

2001 BRAKES**Anti-Lock/TCS - Catera****DESCRIPTION**

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS article in GENERAL INFORMATION before servicing anti-lock brake system.

NOTE: For information on mechanical brake system, see appropriate DISC & DRUM article.

The Bosch 5.3 Anti-Lock Brake System (ABS) with Traction Control System (TCS) is designed to prevent wheel lock-up during heavy braking. This provides improved driver control and reduces the distance required to stop vehicle. The system also monitors rear wheel speed and compares it to front wheel speed. TCS is operational at all vehicle speeds. If excessive front wheel speed is detected at either front wheel, TCS will be activated. TCS uses front brake intervention, fuel cut-off and spark retard to provide improved traction.

Major system components include the Electronic Brake Control Module (EBCM), speed sensors mounted at each wheel, 3 instrument cluster warning indicators, brakelight switch mounted at brake pedal, pump motor relay and solenoid valve relay mounted internal of EBCM, and Brake Pressure Modulator Valve (BPMV). BPMV assembly houses electric pump motor and solenoid valves.

OPERATION

During normal driving and braking operations, ABS acts like a conventional braking system. Each wheel speed sensor constantly sends an AC voltage signal to EBCM. This information is translated to wheel rotation speed. When EBCM detects wheel lock-up is about to occur, it activates appropriate solenoid to pulse on and off rapidly, regulating hydraulic pressure to each wheel. At this time a slight pulsation should be felt through brake pedal, indicating ABS is working.

BRAKE warning indicator (Red) will illuminate when ignition switch is turned to START position and should go out when ignition switch is turned to ON position. ABS indicator (Amber) and TC indicator (Amber) illuminate when ignition is turned on and goes out after about 3 seconds. If any indicator remains illuminated more than 30 seconds after vehicle is started, system malfunction is indicated. See **DIAGNOSIS & TESTING**.

Red BRAKE warning indicator will activate if parking brake is applied or brake fluid is low. Amber ABS indicator is controlled by EBCM and comes on if problem is detected with ABS. When indicator is illuminated, ABS is disabled and braking is accomplished by conventional brake system. If both warning indicators are illuminated, check conventional brake system for hydraulic system failure. Amber Traction Control (TC) indicator is controlled by EBCM and comes on if problem is detected with TCS. When indicator is illuminated, TCS is disabled and braking (conventional and ABS) is unaffected.

BLEEDING BRAKE SYSTEM

NOTE: Use DOT 3 brake fluid only. Protect vehicle exterior paint from possible brake fluid spillage.

MANUAL BLEEDING PROCEDURE

NOTE: Rapid pumping of brake pedal causes master cylinder secondary piston to move into a position that makes bleeding system difficult.

1. Deplete vacuum reserve from power brake booster by depressing brake pedal several times with engine off.

Fill master cylinder reservoir and keep at least half full during bleeding procedure. Reinstall master cylinder reservoir cap. If master cylinder is not suspected of having air in bore, go to step 4 . If master cylinder is known or suspected of having air in bore, go to next step.

2. Disconnect front EBCM brakeline fitting at master cylinder. Allow fluid to flow from fitting. Tighten fitting to specification. See **TORQUE SPECIFICATIONS** . Have an assistant depress brake pedal slowly and hold. Ensure reservoir fluid level is maintained. Again, loosen front EBCM brakeline fitting. Tighten fitting while pedal is still at floor. Release brake pedal slowly. Wait 15 seconds.
3. Repeat step 2) , including 15 second wait, until fluid is clear and free of air bubbles. Repeat procedure at other (rear most) EBCM brakeline fitting on master cylinder. Master cylinder is now bled. If wheel calipers are not suspected of having air in them, it is not necessary to bleed them.
4. If wheel calipers are known or suspected of having air in them, raise and support vehicle. Remove bleeder valve cap from right rear wheel. Place proper size box end wrench over bleeder valve. Attach one end of clear tube over valve and submerge other end in clear container partially filled with clean brake fluid.
5. Have an assistant depress brake pedal slowly and hold. Loosen bleeder valve to purge air from caliper. Tighten bleeder valve to specification and slowly release brake pedal. See **TORQUE SPECIFICATIONS** . Wait 15 seconds. Repeat procedure, including 15 second wait, until all air is removed.
6. Remove tube and wrench. Install bleeder valve cap. Fill master cylinder reservoir with fluid. Proceed to left rear, right front and left front wheels in sequence. Ensure there is no sponginess in brake pedal and that BRAKE warning indicator is off.

PRESSURE BLEEDING

NOTE: Rapid pumping of brake pedal causes master cylinder secondary piston to move into a position that makes bleeding system difficult.

1. Deplete vacuum reserve from power brake booster by depressing brake pedal several times with engine off. Fill master cylinder reservoir and keep at least half full during bleeding procedure. Reinstall master cylinder reservoir cap. If master cylinder is not suspected of having air in bore, go to step 4 . If master cylinder is known or suspected of having air in bore, go to next step.
2. Disconnect front EBCM brakeline fitting at master cylinder. Allow fluid to flow from fitting. Tighten fitting to specification. See **TORQUE SPECIFICATIONS** . Have an assistant depress brake pedal slowly and hold. Ensure reservoir fluid level is maintained. Again, loosen front EBCM brakeline fitting. Tighten fitting while pedal is still at floor. Release brake pedal slowly. Wait 15 seconds.
3. Repeat step 2 , including 15 second wait, until fluid is clear and free of air bubbles. Repeat procedure at other (rear most) EBCM brakeline fitting on master cylinder. Master cylinder is now bled. If wheel calipers are not suspected of having air in them, it is not necessary to bleed them.
4. Fill brake master cylinder reservoir to maximum-fill level. Install brake bleeder to brake master cylinder reservoir. Charge brake bleeder air tank to 25-30 psi (175-205 kPa). Open brake bleeder fluid tank valve to allow pressurized brake fluid to enter brake system. Wait approximately 30 seconds, then inspect entire hydraulic brake system in order to ensure there are no existing external brake fluid leaks. Any brake fluid leaks identified require repair prior to completing this procedure.
5. Install proper box-end wrench onto right rear wheel hydraulic circuit bleeder valve, then install a transparent hose over end of bleeder valve. Submerge open end of transparent hose into a transparent container partially filled with brake fluid from a clean, sealed brake fluid container. Loosen bleeder valve to purge air from wheel hydraulic circuit; allow fluid to flow until air bubbles stop flowing from bleeder, then tighten bleeder valve.
6. Repeat step 5 for left rear wheel, then right front wheel and then left front wheel. After completing final wheel hydraulic circuit bleeding procedure, ensure each of 4 wheel hydraulic circuit bleeder valves are properly tightened.
7. Close pressure bleeder fluid tank valve, then disconnect pressure bleeder. Fill brake master cylinder reservoir to maximum-fill level with DOT-3 brake fluid from a clean, sealed brake fluid container.

8. Slowly depress and release brake pedal. Observe feel of brake pedal. If brake pedal feels spongy, inspect brake system for external leaks. Using scan tool, perform antilock brake system automated bleeding procedure to remove any air that may have been trapped in BPMV. See **AUTOMATED BLEED PROCEDURE**.
9. Turn ignition on, engine off; ensure brake system warning lamp does not remain illuminated.

AUTOMATED BLEED PROCEDURE

CAUTION: Perform MANUAL BLEEDING PROCEDURE or PRESSURE BLEEDING PROCEDURE before performing auto bleed procedure.

NOTE: Auto bleed procedure is used to provide a complete bleed procedure on Anti-Lock Brake System/Traction Control System (ABS/TCS) equipped vehicles. This procedure cycles system valves and runs the pump to purge air from circuits normally closed during non ABS/TCS (normal) brake system operation and bleeding. This procedure should be used when air is suspected in secondary circuits or when Brake Pressure Modulator Valve (BPMV) has been replaced.

1. Raise and support vehicle. Remove wheels. Inspect brake system for leaks or damage. Repair as necessary before continuing. Connect pressure bleeder to master cylinder and pressurize to 30-35 psi (2.1-2.4 kg/cm²).
2. Ensure battery is fully charged. Connect scan tool to DLC. Turn ignition on, engine off. Using scan tool, establish communications with the ABS/TCS system. Select ABS/TCS then Special Function and then AUTOMATED BLEED PROCEDURE.
3. First part of automated bleed procedure will cycle pump and front release valves for one minute. After cycling has stopped, scan tool will enter a "cool down" mode and display a 3 minute timer. Auto bleed will not continue until this timer expired, and cannot be overridden.
4. During next step, scan tool will request technician to open one of bleeder screws. Scan tool will then cycle respective release valve and pump motor for 1 minute. Scan tool will repeat step 3 for remaining bleeder screws.
5. With bleeder tool still attached to vehicle and maintaining 35 psi (2.4 kg/cm²), scan tool will instruct technician to independently open each bleeder screw for approximately 20 seconds. This should allow any remaining air to be purged from brake lines.
6. When automated bleed procedure is completed, scan tool will display appropriate message. Remove pressure from pressure bleeding tool and then disconnect tool from vehicle.
7. Depress brake pedal to gauge pedal height and feel. Repeat procedure until pedal is acceptable. Remove scan tool from DLC connector. Install tire and wheel assemblies, if they were removed. Lower vehicle. Inspect brake fluid level in master cylinder. Road test vehicle while making sure brake pedal remains high and firm.

DIAGNOSIS & TESTING

NOTE: To diagnose ABS/TCS, manufacturer recommends using Tech 2 scan tool, DVOM, Breakout Box (J-39700) and Adapter (J-39700-280).

The EBCM has self-diagnostic capability, which can detect system failures. Diagnostic trouble codes stored by EBCM can be displayed using scan tool. See **RETRIEVING DIAGNOSTIC TROUBLE CODES**. Begin ABS/TCS diagnosis with **PRE-DIAGNOSTIC INSPECTION** procedure.

PRE-DIAGNOSTIC INSPECTION

When checking potential ABS/TCS faults, check following before performing diagnostic trouble code testing:

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- Check ABS fuse No. 19 (10-amp) and HAZARD fuse No. 12 (20-amp) in instrument panel fuse block located behind left side of instrument panel.
- Check fuse V1 (80-amp) in power distribution fuse block located in left front of engine compartment.
- Check all ABS/TCS wiring harness connectors for proper engagement, loose wires or terminals and/or corrosion. Check harness routing paying particular attention to wheel speed sensor wiring harness routing.
- Ensure brake switches are properly adjusted.
- Check brake system for leaks and proper fluid level.
- Check ABS/TCS ground circuit for clean tight connections. Ground is located in left front of engine compartment, in body and instrument panel wiring harness.
- Always perform diagnostic system check before diagnosing DTCs. See **DIAGNOSTIC SYSTEM CHECK**.

Solenoid valve relay is turned off by EBCM when a diagnostic trouble code is set. Using scan tool to monitor data list when trouble codes are set, solenoid will be displayed as being off. This is normal and not an indication of a system malfunction.

EBCM performs an automatic test during each ignition cycle when vehicle speed reaches 4 MPH in either forward or reverse gears. Automatic test cycles each solenoid valve, pump motor and relays to check component operation. EBCM will set a trouble code if an error is detected. Test may be felt and heard while it is taking place and is a normal mode of operation.

RETRIEVING DIAGNOSTIC TROUBLE CODES

Connect Tech 2 scan tool into Data Link Connector (DLC) located under left side of instrument panel. Follow scan tool manufacturer's instructions to retrieve stored fault codes.

If multiple codes are displayed, begin diagnosis with code that is displayed first. See **DIAGNOSTIC TROUBLE CODE DEFINITIONS** table under DIAGNOSTIC SYSTEM CHECK. Diagnose all codes in the order displayed by Tech 2 scan tool.

DIAGNOSTIC SYSTEM CHECK

1. Install scan tool. If scan tool powers up, go to next step. If scan tool does not power up, see **SCAN TOOL DOES NOT POWER UP** under appropriate **BODY CONTROL MODULES** article in **ACCESSORIES & EQUIPMENT**.
2. Turn ignition on, engine off. Try to establish scan tool communication with Electronic Brake Control Module (EBCM), Engine Control Module (ECM) and Transmission Control Module (TCM). If communication with modules is established, go to next step. If communication with modules is not established, see **SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE** under appropriate **BODY CONTROL MODULES** article in **ACCESSORIES & EQUIPMENT**.
3. Select display DTC function for each module. Record all displayed DTCs, status of displayed DTCs and module that set DTC. If DTCs are displayed, go to next step. If no DTCs are displayed, see **SYMPTOM DIAGNOSIS**.
4. Retrieve codes and perform appropriate test. See **DIAGNOSTIC TROUBLE CODE DEFINITIONS** table.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

Code	Definition
BXXXX	(1)
C0035	Left Front Wheel Speed Circuit Malfunction
C0040	Right Front Wheel Speed Circuit Malfunction
C0045	Left Rear Wheel Speed Circuit Malfunction

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C0050	Right Rear Wheel Speed Circuit Malfunction
C0060	Left Front ABS Solenoid No. 1 Circuit Malfunction
C0065	Left Front ABS Solenoid No. 2 Circuit Malfunction
C0070	Right Front ABS Solenoid No. 1 Circuit Malfunction
C0075	Right Front ABS Solenoid No. 2 Circuit Malfunction
C0080	Left Rear ABS Solenoid No. 1 Circuit Malfunction
C0085	Left Rear ABS Solenoid No. 2 Circuit Malfunction
C0090	Right Rear ABS Solenoid No. 1 Circuit Malfunction
C0095	Right Rear ABS Solenoid No. 2 Circuit Malfunction
C0110	Pump Motor Circuit Malfunction
C0121	Valve Relay Circuit Malfunction
C0141	Left TCS Solenoid No. 1 Circuit Malfunction
C0146	Left TCS Solenoid No. 2 Circuit Malfunction
C0151	Right TCS Solenoid No. 1 Circuit Malfunction
C0156	Right TCS Solenoid No. 2 Circuit Malfunction
C0161	ABS/TCS Brake Switch Circuit Malfunction
C0245	Wheel Speed Sensor Frequency Error
C0550	ECU Malfunction
C0800	Device Power No. 1 Circuit Malfunction
PXXXX	(2)
UXXXX	(3)

(1) See DIAGNOSTIC TESTS under appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT.

(2) For any DTC beginning with the letter "P", see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

(3) For any DTC beginning with the letter "U", see SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE under appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT.

CLEARING DIAGNOSTIC TROUBLE CODES

NOTE: DTCs cannot be cleared by disconnecting EBCM or negative battery cable, or by turning ignition off. DTCs will be erased when ignition is cycled 100 times without fault reappearing. Ignition cycle counter in EBCM will then be reset to zero. DTCs may also be cleared using Tech 2 scan tool.

1. Connect Tech 2 scan tool. See **RETRIEVING DIAGNOSTIC TROUBLE CODES** . Before clearing DTCs, check and note current DTC data. Select ABS/TCS function. Select DTC function, and then CLEAR CODES function.
2. Verify DTCs are cleared. If other DTCs are displayed, either DTCs were not cleared or ABS/TCS fault still exists. Diagnose fault and repeat procedure.

SYMPTOM DIAGNOSIS

If no DTCs are stored, perform appropriate symptom diagnostic test as necessary. See **SYMPTOM DIAGNOSTIC INDEX** table.

SYMPTOM DIAGNOSTIC INDEX

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Symptom	Perform Test
ABS Indicator Always On	<u>A</u>
ABS Indicator Inoperative	<u>B</u>
TC Indicator Always On	<u>C</u>
TC Indicator Inoperative	<u>D</u>

INTERMITTENTS & POOR CONNECTIONS

A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

Failures in ABS/TCS may be difficult to diagnose accurately. If an ABS/TCS failure or fault occurs, ABS and/or TC indicator will illuminate. If fault is an intermittent problem which has corrected itself (ABS and/or TC indicator off), DTC will be stored.

ABS/TCS self-diagnostic system can be used to help identify suspect circuit. Perform following procedure:

- Display and record DTC history data. Record any descriptive driving circumstances during failure occurrence. Clear any ABS/TCS DTCs set in EBCM.
- Test drive vehicle. Attempt to repeat failure under condition in which failure occurred. Use Tech 2 scan tool, mode F3 (snapshot), while test driving vehicle. See **RETRIEVING DIAGNOSTIC TROUBLE CODES**.
- After duplicating condition, stop vehicle and display any ABS/TCS DTCs which may have been stored.
- If no trouble codes were stored, see **SYMPTOM TESTS** to diagnose by symptoms.

Most intermittent problems are caused by faulty electrical connectors or wiring. When an intermittent failure is encountered, check suspect circuits for:

- Poor mating of connector halves, or terminals not fully seated in connector body (backed out).
- Improperly formed or damaged terminals. All connector terminals in a problem circuit should be carefully reformed to increase contact tension.
- Check for dirt or corrosion on terminals, which could impede proper terminal contact.
- Poor terminal-to-wire connection. This requires removing terminal from connector body to inspect.
- Wheel speed sensor cables not attached in retainers or routed too close to spark plug wires.
- If low system voltage is detected at EBCM, ABS will turn on ABS indicator until normal system voltage is achieved.

SYMPTOM TESTS

NOTE: For identification of wire color, terminals and circuits referenced in testing, see **WIRING DIAGRAMS**. System testing requires the use of Breakout Box (J-39700) and Adapter (J-39700-280). After repairs, recheck system operation to verify problem has been repaired. See **DIAGNOSTIC SYSTEM CHECK** under **DIAGNOSIS & TESTING**.

TEST A: ABS INDICATOR ALWAYS ON

1. Perform **DIAGNOSTIC SYSTEM CHECK** under **DIAGNOSIS & TESTING**. After performing diagnostic system check, go to next step.
2. Turn ignition off. Disconnect 31-pin EBCM connector C1. Install Breakout Box (J-39700) and Adapter (J-

39700-280) to EBCM harness connector C1. Turn ignition switch on. If ABS indicator illuminates, go to step 4 . If ABS indicator does not illuminate, go to next step.

3. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to step 7 .
4. Turn ignition off. Disconnect 26-pin instrument cluster connector. Using DVOM, measure resistance between breakout box terminals No. 21 and 19. If resistance is infinite, go to step 6 . If resistance is not infinite, go to next step.
5. Repair short to ground in Brown/Yellow wire between instrument cluster and EBCM. After repairs, go to step 7 .
6. Diagnose instrument cluster. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. After repairs, go to next step.
7. Operate system to verify repair.

Diagnostic Aids

If EBCM harness connector is not securely connected to EBCM, shorting bar in harness connector may cause ABS indicator to illuminate. A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

TEST B: ABS INDICATOR INOPERATIVE

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. Turn ignition off. Disconnect 31-pin EBCM connector C1. Install Breakout Box (J-39700) and Adapter (J-39700-280) to EBCM harness connector C1. Connect a fused jumper wire between breakout box terminals No. 21 and 19. Turn ignition switch on, with engine off. If ABS indicator illuminates, go to next step. If ABS indicator does not illuminate, go to step 4 .
3. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to step 7 .
4. Turn ignition off. Disconnect 26-pin instrument cluster connector. Using DVOM, measure resistance between breakout box terminal No. 21 and instrument cluster connector terminal No. 1 (Brown/Yellow wire). If resistance is not 0-5 ohms, go to next step. If resistance is 0-5 ohms, go to step 6 .
5. Repair open or high resistance in Brown/Yellow wire between instrument cluster and EBCM. After repairs, go to step 7 .
6. Diagnose instrument cluster. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. After repairs, go to next step.
7. Operate system to verify repair.

Diagnostic Aids

A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

TEST C: TC INDICATOR ALWAYS ON

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. Turn ignition on, engine off. Using scan tool, select DISPLAY DTC function Engine Control Module (ECM)

and Transmission Control Module (TCM). If any DTCs are present, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE. If no DTCs are present, go to next step.

3. Turn ignition on, with engine off. Using scan tool, enter ABS/TCS data list. While monitoring TCS on/off switch status, press and hold TCS switch for 3 seconds, then release TCS on/off switch. If switch status changes as switch is pressed and released, go to next step. If switch status does not change as switch is pressed and released, go to step 9 .
4. Turn ignition off. Disconnect 31-pin EBCM connector C1. Install Breakout Box (J-39700) and Adapter (J-39700-280) to EBCM harness connector C1. Turn ignition switch on, with engine off. If TC indicator turns off, go to next step. If TC indicator remains illuminated, go to step 6 .
5. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.
6. Turn ignition off. Disconnect 26-pin instrument cluster connector. Using DVOM, measure resistance between breakout box terminals No. 20 and 19. If resistance is infinite, go to step 8 . If resistance is not infinite, go to next step.
7. Repair short to ground in Brown/Yellow wire between instrument cluster and EBCM. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.
8. Diagnose instrument cluster. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.
9. Turn ignition off. Disconnect 31-pin EBCM connector C1. Install Breakout Box (J-39700) and Adapter (J-39700-280) to EBCM harness connector C1. Using DVOM, measure resistance between breakout box terminals No. 31 and 19. If resistance is infinite, go to step 5 . If resistance is not infinite, go to next step.
10. Repair short to ground in Brown/Red wire between TCS on/off switch and EBCM. Also, check for a short in TCS on/off switch. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.

Diagnostic Aids

If EBCM harness connector is not securely connected to EBCM, shorting bar in harness connector may cause TC indicator to illuminate. A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

TEST D: TC INDICATOR INOPERATIVE

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. Turn ignition on, with engine off. Using scan tool, enter ABS/TCS data list. While monitoring TCS on/off switch status, press and release TCS on/off switch. If switch status changes as switch is pressed and released, go to next step. If switch status does not change as switch is pressed and released, go to step 8 .
3. Turn ignition off. Disconnect 31-pin EBCM connector C1. Install Breakout Box (J-39700) and Adapter (J-39700-280) to EBCM harness connector C1. Connect a fused jumper wire between breakout box terminals No. 20 and 19. Turn ignition switch on, with engine off. If TC indicator illuminates, go to next step. If TC indicator does not illuminate, go to step 5 .
4. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.
5. Turn ignition off. Disconnect 26-pin instrument cluster connector. Using DVOM, measure resistance between breakout box terminal No. 20 and instrument cluster connector terminal No. 2 (Brown/Yellow wire). If

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- resistance is not 0-5 ohms, go to next step. If resistance is 0-5 ohms, go to step 7 .
6. Repair open or high resistance in Brown/Yellow wire between instrument cluster and EBCM. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.
 7. Diagnose instrument cluster. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.
 8. Turn ignition off. Disconnect 31-pin EBCM connector C1. Install Breakout Box (J-39700) and Adapter (J-39700-280) to EBCM harness connector C1. Using DVOM, measure resistance between breakout box terminals No. 31 and 19 while an assistance presses and releases TCS on/off switch. If resistance is not 0-5 ohms, go to next step. If resistance is 0-5 ohms, go to step 4 .
 9. Repair open or high resistance in Brown/Red wire between TCS on/off switch and EBCM. Also, check for an open in TCS on/off switch. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.

Diagnostic Aids

A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

DIAGNOSTIC TESTS

NOTE: For identification of terminals and circuits referenced in testing, see **WIRING DIAGRAMS** . System testing requires the use of Breakout Box (J-39700) and Adapter (J-39700-280). After repairs, recheck system operation to verify problem has been repaired. See **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.

DTC C0035, DTC C0040, DTC C0045 OR DTC C0050: WHEEL SPEED CIRCUIT MALFUNCTION

Circuit Description

DTC definitions:

- **C0035**

Left front wheel speed circuit malfunction.

- **C0040**

Right front wheel speed circuit malfunction.

- **C0045**

Left rear wheel speed circuit malfunction.

- **C0050**

Right rear wheel speed circuit malfunction.

Speed sensor used on this vehicle is a single point magnetic pickup. This sensor produces an AC signal that EBCM uses to calculate wheel speed.

DTC sets when:

- **No Signal**

Any time ignition is on and EBCM detects an open or short to voltage.

- **Invalid Signal**

One wheel speed is zero and other WSS are greater than 25 MPH for 10 milliseconds, during drive off, one wheel speed is zero and other WSS are greater than 7.5 MPH or EBCM detects a short to ground.

Diagnosis

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. Install scan tool. Turn ignition on. Set up scan tool snap shot feature to trigger for this DTC. Drive vehicle at a speed greater than 25 MPH. If scan tool indicates wheel speed DTC set, go to next step. If scan tool does not indicate wheel speed DTC set, see **DIAGNOSTIC AIDS** .
3. Raise and support vehicle. Disconnect wheel speed sensor connector. Measure resistance across wheel speed sensor. If resistance is 800-1700 ohms, go to next step. If resistance is not 800-1700 ohms, go to step 8 .
4. Spin wheel. Measure AC voltage across wheel speed sensor. If AC voltage is greater than 30 millivolts, go to next step. If AC voltage is not greater than 30 millivolts, go to step 8 .
5. Check wheel speed connector for poor connections. If problem was found, repair as necessary. After repairs, go to step 10 . If problem was not found, go to next step.
6. Disconnect EBCM connector. Install Braekout Box (J 39700) using Adapter (J 39700-280) to EBCM harness connector only. Check wheel speed sensor circuits for open, short to ground, short to voltage or shorted together. If problem was found, repair as necessary. After repairs, go to step 10 . If problem was not found, go to next step.
7. Check EBCM connector for poor connections. If problem was found, repair as necessary. After repairs, go to step 10 . If problem was not found, go to step 9 .
8. Replace wheel speed sensor. See **WHEEL SPEED SENSOR** under REMOVAL & INSTALLATION. After repairs, go to step 10 .
9. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.
10. Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

- **No Signal**

If ABS/TCS indicator illuminates only during moist conditions, inspect wheel speed sensor circuitry for signs of water intrusion. Clear DTCs and simulate effects of water intrusion using a saltwater solution. If DTC resets, replace suspect wiring harness.

- **Invalid Signal**

Under the following conditions, 2 Wheel Speed Sensor DTCs are set:

- 2 suspect wheel speeds equal zero for 10-20 seconds.
- Other wheel speeds are greater than 10 MPH.
- Other wheel speeds are within 7 MPH of each other.

Diagnose each wheel speed sensor individually.

DTC C0060, DTC C0065, DTC C0070, DTC C0075, DTC C0080, DTC C0085, DTC C0090 OR DTC C0095: ABS SOLENOID CIRCUIT MALFUNCTION**Circuit Description**

DTC definitions:

- **DTC C0060**

Left front ABS solenoid No. 1 circuit malfunction.

- **DTC C0065**

Left front ABS solenoid No. 2 circuit malfunction.

- **DTC C0070**

Right front ABS solenoid No. 1 circuit malfunction.

- **DTC C0075**

Right front ABS solenoid No. 2 circuit malfunction.

- **DTC C0080**

Left rear ABS solenoid No. 1 circuit malfunction.

- **DTC C0085**

Left rear ABS solenoid No. 2 circuit malfunction.

- **DTC C0090**

Right rear ABS solenoid No. 1 circuit malfunction.

- **DTC C0095**

Right rear ABS solenoid No. 2 circuit malfunction.

Inlet and outlet valve solenoid circuits are supplied with battery power when ignition is on. EBCM controls valve functions by grounding circuit when necessary.

DTC sets when EBCM senses an open, short to ground, or short to voltage in circuit.

Diagnosis

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. Using scan tool, clear DTC. Remove scan tool from DLC. Carefully drive vehicle at speed greater than 8 MPH for several minutes. Turn ignition off. Install scan tool. Turn ignition on, engine off. Using scan tool in DIAGNOSTIC TROUBLE CODES, check for DTCs. If any one of DTCs C0060-C0095 reset as a current DTC, go to next step. If DTCs C0060-C0095 do not reset as current, see **INTERMITTENTS & POOR CONNECTIONS** under DIAGNOSIS & TESTING.
3. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.

- Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

Solenoid valve circuit and solenoid coil are internal to EBCM. No part of solenoid circuit is diagnosable external to EBCM. DTC sets when there is a malfunction in solenoid circuit internal to EBCM only.

DTC C0110: PUMP MOTOR CIRCUIT MALFUNCTION

Circuit Description

Pump motor is an integral part of BPMV, while pump motor relay is integral to EBCM. Pump motor relay is not engaged during normal system operation. When ABS or TCS operation is required, EBCM activates pump motor relay and battery power is provided to pump motor.

DTC sets when pump motor voltage is not present 60 milliseconds after activation of pump motor relay, pump motor voltage is present for more than 2.5 seconds with no activation of pump motor relay or pump motor voltage is not present for at least 40 milliseconds after pump motor relay is commanded off.

Diagnosis

- Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
- Disconnect EBCM connector. Connect Breakout Box (J 39700) using Adapter (J 39700-280) to EBCM harness connector only. Check both ground circuits of EBCM, including EBCM ground, for high resistance or open. Check battery voltage circuits for open, high resistance, or short to ground. If problem was found, repair as necessary. After repairs, go to step 8 . If problem was not found, go to next step.
- Disconnect pump motor connector at BPMV. Measure resistance between each pump motor control circuit and housing of BPMV at pump motor connector. If resistance is less than 5 ohms, go to next step. If resistance is not less than 5 ohms, go to step 5 .
- Check pump motor connector for poor connections. If problem was found, repair as necessary. After repairs, go to step 8 . If problem was not found, go to step 6 .
- Check EBCM connector for poor connections. If problem was found, repair as necessary. After repairs, go to step 8 . If problem was not found, go to step 7 .
- Replace BPMV. See **BRAKE PRESSURE MODULATOR VALVE** under REMOVAL & INSTALLATION. After repairs, go to step 8 .
- Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.
- Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

A disconnect pump motor connector will cause this malfunction. A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

DTC C0121: VALVE RELAY CIRCUIT MALFUNCTION

Circuit Description

Solenoid valve relay supplies power to solenoid valve coils in EBCM. Solenoid valve relay, located in EBCM, is activated whenever ignition switch is on and no faults are present. Solenoid valve relay remains engaged until ignition is turned off or a failure is detected.

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DTC sets anytime solenoid valve relay is commanded on and EBCM does not see battery voltage at solenoid valves or anytime EBCM commands solenoid valve relay off and battery voltage is still present at solenoid valves.

Diagnosis

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. Install scan tool. Turn ignition on, engine off. Using scan tool, clear DTCs. If DTC resets, go to next step. If DTC does not reset, see **DIAGNOSTIC AIDS** .
3. Connect Breakout Box (J 39700) using Adapter (J 39700-280) to EBCM harness connector only. Check battery voltage circuit for open, high resistance, or short to ground. If problem was found, repair as necessary. After repairs, go to step 5 . If problem was not found, go to next step.
4. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.
5. Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

Solenoid valve relay is integral of EBCM and is not serviced separately. A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

DTC C0141, DTC C0146, DTC C0151 OR DTC C0156: TCS SOLENOID CIRCUIT MALFUNCTION

Circuit Description

DTC description:

- **DTC C0141**

Left TCS solenoid No. 1 circuit malfunction.

- **DTC C0146**

Left TCS solenoid No. 2 circuit malfunction.

- **DTC C0151**

Right TCS solenoid No. 1 circuit malfunction.

- **DTC C0156**

Right TCS solenoid No. 2 circuit malfunction.

Isolation and prime valve solenoid circuits are supplied with battery power when ignition is on. EBCM controls valve functions by grounding circuit when necessary.

DTC sets when EBCM senses an open, short to ground, or short to voltage in circuit.

Diagnosis

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.

- Using scan tool, clear DTC. Remove scan tool from DLC. Carefully drive vehicle above 8 mph for several minutes. Turn ignition off. Install scan tool. Turn ignition on, engine off. Using scan tool in DIAGNOSTIC TROUBLE CODES, check for DTCs. If any one of DTCs C0141-C0156 reset as a current DTC, go to next step. If DTCs C0141-C0156 did not reset as current, see **DIAGNOSTIC AIDS**.
- Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.
- Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

Solenoid valve circuit and solenoid coil are internal to EBCM. No part of solenoid circuit is diagnosable external to EBCM. DTC sets when there is a malfunction in solenoid circuit internal to EBCM only.

DTC C0161: ABS/TCS BRAKE SWITCH CIRCUIT MALFUNCTION

Circuit Description

Stoplight switch is a normally open switch, when brake pedal is depressed, EBCM senses battery voltage. This allows EBCM to determine state of brake light circuit.

DTC sets when EBCM detects battery voltage at all times, EBCM never detects battery voltage from stoplight switch input circuit or both brake lights are faulty.

Diagnosis

- Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
- Press brake pedal. Using scan tool, observe BRAKE SWITCH STATUS parameter in ABS data list. If BRAKE SWITCH STATUS parameter displays APPLIED, go to step 4. If scan tool does not display APPLIED, go to next step.
- Check Black/Yellow wire of stoplight switch for open. If problem was found, repair as necessary. After repairs, go to step 15. If problem was not found, go to step 11.
- Press brake pedal. If all stoplights are off, go to next step. If all stoplights are not off, go to step 7.
- Check Black/Yellow wire between stoplight switch and stoplights for open or high resistance. If problem was found, repair as necessary. After repairs, go to step 15. If problem was not found, go to next step.
- Check Black wire between stoplights and ground for open or high resistance. If problem was found, repair as necessary. After repairs, go to step 15. If problem was not found, see **DIAGNOSTIC AIDS**.
- Press brake pedal. Using scan tool, observe BRAKE SWITCH STATUS parameter. If BRAKE SWITCH STATUS parameter changes state, see **DIAGNOSTIC AIDS**. If BRAKE SWITCH STATUS parameter does not change state, go to next step.
- Turn ignition off. Inspect stoplight switch and adjust and/or calibrate if needed. See **BRAKELIGHT SWITCH** under ADJUSTMENTS. If problem was found, repair as necessary. After repairs, go to step 15. If problem was not found, go to next step.
- Turn ignition off. Disconnect stoplight switch connector. Turn ignition on, engine off. Using scan tool, observe BRAKE SWITCH STATUS parameter. If scan tool displays RELEASED, go to step 11. If scan tool does not display RELEASED, go to next step.
- Check Black/Yellow wire from stoplight switch for short to voltage. If problem was found, repair as necessary. After repairs, go to step 15. If problem was not found, go to step 12.
- Check stoplight switch connector for poor connections. If problem was found, repair as necessary. After repairs, go to step 15. If problem was not found, go to step 13.
- Check EBCM connector for poor connections. If problem was found, repair as necessary. After repairs, go to step 15. If problem was not found, go to step 14.

13. Replace stoplamp switch. See **STOPLIGHT SWITCH** under REMOVAL & INSTALLATION. After repairs, go to step 15 .
14. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.
15. Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

DTC C0245: WHEEL SPEED SENSOR FREQUENCY ERROR

Circuit Description

Speed sensor used on this vehicle is a single point magnetic pickup. This sensor produces an AC signal that EBCM uses to calculate wheel speed.

DTC sets when one of the following occurs:

- EBCM detects a deviation between the left and right rear wheel speeds of greater than 3.75 MPH at a vehicle speed of less than 62 MPH.
- EBCM detects a deviation between left and right front wheel speeds of greater than 6.25 MPH at a vehicle speed of less than 62 MPH.
- EBCM detects a deviation between left and right rear wheel speeds of greater than 6 percent of vehicle speed at greater than 62 MPH.
- EBCM detects a deviation between left and right front wheel speeds of greater than 2.5 MPH plus 6 percent of vehicle speed at greater than 62 MPH.

This DTC will set when EBCM cannot specifically identify which wheel speed sensor is causing malfunction. If EBCM can identify a specific wheel speed sensor causing malfunction, DTC associated with sensor (DTC C0035, C0040, C0045, or C0050) will be set.

Diagnosis

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. If DTC C0036, C0041, C0046 or C0051 are set concurrently with a history DTC C0245, see **DIAGNOSTIC TROUBLE CODE DEFINITIONS** table under DIAGNOSTIC SYSTEM CHECK under DIAGNOSIS & TESTING. If no other codes are set concurrently with DTC C00245, go to next step.
3. Inspect Wheel Speed Sensor (WSS) for physical damage. If physical damage of WSS is evident, go to next step. If physical damage of WSS is not evident, go to step 5 .
4. Replace WSS. See **WHEEL SPEED SENSOR** under REMOVAL & INSTALLATION. After repairs, go to step 14 .
5. Check WSS wiring harness for physical damage. If physical damage is evident, go to next step. If physical damage is not evident, go to step 7 .
6. Replace or repair WSS wire harness as necessary. After repairs, go to step 14 .
7. Check for proper routing of wheel speed sensor harness. Check that wheel speed sensor harness is routed away from spark plug wires. If wheel speed sensor harness is properly routed, go to step 9 . If wheel speed sensor harness is not properly routed, go to next step.

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8. Reroute WSS harness away from spark plug wires. After repairs, go to step 14 .
9. Install scan tool. Turn ignition on. Set scan tool to SNAP SHOT AUTO TRIGGER mode and monitor the wheel speed sensors. Carefully drive vehicle at speed greater than 8 MPH for several minutes. If scan tool triggered on any WSSs, go to next step. If scan tool did not trigger on any WSSs, go to step 11 .
10. Note which WSS triggered scan tool. Follow appropriate wheel speed sensor malfunction DTC diagnostic procedure for wheel speed sensor that triggered scan tool. See **DIAGNOSTIC TROUBLE CODE DEFINITIONS** table under DIAGNOSTIC SYSTEM CHECK under DIAGNOSIS & TESTING. After repairs, go to step 14 .
11. Reconnect all previously disconnected components. Using scan tool, clear DTC. Remove scan tool from DLC. Carefully drive vehicle above 8 mph for several minutes. If DTC resets as a current DTC, go to step 13 . If DTC doesn't reset, go to next step.
12. Malfunction is intermittent. Inspect all connectors and harnesses for damage that may result in an open or high resistance when connected. After repairs, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.
13. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.
14. Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

If ABS/TCS indicator illuminates only during moist conditions, inspect wheel speed sensor circuitry for signs of water intrusion. Clear DTCs and simulate effects of water intrusion using a saltwater solution. If DTC resets, replace suspect wiring harness.

The following are possible causes of DTC:

- Damaged or missing teeth on one or more wheel speed sensor rings.
- Large grooves or gouges, or foreign material buildup in gaps between wheel speed sensor ring teeth.
- Worn front hub bearing assembly, or inner axle bearing which could allow sensor-to-toothed ring gap to change excessively.

DTC C0550: ECU MALFUNCTION

Circuit Description

DTC identifies a malfunction within EBCM.

DTC sets when an internal EBCM malfunction exists.

Diagnosis

1. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
2. If any other DTCs than DTC C0550 are set, go to appropriate DTC for diagnosis. See **DIAGNOSTIC TROUBLE CODE DEFINITIONS** table under DIAGNOSTIC SYSTEM CHECK under DIAGNOSIS & TESTING. If no other DTCs than DTC C0550 are set, go to next step.
3. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.

- Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

DTC C0800: DEVICE POWER NO. 1 CIRCUIT MALFUNCTION**Circuit Description**

EBCM is required to operate within a specified range of voltage to function properly. During ABS and TCS operation, there are current requirements that will cause voltage to drop. Because of this, voltage is monitored out of ABS/TCS control to indicate a good charging system condition, and also during ABS/TCS control when voltage may drop significantly. EBCM also monitors for high voltage conditions which could damage EBCM.

DTC sets when one of the following occurs:

- EBCM ignition operating voltage at EBCM terminal No. 15 falls to less than 9.4 volts out of ABS/TCS control, or 8.8 volts during ABS/TCS control.
- EBCM ignition operating voltage at EBCM terminal No. 15 increases to greater than 17.4 volts.
- Low voltage or high voltage is detected for more than 500 milliseconds with vehicle speed greater than 3.6 MPH.

Diagnosis

- Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING. After performing diagnostic system check, go to next step.
- Turn all accessories off. Install scan tool. Start engine. Using scan tool, monitor battery voltage while running engine at about 2000 RPM. If voltage is 0-17.4 volts, go to step 4 . If voltage is not 0-17.4 volts, go to next step.
- Using DVOM, measure voltage between battery positive terminal and ground. If voltage is 0-17.4 volts, go to step 5 . If voltage is not 0-17.4 volts, diagnose charging system. See appropriate GENERATORS & REGULATORS article in STARTING & CHARGING SYSTEMS.
- Continue to monitor battery voltage while running engine at about 2000 RPM. If voltage is 0-9.4 volts, go to step 7 . If voltage is not 0-9.4 volts, go to next step.
- Turn ignition off. Disconnect scan tool, if still connected. Test drive vehicle faster than 3.5 MPH. If DTC resets, go to step 13 . If DTC does not reset, go to step 14 .
- Using DVOM, measure voltage between battery positive terminal and ground. If voltage is 0-9.4 volts, see appropriate GENERATORS & REGULATORS article in STARTING & CHARGING SYSTEMS. If voltage is not 0-9.4 volts, go to step 8 .
- Disconnect 31-pin EBCM connector C1. Install Breakout Box (J 39700) and Adapter (J 39700-280) to EBCM harness connector C1. Using DVOM, measure resistance between breakout box terminal No. 19 and ground. If resistance is 0-5 ohms, go to step 9 . If resistance is not 0-5 ohms, go to next step.
- Repair open or high resistance in Black wire between EBCM and ground connection. After repairs, go to step 14 .
- Turn ignition on, with engine off. Using DVOM, measure voltage between breakout box terminals No. 15 and 19. If voltage is greater than 9.4 volts, go to step 12 . If voltage is less than 9.4 volts, go to next step.
- Remove ABS fuse No. 19 (10-amp) located in fuse block, behind left side of instrument panel. Using DVOM, measure resistance between fuse test terminal on EBCM side and breakout box terminal No. 15. If resistance is 0-5 ohms, diagnose charging system. See appropriate GENERATORS article in STARTING & CHARGING SYSTEMS. If resistance is not 0-5 ohms, go to next step.
- Repair high resistance in Black/Red wire between fuse block and EBCM. After repairs, go to step 14 .
- Turn ignition off. Reconnect EBCM connector C1. Disconnect scan tool, if still connected. Test drive vehicle faster than 3.5 MPH. If DTC resets, go to next step. If DTC does not reset, perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.

13. Replace EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** under REMOVAL & INSTALLATION. After repairs, go to next step.
14. Using scan tool, clear DTCs. Operate vehicle. If DTC does not reset, system is okay.

Diagnostic Aids

A thorough inspection of wiring and connectors is important to prevent misdiagnosis. Check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections, or damaged wiring harness. An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a broken wire inside insulation.

REMOVAL & INSTALLATION

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS article in GENERAL INFORMATION before servicing anti-lock brake system.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BRAKE PRESSURE MODULATOR VALVE

NOTE: DO NOT loosen screws located on BPMV. Screws may not be able to be retightened enough to eliminate leakage. BPMV is not serviceable and must be replaced as an assembly.

CAUTION: Avoid getting water, brake fluid and engine coolant in socket of EBCM connector.

Removal

1. Brake Pressure Modulator Valve (BPMV) is located next to EBCM, in lower left side of engine compartment. Disconnect negative battery cable.
2. Pull out lock tab from EBCM harness connector and disconnect connector.
3. Note location of primary and secondary BPMV brakelines, and remove lines. Plug brakelines to prevent loss and contamination of fluid. Remove BPMV pump motor ground wire. Remove BPMV bracket nuts.

NOTE: When removing BPMV, protect vehicle exterior paint from possible brake fluid spillage.

4. Reposition brakelines to one side as necessary for removal of BPMV. Remove BPMV and EBCM as an assembly from bracket. Separate EBCM from BPMV.

Installation

1. To install, reverse removal procedure. Ensure brakelines are installed in original locations. If installing a NEW BPMV, ensure shipping plugs are removed from valve openings. Tighten screws, nuts and brakelines to specification. See **TORQUE SPECIFICATIONS**.
2. Refill brake master cylinder reservoir, bleed brakes and check for leaks. See **BLEEDING BRAKE SYSTEM**. Turn ignition on, with engine off. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.

ELECTRONIC BRAKE CONTROL MODULE

CAUTION: To prevent EBCM damage, never disconnect EBCM wiring harness connector with ignition on. DO NOT attempt to remove relays from EBCM. EBCM must be replaced as an assembly.

CAUTION: Avoid getting water, brake fluid and engine coolant in socket of EBCM connector.

Removal

1. Electronic Brake Control Module (EBCM) is mounted in lower left side of engine compartment. Disconnect negative battery cable. Remove air cleaner housing from engine compartment.
2. Pull out lock tab from EBCM harness connector and disconnect connector. Remove 4 EBCM-to-Brake Pressure Modulator Valve (BPMV) screws. Using care so as not to damage seal and solenoid valves, pull EBCM and separate from BPMV.

Installation

1. To install, clean BPMV gasket surface with alcohol. Install EBCM to BPMV. Install 4 mounting screws and tighten to specifications. See **TORQUE SPECIFICATIONS** .
2. Connect EBCM harness connector and push in lock tab. Install air cleaner housing. Turn ignition on, with engine off. Perform **DIAGNOSTIC SYSTEM CHECK** under DIAGNOSIS & TESTING.

PUMP MOTOR RELAY & SOLENOID VALVE RELAY

Removal & Installation

Pump motor relay and solenoid valve relay are mounted integral of EBCM and are not serviceable. Relays must be replaced as an assembly with EBCM. See **ELECTRONIC BRAKE CONTROL MODULE** .

STOPLIGHT SWITCH

Removal

Remove driver-side instrument panel sound insulator. Remove driver-side front floor air outlet duct. Remove stoplight switch connector. Use angled, pointed pliers to compress both locking tabs to remove stoplight switch.

Installation

Pull both actuating pin and retaining collar out of stoplight switch to full extended position of about 2/3" (17 mm). Engage tangs on stoplight switch with brake pedal bracket to install stoplight switch to brake pedal bracket. Install stoplight switch connector. Install driver-side front floor air outlet duct. Install driver-side instrument panel sound insulator.

TOOTHED SENSOR RING

Removal & Installation (Front)

Front toothed sensor ring is an integral part of front hub, and is not serviced separately. Sensor ring is accessible for inspection by removing front brake rotor. If ring replacement is necessary, hub must be replaced. See appropriate FRONT article in SUSPENSION.

Removal & Installation (Rear)

Rear toothed sensor ring is an integral part of rear axle, and is not serviced separately. If sensor ring requires

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replacement, rear axle must be replaced.

WHEEL SPEED SENSOR

Removal & Installation (Front)

Raise and support vehicle. Remove wheel speed sensor mounting bolt. Remove wheel speed sensor from steering knuckle. Remove wheel speed sensor cable from retaining clips. Disconnect wheel speed sensor electrical connector. Remove wheel speed sensor from vehicle. To install, reverse removal procedure. Clean all contaminants from sensor face before installation. Coat wheel speed sensor with silicone grease to prevent corrosion. Tighten wheel speed sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (Rear)

Raise and support vehicle. Remove appropriate wheel speed sensor mounting bolt, and remove appropriate wheel speed sensor from differential housing. Remove wheel speed sensor cable from retaining clips. Disconnect wheel speed sensor electrical connector. Remove wheel speed sensor from vehicle. To install, reverse removal procedure. Clean all contaminants from sensor face before installation. Coat wheel speed sensor with silicone grease to prevent corrosion. Tighten wheel speed sensor bolt to specification. See **TORQUE SPECIFICATIONS** .

ADJUSTMENTS

BRAKELIGHT SWITCH

Brakelight switch adjusts when brake pedal returns to at-rest position. Brakelight switch self-adjusts by driving actuating pin into switch based on brake pedal position.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
BPMV Brakeline	12 (16)
Wheel Lug Nut	80 (109)
	INCH Lbs. (N.m)
BPMV Bracket Nut	120 (14)
EBTCM-To-BPMV Mounting Screw	44 (5)
Wheel Caliper Bleeder Valves	71 (8)
Wheel Speed Sensor Bolt	71 (8)

WIRING DIAGRAMS

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Fig. 1: Anti-Lock Brake/Traction Control System Wiring Diagram (Catera)

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