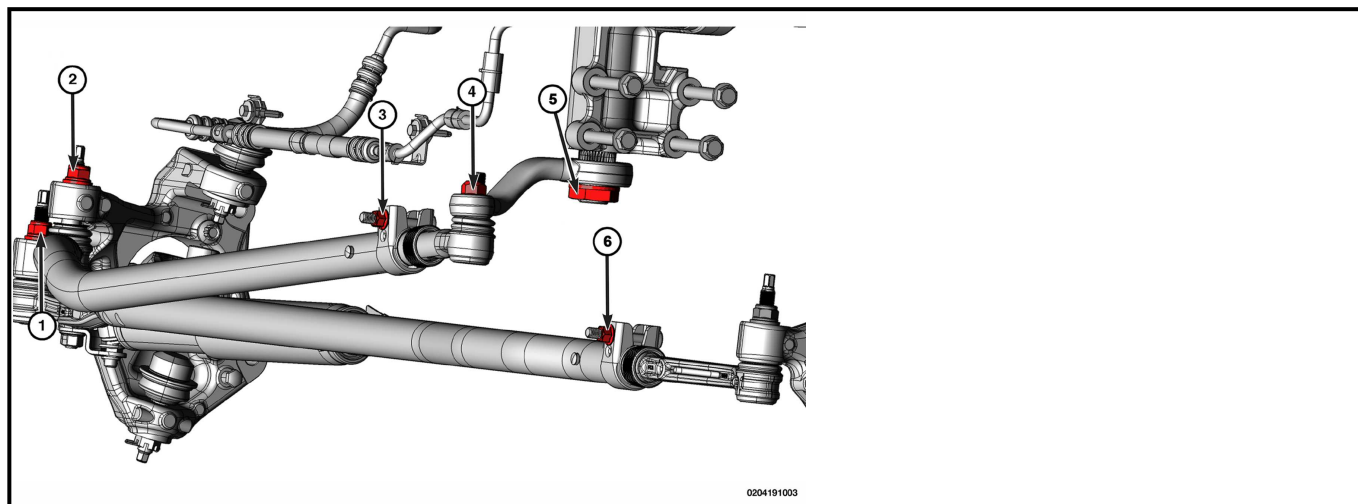
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Install a **NEW** tie rod end nut.
- Set the toe. Refer to [WHEEL ALIGNMENT, STANDARD PROCEDURE](#) .

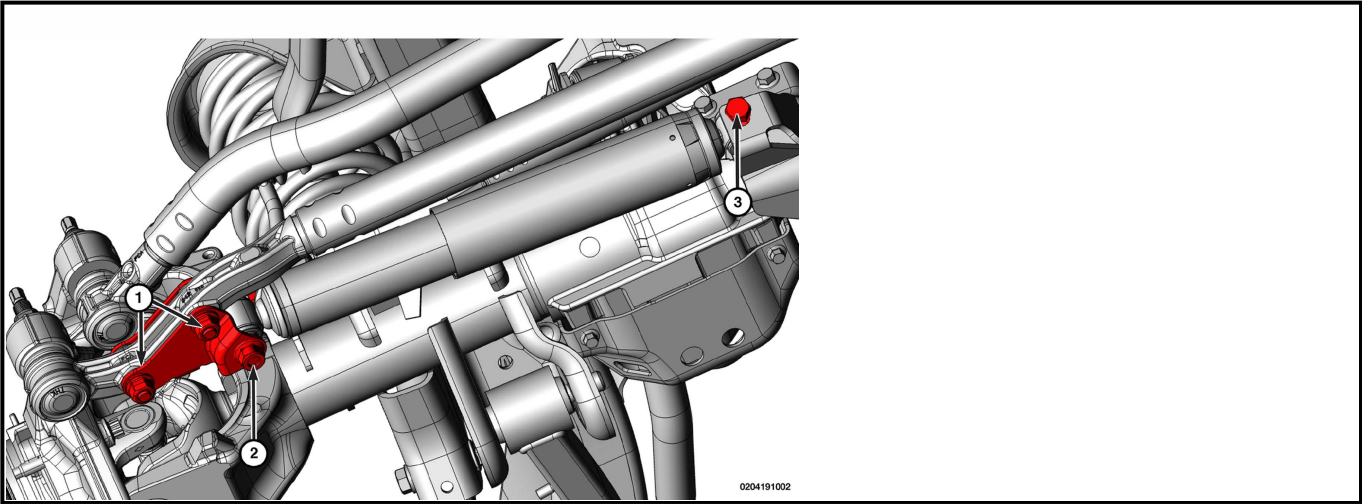
TORQUE SPECIFICATIONS

LINKAGE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Tie Rod End Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Drag Link Outer Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
3	Drag Link Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-
4	Drag Link Inner Nut	39 N. m + 125B° (29 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
5	Pitman Arm Nut	250 N. m (185 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
6	Tie Rod End Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-

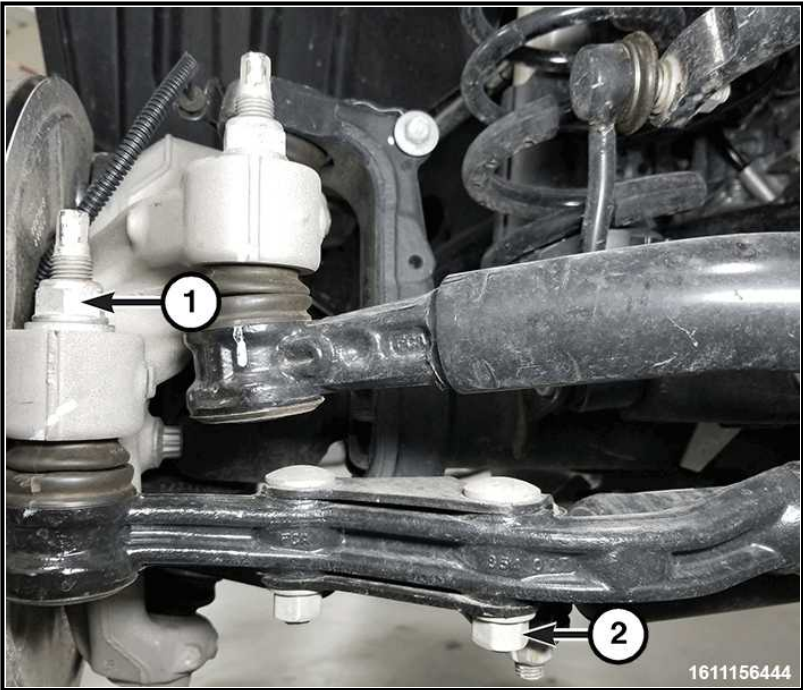


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Damper Bracket Nut	75 N. m (55 Ft. Lbs.)	-
2	Steering Damper Nut	75 N. m (55 Ft. Lbs.)	-
3	Steering Damper Bolt	68 N. m (50 Ft. Lbs.)	-

RIGHT

REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the tire and wheel assembly. Refer to [REMOVAL AND INSTALLATION](#) .



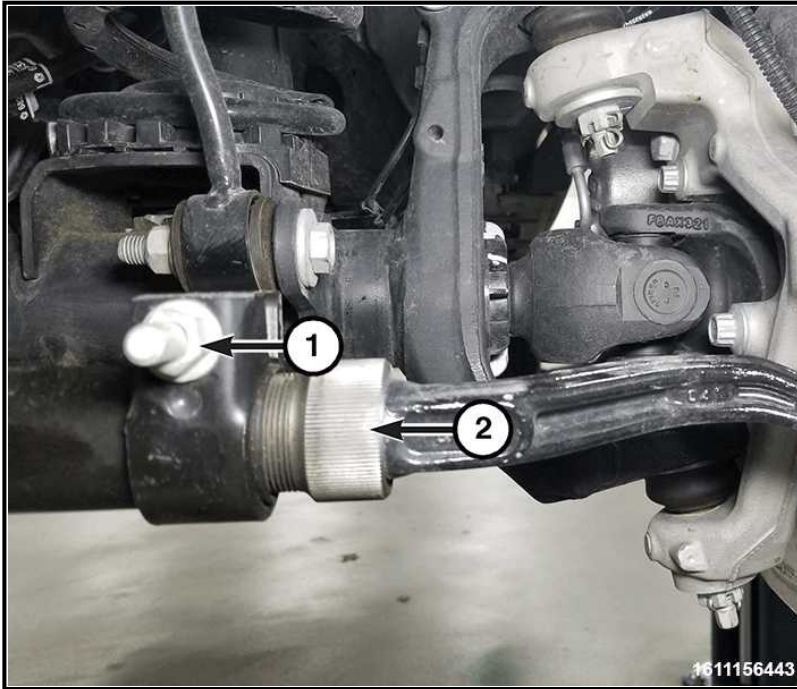
1 - Tie Rod End Nut

2 - Steering Damper Bracket Nuts

3. Remove the two steering damper bracket nuts and bolts.
4. Remove and **DISCARD** the tie rod end nut.

NOTE: Hold the end of the ball stud with a wrench when removing or installing the nuts to prevent damage to the tie rod.

5. Separate the tie rod end from the steering knuckle using (special tool #9360, Remover, Ball Joint).



1 - Tie Rod End Adjuster Clamp

2 - Adjuster Sleeve

6. Loosen the tie rod end adjuster clamp.

NOTE: Count the number of turns when removing the tie rod end. This will give a good starting point for reassembly and toe adjustment.

7. Rotate the adjuster sleeve to disengage the left tie rod from the right tie rod.

NOTE: The tie rod assembly features an alignment pin, the adjustment sleeve **MUST** be rotated to "walk" the left tie rod out of the right tie rod.

INSTALLATION

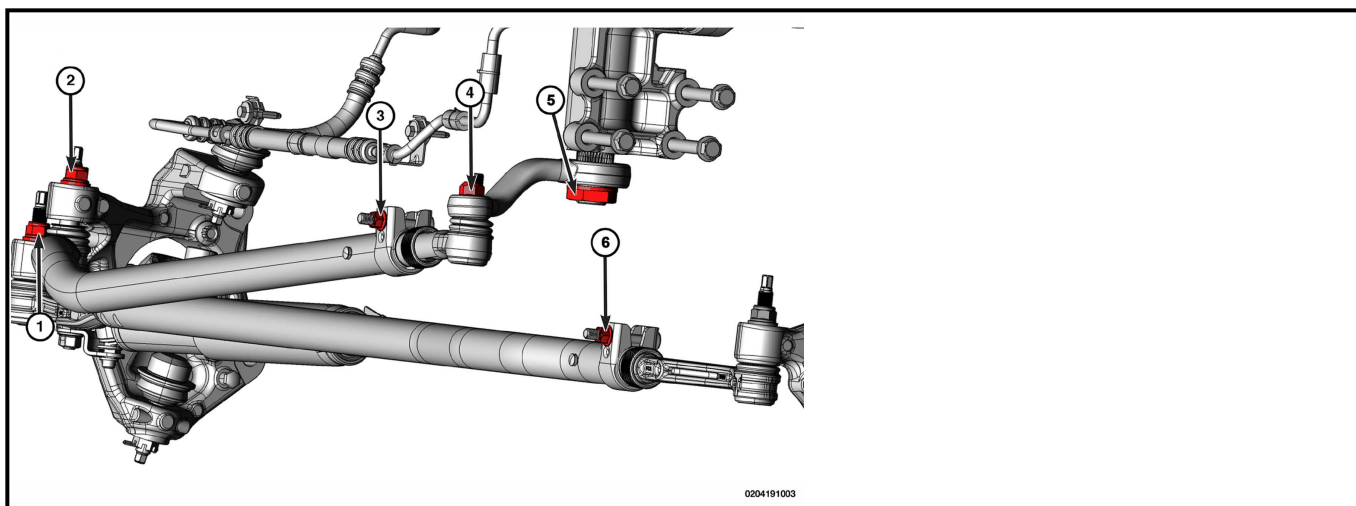
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Install a **NEW** tie rod end nut.
- Set the toe. Refer to [**WHEEL ALIGNMENT, STANDARD PROCEDURE**](#) .

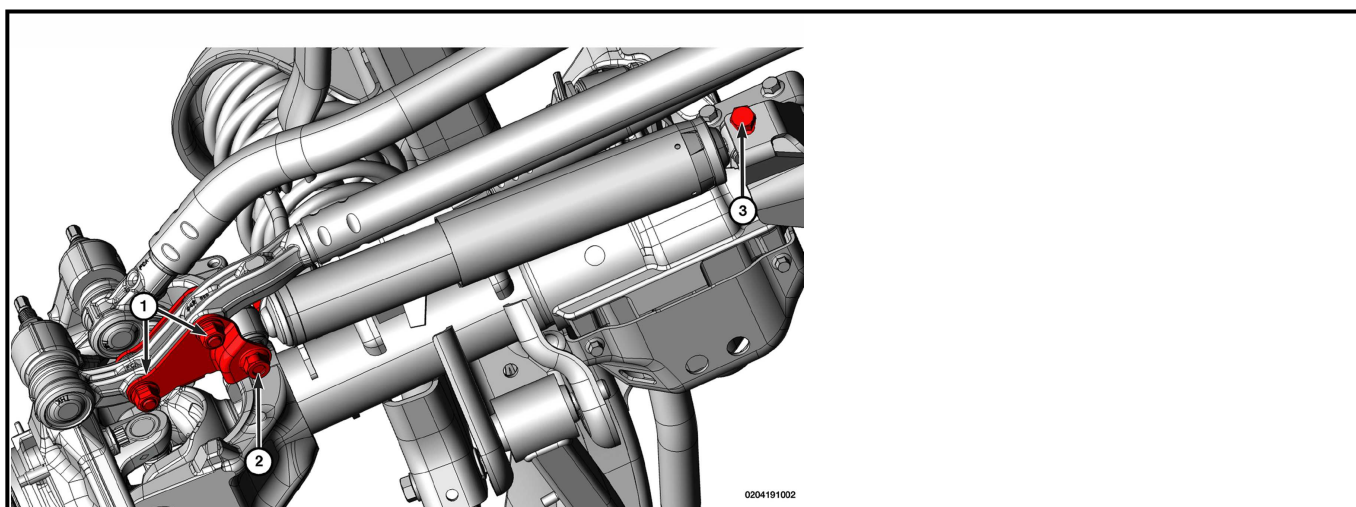
TORQUE SPECIFICATIONS

LINKAGE



0204191003

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Tie Rod End Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
2	Drag Link Outer Nut	40 N. m + 125B° (30 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
3	Drag Link Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-
4	Drag Link Inner Nut	39 N. m + 125B° (29 Ft. Lbs. + 125B°)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
5	Pitman Arm Nut	250 N. m (185 Ft. Lbs.)	Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.
6	Tie Rod End Adjuster Clamp	46 N. m (34 Ft. Lbs.)	-



0204191002

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Steering Damper Bracket Nut	75 N. m (55 Ft. Lbs.)	-
2	Steering Damper Nut	75 N. m (55 Ft. Lbs.)	-
3	Steering Damper Bolt	68 N. m (50 Ft. Lbs.)	-

PUMP

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - POWER STEERING PUMP AND HOSES

NOTE: This information is designed to be used in conjunction with the diagnostic charts at the beginning of the Steering section. Refer to DIAGNOSIS AND TESTING.

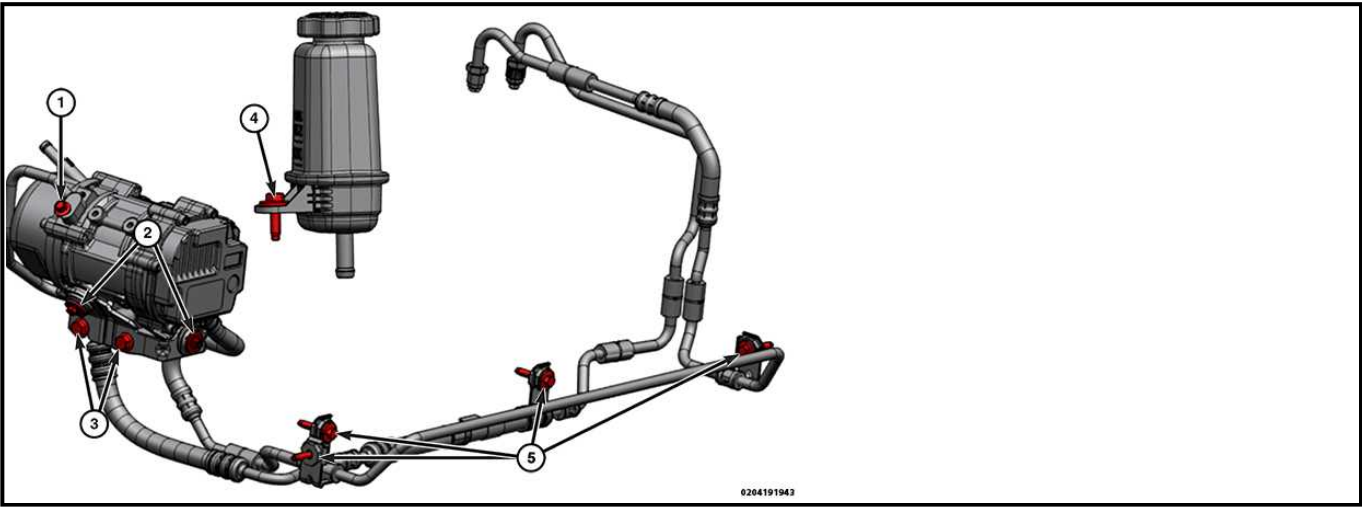
CHECKING FOR POWER STEERING HOSES TOUCHING BODY OR FRAME OF VEHICLE

Check hoses and hose tubes as following:

- Inspect hoses and hose tubes for witness marks. If witness marks are present, adjust hose(s) to the proper position by loosening, repositioning and tightening attachments to the specified torque. Refer to TORQUE SPECIFICATION . **Do not bend tubing to adjust.** Replace the hose assembly if damaged.
- Check fastener torque of hose mounting brackets and tube nuts. Refer to TORQUE SPECIFICATION .
- Have a helper bump the steering gear off of the stops to induce pressure fluctuations which may move the hose. If hose contact is made, adjust hose(s) to the proper position by loosening, repositioning and tightening attachments to the specified torque. Refer to TORQUE SPECIFICATION . **Do not bend tubing to adjust.** Replace the hose assembly if damaged.

TECHNICAL SPECIFICATIONS

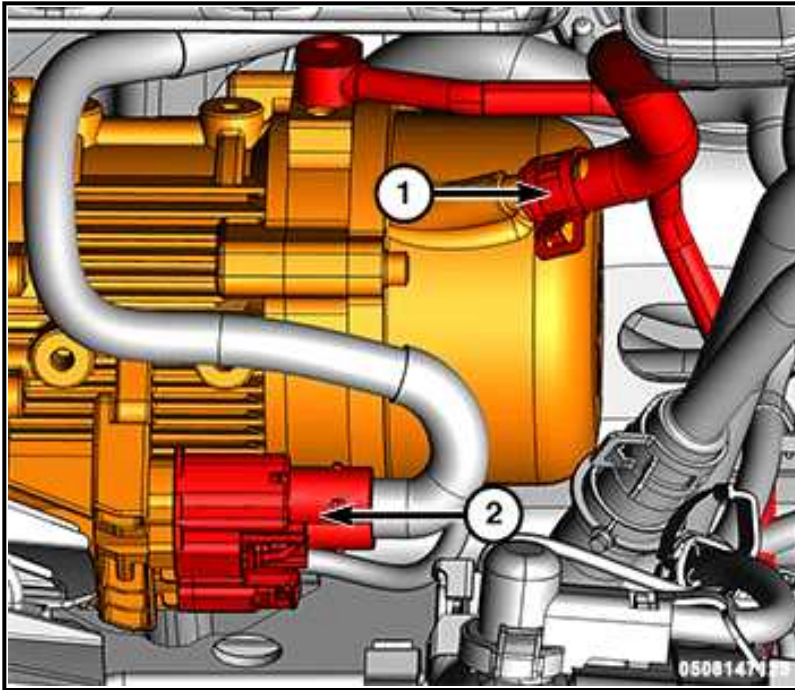
TORQUE SPECIFICATION



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pressure Line to Pump Bolt	20 N. m (15 Ft. Lbs.)	-
2	Power Steering Pump to Bracket Bolts	8 N. m (71 In. Lbs.)	-
3	Power Steering Pump Bracket Frame Bolts	29 N. m (21 Ft. Lbs.)	-
4	Power Steering Fluid Reservoir Bolt	8 N. m (71 In. Lbs.)	-
5	Power Steering Hose Routing Bracket Bolt	5 N. m (44 In. Lbs.)	-

REMOVAL AND INSTALLATION

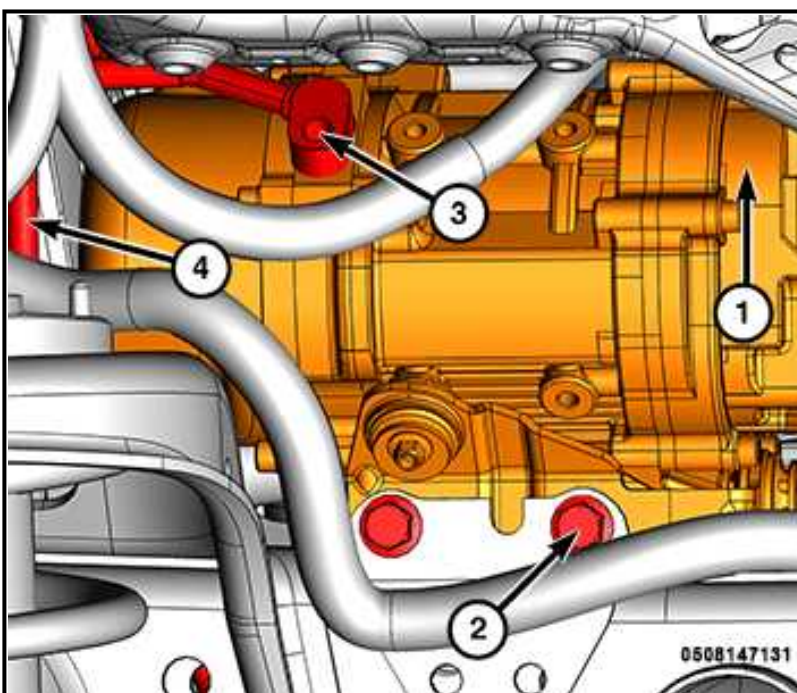
LEFT HAND DRIVE



1 - Supply Line

2 - Wire Harness Connector

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the air cleaner body. Refer to [BODY, AIR CLEANER, REMOVAL AND INSTALLATION](#) .
3. Disconnect the two Electric Hydraulic Power Steering (EHPS) pump wire harness connectors and remove the wiring harness routing clips from the EHPS pump.
4. With the hose clamp released disconnect the supply line from the EHPS pump and secure the hose end higher than the power steering pump reservoir.
5. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
6. Remove the right front wheel house splash shield. Refer to [SHIELD, SPLASH, FRONT WHEELHOUSE, REMOVAL AND INSTALLATION](#) .



1 - Pump

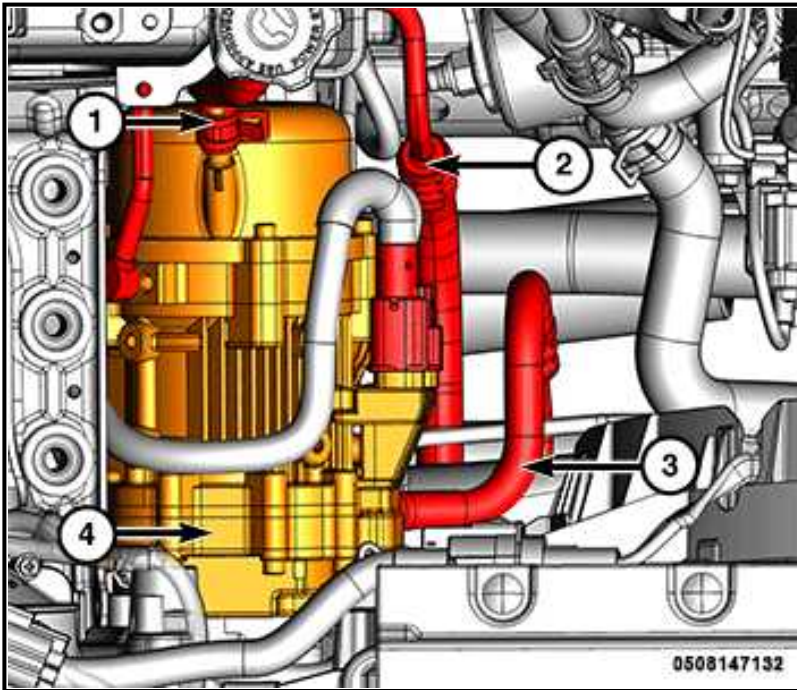
2 - Bracket Frame Bolts

3 - Pressure Line Bolt

4 - Pressure Line

7. Remove the EHPS pump pressure line bolt and remove the EHPS pressure line from the EHPS pump.

8. Loosen the two power steering pump bracket frame bolts.



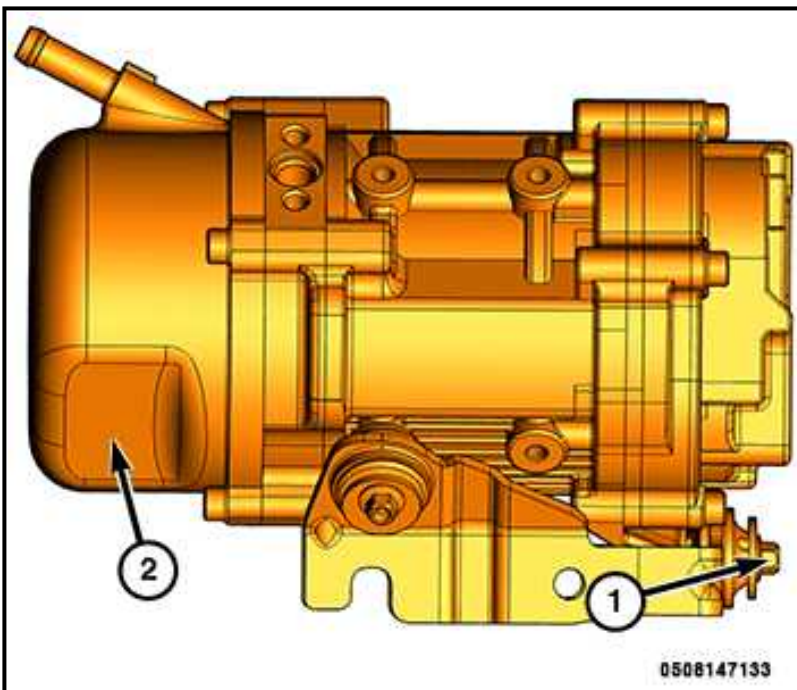
1 - Supply Line

2 - Line

3 - Return Line

4 - Pump

9. With the hose clamp released disconnect the return line from the EHPS pump.



1 - Electric Hydraulic Power Steering (EHPS) Pump Bracket Nuts
--

2 - Power Steering Pump

10. Remove the EHPS pump from the vehicle.

INSTALLATION

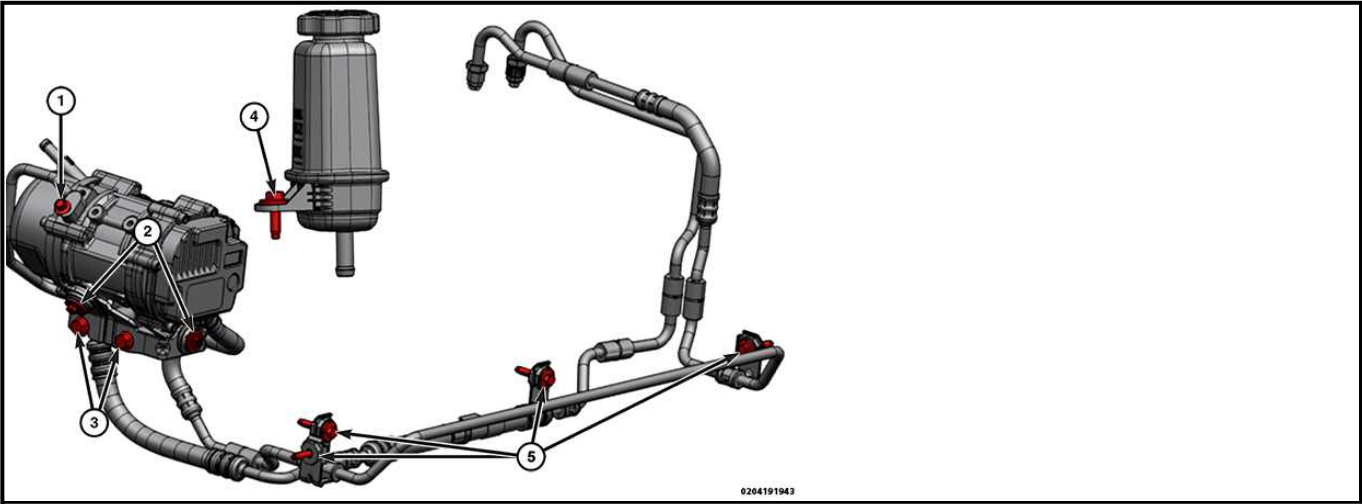
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Refill the power steering fluid and bleed the system. Refer to [STANDARD PROCEDURE](#).

TORQUE SPECIFICATIONS

PUMP

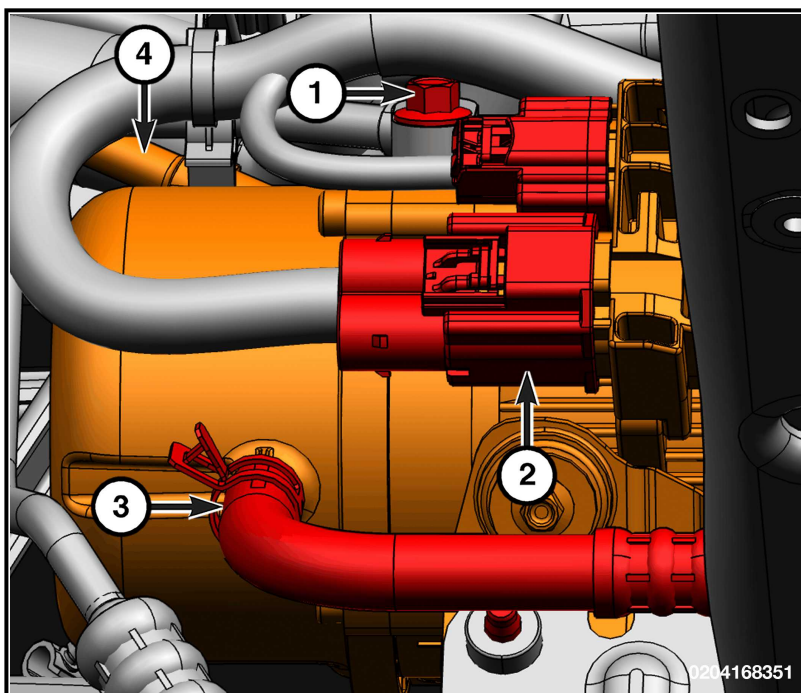


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pressure Line to Pump Bolt	20 N. m (15 Ft. Lbs.)	-
2	Power Steering Pump to Bracket Bolts	8 N. m (71 In. Lbs.)	-
3	Power Steering Pump Bracket Frame Bolts	29 N. m (21 Ft. Lbs.)	-
4	Power Steering Fluid Reservoir Bolt	8 N. m (71 In. Lbs.)	-
5	Power Steering Hose Routing Bracket Bolt	5 N. m (44 In. Lbs.)	-

RIGHT HAND DRIVE

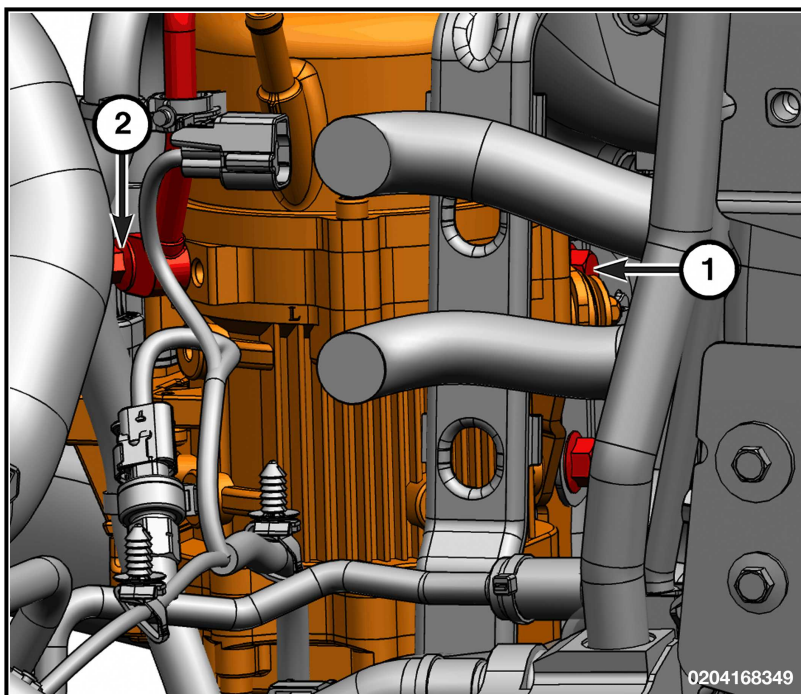
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the power distribution center. Refer to [CENTER, POWER DISTRIBUTION \(PDC\), REMOVAL AND INSTALLATION](#) .



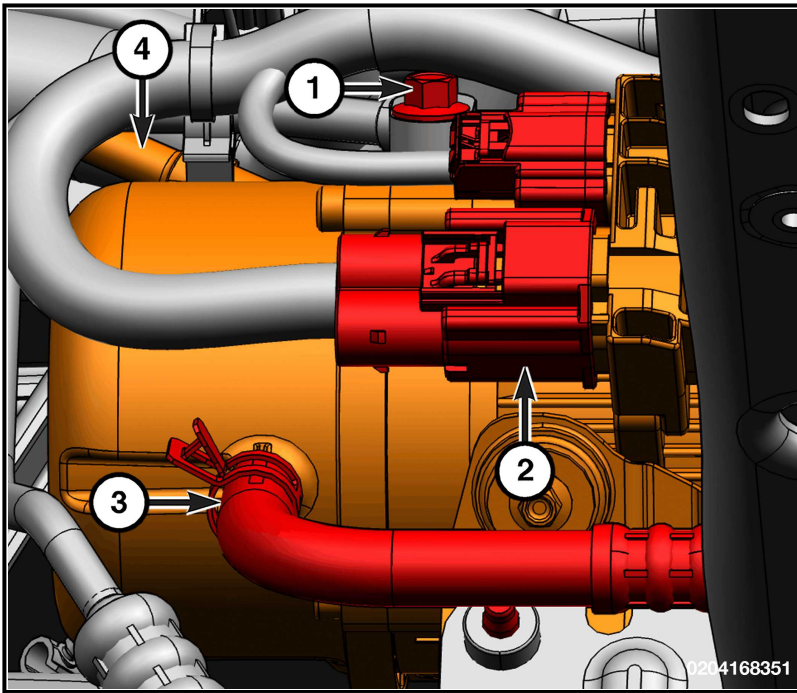
1 - Pressure Line Bolt
2 - Wire Harness Connector
3 - Return Line
4 - Supply Line

3. Disconnect the two Electric Hydraulic Power Steering (EHPS) pump wire harness connectors and remove the wiring harness routing clips from the EHPS pump.
4. With the hose clamp released disconnect the supply line from the EHPS pump and secure the hose end higher than the power steering pump reservoir.
5. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
6. Remove the left front wheel house splash shield. Refer to [SHIELD, SPLASH, FRONT WHEELHOUSE, REMOVAL AND INSTALLATION](#) .



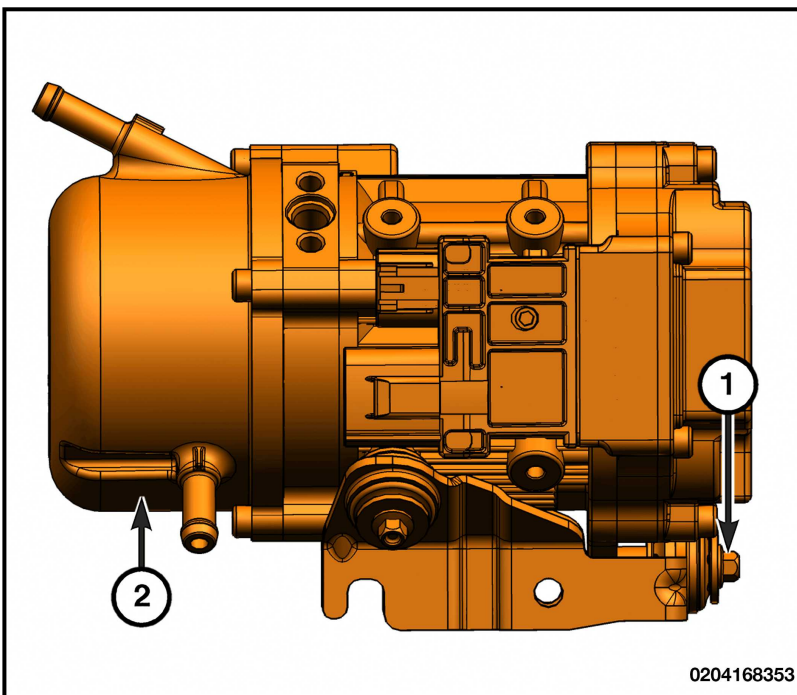
1 - Bracket Frame Bolts
2 - Pressure Line Bolt

7. Remove the EHPS pump pressure line bolt and remove the EHPS pressure line from the EHPS pump.
8. Loosen the two power steering pump bracket frame bolts.



1 - Pressure Line Bolt
2 - Wire Harness Connector
3 - Return Line
4 - Supply Line

9. With the hose clamp released disconnect the return line from the EHPS pump.



1 - Bracket Nuts
2 - EHPS Pump

10. Remove the EHPS pump from the vehicle.

INSTALLATION

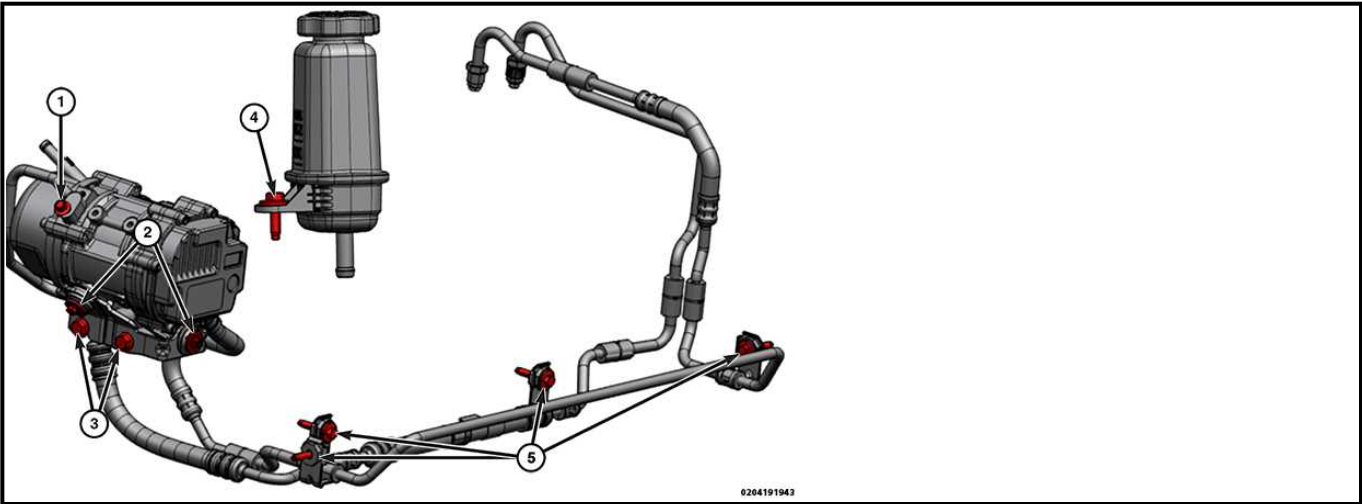
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Refill the power steering fluid and bleed the system. Refer to **POWER STEERING SYSTEM BLEEDING**.

TORQUE SPECIFICATIONS

PUMP



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pressure Line to Pump Bolt	20 N. m (15 Ft. Lbs.)	-
2	Power Steering Pump to Bracket Bolts	8 N. m (71 In. Lbs.)	-
3	Power Steering Pump Bracket Frame Bolts	29 N. m (21 Ft. Lbs.)	-
4	Power Steering Fluid Reservoir Bolt	8 N. m (71 In. Lbs.)	-
5	Power Steering Hose Routing Bracket Bolt	5 N. m (44 In. Lbs.)	-

FLUID

STANDARD PROCEDURE

STANDARD PROCEDURE - POWER STEERING FLUID LEVEL CHECKING

WARNING: Fluid level should be checked with the engine off to prevent personal injury from moving parts.

The Electro-Hydraulic Power Steering (EHPS) system uses fluid which meets material specification **MS-11655** or equivalent.

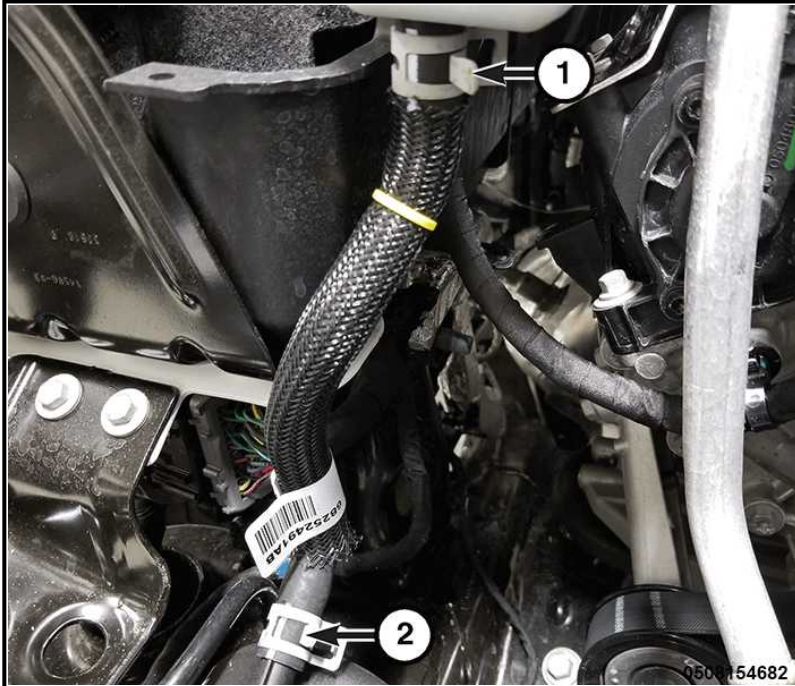
The power steering fluid level can be viewed through the reservoir with "MAX" and "MIN" level indicators on the side. Before opening power steering system, wipe the reservoir filler cap free of dirt and debris. When the fluid is at normal ambient temperature, approximately 21B°C to 27B°C (70B°F to 80B°F), the fluid level should be between "MAX" and "MIN". Use only proper fluids. Do not over fill.

HOSE, POWER STEERING

REMOVAL AND INSTALLATION

RESERVOIR TO PUMP

REMOVAL



1 - Supply Hose Upper Clamp

2 - Supply Hose Lower Clamp

NOTE: LHD as shown in illustration, RHD similar.

1. Siphon the power steering fluid from the reservoir.
2. Remove the air cleaner body. Refer to [BODY, AIR CLEANER, REMOVAL AND INSTALLATION](#) .
3. Release the supply hose upper clamp and disconnect the supply hose from the fluid reservoir.
4. Release the supply hose lower clamp and disconnect the supply hose from the pump.
5. Disengage the hose to battery tray retainer.
6. Remove the supply hose.

INSTALLATION

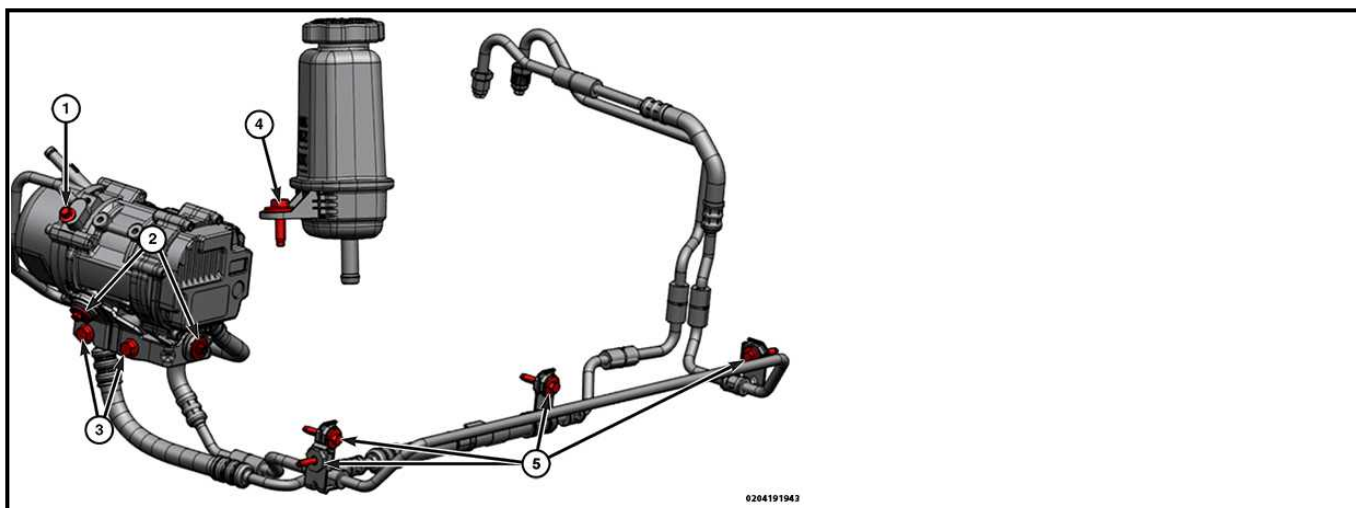
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Refill the power steering fluid and bleed the system. Refer to [POWER STEERING SYSTEM BLEEDING](#) .

TORQUE SPECIFICATIONS

PUMP



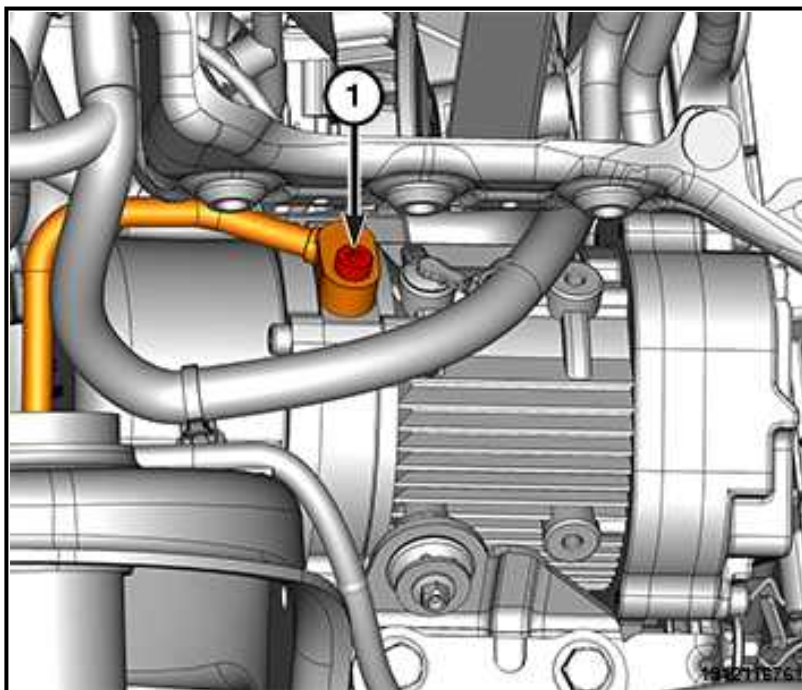
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pressure Line to Pump Bolt	20 N. m (15 Ft. Lbs.)	-
2	Power Steering Pump to Bracket Bolts	8 N. m (71 In. Lbs.)	-
3	Power Steering Pump Bracket Frame Bolts	29 N. m (21 Ft. Lbs.)	-
4	Power Steering Fluid Reservoir Bolt	8 N. m (71 In. Lbs.)	-
5	Power Steering Hose Routing Bracket Bolt	5 N. m (44 In. Lbs.)	-

PUMP TO GEAR

REMOVAL

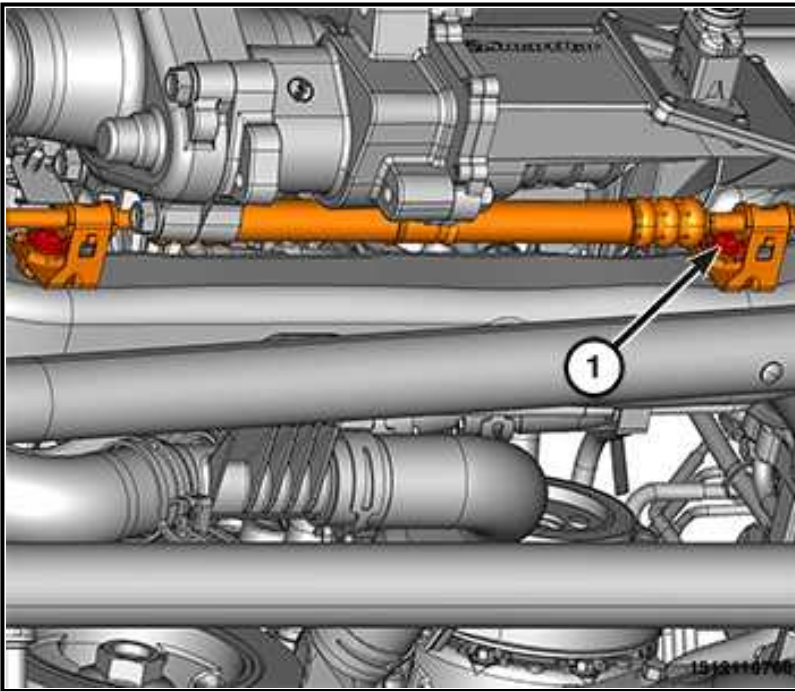
NOTE: LHD as shown in illustration, RHD similar.

1. Raise and support the vehicle Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the front air dam. Refer to [AIR DAM, FRONT, REMOVAL AND INSTALLATION](#) .
3. Remove the right front wheelhouse splash shield. Refer to [SHIELD, SPLASH, FRONT WHEELHOUSE, REMOVAL AND INSTALLATION](#) .



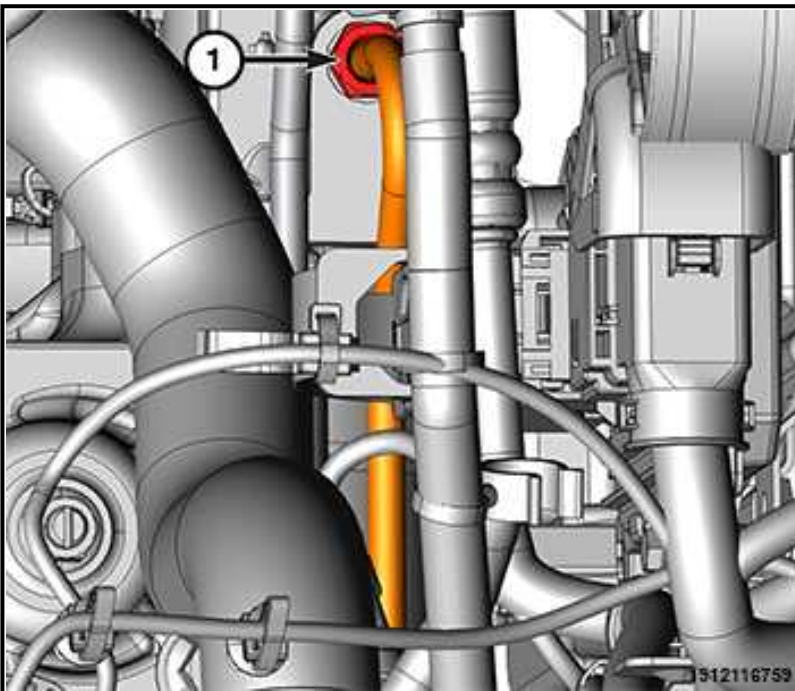
1 - Power Steering Pressure Hose Bolt

4. Remove the power steering pressure hose bolt and disconnect the pressure hose from the Electro Hydraulic Power Steering (EHPS) pump.



1 - Power Steering Hose Routing Bracket Bolts

5. Remove the two power steering hose routing bracket bolts.



1 - Power Steering Hose Flare Nut

6. Power steering hose flare nut from the steering gear and disconnect the pressure line.
7. Remove the power steering hose.

INSTALLATION

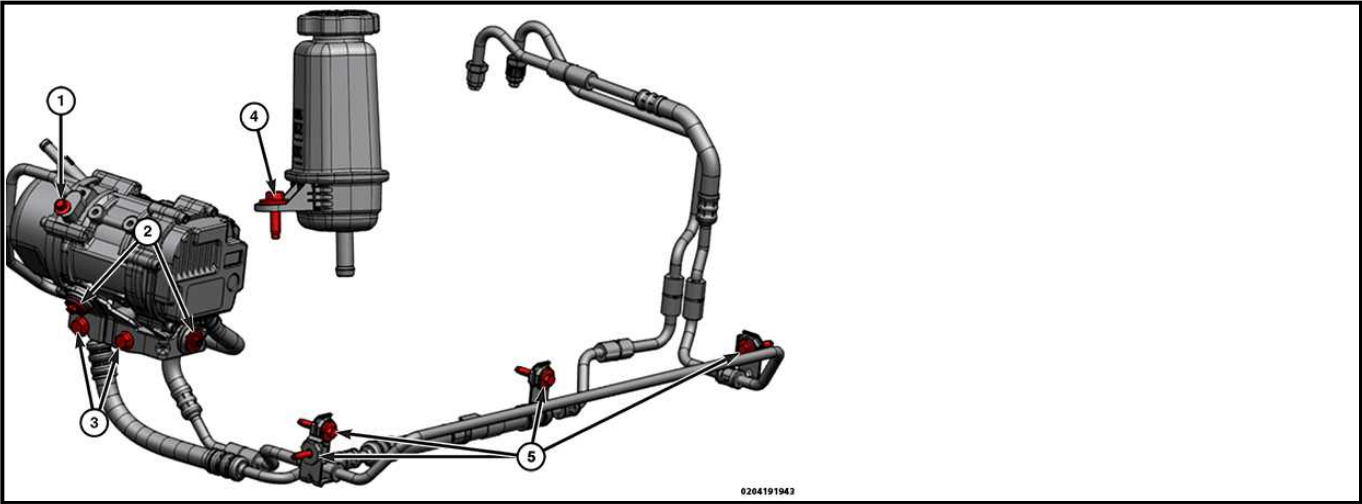
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Refill the power steering fluid and bleed the system. Refer to [POWER STEERING SYSTEM BLEEDING](#) .

TORQUE SPECIFICATIONS

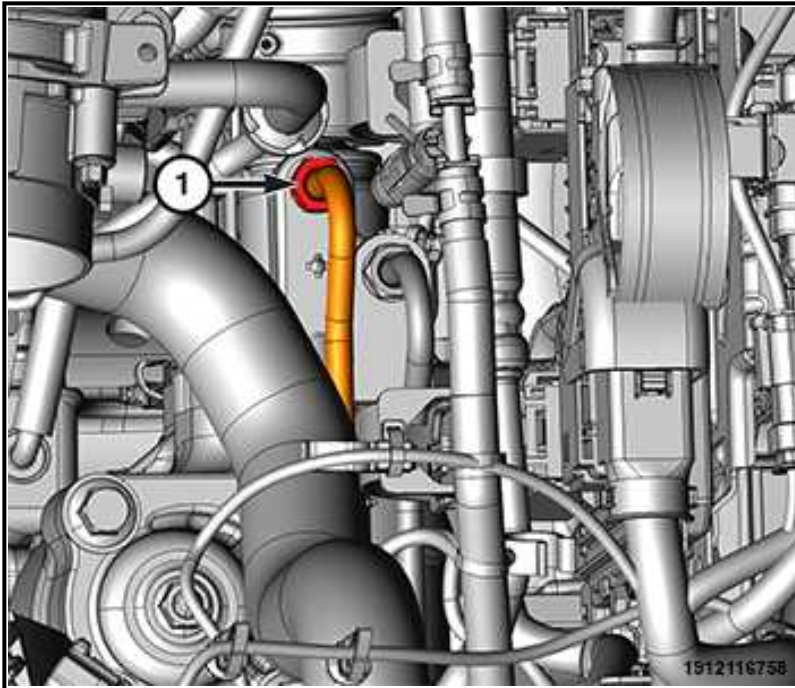
PUMP



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pressure Line to Pump Bolt	20 N. m (15 Ft. Lbs.)	-
2	Power Steering Pump to Bracket Bolts	8 N. m (71 In. Lbs.)	-
3	Power Steering Pump Bracket Frame Bolts	29 N. m (21 Ft. Lbs.)	-
4	Power Steering Fluid Reservoir Bolt	8 N. m (71 In. Lbs.)	-
5	Power Steering Hose Routing Bracket Bolt	5 N. m (44 In. Lbs.)	-

GEAR TO PUMP

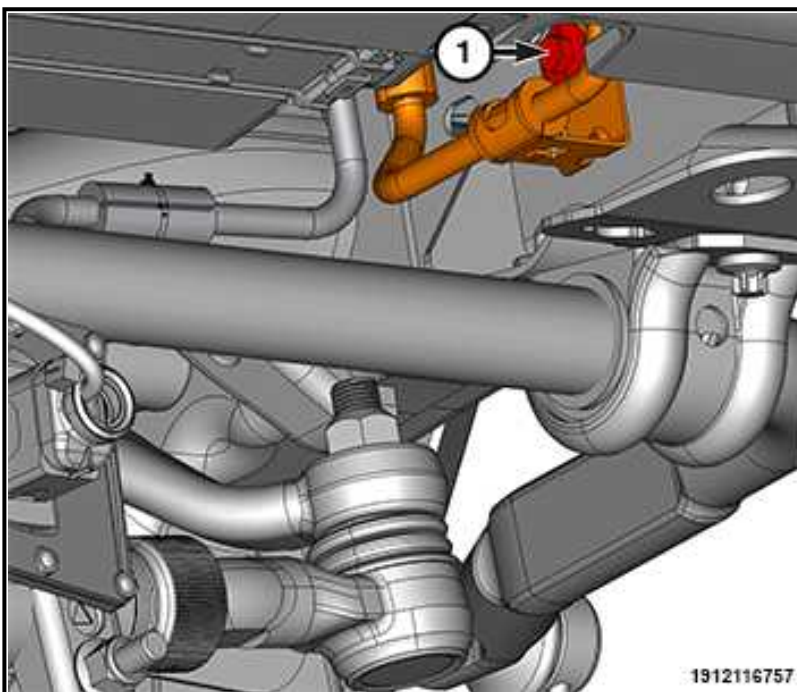
REMOVAL



1 - Power Steering Hose Flare Nut

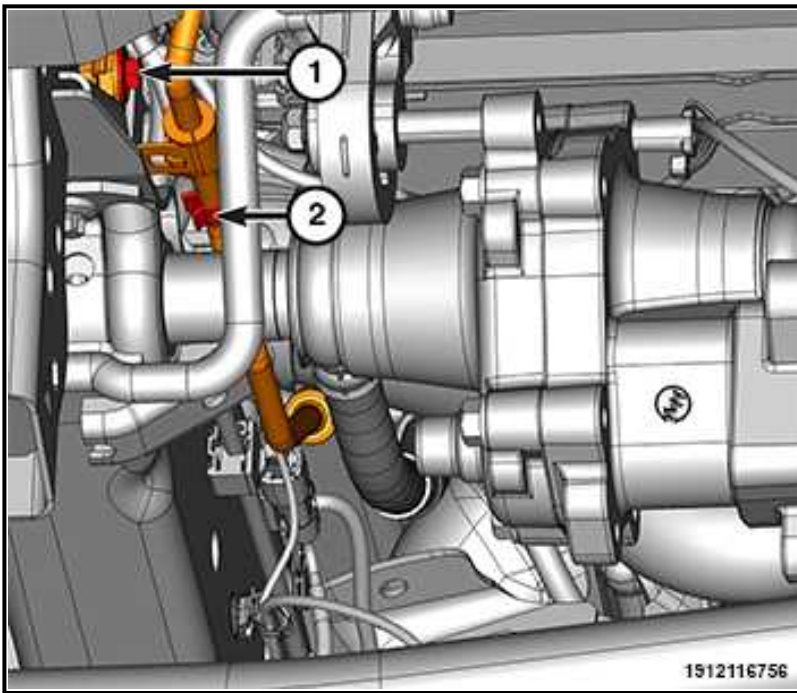
NOTE: LHD as shown in illustration, RHD similar.

1. Remove the power steering hose flare nut and disconnect the hose from the steering gear.
2. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#).
3. Remove the front air dam. Refer to [AIR DAM, FRONT, REMOVAL AND INSTALLATION](#).



1 - Power Steering Hose Routing Bracket Bolt

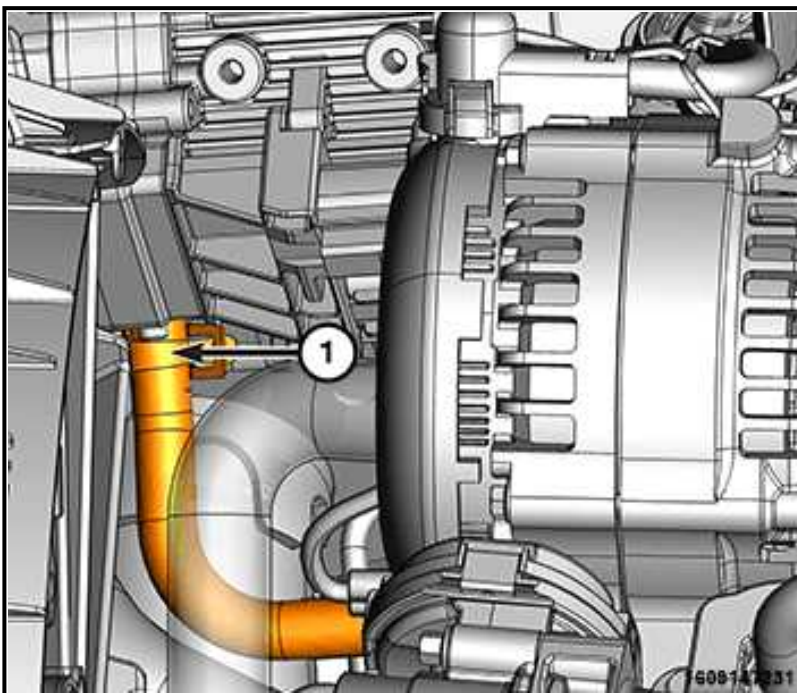
4. Remove the power steering hose routing bracket bolt from the left frame rail.



1 - Power Steering Hose Routing Bracket Bolt

2 - Routing Clip

5. Remove power steering hose routing bracket bolt from the right frame rail and disconnect the line routing clip.



1 - Hose Clamp

6. Release the hose clamp and disconnect the power steering hose from the Electro Hydraulic Power Steering (EHPS) pump.
7. Remove the power steering hose.

INSTALLATION

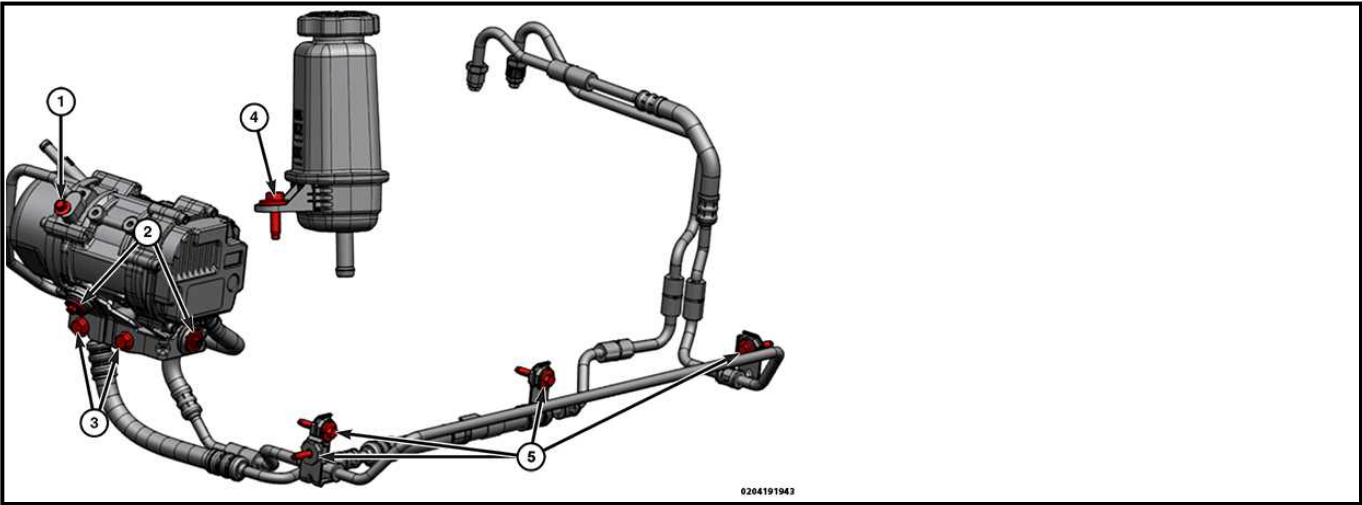
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Refill the power steering fluid and bleed the system. Refer to **POWER STEERING SYSTEM BLEEDING**.

TORQUE SPECIFICATIONS

PUMP



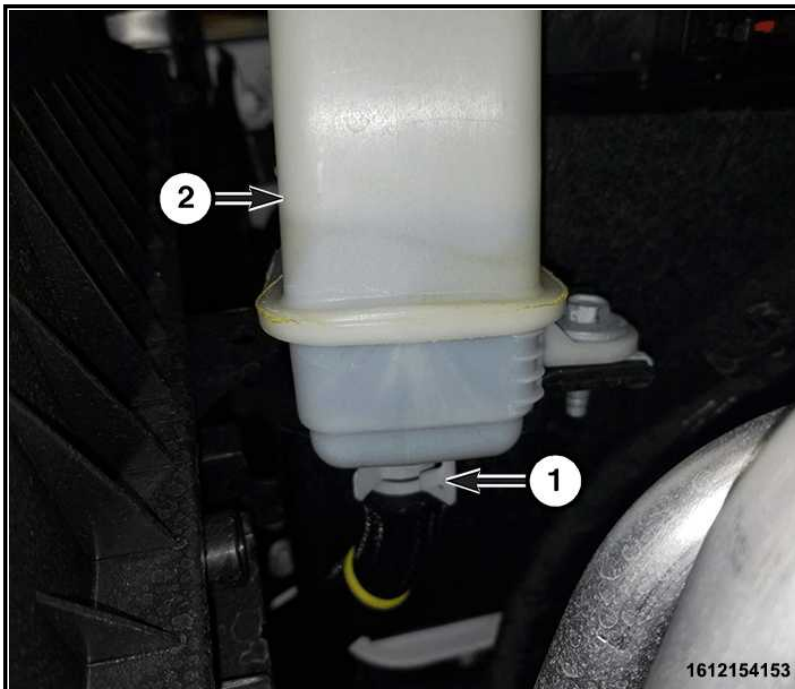
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pressure Line to Pump Bolt	20 N. m (15 Ft. Lbs.)	-
2	Power Steering Pump to Bracket Bolts	8 N. m (71 In. Lbs.)	-
3	Power Steering Pump Bracket Frame Bolts	29 N. m (21 Ft. Lbs.)	-
4	Power Steering Fluid Reservoir Bolt	8 N. m (71 In. Lbs.)	-
5	Power Steering Hose Routing Bracket Bolt	5 N. m (44 In. Lbs.)	-

RESERVOIR, POWER STEERING PUMP

REMOVAL AND INSTALLATION

FLUID RESERVOIR

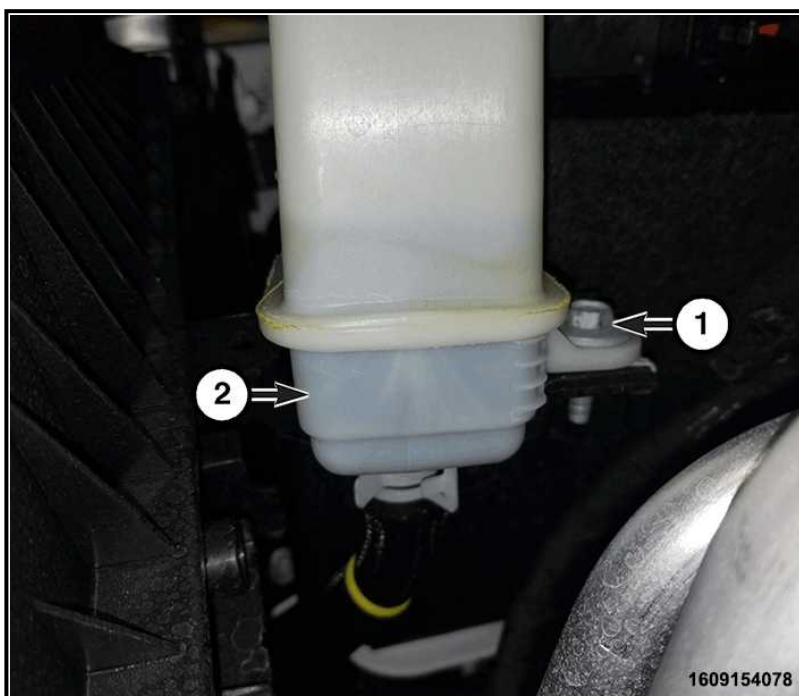
REMOVAL



1 - Supply Line

2 - Power Steering Reservoir

1. Siphon the power steering reservoir.
2. With the hose clamp released disconnect the supply line from the reservoir.



1 - Supply Line

2 - Power Steering Reservoir

3. Remove the power steering fluid reservoir bolt.
4. Remove the fluid reservoir.

INSTALLATION

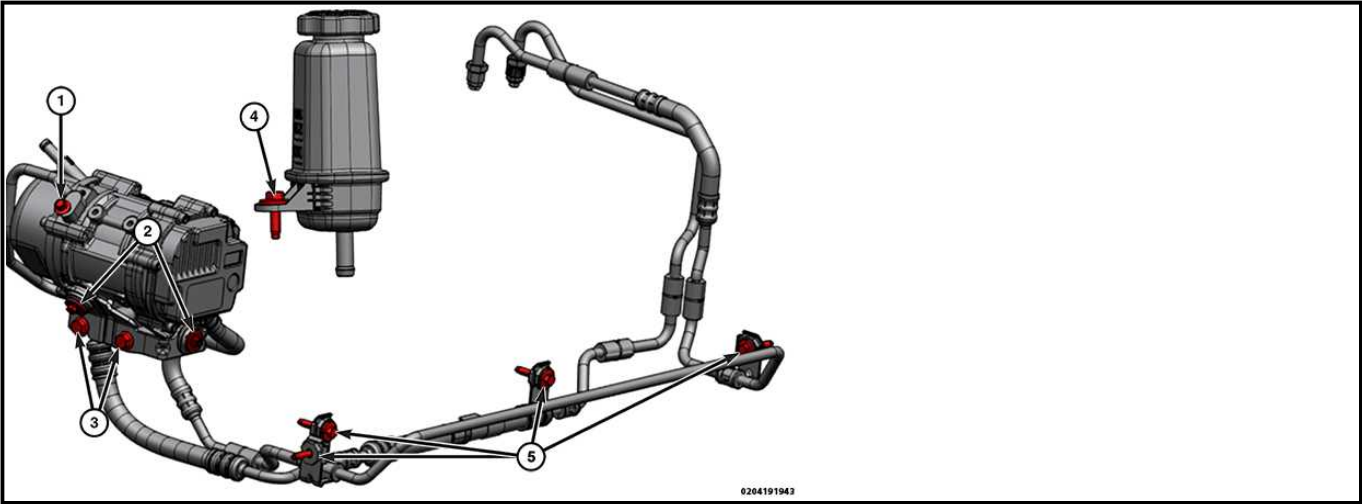
During installation, torque the fasteners to the specifications in the torque table(s) below.

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.

- Add power steering fluid. Refer to [STANDARD PROCEDURE](#).

TORQUE SPECIFICATIONS

PUMP



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Pressure Line to Pump Bolt	20 N. m (15 Ft. Lbs.)	-
2	Power Steering Pump to Bracket Bolts	8 N. m (71 In. Lbs.)	-
3	Power Steering Pump Bracket Frame Bolts	29 N. m (21 Ft. Lbs.)	-
4	Power Steering Fluid Reservoir Bolt	8 N. m (71 In. Lbs.)	-
5	Power Steering Hose Routing Bracket Bolt	5 N. m (44 In. Lbs.)	-