

ANTI-LOCK BRAKE SYSTEM

Article Text

1995 Mazda MX-3

For NONE

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ARTICLE BEGINNING

1995 BRAKES
Mazda - Anti-Lock

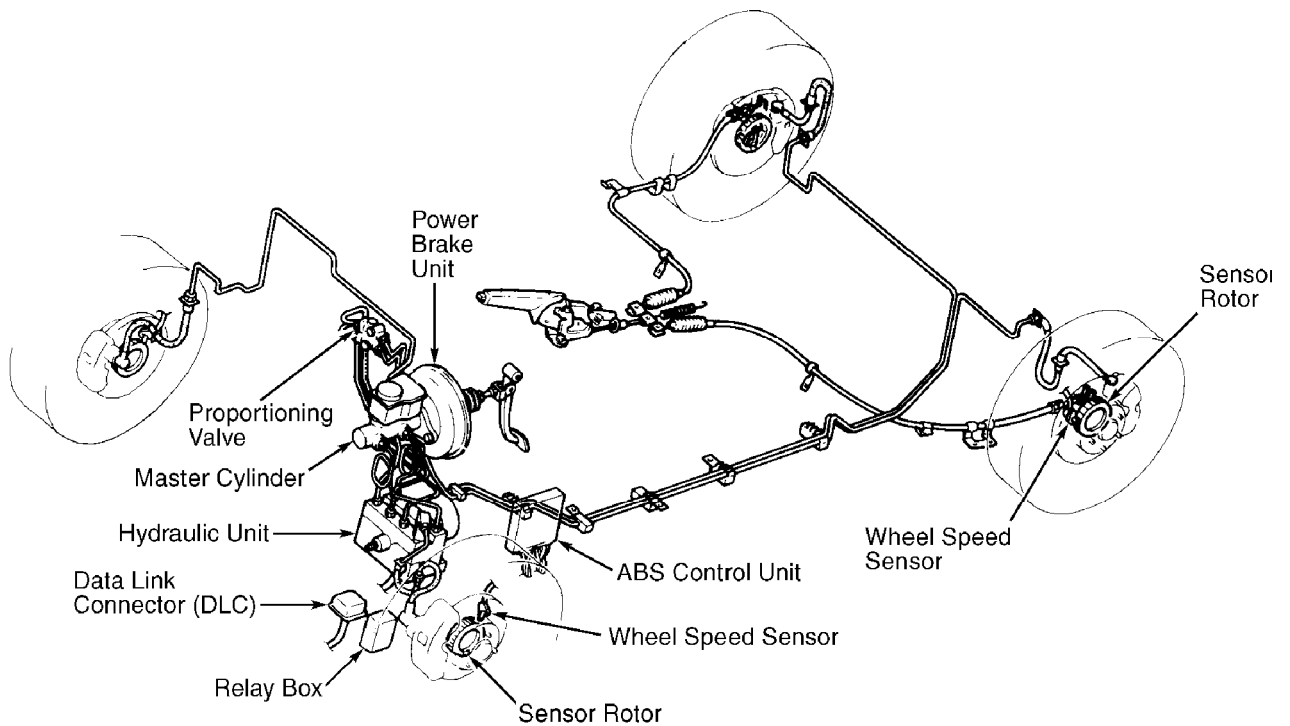
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DESCRIPTION

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

The Anti-Lock Brake System (ABS) control module senses reductions in front and rear wheel speed and modulates hydraulic pressure to the brakes to prevent wheel lock-up. The ABS consists of a hydraulic unit, 4 wheel speed sensors and sensor rotors, ABS relay (fail-safe relay and motor relay), pump motor and ABS control module. See Fig. 1. An ABS warning light is located on the instrument cluster.

NOTE: For more information on brake system, see BRAKE SYSTEM article.



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Fig. 1: Locating ABS Components (Typical)
Courtesy of Mazda Motors Corp.

OPERATION

Under normal driving conditions, Anti-Lock Brake System (ABS) functions like a standard brake system. When vehicle speed reaches 3.8 MPH, ABS will diagnose pump motor by briefly operating motor. Pump motor operation may be heard inside vehicle.

ABS control module controls ABS by detecting speed sensor signals and activating solenoid valve in hydraulic unit. Control

module also controls pump motor and self-diagnostic function. If a problem is detected in ABS, ABS will function like a conventional brake system. ABS warning light will also come on.

With detection of wheel lock-up, short pedal pulsations, occurring in rapid succession, will be felt in brake pedal and steering wheel. Vehicle body may also vibrate slightly. These conditions are normal. Pedal pulsation will continue until there is no longer a need for anti-lock function or until vehicle is stopped.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Application	Location
ABS Control Module	Under Passenger Seat
ABS Relay	Left Front Of Engine Compartment
Data Link Connector	Left Side Of Engine Compartment
Hydraulic Unit	Left Side Of Engine Compartment
Pump Motor	On Hydraulic Unit

BLEEDING BRAKE SYSTEM

CAUTION: DO NOT allow reservoir to run dry during brake bleeding procedure. If brake fluid is spilled, clean surface immediately with alcohol, as brake fluid will damage painted surfaces. Use only DOT 3 brake fluid and DO NOT mix with any other types.

1) Raise and support vehicle. Ensure brake fluid reservoir remains at least half full during bleeding procedure. When bleeding brake system, start with longest brakeline first. Remove bleed screw cap. Connect one end of transparent vinyl tube to bleed screw. Submerge other end of tube in a container half filled with clean brake fluid.

2) Have an assistant depress brake pedal several times and hold in depressed position. Loosen bleed screw and drain fluid into container. Tighten bleed screw.

NOTE: Ensure brake pedal remains depressed until bleed screw is tightened.

3) Refill brake fluid reservoir if necessary. Repeat step 2) until air is no longer discharged. Tighten bleed screw to 52-78 INCH lbs. (5.9-8.8 N.m). Ensure fluid leakage is not present. Add fluid to reservoir. Repeat procedure for remaining wheels.

ADJUSTMENTS

MASTER CYLINDER PUSH ROD

1) Before installing master cylinder, measure clearance between master cylinder piston and power brake unit push rod. Place Adjusting Gauge (49-B043-001) on power brake unit.

2) Using a hand-held vacuum pump, apply 19.7 in. Hg to power brake unit. Turn adjusting gauge nut counterclockwise until gauge rod just contacts push rod end of power brake unit. Perform STEP 1. See Fig. 2.

3) Lightly push on end of adjusting gauge rod to ensure it is

properly seated. Verify no gap exists between adjusting nut and adjusting gauge body. Remove adjusting gauge from power brake unit without disturbing adjusting nut. Place adjusting gauge on master cylinder.

NOTE: When lightly pushing on end of adjusting gauge rod in step 4), only use enough pressure to bottom rod in piston. Too much pressure may cause a false reading.

4) Lightly push on end of adjusting gauge rod to ensure gauge rod is bottomed in master cylinder piston. Ensure no clearance exists between adjusting gauge body and adjusting nut (clearance "B") or between body and master cylinder (clearance "C"). Perform STEP 2. See Fig. 2.

5) If clearance "B" exists, push rod is too short. If clearance "C" exists, push rod is too long. To adjust clearance "B", go to next step. To adjust clearance "C", go to step 8).

NOTE: Push rod threads are specially designed so bolt becomes harder to turn past a certain point to prevent loosening of bolt. Turn bolt only within this range.

6) To adjust clearance "B", lightly push on end of adjusting gauge rod. Using a feeler gauge, measure clearance between adjusting nut and adjusting gauge. Perform STEP 3. See Fig. 2.

7) Using Push Rod Adjuster (49-B043-004) and Adapter (49-B043-003), turn push rod nut to lengthen power brake booster push rod an amount equal to amount measured at clearance "B" in step 6). Perform STEP 4. See Fig. 2.

8) To adjust clearance "C", measure and record adjusting gauge rod height D1. Perform STEP 5. See Fig. 2. Turn adjusting nut until adjusting gauge body sits squarely on master cylinder.

9) Turn adjusting nut only enough for body to touch adjusting gauge. Measure and record adjusting gauge height D2 of adjusting gauge rod. Perform STEP 6. See Fig. 2. Subtract D1 from D2 measurement.

10) Using push rod adjuster and adapter, turn push rod nut to shorten power brake booster push rod an amount equal to difference between height D1 and D2. Perform STEP 4. See Fig. 2.

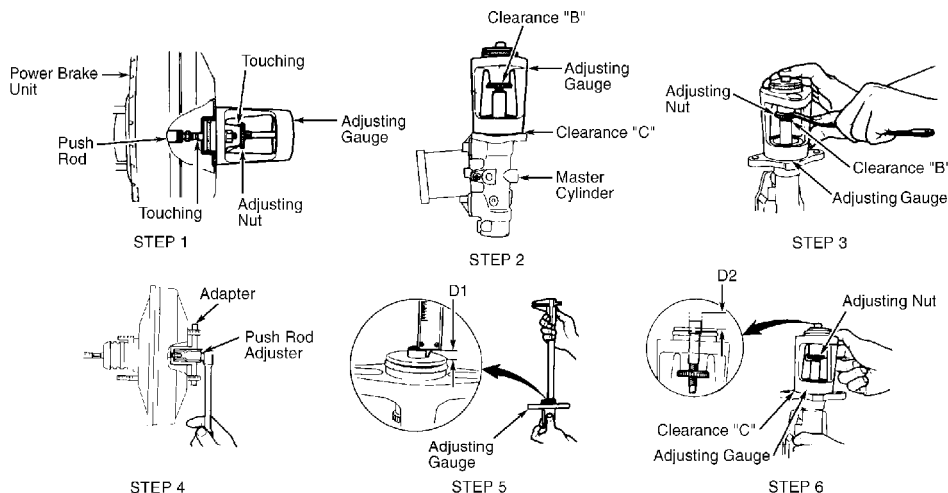


Fig. 2: Adjusting Master Cylinder Push Rod
G92G01540
 Courtesy of Mazda Motors Corp.

NOTE: When adjusting brake pedal height, a NEW stoplight switch must be used. Stoplight switch can only be adjusted one time.

1) Released pedal height is measured from carpet surface, on vertical portion of firewall, to pedal pad center. Disconnect stoplight switch electrical connector. Loosen lock nut on stoplight switch. Rotate switch away from pedal. Loosen push rod lock nut. Rotate push rod until correct pedal height is as specified. See BRAKE PEDAL HEIGHT SPECIFICATIONS table.

2) Adjust pedal free play. See BRAKE PEDAL FREE PLAY. Tighten push rod lock nut to 18-25 ft. lbs. (24-34 N.m). Rotate stoplight switch until it contacts pedal, then rotate an additional 1/2 turn. Tighten stoplight switch lock nut. Reconnect stoplight switch electrical connector.

3) Applied pedal height is measured from angled portion of firewall (without carpet) to pedal pad center. Start engine. Depress brake pedal with a pressure of 132 lbs. (60 kg). Measure applied pedal height. See BRAKE PEDAL HEIGHT SPECIFICATIONS table. If distance is not as specified, check for air in system, faulty rear brake adjustment, or worn shoes or pads. Repair as necessary.

BRAKE PEDAL HEIGHT SPECIFICATIONS TABLE

Application	In. (mm)
Pedal Released	7.6-7.7 (193-196)
Pedal Applied (1)	2.7 (70)

(1) - Minimum height.

BRAKE PEDAL FREE PLAY

With engine off, depress pedal a few times to eliminate vacuum. Depress brake pedal by hand and check pedal free play. See BRAKE PEDAL FREE PLAY SPECIFICATIONS table. Adjust play by loosening push rod lock nut. Turn push rod until correct free play is obtained. Tighten push rod lock nut to 18-25 ft. lbs. (24-34 N.m).

BRAKE PEDAL FREE PLAY SPECIFICATIONS TABLE

Application	In. (mm)
MX-316-.28 (4-7)

PARKING/EMERGENCY BRAKE

1) On models with rear disc brakes, depress brake pedal several times. On models with rear drum brakes, start engine and depress brake pedal several times while vehicle is moving in reverse. Stop engine.

2) Pull parking brake lever with a force of 22 lbs. (10 kg). If stroke is 5-7 notches, parking brake is properly adjusted. If stroke is not as specified, raise and support rear of vehicle. Release parking brake lever.

3) Rotate cable adjusting nut at lever end of cable, located under console cover, until stroke is within specification. Ensure rear brakes do not drag. Ensure parking brake warning light illuminates when brake lever is pulled one notch.

TROUBLE SHOOTING

Before attempting to diagnose vehicle, ensure ABS warning light is functioning properly. ABS warning light will not illuminate and ABS will not operate if battery voltage is insufficient. Perform trouble shooting procedures on ABS warning light to eliminate unnecessary repairs and/or component replacement.

ABS WARNING LIGHT DOES NOT ILLUMINATE WHEN IGNITION IS TURNED ON

1) Check METER fuse. Replace fuse as necessary. If METER fuse is okay, go to next step.

2) Check wiring harness between the following:

- * ABS control module and ABS relay.
- * ABS warning light and ABS control module.
- * ABS warning light and ABS relay.

Also check ABS warning light bulb. Repair or replace as necessary. See WIRING DIAGRAMS.

ABS WARNING LIGHT REMAINS ILLUMINATED

1) Check for ABS DTCs. See RETRIEVING DIAGNOSTIC TROUBLE CODES under DIAGNOSIS & TESTING. If no DTCs are present, go to next step.

2) Check ABS Control Module (ABS CM) connectors for poor connection. Repair as necessary. If connectors are okay, go to next step.

3) Ensure battery is fully charged. Charge or replace as necessary. If battery is fully charged, go to next step.

4) Check wiring harness between the following:

- * ABS control module and ABS relay.
- * ABS warning light and ABS control module.
- * ABS warning light and ABS relay.

Repair or replace as necessary. If wiring harnesses are okay, go to next step.

5) Ground terminal 2J of ABS CM connector. Turn ignition on. Check the following:

- * Listen for operation (click noise) of ABS relay.
- * ABS warning light does not illuminate.
- * Battery voltage is present at terminal 1D of ABS CM connector.

If above checks are okay, go to next step. If above checks are not okay, check the following:

- * ABS (fail-safe) relay.
- * Wiring harness between ABS (fail-safe) relay, ABS CM and battery.
- * Wiring harness between ABS (fail-safe) relay and hydraulic unit.

Repair or replace as necessary. If wiring harnesses and ABS relay are okay, go to next step.

6) Check voltage at terminals 1E, 1F, 1H, 2B, and 2I of ABS CM connector. See ABS CONTROL MODULE TEST under COMPONENT TESTING. If

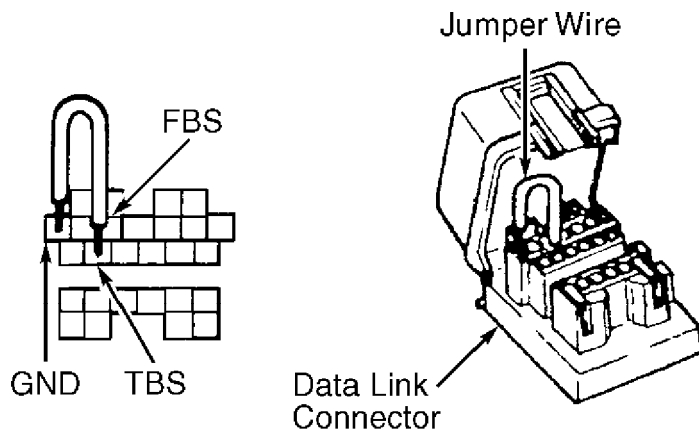
voltage readings are as specified, replace ABS CM. If voltage readings are not as specified, check wiring harness between the following:

- * ABS control module and ground.
- * Ignition switch and ABS control module.
- * Data Link Connector (DLC) and ABS control module.
- * ABS warning light and ABS control module.

Repair or replace as necessary.

ABS WARNING LIGHT FLASHES

Check for continuity between terminal TBS and terminal GND of Data Link Connector (DLC). See Fig. 3. If continuity does not exist, check ABS control module. See ABS CONTROL MODULE TEST under COMPONENT TESTING. If continuity exists, repair short circuit between terminal TBS and terminal GND of DLC.



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Fig. 3: Identifying Data Link Connector (DLC) Terminals
Courtesy of Mazda Motors Corp.

PRE-DIAGNOSIS INSPECTION

Visually inspect ABS components for possible cause of anti-lock problem. Visual inspection may help identify cause of simple malfunction. Ensure ABS warning light is functioning properly. See TROUBLE SHOOTING.

ABS warning light illuminates under the following conditions:

- * Vehicle operated on snow or ice with parking brake activated, or a dragging brake at one wheel.
- * Different size tires being used.
- * Tires with different traction characteristics are used on same axle.
- * Vehicle is jacked up and drive wheels spin for 20 seconds or more with ignition on.
- * Low battery voltage.

If ABS warning light illuminates because of these conditions, turn ignition off, then back on. ABS warning light will go out and no DTCs for described conditions will be stored in ABS control module memory.

ABS DTCs are retrieved using Self-Diagnosis Checker (49-H018-9A1) and System Selector (49-B019-9A0). See RETRIEVING DIAGNOSTIC TROUBLE CODES. On all models, test ABS control module using DVOM. See ABS CONTROL MODULE TEST under COMPONENT TESTING.

If ABS test equipment is unavailable, ensure wiring harness and connectors are okay. Test each ABS component. See COMPONENT TESTING. If wiring harness, connectors and all ABS components are okay, replace ABS control module with a known-good module and retest system.

RETRIEVING DIAGNOSTIC TROUBLE CODES

Using Self-Diagnosis Checker & System Selector

1) Turn ignition off. If ignition is on before connecting test equipment, diagnostic test mode will not start. Connect System Selector (49-B019-9A0) to data link connector. Connect Self-Diagnosis Checker (49-H018-9A1) to system selector and ground. Set self-diagnosis checker select switch to position "A". Turn system selector knob to position "3". Place TEST SWITCH in SELF TEST position. Turn ignition on.

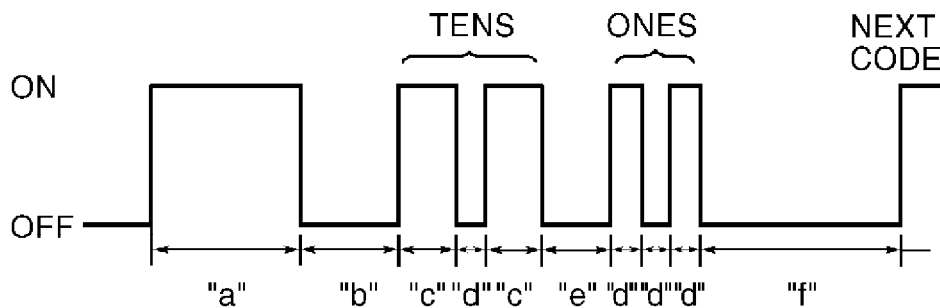
2) Ensure 88 flashes on display and buzzer sounds for 3 seconds. If 88 does not flash, check power supply and ground circuits. If 88 flashes and buzzer continues for more than 20 seconds, check for short in circuit between TBS terminal of Data Link Connector (DLC) and ground. Replace ABS control module if necessary and repeat step 1).

3) Note any codes displayed. Refer to the DIAGNOSTIC TROUBLE CODE DESCRIPTION table. Perform the appropriate test. Refer to DIAGNOSTIC TROUBLE CODE (DTC) TESTING. Clear codes after servicing. See CLEARING CODES.

DIAGNOSTIC TROUBLE CODE DESCRIPTION TABLE

DTC	Description
11	Right Front Wheel Speed Sensor/Sensor Rotor
12	Left Front Wheel Speed Sensor/Sensor Rotor
13	Right Rear Wheel Speed Sensor/Sensor Rotor
14	Left Rear Wheel Speed Sensor/Sensor Rotor
15 (1)	Wheel Speed Sensor/Sensor Rotor
22	Right Front Solenoid Valve
24	Left Front Solenoid Valve
26	Right Rear Solenoid Valve
28	Left Rear Solenoid Valve
51	Fail-Safe Relay
53	Motor Relay/Pump Motor
61	ABS Control Module

(1) - If ignition switch is turned off then on and then vehicle is driven at more than 6 MPH, DTC 15 will be replaced by DTC 11, 12, 13 or 14.



Example: Diagnostic Trouble Code 22

- | | |
|----------------|--------------|
| a. 3 Seconds | d. .4 Second |
| b. 2 Seconds | e. 1 Second |
| c. 1.2 Seconds | f. 4 Seconds |

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Fig. 4: Reading Diagnostic Trouble Code Output Using ABS Warning Light

Courtesy of Mazda Motors Corp.

CLEARING CODES

NOTE: Disconnecting battery does not clear Diagnostic Trouble Codes (DTCs). If DTCs will not clear, ensure stoplight switch is functioning properly.

1) Turn ignition off. Connect a jumper wire between TBS terminal and GND terminal of Data Link Connector (DLC). See Fig. 3. Turn ignition on. Output all Diagnostic Trouble Codes (DTCs) stored in ABS control module memory. When first code is repeated, depress brake pedal 10 times at intervals of less than one second.

2) When DTCs are cleared, ABS warning light will illuminate for 3 seconds, then go out. ABS operation should return to normal control. If ABS warning light does not operate as described and ABS does not return to normal operation, repeat procedure ensuring brake pedal interval does not exceed one second.

DIAGNOSTIC TROUBLE CODE (DTC) TESTING

* PLEASE READ FIRST *

NOTE: Before proceeding with DIAGNOSTIC TROUBLE CODE (DTC) TESTING See the following:

- * PRE-DIAGNOSIS INSPECTION.
- * DIAGNOSIS & TESTING.

After repairs are complete, clear DTCs from ABS control module memory and recheck system operation. See

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DTC 11, 12, 13 OR 14: WHEEL SPEED SENSOR, SENSOR ROTOR, HYDRAULIC UNIT & WIRING HARNESS

1) Check ABS control module connectors for poor connection. Repair as necessary. If connectors are okay, go to next step.

2) Check wiring harness for open or short to ground between suspect wheel speed sensor and ABS control module. Repair wiring

harness as necessary. If wiring harness is okay, go to next step.

3) Check suspect wheel speed sensor, sensor rotor, stoplight switch and hydraulic unit. See appropriate testing procedure under COMPONENT TESTING. Repair as necessary. Clear DTCs and recheck system operation. If components are okay, go to next step.

4) Clear DTCs. See CLEARING CODES under DIAGNOSIS & TESTING. Recheck for DTCs after driving vehicle from a stop to faster than 6 MPH. If DTC 11, 12, 13 or 14 is displayed, replace ABS control module. If DTC 11, 12, 13 or 14 is not displayed, a temporary poor contact in wiring may have occurred and ABS is now functioning properly.

DTC 15: WHEEL SPEED SENSOR OR WIRING HARNESS

Clear DTCs. See CLEARING CODES under DIAGNOSIS & TESTING.

Recheck for DTCs after driving vehicle from a stop to faster than 6 MPH. If DTC 11, 12, 13 or 14 is displayed, perform DTC 11, 12, 13 OR 14: WHEEL SPEED SENSOR, SENSOR ROTOR, HYDRAULIC UNIT & WIRING HARNESS test. If DTC 15 is displayed, replace ABS control module. If DTC 11, 12, 13, 14 or 15 is not displayed, a temporary poor contact in wiring may have occurred and ABS is now functioning properly.

DTC 22, 24, 26 OR 28: SOLENOID VALVE OR WIRING HARNESS

1) Check ABS control module connector for poor connection. Repair as necessary. Clear DTCs and recheck system operation. If connection is okay, go to next step.

2) Check suspect solenoid valve. See SOLENOID VALVES under COMPONENT TESTING. Replace solenoid valve as necessary. If solenoid valve is okay, check wiring harness for open or short to ground between hydraulic unit and ABS control module. Repair as necessary. If wiring harness is okay, go to next step.

3) Clear DTCs. See CLEARING CODES under DIAGNOSIS & TESTING. Recheck for DTCs. If DTC 22, 24, 26 or 28 is displayed, replace ABS control module. If DTC 22, 24, 26 or 28 is not displayed, a temporary poor contact in wiring may have occurred and ABS is now functioning properly.

DTC 29 OR 30: HYDRAULIC UNIT BRAKELINE

NOTE: DTC 29 applies to right front-left rear hydraulic unit brakeline. DTC 30 applies to left front-right rear ABS hydraulic unit brakeline.

1) Check hydraulic unit. See HYDRAULIC UNIT TEST under COMPONENT TESTING. Replace hydraulic unit as necessary. If hydraulic unit is okay, go to next step.

2) Check brake fluid level. Top off fluid as necessary. Clear DTCs and recheck system operation. If fluid level is okay, raise and support vehicle. Check for uneven brake force distribution by applying brakes and attempting to rotate tires. If brake operation is okay, go to next step. If brake operation is not okay, check for pinched, kinked or damaged conventional brakeline. Replace brakeline as necessary.

3) Release parking brake. Rotate wheels by hand and check for brake drag. If brake drag exists, check and repair parking brake system as necessary. If brake drag does not exist, no problem is indicated at this time. Clear DTCs and recheck system operation. If DTC resets, replace hydraulic unit.

DTC 51: FAIL-SAFE RELAY OR WIRING HARNESS

1) Check fuses for fail-safe relay. See WIRING DIAGRAMS.

Replace fuses as necessary. If fuses are okay, go to next step.

2) Check fail-safe relay. See FAIL-SAFE RELAY TEST under COMPONENT TESTING. Replace relay as necessary. If fail-safe relay is okay, check wiring harness for open or short to ground between fail-safe relay and ABS control module. Repair as necessary. If wiring harness is okay, go to next step.

3) Clear DTCs. See CLEARING CODES under DIAGNOSIS & TESTING. Recheck for DTCs. If DTC 51 is displayed, replace ABS control module. If DTC 51 is not displayed, a temporary poor contact in wiring may have occurred and ABS is now functioning properly.

DTC 53: PUMP MOTOR, MOTOR RELAY OR WIRING HARNESS

1) Turn ignition off and check if pump motor continues to operate. If pump motor continues operating after ignition is off, check motor relay. See MOTOR RELAY under COMPONENT TESTING. Replace relay as necessary. Clear codes and recheck system operation. If pump motor does not continue to operate after ignition is off, go to next step.

2) Check ABS (60-amp) fuse. Replace fuse as necessary. Clear DTCs and recheck system operation. If ABS fuse is okay, go to next step.

3) Check motor relay. See MOTOR RELAY under COMPONENT TESTING. Replace relay as necessary. Clear codes and recheck system operation. If motor relay is okay, check wiring harness for open or short to ground between motor relay and ABS control module. Repair as necessary. If wiring harness is okay, go to next step.

4) Check pump motor. See PUMP MOTOR under COMPONENT TESTING. Replace pump motor as necessary. If pump motor is okay, check wiring harness for open or short to ground between hydraulic unit and ABS control module. Repair as necessary. If wiring harness is okay, go to next step.

5) Clear DTCs. See CLEARING CODES under DIAGNOSIS & TESTING. Recheck for DTCs. If DTC 53 is displayed, replace ABS control module. If DTC 53 is not displayed, a temporary poor contact in wiring may have occurred and ABS is now functioning properly.

DTC 61: ABS CONTROL MODULE

Clear DTCs. See CLEARING CODES under DIAGNOSIS & TESTING. Recheck for DTCs. If DTC 61 is displayed, replace ABS control module. If DTC 61 is not displayed, a temporary poor contact in wiring may have occurred and ABS is now functioning properly.

DTC 63: POWER SUPPLY

1) Check battery and charging system. Repair as necessary. If battery and charging system are okay, check ABS (60-amp) fuse. Replace fuse as necessary. Clear DTCs and recheck system operation. If ABS fuse is okay, go to next step.

2) Measure voltage between ground and input side of ABS (60-amp) fuse holder. See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, repair wiring harness between battery and fuse holder.

3) Measure voltage between ground and Black/Blue wire at fail-safe relay connector. If battery voltage exists, go to next step. If battery voltage does not exist, repair open Black/Blue wire between fail-safe relay and fuse holder.

4) Check fail-safe relay. See FAIL-SAFE RELAY TEST under COMPONENT TESTING. Replace relay as necessary. If relay is okay, clear DTCs. See CLEARING CODES under DIAGNOSIS & TESTING. Recheck for DTCs. If DTC 63 is displayed, replace ABS control module. If DTC 63 is

displayed, a temporary poor contact in wiring may have occurred and ABS is now functioning properly.

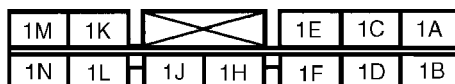
COMPONENT TESTING

* PLEASE READ FIRST *

NOTE: Before testing ABS components, ensure battery and charging system are functioning properly.

ABS CONTROL MODULE TEST

ABS control module is located under passenger seat. Unless indicated otherwise, test with ignition on and ABS control module connector connected. Measure voltage between ground and applicable terminal of ABS CM connector. If voltage is not as specified, check appropriate component listed under INSPECTION POINT. See Figs. 5-6. If components are okay, replace ABS CM.



B+: Battery positive voltage

Terminal	Signal name	Connected to	Condition	Voltage	Inspection point	
1A	Right rear wheel solenoid	Right rear wheel solenoid	Solenoid ON*	0—2	<ul style="list-style-type: none"> • Harness (HU—ABS CM) • Solenoid valve 	
			Ignition switch ON	B+		
1B	Left front wheel solenoid	Left front wheel solenoid	Solenoid ON*	0—2		
			Ignition switch ON	B+		
1C	Right front wheel solenoid	Right front wheel solenoid	Solenoid ON*	0—2		
			Ignition switch ON	B+		
1D	Left rear wheel solenoid	Left rear wheel solenoid	Solenoid ON*	0—2		
			Ignition switch ON	B+		
1E	Ground	Ground	—	0		<ul style="list-style-type: none"> • Harness condition, open circuit
1F	Ground	Ground	—	0		
1H	Battery	Ignition switch	Ignition switch ON	B+		<ul style="list-style-type: none"> • Harness, fuse (Battery—IG SW—ABS CM)
			Ignition switch OFF	0		
1J	—	—	—	—	—	
1K	—	—	—	—	—	
1L	Motor monitor	Motor	Motor running	B+	<ul style="list-style-type: none"> • Harness (HU—ABS CM) 	
			Motor stopped	0		
1M	Brake switch	Brake switch	Brake pedal depressed	B+	<ul style="list-style-type: none"> • Harness, fuse (Battery — brake SW—ABS CM) 	
			Brake pedal released	0		
1N	—	—	—	—	—	

* Solenoid valve is ON only when ABS is functioning. Voltage when solenoid is ON can be measured by following HYDRAULIC UNIT SYSTEM INSPECTION.

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Fig. 5: Testing ABS Control Module (1 Of 2)
Courtesy of Mazda Motors Corp.

2S	2Q	2O	2M	X	2G	2E	2C	2A	
2T	2R	2P	2N	2L	2J	2H	2F	2D	2B

B+: Battery positive voltage

Terminal	Signal name	Connected to	Condition	Voltage	Inspection point
2A	On-board diagnosis	FBS check terminal	—	10—12	• Harness, fuse (Battery—ABS CM)
2B	On-board diagnosis	TBS check terminal	Normal mode	10—12	
			Diagnostic test mode	0	
2C	—	—	—	—	—
2D	—	—	—	—	—
2E	—	—	—	—	—
2F	—	—	—	—	—
2G	—	—	—	—	—
2H	Motor relay (coil)	Motor relay	Motor relay ON	0—2	• Harness (ABS relay—ABS CM) • Motor relay
			Motor relay OFF	B+	
2J	Fail-safe relay (coil)	Fail-safe relay	Normal	0—2	• Harness (ABS relay—ABS CM) • Fail-safe relay
			If malfunction present	B+	
2L	ABS warning light	ABS warning light	Illuminated	0	• Harness, fuse (Battery—warning light—ABS CM) • ABS warning light
			Not illuminated	B+	
2M*	Right front wheel-speed	Right front wheel-speed sensor	Vehicle stopped	0	• Harness (wheel-speed sensor—ABS CM) • Wheel-speed sensor
2N*			Wheel turned 1 revolution per second	0.25—3.0 (AC)	
2O*	Left front wheel-speed	Left front wheel-speed sensor	Vehicle stopped	0	
2P*			Wheel turned 1 revolution per second	0.25—3.0 (AC)	
2Q*	Left rear wheel-speed	Left rear wheel-speed sensor	Vehicle stopped	0	
2R*			Wheel turned 1 revolution per second	0.25—3.0 (AC)	
2S*	Right rear wheel-speed	Right rear wheel-speed sensor	Vehicle stopped	0	
2T*			Wheel turned 1 revolution per second	0.25—3.0 (AC)	

* Check following terminals in AC range: 2M—2N (right front), 2O—2P (left front), 2R—2Q (left rear), 2S—2T (right-rear) In DC range, voltage will be approx. 1.0V (with ignition switch ON)

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Fig. 6: Testing ABS Control Module (2 Of 2)

Courtesy of Mazda Motors Corp.

HYDRAULIC UNIT TEST

On-Vehicle Inspection

1) Ensure all diagnostic trouble codes have been cleared and battery is fully charged. See CLEARING CODES under DIAGNOSIS & TESTING. Turn ignition on and check if ABS warning light goes out after 2-4 seconds. If ABS warning light remains illuminated, ABS control module has detected a failure and will not activate hydraulic unit. Retrieve DTCs and repair as necessary. See DIAGNOSIS & TESTING.

2) Turn ignition off. Ensure vehicle is on level surface. Raise and support vehicle on safety stands. Place transmission in Neutral. Release parking brake. Rotate wheels by hand and check for brake drag. Connect a jumper wire between TBS terminal and GND terminal of data link connector. See Fig. 3. Depress brake pedal and

have an assistant attempt to rotate right front wheel. Wheel should not rotate.

3) With brake pedal still depressed, turn ignition on. Brake should be momentarily released (about .5 second) and wheel should turn when pressure reduction operates. Check operation of remaining wheels using same procedure beginning with left front, right rear, then left rear wheels.

4) If all wheels operate as specified, the following systems are operating properly.

- * Brake piping to hydraulic unit.
- * Braking system, including hydraulic unit.
- * Hydraulic unit electrical system (solenoid, pump motor, etc.)
- * ABS control module output system (solenoid, relay, etc.) and harness.

5) If all wheels do not operate as specified, check ABS control module input system and harness for intermittent failure. Check for fluid leakage. Repair as necessary. If input system, harness, intermittent failure or fluid leakage are not present, replace hydraulic unit.

PUMP MOTOR

1) Turn ignition off. Disconnect pump motor/hydraulic unit 2-pin connector. Using ohmmeter, measure resistance between terminals of pump motor/hydraulic unit connector. Resistance should not be more than one ohm.

CAUTION: To avoid damaging pump, DO NOT allow pump to run for more than 2 seconds.

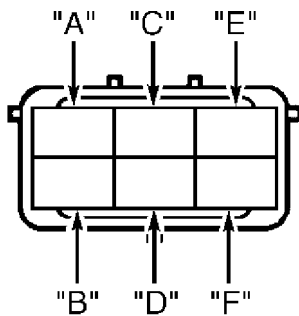
2) Apply 12 volts across pump motor/hydraulic unit 2-pin connector terminals (use Black wire for ground). Pump motor should operate. If resistance is not as specified or pump motor does not operate, check wiring harness. If wiring harness is okay, replace hydraulic unit.

SOLENOID VALVES

Turn ignition off. Disconnect hydraulic unit 6-pin connector. Hydraulic unit is located in left front of engine compartment, near battery. Using ohmmeter, measure resistance between specified terminals of hydraulic unit connector. See Fig. 7. See HYDRAULIC UNIT CONNECTOR TERMINAL RESISTANCE table. If resistance is not as specified, check wiring harness. If wiring harness is okay, replace hydraulic unit.

HYDRAULIC UNIT CONNECTOR TERMINAL RESISTANCE TABLE

Terminals	Ohms
A & F	3
B & F	3
C & E	3
D & E	3

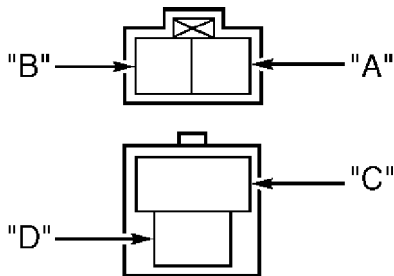


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Fig. 7: Identifying Hydraulic Unit Connector Terminals
Courtesy of Mazda Motors Corp.

STOPLIGHT SWITCH

Disconnect stoplight switch connectors. Using ohmmeter, check continuity between stoplight switch terminals. See Fig. 8. With brake pedal depressed, continuity should only exist between terminals "C" and "D". With brake pedal released, continuity should only exist between terminals "A" and "B". If continuity is not as specified, replace stoplight switch.



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Fig. 8: Identifying Stoplight Switch Terminals
Courtesy of Mazda Motors Corp.

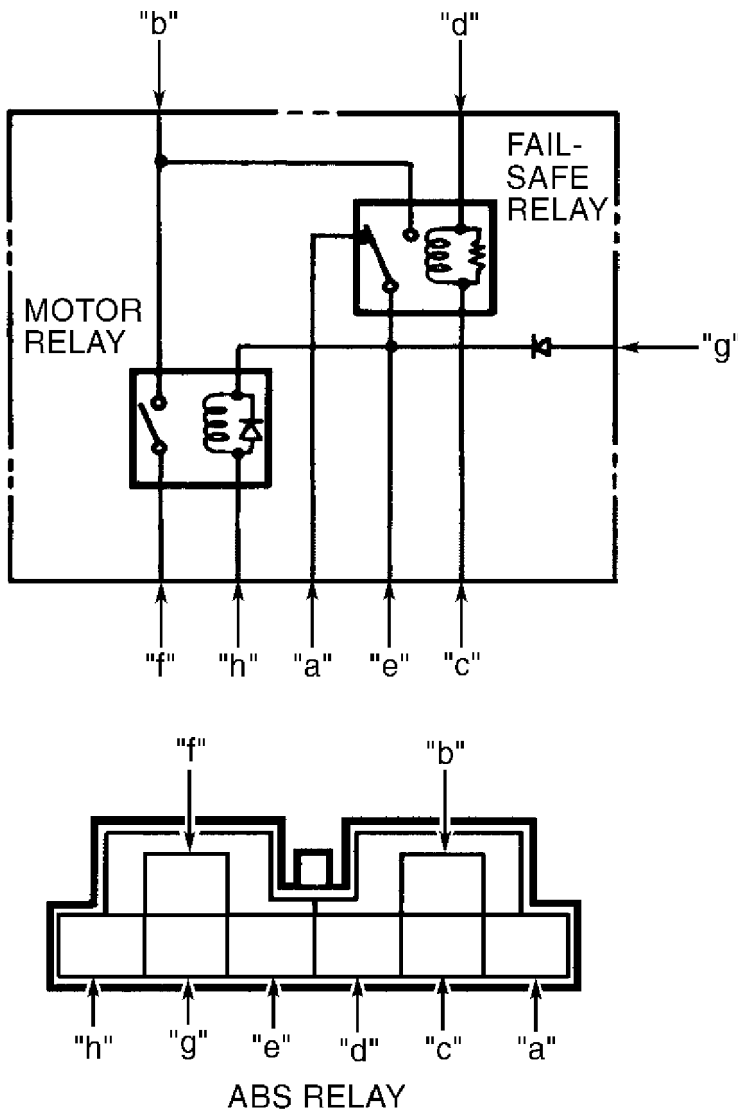
FAIL-SAFE RELAY TEST

NOTE: Fail-safe relay is part of ABS relay. If fail-safe relay is defective, replace ABS relay.

1) Using ohmmeter, measure resistance between terminals "C" and "D" of ABS relay. See Fig. 9. Resistance should be 60-100 ohms. If resistance is not as specified, replace ABS relay. If resistance is as specified, go to next step.

2) Using ohmmeter, check continuity between terminals "A" and "E" of ABS relay. See Fig. 9. Continuity should exist. Also, check continuity between terminals "B" and "E" of ABS relay. Continuity should not exist. If continuity is not as specified, replace ABS relay. If continuity is as specified, go to next step.

3) Apply 12 volts to terminal "D" and ground terminal "C" of ABS relay. See Fig. 9. Using ohmmeter, check continuity between terminals "A" and "E" of ABS relay. Continuity should not exist. Also, check continuity between terminals "B" and "E" of ABS relay. Continuity should exist. If continuity is not as specified, replace



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 Fig. 9: Identifying ABS Relay Connector Terminals
 Courtesy of Mazda Motors Corp.

MOTOR RELAY

NOTE: Motor relay is part of ABS relay. If motor relay is defective, replace ABS relay.

1) Using ohmmeter, measure resistance between terminals "E" and "H", or between terminals "A" and "H" of ABS relay. See Fig. 9. Resistance should be 50-90 ohms. If resistance is not as specified, replace ABS relay. If resistance is as specified, go to next step.

2) Using ohmmeter, check continuity between terminals "B" and "F" of ABS relay. Continuity should not exist. If continuity is not as specified, replace ABS relay. If continuity is as specified, go to next step.

3) Apply 12 volts to terminal "G" and ground terminal "H" of ABS relay. See Fig. 9. Using ohmmeter, check continuity between terminals "B" and "F" of ABS relay. Continuity should exist. If continuity is not as specified, replace ABS relay.

WHEEL SPEED SENSORS

On-Vehicle Inspection

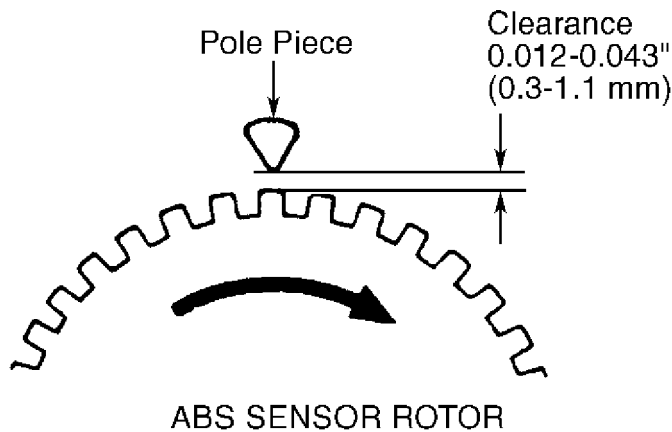
Remove wheel. Inspect wheel speed sensor for looseness and damage. Replace as necessary. Measure clearance between wheel speed sensor and sensor rotor. See Fig. 10. Clearance should be .012-.043" (.3-1.1 mm). If clearance is not as specified, replace wheel speed sensor or sensor rotor.

Resistance Test

Disconnect wheel speed sensor connector. Using ohmmeter, measure resistance between wheel speed sensor terminals. Resistance should be 1600-2000 ohms. If resistance is not as specified, replace wheel speed sensor.

Voltage Test

Ensure vehicle is on level surface. Raise and support vehicle. Disconnect wheel speed sensor connector. Using voltmeter, while rotating wheel one revolution per second, measure voltage between wheel speed sensor terminals. Voltage should be .25-3.0 volts (AC). If voltage is not as specified, replace wheel speed sensor or sensor rotor.



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Fig. 10: Measuring Wheel Speed Sensor Clearance
Courtesy of Mazda Motors Corp.

WHEEL SPEED SENSOR ROTORS

Inspection

Perform a comprehensive visual inspection of wheel speed sensor rotor. If any teeth are damaged or missing, or any other damage is noted, replace wheel speed sensor rotor.

REMOVAL & INSTALLATION

ABS CONTROL MODULE

Removal & Installation

1) Disconnect negative battery cable. ABS control module is located under passenger seat.

2) Remove ABS control module mounting bolts/nuts. Disconnect ABS control module electrical connectors. Remove ABS control module. To install, reverse removal procedure. Tighten bolts/nuts.

specification. See TORQUE SPECIFICATIONS.

HYDRAULIC UNIT

Removal & Installation

1) Disconnect negative battery cable. Remove nuts mounting fuel filter and ignitor to bracket. Move filter and igniter aside. Remove air cleaner assembly. Using Flare Nut Wrench (49-0259-770B), disconnect brakelines from hydraulic unit. Note locations of brakelines for installation reference.

2) Disconnect hydraulic unit electrical connectors. Remove hydraulic unit mounting nuts. Remove hydraulic unit. To install, reverse removal procedure. Tighten nuts to specification. Refer to TORQUE SPECIFICATIONS. Add fluid and bleed air from system. See BLEEDING BRAKE SYSTEM.

FRONT WHEEL SPEED SENSOR ROTORS

Removal

Drain transaxle fluid. Raise and support vehicle. Remove front wheel assemblies. Remove splash shield. Remove grease cap and wheel bearing lock nut. Remove stabilizer bar from lower control arm. Using Puller (49-T028-3A0), separate tie rod end from steering knuckle. Remove lower control arm. Remove drive axle. Using chisel and hammer, remove sensor rotor from drive axle.

Installation

To install, reverse removal procedure. Using Installer (49-G025-001), press NEW sensor rotor onto drive axle. Install sensor rotor with chamfered edge toward drive axle. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

REAR WHEEL SPEED SENSOR ROTORS

Removal

1) Raise and support vehicle. Remove rear wheel assemblies. Remove grease cap and wheel bearing lock nut. On models with rear disc brakes, remove brake caliper and support aside. Remove disc brake rotor and hub.

2) On models with rear drum brakes, remove brake drum and hub. On all models, using chisel and hammer, remove sensor rotor from hub.

Installation

To install, reverse removal procedure. Using speed sensor rotor installer, press NEW sensor rotor onto hub. See REAR WHEEL SPEED SENSOR ROTOR INSTALLER IDENTIFICATION table. Tighten bolts and nut to specification. See TORQUE SPECIFICATIONS.

REAR WHEEL SPEED SENSOR ROTOR INSTALLER IDENTIFICATION TABLE

Application	Part Number
MX-3	49-M005-796

WHEEL SPEED SENSOR

Removal & Installation

Raise and support vehicle. Remove wheel assemblies. Disconnect wheel speed sensor connector. Remove wheel speed mounting bolt(s). Remove wheel speed sensor from vehicle. To install,

reverse removal procedure. Tighten mounting bolt(s) to specification. See TORQUE SPECIFICATIONS.

ABS RELAY

NOTE: Motor relay and fail-safe relay are part of ABS relay.

Removal & Installation

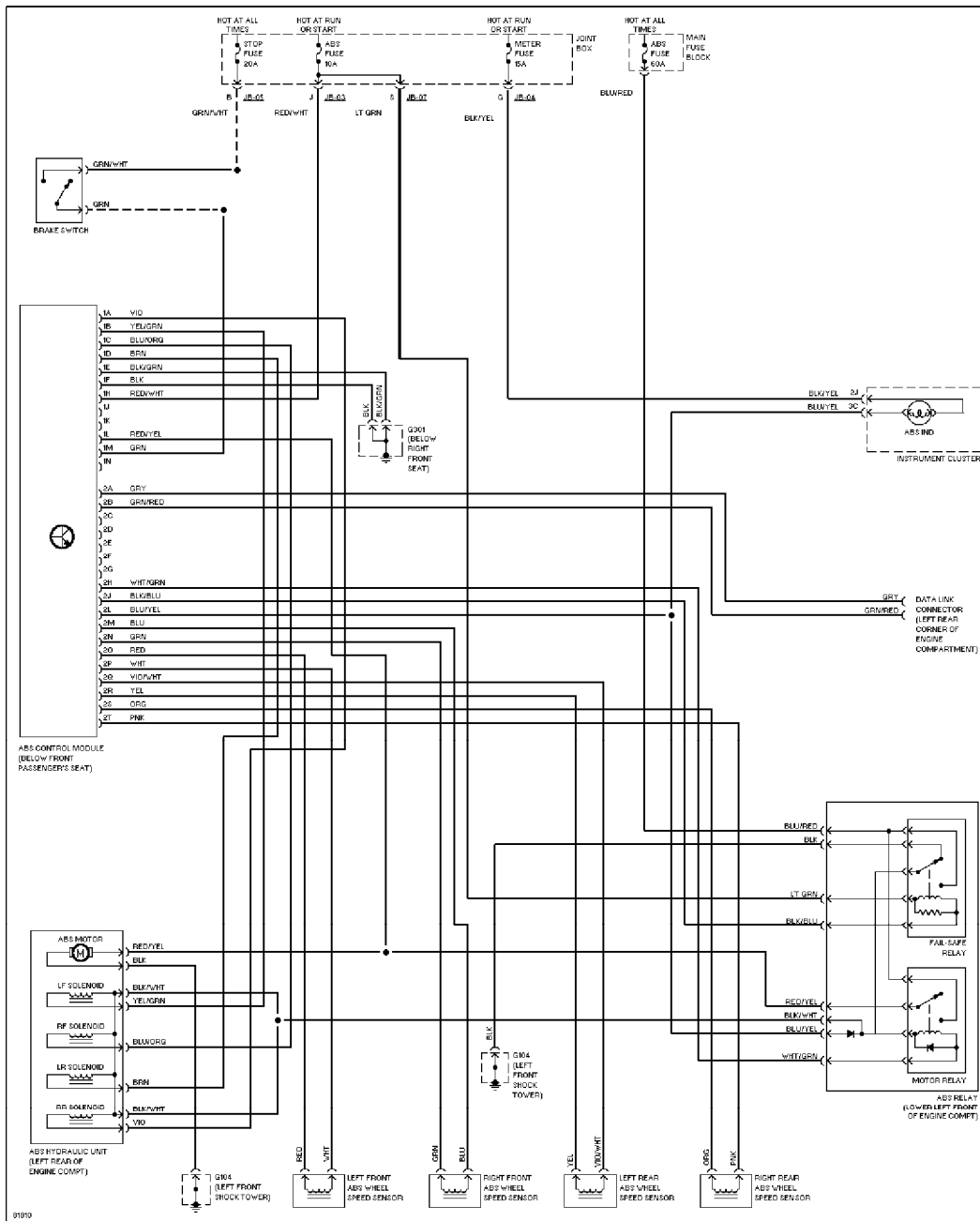
Disconnect negative battery cable. ABS relay is located in left front corner of engine compartment and is bolted to inner fenderwell. Remove ABS relay mounting bolt. Remove ABS relay from vehicle. To install, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Brakeline Nuts	10-16 (13-22)
Front Wheel Bearing Lock Nut	174-235 (236-318)
Hydraulic Unit Mounting Nuts	14-16 (19-22)
Rear Wheel Bearing Lock Nut	131-173 (177-235)
Stabilizer Bar-To-Lower Control Arm Nut	32-44 (43-60)
Tie Rod End-To-Steering Knuckle Nut	32-41 (43-56)
Wheel Lug Nuts	66-86 (89-117)
Wheel Speed Sensor Mounting Bolt	14-18 (19-25)
	INCH Lbs. (N.m)
ABS Control Module Mounting Bolts/Nuts ...	61-86 (6.9-9.8)

WIRING DIAGRAMS



ANTI-LOCK

98 Mitchell Repair In

Fig. 11: Anti-Lock Brake System (ABS) Wiring Diagram

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