

1999-2000 BRAKES

Anti-Lock - RAV4

DESCRIPTION

Anti-Lock Brake System (ABS) consists of hydraulic actuator, solenoids, pump motor, ABS Electronic Control Unit (ECU), relays, deceleration sensor (4WD) and wheel speed sensors. See **Fig. 1**.

An ABS warning light is located on the instrument cluster. Warning light comes on for 3 seconds as a bulb test when ignition is turned on. A primary check is performed after each engine start and initial vehicle speed exceeds 6 MPH. An actuator noise is heard as vehicle is started or as speed exceeds 6 MPH. This is normal. Anti-lock systems remains active until vehicle speed drops below 3 MPH.

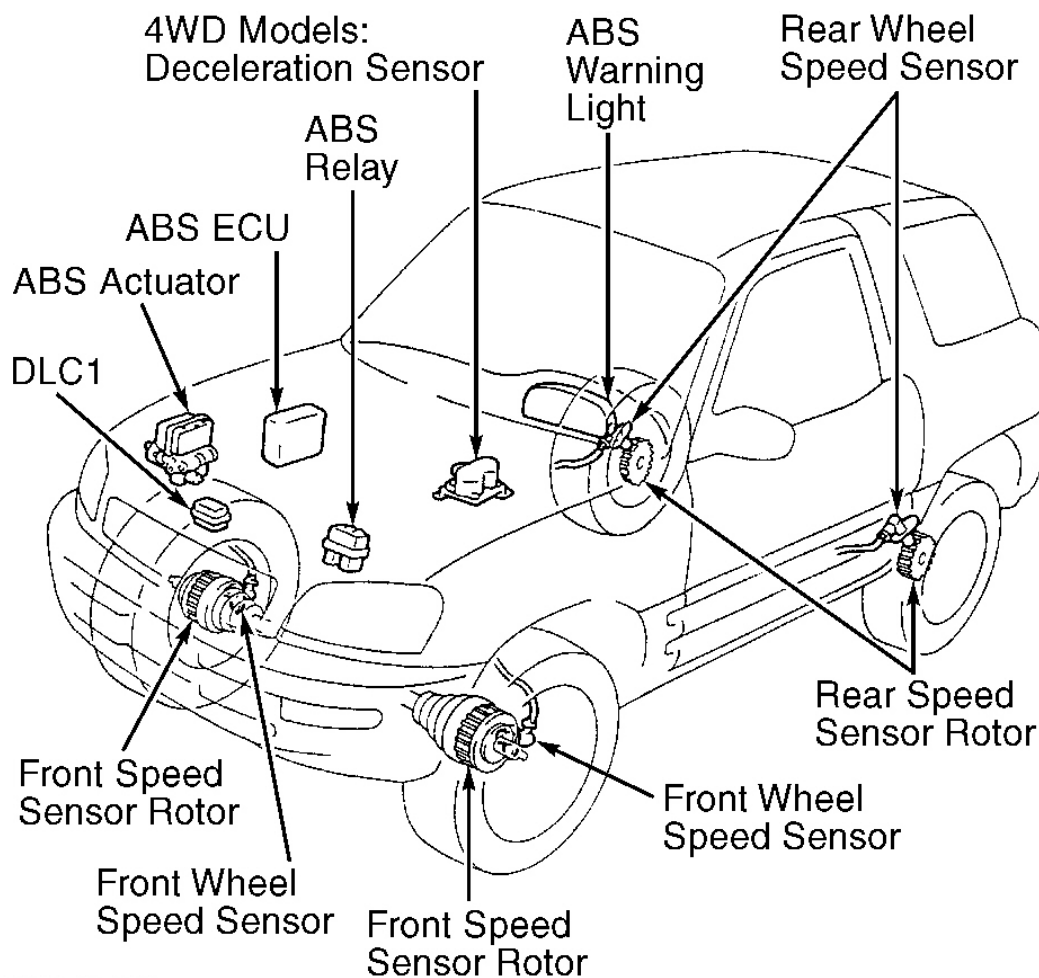


Fig. 1: Locating ABS Components

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: For more information on brake system, see DISC & DRUM - FWD CARS article.

OPERATION

Under normal driving conditions, ABS functions as a standard brake system. With detection of wheel lock-up, short pedal pulsations occurring in rapid succession will be felt in brake pedal. Pedal pulsation will continue until there is no longer a need for ABS function or until vehicle speed falls below 3 MPH. Maintaining a constant force on the brake pedal provides shortest stopping distance.

CAUTION: See **ANTI-LOCK BRAKE SAFETY PRECAUTIONS** article in **GENERAL INFORMATION**.

BLEEDING BRAKE SYSTEM

CAUTION: Brake fluid will damage painted surfaces. If brake fluid contacts a painted surface, wipe off immediately and clean with alcohol. Use only DOT 3 brake fluid from a sealed container. **DO NOT** mix brake fluid with any other type.

MASTER CYLINDER

Ensure brake fluid reservoir is full. Disconnect brakelines from master cylinder. Have an assistant slowly depress brake pedal and hold. Block off outlet ports on master cylinder with finger, then have assistant release brake pedal. Repeat 3 or 4 times or until master cylinder is bled.

BRAKELINES

NOTE: Bleed brakes from farthest wheel first to closest wheel.

Install bleeder hose with container of clean brake fluid on wheel cylinder or caliper. Depress brake pedal several times and hold, then loosen bleeder valve. Tighten bleeder valve when fluid flow stops, then release brake pedal. Repeat until air bubbles are no longer present for each wheel.

TROUBLE SHOOTING

PRELIMINARY INSPECTION

Begin diagnosis with a basic visual inspection of brake fluid level, tire size and other mechanical brake system components which may affect anti-lock operation. Check system sensors, wire harnesses and connectors for proper installation, routing and connection. Ensure all system fuses are okay. Repair as necessary.

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If cause of faulty operation cannot be located with basic diagnosis, ABS electronic control system must be checked. See **DIAGNOSIS & TESTING** .

When ignition is turned on, ABS warning light should come on, then go out after 3 seconds. If ABS warning light does not operate as specified, go to ABS WARNING LIGHT under **DIAGNOSIS & TESTING** .

DIAGNOSIS & TESTING

RETRIEVING DIAGNOSTIC TROUBLE CODES

NOTE: **DO NOT start engine when retrieving DTCs.**

NOTE: **Speed sensor diagnostics and code retrieval use different DLC1 terminals to access DTCs. If a speed sensor or speed sensor circuit problem is suspected, see SPEED SENSOR DIAGNOSTICS .**

ABS Warning Light Diagnostics

1. Ensure battery voltage is 12 volts. Turn ignition switch to ON position. ABS warning light should illuminate, then go out after 3 seconds. If ABS warning light does not illuminate, check fuse, bulb, and wiring harness. See **ABS WARNING LIGHT** .
2. Remove short pin from DLC1. DLC1 is located in engine compartment, on left side of engine. See **Fig. 2** . Using a jumper wire, jumper DLC1 terminals Tc and E₁ . If a malfunction is detected, ABS warning light will begin to flash a 2-digit Diagnostic Trouble Code (DTC). First number of blinks will equal first digit in DTC. After a 1.5-second pause, second number of blinks will equal second digit in DTC.
3. If 2 or more DTCs are stored, there will be a 2.5-second pause between each DTC. After all DTCs are flashed, there will be a 4 second pause and all DTCs will repeat. If ABS system is functioning properly, ABS warning light will blink 2 times per second. For code definitions, see **DTC DEFINITIONS** . For DTC diagnosis, see **DIAGNOSTIC TESTS** .
4. After replacing or repairing components, clear DTCs. If battery cables were disconnected during repairs, all DTCs will be erased. If battery cables were not disconnected during repairs, see **CLEARING DTCS** .

DTC DEFINITIONS

DTC	Circuit/Malfunction
ABS-Related DTCs ⁽¹⁾	
<u>11</u>	Open In ABS Solenoid Relay Circuit
<u>12</u>	Short In ABS Solenoid Relay Circuit
<u>13</u>	Open In ABS Pump Motor Relay Circuit
<u>14</u>	Short In ABS Pump Motor Relay Circuit
<u>21</u>	Open/Shorted RF Solenoid, Defective ABS Actuator
<u>22</u>	Open/Shorted LF Solenoid, Defective ABS Actuator

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<u>23</u>	Open/Shorted RR Solenoid, Defective ABS Actuator
<u>24</u>	Open/Shorted LR Solenoid, Defective ABS Actuator
<u>31</u> ⁽²⁾	Malfunction In RF Speed Sensor Signal
<u>32</u> ⁽²⁾	Malfunction In LF Speed Sensor Signal
<u>33</u> ⁽²⁾	Malfunction In RR Speed Sensor Signal
<u>34</u> ⁽²⁾	Malfunction In LR Speed Sensor Signal
<u>37</u> ⁽³⁾	One Tire Is Different Size Than The Others
<u>41</u>	Excessively Low/High Battery Voltage
<u>43</u> ⁽⁴⁾	Deceleration Sensor Malfunction (Constant Output)
<u>44</u> ⁽⁴⁾	Open/Short In Deceleration Sensor Circuit
<u>45</u> ⁽⁵⁾	Deceleration Sensor Malfunction
<u>49</u> ⁽⁴⁾	Open In Stoplight Switch Circuit
<u>51</u>	Pump Motor Locked Up, Open Ground Circuit
Speed Sensor-Related DTCs ⁽⁶⁾	
<u>71</u>	RF Speed Sensor Signal Low Voltage
<u>72</u>	LF Speed Sensor Signal Low Voltage
<u>73</u>	RR Speed Sensor Signal Low Voltage
<u>74</u>	LR Speed Sensor Signal Low Voltage
<u>75</u>	RF Speed Sensor Abnormal Change In Output Voltage
<u>76</u>	LF Speed Sensor Abnormal Change In Output Voltage
<u>77</u>	RR Speed Sensor Abnormal Change In Output Voltage
<u>78</u>	LR Speed Sensor Abnormal Change In Output Voltage
<u>79</u> ⁽⁴⁾	Deceleration Sensor Faulty

(1) For ABS ECU DTCs, connect jumper wire between terminals Tc and E₁ of DLC1.

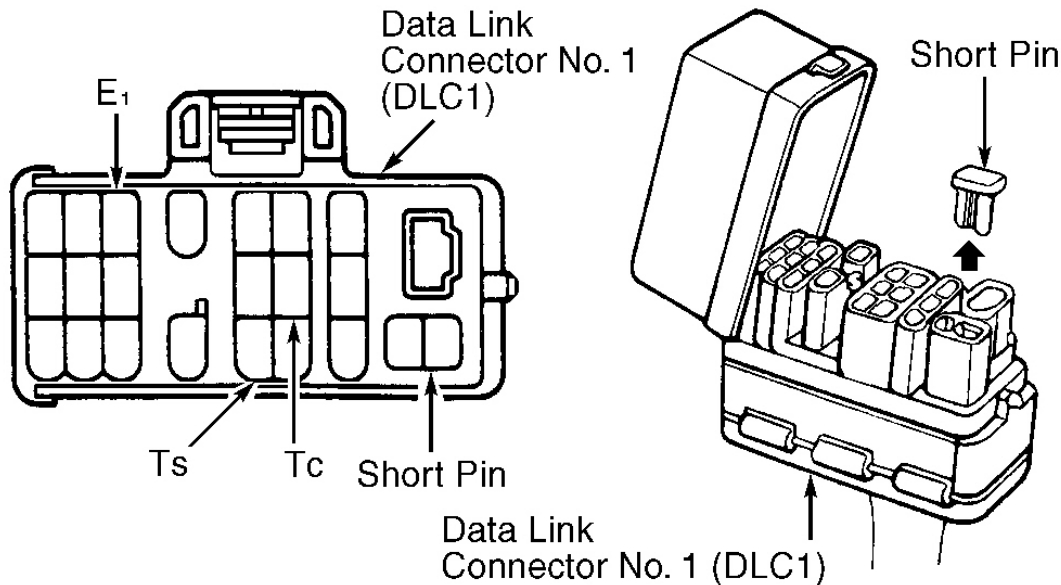
(2) To clear DTC, either drive vehicle over 12 MPH for 30 seconds or more, or use procedure to clear DTC. See **CLEARING DIAGNOSTIC TROUBLE CODES** .

(3) 2WD models.

(4) 4WD models.

(5) 4WD 2 door models.

(6) For speed sensor DTCs, connect jumper wire between terminals Ts and E₁ of DLC1. See **SPEED**

SENSOR DIAGNOSTICS

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Fig. 2: Identifying DLC1 Terminals

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CLEARING DIAGNOSTIC TROUBLE CODES

Remove short pin from DLC1. DLC1 is located in engine compartment on left side of engine. See **Fig. 2** . Using a jumper wire, jumper DLC1 terminals T_c and E_1 . Turn ignition on. With vehicle stopped, depress brake pedal 8 or more times within 5 seconds. DTCs are now erased. Ensure ABS warning light blinks 2 times per second. Remove jumper wire. Reconnect short pin.

SPEED SENSOR DIAGNOSTICS

NOTE: While diagnosing speed sensors, brake system functions as a conventional system.

1. Ensure battery voltage exists. Turn ignition on. Ensure ABS warning light illuminates, then goes out after about 3 seconds. If ABS warning light does not illuminate, check fuse, bulb and wiring harness. See **ABS WARNING LIGHT** .
2. Turn ignition off. Using a jumper wire, jumper terminals T_s and E_1 of DLC1. DLC1 is located in engine compartment on left side of engine. See **Fig. 2** . Start engine. Ensure ABS warning light blinks 4 times

per second. If ABS light does not blink, go to **ABS WARNING LIGHT** . If ABS warning light blinks, go to next step.

3. Drive vehicle straight ahead above 28 MPH for several seconds. Stop vehicle. Jumper terminals Tc and E₁ of DLC1. See **Fig. 2** . If all sensors are okay, a normal DTC is displayed (ABS warning light blinks 2 times a second). If a malfunction is detected, ABS warning light will begin to flash a 2-digit DTC. First number of blinks will equal first digit in a DTC. After a 1.5-second pause, second number of blinks will equal second digit in a DTC.
4. If 2 or more DTCs are stored, there will be a 2.5-second pause between each DTC. After all DTCs are flashed, there will be a 4 second pause and all DTCs will repeat.
5. Record DTCs. Turn ignition off. Repair as necessary. See **DTC DEFINITIONS** . Remove jumper wire from DLC1. Clear DTCs. See **CLEARING DTCs** .

ABS WARNING LIGHT

Circuit Description

If ABS ECU detects a system malfunction, ABS ECU illuminates ABS warning light while at the same time prohibiting ABS control. At this time, ABS ECU records a DTC in memory. After removing short pin from DLC1, connecting terminals Tc and E₁ of DLC1 causes ABS warning light to blink and output a DTC. See **Fig. 2** .

Diagnostic Procedure

1. If ABS warning light stays on, go to step 3 . If ABS warning light does not illuminate, check fuse, light bulb and wiring. Repair or replace as necessary. If bulb is okay, diagnose combination meter (instrument panel). See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. If no problems were found, go to next step.
2. Check ABS control relay. See **SOLENOID RELAY SECTION** under ABS CONTROL RELAY under COMPONENT TESTS. Replace as necessary. If ABS control relay is okay, go to next step.
3. Retrieve DTCs. See **RETRIEVING DTCs** under DIAGNOSIS & TESTING. If DTC is present, perform appropriate test under DIAGNOSTIC TESTS. If DTC is not present, and ABS warning light goes off when short pin is removed, go to next step. If ABS warning light does not turn off, check for short circuit in wiring harness between ABS warning light, DLC1 and ABS ECU. Repair as necessary. See **WIRING DIAGRAMS** .
4. Check ABS control relay. See **SOLENOID RELAY SECTION** under ABS CONTROL RELAY under COMPONENT TESTS. Replace relay as necessary. If relay is okay, check for short circuit in wiring harness between DLC1 and ABS control relay. Repair as necessary. See **WIRING DIAGRAMS** .

TC TERMINAL

Circuit Description

Connecting terminals Tc and E₁ of DLC1 causes ABS warning light to blink and output a DTC. See **Fig. 2** .

Diagnostic Procedure

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Turn ignition on. Measure voltage between terminals Tc and E₁ of DLC1. If voltage is 10-14 volts, circuit is okay. If ABS warning light does not blink even after terminals are connected, malfunction may exist in ABS ECU. If voltage is not 10-14 volts, check for open or short circuit in wiring harness between ABS actuator and DLC1, or between ground and DLC1. See **WIRING DIAGRAMS** . Repair as necessary. If wiring harness is okay, replace ABS ECU.

TS TERMINAL

Circuit Description

Sensor check circuit detects abnormalities in speed sensor signal which cannot be detected when checking for DTCs. Connecting terminals Ts and E₁ of DLC1 in engine compartment starts DTC check. See **Fig. 2** .

Diagnostic Procedure

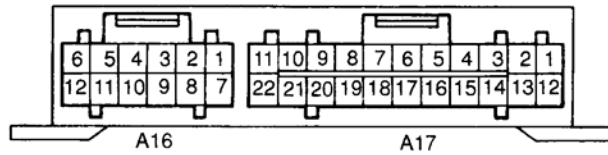
Turn ignition on. Measure voltage between terminals Ts and E₁ of DLC1. If voltage is 10-14 volts, circuit is okay. If ABS warning light does not blink even after terminals are connected, malfunction may exist in ABS ECU. If voltage is not 10-14 volts, check for open or short circuit in wiring harness between ABS ECU and DLC1, or between ground and DLC1. See **WIRING DIAGRAMS** . Repair as necessary. If wiring harness is okay, replace ABS ECU.

ABS ECU PIN VOLTAGES

ABS circuits and harness can be tested by backprobing ABS ECU connectors and comparing measured voltages with ABS ECU standard values chart. See **Fig. 3** .

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Symbols (Terminals No.)	Condition	STD Voltage (V)
IG1 (A17-13)-GND (A17-12, 25)	IG switch ON	10-14
SR (A16-7)-R+ (A17-26)	IG switch ON, ABS warning light OFF	10-14
MR (A16-1)-R+ (A17-26)	IG switch ON	Below 1.0
R+ (A17-26)-GND (A17-12, 25)	IG switch ON	10-14
SFRH (A17-2)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
SFRR (A17-1)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
SFLH (A16-5)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
SFLR (A16-6)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
SRRH (A16-11)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
SRRR (A16-12)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
SRLH (A17-15)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
SRLR (A17-14)-GND (A17-12, 25)	IG switch ON, ABS warning light OFF	10-14
WA (A16-11)-GND (A17-12, 25)	IG switch ON, ABS warning light ON	Below 2.0
	IG switch ON, ABS warning light OFF	10-14
MT (A16-10)-GND (A17-12, 25)	IG switch ON	Below 1.5
STP (A17-5)-GND (A17-12, 25)	Stoplight switch OFF	Below 1.5
	Stoplight switch ON	8-14
Tc (A17-8)-GND (A17-12, 25)	IG switch ON	10-14
Ts (A17-21)-GND (A17-12, 25)	IG switch ON	10-14
FR+ (A16-3)-FR- (A16-9)	IG switch ON, Slowly turn right front wheel	AC generation
FL+ (A16-8)-FL- (A16-2)	IG switch ON, Slowly turn left front wheel	AC generation
RR+ (A17-10)-RR- (A17-23)	IG switch ON, Slowly turn right rear wheel	AC generation
RL+ (A17-22)-RL- (A17-9)	IG switch ON, Slowly turn left rear wheel	AC generation
*3 GS1 (A17-6)-GND (A17-12, 25)	IG switch ON (Vehicle horizontal)	4-6 or 7-11
*3 GS2 (A17-15)-GND (A17-12, 25)	IG switch ON (Vehicle horizontal)	4-6
*4VGS (A17-3)-G GND (A17-17)	IG switch ON	4.5-5.5

*1: Except 2 Door Models for Canada

*2: 2 Door Models for Canada

*3: 4WD 4 Door Models only

*4: 4WD 2 Door Models only

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Fig. 3: ABS ECU Standard Values Chart
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYMPTOM DIAGNOSIS

If a normal DTC is displayed during DTC check but problem still occurs, check circuits for each problem symptom in order given in **SYMPTOM DIAGNOSIS** , then see specified procedure or appropriate test under **DIAGNOSIS & TESTING** , **DIAGNOSTIC TESTS** or **COMPONENT TESTS** .

SYMPTOM DIAGNOSIS

Symptom	Circuit	Circuit, DTC Or Procedure
	Check DTC, Confirm Normal DTC	RETRIEVING DIAGNOSTIC TROUBLE

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ABS Inoperative ⁽¹⁾	Is Output	<u>CODES</u>
	IG Power Source Circuit	<u>DTC 41</u>
	Speed Sensor Circuit	<u>DTCS 31, 32, 33 & 34: SPEED SENSOR CIRCUIT</u>
	Check ABS Actuator ⁽²⁾	<u>ACTUATOR CHECK</u>
ABS Operates Intermittently ⁽¹⁾	Check DTC, Confirm Normal DTC Is Output	<u>RETRIEVING DIAGNOSTIC TROUBLE CODES</u>
	Speed Sensor Circuit	<u>DTCS 31, 32, 33 & 34: SPEED SENSOR CIRCUIT</u>
	Stoplight Switch Circuit	<u>DTC 49: STOPLIGHT SWITCH CIRCUIT</u>
	Check ABS Actuator ⁽²⁾	<u>ACTUATOR CHECK</u>
ABS Warning Light Abnormal	ABS Warning Light Circuit	<u>ABS WARNING LIGHT</u>
	ABS ECU	<u>ABS LIGHT ON: ABS ECU MALFUNCTION</u>
Unable To Perform DTC Check ⁽¹⁾	ABS Warning Light Circuit	<u>ABS WARNING LIGHT</u>
	Tc Terminal Circuit	<u>Tc TERMINAL</u>
Unable To Do Speed Sensor Diagnostics	Ts Terminal Circuit	<u>Ts TERMINAL</u>
	ABS ECU	<u>ABS LIGHT ON: ABS ECU MALFUNCTION</u>

(1) If all circuits check okay and problem is still occurring, replace ABS ECU.

(2) If actuator check is abnormal, check for hydraulic leakage, perform visual inspection.

SYMPTOM TESTS

ABS LIGHT ON: ABS ECU MALFUNCTION

Circuit Description

This circuit is the power source for ABS ECU and actuator.

DTC Detecting Condition

If voltage at ABS ECU terminal IG1 remains more than 17 volts, this DTC will set. If a malfunction occurs in power source circuit, ABS ECU cuts off current to ABS control relay and prohibits ABS control.

Diagnostic Procedure

1. Retrieve DTCs. See **RETRIEVING DTCS** under DIAGNOSIS & TESTING. If DTC is output using ABS warning light, perform appropriate test under **DIAGNOSTIC TESTS** . If ABS warning light does not operate normally, go to next step. If ABS warning light operates normally (lights blink 2 times per second and no DTCs are present), check ABS control (solenoid) relay. See **SOLENOID RELAY SECTION** under ABS CONTROL RELAY under COMPONENT TESTS. Check for short circuit in

wiring harness between ABS control relay and DLC1. Repair or replace as necessary. See **WIRING DIAGRAMS** .

2. If ABS warning light is on, go to next step. If ABS warning light is off, check for open or short circuit in wiring harness between ECU-IG fuse and ABS ECU. Repair as necessary. See **WIRING DIAGRAMS** .
3. Start engine and check charging system voltage. If voltage is 10-16 volts, go to next step. If voltage is not 10-16 volts, diagnose charging system. Repair as necessary.
4. Turn ignition off. Disconnect appropriate ABS ECU connector supporting IG1 terminal. See **Fig. 3** . Turn ignition switch to ON position. Ensure ABS warning light turns off. If light turns off, replace ABS ECU. If light does not turn off, check for short circuit in wiring harness between combination meter (instrument panel) and ABS ECU, or between combination meter and DLC1. Repair as necessary. See **WIRING DIAGRAMS** .

DIAGNOSTIC TESTS

DTC 11 & DTC 12: ABS CONTROL (SOLENOID) RELAY CIRCUIT

Circuit Description

This relay supplies power to each ABS solenoid. After ignition switch is turned to ON position, if initial check is okay, this relay turns on. If malfunction occurs in ABS control relay circuit, ABS ECU cuts off current to ABS control relay and prohibits ABS control.

DTC Detecting Condition

Detection of following conditions may set DTC 11 or DTC 12 if condition occurs for .2 seconds or more:

- If voltage at ABS control relay connector terminal A9-1 is less than 1.5 volts and voltage at connector terminal A9-5 is zero volts, DTC 11 may set.
- If voltage at ABS control relay connector terminal A9-1 is 10-14 volts and voltage at connector terminal A9-5 is 10-14 volts, DTC 12 may set.

Diagnostic Procedure

1. Disconnect ABS control relay 6-pin connector A9, located in engine compartment at front of vehicle. See **Fig. 1** . Measure voltage between connector terminals A9-2 and A9-6. See **Fig. 4** . If voltage is 10-14 volts, go to next step. If voltage is not 10-14 volts, repair wiring harness between ground, battery and ABS control relay.
2. Measure resistance between ABS control relay terminal A9-5 and appropriate ABS ECU terminals. See **ABS ECU-TO-ACTUATOR CIRCUIT IDENTIFICATION/RESISTANCE VALUES** . See **Fig. 3** . If resistance on every circuit is between 26-40 ohms, go to next step. If resistance is not as specified, check for open or short circuit in appropriate wiring between ABS control relay, ABS actuator and ABS ECU. See **WIRING DIAGRAMS** . Repair as necessary. If wiring is okay, replace ABS actuator.

ABS ECU-TO-ACTUATOR CIRCUIT IDENTIFICATION/RESISTANCE VALUES

Circuit	ABS ECU Connector/Terminal	Wire Color

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SRLR	A17-14	Brown/Red
SRLH	A17-15	Brown/White
SRRR	A16-12	Green/Yellow
SRRH	A16-11	Green/Black
SFLR	A16-6	Blue/White
SFLH	A16-5	Blue/Red
SFRR	A17-1	Red/Green
SFRH	A17-2	Red/White

3. Check ABS control relay. See **SOLENOID RELAY SECTION** under ABS CONTROL RELAY under COMPONENT TESTS. Replace as necessary. If ABS control relay is okay, go to next step.
4. Check for open or short circuit in wiring harness between ABS control relay and ABS ECU. Repair as necessary. See **WIRING DIAGRAMS** . If circuit is okay, go to next step.
5. Clear DTCs and then recheck for DTCs. See **RETRIEVING DTCS** under DIAGNOSIS & TESTING. If same DTC is output after DTC is cleared, check contact condition of each connection. Repair as necessary. If connections are okay, replace ABS ECU. See **ABS ECU** under REMOVAL & INSTALLATION.

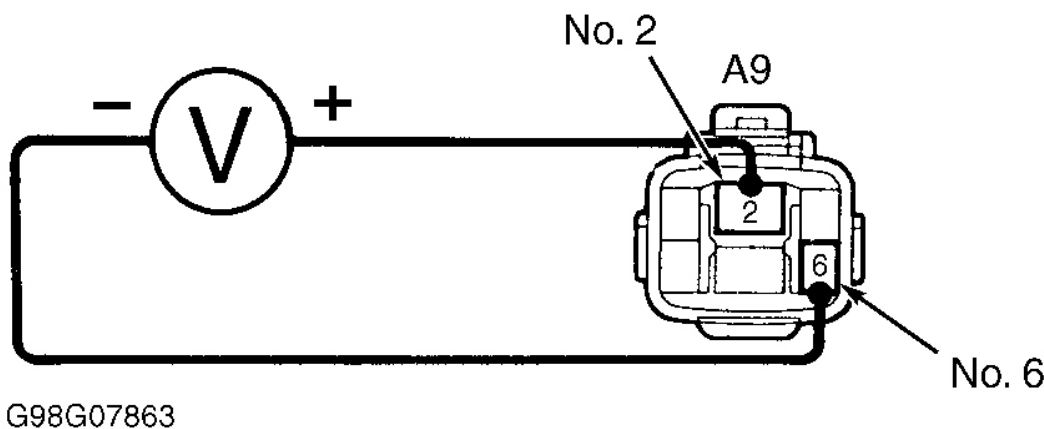


Fig. 4: Testing ABS Control (Solenoid) Relay Power/Ground Circuits
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC 13 & DTC 14: ABS CONTROL (MOTOR) RELAY CIRCUIT

Circuit Description

ABS control relay supplies power to ABS pump motor. While ABS is activated, ABS ECU switches ABS control relay on and operates ABS pump motor. If malfunction occurs in ABS control relay circuit, ABS ECU cuts off current to ABS control relay and prohibits ABS control.

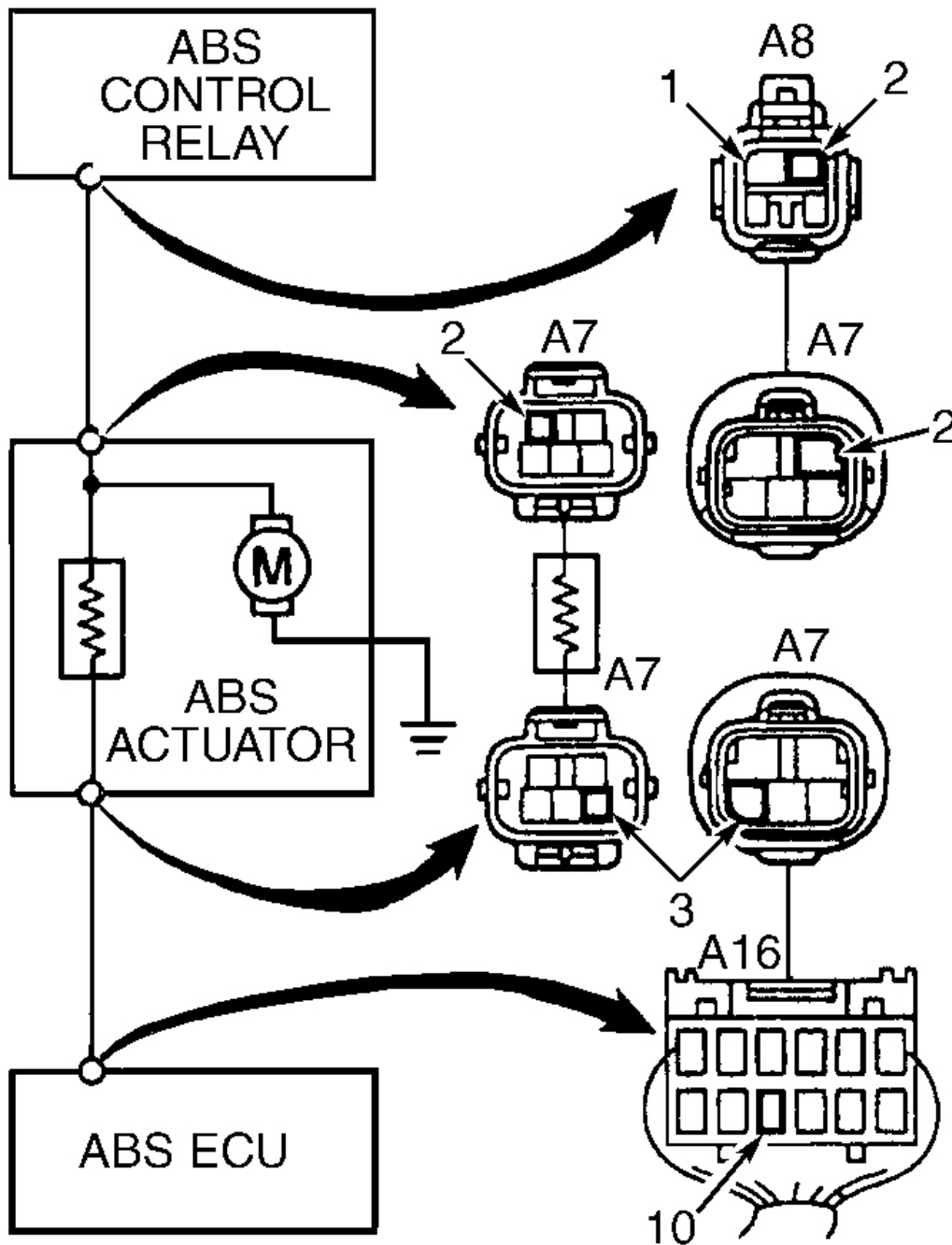
DTC Detecting Condition

Detection of any of the following conditions may set DTC 13 or DTC 14 if condition occurs for .2 seconds or more:

- If voltage at ABS control relay connector terminal A8-4 is less than 1.5 volts, and voltage at connector terminal A8-2 is zero volts, DTC 13 may set.
- If voltage at ABS control relay connector terminal A8-4 is 10-14 volts, and voltage at connector terminal A8-2 is 10-14 volts, DTC 14 may set.

Diagnostic Procedure

1. Disconnect ABS control relay connector A8, located in engine compartment at front of vehicle. See **Fig. 1** . Measure voltage between ground and motor relay connector terminal A8-1. See **Fig. 5** . If voltage is 10-14 volts, go to next step. If voltage is not 10-14 volts, repair wiring harness between battery and motor relay. See **WIRING DIAGRAMS** .
2. Disconnect 2 ABS actuator connectors. Check for continuity on Blue/Red wire between ABS actuator connector terminal A7-2 and ABS control relay connector terminal A8-2. Also check for continuity on Blue/Red wire between ABS actuator connector terminal A7-3 and ABS ECU connector terminal A16-10. See **Fig. 5** . Continuity should exist. If continuity is not present on either wire, repair open circuit on affected wire between ABS control relay and ABS ECU. If continuity is present on both wires, go to next step.
3. Check resistance between ABS actuator terminals A7-2 and A7-3. Resistance should be 26-40 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace ABS actuator.
4. Check ABS control relay. See **MOTOR RELAY SECTION** under ABS CONTROL RELAY under COMPONENT TESTS. Replace relay as necessary. If relay tests okay, go to next step.
5. Check for open or short circuit in wiring harness between ABS control relay and ABS ECU. Repair as necessary. See **WIRING DIAGRAMS** . If circuit is okay, go to next step.
6. Clear DTCs and then recheck for DTCs. See **RETRIEVING DTCS** under DIAGNOSIS & TESTING. If same DTC is output after DTC is cleared, check contact condition of each connection. Repair as necessary. If connections are okay, replace ABS ECU.



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Fig. 5: Testing Circuit Between ABS ECU & ABS Control (Motor) Relay
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC 21, DTC 22, DTC 23 & DTC 24: ABS ACTUATOR SOLENOID CIRCUIT**Circuit Description**

This solenoid turns on when signals are received from ABS ECU and controls pressure acting on calipers/wheel cylinders, thus controlling braking force. If malfunction occurs in actuator solenoid circuit, ABS ECU cuts off current to ABS control relay and prohibits ABS control.

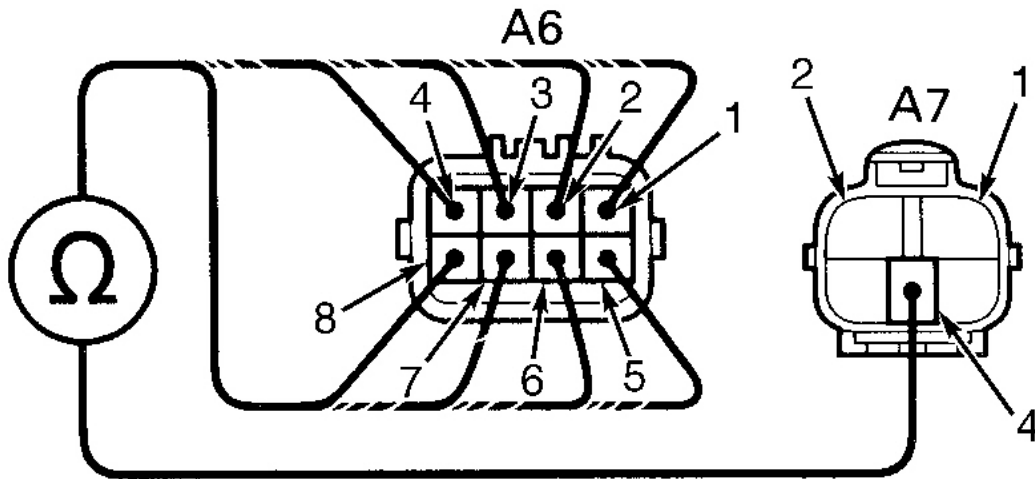
DTC Detecting Conditions

If the following conditions continue for .05 seconds or more, DTC will set. Voltage at ABS control relay connector terminal A9-1 is less than 1.5 volts, and one of the following conditions is met:

- If power transistor of ABS ECU is on, and voltage at terminal SFRR or terminal SFRH is zero volts or battery voltage is detected, DTC 21 will set.
- If power transistor of ABS ECU is on, and voltage at terminal SFLR or terminal SFLH is zero volts or battery voltage is detected, DTC 22 will set.
- If power transistor of ABS ECU is on, and voltage at terminal SRRR or terminal SRRH is zero volts or battery voltage is detected, DTC 23 will set.
- If power transistor of ABS ECU is on, and voltage at terminal SRLR or terminal SRLH is zero volts or battery voltage is detected, DTC 24 will set.

Diagnostic Procedure

1. Disconnect 2 ABS actuator connectors. Check continuity between actuator connector terminal A7- 4 and actuator connector terminals A6-1 through A6-8. See **Fig. 6** . Continuity should exist at each pair of terminals. Check resistance at each pair of terminals. Resistance should be 4.3 ohms for each solenoid coil at terminals SFRR, SFLR, SRRR and SRLR. Resistance should be 8.8 ohms for each solenoid coil at terminals SFRH, SFLH, SRRH and SRLH. See **WIRING DIAGRAMS** . If continuity and resistance is as specified, go to next step. If continuity and resistance is not as specified, replace ABS actuator.
2. Check for open or short circuit in wiring harness between ABS ECU and actuator. Repair as necessary. See **WIRING DIAGRAMS** . If circuits are okay, go to next step.
3. Clear DTCs and then recheck for DTCs. See **RETRIEVING DTCS** under DIAGNOSIS & TESTING. If same DTC is output after DTC is cleared, check contact condition of each connection. Repair as necessary. If connections are okay, replace ABS ECU.



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Fig. 6: Testing ABS Actuator Solenoid Coils

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC 31, DTC 32, DTC 33 & DTC 34: SPEED SENSOR CIRCUIT**Circuit Description**

Speed sensor detects wheel speed and sends appropriate signals to ABS ECU. These signals are used to control ABS system. Front and rear sensor rotors each have 48 teeth. When rotor rotates, magnetic field emitted by permanent magnet in speed sensor generates an AC voltage. Since frequency of this AC voltage changes in direct proportion to speed of rotor, frequency is used by ABS ECU to detect speed of each wheel. If malfunction occurs in speed sensor circuit, ABS ECU cuts off current to ABS control relay and prohibits ABS control.

DTC Detecting Condition

Detection of any of the following conditions may set DTCs 31-34:

- Vehicle speed is 6 MPH or more and pulses are not input for 30 seconds.
- Momentary interruption of speed sensor signal occurs at least 7 times during one ignition cycle.
- Abnormal fluctuation of speed sensor signals when vehicle speed is 12 MPH or more.

Diagnostic Procedure

NOTE: To determine which speed sensor circuit is malfunctioning, see DTC

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DEFINITIONS under DIAGNOSIS & TESTING. For front speed sensor diagnosis, start at step 1 . For rear speed sensor, start at step 2 .

1. Disconnect front speed sensor connector. Measure resistance between speed sensor connector terminals. Resistance should be 1.4-1.8 k/ohms. Measure resistance between ground and each speed sensor connector terminal. Resistance should be one megohm or more. If resistance is as specified, go to step 3 . If resistance is not as specified, replace speed sensor.
2. Disconnect rear speed sensor connector. Measure resistance between speed sensor connector terminals. Resistance should be 1.28-1.48 k/ohms. Measure resistance between ground and each speed sensor connector terminal. Resistance should be one megohm or more. If resistance is as specified, go to next step. If resistance is not as specified, replace speed sensor.
3. Check for open or short circuit in wiring harness between affected speed sensor and ABS ECU. See **WIRING DIAGRAMS** . Repair as necessary. If wiring harness is okay, go to next step.
4. Check speed sensor installation. Ensure mounting bolt is tightened to specification. See **TORQUE SPECIFICATIONS** . Ensure zero clearance exists between sensor and front steering knuckle or rear axle carrier. Replace speed sensor if necessary. If speed sensor installation is okay, check speed sensor signal. See **SPEED SENSOR DIAGNOSTICS** under DIAGNOSIS & TESTING. If signal is normal, go to next step.
5. If oscilloscope is available, check speed sensor signal wave form. Remove ABS ECU. Do not disconnect electrical connectors. Connect oscilloscope between GND terminal and terminals FR+, FL+, RR+ and RL+ at ABS ECU connector. See **Fig. 3** . Drive vehicle at 19 MPH and observe signal wave form. Signal should be smooth and consistent without any irregular wave forms. If wave form is smooth and consistent, replace ABS ECU. If wave form is not smooth and consistent, go to next step.
6. Check speed sensor rotor for missing teeth or damage. Check sensor tip for scratches, damage or foreign objects. Replace components as necessary. If rotor and sensor are okay, replace ABS ECU.

DTC 37: TIRES OF DIFFERENT SIZE (2WD MODELS ONLY)

DTC Detecting Condition

Detection of the following condition may set DTC 37:

- Driving vehicle at speed of more than 12 MPH for more than 20 seconds with one or 2 tires of different sizes, 3 different times continuously will set DTC 37.

Diagnostic Procedure

Ensure vehicle tires are all the same size and correct size for vehicle. Replace tires as necessary. If tire size is okay, replace ABS ECU.

DTC 41: LOW BATTERY VOLTAGE

Circuit Description

Circuit is power source for ABS ECU, which includes actuator. If malfunction occurs in power source circuit, ABS ECU cuts off current to ABS control relay and prohibits ABS control.

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DTC Detecting Condition

Detection of the following condition may set DTC 41:

- At vehicle speed of about 2 MPH or more, if voltage at ABS ECU terminal IG1 is less than 9.5 volts for 10 seconds or more, DTC 41 may set.

Diagnostic Procedure

1. Check charging system voltage. If voltage is 10-14 volts, system is okay. Go to next step. If voltage is not 10-14 volts, repair charging system. Ensure system fuses are okay.
2. Turn ignition off. Remove ABS ECU. Do not disconnect electrical connectors. Turn ignition switch to ON position. Measure voltage between terminals IG1 and GND at ABS ECU harness connector. See **Fig. 3**. If voltage is 10-14 volts, turn ignition off. Condition may be intermittent. Check ABS ECU connectors for poor connection or damage. Repair as necessary. If connectors are okay, replace ABS ECU. If voltage is not as specified, go to next step.
3. Measure resistance between ground and GND terminals at ABS ECU harness connector. See **Fig. 3**. If resistance is one ohm or less, go to next step. If resistance is more than one ohm, repair ground circuit wiring. See **WIRING DIAGRAMS**.
4. Remove ECU-IG fuse from instrument panel junction block. If fuse is blown, check for short circuit in all wiring harnesses and components connected to ECU-IG fuse (ECM, A/C, cruise control, deceleration sensor, combination meter, sun roof, shift lock, transmission pattern select switch). See **WIRING DIAGRAMS**. Repair as necessary. If fuse is not blown, check for open circuit in wiring harness between battery and ABS ECU. Repair as necessary.

DTC 43 & DTC 45: DECELERATION SENSOR MALFUNCTION (4WD MODELS ONLY)

DTC Detecting Conditions

Detection of the following conditions may set DTCs 43 or 45:

- On 2-door models, if output voltage from deceleration sensor does not change for 16 consecutive times or more when vehicle speed is decreased from 19 MPH to zero MPH, DTC 43 will set.
- On 4-door models, after battery cables are connected, if input from deceleration sensor does not change at one cycle (zero MPH to 19 MPH or more, then back to zero) for 16 consecutive times, DTC 43 will set. When brake pedal is not depressed at vehicle speed of 3 MPH or more, and forward and backward force (force of more than 0.4 "G") is detected for 30 seconds or more, DTC 43 will set.
- On 2-door models, at vehicle speed of 19 MPH or more, if deceleration sensor output and vehicle acceleration from wheel speed remains abnormally different for one minute or more, DTC 45 will set.

Diagnostic Procedure

1. Check deceleration sensor. See **DECELERATION SENSOR CHECK** under COMPONENT TESTS. Replace sensor as necessary. If sensor is okay, go to next step.
2. Check for open or short circuit in wiring harness between deceleration sensor and ABS ECU. See **WIRING DIAGRAMS**. Repair as necessary. If wiring harness is okay, replace ABS ECU.

DTC 44: DECELERATION SENSOR CIRCUIT (4WD MODELS ONLY)**Circuit Description**

Deceleration sensor detects vehicle deceleration. Sensor signal is used in ABS control. If sensor functions abnormally, ABS warning light will illuminate, but ABS will still operate.

DTC Detecting Conditions

Detection of the following conditions may set DTC 44:

- On 2-door models, with ignition switch in ON position, and output voltage of terminals GL1 or GL2 remains 0.5 volts or less or 4.5 volts or more for more than one minute, DTC 44 will set.
- On 2-door models, at vehicle speed of zero MPH, if outputs of terminals GL1 and GL2 remain abnormally different for one minute or more, DTC 44 will set.
- On 2-door models, if after ignition switch is turned to ON position, voltage at terminal VGS is 4.4 volts or less, or 5.5 volts or more, and voltage continues for 1.2 seconds or more, DTC 44 will set.
- On 4-door models, if an open or short circuit is detected in circuits GS1 or GS2 for one second, DTC 44 will set.
- On 4-door models, after ignition switch is turned to ON position, a test signal is output at terminal GST. During this time, if a trouble signal is detected for 0.5 seconds, DTC 44 will set.

Diagnostic Procedure

1. Check for open or short circuit in wiring harness between deceleration sensor and ABS ECU. Repair as necessary. See **WIRING DIAGRAMS** . If wiring harness is okay, go to next step.
2. Turn ignition off. Remove ABS ECU. Do not disconnect electrical connectors. Disconnect deceleration sensor connector. Turn ignition switch to ON position. On 4-door models, go to next step. On 2-door models, measure voltage between ground and terminals GL1, GL2 and VGS at ABS ECU harness connector. See **Fig. 3** . Voltage should be 0.5-4.5 volts at terminals GL1 and GL2. Voltage should be 4.5-5.5 volts at terminal VGS. If voltage is as specified, check deceleration sensor. See **DECELERATION SENSOR CHECK** under COMPONENT TESTS. If voltage is not as specified, replace ABS ECU.
3. On 4-door models, measure voltage between ground and terminals GS1, GS2 and GST at ABS ECU harness connector. See **Fig. 3** . Voltage should be 4-6 volts or 7-11 volts at terminal GS1. Voltage should be 4-6 volts at terminal GS2. Voltage at terminal GST should pulse from 12 volts for 0.5 seconds to zero volts, with a 1.5 second pause between pulses. If voltage is as specified, check deceleration sensor. See **DECELERATION SENSOR CHECK** under COMPONENT TESTS. If voltage is not as specified, replace ABS ECU.

DTC 49: STOPLIGHT SWITCH**DTC Detection Condition**

Detection of the following condition may set DTC 49:

- Voltage at ABS ECU terminal STP is 1.2-1.7 volts and continues for 0.3 seconds or more.

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Diagnostic Procedure

1. Depress brake pedal and ensure brakelights illuminate. If brakelights illuminate, go to next step. If brakelights do not illuminate, check stoplight switch adjustment. See **STOPLIGHT SWITCH** under ADJUSTMENTS. If stoplight switch adjustment is okay, locate and repair fault in stoplight circuit. See **WIRING DIAGRAMS**.
2. Turn ignition off. Remove ABS ECU. Do not disconnect electrical connectors. Measure voltage between ground and terminal STP at ABS ECU harness connector when brake pedal is depressed. See **Fig. 3**. If voltage is 8-14 volts, stoplight switch circuit is okay at this time. If voltage is not 8-14 volts, go to next step.
3. Check for open circuit in wiring harness between stoplight switch and ABS ECU. Repair as necessary. See **WIRING DIAGRAMS**. If wiring harness is okay, replace ABS ECU.

DTC 51: ABS PUMP MOTOR LOCKED

Circuit Description

If malfunction occurs in ABS pump motor, ABS ECU cuts off current to ABS control relay and prohibits ABS control.

DTC Detection Condition

Detection of the following condition may set DTC 51:

- ABS actuator pump motor is not operating properly during initial check.

Diagnostic Procedure

Disconnect ABS actuator connector A7. Connect jumper wires between battery positive terminal and actuator terminal A7-2, and battery negative terminal to terminal A7-1. See **Fig. 6**. Ensure pump motor operates. If pump motor operates, check for open circuit in wiring harness between ABS control relay, actuator and ABS ECU. Repair as necessary. See **WIRING DIAGRAMS**. If pump motor does not operate, replace ABS actuator.

COMPONENT TESTS

ABS CONTROL RELAY

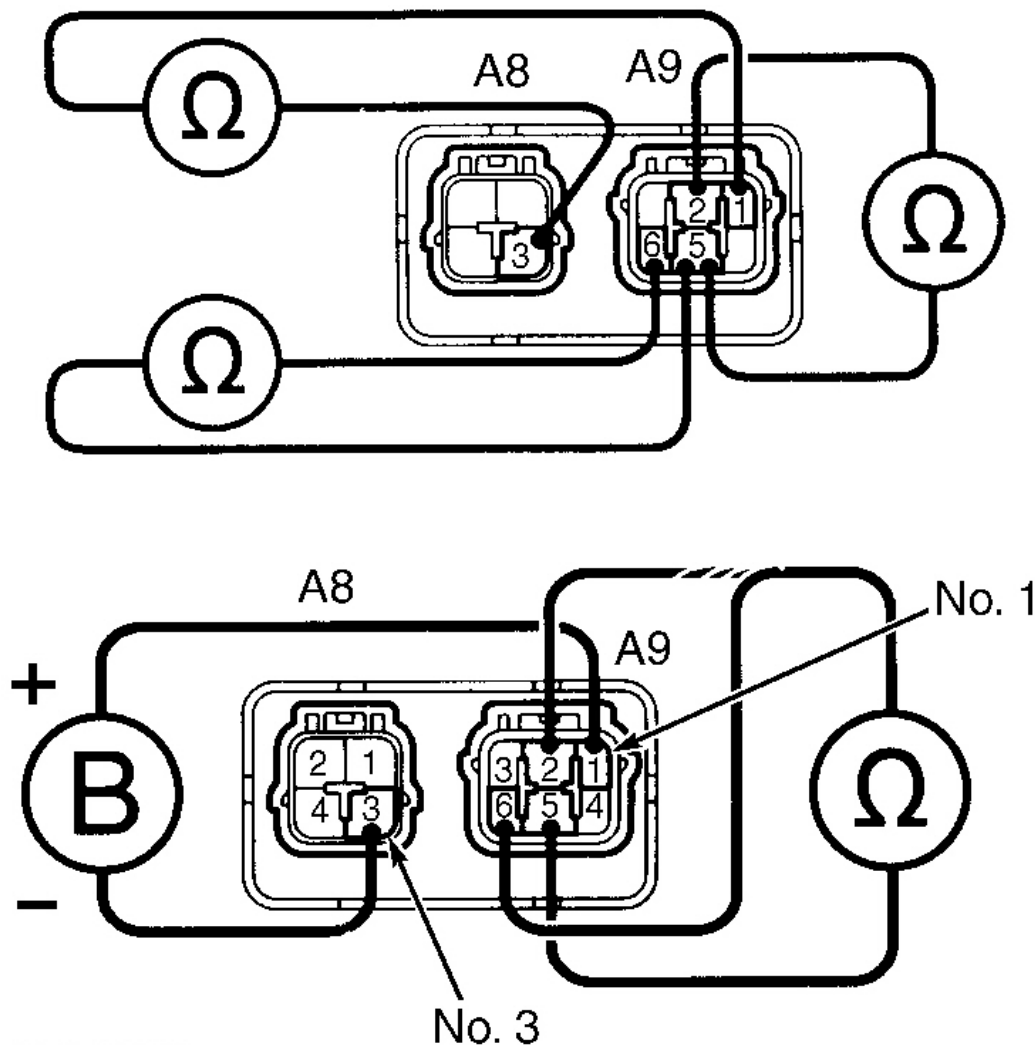
NOTE: **ABS control relay has both ABS solenoid relay and ABS motor relay integrated into one component. Replace complete ABS control relay if either solenoid or motor section fails.**

Solenoid Relay Section

1. Check continuity between specified ABS control relay terminals. See **Fig. 7**. Continuity should exist between ABS control relay terminals A9-5 and A9-6. Continuity should not exist between terminals A9-2

and A9-5. Measure resistance between terminals A8-3 and A9-1. Resistance should be 80 ohms. Replace ABS control relay if it does not test as described.

2. If relay tests as described, apply battery voltage and ground to ABS control relay terminals A8-3 and A9-1. See **Fig. 7** . Check continuity between terminals A9-2 and A9-5. Continuity should exist. Check continuity between terminals A9-5 and A9-6. Continuity should not exist. Check for continuity between terminals A9-4 and A9-5. If continuity does not exist, reverse test leads and recheck. If continuity still does not exist, or if relay does not test as described, replace ABS control relay.



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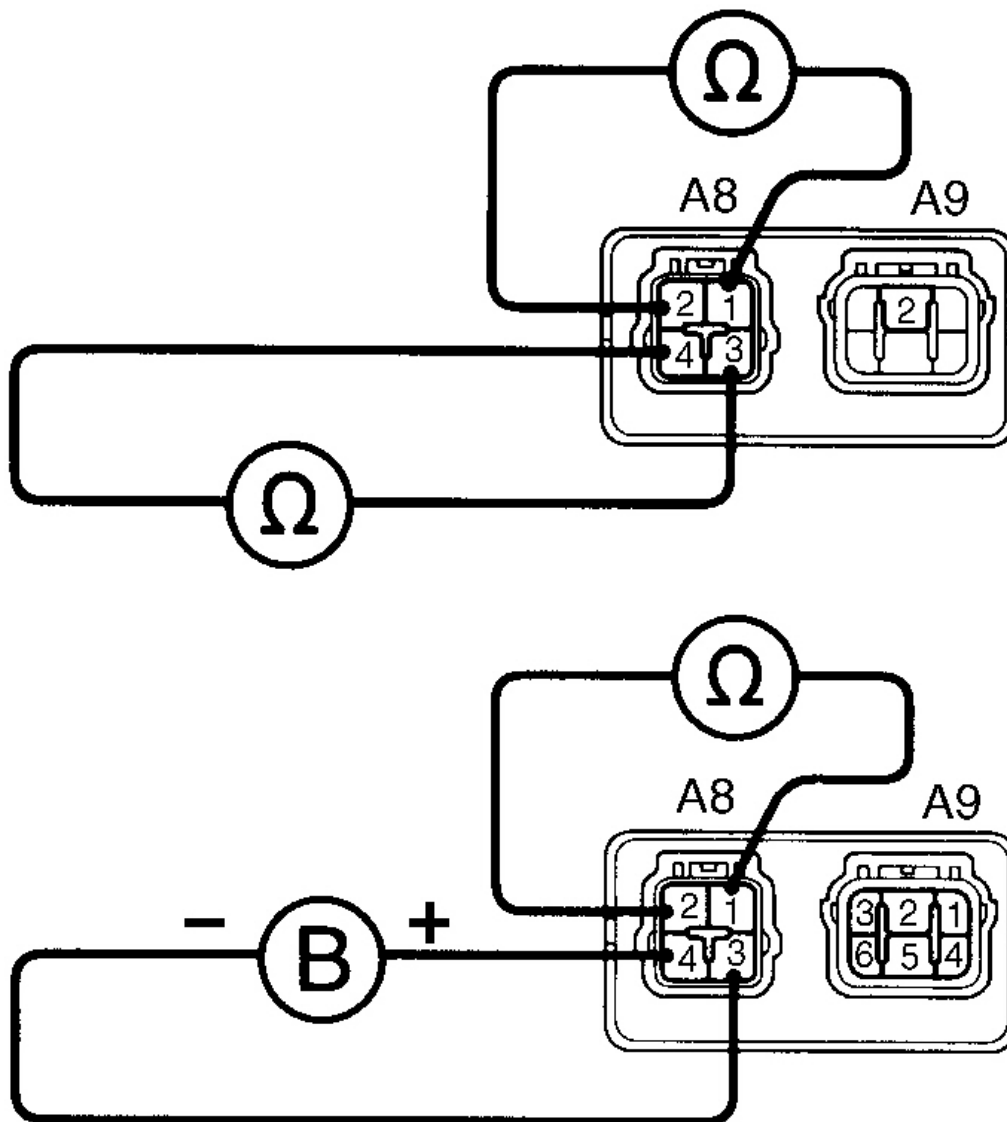
Fig. 7: Testing ABS Control Relay Continuity - Solenoid Section
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Motor Relay Section

1. Check continuity between specified ABS control relay terminals. See **Fig. 8** . Continuity should exist between terminals A8-3 and A8-4. Continuity should not exist between terminals A8-1 and A8-2. Measure resistance between terminals A8-3 and A8-4. Resistance should be 68 ohms. Replace motor relay if it does not test as described.
2. If relay tests as described, apply battery voltage and ground between terminals A8-3 and A8-4. Check continuity between terminals A8-1 and A8-2. Continuity should exist. If continuity is not as described, replace ABS control relay.



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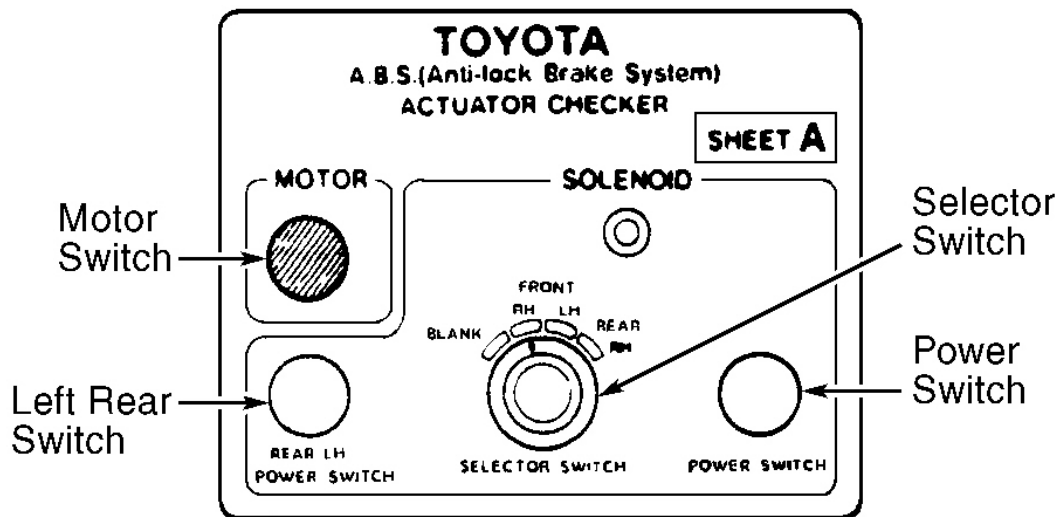
Fig. 8: Testing ABS Control Relay Continuity - Motor Section
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ACTUATOR CHECK

1. Ensure battery voltage exists. Disconnect actuator and control relay electrical connectors. Connect Test Harness (09990-00200 and 09990-00300) and Actuator Checker (09990-00150) to vehicle, following manufacturer's instructions. Connect actuator checker positive and negative power cables to vehicle

battery.

- Place Sheet "A" (09990-00163) on actuator checker. Start engine and let idle. Turn actuator checker SELECTOR switch to FRONT RH position. See [Fig. 9](#) . Press and hold MOTOR switch for a few seconds. Ensure motor can be heard running. Depress and hold brake pedal for 15 seconds. Ensure brake pedal does not go down. While holding brake pedal, press MOTOR switch for a few seconds. Ensure brake pedal does not pulsate.



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Fig. 9: Identifying Actuator Checker Switches
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: DO NOT press POWER switch for more than 10 seconds.

- Press and hold POWER switch for a few seconds and ensure brake pedal does not go down. While holding brake pedal, release POWER switch. Ensure brake pedal goes down. While holding brake pedal, press MOTOR switch and ensure brake pedal returns. Release brake pedal.
- Set SELECTOR switch to each of the other wheels and repeat steps 2 -3 . When checking REAR LH position, press REAR LH POWER switch, instead of POWER switch. Left rear wheel can be checked in any selector switch position.
- After checking remaining wheels, press and hold MOTOR switch for a few seconds. Stop engine. Remove actuator checker and test harnesses. Reconnect vehicle harnesses to actuator and control relay. Clear diagnostic DTCs. See [CLEARING DTCs](#) under DIAGNOSIS & TESTING.

DECELERATION SENSOR CHECK

NOTE: During deceleration sensor diagnosis, ABS functions like a standard brake

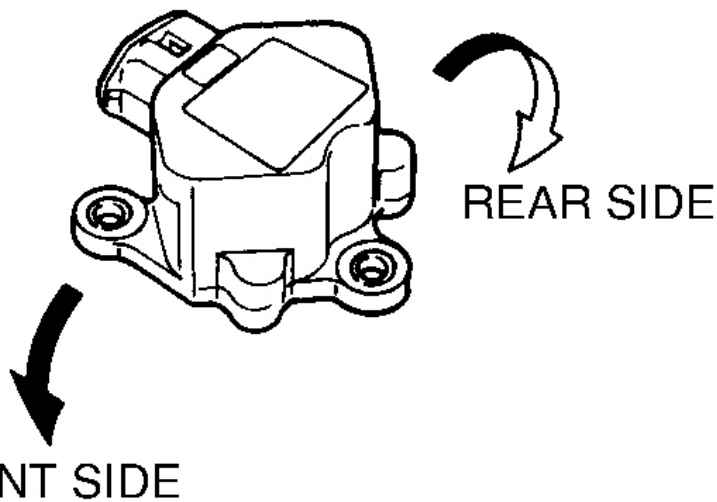
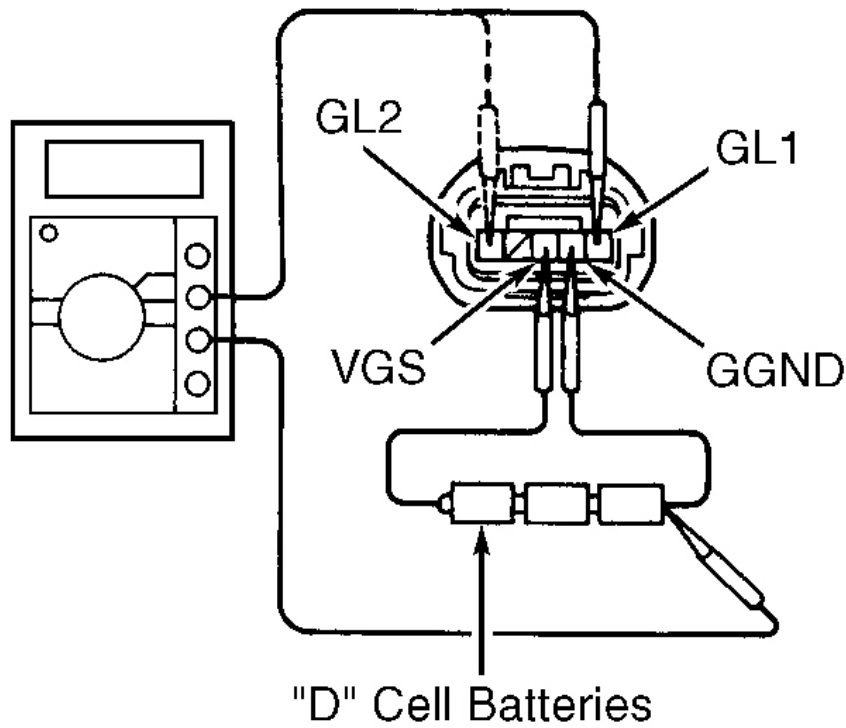
system.

2-Door Models

1. Connect 3 "D" cell batteries in series, creating 4.5 volts. Connect VGS terminal of deceleration sensor to positive (+) side of batteries. See **Fig. 10** . Connect GGND terminal to negative (-) side of batteries.
2. Measure voltage between terminal GL1 and ground, and between terminal GL2 and ground at deceleration sensor. Ensure sensor is within specifications. See **DECELERATION SENSOR SPECIFICATIONS** . If sensor is not within specification, replace sensor.

DECELERATION SENSOR SPECIFICATIONS

Terminal	Position	(1) Voltage
GL1	Horizontal	2.3
GL1	Leaning Forward	0-2.3
GL1	Leaning Rearward	2.3-4.5
GL2	Horizontal	2.3
GL2	Leaning Forward	2.3-4.5
GL2	Leaning Rearward	0-2.3
(1) Voltage value is approximate.		



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Fig. 10: Checking Deceleration Sensor (2-Door Models)
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1. Check charging system voltage. Ensure 10-14 volts is present. If charging system voltage is okay, go to next step. If charging system voltage is not okay, check and repair charging system.
2. Turn ignition switch to ON position. Ensure ABS warning light comes on, then goes out after 3 seconds. If ABS warning light does not illuminate, check fuse, bulb, and wiring harness. See **ABS WARNING LIGHT** under DIAGNOSIS & TESTING. Turn ignition off.
3. Using a jumper wire, jumper terminals Ts and E₁ of DLC1. DLC1 is located in engine compartment on left side of engine. See **Fig. 2**. Ensure ABS warning light blinks 4 times per second. If ABS light does not blink, go to **ABS WARNING LIGHT** under DIAGNOSIS & TESTING. If ABS warning light blinks, go to next step.

NOTE: When measuring vehicle height in following steps, measure at center of lower body of vehicle.

4. Using a floor jack, slowly jack up rear of vehicle. On vehicles with 215/70R16 tires, raise vehicle to a height of 25.59-27.95" (650-710 mm). On vehicles with 235/60R16 tires, raise vehicle to a height of 26.38-28.74" (670-730 mm). If ABS warning light illuminates at specified height, check deceleration sensor installation. If installation is okay, replace deceleration sensor. Lower vehicle.
5. Using a floor jack, slowly jack up front of vehicle. On vehicles with 215/70R16 tires, raise vehicle to a height of 21.20-23.56" (550-610 mm). On vehicles with 235/60R16 tires, raise vehicle to a height of 22.44-24.80" (570-630 mm). If ABS warning light illuminates at specified height, check deceleration sensor installation. If installation is okay, replace deceleration sensor. Lower vehicle.
6. Drive vehicle straight ahead at speed of 13 MPH or more. Lightly depress brake pedal. Ensure ABS warning light pattern is normal (light blinks 4 times per second).
7. While driving vehicle straight ahead at speed of 13 MPH or more, moderately depress brake pedal. Ensure ABS warning light illuminates in a solid pattern (light does not blink) while braking.
8. While driving vehicle straight ahead at speed of 13 MPH or more, firmly depress brake pedal. Ensure ABS warning light illumination pattern changes from a solid pattern (light does not blink) to a normal pattern (light blinks 4 times per second), then back to a solid pattern while braking.
9. If ABS warning light does not illuminate as described in steps 6 -8, check deceleration sensor installation. If installation is okay, replace deceleration sensor. Stop vehicle and turn ignition off. Remove jumper wire from DLC1.

REMOVAL & INSTALLATION

WARNING: Hydraulic system may be under high pressure. Use caution when opening hydraulic system.

ACTUATOR

Removal & Installation

Turn ignition off. Disconnect brakelines attached to actuator. Remove power steering hose retaining bracket bolt and power steering reservoir. Disconnect actuator electrical connectors. Remove bolts, nuts and washers. Remove actuator assembly. Remove actuator from actuator bracket. Remove cushions and holders from

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actuator. See **Fig. 11** . To install, reverse removal procedure. Bleed brake system. See **BLEEDING BRAKE SYSTEM** .

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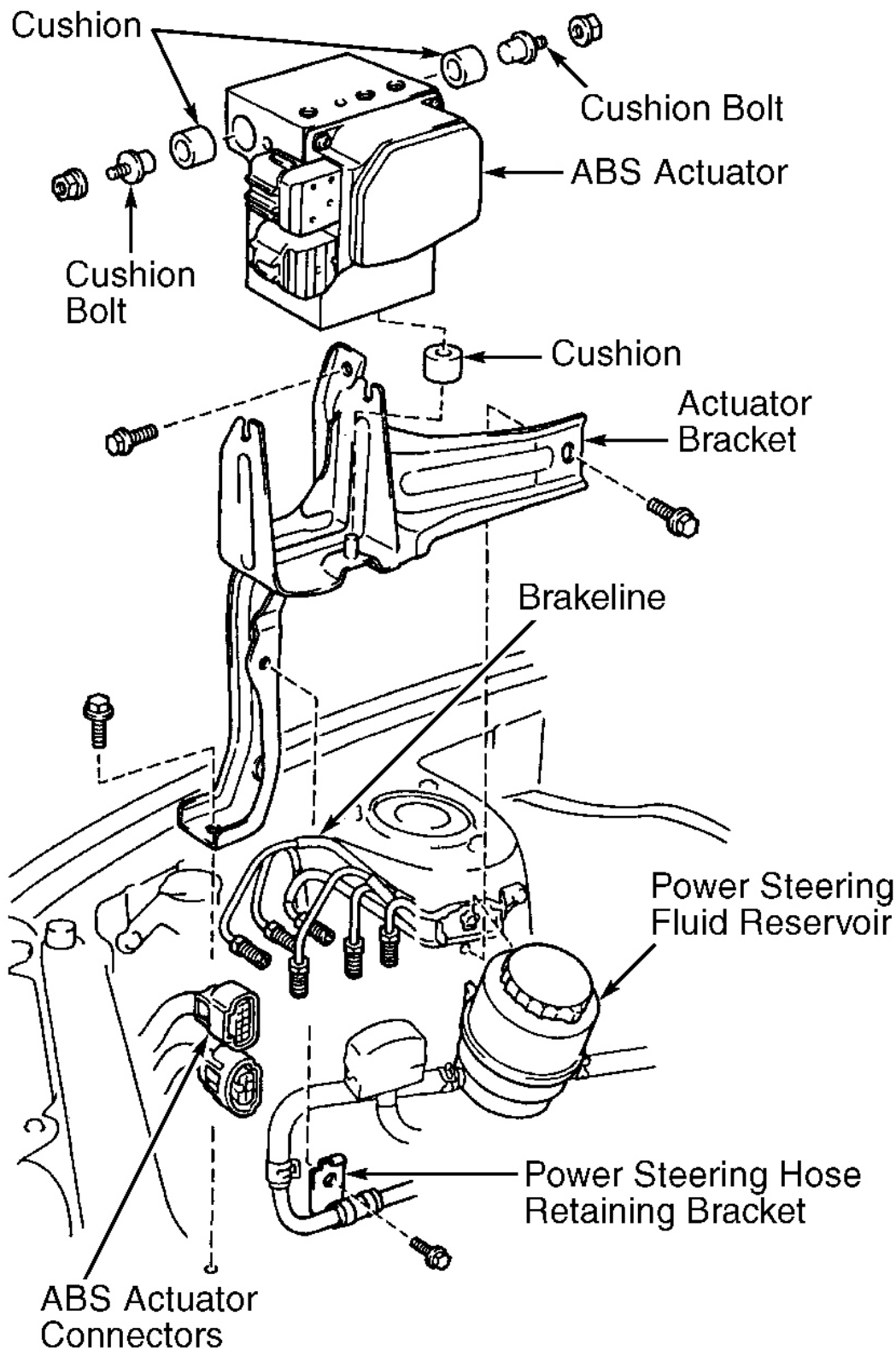


Fig. 11: Exploded View of ABS Actuator

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ABS ECU**Removal & Installation**

Ensure ignition is off. Disconnect negative battery cable. Access ABS ECU, located at right side of passenger compartment. See **Fig. 1** . Disconnect ABS ECU connectors. Remove ABS ECU from vehicle. To install, reverse removal procedure.

FRONT SENSOR ROTOR

NOTE: **Front hub must be removed to service sensor rotor.**

Removal & Installation

Front sensor is part of front hub. For removal and installation of front hub, see **AXLE SHAFTS - RAV4** article in DRIVE AXLES.

REAR SENSOR ROTOR**Removal & Installation**

Rear sensor rotor is pressed onto axle shaft. For axle shaft removal and installation procedure, see **AXLE SHAFTS - RAV4** article in DRIVE AXLES.

FRONT WHEEL SPEED SENSORS**Removal & Installation**

1. Raise and support front of vehicle. Remove front wheel. Remove inner fender panel. Disconnect wheel speed sensor connector. Remove clamp bolts holding sensor harness to body, strut assembly and steering knuckle.
2. Remove wheel speed sensor mounting bolt. Remove wheel speed sensor from steering knuckle. To install, reverse removal procedure. Ensure wheel speed sensor is flat against knuckle when bolt is tightened. Tighten wheel speed sensor mounting bolt to specification. See **TORQUE SPECIFICATIONS** .

REAR WHEEL SPEED SENSORS**Removal & Installation**

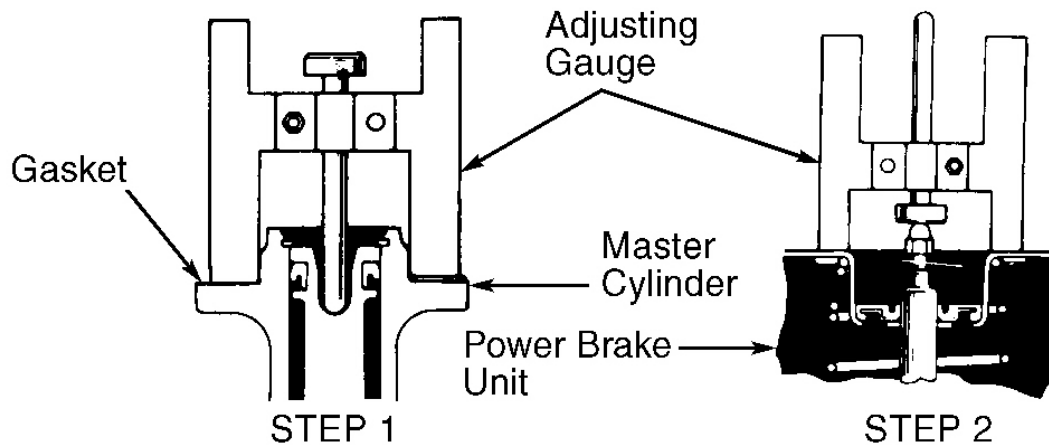
1. Remove rear seat cushion and side trim panel. Raise and support vehicle. Remove wheel. Unplug wheel speed sensor connector and remove wire harness from grommet. Disconnect parking brake cable from suspension arm. Remove clamp bolts holding sensor wiring harness to body and suspension arm.
2. Remove wheel speed sensor. To install, reverse removal procedure. Ensure wheel speed sensor is flat

against knuckle when bolt is tightened. Tighten wheel speed sensor and brake components to specification. See **TORQUE SPECIFICATIONS** .

ADJUSTMENTS

BRAKE BOOSTER PUSH ROD

1. Install adjusting gauge on master cylinder with master cylinder gasket in place. Lower adjusting gauge pin until pin slightly touches master cylinder piston. See **Fig. 12** . Turn adjusting gauge upside-down and install on power brake booster. See **Fig. 12** . Measured clearance should be zero. If clearance is not zero, adjust brake booster push rod length until push rod lightly touches adjusting gauge pin head.



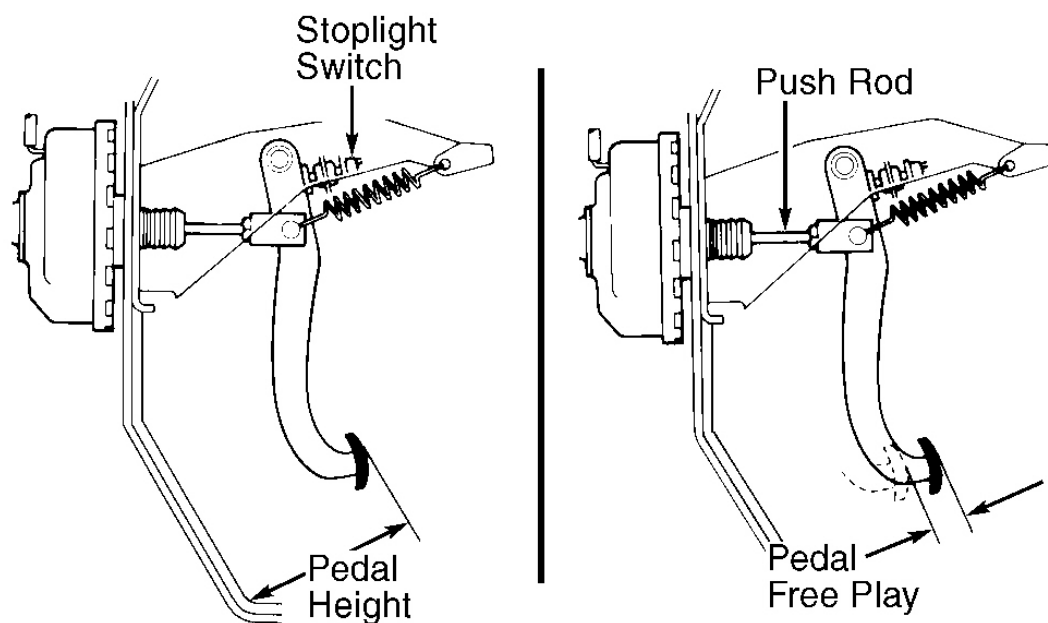
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Fig. 12: Adjusting Master Cylinder Push Rod

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BRAKE PEDAL HEIGHT

1. Remove instrument panel lower finish panel. Brake pedal height is measured from face of brake pedal pad to asphalt sheet under carpet. See **Fig. 13** .
2. Brake pedal height should be 6.19-6.58" (157.2-167.2 mm). To adjust brake pedal height, disconnect stoplight switch connector. Loosen stoplight switch lock nut and remove switch. Loosen lock nut on brake pedal push rod. Adjust pedal height by turning push rod.
3. After adjusting brake pedal height, tighten push rod lock nut. Adjust stoplight switch. See **STOPLIGHT SWITCH** . Check and adjust brake pedal free play. See **BRAKE PEDAL FREE PLAY** .



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Fig. 13: Measuring Pedal Height

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BRAKE PEDAL FREE PLAY

NOTE: Stoplight switch adjustment should be performed before brake pedal free play adjustment is made. See STOPLIGHT SWITCH .

1. Brake pedal free play is distance brake pedal travels before feeling resistance with engine stopped. To check brake pedal free play, depress brake pedal several times to exhaust vacuum from power brake unit. Depress brake pedal and measure travel until initial resistance is felt.
2. Brake pedal free play should be .04-.24" (1.0-6.0 mm). If free play is not within specification, adjust by turning brake booster push rod. See Fig. 13 . After adjusting brake pedal free play, check brake pedal height. See BRAKE PEDAL HEIGHT . Install instrument panel lower finish panel.

STOPLIGHT SWITCH

Stoplight switch is located above brake pedal. See Fig. 13 . To adjust stoplight switch, remove instrument panel lower finish panel. Loosen stoplight switch lock nut. Turn stoplight switch until clearance between switch and brake pedal stop is .02-.09" (.5-2.4 mm). Tighten lock nut. Check stoplight operation. Check brake pedal free play, see BRAKE PEDAL FREE PLAY .

BRAKE PEDAL DEPRESSED HEIGHT

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Brake pedal depressed height is measured from face of brake pedal pad to asphalt sheet under carpet with brakes applied. Measure brake pedal depressed height with engine running and weight of 110 lbs. (50 kg) applied against brake pedal. Minimum brake pedal depressed height should be 2.95" (75.0 mm). If measured distance is less than minimum height, inspect brake system.

TORQUE SPECIFICATIONS

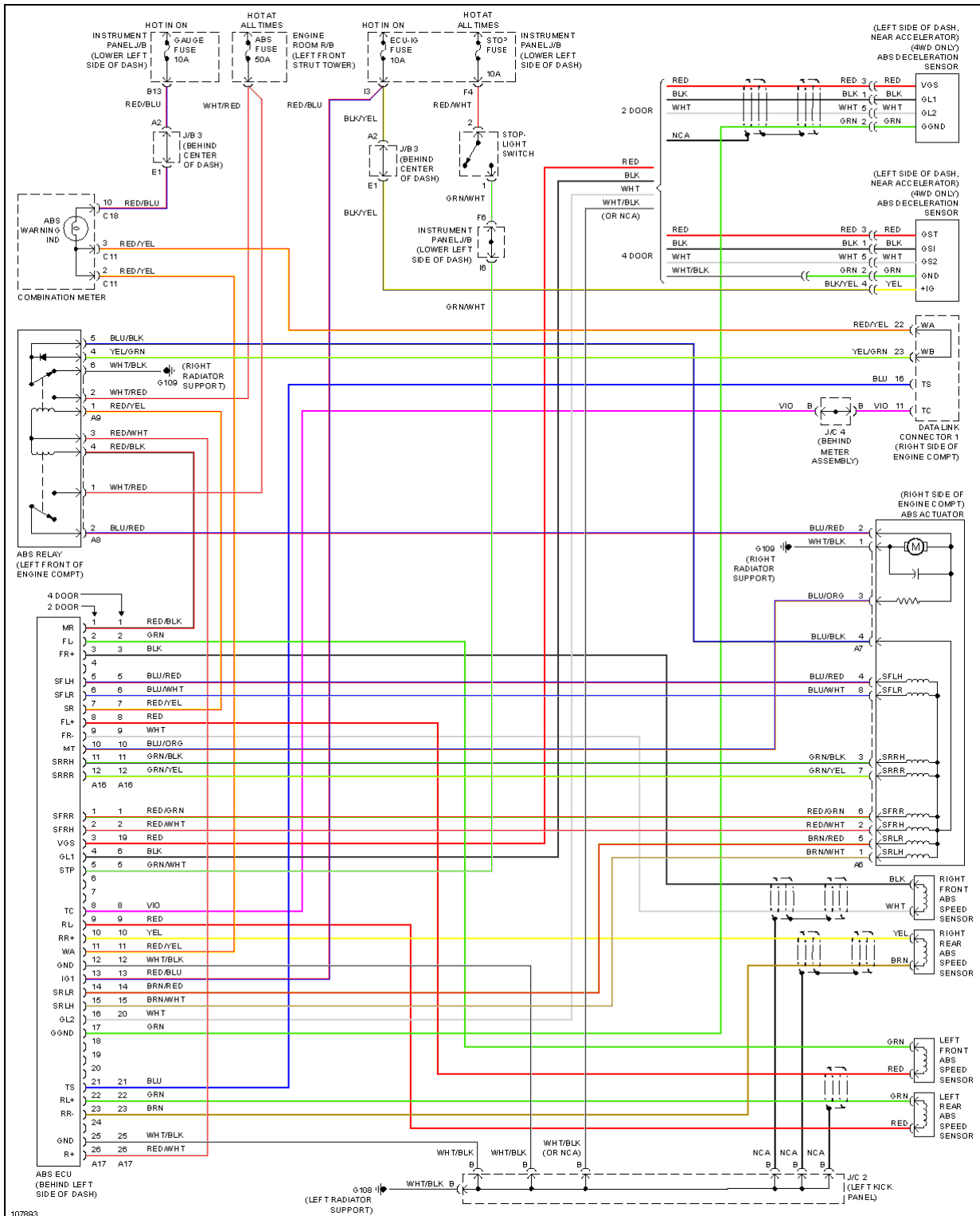
TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Actuator Bracket Mounting Bolts	14 (19)
Brakeline Fittings	11 (15)
Hub Nut	83 (110)
Push Rod Lock Nut	18 (25)
Speed Sensor Harness-To-Rear Suspension Arm Bolts	9 (13)
	INCH Lbs. (N.m)
Actuator-To-Bracket Mounting Nuts	48 (5.4)
Speed Sensor Harness-To-Body Bolts	48 (5.4)
Wheel Speed Sensor Mounting Bolt	71 (8)

WIRING DIAGRAMS

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Fig. 14: Anti-Lock Brake System Wiring Diagram (1999-2000 RAV4)