

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	SYSTEM COVERAGE	1
1.2	SIX-STEP TROUBLESHOOTING PROCEDURE	1
2.0	IDENTIFICATION OF SYSTEM	1
3.0	SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION	1
3.1	TEVES MARK 20I SYSTEM DESCRIPTION	1
3.1.1	PEDAL FEEL/VEHICLE CHARACTERISTICS	2
3.1.2	SYSTEM COMPONENTS	2
3.1.3	ABS AND BRAKE WARNING INDICATORS	2
3.1.4	CONTROLLER ANTILOCK BRAKE (CAB)	2
3.1.5	HYDRAULIC CONTROL UNIT	3
3.1.6	RELAYS/SWITCHES	3
3.1.7	SENSORS	3
3.2	DIAGNOSTIC TROUBLE CODES	4
3.2.1	SYSTEM INITIALIZATION	4
3.2.2	DIAGNOSTIC MODE	4
3.2.3	INTERMITTENT DIAGNOSTIC TROUBLE CODES	4
3.3	AXLE LOCK	4
3.3.1	GENERAL	4
3.3.2	DESCRIPTION	4
3.4	USING THE DRBIII®	5
3.5	DRBIII® ERROR MESSAGES	5
3.5.1	DRBIII® DOES NOT POWER UP (BLANK SCREEN)	5
3.5.2	DISPLAY IS NOT VISIBLE	5
4.0	DISCLAIMERS, SAFETY WARNINGS	5
4.1	DISCLAIMERS	5
4.2	SAFETY	6
4.2.1	TECHNICIAN SAFETY INFORMATION	6
4.2.2	VEHICLE PREPARATION FOR TESTING	6
4.2.3	SERVICING SUB-ASSEMBLIES	6
4.2.4	DRBIII® SAFETY INFORMATION	6
4.3	WARNING	6
4.3.1	VEHICLE DAMAGE WARNINGS	6
4.3.2	ROAD TESTING A COMPLAINT VEHICLE	7
4.4	DIAGNOSIS	7
5.0	REQUIRED TOOLS AND EQUIPMENT	7
6.0	GLOSSARY OF TERMS	8
7.0	DIAGNOSTIC INFORMATION AND PROCEDURES	9
	BRAKES (CAB)	
	CAB POWER FEED CIRCUIT	10
	CONTROLLER FAILURE	13
	G-SWITCH NOT PROCESSABLE	15
	LEFT FRONT SENSOR CIRCUIT FAILURE	19
	LEFT REAR SENSOR CIRCUIT FAILURE	19

TABLE OF CONTENTS - Continued

RIGHT FRONT SENSOR CIRCUIT FAILURE	.19
RIGHT REAR SENSOR CIRCUIT FAILURE	.19
LEFT FRONT SENSOR SIGNAL FAILURE	.22
LEFT REAR SENSOR SIGNAL FAILURE	.22
RIGHT FRONT SENSOR SIGNAL FAILURE	.22
RIGHT REAR SENSOR SIGNAL FAILURE	.22
PUMP MOTOR NOT WORKING PROPERLY	.25
SYSTEM OVER VOLTAGE	.29
SYSTEM UNDER VOLTAGE	.31
*ABS WARNING INDICATOR ALWAYS ON	.33
*ABS WARNING INDICATOR INOPERATIVE	.35
*BRAKE LAMP SWITCH	.37
*FRONT AXLE LOCK INDICATOR REMAINS FLASHING	.38
*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE	.40
*REAR AXLE LOCK INDICATOR REMAINS FLASHING	.42
*REAR AXLE LOCK INOPERATIVE	.45
VERIFICATION TESTS	
VERIFICATION TESTS	.47
8.0 COMPONENT LOCATIONS	.49
8.1 CONTROLLER ANTILOCK BRAKE	.49
8.2 DATA LINK CONNECTOR	.49
8.3 G-SWITCH	.49
8.4 FUSES & RELAYS	.50
8.5 WHEEL SPEED SENSORS	.50
8.6 WHEEL SPEED SENSOR CONNECTORS	.50
8.7 BRAKE SWITCHES	.51
8.7.1 PARKING BRAKE	.51
8.7.2 BRAKE SWITCH	.51
9.0 CONNECTOR PINOUTS	.53
AXLE LOCK SWITCH (OFF-ROAD PACKAGE)	.53
BRAKE LAMP SWITCH	.53
CONTROLLER ANTILOCK BRAKE	.53
DATA LINK CONNECTOR	.54
FRONT LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)	.54
FRONT LOCKER PUMP (OFF-ROAD PACKAGE)	.54
G-SWITCH (LHD)	.55
INSTRUMENT CLUSTER C1	.55
INSTRUMENT CLUSTER C2	.55
LEFT FRONT WHEEL SPEED SENSOR	.56
LEFT REAR WHEEL SPEED SENSOR	.56
FRONT LOCKER RELAY (OFF-ROAD PACKAGE)	.58
REAR LOCKER RELAY (OFF-ROAD PACKAGE)	.58
REAR LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)	.58
REAR LOCKER PUMP (OFF-ROAD PACKAGE)	.58
RIGHT FRONT WHEEL SPEED SENSOR	.59
RIGHT REAR WHEEL SPEED SENSOR	.59

TABLE OF CONTENTS - Continued

10.0	SCHEMATIC DIAGRAMS.....	.61
10.1	TEVES MARK 20I CONTROLLER ANTILOCK BRAKE - ABS.....	.61
10.2	AXLE LOCK.....	.62

NOTES

1.0 INTRODUCTION

The procedures contained in this manual include all the specifications, instructions, and graphics needed to diagnose the 2003 TJ Chassis system problems: Teves Mark 20i Antilock Braking System (ABS) and Axle Lock. The diagnostics in this manual are based on the failure condition or symptom being present at time of diagnosis.

Follow the recommendations below when choosing your diagnostic path.

1. First make sure the DRBIII® is communicating with the CAB. If the DRBIII® displays a “No Response” condition, you must diagnose that first.
2. Read DTC's (diagnostic trouble codes) with the DRBIII®.
3. If no DTC's are present, identify the customer complaint.
4. Once the DTC or customer complaint is identified, locate the matching test in the Table of Contents and begin to diagnose the symptom.

All component location views are in Section 8.0. All connector pinouts are in Section 9.0. All schematics are in Section 10.0.

An asterisk (*) placed before the symptom description indicates a customer complaint.

When repairs are required, refer to the appropriate service manual for the proper removal and repair procedure. Diagnostic procedures change every year. New diagnostic systems may be added; carryover systems may be enhanced. **READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE DIAGNOSTIC TROUBLE CODE.** It is recommended that you review the entire manual to become familiar with all new and changed diagnostic procedures.

After using this book, if you have any comments or recommendations, please fill out the form at the back of the book and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic manual covers the Teves Mark 20i Antilock Braking System (ABS) found on the Jeep Wrangler. Diagnosis of the Axle Lock is covered in this manual.

1.2 SIX-STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the antilock brake system is done in six basic steps:

- verification of complaint
- verification of any related symptoms
- symptom analysis
- problem isolation

- repair of isolated problem
- verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

Vehicles equipped with the Teves Mark 20i antilock brake system can be identified by the presence of the hydraulic control unit (HCU) located under the hood near the power brake booster. Vehicles equipped with Axle Lock can be identified by the presence of the Axle Lock Switch located on the lower center of the instrument panel.

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 TEVES MARK 20I SYSTEM DESCRIPTION

An electronic control module is used to monitor wheel speeds and to modulate (control) hydraulic pressure in each brake channel to prevent wheel lock-up during braking.

During a non-ABS stop, the system functions as a standard front/rear split configuration. The primary hydraulic system supplies brake fluid pressure to the front brakes, and the secondary hydraulic system supplies the rear brakes. A conventional combination/proportioning valve is used.

During an ABS stop, the system still uses the front/rear hydraulic split; however, the brakes system pressure is further split into three control channels. During ABS operation, the front wheels are controlled independently and are on two separate control channels. The rear wheels are controlled together through one control channel. By using a separate control channel for each front wheel, more steering control is maintained during maximum braking.

During an antilock stop, “wheel lock-up” does not necessarily mean that the wheel has locked, it means only that the wheel is turning slower than the vehicle speed. This is called “wheel slip” and is indicated as a percentage. 0% slip means that the wheel is rolling free and 100% slip means that the wheel is locked. The antilock system maintains an average of approximately 20% wheel slip.

It is important to remember that the antilock brake system does not shorten the vehicle stopping distance under all driving conditions, but provides improved control of the vehicle while stopping. Vehicle stopping distance is still dependent on vehicle speed, weight, tires, road surface, and other factors.

GENERAL INFORMATION

3.1.1 PEDAL FEEL/VEHICLE CHARACTERISTICS

There are several pedal feel/vehicle characteristics that are considered normal for antilock braking that may require further explanation.

When stopping conditions activate the antilock brakes, the driver may feel some vibrations/pulsations in the brake pedal and may hear the solenoid valves clicking and the pump motor running. The vibrations/pulsations are caused by the isolating, building and decaying of brake fluid pressure within the brake lines. The ABS prevents complete wheel lock-up, but some wheel slip is required for the best braking performance. This slip may result in some tire chirping, depending on the road surface. This chirping should not be interpreted as total wheel lock-up. Total wheel lock-up leaves black tire marks on dry pavement. Antilock braking may leave some light marks.

At the end of an ABS stop, the ABS system may not function below 5 Km/h (3 mph). There may be a slight brake pedal drop anytime the ABS is deactivated.

In case of braking on a bumpy surface, the ABS module may detect wheel locking tendencies due to wheel hop and cycle ABS. In that event the brake pedal may pulsate with a perceived loss of deceleration. ABS braking may also be activated at times while on dry pavement with sand, gravel, or other loose debris on the road.

It should be noted that the pulsating pedal feel characteristic will not illuminate the brake warning indicators or set a diagnostic trouble code that is stored in the Controller Antilock Brake (CAB). When investigating a hard pedal feel, inspect the sensor and tone wheel teeth for chips/broken teeth, damaged sensor pole tips, excessive runout of the tone wheel, or excessive gap.

3.1.2 SYSTEM COMPONENTS

Antilock Brake System

- controller antilock brake (CAB)
- vacuum booster
- master cylinder (w/center valves)
- hydraulic control unit (HCU)
 - valve block assembly: 6 valve solenoids (3 inlet valves, 3 outlet valves), 3 accumulators
- pump/motor assembly: 1 motor
2 pumps
- G (acceleration) switch
- 1 proportioning valve
- 4 wheel speed sensor/tone wheel assemblies
- ABS warning indicator

- fuses and wiring harness
- fluid reservoir (integral part of master cylinder assembly)

3.1.3 ABS AND BRAKE WARNING INDICATORS

The amber ABS warning indicator is located in the instrument cluster. It is used to inform the driver that the antilock function has been turned off due to a system malfunction. On a TJ model the warning indicator is controlled by the CAB and the ABS relay. The CAB controls the indicator by directly grounding the ABS relay control circuit. The ABS relay grounds the indicator circuit when it is de-energized.

The red brake warning indicator is located in the instrument cluster. It can be activated by application of the parking brake, low brake fluid level or by turning the ignition switch to the start position.

3.1.4 CONTROLLER ANTILOCK BRAKE (CAB)

The controller antilock brake (CAB) is a microprocessor-based device that monitors wheel speeds and controls the antilock functions.

The primary functions of the CAB are:

- monitor wheel speeds
- detect wheel locking tendencies
- control fluid pressure modulation to the brakes during antilock stop operation
- monitor the system for proper operation
- provide communication to the DRBIII® while in diagnostic mode
- control the ABS relay
- store diagnostic information in non-volatile memory

The CAB continuously monitors the speed of each wheel. When a wheel locking tendency is detected, the CAB will command the appropriate valve in the HCU to modulate brake fluid pressure to that wheel. Brake pedal position is maintained during an antilock stop by being a closed system with the use of three accumulators. The CAB continues to control pressure in individual hydraulic circuits until a wheel locking tendency is no longer present. The CAB turns on the pump/motor during an antilock stop.

The antilock brake system is constantly monitored by the CAB for proper operation. If the CAB detects a system malfunction, it can disable the antilock system and turn on the ABS warning indicator. If the antilock function is disabled, the system will revert to standard base brake system operation.

The CAB inputs include the following:

- four wheel speed sensors
- brake lamp switch
- ignition switch
- battery voltage
- diagnostic communication
- G switch (acceleration switch)

The CAB outputs include the following:

- six valve/solenoid drivers
- pump/motor actuation
- ABS warning indicator control
- diagnostic communication

3.1.5 HYDRAULIC CONTROL UNIT

The hydraulic control unit (HCU) contains the valve block assembly, three accumulators, and the pump/motor assembly.

Valve Block Assembly: The valve block assembly contains 6 valves with three inlet valves and three outlet valves. The inlet valves are spring-loaded in the open position and the outlet valves are spring loaded in the closed position. During an antilock stop, these valves are cycled to maintain the proper slip ratio for each channel. If a wheel locks, the inlet valve is closed to prevent any further pressure increase. Then the outlet valve is opened to release the pressure to the accumulators until the wheel is no longer slipping. Once the wheel is no longer slipping, the outlet valve is closed and the inlet valve is opened to reapply pressure. If the wheel is decelerating within its predetermined limits (proper slip ratio), both valves will close to hold the pressure constant.

Pump/Motor Assembly: The pump/motor assembly provides the extra amount of fluid needed during antilock braking. The pump is supplied fluid that is released to the accumulators when the outlet valve is opened during an antilock stop. The pump is also used to drain the accumulator circuits after the antilock stop is complete. The pump is operated by an integral electric motor. This motor is controlled by the CAB. The CAB turns on the motor when an antilock stop is detected. The pump continues to run during the antilock stop and is turned off approximately 3-5 seconds after the stop is complete. The pump mechanism consists of two opposing pistons operated by an eccentric cam. One piston supplies the primary hydraulic circuit. The opposing piston supplies the secondary hydraulic circuit. In operation, one piston draws fluid from the accumulators. The opposing piston pumps fluid to the valve body solenoids. The CAB monitors the pump/motor operation.

Accumulators: The accumulators provide temporary fluid storage during an antilock stop and are drained by the pump/motor.

3.1.6 RELAYS/SWITCHES

Relays: The ABS Relay is located in the power distribution center (PDC). When the relay is de-energized, it supplies a ground to turn on the ABS warning indicator. The ABS relay is controlled by the CAB. The CAB energizes the relay when it receives an ignition input signal.

3.1.7 SENSORS

Wheel Speed Sensors and Tone Wheels: One wheel speed sensor (WSS) is located at each wheel and sends a small AC signal to the Controller Antilock Brake (CAB). This voltage is generated by magnetic induction when a toothed sensor ring (tone wheel) passes by a stationary magnetic sensor (wheel speed sensor). The CAB converts the AC signals into digital signals for each wheel.

The front wheel sensor is attached to a boss in the steering knuckle. The tone wheel is an integral part of the front axle shaft. The rear speed sensor is mounted in the caliper adapter plate (rear disc only) and the rear tone wheel is an integral part of the rear rotor hub. The front wheel speed sensor air gap is NOT adjustable. The correct front wheel speed sensor air gap is from 0.40mm to 1.3mm (0.016" to 0.051"). Preferred rear sensor air gap for drum brake systems is 1.1mm (0.043"). Acceptable air gap range is 0.92mm to 1.275mm (0.036" to 0.050"). All wheel speed sensors have a resistance between 900 and 1300 ohms.

Correct antilock system operation is dependent on correct wheel speed signals from the wheel speed sensors. The vehicle's wheels and tires should all be the same size and type. In addition, the tires should be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals; however, the system will continue to function when using the mini-spare. When driven over rough road surfaces, the rear wheel speed sensor signals may be erratic and cause a false trouble code.

G (Acceleration) Switch: The CAB monitors the acceleration switch at all times. The switch assembly contains three mercury switches that monitor vehicle deceleration rates (G-force). Sudden, rapid changes in vehicle and wheel deceleration rate trigger the switch, sending a signal to the CAB. The switch assembly responds to three deceleration rates; two for forward braking and one for rearward braking.

GENERAL INFORMATION

3.2 DIAGNOSTIC TROUBLE CODES

The Teves Mark 20i Antilock Brake System (ABS) module may report any of the following diagnostic trouble codes:

- Controller Failure
- G Switch Not Processable
- Left Front Sensor Circuit Failure
- Left Front Sensor Signal Failure
- Left Rear Sensor Circuit Failure
- Left Rear Sensor Signal Failure
- CAB Power Feed Circuit
- System Over voltage
- System Under voltage
- Pump Motor Not Working Properly
- Right Front Sensor Circuit Failure
- Right Front Sensor Signal Failure
- Right Rear Sensor Circuit Failure
- Right Rear Sensor Signal Failure

Diagnostic trouble codes are retained in memory until erased using the DRBIII®, or automatically erased after 255 key cycles.

3.2.1 SYSTEM INITIALIZATION

System initialization starts when the key is turned to RUN. At this point, the CAB performs a complete self-check of all electrical components in the antilock brake systems.

At around 19 km/h (12 miles per hour), the pump motor is briefly activated to ensure operation, and wheel speed sensor circuitry is checked. If the brake pedal is applied when the vehicle reaches 19 km/h (12 mph), this check will be delayed until 40 km/h (25 mph). If, during the dynamic test, the brake pedal is applied, the driver may feel the test through brake pedal pulsations. This is a normal condition. Throughout the remainder of the drive cycle, ongoing tests are performed, and the CAB monitors ABS circuits for continuity.

If any component causes a diagnostic trouble code during system initialization or dynamic check, the CAB will illuminate the ABS warning indicator.

3.2.2 DIAGNOSTIC MODE

To enter diagnostic mode, vehicle speed must be below 10 km/h (6 mph), a “no response” message will be displayed by the DRBIII®. The following are characteristics of diagnostic mode:

- The ABS warning indicator will flash. If a hard diagnostic trouble code is present, such as a Speed Sensor Circuit or Signal Failure trouble code or CAB Power Feed Circuit diagnostic trouble code, the indicator will be illuminated without

blinking and limited diagnostic operations only will be available until the diagnostic trouble code condition is corrected.

- Antilock operation is disabled.

3.2.3 INTERMITTENT DIAGNOSTIC TROUBLE CODES

If the malfunction is not present while performing a test procedure, the diagnostic procedures will not locate the problem. In this case, the code can only suggest an area to inspect. Check for the following:

- loose or corroded connections
- damaged components (sensors, tone wheels especially)
- damaged wiring
- excessive axle shaft runout
- brake system hydraulic leaks
- base brake system problems, non-ABS related.

If no obvious problems are found, erase diagnostic trouble codes and, with the key on, wiggle the wire harness and connectors. Recheck for codes periodically as you work through the system. This procedure may uncover an intermittent or difficult to locate malfunction.

3.3 AXLE LOCK

3.3.1 GENERAL

For this vehicle, the Axle Lock has no dedicated module controller. A manual switch located on the instrument panel controls the system. No DTC's will occur for this system.

3.3.2 DESCRIPTION

The axle lock has the ability to lock the front and rear axle differentials. The system components are the instrument cluster, axle lock switch, front and rear locker relays, front and rear locker pumps, and locker indicator switches. To operate both lockers three requirements need to be met:

1. ignition in the ON position
2. transfer case range sensor indicating 4 “LOW” range
3. vehicle speed less than 16km/h (10 mph)

The 16km/h (10 mph) engagement is for engagement only. All axles will remain locked if vehicle speed does not exceed 72 km/h (45 mph).

The instrument cluster has the control logic that monitors these requirements. If the requirements are not met the axle lock switch will be disabled. The axle lock switch receives the enable signals from the instrument cluster. Any subsequent down-

ward press of the axle lock switch will operate the front locker relay and front locker pump. The first downward press on the axle lock switch locks the rear axle, the second downward press locks the front axle (rear is still locked), the third downward press unlocks the front axle (rear is still locked), the fourth downward press locks the front axle (rear axle is still locked). An upward press on the axle lock switch at any time will unlock any axle that is currently locked.

The enabled axle lock switch energizes the locker relay and voltage is sent to the locker pump to supply 5 psi of air to the axle allowing the differential to lock up. The "axle lock" indicator on the instrument cluster flashes during the transition state. The instrument cluster is seeking lock feedback from the locking indicator switch. With a successful lock request the "axle lock" indicator will be illuminated and a chime will sound.

If an axle is engaged the axle lock switch remains enabled until all axles are unlocked, regardless if the key is removed from the ignition switch. If the ignition key is removed and either axle is locked the instrument cluster "axle lock" indicator to the corresponding axle will flash and the chime will sound three times to alert of battery discharge. Flashing "axle lock" indicators will continue until axles are unlocked. Once the axles have been locked it will remain locked until one of the following happens:

1. an upward press of the axle lock switch for all locked axles or downward press for front axle only
2. transfer case is shifted out of 4 "LOW" range
3. vehicle speed exceeds 72 km/h (45 mph)
4. loss of battery power

3.4 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading diagnostic trouble codes, erasing trouble codes and other DRB functions.

3.5 DRBIII® ERROR MESSAGES

Under normal operation, the DRBIII® will display one of only two error messages:

- User-Requested WARM Boot or User-Requested COLD Boot

This is a sample of such an error message display:

ver: 2.14
 date: 26 Jul93
 file: key_itf.cc
 date: Jul 26 1993
 line: 548
 err: 0x1
 User-Requested COLD Boot

Press MORE to switch between this display and the application screen.
 Press F4 when done noting information.

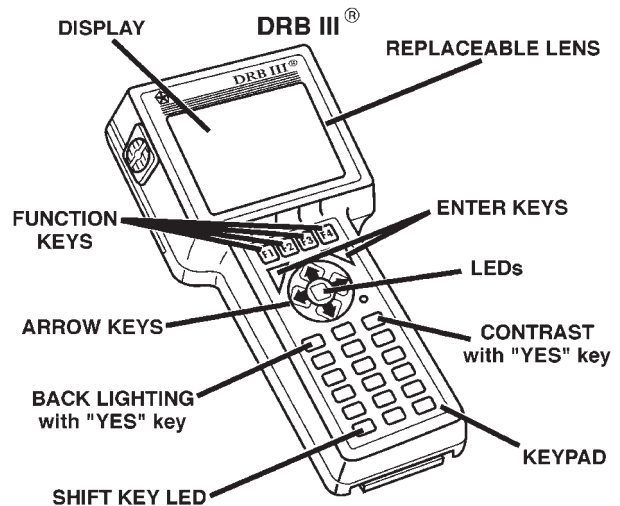
3.5.1 DRBIII® DOES NOT POWER UP (BLANK SCREEN)

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage (data link 16-way connector cavity 16). A minimum of 11 volts is required to adequately power the DRBIII®. Also, check for a good ground at the DLC.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, and inoperative DRBIII® may be the result of faulty cable or vehicle wiring.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



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4.0 DISCLAIMERS, SAFETY WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest

GENERAL INFORMATION

information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles; the parking brake does not hold the drive wheels.

When servicing a vehicle always wear eye protection and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

Additional safety procedures can be found in the service manual. Following these procedures is very important to avoid injury.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic trouble codes or error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the antilock brake system are intended to be serviced in assembly only. Attempting to remove or repair certain system sub-components may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

- Follow the vehicle manufacturer's service specifications at all times.

- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0 - 500 peak volts AC 0 - 500 volts DC
Ohms (resistance)*	0 - 1.12 megohms
Frequency Measured Frequency Generated	0 - 10 kHz
Temperature	-50 - 600°C -58 - 1100°F

* Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measuring voltage above 25v DC or 25v AC.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNING

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is OFF. Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not pierce wire insulation; this will damage it and eventually cause it to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second code could be set, making diagnosis of the original problem more difficult.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

NOTE: After the repair of pump or speed signal DTC's, the vehicle must be driven at 25 km/h (15 mph) to clear the DTC from the CAB.

WARNING: BEFORE ROAD TESTING A VEHICLE, BE SURE THAT ALL COMPONENTS ARE REASSEMBLED. DURING THE TEST DRIVE, DO NOT TRY TO READ THE DRBIII® SCREEN WHILE IN MOTION. DO NOT HANG THE DRB FROM THE REAR VIEW MIRROR OR OPERATE IT YOURSELF. HAVE AN ASSISTANT AVAILABLE TO OPERATE THE DRBIII®.

4.4 DIAGNOSIS

1. Your diagnostic test procedure must begin with a thorough visual inspection of the ABS for damaged components or disconnected connectors. The brake lamps must be operational prior to continuing.
2. Connect the DRBIII® to the data link connector located under the dash. If the DRBIII® does not power up, check the power and ground supplies to the connector.
3. Select "Antilock Brakes". Turn the ignition on. If the DRBIII® displays "No Response", perform the proper test.
4. Read and record all ABS diagnostic trouble codes. If the "CAB Power Feed Circuit" trouble code is present, it must be repaired prior to addressing any other DTC's. If any additional codes are present, proceed to the appropriate test.
5. If there are no diagnostic trouble codes present, select "Inputs/Outputs" and read the brake switch input as you press and release the brake pedal. If the display does not match the state of the pedal, perform the appropriate test. Read the "G-Switch" status, with the vehicle on a level surface, both switches should read "CLOSED". If the status is not correct, perform the appropriate

test. If a problem with the ABS warning indicator exists, refer to the appropriate test.

6. If no other problem are found, it will be necessary to road test the vehicle. **THE DRBIII® MUST NOT BE CONNECTED TO THE DATA LINK CONNECTOR WHEN ROAD TESTING FOR PROPER ANTILOCK OPERATION. THE SYSTEM IS DISABLED WHILE IN DIAGNOSTIC MODE.** Perform several antilock stops from above 50 Km/h (30 mph) and then repeat steps 2, 3, and 4. If any diagnostic trouble codes are present, proceed to the appropriate test.
7. The following conditions should be considered "NORMAL" operation, and no repairs should be attempted to correct them.
 - Brake pedal feedback during an ABS stop (clicking, vibrating)
 - Clicking, groaning or buzzing at 10 Km/h (6 mph) (drive off self test)
 - Groaning noise during an ABS stop
 - Slight brake pedal drop and pop noise when ignition is initially turned on
 - Brake pedal ratcheting down at the end of an ABS stop
8. If the complaint is "ABS cycling" at the end of a stop at low speeds, it may be caused by a marginal wheel speed sensor signal. The sensor air gap, tone wheel condition, and/or brakes hanging up are possible causes of this condition.
9. After a road test in which no problems were found, refer to any Technical Service Bulletins that may apply.

5.0 REQUIRED TOOLS AND EQUIPMENT

DRBIII® (diagnostic read-out box)
 jumper wires
 ohmmeter
 voltmeter
 test lamp

GENERAL INFORMATION

6.0 GLOSSARY OF TERMS

ABS	antilock brake system	JBLK	junction block
AC	alternating current	JTEC	Jeep and Truck Engine Controller
BCM	Body Control Module	LF	left front
CAB	controller antilock brake	LR	left rear
CCD	Chrysler Collision Detection	PCM	Powertrain Control Module
DC	direct current	PDC	power distribution center
DLC	data link connector	P/M	pump motor
DRBIII®	diagnostic read-out box	RF	right front
DTC	diagnostic trouble code	RR	right rear
HCU	hydraulic control unit	SCI	Serial Communication Interface
HZ	Hertz	SOL	Solenoid
		WSS	wheel speed sensor

7.0

DIAGNOSTIC INFORMATION AND
PROCEDURES

BRAKES (CAB)

Symptom:

CAB POWER FEED CIRCUIT

When Monitored and Set Condition:

CAB POWER FEED CIRCUIT

When Monitored: Ignition on. The CAB monitors the Fused B(+) circuit at all times for proper system voltage.

Set Condition: If the Fused B(+) voltage is missing when the CAB detects that an internal main driver is not "on", the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES

INTERMITTENT DTC

B(+) CIRCUIT SHORTED TO GROUND

BLOWN FUSE - FUSED B(+) CIRCUIT

CAB - FUSED B(+) CIRCUIT SHORTED TO GROUND

FUSED B(+) CIRCUIT OPEN

NO B+ SUPPLY TO FUSE

CAB - FUSED B(+) CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Drive the vehicle above 25 km/h (15 mph) for at least 10 seconds. Stop the vehicle. With the DRBIII®, read DTC's. Does the DRBIII® display CAB Power Feed Circuit DTC present right now? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Remove and Inspect Fuse 12 in the PDC. Is the Fuse blown? Yes → Go To 3 No → Go To 6	All

CAB POWER FEED CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove Fuse 12 from the PDC. Disconnect the CAB harness connector. Note: Check connector - Clean/repair as necessary. Using a test light connected to 12 volts, probe the Fused B(+) Circuit. Does the test light illuminate brightly? Yes → Repair the Fused B(+) Circuit Shorted to Ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove Fuse 12 from the PDC. The CAB must be connected for the results of this test to be valid. Using a test light connected to 12 volts, probe the Fused B+ circuit at the PDC fuse terminal. Does the test light illuminate brightly? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. If there are no potential causes remaining, view repair. Continue Replace the Fuse. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Remove Fuse 12 from the PDC. Disconnect the CAB harness connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the Fused B+ circuit between the PDC fuse terminal and the CAB connector. Is the resistance below 5 ohms? Yes → Go To 7 No → Repair the Fused B+ circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
7	Remove Fuse 12 from the PDC. Turn the ignition on. Measure the voltage of the Fused B+ supply to Fuse 12 in the PDC. Is the voltage above 10 volts? Yes → Go To 8 No → Repair the B+ Supply circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
8	If there are no potential causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All

CAB POWER FEED CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
9	<p>Turn the ignition off.</p> <p>Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.</p> <p>Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.</p> <p>Refer to any Hotline letters or Technical Service Bulletins that may apply.</p> <p>Were any problems found?</p> <p style="padding-left: 40px;">Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1.</p> <p style="padding-left: 40px;">No → Test Complete.</p>	All

Symptom:
CONTROLLER FAILURE

When Monitored and Set Condition:

CONTROLLER FAILURE

When Monitored: Ignition on. The CAB monitors its internal microprocessors for correct operation.

Set Condition: If the CAB detects an internal fault, the DTC is set.

POSSIBLE CAUSES

GROUND AND POWER CONNECTIONS
 GROUND CIRCUIT HIGH RESISTANCE
 GROUND CIRCUIT INTERFERENCE
 CAB - INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	Inspect for non-factory wiring that may interfere with CAB power or ground circuits. Disconnect the CAB harness connector. Inspect the CAB wiring harness for incorrect routing and damage. Inspect the CAB harness and component connectors for corrosion and damage. Were any concerns found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the CAB harness connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the CAB ground circuits to body ground. Is the resistance below 1.0 ohm? Yes → Go To 3 No → Repair the Ground circuit high resistance. Perform ABS VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the CAB harness connector. Note: Check connector - Clean/repair as necessary. Turn the ignition on. Turn on all accessories. Measure the voltage of the Ground circuit. Is the voltage below 1.0 volts? Yes → Go To 4 No → Repair as necessary. Unsplice any accessories connected to the CAB ground circuit. Reroute and shield any high voltage cables away from the CAB ground circuit. Perform ABS VERIFICATION TEST - VER 1.	All

BRAKES (CAB)

CONTROLLER FAILURE — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
G-SWITCH NOT PROCESSABLE

When Monitored and Set Condition:

G-SWITCH NOT PROCESSABLE

When Monitored: Ignition on. The CAB sends a test signal out to the G-switch and monitors the sense circuits #1 and #2.

Set Condition: If the sense circuits are open for 2 minutes while driving or an otherwise improper signal is detected at any time, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES

- G-SWITCH TEST SIGNAL CIRCUIT OPEN
- INTERMITTENT DTC
- G-SWITCH TEST SIGNAL OR SENSE CIRCUIT SHORT TO VOLTAGE OR GROUND
- G-SWITCH SIGNAL CIRCUIT INTERNAL OPEN
- CAB - TEST SIGNAL CIRCUIT OPEN
- G-SWITCH #1 SENSE CIRCUIT OPEN
- G-SWITCH #1 SENSE SWITCH OPEN
- CAB - #1 SENSE CIRCUIT OPEN
- G-SWITCH #2 SENSE CIRCUIT OPEN
- G-SWITCH #2 SENSE SWITCH OPEN
- CAB - #2 SENSE CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read the status of the G-Switch internal switches. What is the status of both of the G-Switches? Both G-Switches are closed. Go To 2 Both G-Switches are open. Go To 3 Only the #1 G-Switch is open. Go To 7 Only the #2 G-Switch is open. Go To 10	All

BRAKES (CAB)

G-SWITCH NOT PROCESSABLE — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All
3	Turn the ignition off. Disconnect the CAB connector. Check connector - Clean/repair as necessary. Disconnect the G-Switch Sensor Connector. NOTE: Check connector - Clean/repair as necessary. Measure the resistance of the G-Switch Test Signal circuit. Is the resistance below 5 ohms? Yes → Go To 4 No → Repair the G-Switch Test Signal Circuit Open. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the CAB Connector. Check connector - Clean/repair as necessary. Disconnect the G-Switch Sensor Connector. Check connector - Clean/repair as necessary. Turn the ignition on. Using a 12-volt test light connected to ground, check the Test Signal and both Sense circuits. Using a 12-volt test light connected to 12-volts, check the Test Signal and both Sense circuits. CAUTION: The test light should not light at any test point. Does the test light illuminate at any test point? Yes → Repair the G-Switch Test Signal or Sense circuit for a short to voltage or ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the G-Switch Connector. Check connector - Clean/repair as necessary. Remove G-Switch from vehicle. While holding the G-Switch level, measure the resistance of the G-Switch Test Signal circuit and the G-Switch #1 Sense circuit in the G-Switch connector. Is the resistance below 5 ohms? Yes → Go To 6 No → Replace G-Switch. Perform ABS VERIFICATION TEST - VER 1.	All

G-SWITCH NOT PROCESSABLE — Continued

TEST	ACTION	APPLICABILITY
6	If there are no potential causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Disconnect the CAB Connector. Note: Check connector - Clean/repair as necessary. Disconnect the G-Switch Sensor Connector. Measure the resistance of the G-Switch #1 Sense Circuit. Is the resistance below 5 ohms? Yes → Go To 8 No → Repair the G-Switch #1 Sense circuit open. Perform ABS VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. Check connector - Clean/repair as necessary. Remove G-Switch from vehicle. While holding the G-Switch level, measure the resistance of the G-Switch Test Signal circuit and the G-Switch #1 Sense circuit in the G-Switch connector. Is the resistance below 5 ohms? Yes → Go To 9 No → Replace G-Switch Assembly. Perform ABS VERIFICATION TEST - VER 1.	All
9	If there are no potential causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Disconnect the CAB Connector. Note: Check connector - Clean/repair as necessary. Disconnect the G-Switch Connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the G-Switch #2 Sense Circuit. Is the resistance below 5 ohms? Yes → Go To 11 No → Repair the G-Switch #2 Sense Circuit Open. Perform ABS VERIFICATION TEST - VER 1.	All
11	Turn the ignition off. Disconnect the G-Switch connector. Note: Check connector - Clean/repair as necessary. Remove the G-Switch from vehicle. While holding the G-Switch level, measure the resistance of the G-Switch Test Signal circuit and the G-Switch #2 Sense circuit in the G-Switch connector. Is the resistance below 5 ohms? Yes → Go To 12 No → Replace the G-Switch Assembly. Perform ABS VERIFICATION TEST - VER 1.	All

BRAKES (CAB)

G-SWITCH NOT PROCESSABLE — Continued

TEST	ACTION	APPLICABILITY
12	If there are no potential causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom List:

LEFT FRONT SENSOR CIRCUIT FAILURE
LEFT REAR SENSOR CIRCUIT FAILURE
RIGHT FRONT SENSOR CIRCUIT FAILURE
RIGHT REAR SENSOR CIRCUIT FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be LEFT FRONT SENSOR CIRCUIT FAILURE.

When Monitored and Set Condition:**LEFT FRONT SENSOR CIRCUIT FAILURE**

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

LEFT REAR SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

RIGHT FRONT SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

RIGHT REAR SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted Wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

POSSIBLE CAUSES

SENSOR OR CONNECTOR DAMAGE

INTERMITTENT DTC

WHEEL SPEED SENSOR OPEN OR SHORTED TO GROUND

WHEEL SPEED SENSOR (+) OR (-) CIRCUIT SHORTED TO VOLTAGE

BRAKES (CAB)

LEFT FRONT SENSOR CIRCUIT FAILURE — Continued

POSSIBLE CAUSES	
WHEEL SPEED SENSOR (+) OR (-) CIRCUIT SHORTED TO GROUND	
WHEEL SPEED SENSOR CIRCUITS SHORTED TOGETHER	
SPEED SENSOR (+) OR (-) CIRCUIT OPEN	
CAB - INTERNAL SHORT OR OPEN	

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTC's. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display a Wheel Speed Sensor Circuit Failure DTC? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Inspect the affected Wheel Speed Sensor and Connector. Is the Sensor or Connector Damaged? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the affected Wheel Speed Sensor connector. Note: Check connector - Clean/repair as necessary. Measure the resistance across the Wheel Speed Sensor (+) and (-) circuits at the Sensor side of the connector. Measure the resistance between ground and the (+) and (-) circuits on the Sensor side of the connector. Is the Sensor resistance 900 to 1300 ohms and resistance to ground more than 15k ohms? Yes → Go To 4 No → Repair the short or replace the Wheel Speed Sensor, as necessary. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the affected Wheel Speed Sensor connector. Note: Check connector - Clean/repair as necessary. Disconnect the CAB connector. Note: Check connector - Clean/repair as necessary. Turn the ignition on. Measure the voltage of the Wheel Speed Sensor (+) and (-) circuits. Is the voltage above 1 volt at either circuit? Yes → Repair the Wheel Speed Sensor circuit for a short to voltage. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All

LEFT FRONT SENSOR CIRCUIT FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the affected Wheel Speed Sensor Connector. Disconnect the CAB Connector. Measure the resistance between the Wheel Speed Sensor (+) and (-) circuits and ground. Is the resistance below 15,000 ohms for either circuit? Yes → Repair the Wheel Speed Sensor circuit short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the CAB Connector. Disconnect the affected Wheel Speed Sensor harness connector. Measure the resistance through the Wheel Speed Sensor (+) and (-) circuits at the CAB harness connector. Is the resistance below 200 ohms? Yes → Repair the Wheel Speed Sensor circuits shorted together. Perform ABS VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the affected Wheel Speed Sensor Connector. Note: Check connector - Clean/repair as necessary. Disconnect the CAB Connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the Wheel Speed Sensor (+) and (-) circuits. Is the resistance below 5 ohms for both circuits? Yes → Go To 8 No → Repair the Wheel Speed Sensor (+) or (-) circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness component and in-line connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom List:

LEFT FRONT SENSOR SIGNAL FAILURE
LEFT REAR SENSOR SIGNAL FAILURE
RIGHT FRONT SENSOR SIGNAL FAILURE
RIGHT REAR SENSOR SIGNAL FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be LEFT FRONT SENSOR SIGNAL FAILURE.

When Monitored and Set Condition:

LEFT FRONT SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

LEFT REAR SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

RIGHT FRONT SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

RIGHT REAR SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

LEFT FRONT SENSOR SIGNAL FAILURE — Continued**POSSIBLE CAUSES**

SPEED SENSOR OR CONNECTOR DAMAGED
 TONE WHEEL DAMAGED
 WHEEL SPEED SENSOR AIR GAP OUT OF SPECIFICATION
 WHEEL BEARING EXCESS RUNOUT
 WHEEL SPEED SENSOR INOPERATIVE
 CAB - CAN'T READ WHEEL SPEED SENSOR SIGNAL
 INTERMITTENT SIGNAL DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Using the DRBIII®, monitor all Wheel Speed Sensors while an assistant drives the vehicle. Slowly accelerate as straight as possible from a stop to 24 km/h (15 mph). Note the DRBIII® Wheel Speed Sensor readings. Is one wheel speed signal zero or differing from others by more than 5 km/h (3 mph)? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Inspect the Wheel Speed Sensor and Connector at the affected wheel. Is the Sensor or Connector Damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. At the affected wheel, inspect the Tone Wheel for damaged or missing teeth, cracks, or looseness. Note: The Tone Wheel Teeth should be perfectly square, not bent or nicked. Is the Tone Wheel OK? Yes → Go To 4 No → Replace the Tone Wheel. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Using a Feeler Gauge, measure the Wheel Speed Sensor Air Gap. NOTE: The Air Gap should be checked in at least four places on the Tone Wheel. Is the Air Gap between 0.42 mm - 1.71 mm (0.017" - 0.068") ? Yes → Go To 5 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

LEFT FRONT SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	<p>Turn the ignition off. Inspect the wheel bearing for excessive runout or clearance. Note: Refer to the appropriate service information, if necessary, for procedures or specifications. Is the bearing runout OK ?</p> <p style="padding-left: 40px;">Yes → Go To 6</p> <p style="padding-left: 40px;">No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p>	All
6	<p>Turn the ignition off. Raise the affected wheel off the ground. Disconnect the Wheel Speed Sensor connector at the affected wheel. Set up an AC voltmeter to read the output of the Wheel Speed Sensor. Quickly rotate the wheel by spinning the tire by hand. Measure the Wheel Speed Sensor AC voltage output. Does the voltage go above 650 millivolts as the wheel is rotated?</p> <p style="padding-left: 40px;">Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.</p> <p style="padding-left: 40px;">No → Replace the Wheel Speed Sensor in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p>	All
7	<p>Turn the ignition off. Visually inspect the affected Wheel Speed Sensor for correct installation. Visually inspect the Tone Wheel for looseness and correct installation. Visually inspect the wiring harness for loose or intermittent connections. Visually inspect mechanical brake components. Inspect for conditions that may cause lockup or drag. Inspect for seized caliper or wheel cylinder piston. Inspect all components for a condition which may cause a Wheel Speed Signal DTC to set. Is any Component Damaged?</p> <p style="padding-left: 40px;">Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p> <p style="padding-left: 40px;">No → Test Complete.</p>	All

Symptom:**PUMP MOTOR NOT WORKING PROPERLY****When Monitored and Set Condition:****PUMP MOTOR NOT WORKING PROPERLY**

When Monitored: Ignition on. The CAB commands the pump on at 20 km/h (12 mph) to check its operation, if the brake switch is not applied. If the driver has their foot on the brake, the test will run at 40 km/h (25 mph). The CAB monitors pump voltage continuously.

Set Condition: The DTC is stored when the CAB detects: 1) Improper voltage decay after the pump was turned off. 2) Pump not energized by the CAB, but voltage is present for 3.5 seconds. 3) Pump is turned on by the CAB, but there is insufficient voltage to operate it.

POSSIBLE CAUSES

ABS PUMP MOTOR INTERMITTENT DTC
 FUSED B(+) CIRCUIT INTERMITTENTLY SHORTED TO GROUND
 FUSED B(+) CIRCUIT SHORTED TO GROUND
 CAB - FUSED B(+) CIRCUIT SHORTED TO GROUND
 FUSE BLOWN - PUMP MOTOR CIRCUIT
 NO B+ SUPPLY TO FUSE
 ABS PUMP MOTOR INOPERATIVE
 FUSED B(+) CIRCUIT OPEN
 GROUND CIRCUIT OPEN
 GROUND CIRCUIT HIGH RESISTANCE
 CAB - INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTC's. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, actuate the ABS pump motor. Did the Pump Motor operate when actuated? No → Go To 2 Yes → Go To 13	All
2	Turn the ignition off. Remove and inspect the ABS Pump fuse in the PDC. Is the Fuse blown? Yes → Go To 3 No → Go To 7	All

BRAKES (CAB)

PUMP MOTOR NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
3	<p>Turn the ignition off. Make sure the Pump Motor connector is secure. Visually inspect the Fused B(+) Circuit in the wiring harness from the PDC to the CAB. Look for any sign of an Intermittent Short to Ground. Is the wiring harness OK?</p> <p>Yes → Go To 4</p> <p>No → Repair the Fused B(+) Circuit shorted to ground. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p>	All
4	<p>Turn the ignition off. Remove ABS PUMP Fuse 8 from the Power Distribution Center (PDC). Disconnect the CAB connector. Make sure the Pump Motor connector is secure. Note: Check connector - Clean/repair as necessary. Using a test light connected to 12 volts, probe the Fused B (+) Circuit. Is the test light on?</p> <p>Yes → Repair the Fused B(+) circuit short to ground. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p> <p>No → Go To 5</p>	All
5	<p>Turn the ignition off. Remove ABS PUMP Fuse 12 from the PDC. The CAB must be connected for the results of this test to be valid. Using a test light connected to 12 volts, probe the Fused B (+) circuit in the PDC. Is the test light on?</p> <p>Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.</p> <p>No → Go To 6</p>	All
6	<p>Turn the ignition off. Make sure the Pump Motor connector is secure If there are no potential causes remaining, replace the Fuse. If there are no possible causes remaining, view repair.</p> <p>Repair</p> <p>Replace the ABS Pump Motor Fuse. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p>	All

PUMP MOTOR NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Remove ABS PUMP Fuse #12 from the Power Distribution Center (PDC). Disconnect the CAB connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the Fused B (+) circuit between the PDC Fuse Terminal and the CAB connector. Is the resistance below 10 ohms? Yes → Go To 8 No → Repair the Fused B(+) circuit for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
8	Turn the ignition on. Using a 12-volt test light connected to ground, check the B+ supply to Fuse 12 in the PDC. Is the B+ supply OK? Yes → Go To 9 No → Repair the B+ supply for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Disconnect Pump Motor Connector. Connect a 10 gauge jumper wire between pump motor Fused B (+) circuit and a 40 Amp Fused B (+) circuit. Connect a 10 gauge jumper wire between pump motor ground circuit and a known good body ground. Monitor Pump Motor operation. Is the pump motor running? Yes → Go To 10 No → Replace the Controller Antilock Brake in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Disconnect CAB Connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the CAB ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 11 No → Repair the ground circuit for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

PUMP MOTOR NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
11	<p>Make sure the Pump Motor connector is secure. Turn the ignition on. With the DRBIII®, enable pump motor actuation. NOTE: Pump motor will not operate, but voltage will be applied. Measure the voltage drop across the ABS ground circuit connection, with pump motor actuation enabled. Is the voltage below 0.1 volt?</p> <p style="padding-left: 40px;">Yes → Go To 12</p> <p style="padding-left: 40px;">No → Repair the Ground circuit for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p>	All
12	<p>If there are no possible causes remaining, view repair.</p> <p style="padding-left: 40px;">Repair</p> <p style="padding-left: 80px;">Replace the Controller Anti-Lock Brake in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p>	All
13	<p>Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Make sure the Pump Motor connector is secure. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found?</p> <p style="padding-left: 40px;">Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.</p> <p style="padding-left: 40px;">No → Test Complete.</p>	All

Symptom:
SYSTEM OVER VOLTAGE

When Monitored and Set Condition:

SYSTEM OVER VOLTAGE

When Monitored: Ignition on. The CAB monitors the Fused B(+) circuit at all times for proper system voltage.

Set Condition: If the voltage is above 16.5 volts, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES

BATTERY OVERCHARGED
 FUSED IGNITION SWITCH OUTPUT HIGH
 GROUND CIRCUIT OPEN
 CAB - INTERNAL FAULT
 INTERMITTENT DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Start the engine. With the DRBIII®, read DTC's. Does the DRBIII® display System Overvoltage DTC? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Inspect for battery charger connected to battery. Is a battery charger connected to the battery? Yes → Charge battery to proper level. Disconnect the battery charger. Clear DTC's. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

BRAKES (CAB)

SYSTEM OVER VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the CAB connector. Note: Check connector - Clean/repair as necessary. Start the engine. Raise engine RPM's above 1,800. Measure the battery voltage. Is the voltage above 16.5 volts ? Yes → Refer to appropriate service information for charging system testing and repair. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the CAB connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 5 No → Repair the Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
5	If there are no potential causes remaining, view repair. Repair Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SYSTEM UNDER VOLTAGE

When Monitored and Set Condition:

SYSTEM UNDER VOLTAGE

When Monitored: Ignition on. The CAB monitors the Fused Ignition Switch Output for proper system voltage.

Set Condition: If the voltage is below 9.5 volts, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES

BATTERY VOLTAGE LOW
 INTERMITTENT DTC
 FUSED IGNITION SWITCH OUTPUT CIRCUIT HIGH RESISTANCE
 GROUND CIRCUIT OPEN
 CAB - INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Start the engine. Drive the vehicle above 16 km/h (10 mph) for at least 20 seconds. Stop the vehicle With the DRBIII®, read DTC's. Does the DRBIII® display System Undervoltage DTC? Yes → Go To 2 No → Go To 6	All
2	Engine Running. Measure the battery voltage. Is the battery voltage below 10 volts? Yes → Refer to appropriate service information for charging system testing and repair. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the CAB connector. Note: Check connector - Clean/repair as necessary. Measure the resistance of the ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 4 No → Repair the Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

BRAKES (CAB)

SYSTEM UNDER VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the CAB harness connector. Turn the ignition on. Measure the voltage of the Fused Ignition Switch circuit. Is the voltage above 10 volts? Yes → Go To 5 No → Repair the Fused Ignition Switch Output Circuit for high resistance Perform ABS VERIFICATION TEST - VER 1.	All
5	If there are no potential causes remaining, view repair. Repair Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:

***ABS WARNING INDICATOR ALWAYS ON**

POSSIBLE CAUSES
ABS RELAY STUCK ABS RELAY FUSED B+ CIRCUIT OPEN ABS RELAY CONTROL CIRCUIT OPEN CAB INTERNAL OPEN ABS INDICATOR DRIVER SHORT TO GROUND INSTRUMENT CLUSTER CONCERN

TEST	ACTION	APPLICABILITY
1	Remove the ABS relay from PDC. Perform the key-on bulb test. Does the ABS Indicator light and remain lit? Yes → Go To 2 No → Go To 3	All
2	Disconnect the Instrument Cluster C2 harness connector. Remove the ABS relay from the PDC. Using a 12-volt test light connected to 12-volts, check the ABS Warning Indicator Driver circuit. Does the test light illuminate? Yes → Repair the ABS Indicator circuit for a short to ground. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Refer to symptom list for problems related to Instrument Cluster. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
3	Install a substitute relay in place of the ABS relay. Perform the key-on bulb check. Does the ABS Warning Indicator operate OK? Yes → Replace the ABS relay. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All

BRAKES (CAB)

*ABS WARNING INDICATOR ALWAYS ON — Continued

TEST	ACTION	APPLICABILITY
4	Remove the ABS relay from the PDC. Turn the ignition on. Using a 12-volt test light connected to ground, check the Fused B+ circuit. Does the test light illuminate? Yes → Go To 5 No → Repair the ABS relay Fused B+ circuit for an open. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
5	Remove the ABS relay. Disconnect the CAB harness connector. Measure the resistance of the ABS Relay Control circuit. Is the resistance below 5.0 ohms? Yes → Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1. No → Repair the ABS Relay Control circuit for an open. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:***ABS WARNING INDICATOR INOPERATIVE****POSSIBLE CAUSES**

INSTRUMENT CLUSTER CONCERN
 ABS RELAY STUCK
 ABS RELAY GROUND CIRCUIT OPEN
 ABS RELAY CONTROL CIRCUIT SHORT TO GROUND
 CAB INTERNAL SHORT TO GROUND
 ABS INDICATOR BULB OPEN
 ABS INDICATOR DRIVER OPEN
 INSTRUMENT CLUSTER INTERNAL OPEN

TEST	ACTION	APPLICABILITY
1	Perform the key-on bulb check. Do all bulbs check OK except for the ABS Warning Indicator? Yes → Go To 2 No → Refer to symptom list for problems related to Instrument Cluster. Perform ABS VERIFICATION TEST - VER 1.	All
2	Install a substitute relay in place of the ABS relay. Perform the key-on bulb check. Does the ABS Warning Indicator operate OK? Yes → Replace the ABS relay. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Remove the ABS relay from PDC. Connect a jumper wire between the ABS Warning Indicator driver cavity of the ABS relay socket and ground. Key to RUN Does the ABS Indicator light? Yes → Go To 4 No → Go To 6	All
4	Remove the ABS relay from the PDC. Using a 12-volt test light connected to 12-volts, check the ABS relay ground circuit. Does the test light illuminate? Yes → Go To 5 No → Repair the ABS relay Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

BRAKES (CAB)

*ABS WARNING INDICATOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
5	Remove the ABS relay. Disconnect the CAB harness connector. Using a 12-volt test light connected to 12-volts, check the ABS Relay Control circuit. Does the test light illuminate? Yes → Repair the ABS Relay Control circuit for a short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
6	Install a substitute bulb in place of the ABS Indicator bulb. Perform the key-on bulb check. Does the ABS bulb illuminate? Yes → Replace the ABS indicator bulb. Perform ABS VERIFICATION TEST - VER 1. No → Go To 7	All
7	Disconnect the Instrument Cluster C2 harness connector. Remove the ABS relay from the PDC. Measure the resistance of the ABS Indicator driver circuit. Is the resistance below 5.0 ohms? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Repair the ABS Indicator Driver circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:***BRAKE LAMP SWITCH****POSSIBLE CAUSES**

CHECK BRAKE LAMP SWITCH OUTPUT

BRAKE LAMP SWITCH B+ OPEN

BRAKE LAMP SWITCH OUTPUT CIRCUIT SHORT OR OPEN

BRAKE LAMP SWITCH OPEN

CAB -- INTERNAL OPEN

TEST	ACTION	APPLICABILITY
1	<p>With the DRBIII® in Inputs/Outputs, read the Brake Lamp Switch state. Press and release the brake pedal. Does the DRBIII® display PRESSED and RELEASED?</p> <p>Yes → The Brake Lamp Switch is OK. Perform ABS VERIFICATION TEST - VER 1.</p> <p>No → Go To 2</p>	All
2	<p>Disconnect the Brake Lamp Switch harness connector. Using a 12-volt test light connected to ground, check the Brake Lamp Switch Fused B+ circuit. Does the test light illuminate brightly ?</p> <p>Yes → Go To 3</p> <p>No → Repair the Brake Lamp Switch Fused B+ circuit for an open. Perform ABS VERIFICATION TEST - VER 1.</p>	All
3	<p>Disconnect the Brake Lamp Switch harness connector. Connect a jumper wire between the Brake Lamp Switch B+ and Output circuits. With the DRBIII® in Inputs/Outputs, read the Brake Lamp Switch state. Does the DRBIII® display PRESSED?</p> <p>Yes → Replace the Brake Lamp Switch in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.</p> <p>No → Go To 4</p>	All
4	<p>Disconnect the CAB harness connector. Disconnect the Brake Lamp Switch harness connector. Check the Brake Lamp Switch Output circuit for a short to voltage and an open. Is the Brake Lamp Switch Output circuit shorted or open?</p> <p>Yes → Repair the Brake Lamp Switch Output circuit for a short to voltage or an open. Perform ABS VERIFICATION TEST - VER 1.</p> <p>No → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.</p>	All

BRAKES (CAB)

Symptom:

*FRONT AXLE LOCK INDICATOR REMAINS FLASHING

POSSIBLE CAUSES

CHECKING OPERATION
 INTERMITTENT CONDITION
 FUSED B(+) CIRCUIT OPEN TO THE FRONT LOCKER RELAY
 FRONT LOCKER RELAY
 FRONT LOCKER RELAY OUTPUT CIRCUIT OPEN
 FRONT LOCKER PUMP GROUND CIRCUIT OPEN
 FRONT LOCKER PUMP
 FRONT LOCKER INDICATOR SWITCH SENSE CIRCUIT OPEN
 FRONT LOCKER INDICATOR SWITCH GROUND CIRCUIT OPEN
 MECHANICAL FAULT EXISTS

TEST	ACTION	APPLICABILITY
1	<p>NOTE: For this test to be valid the Rear Axle must be locked and the Rear Lock indicator must be illuminated. Turn the ignition on. Ensure Transfer Case is in 4 "LOW" range. Vehicle speed is less than 16km/h (10 mph). Depress the Axle Lock Switch once. Does the Front Axle Lock indicator remain flashing?</p> <p>Yes → Go To 2</p> <p>No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wiring harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.</p>	All
2	<p>Disconnect the Front Locker Relay. Measure the voltage of the Fused B(+) circuit in the Front Locker Relay PDC connector. Is the voltage above 10 volts?</p> <p>Yes → Go To 3</p> <p>No → Repair the Fused B(+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1.</p>	All
3	<p>Turn the ignition off. Replace the Front Locker Relay with a known good part. Turn the ignition on. Ensure Transfer Case is in 4 "LOW" range. Depress the Axle Lock Switch once. Did the Front Locker Pump turn ON?</p> <p>Yes → Replace the Front Locker Relay. Perform BODY VERIFICATION TEST - VER 1.</p> <p>No → Go To 4</p>	All

***FRONT AXLE LOCK INDICATOR REMAINS FLASHING — Continued**

TEST	ACTION	APPLICABILITY
4	Measure the resistance of the Front Locker Relay Output circuit between the PDC connector and the Front Locker Pump connector. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Relay Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Front Locker Pump harness connector. Measure the resistance between ground and the Front Locker Pump Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Pump Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition on. Ensure Transfer Case is in 4 "LOW" range. Depress the Axle Lock Switch once. Did the Front Locker Pump operate? Yes → Go To 7 No → Refer to Differential/Driveline for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Disconnect the Instrument Cluster C2 harness connector. Disconnect the Front Locker Indicator Switch harness connector. Measure the resistance of the Front Locker Indicator Switch Sense circuit between the Instrument Cluster C2 connector and the Front Locker Indicator Switch connector. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Indicator Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off. Disconnect the Front Locker Indicator Switch harness connector. Measure the resistance between ground and the Front Locker Indicator Switch Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Indicator Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Refer to Differential/Driveline information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All

BRAKES (CAB)

Symptom List:

*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE PCM CHECK FUSE #7 IN FUSE BLOCK OPEN GROUND CIRCUITS OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT SCI TRANSMIT CIRCUIT OPEN CONTROLLER ANTILOCK BRAKE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB attempt to communicate with the PCM. Was the DRB able to communicate with the PCM? Yes → Go To 2 No → Refer to symptom list for problems related to No Response From PCM. Perform ABS VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Remove and inspect fuse #7 in the Fuse Block. Is the fuse open? Yes → Refer to the wiring diagrams located in the service information to help isolate a possible short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the CAB harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. NOTE: Ensure fuse #7 is installed in the Fuse Block. Disconnect the CAB harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 5 No → Repair the Fused Ignition Switch Output circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

***NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE — Continued**

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the CAB harness connector. Measure the resistance of the SCI Transmit circuit between the CAB connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the SCI Transmit circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All

BRAKES (CAB)

Symptom:

*REAR AXLE LOCK INDICATOR REMAINS FLASHING

POSSIBLE CAUSES

CHECKING OPERATION
 INTERMITTENT CONDITION
 OPEN FUSE IN PDC
 FUSED B(+) CIRCUIT OPEN TO THE REAR LOCKER RELAY
 REAR LOCKER RELAY
 REAR LOCKER RELAY OUTPUT CIRCUIT OPEN
 REAR LOCKER PUMP GROUND CIRCUIT OPEN
 REAR LOCKER PUMP
 REAR LOCKER INDICATOR SWITCH SENSE CIRCUIT OPEN
 REAR LOCKER INDICATOR SWITCH GROUND CIRCUIT OPEN
 MECHANICAL FAULT EXISTS

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure Transfer Case is in 4 "LOW" range. Vehicle speed is less than 16km/h (10 mph). Depress the Axle Lock Switch once. Does the Rear Axle Lock indicator remain flashing? Yes → Go To 2 No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wiring harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All
2	Inspect Fuse 24 in the PDC. Is the Fuse open, missing, or loose? Yes → Replace the open or missing fuse. If the fuse is open make sure to check for a short to ground in the Fused B(+) circuit between the fuse and the relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the Rear Locker Relay. Measure the voltage of the Fused B(+) circuit in the Rear Locker Relay PDC connector. Is the voltage above 10 volts? Yes → Go To 4 No → Repair the Fused B(+)circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

***REAR AXLE LOCK INDICATOR REMAINS FLASHING — Continued**

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Replace the Rear Locker Relay with a known good part. Turn the ignition on. Ensure Transfer Case is in 4 "LOW" range. Depress the Axle Lock Switch once. Did the Rear Locker Pump turn ON? Yes → Replace the Rear Locker Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Measure the resistance of the Rear Locker Relay Output circuit between the PDC connector and the Rear Locker Pump connector. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Relay Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the Rear Locker Pump harness connector. Measure the resistance between ground and the Rear Locker Pump Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Pump Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition on. Ensure Transfer Case is in 4 "LOW" range. Depress the Axle Lock Switch once. Did the Rear Locker Pump operate? Yes → Go To 8 No → Refer to Differential/Driveline for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Disconnect the Rear Locker Indicator Switch harness connector. Measure the resistance of the Rear Locker Indicator Switch Sense circuit between the Instrument Cluster C1 connector and the Rear Locker Indicator Switch connector. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Indicator Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All

BRAKES (CAB)

*REAR AXLE LOCK INDICATOR REMAINS FLASHING — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the Rear Locker Indicator Switch harness connector. Measure the resistance between ground and the Rear Locker Indicator Switch Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Indicator Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Refer to Differential/Driveline information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:***REAR AXLE LOCK INOPERATIVE****POSSIBLE CAUSES**

CHECKING OPERATION

INSTRUMENT CLUSTER NOT PROPERLY CONFIGURED

VSS, PCM, OR TRANSFER CASE DTC'S PRESENT

OPEN FUSE IN PDC

AXLE LOCK SWITCH GROUND CIRCUIT OPEN

FUSED B(+) CIRCUIT OPEN TO AXLE LOCK SWITCH

AXLE LOCK SWITCH FAILURE

TEST	ACTION	APPLICABILITY
1	<p>Turn the ignition on. Ensure Transfer Case is in 4 "LOW" range. Vehicle speed is less than 16 km/h (10 mph). Depress the Axle Lock Switch once. Does the Axle Lock Switch indicator illuminate?</p> <p>Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wiring harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.</p> <p>No → Go To 2</p>	All
2	<p>Turn the ignition on. With the DRBIII®, ensure the Instrument Cluster is correctly configured for Tire size, Axle type, and Transfer Case. Is the vehicle Instrument Cluster configured correctly?</p> <p>Yes → Go To 3</p> <p>No → Refer to Body for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.</p>	All
3	<p>Turn the ignition on. With the DRBIII®, ensure there are no VSS, PCM, or Transfer Case DTC's present. NOTE: When ALL conditions are met the Instrument Cluster Enable 1 State must indicate - LOW. Vehicle must indicate the transfer case is in 4 "LOW" range, the ignition ON, and vehicle speed is less than 16 km/h (10 mph). Are any VSS, PCM, or Transfer Case DTC's present?</p> <p>Yes → Refer to the appropriate service information for the related DTC's. Perform BODY VERIFICATION TEST - VER 1.</p> <p>No → Go To 4</p>	All

BRAKES (CAB)

*REAR AXLE LOCK INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Inspect Fuse 26 in the PDC. Is the Fuse open, missing, or loose? Yes → Replace the open or missing fuse. If the fuse is open make sure to check for a short to ground in the Fused B(+) circuit from the fuse to the switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn on the Park lamps. Observe the Axle Lock Switch. Does the Axle Lock Switch illuminate? Yes → Go To 6 No → Repair the Axle Lock Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Axle Lock Switch connector. Measure the voltage of the Fused B(+) circuit in the Axle Lock Switch connector. Is the voltage above 10 volts? Yes → Replace the Axle Lock Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Fused B(+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

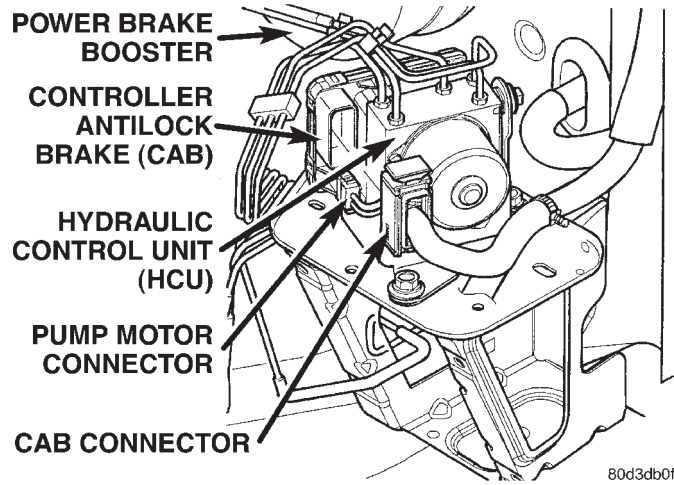
Verification Tests

ABS VERIFICATION TEST - VER 1	APPLICABILITY
<p>1. Turn the ignition off.</p> <p>2. Connect all previously disconnected components and connectors.</p> <p>3. Ensure all accessories are turned off and the battery is fully charged.</p> <p>4. Ensure that the Ignition is on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning.</p> <p>5. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules.</p> <p>6. If any Diagnostic Trouble Codes are present, return to Symptom list and troubleshoot new or recurring symptom.</p> <p>7. NOTE: For Sensor Signal and Pump Motor faults, the CAB must sense all 4 wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator.</p> <p>8. If there are no DTC's present after turning ignition on, road test the vehicle for at least 5 minutes. Perform several antilock braking stops.</p> <p>9. Caution: Ensure braking capability is available before road testing.</p> <p>10. Again, with the DRBIII® read DTC's. If any DTC's are present, return to Symptom list.</p> <p>11. If there are no Diagnostic Trouble Codes (DTC's) present, and the customer's concern can no longer be duplicated, the repair is complete.</p> <p>Are any DTC's present or is the original concern still present?</p> <p>Yes → Repair is not complete, refer to appropriate symptom.</p> <p>No → Repair is complete.</p>	<p>All</p>

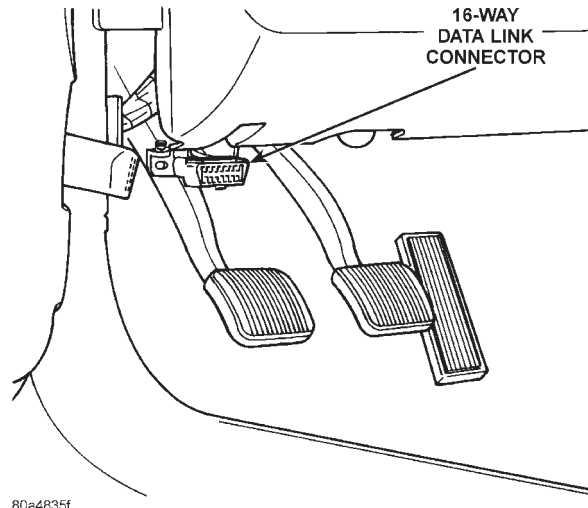
BODY VERIFICATION TEST - VER 1	APPLICABILITY
<p>1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors.</p> <p>2. NOTE: If the SKIM or PCM was replaced, refer to the service information for proper programming procedures.</p> <p>3. NOTE: If the MIC was replaced, configure new cluster with Tire Size, Axle, T-Case Type, and EQ Setting.</p> <p>4. Ensure all accessories are turned off and the battery is fully charged.</p> <p>5. With the DRBIII®, record and erase all DTC's from ALL modules. Start and run the engine for 2 minutes. Operate all functions of the system that caused the original concern.</p> <p>6. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII®, read DTC's from ALL modules.</p> <p>Are any DTCs present or is the original condition still present?</p> <p>Yes → Repair is not complete, refer to the appropriate symptom.</p> <p>No → Repair is complete.</p>	<p>All</p>

8.0 COMPONENT LOCATIONS

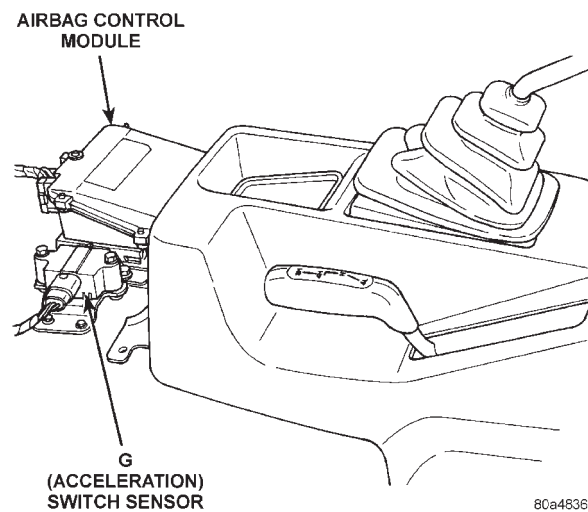
8.1 CONTROLLER ANTILOCK BRAKE



8.2 DATA LINK CONNECTOR

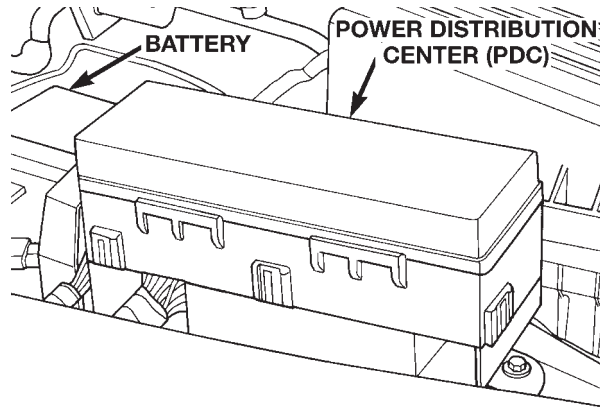


8.3 G-SWITCH



COMPONENT LOCATIONS

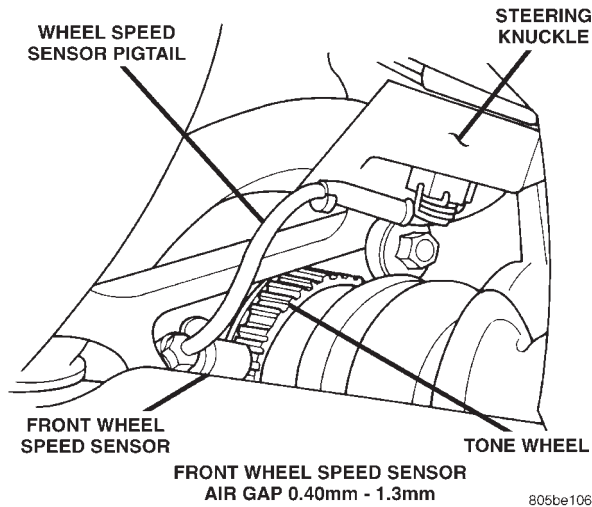
8.4 FUSES & RELAYS



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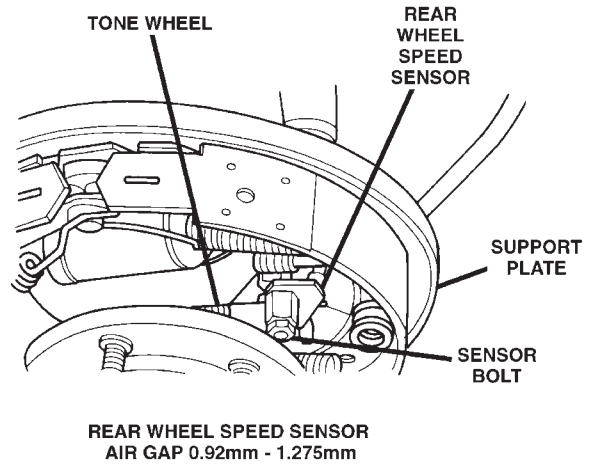
8.5 WHEEL SPEED SENSORS

FRONT



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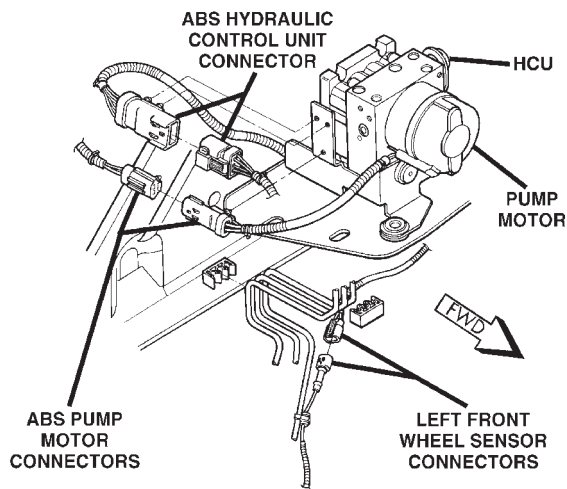
REAR DRUM BRAKES



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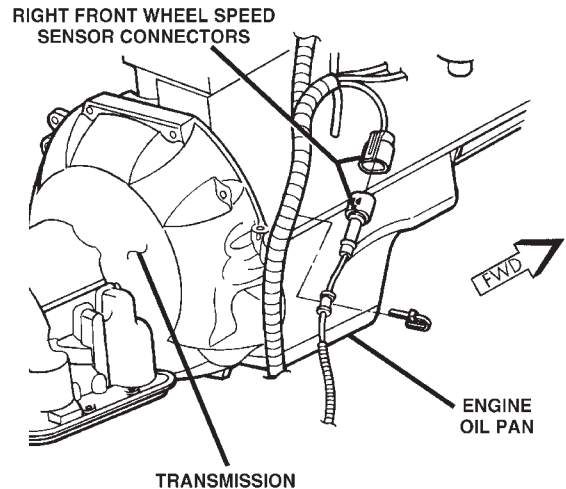
8.6 WHEEL SPEED SENSOR CONNECTORS

LEFT FRONT



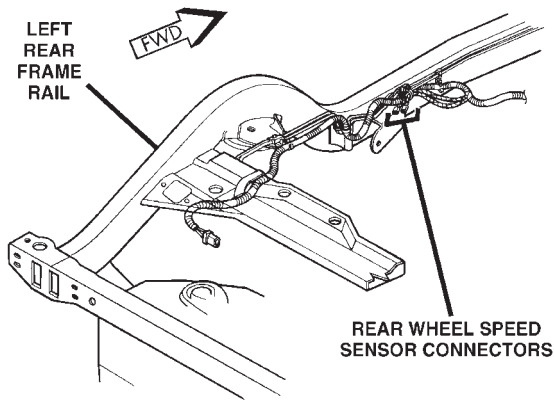
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RIGHT FRONT



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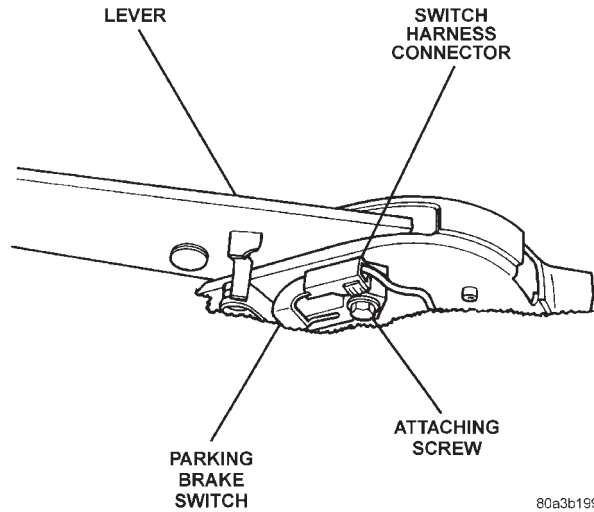
REAR



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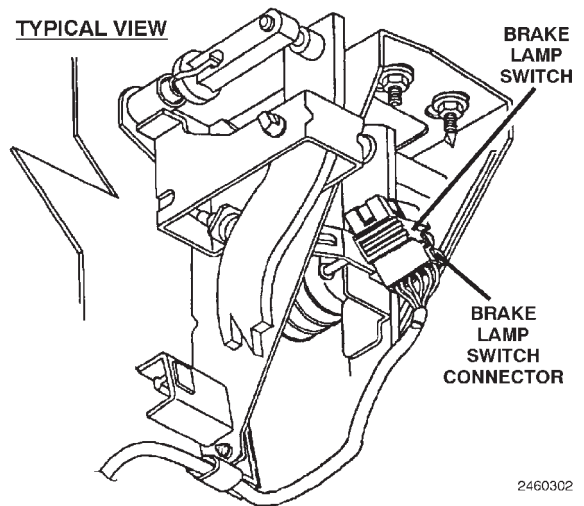
8.7 BRAKE SWITCHES

8.7.1 PARKING BRAKE



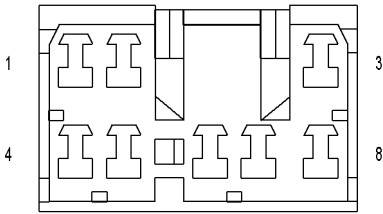
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8.7.2 BRAKE SWITCH



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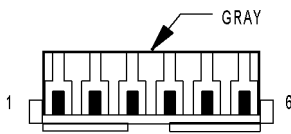
9.0 CONNECTOR PINOUTS



AXLE
LOCK
SWITCH
(OFF-ROAD
PACKAGE)

AXLE LOCK SWITCH (OFF-ROAD PACKAGE)

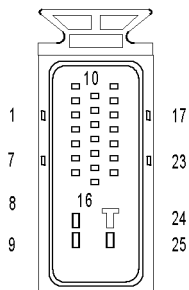
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	E2 20OR	PANEL LAMPS FEED
3	M1 20PK/WT	FUSED B(+)
4	G302 20RD/WT	LOCKER ENABLE SIGNAL 1
5	G303 20VT/DG	LOCKER ENABLE SIGNAL 2
6	G305 20VT/LG	REAR LOCKER REQUEST
7	G304 20VT/DB	FRONT LOCKER REQUEST
8	-	-



BRAKE LAMP
SWITCH

BRAKE LAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
2	Z1 20 BK	GROUND
3	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
4	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
5	F32 18PK/DB	FUSED B(+)
6	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT

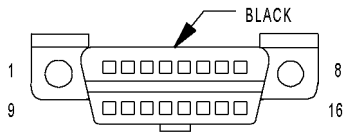


CONTROLLER
ANTILOCK
BRAKE

CONTROLLER ANTILOCK BRAKE

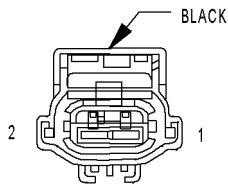
CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
3	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
4	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)
5	-	-
6	B41 18YL/VT	G-SWITCH NO. 1 SENSE
7	B42 18TN/WT	G-SWITCH NO. 2 SENSE
8	Z22 12BK/PK	GROUND
9	A20 12RD/DB	FUSED B(+)
10	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)
11	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
12	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
13	B43 18PK/OR	G-SWITCH TEST SIGNAL
14	-	-
15	-	-
16	G83 18GY/BK	ABS RELAY CONTROL
17	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
18	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
19	-	-
20	D21 18PK	SCI TRANSMIT
21	-	-
22	-	-
23	F20 18VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
24	Z22 12BK/PK	GROUND
25	A10 12RD/DG	FUSED B(+)

CONNECTOR PINOUTS



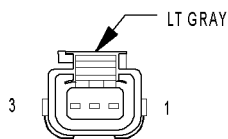
DATA LINK CONNECTOR

DATA LINK CONNECTOR		
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	Z2 20BK/LG	GROUND
5	Z12 20BK/TN	GROUND
6	D32 20LG/WT	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG/PK	SCI RECEIVE
15	-	-
16	M1 20PK/WT	FUSED B(+)



FRONT LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)

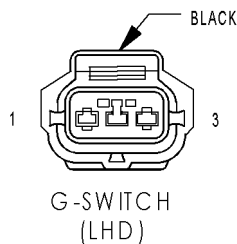
FRONT LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)		
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G300 20VT/WT	FRONT LOCKER INDICATOR SWITCH SENSE



FRONT LOCKER PUMP (OFF-ROAD PACKAGE)

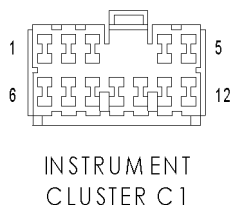
FRONT LOCKER PUMP (OFF-ROAD PACKAGE)		
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	-	-
3	A750 18TN/RD	FRONT LOCKER RELAY OUTPUT

CONNECTOR PINOUTS



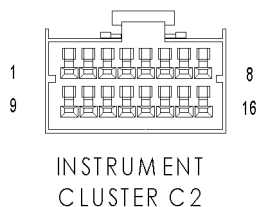
G-SWITCH (LHD)

CAV	CIRCUIT	FUNCTION
1	B42 20TN/WT	G-SWITCH NO. 2 SENSE
2	B41 20YL/VT	G-SWITCH NO. 1 SENSE
3	B43 20PK/OR	G-SWITCH TEST SIGNAL



INSTRUMENT CLUSTER C1

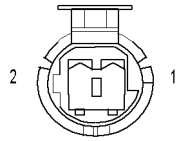
CAV	CIRCUIT	FUNCTION
1	L61 18GY	LEFT TURN SIGNAL
2	L60 18TN	RIGHT TURN SIGNAL
3	G34 16RD/GY (LHD)	HIGH BEAM INDICATOR DRIVER
3	L3 16RD/OR (RHD)	HIGH BEAM INDICATOR DRIVER
4	L39 16LB (EXCEPT EXPORT)	FOG LAMP FEED
4	L38 16BR/WT (EXPORT)	REAR FOG LAMP FEED
5	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
6	G305 20VT/LG (OFF-ROAD PACKAGE)	REAR LOCKER REQUEST
7	G301 20VT/LB (OFF-ROAD PACKAGE)	REAR LOCKER INDICATOR SWITCH SENSE
8	Z2 18BK/LG	GROUND
9	G303 20VT/DG (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 2
10	-	-
11	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	M1 20PK/WT	FUSED B(+)



INSTRUMENT CLUSTER C2

CAV	CIRCUIT	FUNCTION
1	C80 20DB/WT (HARD TOP)	REAR WINDOW DEFOGGER SWITCH SENSE
2	G10 20LG/RD	SEAT BELT SWITCH SENSE
3	G76 20TN/YL	PASSENGER DOOR AJAR SWITCH SENSE
4	G75 20TN	DRIVER DOOR AJAR SWITCH SENSE
5	M2 20YL	COURTESY LAMP FEED
6	E2 20OR	PANEL LAMPS FEED
7	C81 20LB/WT (HARD TOP)	REAR WINDOW DEFOGGER RELAY CONTROL
8	G19 20LG/OR (ABS)	ABS WARNING INDICATOR DRIVER
9	G99 20GY/WT	BRAKE WARNING INDICATOR DRIVER
10	G304 20VT/DB (OFF-ROAD PACKAGE)	FRONT LOCKER REQUEST
11	G107 20BK/RD (4X4)	4WD INDICATOR
12	D25 20VT/YL	PCI BUS
13	G26 20LB	KEY-IN IGNITION SWITCH SENSE
14	G302 20RD/WT (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 1
15	E19 20RD	PANEL LAMPS DIMMER SIGNAL
16	G300 20VT/WT (OFF-ROAD PACKAGE)	FRONT LOCKER INDICATOR SWITCH SENSE

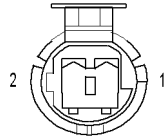
CONNECTOR PINOUTS



LEFT FRONT
WHEEL SPEED
SENSOR

LEFT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)

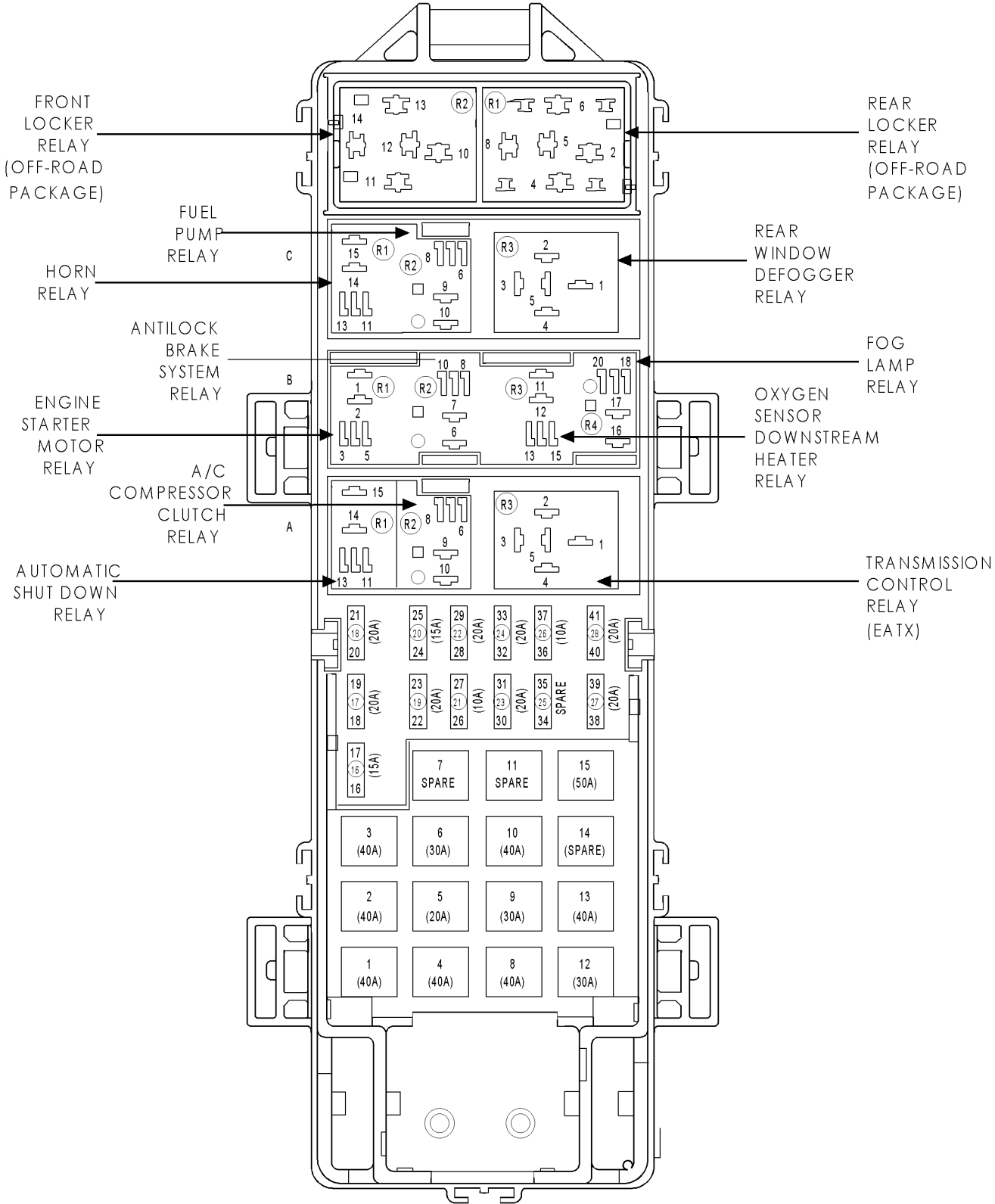


LEFT REAR
WHEEL SPEED
SENSOR

LEFT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)

POWER DISTRIBUTION CENTER



CONNECTOR PINOUTS

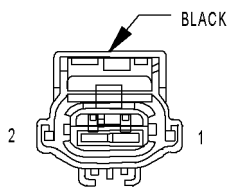
CONNECTOR PINOUTS

FRONT LOCKER RELAY (OFF-ROAD PACKAGE)

CAV	CIRCUIT	FUNCTION
D10	A88 18RD/DB	FUSED B(+)
D11	G304 20VT/DB	FRONT LOCKER REQUEST
D12	-	-
D13	A88 18RD/DB	FUSED B(+)
D14	A750 18TN/RD	FRONT LOCKER RELAY OUTPUT

REAR LOCKER RELAY (OFF-ROAD PACKAGE)

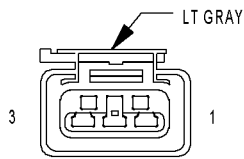
CAV	CIRCUIT	FUNCTION
D2	A88 18RD/DB	FUSED B(+)
D4	A88 18RD/DB	FUSED B(+)
D5	-	-
D6	G305 20VT/LG	REAR LOCKER REQUEST
D8	A850 18RD/WT	REAR LOCKER RELAY OUTPUT



REAR LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)

REAR LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)

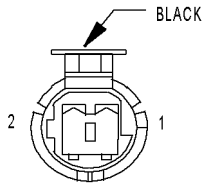
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G301 20VT/LB	REAR LOCKER INDICATOR SWITCH SENSE



REAR LOCKER PUMP (OFF-ROAD PACKAGE)

REAR LOCKER PUMP (OFF-ROAD PACKAGE)

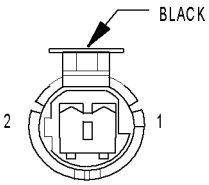
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	-	-
3	A850 18RD/WT	REAR LOCKER RELAY OUTPUT



RIGHT FRONT WHEEL SPEED SENSOR

RIGHT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



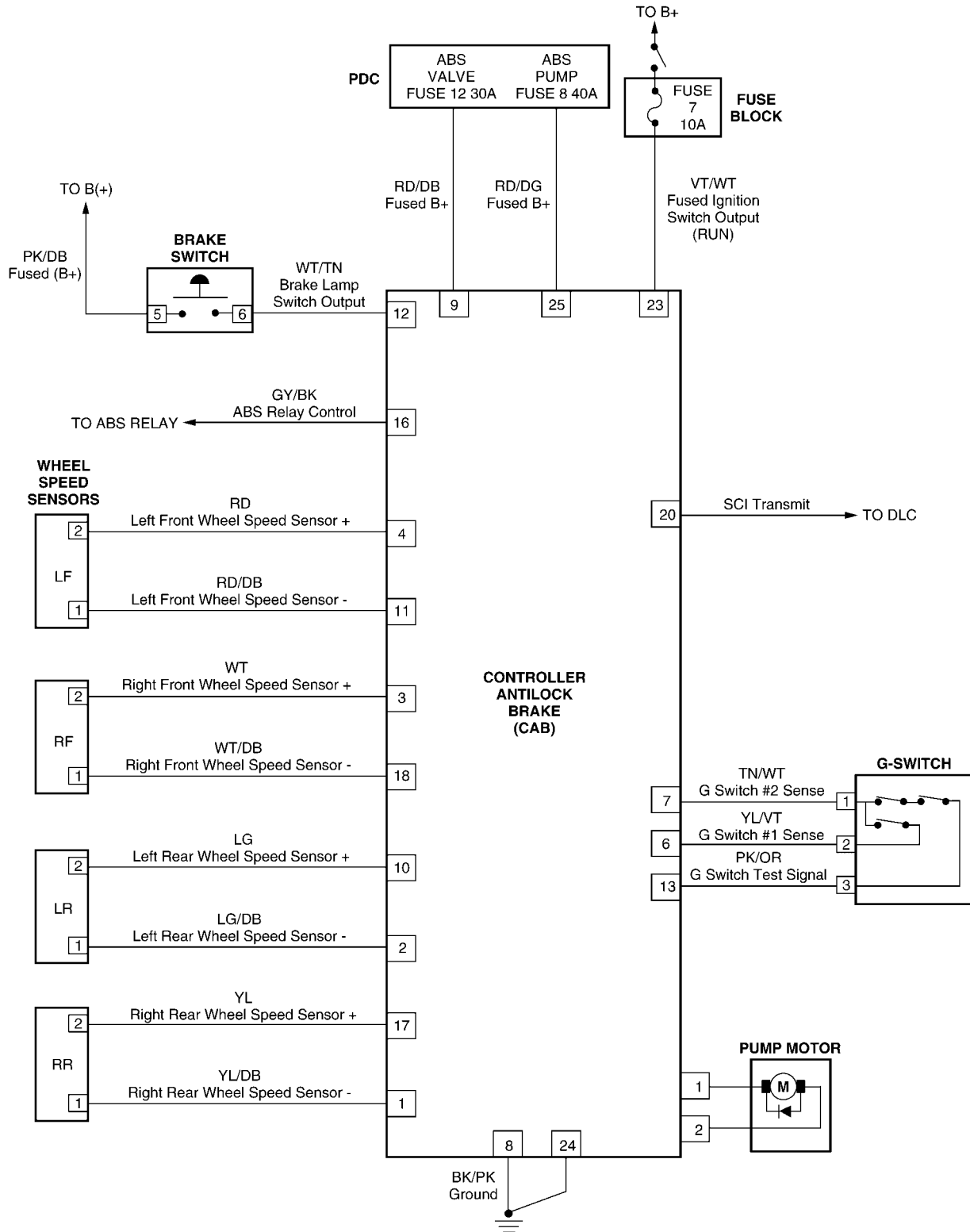
RIGHT REAR WHEEL SPEED SENSOR

RIGHT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)

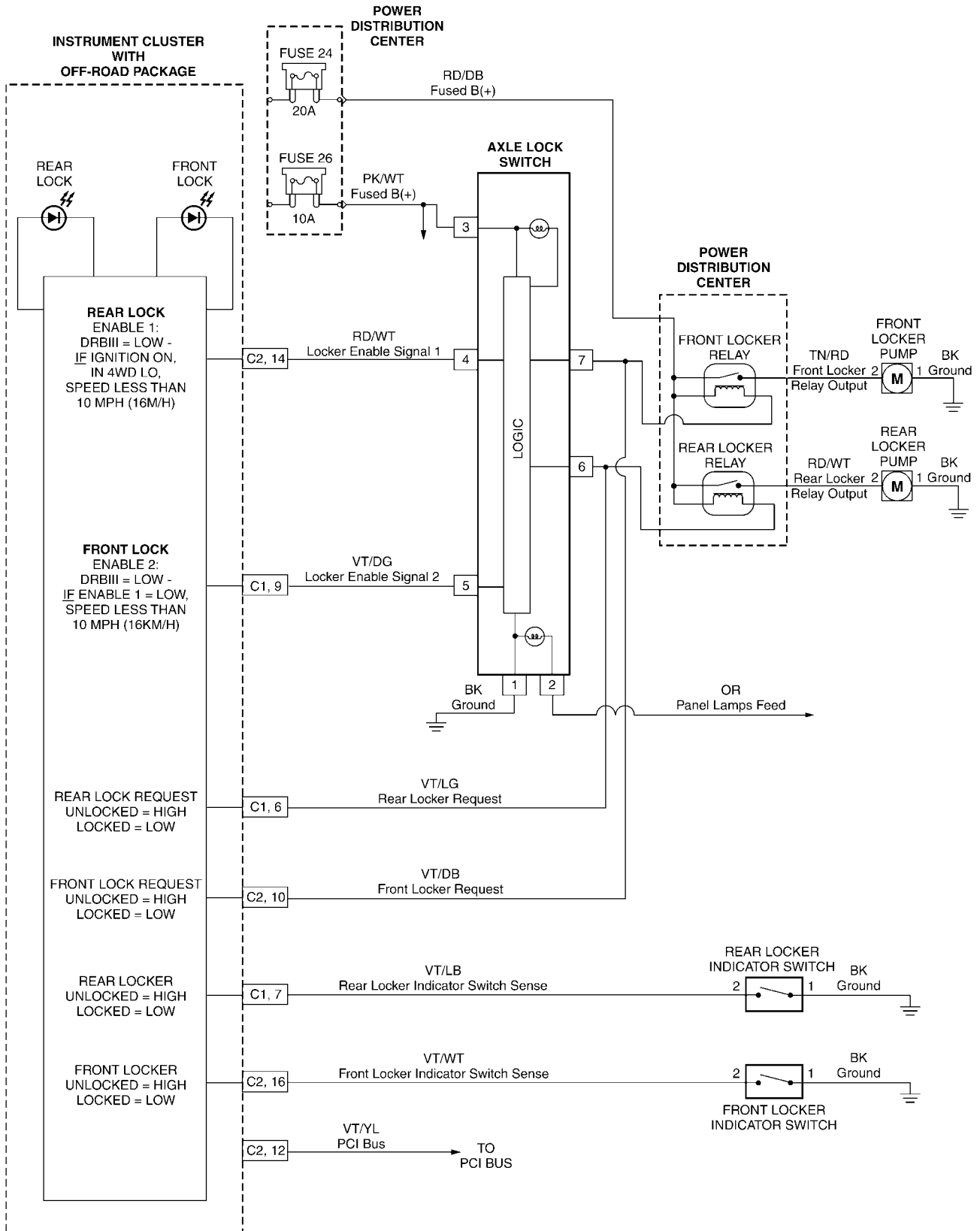
10.0 SCHEMATIC DIAGRAMS

10.1 TEVES MARK 20I CONTROLLER ANTILOCK BRAKE - ABS



SCHEMATIC DIAGRAMS

10.2 AXLE LOCK



SCHEMATIC DIAGRAMS

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