

BRAKING SYSTEM

GENERAL PROCEDURES	P- 2		
CONVENTIONAL BRAKE SYSTEM	P- 3		
AIR BLEEDING	P- 3		
VACUUM LINE INSPECTION	P- 3		
BRAKE PEDAL INSPECTION	P- 3		
BRAKE PEDAL REMOVAL/INSTALLATION ..	P- 4		
BRAKE SWITCH INSPECTION	P- 5		
MASTER CYLINDER REMOVAL/ INSTALLATION (VEHICLES BUILT UP TO 07/2002)	P- 5		
MASTER CYLINDER REMOVAL/ INSTALLATION (VEHICLES BUILT FROM 08/2002)	P- 8		
FLUID LEVEL SENSOR INSPECTION	P-10		
MASTER CYLINDER DISASSEMBLY/ ASSEMBLY (VEHICLES BUILT UP TO 07/2002)	P-11		
MASTER CYLINDER DISASSEMBLY/ ASSEMBLY (VEHICLES BUILT FROM 08/2002)	P-13		
POWER BRAKE UNIT INSPECTION (VEHICLES BUILT UP TO 07/2002)	P-14		
POWER BRAKE UNIT INSPECTION (VEHICLES BUILT FROM 08/2002)	P-15		
POWER BRAKE UNIT REMOVAL/ INSTALLATION	P-16		
VACUUM SWITCH INSPECTION (DIESEL) ..	P-16		
VACUUM SWITCH REMOVAL/INSTALLATION (DIESEL)	P-17		
VACUUM PUMP INSPECTION (DIESEL)	P-17		
VACUUM PUMP REMOVAL/INSTALLATION (DIESEL)	P-17		
LOAD SENSING PROPORTIONING VALVE INSPECTION (VEHICLES BUILT UP TO 07/2002)	P-18		
LOAD SENSING PROPORTIONING VALVE INSPECTION (VEHICLES BUILT FROM 08/2002)	P-19		
LOAD SENSING PROPORTIONING VALVE ADJUSTMENT (VEHICLES BUILT UP TO 07/2002)	P-20		
LOAD SENSING PROPORTIONING VALVE ADJUSTMENT (VEHICLES BUILT FROM 08/2002)	P-21		
LOAD SENSING PROPORTIONING VALVE REMOVAL/INSTALLATION (VEHICLES BUILT UP TO 07/2002)	P-22		
LOAD SENSING PROPORTIONING VALVE REMOVAL/INSTALLATION (VEHICLES BUILT FROM 08/2002)	P-23		
FRONT BRAKE (DISC) INSPECTION	P-24		
FRONT BRAKE (DISC) REMOVAL/ INSTALLATION (VEHICLES BUILT UP TO 07/2002)	P-25		
DISC PAD (FRONT) REPLACEMENT (VEHICLES BUILT UP TO 07/2002)	P-26		
FRONT BRAKE (DISC) REMOVAL/ INSTALLATION (4x4) (VEHICLES BUILT FROM 08/2002)	P-27		
		DISC PAD (FRONT) REPLACEMENT (4x4) (VEHICLES BUILT FROM 08/2002) ...	P-29
		CALIPER (FRONT) DISASSEMBLY/ ASSEMBLY (VEHICLES BUILT UP TO 07/2002)	P-29
		CALIPER (FRONT) DISASSEMBLY/ ASSEMBLY (4x4) (VEHICLES BUILT FROM 08/2002)	P-30
		REAR BRAKE (DRUM) INSPECTION	P-31
		REAR BRAKE (DRUM) REMOVAL/ INSTALLATION	P-31
		BRAKE DRUM INSPECTION	P-32
		WHEEL CYLINDER DISASSEMBLY/ ASSEMBLY	P-32
		PARKING BRAKE SYSTEM	P-32
		PARKING BRAKE (STICK TYPE) INSPECTION	P-32
		PARKING BRAKE (STICK TYPE) ADJUSTMENT	P-32
		PARKING BRAKE LEVER (STICK TYPE) REMOVAL/INSTALLATION	P-33
		PARKING BRAKE CABLE (STICK TYPE) REMOVAL/INSTALLATION	P-34
		ANTILOCK BRAKE SYSTEM	P-35
		ABS LOCATION INDEX	P-35
		ABS HU/CM SYSTEM INSPECTION	P-36
		ABS HU/CM REMOVAL/INSTALLATION	P-38
		ABS HU/CM INSPECTION	P-39
		FRONT ABS WHEEL-SPEED SENSOR REMOVAL/INSTALLATION	P-42
		FRONT ABS WHEEL-SPEED SENSOR INSPECTION	P-43
		REAR ABS WHEEL-SPEED SENSOR REMOVAL/INSTALLATION	P-45
		REAR ABS WHEEL-SPEED SENSOR INSPECTION	P-46
		G SENSOR REMOVAL/INSTALLATION	P-47
		G SENSOR INSPECTION	P-47
		ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)	P-48
		ABS SYSTEM DIAGRAM	P-48
		ABS ON-BOARD DIAGNOSTIC	P-49
		DTC TABLE	P-51
		DTC PID/DATA MONITOR TABLE	P-53
		ACTIVE COMMAND MODES TABLE	P-55
		DTC B1318 (63)	P-56
		DTC B1342 (61)	P-57
		DTC C1095 (54), C1096 (53)	P-58
		DTC C1140 (30)	P-59
		DTC C1145 (11), C1155 (12), C1165 (13), C1175 (14)	P-60
		DTC 1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45) C1235 (47), C1236 (48)	P-62
		DTC 1186 (51), C1266 (52)	P-65
		DTC C1194 (24), C1198 (25), C1202 (26) C1206 (27), C1210 (22), C1214 (23)	P-67
		DTC C1414 (64)	P-67
		DTC C1510 (32), C1511 (33), C1512 (34), C1513 (35)	P-68

DTC C1949 (03), C1950 (04)	P-69
TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM) (2003 MY ONWARDS)	P-71
ABS SYSTEM DIAGRAM	P-71
FOREWORD	P-72
PRECAUTION	P-72
SYMPTOM TROUBLESHOOTING	P-73
NO.1 ABS WARNING LIGHT DOES NOT ILLUMINATE WITH IGNITION SWITCH (ENGINE SWITCH) ON	P-73
NO.2 ABS WARNING LIGHT STAYS ON FOR MORE THAN 4 SECONDS WITH IGNITION SWITCH (ENGINE SWITCH) ON	P-74

NO.3 THERE IS A MALFUNCTION IN SYSTEM EVEN THOUGH ABS WARNING LIGHT INDICATES THAT THE SYSTEM IS NORMAL	P-78
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GENERAL PROCEDURES

Wheel and tires removal/installation

- The removal and installation procedures for the wheels and tires are not mentioned in this section. When a wheel is removed, retighten the wheel nuts to the specified torque. (See TD Wheels and Tires.

Brake lines disconnection/connection

Caution

- **Brake fluid will damage painted surfaces. If brake fluid get on a painted surface, wipe it off immediately.**
- If any brake line has been disconnected anytime during the procedure, add brake fluid, bleed the brakes, and inspect leakage after the procedure has been completed.

Fluid specification

SAE J1703 or FMVSS116 DOT-3 or DOT-4

Brake pipe flare nut tightening

- Tighten the brake pipe flare nut by using the **SST** (49 0259 770B). Be sure to modify the brake pipe flare nut tightening torque to allow for use of a torque wrench-**SST** combination. (Refer to section GI, FUNDAMENTAL PROCEDURES, TORQUE FORMULAS.)

Connectors disconnection

- Disconnect the negative battery cable before performing any work that requires handling of connectors. Reconnect the negative battery cable only after the work is completed.

ABS components operation Note

- Make sure that there are no DTCs in the ABS memory after working on ABS components. If there are any DTCs in the memory, clear them.

CONVENTIONAL BRAKE SYSTEM

AIR BLEEDING

Note

- The reservoir should be kept 3/4 full during bleeding.
- The brakes should be bled whenever a brake line is disconnected. If a hydraulic line is disconnected at the master cylinder, start at the slave cylinder farthest from the brake master cylinder, and move to the next farthest slave cylinder until all four cylinders have been bled. If the disconnection point is anywhere except the master cylinder, start at the point closest to the disconnection, and move to the next closest slave cylinder until all four cylinders have been bled.

1. Remove the bleeder cap and attach a vinyl tube to the bleeder screw.
2. Place the other end of the vinyl tube in a clear fluid-filled container.
3. One person should depress the brake pedal a few times, and then hold it in the depressed position.
4. A second person should loosen the bleeder screw, drain out the fluid and retighten the screw using the SST.

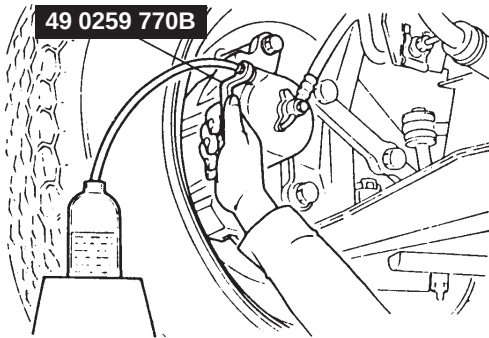
Tightening torque

Front:

9—14 N·m {92—142 kgf·cm, 80—123 in·lbf}

Rear:

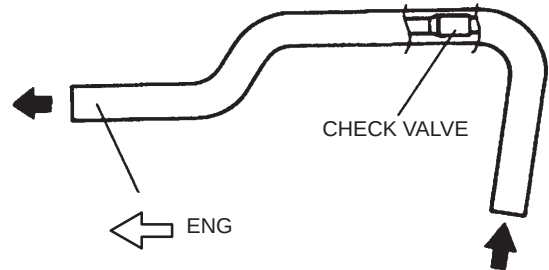
5.9—8.8 N·m {60—90 kgf·cm, 53—78 in·lbf}



5. Repeat steps 3 and 4 until no air bubbles are seen.
6. After air bleeding, inspect the following:
 - (1) brake operation
 - (2) fluid leakage
 - (3) fluid level

VACUUM LINE INSPECTION

1. Remove the clamps and the vacuum hose.
2. Apply both suction and pressure to the engine-side hose (Gasoline) or vacuum pump side of the hose (Diesel), and verify that air blows only toward that side. If air flows in both directions or not at all, replace the vacuum hose.



BRAKE PEDAL INSPECTION

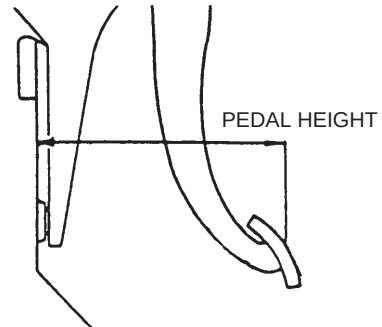
Brake Pedal Height Inspection

- Verify that the distance from the center of the upper surface of the pedal pad to the floor panel is as specified.

Pedal height

L.H.D.: 214—219 mm {8.43—8.81 in}

R.H.D.: 219—224 mm {8.63—8.81 in}



CONVENTIONAL BRAKE SYSTEM

Brake Pedal Height Adjustment

1. Disconnect the brake switch connector.
2. Loosen locknut B and turn switch A until it does not contact the pedal.
3. Loosen locknut D and turn rod C to adjust the height.
4. Tighten the bolt with locknut B so that clearance between the bolt for brake light switch A and pedal stopper is within the specification.

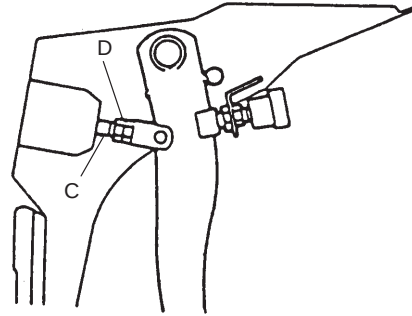
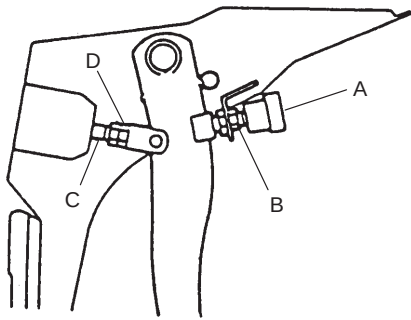
Specification

0.1—1.0 mm {0.004—0.039 in}

Tightening torque

14—17 N·m {140—180 kgf·cm, 122—156 in·lbf}

5. Connect the brake switch connector.
6. After adjustment, inspect the pedal play and the brake light operation.



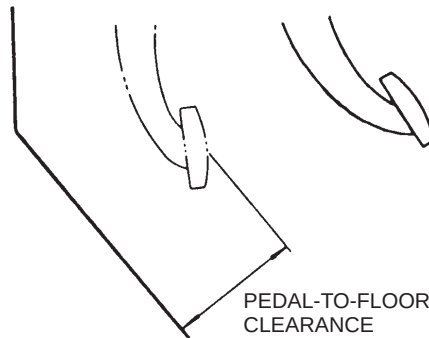
5. After adjustment, inspect the pedal height and the brake light operation.

Pedal-to-floor Clearance Inspection

1. Start the engine and verify that the distance from the floor panel to the pedal pad center is as specified when the pedal is depressed with a force of 589 N {60 kgf, 132 lbf}.

Clearance

105 mm {4.2 in} min.



2. If the distance is less than specified, inspect the following:
 - (1) Air in brake system
 - (2) Malfunction of the automatic adjuster
 - (3) Excessive shoe clearance

Brake Pedal Play Inspection

1. Depress the pedal a few times to eliminate the vacuum in the system.
2. Remove the snap pin, verify that the holes in the fork and in the pedal are aligned, and reinstall the pin.
3. Gently depress the pedal by hand until resistance is felt (approx. 20N {2 kgf, 4.4 lbf}) and inspect the free play.

Pedal play

3—8 mm {0.12—0.31 in}



Brake Pedal Play Adjustment

1. Remove the snap pin and clevis pin.
2. Loosen locknut D and turn rod C to align the holes in the fork and in the pedal.
3. Install the clevis pin and the snap pin.
4. Tighten locknut D.

Tightening torque

24—34 N·m {2.4—3.5 kgf·m, 18—25 ft·lbf}

BRAKE PEDAL REMOVAL/INSTALLATION

R.H.D.

The brake pedal is mounted on the bracket integrated with the clutch pedal and accelerator pedal. Refer to section F1—F4, INTAKE AIR SYSTEM, ACCELERATOR PEDAL REMOVAL/INSTALLATION for the brake pedal removal/installation.

L.H.D.

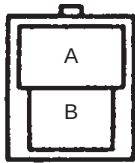
The brake pedal is mounted on the bracket integrated with the clutch pedal. Refer to section H, CLUTCH PEDAL REMOVAL/INSTALLATION for the brake pedal removal/installation.

CONVENTIONAL BRAKE SYSTEM

BRAKE SWITCH INSPECTION

1. Disconnect the brake switch connector.
2. Inspect for continuity between the terminals of the brake switch connector using the circuit tester.
○—○ : Continuity

Condition	Terminal	
	A	B
When the brake pedal is depressed.	○—○	○—○
When the brake pedal is not depressed.		

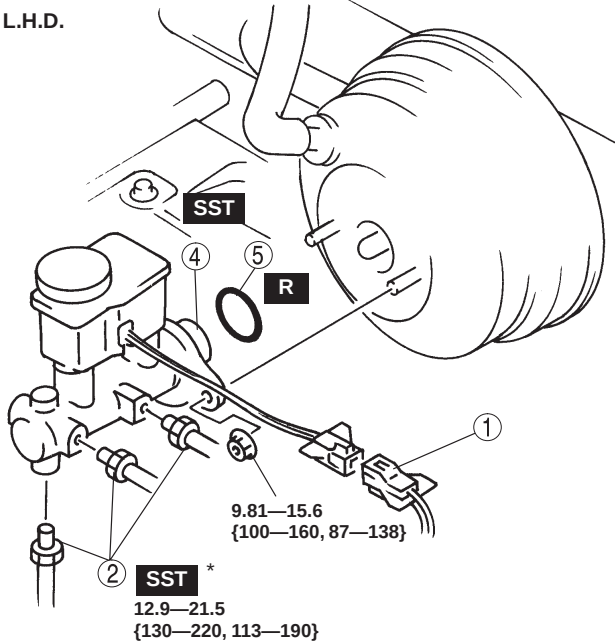


3. If not as specified, replace the brake switch.

MASTER CYLINDER REMOVAL/INSTALLATION (VEHICLES BUILT UP TO 07/2002)

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.

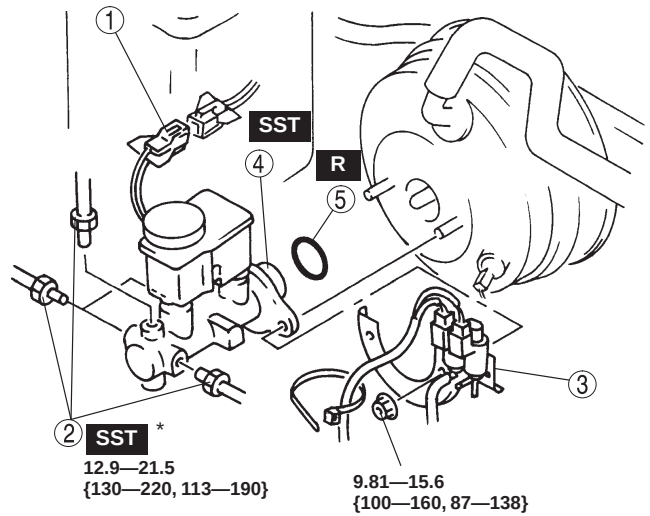
L.H.D.



* 49 0259 770B

N·m {kgf·cm, in·lbf}

R.H.D.



* 49 0259 770B

N·m {kgf·cm, in·lbf}

1	Brake fluid level sensor connector
2	Brake pipe
3	Bracket (R.H.D.)
4	Master cylinder + Installation Note
5	O-ring

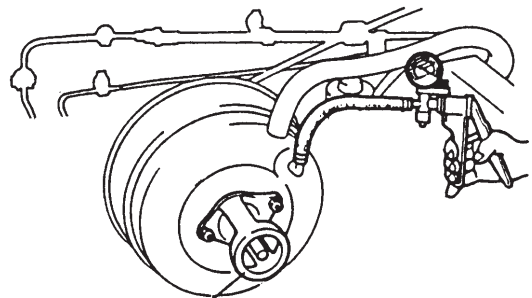
Master Cylinder Installation Note

1. Loosen the adjusting nut of the SST.
2. Place the SST on the power brake unit and tighten the nut and washer.

Tightening torque

9.81—15.6 N·m
{100—160 kgf·cm, 87—138 in·lbf}

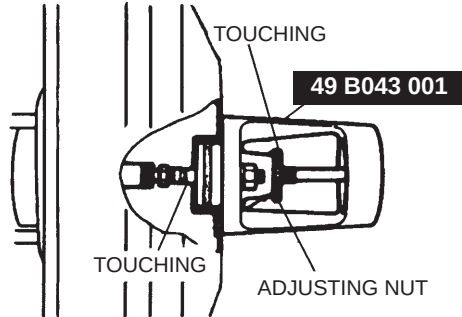
3. Apply 66.7 kPa {500 mmHg, 19.7 inHg} vacuum to the power brake unit using a vacuum pump.



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CONVENTIONAL BRAKE SYSTEM

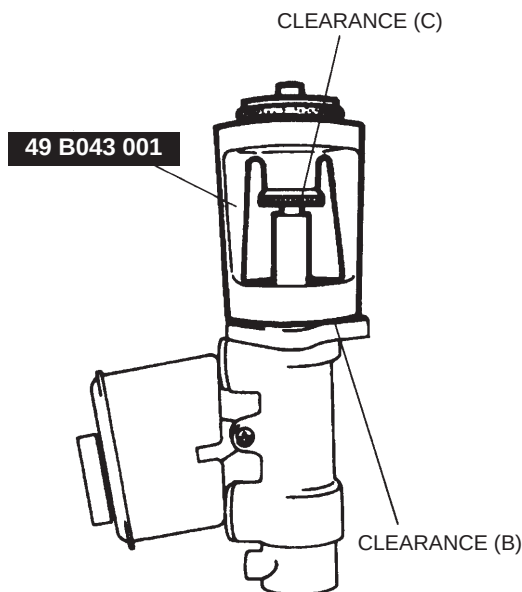
- Turn the adjusting nut of the **SST** counterclockwise until the gauge rod just contacts the push rod end of the power brake unit. Push lightly on the end of the gauge rod to be sure it is seated. Verify that there is no gap between the adjusting nut and **SST** body.
- Remove the **SST** from the power brake unit.



- Remove the **SST** from the power brake unit without disturbing the adjusting nut. Set the **SST** onto the master cylinder as shown in the figure.
- Push lightly on the end of the **SST** gauge rod to be sure that it is contacting the bottom of the master cylinder piston, but do not push so hard that the piston moves. Note any clearance between the **SST** body and the adjusting nut: clearance B, or between the body and the master cylinder: clearance C. Adjust the push rod as necessary as outlined in "Adjustment" below.

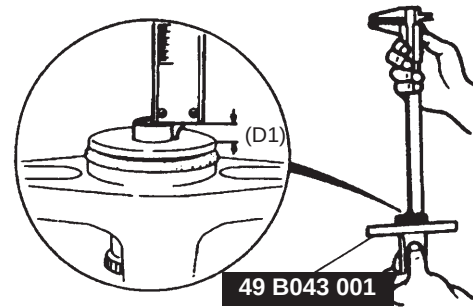
Adjustment

Measurement	Push rod
Clearance at B	Too long
Clearance at C	Too short
No clearance at B or C	Okay

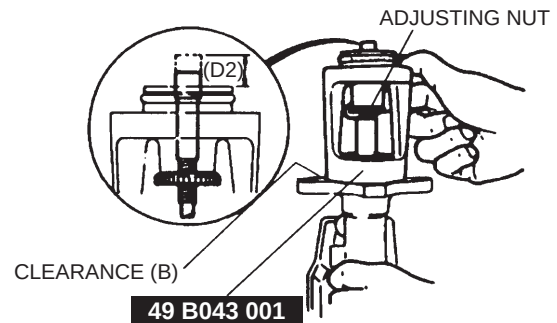


Clearance at B

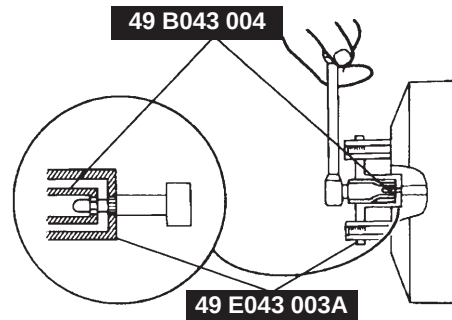
- Measure and record the height D1 of the gauge rod.



- Turn the adjusting nut until the **SST** body sets closely on the master cylinder. Turn only enough for the body to touch.
- Measure and record height D2 of the gauge rod.



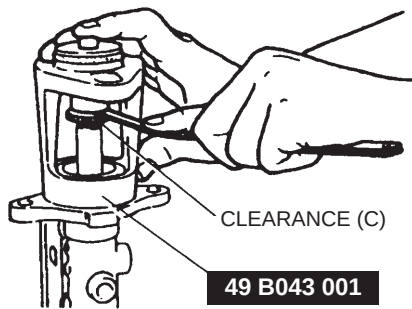
- Subtract D1 from D2. Using the **SST**, turn the nut to shorten the power brake unit push rod an amount equal to the difference.



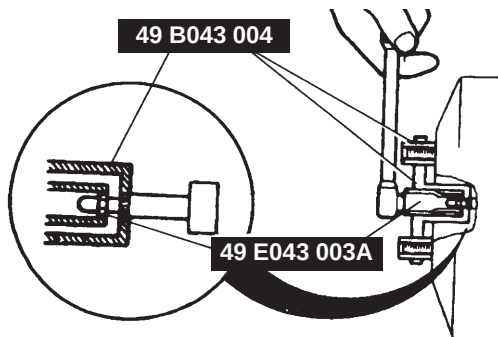
CONVENTIONAL BRAKE SYSTEM

Clearance at C

1. Push lightly on the end of the **SST** gauge rod, and measure the clearance between the adjusting nut and the **SST** body.



2. Using the **SSTs**, turn the nut to lengthen the power brake unit push rod an amount equal to the clearance measured at B.

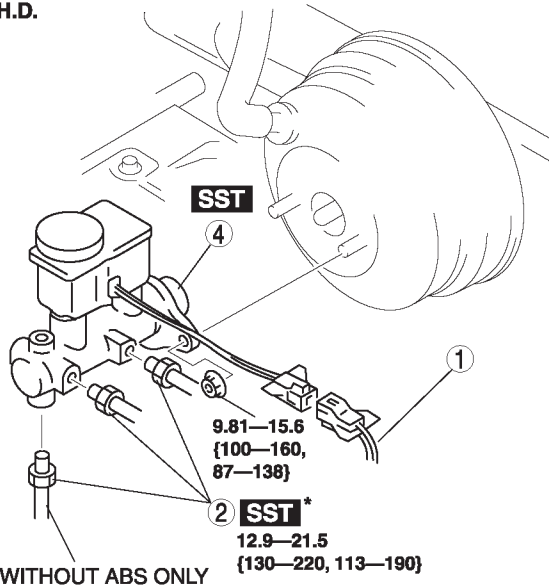


CONVENTIONAL BRAKE SYSTEM

MASTER CYLINDER REMOVAL/INSTALLATION (VEHICLES BUILT FROM 08/2002)

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.

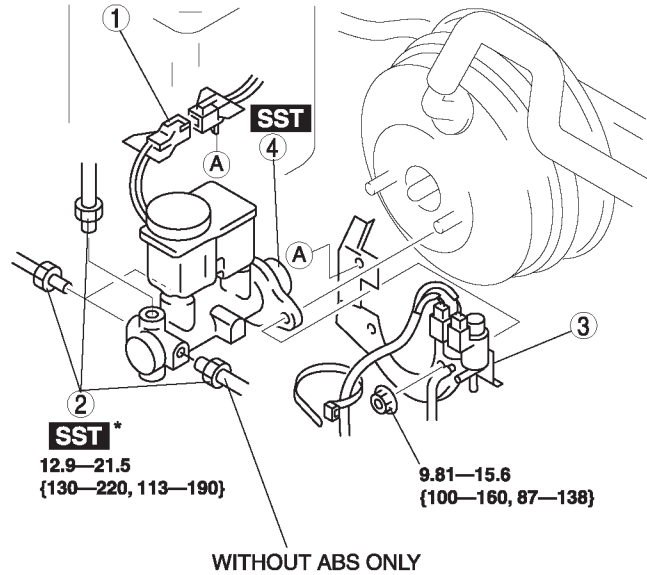
L.H.D.



* 49 0259 770B

1	Brake fluid level sensor connector
2	Brake pipe

R.H.D.



N·m {kgf·cm, in·lbf}

3	Bracket
4	Master cylinder (See Master Cylinder Installation Note)

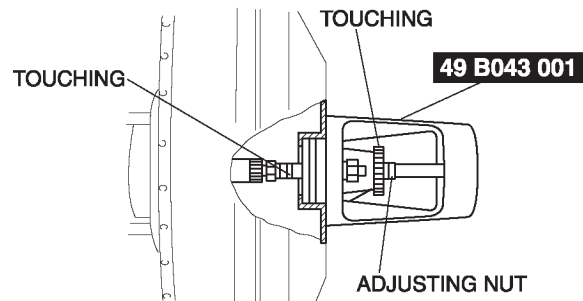
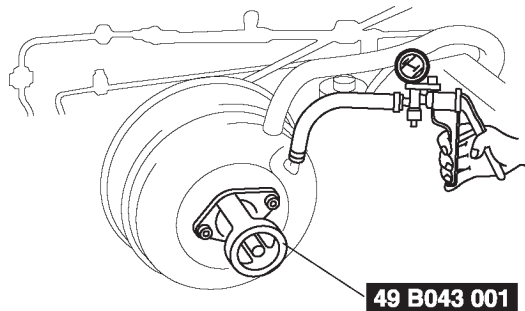
Master Cylinder Installation Note

1. Turn the nut of the **SST** clockwise to fully retract the **SST** gauge rod. Attach the **SST** to the power brake unit.

Tightening torque

9.9–15 N·m {1.0–1.6 kgf·m, 7.3–11 ft·lbf}

2. Apply vacuum of 66.7 kPa {500 mmHg, 19.7 inHg} using a vacuum pump.



Caution

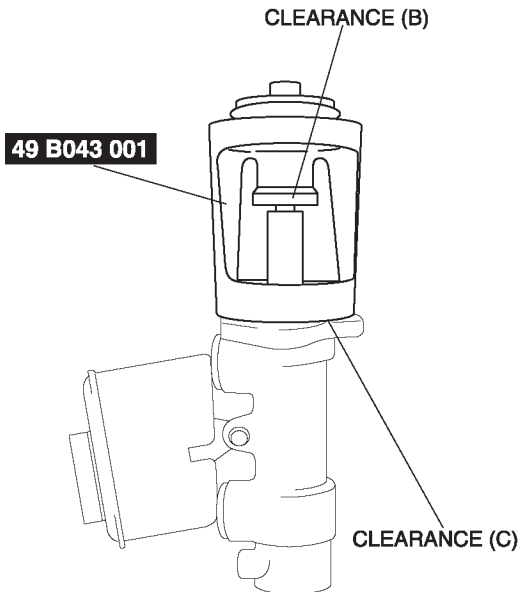
- When pushing the **SST** gauge rod into the master cylinder piston, only use enough pressure to push the rod to the bottom of the piston. If too much pressure is applied, a false reading will occur.

3. Turn the adjusting nut of the **SST** counterclockwise until the gauge rod just contacts the push rod end of the power brake unit. Push lightly on the end of the gauge rod to be sure it is seated. Verify that there is no gap between the adjusting nut and **SST** body.
4. Remove the **SST** from the power brake unit without disturbing the adjusting nut. Set the **SST** onto the master cylinder as shown in the figure.

CONVENTIONAL BRAKE SYSTEM

5. Push lightly on the end of the **SST** gauge rod to be sure it has contacted the bottom of the master cylinder piston, but do not push so hard that the piston moves. Take note of any clearance between the **SST** body and the adjusting nut (clearance B) or between the body and the master cylinder (clearance C).

Measurement	Push rod
Clearance at (B)	Too short
Clearance at (C)	Too long
No clearance at (B) or (C)	



49 B043 004

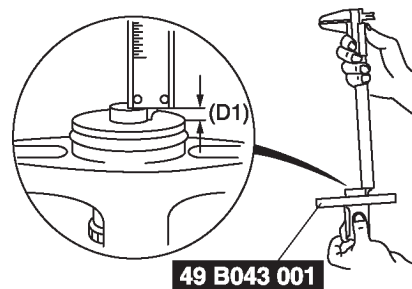
49 E043 003A

Adjusting the push rod clearance at C or no clearance at B or C

Note

- The threads of the push rod are specially designed so that the bolt becomes harder to turn past a certain point. This is to prevent the bolt from coming loose. Turn the bolt only within this range when adjusting.

- Measure and record height D1 of the gauge rod.
- Turn the adjusting nut until the **SST** body sets squarely on the master cylinder. (Turn only enough for the body to touch.)



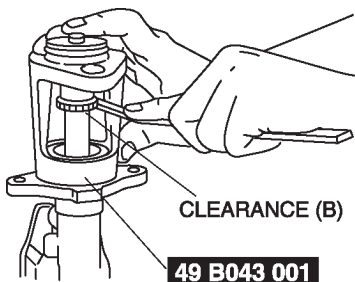
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Adjusting the push rod clearance at B

Note

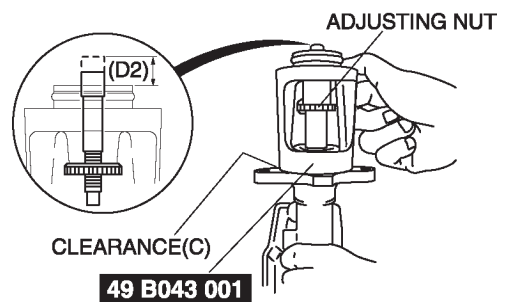
- The threads of the push rod are specially designed so that the bolt becomes harder to turn past a certain point. This is to prevent the bolt from coming loose. Turn the bolt only within this range when adjusting.

- Push lightly on the end of the **SST** gauge rod, and measure the clearance between the adjusting nut and the **SST** body.



49 B043 001

- Measure and record height D2 of the gauge rod.

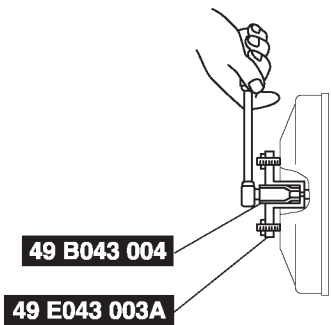


49 B043 001

- Using the **SST**, turn the nut to lengthen the power booster push rod an amount equal to the sum subtracting **0.1—0.4 mm {0.004—0.016 in}** from the clearance measured at B.

CONVENTIONAL BRAKE SYSTEM

4. Subtract D1 from D2 and add **0.1—0.4 mm** {**0.004—0.016 in**}. Using the **SST**, turn the nut to shorten the power booster push rod an amount equal to the sum.



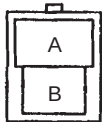
FLUID LEVEL SENSOR INSPECTION

- 1. Disconnect the sensor connector.
- 2. Connect an ohmmeter to the connector.
- 3. Starting with the fluid level above MIN, verify that there is no continuity.
- 4. Remove the brake fluid and verify that there is continuity when the level is below MIN.

○—○ : Continuity

Fluid level	Terminal	
	A	B
Below MIN.	○—	—○
Above MIN.		

5. If not as specified, replace the sensor.



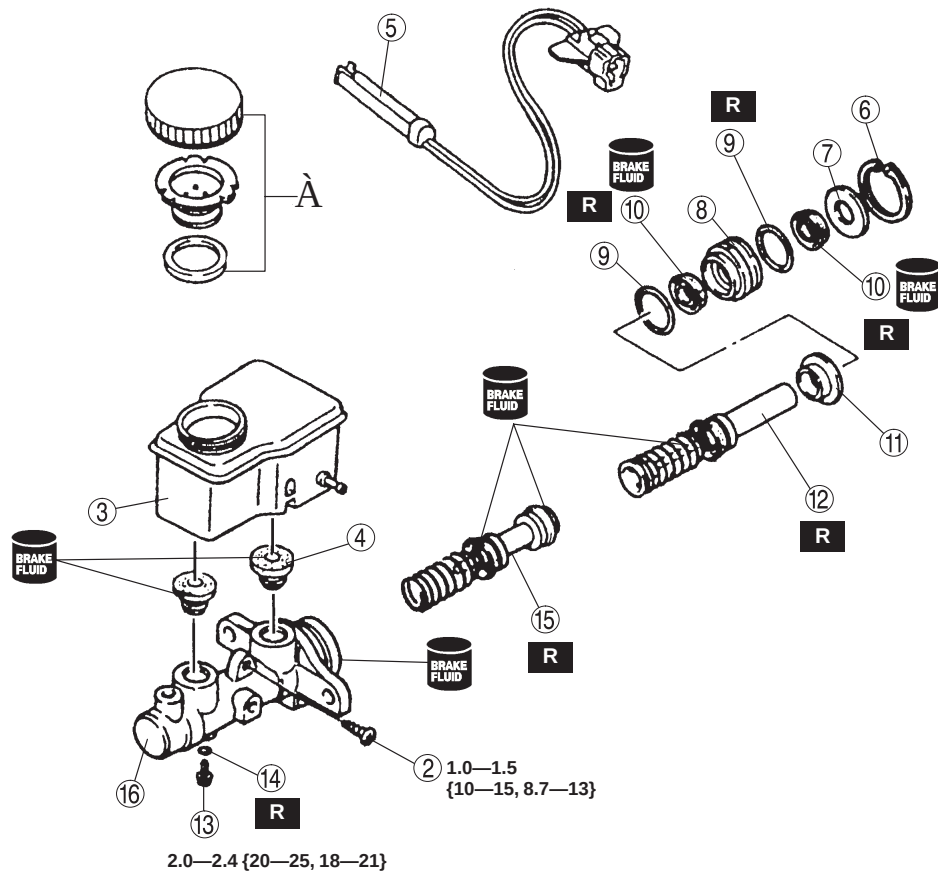
CONVENTIONAL BRAKE SYSTEM

MASTER CYLINDER DISASSEMBLY/ASSEMBLY (VEHICLES BUILT UP TO 07/2002)

Caution

- If the master cylinder body is damaged, replace the unit as a component. When securing the master cylinder in a vise, tighten only the flange of the master cylinder.

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



N·m {kgf·cm, in·lbf}

1	Cap set
2	Screw
3	Reservoir
4	Joint bushing
5	Fluid level sensor
6	Snap ring
7	Spacer
8	Piston guide
9	O-ring

10	Cup
11	Primary piston stopper
12	Primary piston
13	Stop screw + Assembly Note
14	O-ring
15	Secondary piston
16	Master cylinder body

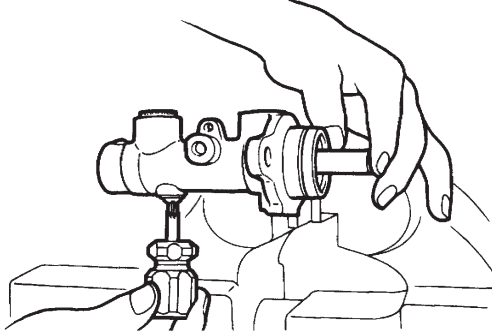
CONVENTIONAL BRAKE SYSTEM

Stop Screw and O-ring Assembly Note

1. Install a new O-ring onto the stop screw.
2. Push the primary piston component in full.
3. Install and tighten the stop screw.

Tightening torque

2.0—2.4 N·m {20—25 kgf·cm, 18—21 in·lbf}

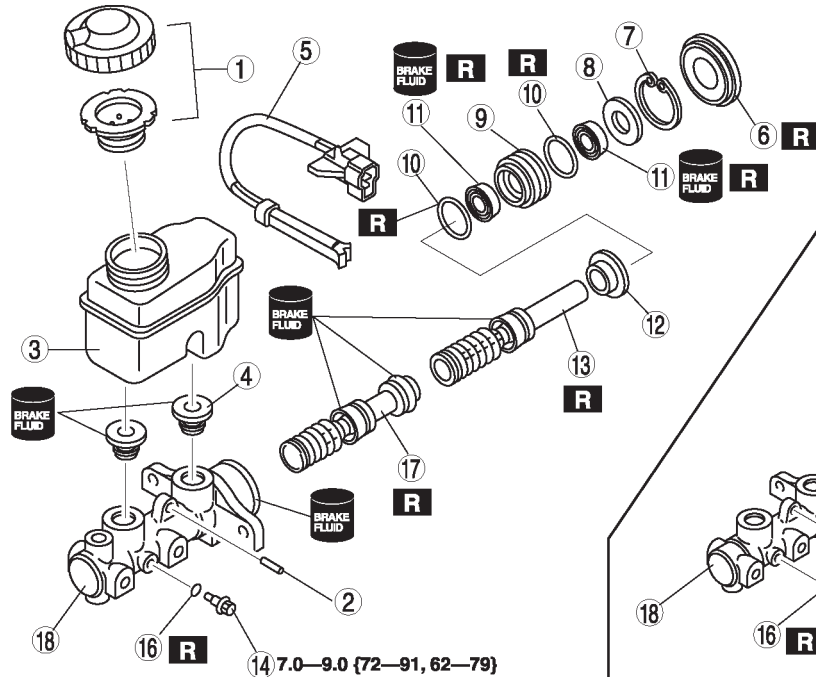


CONVENTIONAL BRAKE SYSTEM

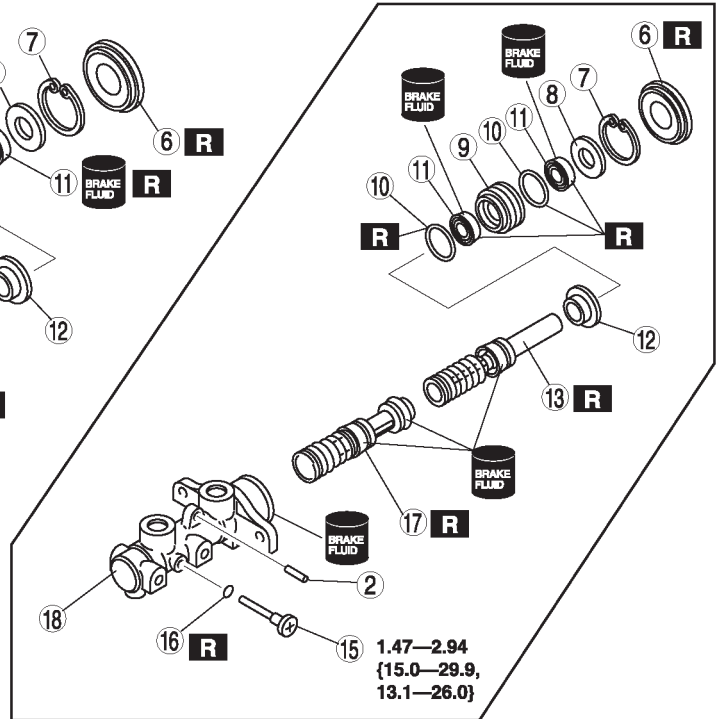
MASTER CYLINDER DISASSEMBLY/ASSEMBLY (VEHICLES BUILT FROM 08/2002)

1. After removing the brake fluid, disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.

WITHOUT ABS



WITH ABS



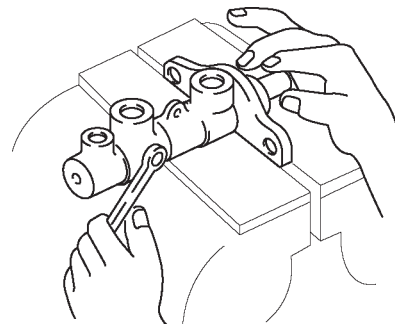
N·m {kgf·cm, in·lbf}

1	Cap set
2	Pin
3	Reservoir
4	Joint bushing
5	Brake fluid level sensor
6	Seal and plate assembly
7	Snap ring
8	Spacer
9	Piston guide
10	O-ring

11	Cup
12	Primary piston stopper
13	Primary piston
14	Stop screw (without ABS) (See Stop Screw (without ABS) Assembly Note)
15	Stop pin (with ABS) (See Stop Pin (with ABS) Assembly Note)
16	Gasket
17	Secondary piston
18	Master cylinder body

Stop Screw (without ABS) Assembly Note

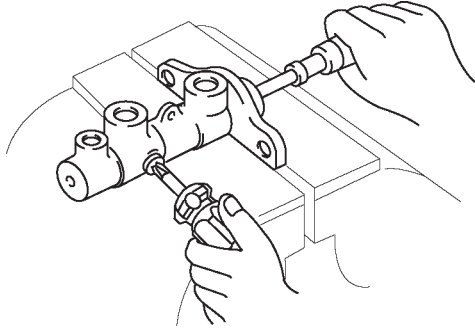
1. Push the primary piston component in fully.
2. Install and tighten a new gasket and the stop screw.
3. Push and release the piston to verify that it is held by the stop screw.



CONVENTIONAL BRAKE SYSTEM

Stop Pin (with ABS) Assembly Note

1. Install the secondary piston component with the piston hole facing the stop pin.
2. Install and tighten a new gasket and the stop pin.
3. Push and release the piston to verify that it is held by the stop pin.



POWER BRAKE UNIT INSPECTION (VEHICLES BUILT UP TO 07/2002) Power Brake Unit Function Inspection (Simple method)

Note

- Replace power brake unit component as necessary.

Step 1

1. With the engine stopped, depress the pedal a few times.
2. With the pedal depressed, start the engine.
3. If the pedal moves down slightly, immediately after the engine starts, the unit is operating.

Step 2

1. Start the engine.
2. Stop the engine after it has run for **1 or 2 minutes**.
3. Depress the pedal with the usual force.
4. If the first pedal stroke is long and becomes shorter with subsequent strokes, the unit is operating.

Note

- If a problem is found, inspect for damage on the check valve or vacuum hose, and examine the installation. Repair as necessary, and inspect it again.

Step 3

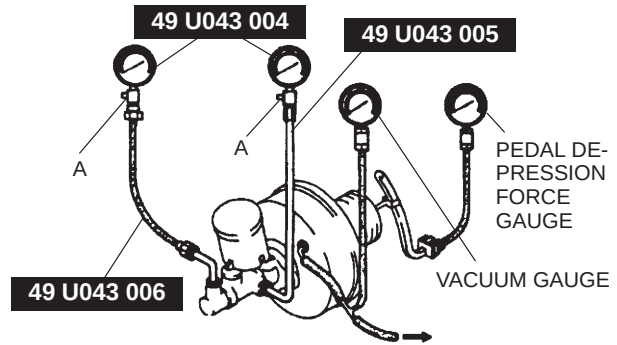
1. Start the engine.
2. Depress the pedal with the usual force.
3. Stop the engine with the pedal held depressed.
4. Hold the pedal down for **about 30 seconds**.
5. If the pedal height does not change, the unit is operating.

(Inspection using the testers)

1. Connect the **SSTs**, vacuum gauge, and pedal depression force gauge as shown in the figure.

Note

- Use commercially available gauges and pedal depression force gauge.
- Bleed the air from the **SST** at gauge A.



2. After bleeding the air from the **SST**, conduct the test as described in the following steps.

a) Inspection for vacuum loss

Unloaded condition

1. Start the engine.
2. Stop the engine when the vacuum gauge reading reaches **66.7 kPa {500 mmHg, 19.7 inHg}**.
3. Observe the vacuum gauge for **15 seconds**. If the gauge shows **63.3—66.7 kPa {475—500 mmHg, 18.7—19.7 inHg}**, the unit is operating.

Loaded condition

1. Start the engine.
2. Depress the brake pedal with a force of **196 N {20 kgf, 44 lbf}**.
3. With the brake pedal depressed, stop the engine when the vacuum gauge reading reaches **66.7 kPa {500 mmHg, 19.7 inHg}**.
4. Observe the vacuum gauge for **15 seconds**. If the gauge shows **63.3—66.7 kPa {475—500 mmHg, 18.7—19.7 inHg}**, the unit is operating.

b) Inspection for hydraulic pressure

1. When the engine is stopped (vacuum **0 kPa {0 mmHg, 0 inHg}**) and the fluid pressure is within the specification, the unit is operating.

Pedal force	Fluid pressure
196 N {20 kgf, 44 lbf}	790 kPa {8 kgf/cm ² , 114 psi} min

2. Start the engine. Depress the brake pedal when the vacuum reaches **66.7 kPa {500 mmHg, 19.7 inHg}**. If the fluid pressure is within the specification, the unit is operating.

Pedal force	Fluid pressure
196 N {20 kgf, 44 lbf}	8,240 kPa {84 kgf/cm ² , 1,200 psi} min

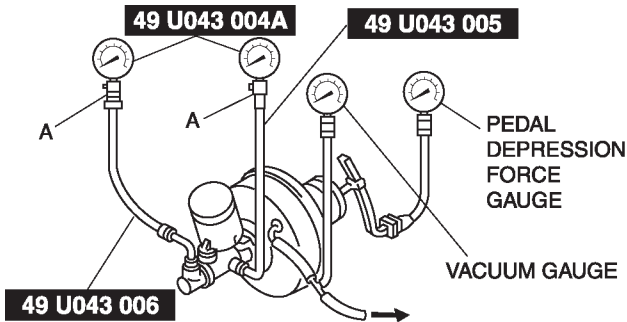
CONVENTIONAL BRAKE SYSTEM

POWER BRAKE UNIT INSPECTION

(VEHICLES BUILT FROM 08/2002)

Power Brake Unit Function Inspection (Inspection using gauges)

1. Connect the **SST** gauges, a vacuum gauge, and a pedal depression gauge as shown in the figure. Bleed the air from the **SST** gauges before performing the following tests.



Checking for vacuum loss (unloaded condition)

1. Start the engine.
2. Stop the engine when the vacuum gauge indicates **66.7 kPa {500 mmHg, 19.7 inHg}**.
3. Observe the vacuum gauge for **15 seconds**.
 - If the gauge indicates **63.4—66.6 kPa 475—500 mmHg, 18.8—19.6 inHg**, the unit is operating.

Checking for vacuum loss (loaded condition)

1. Start the engine.
2. Depress the brake pedal with a force of **196 N {20 kgf, 44 lbf}**.
3. With the brake pedal held depressed, stop the engine when the vacuum gauge indicates **66.7 kPa {500 mmHg, 19.7 inHg}**.
4. Observe the vacuum gauge for **15 seconds**.
 - If the gauge indicates **63.4—66.6 kPa 475—500 mmHg, 18.8—19.6 inHg**, the unit is operating.

Checking for hydraulic pressure

1. If the engine is stopped (vacuum **0 kPa {0 mmHg, 0 inHg}**) and the fluid pressure is within the specification, the unit is operating.

Pedal force	Fluid pressure
196 N {20 kgf, 44 lbf}	790 kPa {8 kgf/cm ² , 114 psi}

2. Start the engine. Depress the brake pedal when the vacuum reaches **66.7 kPa {500 mmHg, 19.7 inHg}**.
 - If the fluid pressure is within specification, the unit is operating.

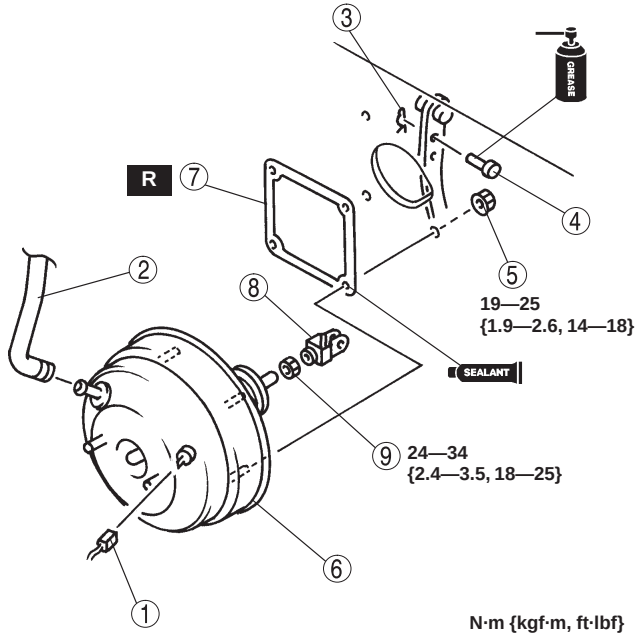
Pedal force	Fluid pressure
196 N {20 kgf, 44 lbf}	8,040 kPa {82 kgf/cm ² , 1,166 psi}

CONVENTIONAL BRAKE SYSTEM

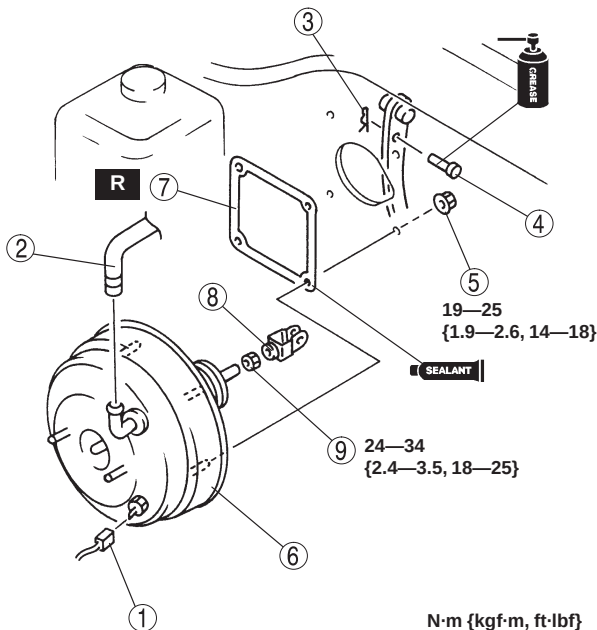
POWER BRAKE UNIT REMOVAL/INSTALLATION

1. Remove the master cylinder. (Refer to CONVENTIONAL BRAKE SYSTEM, MASTER CYLINDER REMOVAL/INSTALLATION.)
2. Remove in the order indicated in the table.
3. Install in the reverse order of removal.

L.H.D.

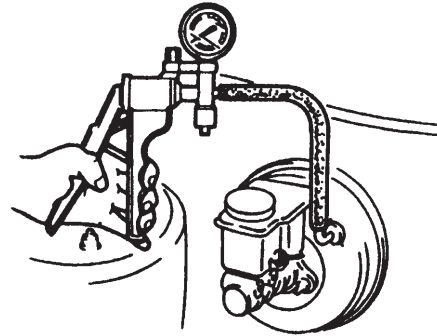


R.H.D.



VACUUM SWITCH INSPECTION (DIESEL)

1. Remove the vacuum hose from the power brake unit.
2. Set the vacuum pump hose (commercially available on the market) onto the power brake unit as shown.



3. Turn the engine switch on.
4. Release the parking brake.
5. Apply vacuum to the power brake unit using the vacuum pump (commercially available on the market) and verify the operating condition of the brake light warning light.

Vacuum kPa {mmHg, inHg}	Brake warning light
Below 10.7 ± 1.3 { 80 ± 10 , 3.2 ± 0.4 }	ON
Above 10.7 ± 1.3 { 80 ± 10 , 3.2 ± 0.4 }	OFF

6. The vacuum switch is functioning normally if it corresponds to the above specifications. Replace the vacuum switch as necessary.

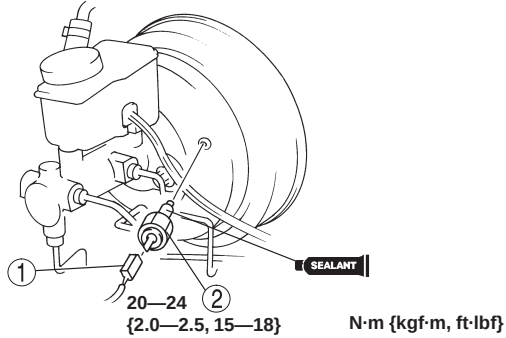
1	Vacuum switch connector (Diesel)
2	Vacuum hose
3	Snap pin
4	Clevis pin
5	Nut
6	Power brake unit
7	Gasket
8	Fork
9	Nut

CONVENTIONAL BRAKE SYSTEM

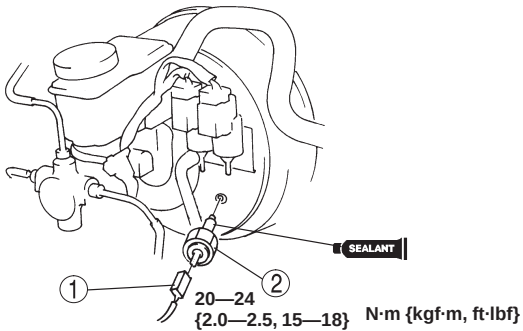
VACUUM SWITCH REMOVAL/INSTALLATION (DIESEL)

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.

L.H.D.



R.H.D.



1	Vacuum switch connector
2	Vacuum switch + Installation Note

Vacuum Switch Installation Note

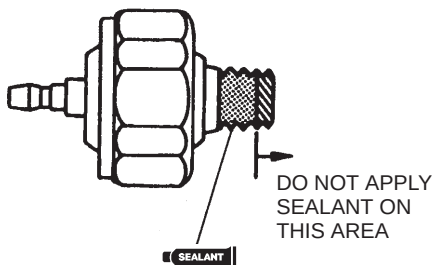
1. Remove the old sealant.

Caution

- Do not apply sealant to the tip of the vacuum switch as a malfunction may occur.
2. Apply sealant to the area shown before installation of the vacuum switch onto the power brake unit, and then tighten it to the specified torque.

Tightening torque

20—24 N·m {2.0—2.5 kgf·m, 15—18 ft·lbf}



VACUUM PUMP INSPECTION (DIESEL)

1. Warm up the engine.
2. Disconnect the vacuum hose from the vacuum pump and connect a vacuum gauge as shown in the figure, then inspect the vacuum.

Vacuum specification (In 20 seconds)

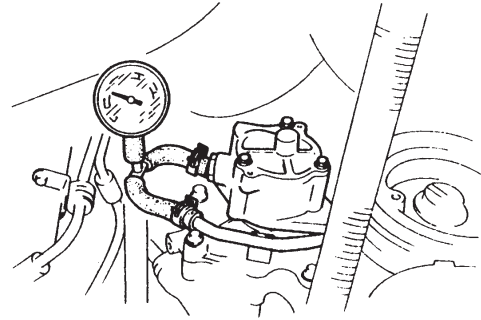
Engine speed 1,500 rpm

73.3 kPa {550 mmHg, 21.7 inHg}

Maximum vacuum

Engine speed 3,000 rpm

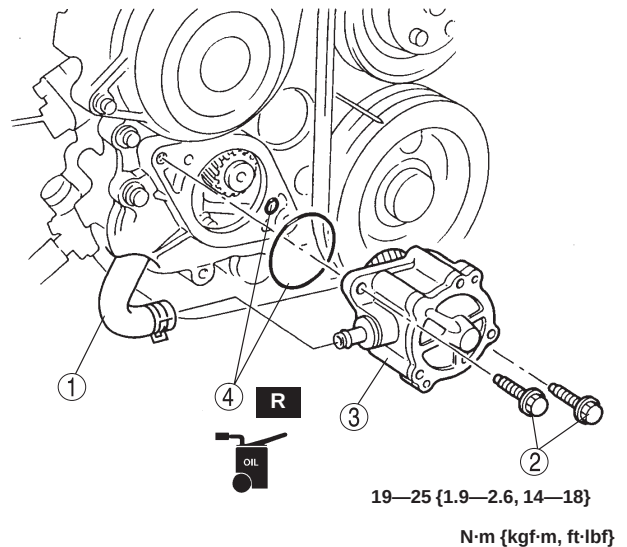
93.3 kPa {700 mmHg, 27.6 inHg}



3. If the pressure is less than the specification, inspect for the following.
 - (1) Malfunction of the vacuum pump
 - (2) Shortage of the lubrication oil pressure

VACUUM PUMP REMOVAL/INSTALLATION (DIESEL)

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.

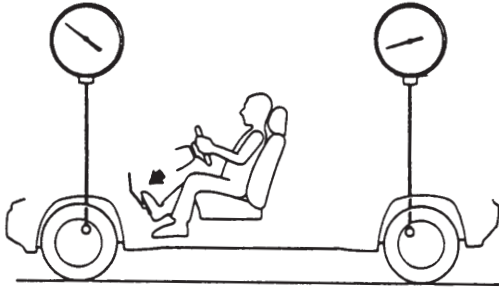


1	Vacuum hose
2	Bolt
3	Vacuum pump
4	O-ring

CONVENTIONAL BRAKE SYSTEM

LOAD SENSING PROPORTIONING VALVE INSPECTION (VEHICLES BUILT UP TO 07/2002)

1. Place the vehicle on level ground.
2. Inspect the tire inflations and set them to the recommended pressure as necessary.
3. Prepare the vehicle with a person in the driver's seat; include the standard vehicle tools, the spare wheel and tire, and a full tank of fuel.
4. Connect pressure gauges (commercially available) to the front and rear calipers.



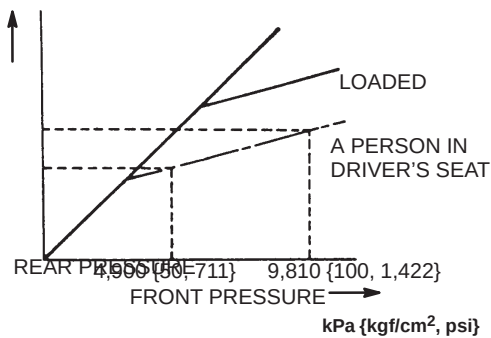
Note

- When applying the specified pressure, the brake pedal must not be "double pumped" or released.
- Approximately two seconds after setting the front wheel cylinder fluid pressure, read the rear pressure.

5. Bleed the air from the brake system.
6. Slowly depress the brake pedal until the front pressure gauge indicates the specified pressure shown in the table, then note the reading on the rear pressure gauge.

kPa {kgf/cm², psi}

Front pressure	Rear pressure
4,900 {50, 711}	2,550 {26, 370}
9,810 {100, 1,422}	3,530 {36, 512}

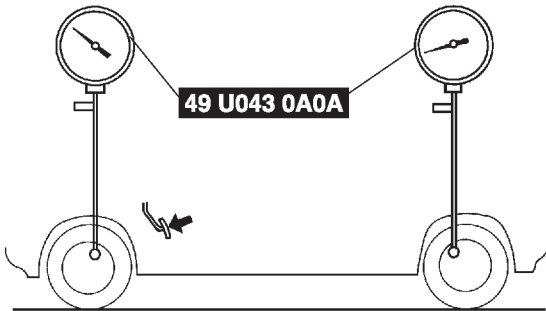


7. If not as specified, replace and adjust the LSPV.

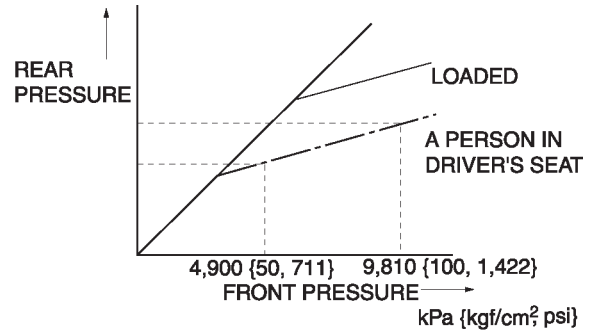
CONVENTIONAL BRAKE SYSTEM

LOAD SENSING PROPORTIONING VALVE (LSPV) INSPECTION (VEHICLES BUILT FROM 08/2002)

1. Place the vehicle on level ground.
2. Check the tire inflations and set them to the recommended pressure if necessary.
 - If not as specified, replace or adjust.
3. Check the vehicle with a person in the driver's seat; include the standard vehicle tools, the spare wheel and tire, and a full tank of fuel.
4. Install the **SST** to the front wheel cylinder and rear wheel cylinder, then bleed the air in the brake line and load sensing proportioning valve (LSPV) using a air bleed valve A.



5. Inspect the fluid pressure of rear wheel cylinder while the fluid pressure of front wheel cylinder is **4,900 kPa {50 kgf/cm², 711 psi}** and **9,800 kPa {100 kgf/cm², 1,422 psi}**.
 - If not as specified, adjust the LSPV.



Specification

kPa {kgf/cm², psi}

Type		Front wheel cylinder fluid pressure	Rear wheel cylinder
4x2	Without ABS	4,900 {50, 711}	2,250—2,850 {22.95—29.06, 327—413}
		9,800 {100, 1,422}	3,130—3,930 {31.92—40.07, 454—569}
	With ABS	4,900 {50, 711}	2,910—3,710 {29.68—37.83, 423—538}
		9,800 {100, 1,422}	4,970—6,170 {50.68—62.91, 721—894}
4x4	Without ABS	4,900 {50, 711}	2,250—2,850 {22.95—29.06, 327—413}
		9,800 {100, 1,422}	3,130—3,930 {31.92—40.07, 454—569}
	With ABS	4,900 {50, 711}	2,650—3,450 {27.03—35.18, 385—500}
		9,800 {100, 1,422}	4,700—5,900 {47.93—60.16, 682—855}

CONVENTIONAL BRAKE SYSTEM

LOAD SENSING PROPORTIONING VALVE ADJUSTMENT (VEHICLES BUILT UP TO 07/2002)

1. Place the unloaded vehicle on level ground.
Unloaded condition: Fuel tank is full. Engine coolant and engine oil are at specified levels. Spare tire, jack, and tools are in designated position.

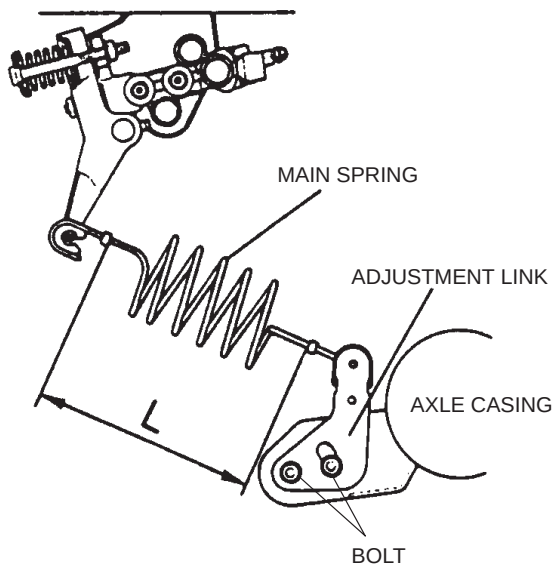
Note

- A change of **5 mm {0.197 in}** dimension L results in a change of **853 kPa {8.7 kgf/cm², 124 psi}** for 4 × 2 and **1020 kPa {10.4 kgf/cm², 148 psi}** for 4 × 4.
2. Adjust main spring dimension L between the LSPV and the adjustment link by loosening and repositioning the LSPV.
 - (1) Decrease dimension L if the fluid pressure is low.
 - (2) Increase dimension L if the fluid pressure is high.

Reference value

Dimension L

- 4 × 2: **147.5—154.5 mm {5.808—6.082 in}**
4 × 4: **175.5—182.5 mm {6.910—7.185 in}**



3. After adjustment, recheck the fluid pressure. If not as specified, replace the LSPV as a component.

CONVENTIONAL BRAKE SYSTEM

LOAD SENSING PROPORTIONING VALVE (LSPV) ADJUSTMENT (VEHICLES BUILT FROM 08/2002)

kPa {kgf/cm², psi}

- Place the unloaded vehicle on level ground.
Unloaded: Fuel tank is full. Engine coolant and tire, jack and tools are in designated position.

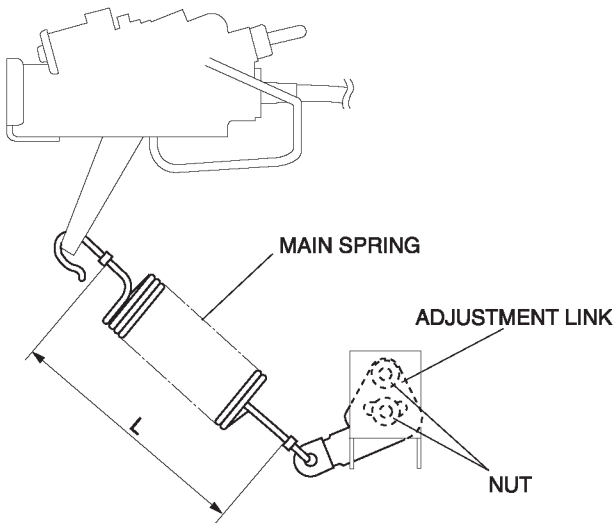
Note

- A change of **5mm {0.197 in}** in dimension L results in a change of the following.

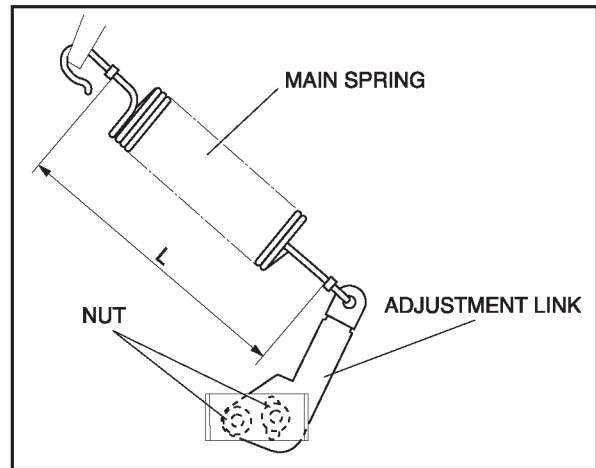
Type		Change
4x2	without ABS	850 {8.67, 123}
	with ABS	1,020 {10.40, 148}
4x4	without ABS	1,060 {10.81, 154}
	with ABS	1,080 {11.01, 157}

- Adjust main spring dimension L between the LSPV and the adjustment link loosening and repositioning the LSPV.

4x2



4x4



- Decrease dimension L if the fluid pressure is low.
- Increase dimension L if the fluid pressure is high.

Specification Dimension L

mm {in}

Type		Dimension L
4x2	without ABS	147.5—154.5
	with ABS	{5.81—6.08}
4x4	without ABS	175.5—182.5
	with ABS	{6.91—7.18}

- Tighten the nut.

Specification

18.6—25.4 N·m {1.89—2.60 kgf·m, 13.7—18.8 ft·lbf}

- After adjustment, recheck the fluid pressure.
 - If not as specified, replace the LSPV as a component

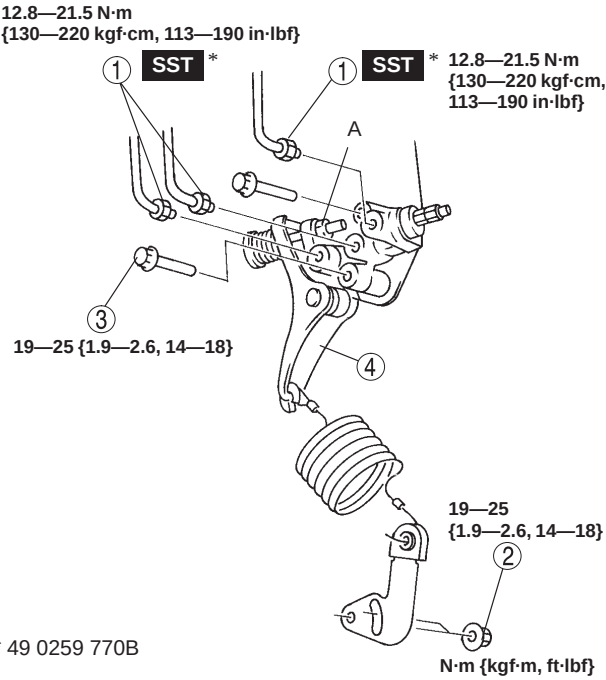
CONVENTIONAL BRAKE SYSTEM

LOAD SENSING PROPORTIONING VALVE REMOVAL/INSTALLATION (VEHICLES BUILT UP TO 07/2002)

Caution

- Do not disassemble the LSPV.
- Do not move the nut A.

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.
3. After installation, adjust the main spring dimension.
(Refer to CONVENTIONAL BRAKE SYSTEM,
LOAD SENSING PROPORTIONING VALVE
ADJUSTMENT.)



* 49 0259 770B

1	Brake pipe
2	Nut
3	Bolt
4	Load sensing proportioning valve

CONVENTIONAL BRAKE SYSTEM

LOAD SENSING PROPORTIONING VALVE (LSPV) REMOVAL/INSTALLATION (VEHICLES BUILT FROM 08/2002)

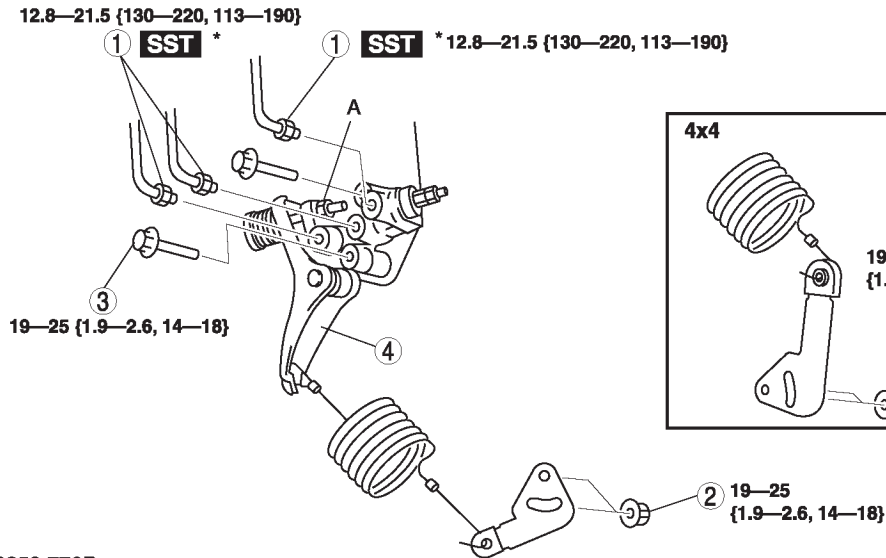
Caution

- Do not disassemble the LSPV.

- Do not move nut A.

- Remove in the order indicated in the table.
- Install in the reverse order of removal.
- After installation, adjust the main spring dimension.
(See LOAD SENSING PROPORTIONING VALVE (LSPV) ADJUSTMENT.)

4x2



* 49 0259 770B

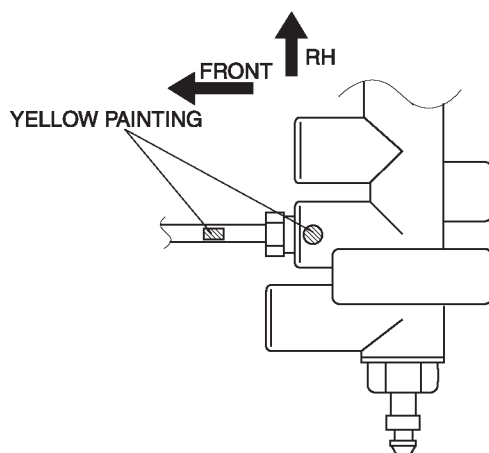
N·m {kgf·cm, in·lbf}

1	Brake pipe (See Brake Pipe Installation Note)
2	Nut

3	Bolt
4	Load sensing proportioning valve (LSPV)

Brake Pipe Installation Note

- Install the brake pipe to the load sensing proportioning valve (LSPV) and align yellow painting on the brake pipe and LSPV.



CONVENTIONAL BRAKE SYSTEM

FRONT BRAKE (DISC) INSPECTION

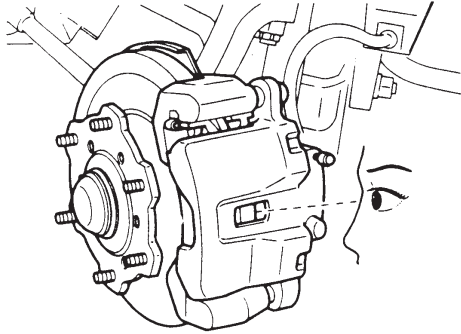
Disc Pad Thickness Inspection

1. Jack up the front of the vehicle and support it on safety stands.
2. Remove the wheel and tires.
3. Look through the caliper inspection hole and inspect the remaining thickness of the pads.

Thickness

2.0 mm {0.08 in} min.

4. Replace the pads as a set (right and left wheels) if either is at or less than the minimum thickness.



Disc Plate Thickness Inspection

1. Measure the thickness of the disc plate.

Caution

- When it is necessary to machine the disc plate, if the disc plate is removed from the vehicle then machined, excessive runout may result. Machine the disc plate with it installed on the vehicle.

(Vehicles built up to 07/2002)

Standard

24 mm {0.94 in}

Minimum

22 mm {0.87 in}

Minimum thickness after machining by using a brake lathe on-vehicle

22.8 mm {0.90 in}

(Vehicles built from 08/2002)

Standard thickness:

28.0 mm {1.10 in}

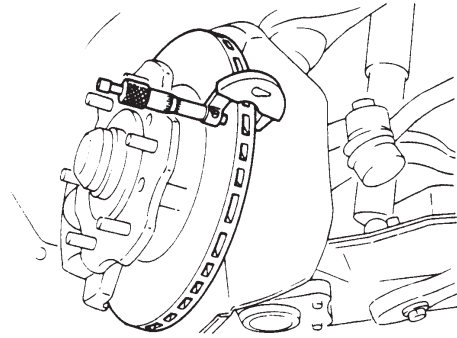
Minimum thickness:

26.0 mm {1.02 in}

Minimum thickness after machining by using a brake lathe on-vehicle

26.8 mm {1.06 in}

2. If the thickness is not within the specification, replace the disc plate.



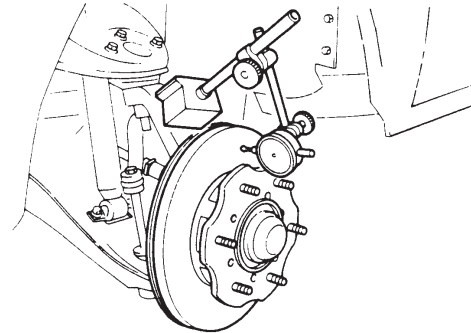
Disc Plate Runout Inspection (Vehicles built up to 07/2002)

1. Verify that there is no wheel bearing looseness.
2. Measure the runout at the outer edge of the contact surface of the disc pad.

Runout

0.05 mm {0.002 in} max.

3. If the runout is not within the specification, repair or replace the disc plate.

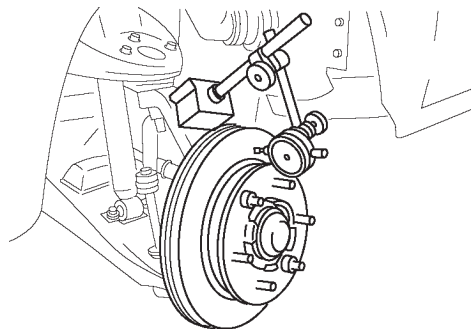


Disc Plate Runout Inspection (Vehicles built from 08/2002)

1. Tighten the disc plate to the wheel hub using two wheel nuts. When measuring runout, measure at the outer edge of the disc plate surface.

Runout limit

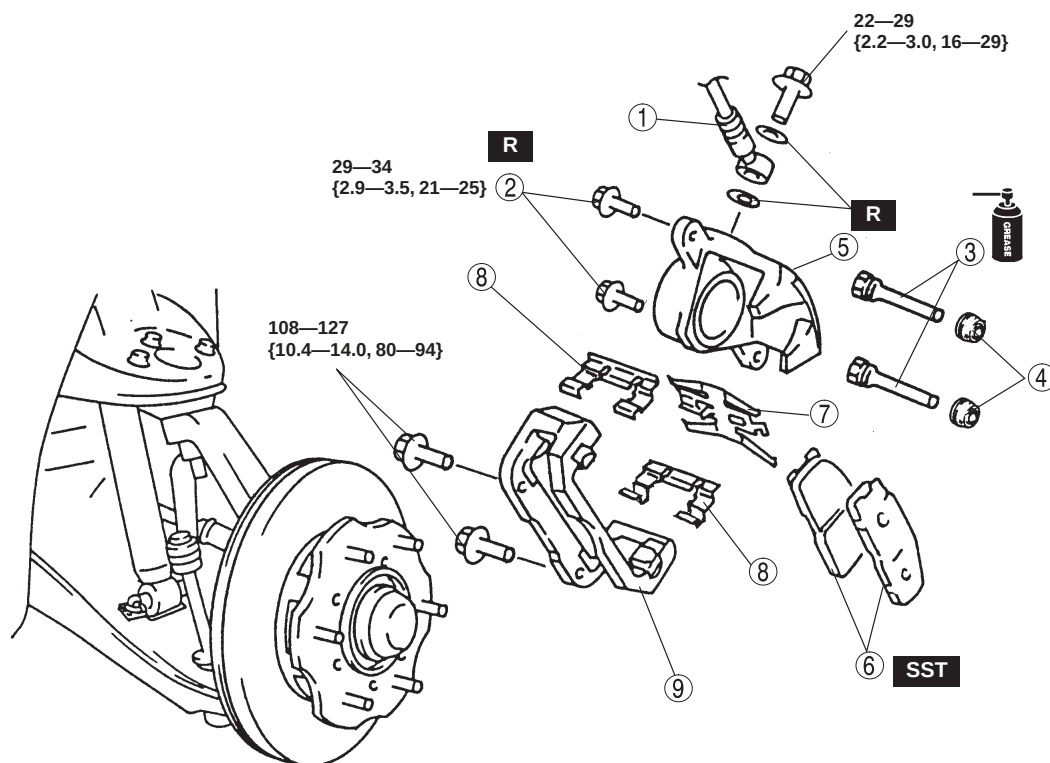
0.05 mm {0.002 in} max.



CONVENTIONAL BRAKE SYSTEM

FRONT BRAKE (DISC) REMOVAL/INSTALLATION (VEHICLES BUILT UP TO 07/2002)

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.
3. After installation, depress the pedal a few times, rotate the wheel by hand, and verify that the brake does not drag.



N·m {kgf·m, ft·lbf}

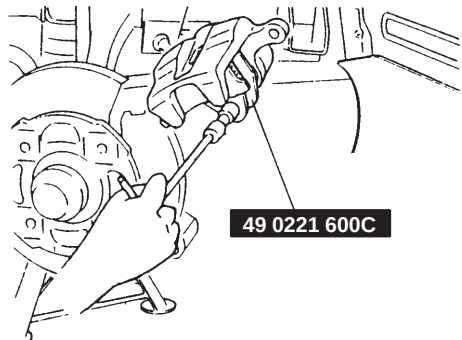
1	Brake hose
2	Bolt
3	Guide pin
4	Dust boot
5	Caliper

6	Disc pad + Installation Note
7	Plate
8	Guide plate
9	Mounting support

CONVENTIONAL BRAKE SYSTEM

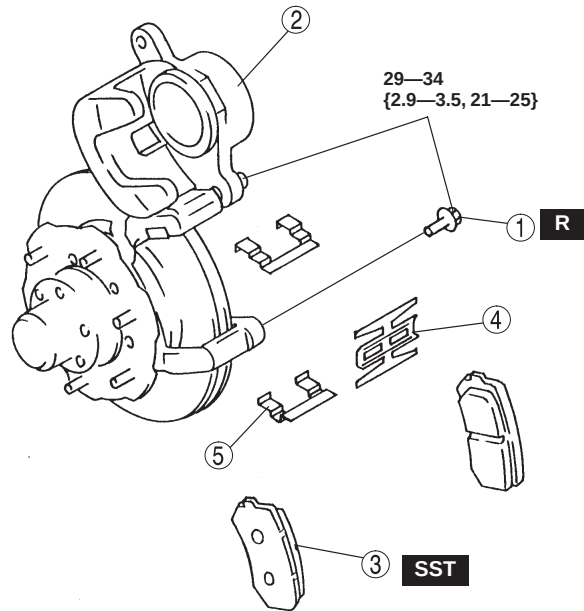
Disc Pad Installation Note

- 1. Push the piston fully inward using the SST.
- 2. Install the disc pad.



DISC PAD (FRONT) REPLACEMENT (VEHICLES BUILT UP TO 07/2002)

- 1. Remove in the order indicated in the table.
- 2. Install in the reverse order of removal.



N·m {kgf·m, ft·lbf}

1	Bolt
2	Caliper
3	Disc pad + CONVENTIONAL BRAKE SYSTEM, FRONT BRAKE (DISC) REMOVAL/INSTALLATION, Disc Pad Installation Note
4	Plate
5	Guide plate

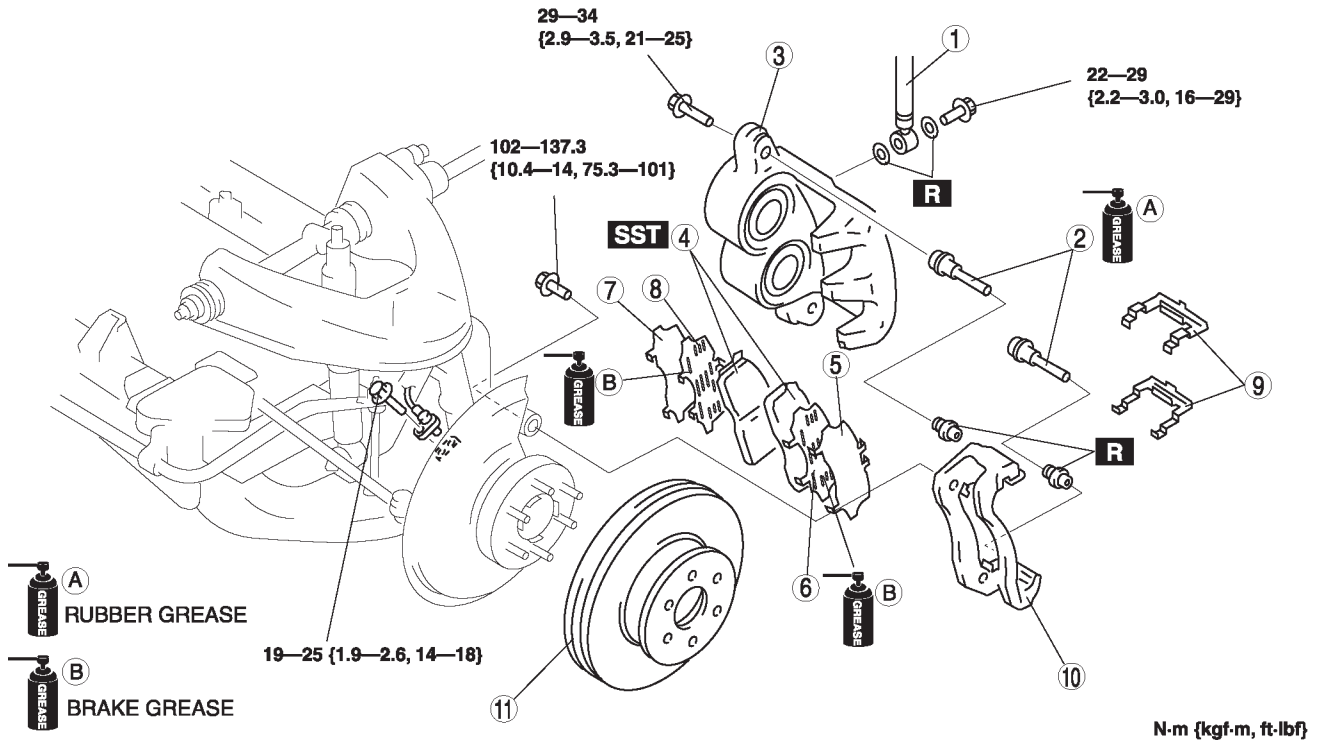
CONVENTIONAL BRAKE SYSTEM

FRONT BRAKE (DISC) REMOVAL/INSTALLATION (4X4) (VEHICLES BUILT FROM 08/2002)

Caution

- Performing the following procedures without first removing the ABS wheel-speed sensor may possibly cause an open circuit in the harness if it is pulled by mistake. Before performing the following procedures, remove the ABS wheel-speed sensor (axle side) and fix it to an appropriate place where the sensor will not be pulled by mistake while the vehicle is being serviced.

- Remove in the order indicated in the table.
- Install in the reverse order of removal.
- After installation, depress the pedal a few times, rotate the wheel by hand, and verify that the brake does not drag.



1	Flexible hose
2	Guide pin
3	Caliper
4	Disc pad (See Disc Pad Installation Note)
5	Outer shim (cover shim) (See Outer Shim, Inner shim Installation Note)
6	Outer shim (rubber coated shim) (See Outer Shim, Inner shim Installation Note)

7	Inner shim (cover shim) (See Outer Shim, Inner shim Installation Note)
8	Inner shim (rubber coated shim) (See Outer Shim, Inner shim Installation Note)
9	Guide plate (See Guide Plate Removal Note)
10	Mounting support
11	Disc plate (See Disc Plate Removal Note) (See Disc Plate Installation Note)

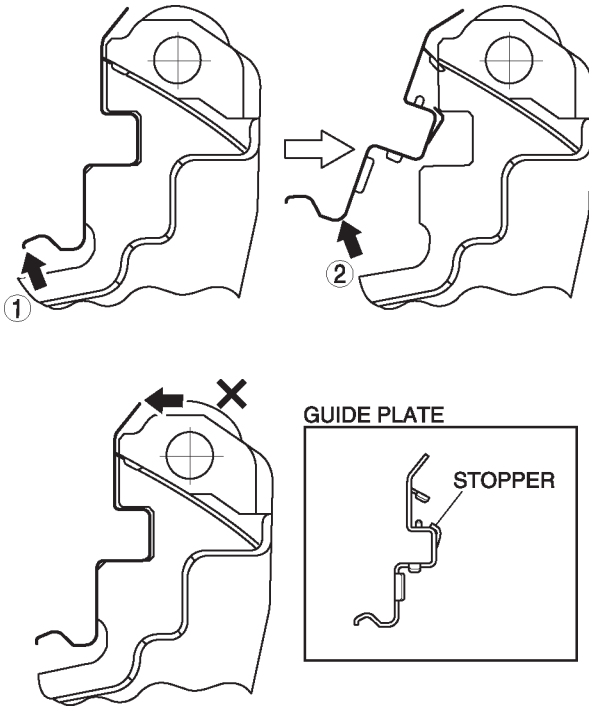
CONVENTIONAL BRAKE SYSTEM

Guide Plate Removal Note

1. Pull up and at a slant on the supporting part of the guide plate in the direction indicated by the arrow (1) and (2) as shown in the figure, to remove the guide plate from the mounting support.

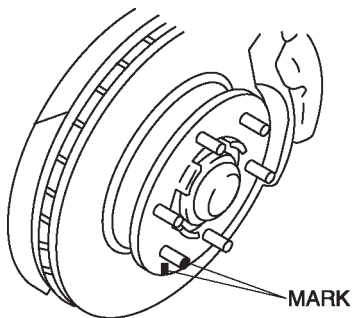
Caution

- If the guide plate is removed by pulling in the direction indicated by the arrow as shown in the figure, the stopper may be deformed and not able to be reused. Do not remove in this manner



Disc Plate Removal Note

1. Mark the wheel hub bolt and disc plate before removal for reference during installation.

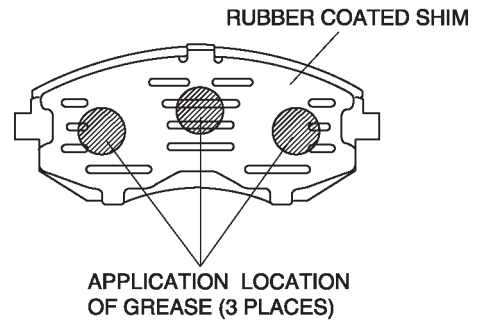


Disc Plate Installation Note

1. Remove any rust or grime on the contact face of the disc plate and wheel hub.
2. Install the disc plate and align the marks made before removal.

Outer Shim, Inner shim Installation Note

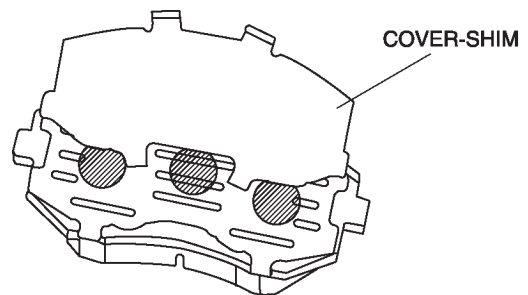
1. Assemble the rubber coated shim to the back plate of the disc pad.
2. Apply brake grease to the rubber coated shim as shown in the figure.



3. Assemble the cover-shim to the grease-applied rubber coated shim.

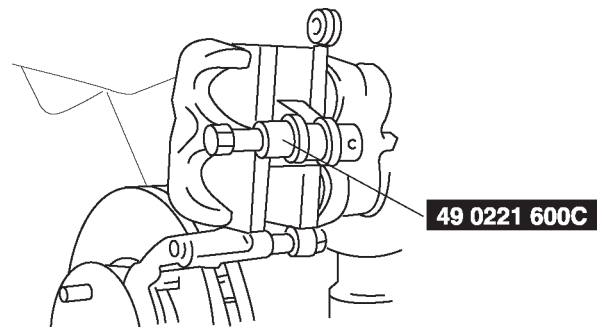
Caution

- Be careful not to get any grease on the pad lining surface.



Disc Pad Installation Note

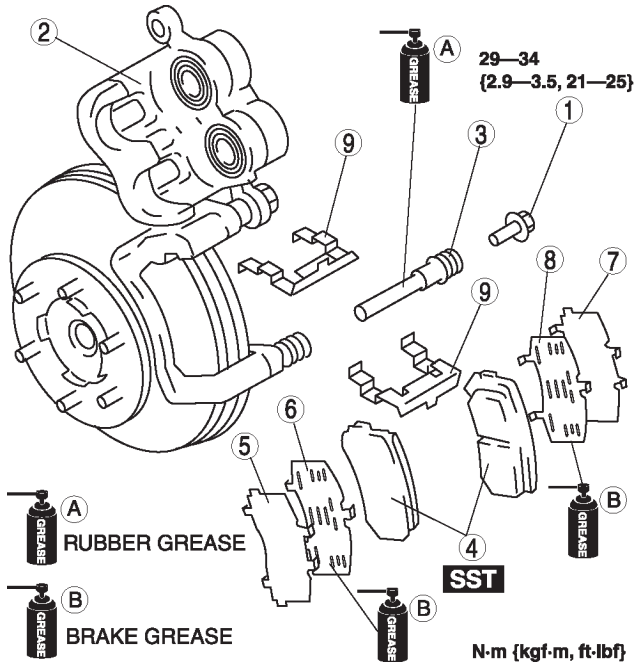
1. Push the piston fully inward using the SST.
2. Install the disc pad.



CONVENTIONAL BRAKE SYSTEM

DISC PAD (FRONT) REPLACEMENT (4X4) (VEHICLES BUILT FROM 08/2002)

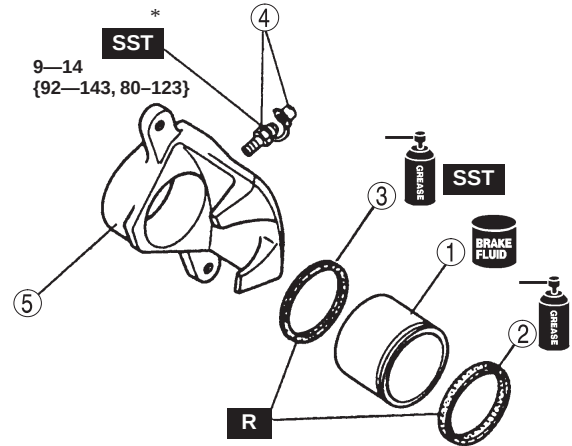
1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.



1	Bolt
2	Caliper
3	Guide pin
4	Disc pad (See Disc Pad Installation Note)
5	Outer shim (cover shim) (See Outer Shim, Inner shim Installation Note)
6	Outer shim (rubber coated shim) (See Outer Shim, Inner shim Installation Note)
7	Inner shim (cover shim) (See Outer Shim, Inner shim Installation Note)
8	Inner shim (rubber coated shim) (See Outer shim, Inner shim Installation Note)
9	Guide plate (See Guide Plate Removal Note)

CALIPER (FRONT) DISASSEMBLY/ASSEMBLY (VEHICLES BUILT UP TO 07/2002)

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



*49 0259 770B

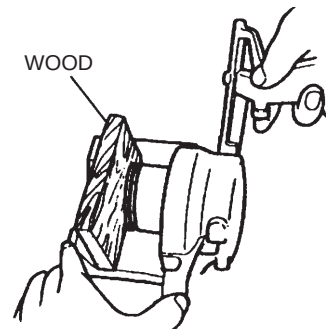
N·m {kgf·cm, in·lbf}

1	Piston + Disassembly Note
2	Dust seal
3	Piston seal + Disassembly Note
4	Bleeder cap, screw
5	Caliper body

Piston Disassembly Note

Caution

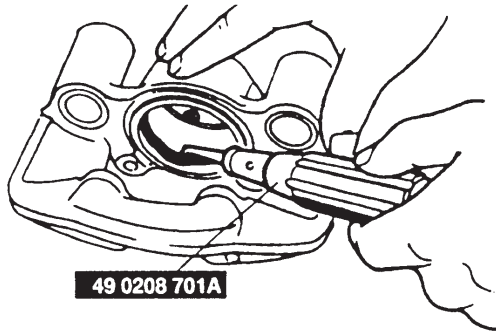
- Blow the compressed air slowly to prevent the piston from suddenly popping out.
- Place a piece of wood in the caliper, then blow compressed air through the hole to force the piston out of the caliper.



CONVENTIONAL BRAKE SYSTEM

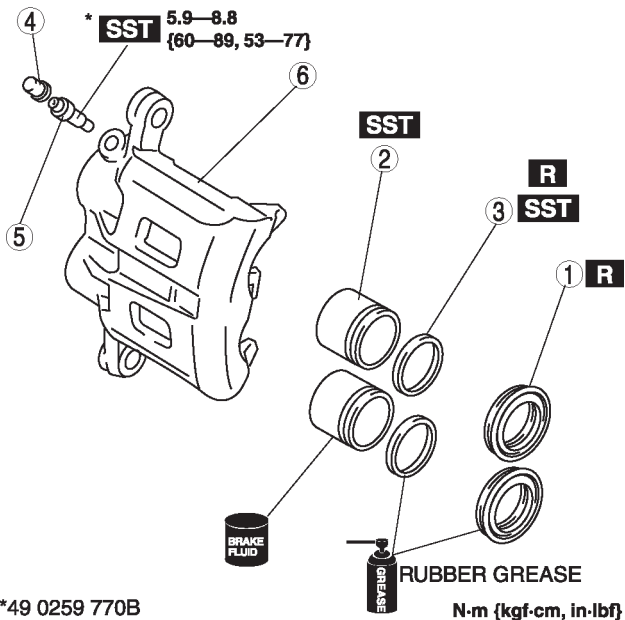
Piston Seal Disassembly Note

- Remove the piston seal from the brake caliper using the SST.



CALIPER (FRONT) DISASSEMBLY/ASSEMBLY (4X4) (VEHICLES BUILT FROM 08/2002)

- Disassemble in the order indicated in the table.
- Assemble in the reverse order of removal.



*49 0259 770B

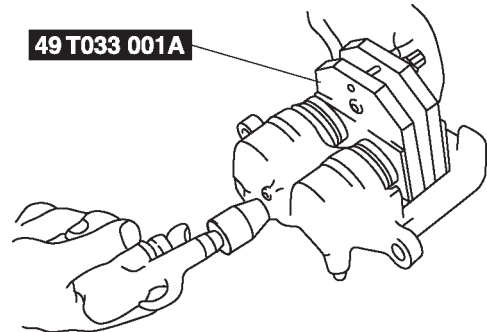
1	Dust seal
2	Piston (See Piston Disassembly Note)
3	Piston seal (See Piston Seal Disassembly Note)
4	Bleeder cap
5	Bleeder screw
6	Caliper

Piston Disassembly Note

Caution

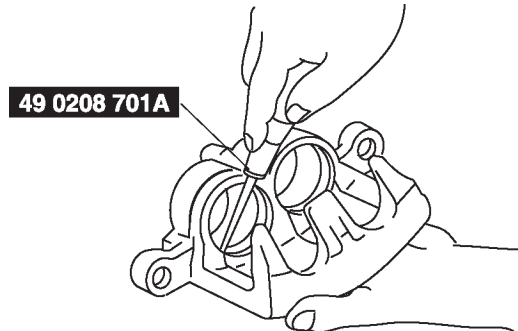
- Blow the compressed air slowly to prevent the piston from suddenly popping out.

- Place the SST in the caliper, then blow compressed air through the hole to force the piston out of the caliper.



Piston Seal Disassembly Note

- Remove the piston seal from the brake caliper using the SST.



CONVENTIONAL BRAKE SYSTEM

REAR BRAKE (DRUM) INSPECTION

Brake Lining Thickness Inspection

1. Remove the brake drum.
2. Inspect the remaining thickness of the lining.

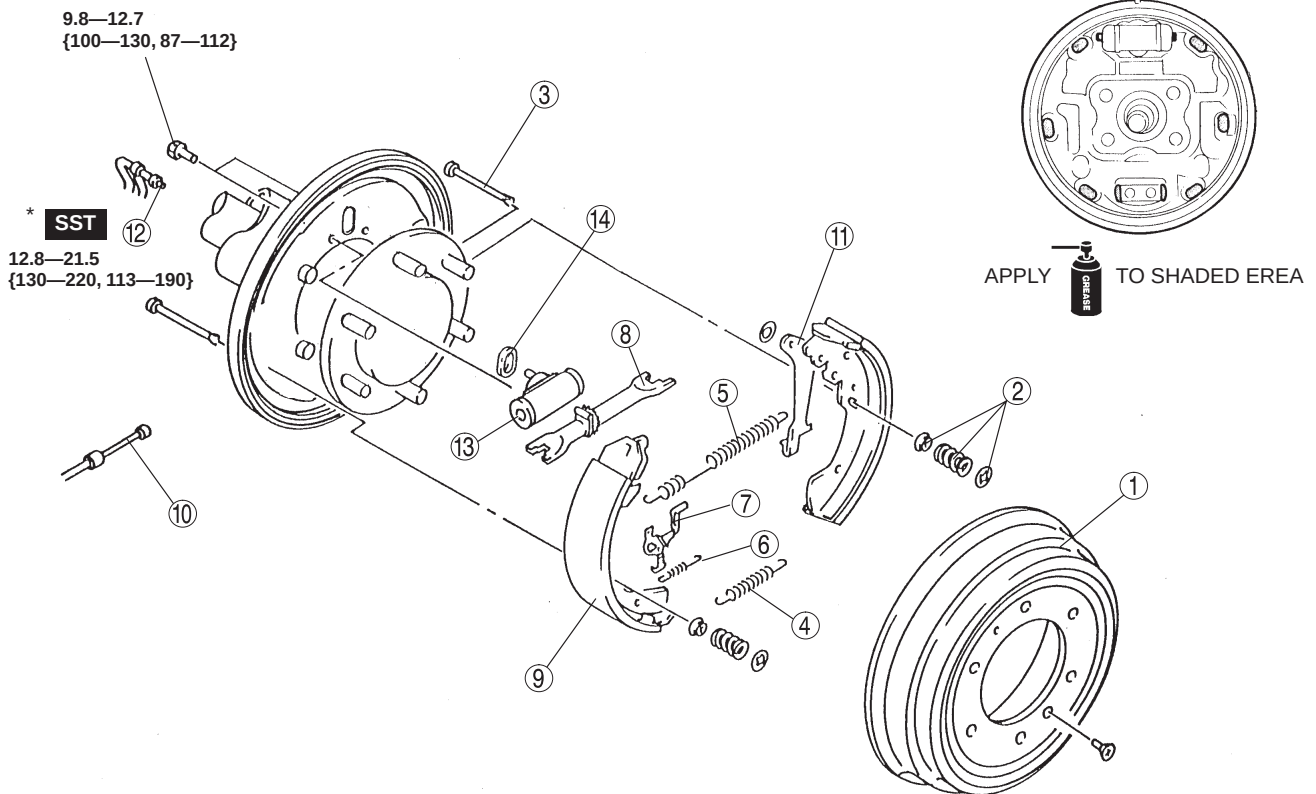
Thickness

1.0 mm {0.04 in} min.

3. Replace both left and right brake shoes if either is at or less than the minimum thickness.

REAR BRAKE (DRUM) REMOVAL/INSTALLATION

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.
3. After installation.
 - (1) Depress the brake pedal a few times, then verify that the brakes do not drag.
 - (2) Inspect the parking brake lever stroke. (Refer to PARKING BRAKE SYSTEM, PARKING BRAKE (STICK TYPE) INSPECTION, Parking Brake Lever Stroke Inspection.)



1	Brake drum
2	Hold spring, washer
3	Hold pin
4	Lower return spring
5	Upper return spring
6	Pawl lever spring
7	Pawl lever

8	Adjust strut
9	Brake shoe
10	Parking brake cable
11	Operating lever
12	Brake pipe
13	Wheel cylinder
14	Gasket

CONVENTIONAL BRAKE SYSTEM

BRAKE DRUM INSPECTION

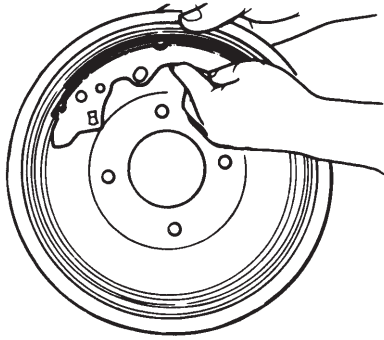
1. Measure the inner diameter of the drum.

Maximum diameter

4 × 2: 271.5 mm {10.68 in}

4 × 4: 296.5 mm {11.67 in}

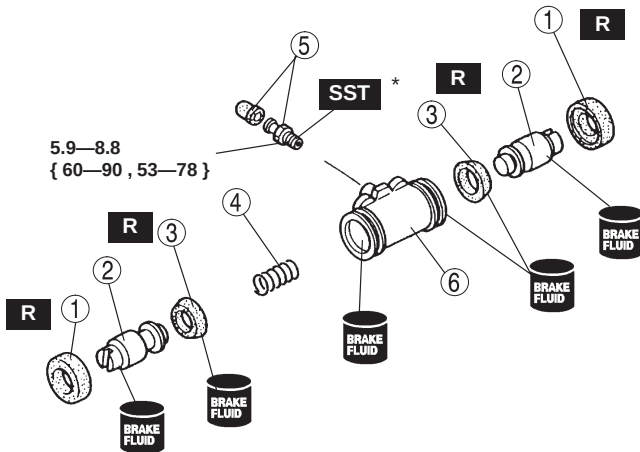
2. Apply chalk to the inside of the brake drum.
3. Inspect for scratches and uneven or abnormal wear inside the drum as shown in the figure.



4. Repair or replace the drum as necessary. Repair if the problem is minor.
5. When repairing or replacing the drum, check the contact with the shoes.
6. Wipe the chalk off after inspection.

WHEEL CYLINDER DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



* 49 0259 770B

N·m { kgf·cm , in·lbf }

1	Dust boot
2	Piston
3	Piston cap
4	Spring
5	Bleeder cap, screw
6	Cylinder body

PARKING BRAKE SYSTEM

PARKING BRAKE (STICK TYPE) INSPECTION

Parking Brake Lever Stroke Inspection

1. Pull the parking brake lever a few times.
2. Verify that the stroke is within the specification when the parking brake lever is pulled with a force of 98 N {10 kgf, 22 ibf}.

Stroke

1—7 notches

3. If not as specified, adjust the parking brake lever stroke.

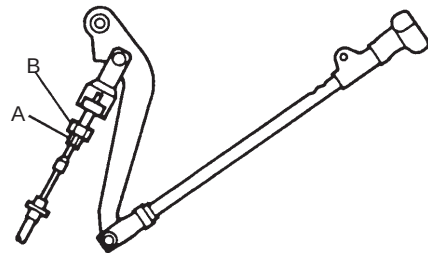
PARKING BRAKE (STICK TYPE) ADJUSTMENT

Parking Brake Lever Stroke Adjustment

1. Before adjustment, depress the brake pedal several times while the vehicle is moving in reverse.
2. Loosen the locknut A and turn the adjustment nut B so that the stroke is within the above range.
3. After adjustment, tighten the locknut A.

Tightening torque

6.9—9.8 N·m {70—100 kgf·cm, 43—86 in·lbf}

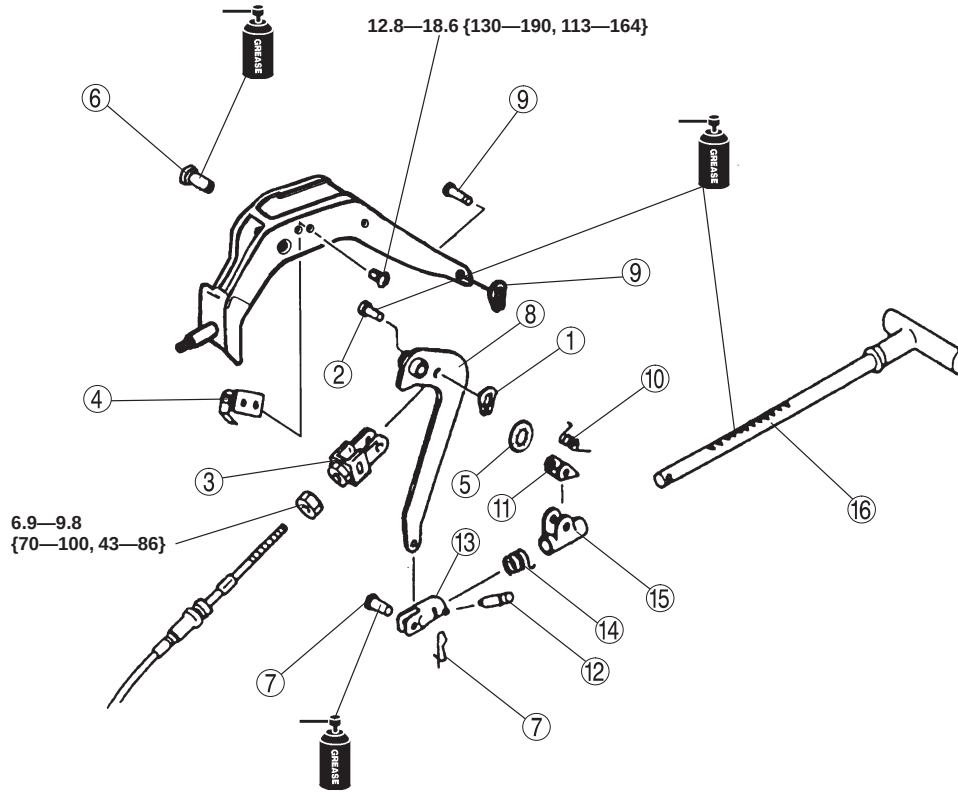


4. After adjustment, inspect the following points.
 - (1) Turn the ignition (engine) switch on, pull the parking brake lever one notch, and verify that the brake warning light illuminates.
 - (2) Verify that the rear brakes do not drag when the wheels are turned by hand.

PARKING BRAKE SYSTEM

PARKING BRAKE LEVER (STICK TYPE) REMOVAL/INSTALLATION

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.
3. After installation, inspect the parking brake lever stroke. (Refer to PARKING BRAKE SYSTEM, PARKING BRAKE (STICK TYPE) INSPECTION.)



N·m {kgf·cm, in·lbf}

1	Clip
2	Joint pin
3	Cable connector
4	Parking brake switch
5	Clip
6	Pin
7	Clip and joint pin
8	Lever

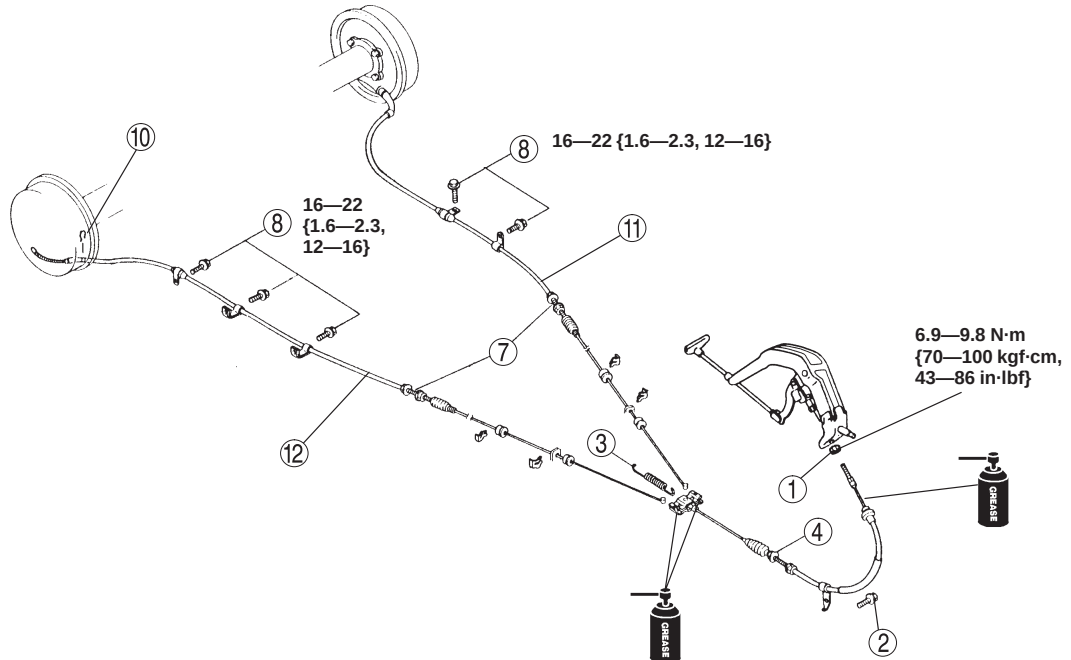
9	Pin and clip
10	Spring
11	Ratchet pawl
12	Stopper
13	Fork joint
14	Spring
15	Guide
16	Rod

PARKING BRAKE SYSTEM

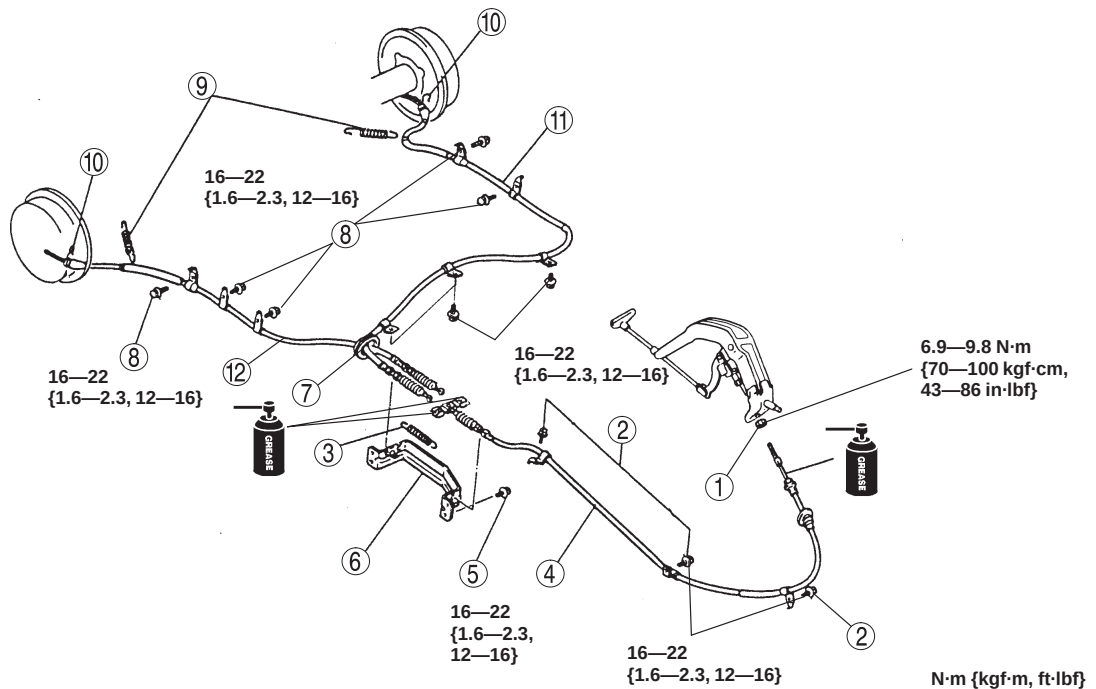
PARKING BRAKE CABLE (STICK TYPE) REMOVAL/INSTALLATION

1. Remove the under guard. (Refer to section F1–F2, FUEL SYSTEM, FUEL TANK REMOVAL/INSTALLATION.)
2. Remove in the order indicated in the table.
3. Install in the reverse order of removal.
4. After installation, inspect the parking brake lever stroke. (Refer to PARKING BRAKE SYSTEM, PARKING BRAKE (STICK TYPE) INSPECTION.)

4x2



4x4



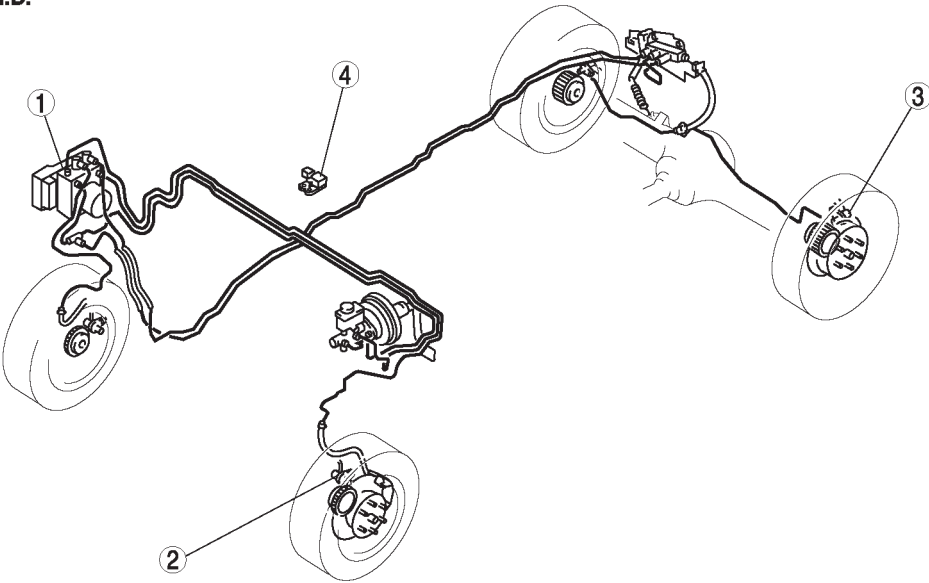
1	Nut
2	Bolt
3	Spring
4	Front brake cable
5	Bolt (4 × 4)
6	Bracket (4 × 4)

7	Grommet
8	Bolt
9	Spring (4 × 4)
10	Clip
11	Rear cable (left)
12	Rear cable (right)

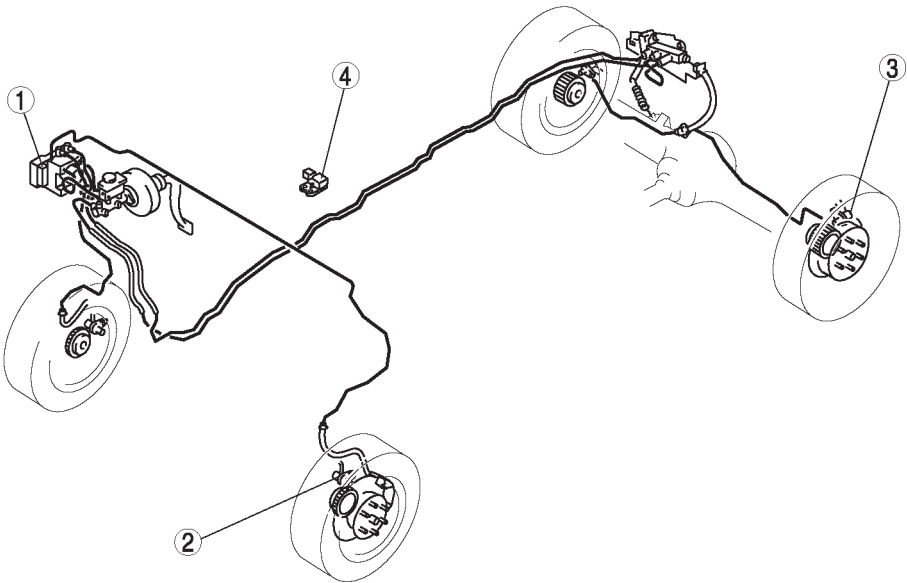
ANTILOCK BRAKE SYSTEM

ABS LOCATION INDEX

L.H.D.



R.H.D.



1	ABS HU/CM (See ABS HU/CM SYSTEM INSPECTION) (See ABS HU/CM REMOVAL/ INSTALLATION) (See ABS HU/CM INSPECTION)
2	ABS wheel speed (front) (See FRONT ABS WHEEL-SPEED SENSOR REMOVAL/INSTALLATION) (See FRONT ABS WHEEL-SPEED SENSOR INSPECTION)

3	ABS wheel speed sensor (rear) (See REAR ABS WHEEL-SPEED SENSOR REMOVAL/INSTALLATION) (See REAR ABS WHEEL-SPEED SENSOR INSPECTION)
4	G sensor (4x4) (See G SENSOR REMOVAL/INSTALLATION) (See G SENSOR INSPECTION)

ANTILOCK BRAKE SYSTEM

ABS HU/CM SYSTEM INSPECTION

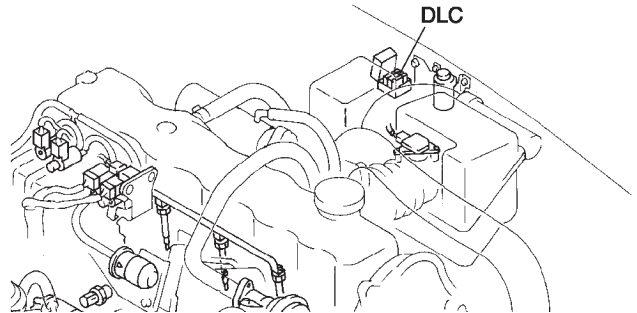
System Inspection

Preparation

1. Verify that the battery is fully charged. With the ignition switch (engine switch) on, verify that the ABS warning lights goes out after **3 seconds**.
2. If the lights stays on after **3 seconds** elapse, the ABS HU/CM detects a failure. Follow the troubleshooting procedures.
3. Turn the ignition switch (engine switch) off.
4. Jack up the vehicle on level ground and support it evenly on safety stands. Shift the transmission to N position.
5. Release the parking brake.
6. Rotate the wheels by hand, and inspect for brake–drag.

Using the SST (WDS or equivalent)

1. Perform the “Preparation.” (See Preparation.)
2. Connect the **SST** (WDS or equivalent) to the data link connector (DLC).
3. Set up an active command mode inspection according to the combination of commands below. (See ABS ON–BOARD DIAGNOSTIC.)



OPERATION	COMMAND NAME			COMMAND TYPE
	PMP MOTOR	RF OUTLET	RF INLET	
Pressure retention	OFF	OFF	ON	Manual
Pressure reduction	ON	ON	OFF	

The chart above shows an example of a right wheel inspection.

Note

- When working with two people, one should depress the brake pedal, the other should attempt to rotate the wheel being inspected.

4. Send the command while depressing on the brake pedal and attempting to rotate the wheel being inspected.
5. When pressure is being maintained, and a click sound indicating the solenoid is operating is heard from the ABS HU/CM, confirm that the wheel does not rotate. When pressure is being reduced, and the click sound indicating the solenoid is operating is heard from the ABS HU/CM, confirm that the wheel rotates, even though the brake pedal is being depressed.

Note

- To protect the ABS HU/CM, the solenoid valve used for simulations and the ABS motor stay on for **10 seconds** each time they are switched on.
- Performing the inspections above determines the following.
 - The ABS HU/CM brake lines are normal.
 - The ABS HU/CM hydraulic system is not significantly abnormal.
 - The ABS HU/CM wiring is normal.
- However, the following items cannot be checked.
 - ABS HU/CM input system harness and parts.
 - Extremely small leaks in the ABS HU/CM internal hydraulic system.
 - Unusual intermittent occurrences in the above items.

ANTILOCK BRAKE SYSTEM

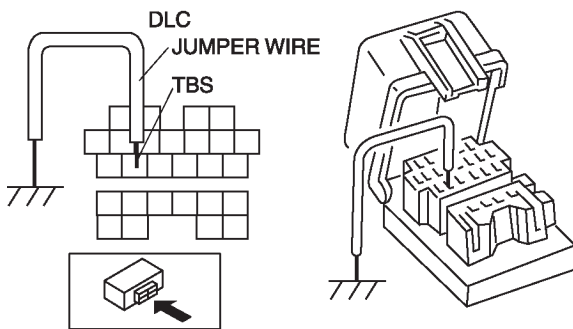
Without using the SST (WDS or equivalent)

1. Perform the "Preparation" (See Preparation.)

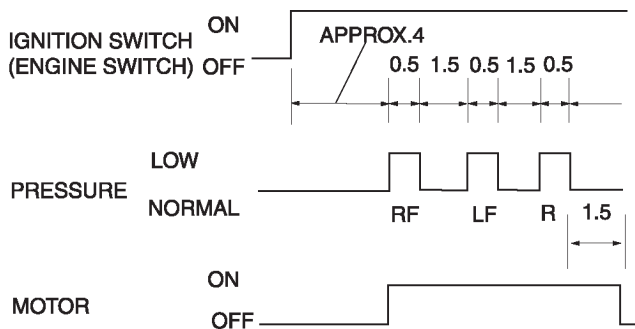
Caution

- Connecting to the wrong data link connector (DLC) terminal may cause a malfunction. Carefully connect only to the specified terminal only.

2. Use a jumper wire to short terminal TBS of the DLC to body ground.
3. Depress the brake pedal, and have an assistant verify that the right front wheel does not turn.
4. With the brake pedal still depressed, turn the ignition switch on and verify that the brake is released momentarily (**approx. 0.5 seconds**) and that the wheel turns when pressure-reduction operates.



5. Inspect the operation of the remaining wheels in order: right front, left front, rear.
 - Replace the ABS HU/CM if wheels do not rotate.
 - Inspect brake piping to ABS HU/CM if operation of the remaining wheel order is not within specified.



Note

- If Steps 4 and 5 show correct operation, the following systems are okay:
 - Brake piping to ABS HU/CM.
 - Braking system, including ABS HU/CM.
 - Electrical system in ABS HU/CM (solenoid, ABS motor, etc.)
- The following are not inspected with above steps:
 - Input system and harness of ABS HU/CM.
 - Intermittent failure.
 - Fluid leakage from brake including the ABS HU/CM and master cylinder.

6. Turn the ignition switch (engine switch) off and remove the jumper wire.

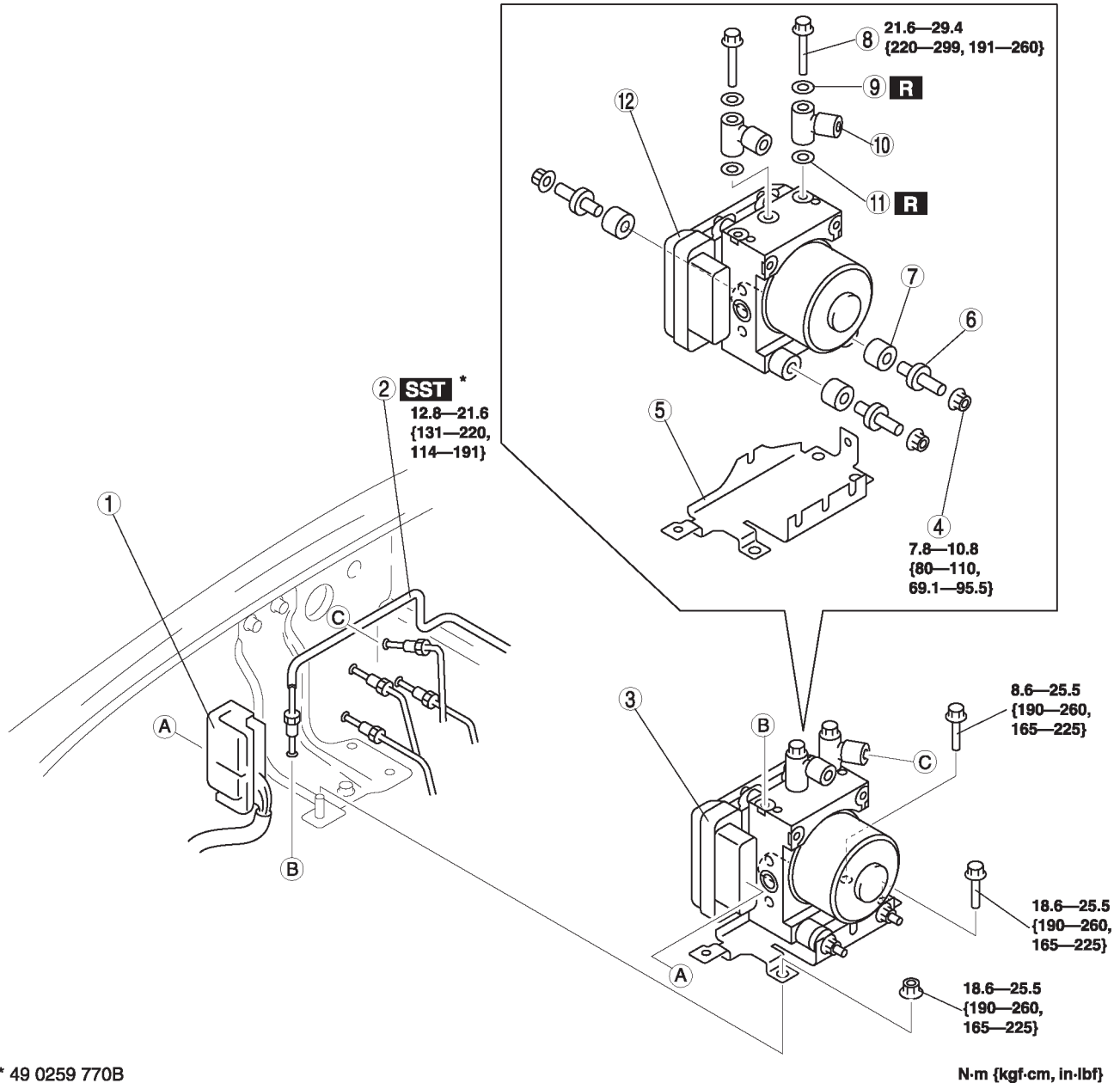
ANTILOCK BRAKE SYSTEM

ABS HU/CM REMOVAL/INSTALLATION

Caution

- Do not drop the ABS HU/CM, Replace it if it is subjected to an impact.

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.



* 49 0259 770B

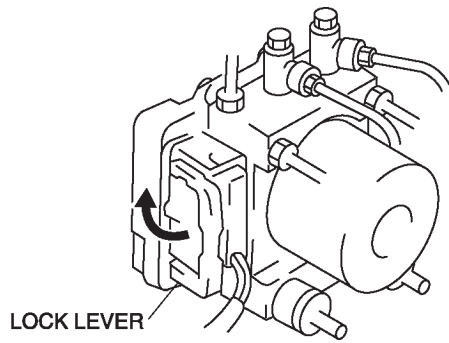
1	Connector (See Connector Removal Note) (See Connector Installation Note)
2	Brake pipe(See Brake Pipe Removal Note)(See Brake Pipe Installation Note)
3	ABS HU/CM component (See ABS HU/CM Removal/Installation Note)
4	Nut
5	Bracket

6	Stud
7	Bushing
8	Joint bolt
9	Gasket
10	Joint (See Joint Installation Note)
11	Gasket
12	ABS HU/CM

ANTILOCK BRAKE SYSTEM

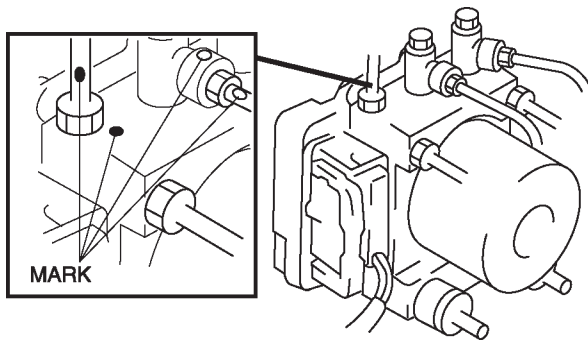
Connector Removal Note

1. Pull the lock lever to disconnect the connector.



Brake Pipe Removal Note

1. Mark the brake pipe connecting positions before removal for reference during installation.

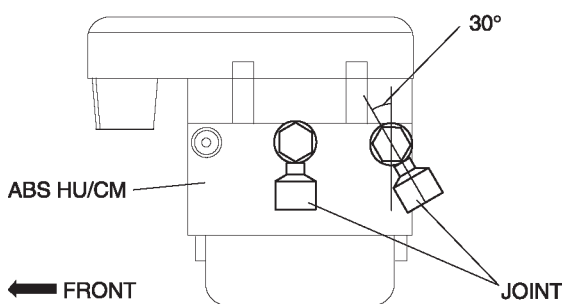


ABS HU/CM Removal/Installation Note

1. When removing/installing the ABS HU/CM from/to the vehicle, attach a strip of protective tape on the ABS HU/CM connector to prevent brake fluid from entering.

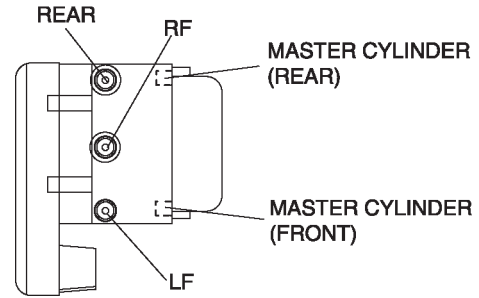
Joint Installation Note

1. Install the Joint with the ABS HU/CM as shown in the figure.



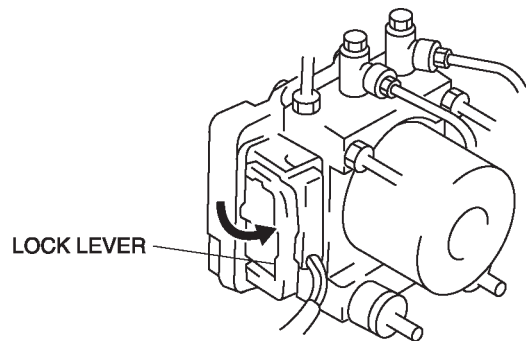
Brake Pipe Installation Note

1. When install the brake pipe, align the marks made before removal with the ABS HU/CM DSC HU as shown in the figure.



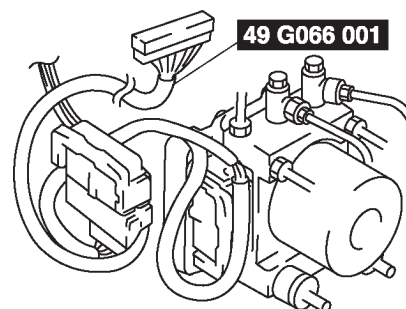
Connector Installation Note

1. Verify that the connection part and waterproof packing are free of foreign material, then connect the connector.
2. Verify that the lock lever is completely pushed in.



ABS HU/CM INSPECTION

1. Disconnect the negative battery cable.
2. Connect the **SST** between the ABS HU/CM and harness connector with the ignition (engine switch) off.
3. Attach the tester leads to the **SST** and inspect voltage referring to the table below.



ANTILOCK BRAKE SYSTEM

Terminal Voltage Table (Reference)

(Engine is idling, and connector is connected unless otherwise indicated)

SST (49 G066 001)					
ADACABAA ZYXWVUTSRQ POMLJIHGFE DCBA 					
Terminal	Signal	Connected to	Test condition	Voltage (V)	Action
A B	RR wheel-speed	RR wheel-speed sensor	Vehicle is stopped.	0 (AC)	- Inspect related harness. - Inspect ABS wheel-speed sensor.
			Inspect using the wave profile. (See Inspection Using An Oscilloscope (Reference))		
C F	LR wheel-speed	LR wheel-speed sensor	Vehicle is stopped.	0 (AC)	
			Inspect using the wave profile. (See Inspection Using An Oscilloscope (Reference))		
C F	LR wheel-speed	LR wheel-speed sensor	Inspect using the wave profile. (See Inspection Using An Oscilloscope (Reference))		
G D	RF wheel-speed	RF wheel-speed sensor	Vehicle is stopped.	0 (AC)	- Inspect related harness. - Inspect ABS wheel-speed sensor.
			Inspect using the wave profile. (See Inspection Using An Oscilloscope (Reference))		
I E	LR wheel-speed	LR wheel-speed sensor	Vehicle is stopped.	0 (AC)	
			Inspect using the wave profile. (See Inspection Using An Oscilloscope (Reference))		
H ^{*1}	G sensor input	G sensor	Vehicle is stopped or driving with constant speed.	2.4–2.6	- Inspect related harness. - Inspect G sensor.
			Vehicle driving with acceleration.	2.5–1.0	
			Vehicle driving with deceleration.	2.5–4.0	
J ^{*1}	G sensor ground	G sensor	–	0	Inspect related harness.
K	–	–	–	–	–
L	–	–	–	–	–
M	–	–	–	–	–
O	–	–	–	–	–
P	–	–	–	–	–
Q	–	–	–	–	–
R	–	–	–	–	–
S	–	–	–	–	–
T	On-board diagnostic	KLN terminal of DLC	–	No need to check	–
U ^{*2}	–	DLC	–	No need to check	–
V	On-board diagnostic	TBS terminal of DLC	–	10–14	Inspect related harness.
Z	Power supply	Ignition switch (engine switch)	–	B+	Inspect related harness.

ANTILOCK BRAKE SYSTEM

Terminal	Signal	Connected to	Test condition	Voltage (V)	Action
AA	Power supply (Solenoid valve)	Battery	—	B+	• Inspect related harness.
AB	Power supply (ABS motor)	Battery	—	B+	• Inspect related harness.
AC	Ground	Ground	—	0	
AD	Ground	Ground	—	0	• Inspect related harness.

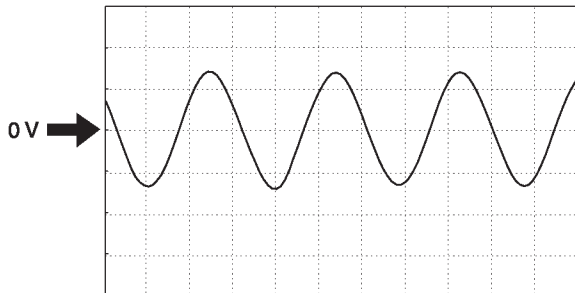
*1: 4x4 only.

*2: Use this terminal at factory only, not used for inspection and repair at field.

Inspection Using An Oscilloscope (Reference)

Wheel speed

- ABS HU/CM terminal:
 RF: G (+)–D (–)
 RR: A (+)–B (–)
 LF: I (+)–E (–)
 LR: C (+)–F (–)
- Oscilloscope setting: 1 VDIV (Y), 2 msDIV (X), AC range.
- Vehicle condition: Driving 30 kmh {18.6 mph}



Note

- As vehicle speed increases, period of wave shortens.
- There is a malfunction in the sensor rotor, the wave profile warps.

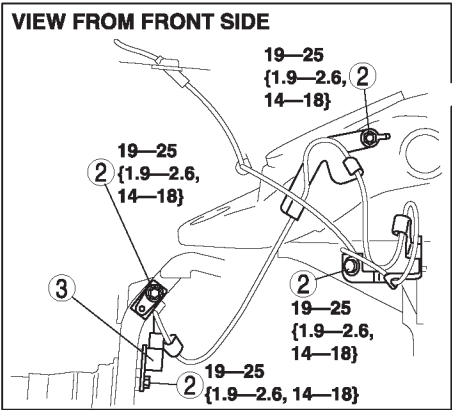
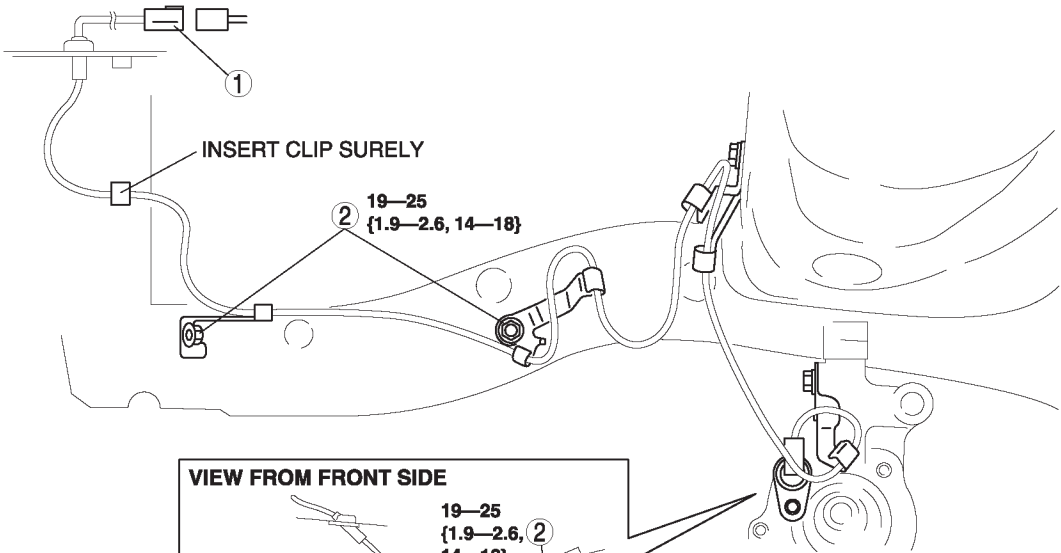
ANTILOCK BRAKE SYSTEM

FRONT ABS WHEEL-SPEED SENSOR REMOVAL/INSTALLATION

- 1. Remove in the order indicated in the table.
- 2. Install in the reverse order of removal.

4x2

VIEW FROM LEFT SIDE



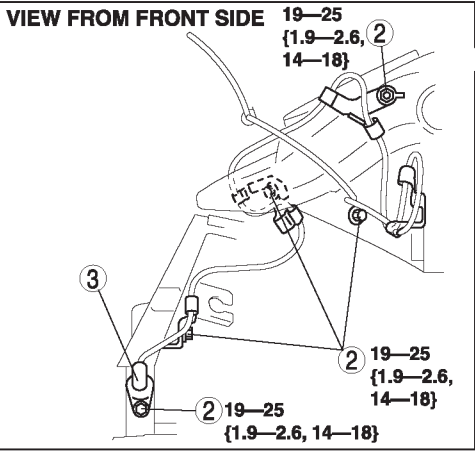
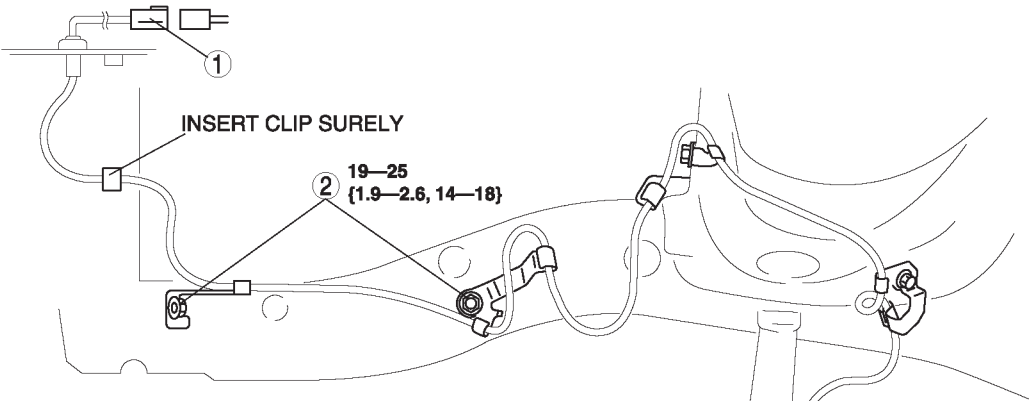
N·m {kgf·m, ft·lbf}

1	Connector
2	Bolt

3	Front ABS wheel-speed sensor
---	------------------------------

4x4

VIEW FROM LEFT SIDE



N·m {kgf·m, ft·lbf}

1	Connector
2	Bolt

3	Front ABS wheel-speed sensor
---	------------------------------

FRONT ABS WHEEL-SPEED SENSOR INSPECTION

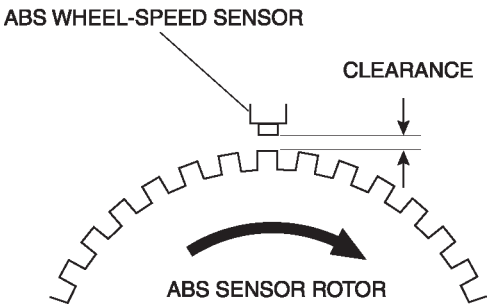
Visual Inspection

1. Remove the wheel and tire, and inspect the sensor for looseness and damage. Replace the sensor if necessary.

Clearance Inspection

1. Inspect the clearance between the wheel-speed sensor and the sensor rotor.

Clearance
0.3-1.1 mm {0.012-0.043 in}



Resistance Inspection

1. Disconnect the ABS wheel-speed sensor connector.
2. Inspect the resistance at the ABS wheel-speed sensor.
 - If not as specified, replace the ABS wheel-speed sensor.

Resistance
1.2-1.6 kilohm

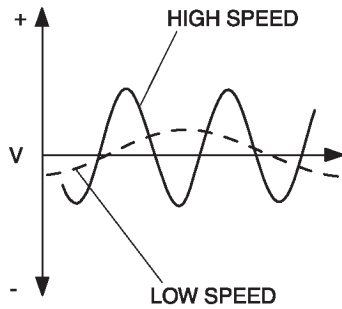
Voltage Inspection

1. Jack up the vehicle on level ground and support it evenly on safety stands.
2. Disconnect the ABS wheel-speed sensor connector.
3. Inspect each sensor by rotating each wheel one revolution per second.
 - If not as specified, replace the ABS wheel-speed sensor.

Voltage
0.15-1.2 V (AC)

Voltage Pattern Inspection

1. Jack up the vehicle on level ground and support it evenly on safety stands.
2. Disconnect the ABS wheel-speed sensor connector.
3. Using an oscilloscope, inspect voltage pattern for distortion and noise by rotating each wheel.
 - If there is distortion or noise, inspect the ABS sensor rotor.

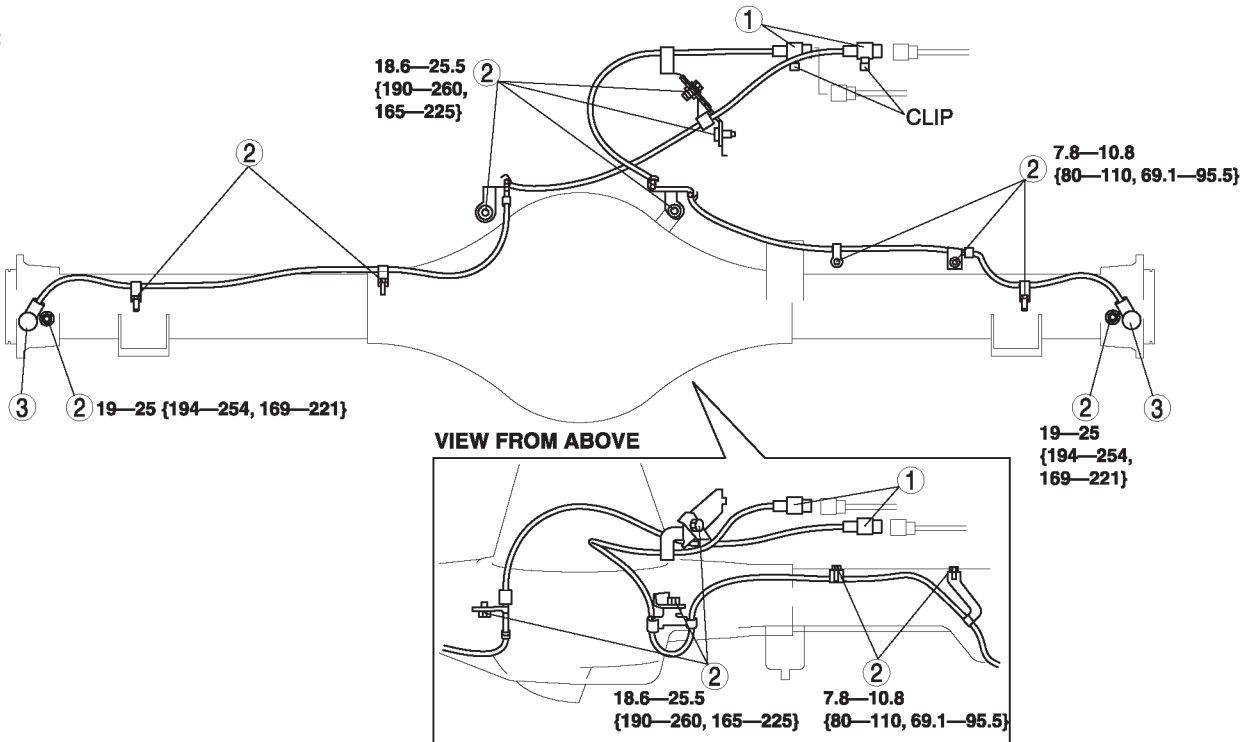


ANTILOCK BRAKE SYSTEM

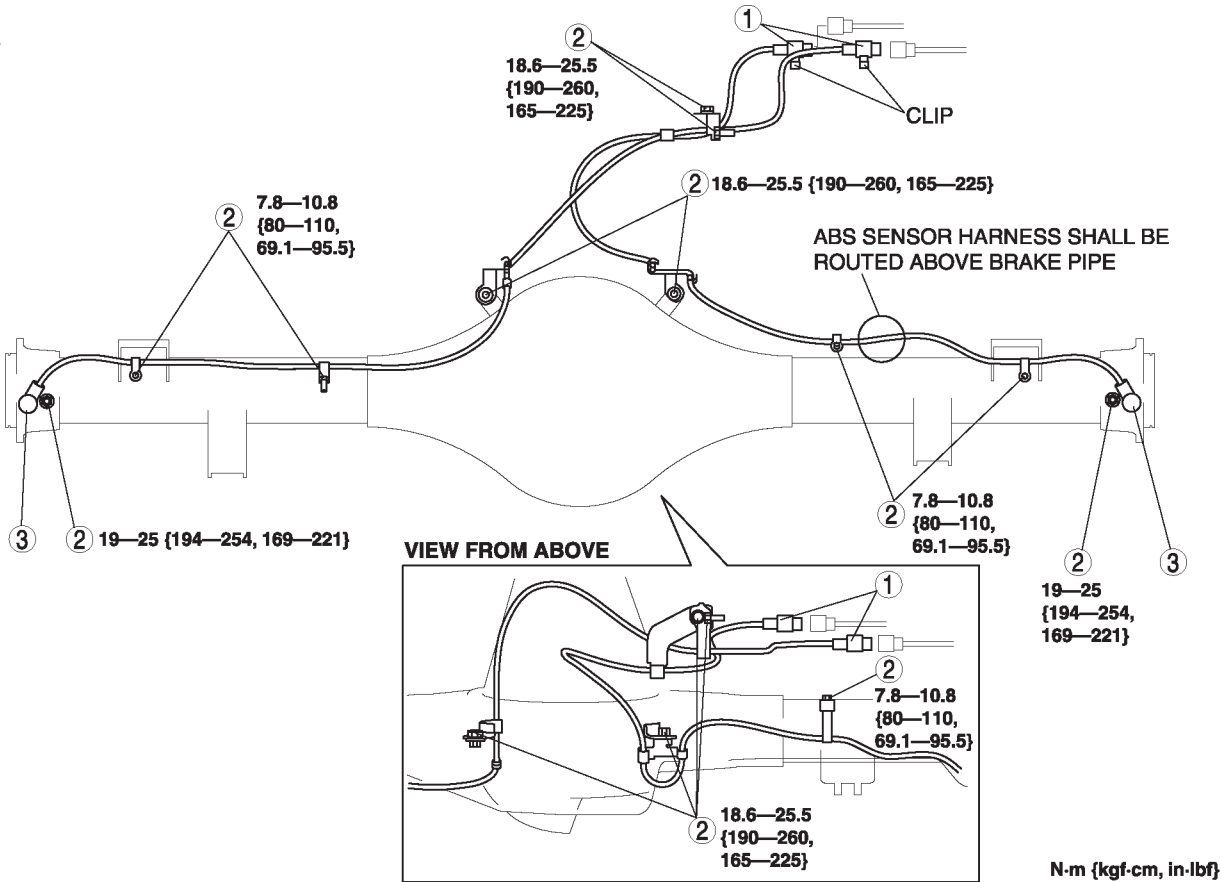
REAR ABS WHEEL-SPEED SENSOR REMOVAL/INSTALLATION

- 1. Remove in the order indicated in the table.
- 2. Install in the reverse order of removal.

4x2



4x4



1	Connector
2	Bolt

3	Rear ABS wheel-speed sensor
---	-----------------------------

REAR ABS WHEEL-SPEED SENSOR INSPECTION

Visual Inspection

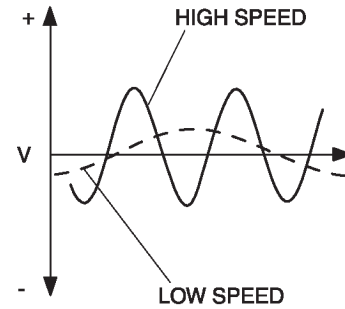
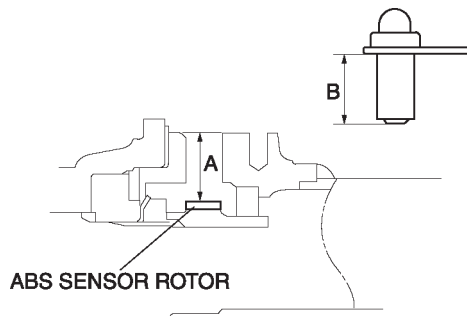
1. Inspect the sensor for looseness and damage.
Replace the sensor if necessary.

Clearance Inspection

1. Remove the ABS wheel-speed sensor.
2. Measure the length A and B shown in the figure using vernier calipers.
3. Subtract B from A then verify the clearance between the wheel-speed sensor and the sensor rotor.

Clearance

0.3–1.1mm {0.012–0.043 in}



Resistance Inspection

1. Disconnect the ABS wheel-speed sensor connector.
2. Inspect the resistance at the ABS wheel-speed sensor.
 - If not as specified, replace the ABS wheels-peed sensor..

Resistance

1.2–1.6 kilohm

Voltage Inspection

1. On level ground, jack up the vehicle and support it evenly on safety stands.
2. Disconnect the ABS wheel-speed sensor connector.
3. Inspect each sensor by rotating each wheel one revolution per second.
 - If not as specified, replace the ABS wheel-speed sensor.

Voltage

0.15–1.2 V (AC)

Voltage Pattern Inspection

1. Jack up the vehicle on level ground and support it evenly on safety stands.
2. Disconnect the ABS wheel-speed sensor connector.
3. Using an oscilloscope, inspect voltage pattern for distortion and noise by rotating each wheel.
 - If there is distortion or noise, inspect the ABS sensor rotor.

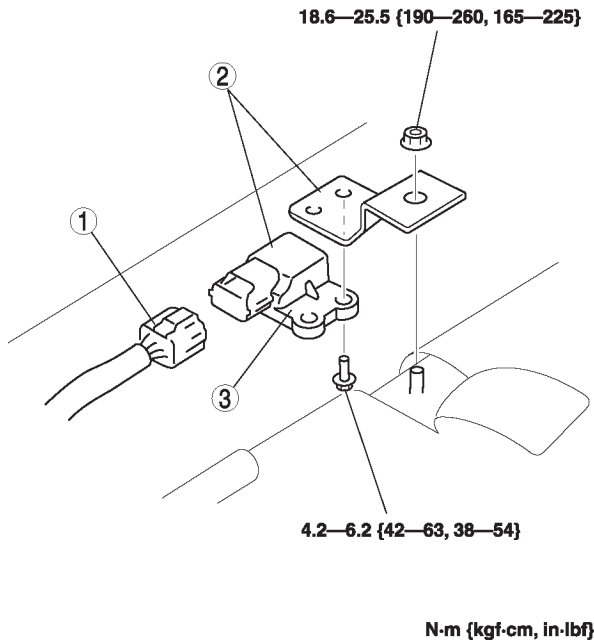
ANTILOCK BRAKE SYSTEM

G SENSOR REMOVAL/INSTALLATION

Caution

- Do not drop the G sensor. Replace it if it is subjected to an impact.

- Slide the RH front seat fully backward.
- Remove in the order indicated in the table.



1	Connector
2	G sensor and bracket
3	G sensor

- Install in the reverse order of removal.

G SENSOR INSPECTION

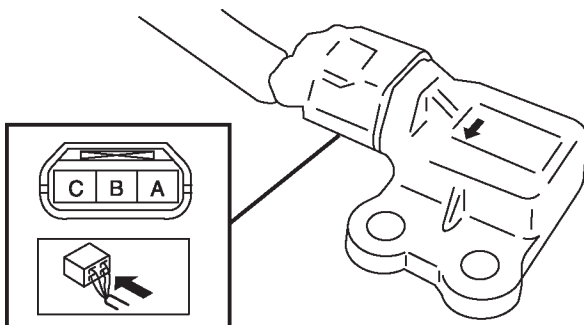
- Connect the connector.
- Turn ignition switch (engine switch) on, and verify the voltage between terminals A and B under the following conditions.

- If not within the specification, replace the G sensor.

- Horizontal

Voltage

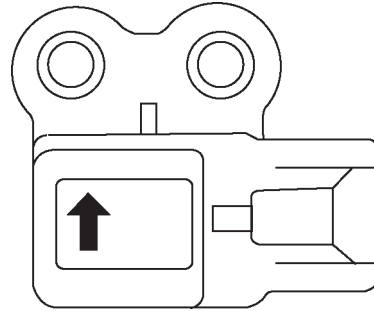
2.4–2.6 V



- Facing up (inclined 90° from horizontal)

Voltage

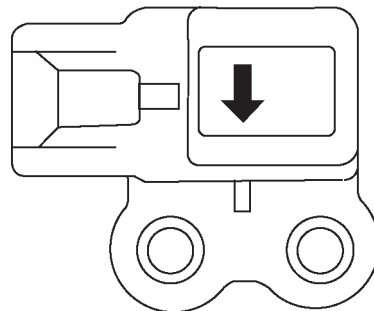
1.3–1.7 V



- Facing down (declined 90° from horizontal)

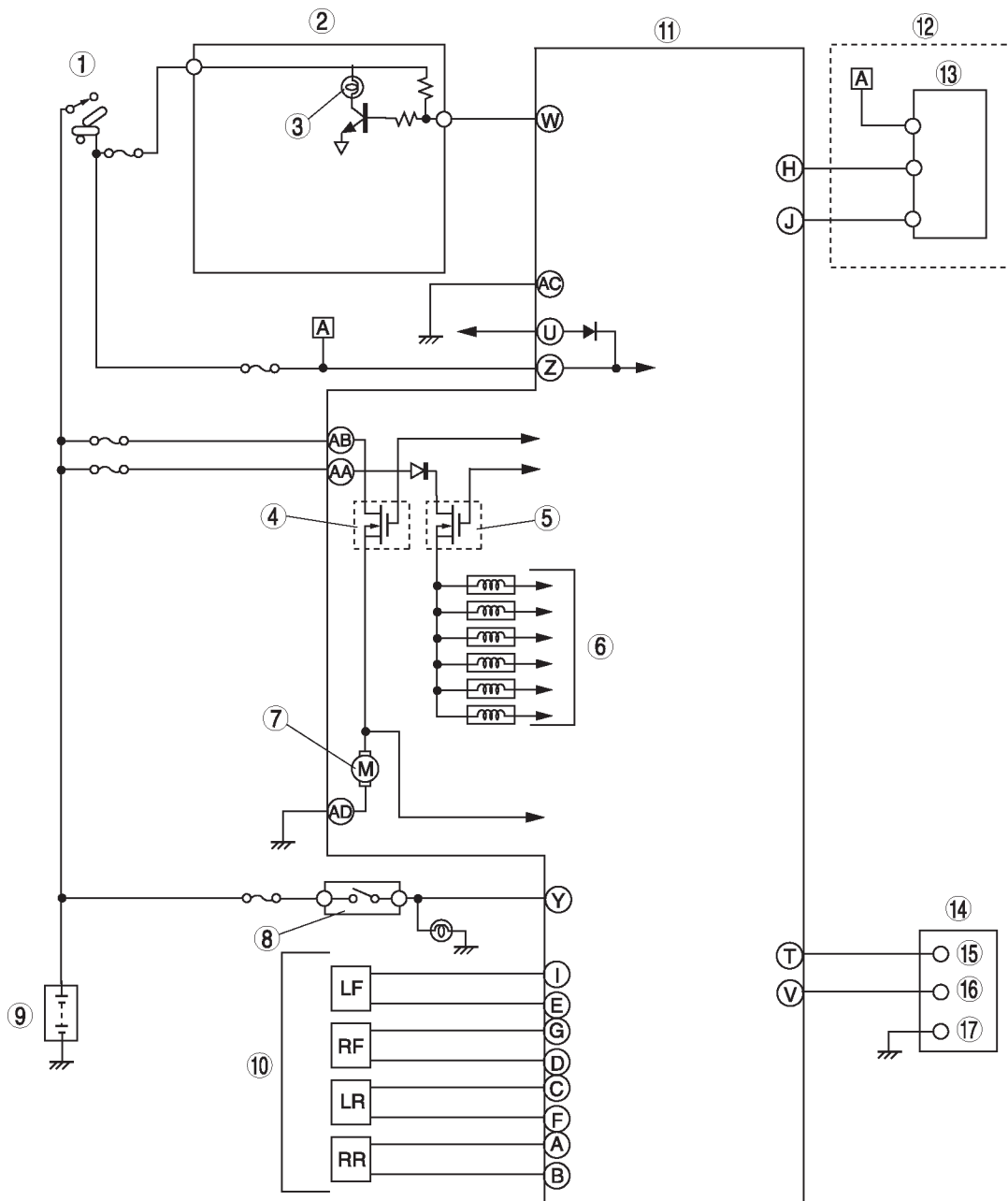
Voltage

3.3–3.7 V



ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

ABS SYSTEM DIAGRAM



1	Ignition switch (engine switch)
2	Instrument cluster
3	ABS warning light
4	ABS motor relay (FET)
5	Valve relay (FET)
6	Solenoid valve
7	ABS motor
8	Brake switch
9	Battery

10	ABS wheel-speed sensor
11	ABS HU/CM
12	4x4 only
13	G sensor
14	DLC
15	KLN
16	TBS
17	GND

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

ABS ON-BOARD DIAGNOSTIC

On-Board Diagnostic (OBD) Test Description

- The OBD test inspects the integrity and function of the ABS and outputs the results when requested by the specific tests.
- On-board diagnostic test also:
 - Provides a quick inspection of the ABS.
 - Is usually performed at the start of each diagnostic procedure.
 - Provides verification after repairs to ensure that no other faults occurred during service.
- The OBD test is divided into 3 tests:
 - Read/clear diagnostic results, PID monitor and record and active command modes.

Read/clear diagnostic results

- This function allows you to read or clear DTCs in the ABS HU/CM memory.

PID/data monitor and record

- This function allows you to access certain data values, input signals, calculated values, and system status information.

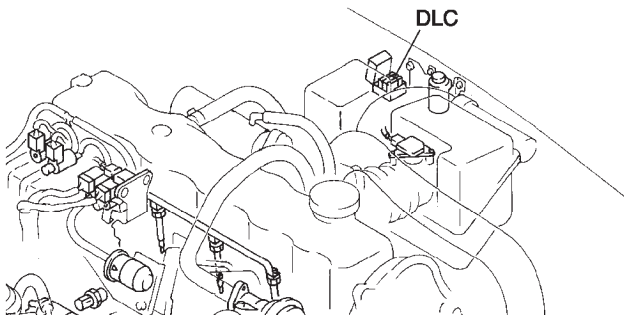
Active command modes

- This function allows you to control devices through the SST (WDS or equivalent).

DTCs Retrieving Procedure

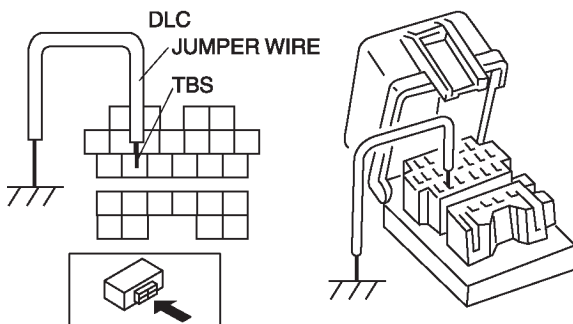
Using SST (WDS or equivalent)

- (1) Connect SST (WDS or equivalent) to the vehicle data link connector (DLC) located in the left side of the engine compartment.
- (2) Retrieve DTC by SST (WDS or equivalent).



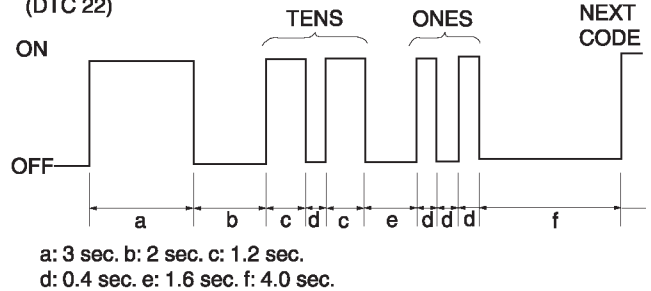
Without using SST (WDS or equivalent)

- (1) Connect the TBS terminal at DLC to body ground using a jumper wire.
- (2) Turn the ignition key (engine key) to ON (engine OFF).



- (3) After the ABS warning light illuminates for **3 seconds**, the ABS warning light indicates DTCs.
- (4) After completion of repairs, clear DTCs.

WARNING LIGHT FLASHING PATTERN (DTC 22)



a: 3 sec. b: 2 sec. c: 1.2 sec.
d: 0.4 sec. e: 1.6 sec. f: 4.0 sec.

Clearing DTCs Procedures

Using SST (WDS or equivalent)

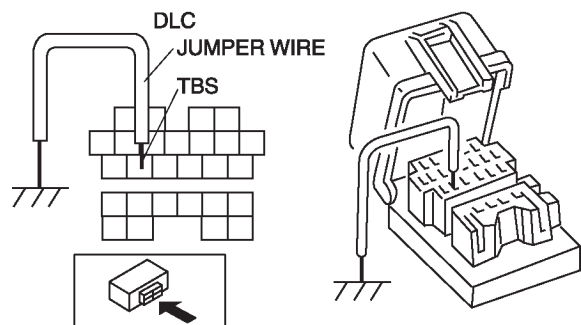
- (1) After repairs have been made, perform the **DTCs reading procedure**.
- (2) Erase DTCs by **SST** (WDS or equivalent).
- (3) Ensure that the customers concern has been resolved.

Without using SST (WDS or equivalent)

Caution

- **Connecting to the wrong DLC terminal may cause a malfunction. Carefully connect only to the specified terminal.**

- (1) Connect the TBS terminal at the DLC to body ground using a jumper wire.
- (2) Turn the ignition key (engine key) to ON (engine OFF).
- (3) Output all stored DTCs.
- (4) After verifying that the first code is repeated, depress the brake pedal **10 times or more** at intervals of less than **1 second**.
- (5) Turn the ignition key (engine key) to OFF and disconnect the jumper wire.



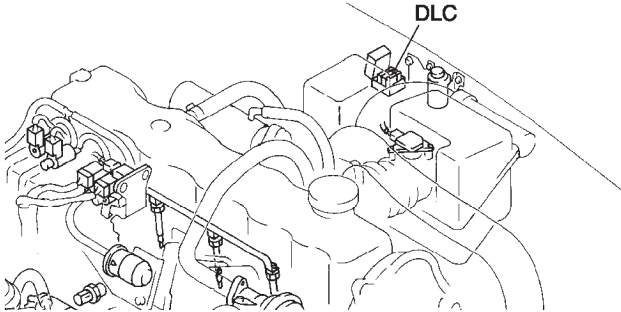
Note

- DTCs cannot be cleared if the following occur:
 - If intervals of depressing the brake pedal exceed **1 second**.
 - The brake switch has failed.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

PID/Data Monitor and Record Procedure

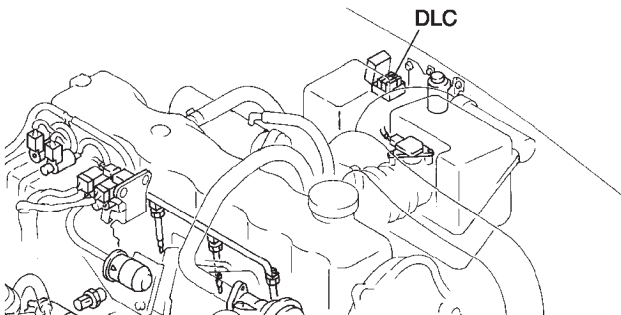
- (1) Connect **SST** (WDS or equivalent) to the vehicle DLC located in the left side of the engine compartment.
- (2) Access and monitor PIDs by **SST** (WDS or equivalent).



Active Command Modes Procedure

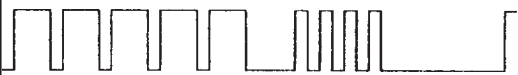
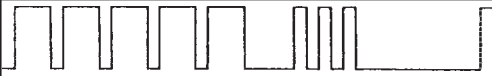
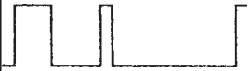
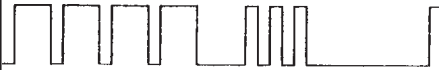
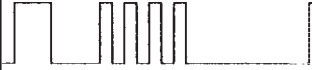
Note

- When driving, the ABS motor and each valve forcibly turn ABS_POWER on, and then each command on. ABS_POWER regulates the power supply for the ABS motor and 6 valves.
- (1) Connect **SST** (WDS or equivalent) to the vehicle DLC located in the left side of the engine compartment.
 - (2) Turn the ignition key (engine key) to ON (Engine OFF) or start engine.
 - (3) Activate active command modes using **SST** (WDS or equivalent).

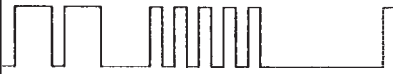
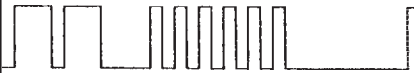


ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

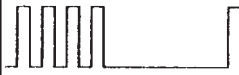
DTC Table

DTC		ABS warning light flashing pattern	Diagnostic system component	Action
SST (WDS or equivalent)	ABS warning light			
B1318	63		ABS HU/CM power supply	(See DTC B1318 (63))
B1342	61		ABS HU/CM	(See DTC B1342 (61))
C1095	54		Motor relay, pump motor	(See DTC C1095 (54), C1096 (53))
C1096	53		Motor relay, pump motor	(See DTC C1095 (54), C1096 (53))
C1140	30		ABS HU/CM (pump)	(See DTC C1140 (30))
C1145	11		Right front ABS wheel-speed sensor	(See DTC C1145 (11), C1155 (12), C1165 (13), C1175 (14))
C1148	41		Right front ABS wheel speed-sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48))
C1155	12		Left front ABS wheel-speed sensor	(See DTC C1145 (11), C1155 (12), C1165 (13), C1175 (14))
C1158	42		Left front ABS wheel-speed sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48))
C1165	13		Right rear ABS wheel-speed sensor	(See DTC C1145 (11), C1155 (12), C1165 (13), C1175 (14))
C1168	43		Right rear ABS wheel speed-sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (57), C1236 (48))
C1175	14		Left rear ABS wheel-speed sensor	(See DTC C1145 (11), C1155 (12), C1165 (13), C1175 (14))
C1178	44		Left rear ABS wheel-speed sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48))

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

DTC		ABS warning light flashing pattern	Diagnostic system component	Action
SST (WDS or equivalent)	ABS warning light			
C1186	51		Valve relay	(See DTC C1186 (51), C1266 (52))
C1194	24		Left front outlet solenoid valve	(See DTC C1194 (24), C1198 (25), C1202 (26), C1206 (27), C1210 (22), C1214 (23))
C1198	25		Left front inlet solenoid valve	(See DTC C1194 (24), C1198 (25), C1202 (28), C1206 (27), C1210 (22), C1214 (23))
C1202	26		R outlet solenoid valve	(See DTC C1194 (24), C1198 (25), C1202 (26), C1206 (27), C1210 (22), C1214 (23))
C1206	27		R inlet solenoid valve	(See DTC C1194 (24), C1198 (25), C1202 (25), C1206 (27), C1210 (22), C1214 (23))
C1210	22		Right front outlet solenoid valve	(See DTC C1194 (24), C1198 (25), C1202 (26), C1206 (27), C1210 (22), C1214 (23))
C1214	23		Right front inlet solenoid valve	(See DTC C1194 (24), C1198 (25), C1202 (26), C1206 (27), C1210 (22), C1214 (23))
C1233	46		Left front wheel-speed sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48))
C1234	45		Right front wheel-speed sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48))
C1235	47		Right rear wheel-speed sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48))

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

DTC		ABS warning light flashing pattern	Diagnostic system component	Action
SST (WDS or equivalent)	ABS warning light			
C1236	48		Left rear wheel-speed sensor/sensor rotor	(See DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48))
C1266	52		Valve relay	(See DTC C1186 (51), C1266 (52))
C1414	64		ABS HU/CM mismatched installation	(See DTC C1414 (64))
C1510	32		Right front solenoid valve, motor or wheel-speed sensor/sensor rotor	(See DTC C1510 (32), C1511 (33), C1512 (34), C1513 (35))
C1511	33		Left front solenoid valve, motor or wheel-speed sensor/sensor rotor	(See DTC C1510 (32), C1511 (33), C1512 (34), C1513 (35))
C1512	34		R solenoid valve, motor or right rear wheel-speed sensor/sensor rotor	(See DTC C1510 (32), C1511 (33), C1512 (34), C1513 (35))
C1513	35		R solenoid valve, motor or left rear wheel-speed sensor/sensor rotor	(See DTC C1510 (32), C1511 (33), C1512 (34), C1513 (35))
C1949*	03*		G sensor	(See DTC C1949 (03), C1950 (04))
C1950*	04*		G sensor	(See DTC C1949 (03), C1950 (04))

* : 4x4 only

PID/DATA Monitor Table

PID Name (Definition)	Unit/Condition	Condition/Specification	Action	ABS HU/CM terminal
ABS_LAMP (ABS warning lamp driver output state)	ON/OFF	- ABS warning light is illuminated: ON. - ABS warning light is not illuminated: OFF.	Inspect ABS warning light.	W
ABS_VOLT (System battery voltage value)	V	- Ignition key at ON: B+ - Idle: Approx. 13–16 V	Inspect power supply circuit. (See ABS HU/CM INSPECTION)	Z

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

PID Name (Definition)	Unit/Condition	Condition/Specification	Action	ABS HU/CM terminal
ABSLF_I (LF ABS inlet valve output state)	ON/OFF	- During ABS control: ON/ OFF (solenoid valve is activated/deactivated.) - Not ABS control: OFF (solenoid valve is deactivated.)	Internal fault of ABS HU/ CM. Replace ABS HU/CM. (See ABS HU/ CM REMOVAL/ INSTALLATION	—
ABSLF_O (LF ABS outlet valve output state)	ON/OFF	- During ABS control: ON/ OFF (solenoid valve is activated/deactivated.) - Not ABS control: OFF (solenoid valve is deactivated.)	Internal fault of ABS HU/ CM. Replace ABS HU/CM. (See ABS HU/ CM REMOVAL/ INSTALLATION	—
ABSPMPRLY (ABS pump motor relay output state)	ON/OFF	- Motor relay is activated: ON. - Motor relay is deactivated: OFF.	Inspect ABS HU/CM. (See ABS HU/CM INSPECTION	—
ABSR_I (R ABS inlet valve output state)	ON/OFF	- During ABS control: ON/ OFF (solenoid valve is activated/deactivated.) - Not ABS control: OFF (solenoid valve is deactivated.)	Internal fault of ABS HU/ CM. Replace ABS HU/CM. (See ABS HU/ CM REMOVAL/ INSTALLATION	—
ABSR_O (R ABS outlet valve output state)	ON/OFF	- During ABS control: ON/ OFF (solenoid valve is activated/deactivated.) - Not ABS control: OFF (solenoid valve is deactivated.)	Internal fault of ABS HU/ CM. Replace ABS HU/CM. (See ABS HU/ CM REMOVAL/ INSTALLATION	—
ABSR_I (RF ABS inlet valve output state)	ON/OFF	- During ABS control: ON/ OFF (solenoid valve is activated/deactivated.) - Not ABS control: OFF (solenoid valve is deactivated.)	Internal fault of ABS HU/ CM. Replace ABS HU/CM. (See ABS HU/ CM REMOVAL/ INSTALLATION	—
ABSRF_O (RF ABS inlet valve output state)	ON/OFF	- During ABS control: ON/ OFF (solenoid valve is activated/deactivated.) - Not ABS control: OFF (solenoid valve is deactivated.)	Internal fault of ABS HU/ CM. Replace ABS HU/CM. (See ABS HU/ CM REMOVAL/ INSTALLATION	—
ABSVLVRLY (ABS valve relay output state)	ON/OFF	- Valve relay is activated: ON. - Valve relay is deactivated: OFF	Inspect ABS HU/CM. (See ABS HU/CM INSPECTION	—
ACCLMTR* (Accelerometer)	ACCELERATION	- Vehicle is stopped or driving at a constant speed: 0 G. - Vehicle is driving at a acceleration: Changes between 0 – –1.28 G. - Vehicle is driving at a deceleration: Changes between 0 – 1.27 G.	Inspect G sensor. (See G SENSOR INSPECTION)	H, J
BOO_ABS (Brake pedal switch)	ON/OFF	- Brake pedal is depressed: ON. - Brake pedal is released: OFF.	Inspect brake switch.	Y

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

PID Name (Definition)	Unit/Condition	Condition/Specification	Action	ABS HU/CM terminal
CCNTABS (Number of continuous trouble code set)	—	- DTC is detected: 1–255. - DTC is not detected: 0.	Perform inspection using appropriate DTC. (See ABS ON-BOARD DIAGNOSTIC)	—
LF_WSPD (LF wheel-speed sensor input)	KPH or MPH	- Vehicle is stopped: 0 KPH {0 MPH}. - Vehicle is driving: Indicates vehicle speed.	Inspect wheel-speed sensor/sensor rotor.	E, I
LR_WSPD (LR wheel-speed sensor input)	KPH or MPH	- Vehicle is stopped: 0 KPH {0 MPH}. - Vehicle is driving: Indicates vehicle speed.	Inspect wheel-speed sensor/sensor rotor.	C, F
PMPSTAT (ABS motor status)	ON/OFF	- Pump motor is activated: ON. - Pump motor is deactivated: OFF	Inspect ABS HU/CM. (See ABS HU/CM INSPECTION)	—
RF_WSPD (RF wheel-speed sensor input)	KPH or MPH	- Vehicle is stopped: 0 KPH {0 MPH}. - Vehicle is driving: Indicates vehicle speed.	Inspect wheel-speed sensor/sensor rotor.	D, G
RR_WSPD (RR wheel-speed sensor input)	KPH or MPH	- Vehicle is stopped: 0 KPH {0 MPH}. - Vehicle is driving: Indicates vehicle speed.	Inspect wheel-speed sensor/sensor rotor.	A, B

* : 4x4 only

Active Command Modes Table

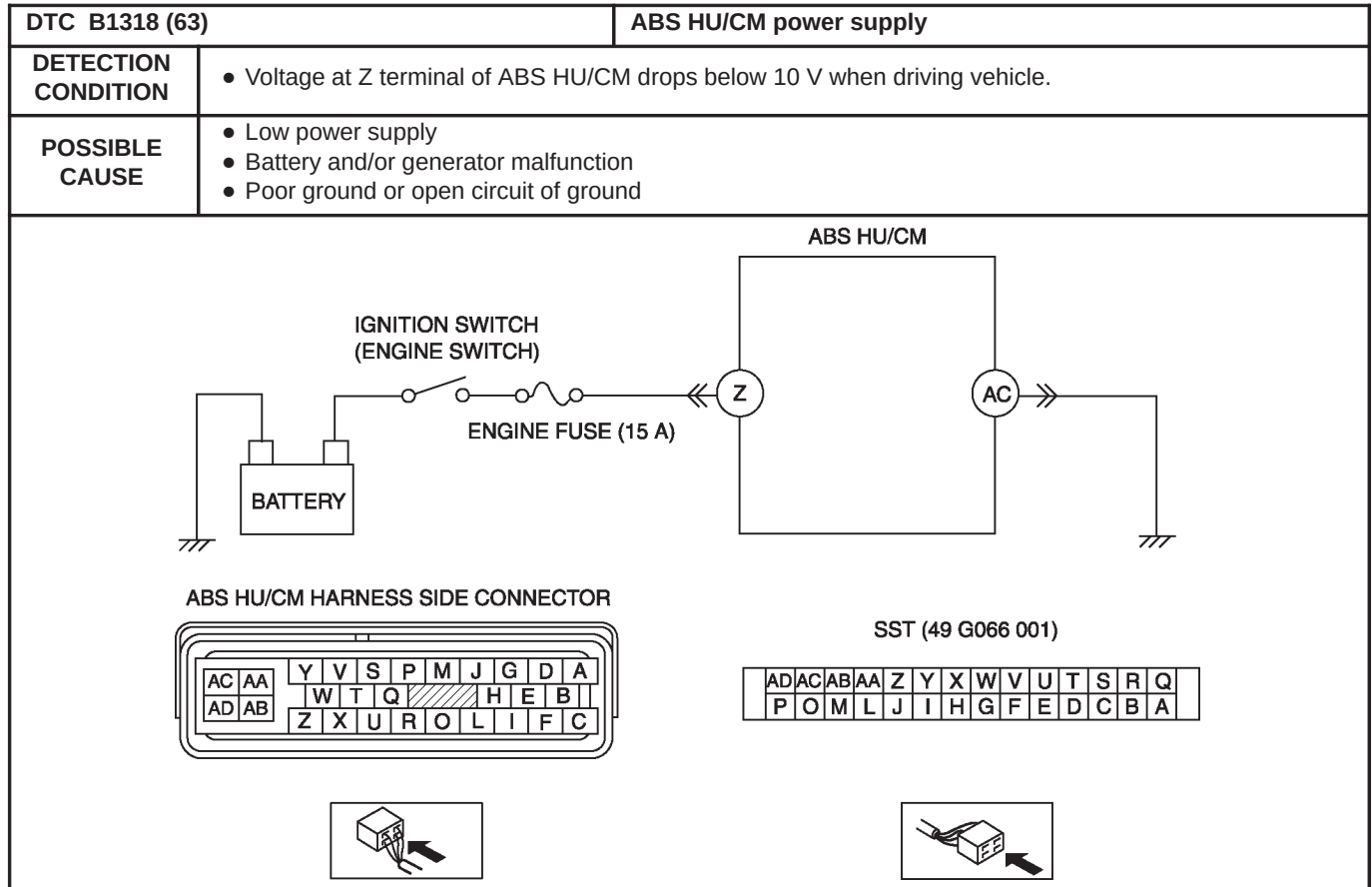
SST (WDS or equivalent) display		Output part	Operation/unit (SST (WDS or equivalent display))	Note
Menu	Command name			
ABS OUTPUT CONTROL	ABS_POWER	Valve relay	ON/OFF	Ignition key (engine key) at ON (Engine OFF)
	LF_INLET	LF inlet solenoid valve	ON/OFF	
	LF_OUTLET	LF outlet solenoid valve	ON/OFF	
	PMP_MOTOR	ABS motor	ON/OFF	
	REAR_INLET	R inlet solenoid valve	ON/OFF	
	REAR_OUTLET	R outlet solenoid valve	ON/OFF	
	RF_INLET	RF inlet solenoid valve	ON/OFF	
	RF_OUTLET	RF outlet solenoid valve	ON/OFF	

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

DTC B1318 (63)

Caution

- When attaching the tester lead to the ABS HU/CM or the ABS HU/CM harness connector, the SST (49 G066 001) must be used. (See ABS HU/CM INSPECTION.)



Diagnostic procedure

STEP	INSPECTION		ACTION
1	INSPECT ABS HU/CM POWER SUPPLY CIRCUIT FOR OPEN CIRCUIT - Turn ignition key (engine key) to OFF. - Disconnect ABS HU/CM connector. - Connect SST (adapter harness) to ABS HU/CM connector (harness side) with ABS HU/CM disconnected. - Start engine. - Measure voltage between terminal Z of SST (harness side) and ground. - Is voltage above 10 V?	Yes	Go to next step.
		No	Go to Step 3.
2	INSPECT ABS HU/CM GROUND CIRCUIT FOR POOR GROUND AND OPEN CIRCUIT - Turn ignition key (engine key) to OFF. - Measure resistance between terminal AA of SST and ground. - Is resistance within 0–1 ohm?	Yes	Go to Step 5.
		No	If there is no continuity: - Repair or replace harness for open between ABS HU/CM and ground, then go to Step 5. - Repair or replace harness for poor ground then go to Step 5.
3	INSPECT BATTERY POWER - Inspect battery. - Is it okay?	Yes	Go to next step.
		No	Replace battery, then go to Step 5.
4	INSPECT GENERATOR - Inspect generator. - Is it okay?	Yes	Go to next step.
		No	Repair or replace generator, then go to Step 5.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION		ACTION
5	VERIFY TROUBLESHOOTING COMPLETED - Make sure to connect all disconnected connectors. - Clear DTC from memory. (See Clearing DTCs Procedures) - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
6	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

DTC B1342 (61)

DTC B1342 (61)		ABS HU/CM
DETECTION CONDITION	The on-board diagnostic program detects computer malfunction.	
POSSIBLE CAUSE	Malfunction of ABS HU/CM (CM part)	

Diagnostic procedure

STEP	INSPECTION		ACTION
1	VERIFY CURRENT STATUS OF MALFUNCTION - Clear DTC memory. (See Clearing DTCs Procedures) - Start engine and drive vehicle at 10 km/h {6.2 mph} or above. - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
2	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

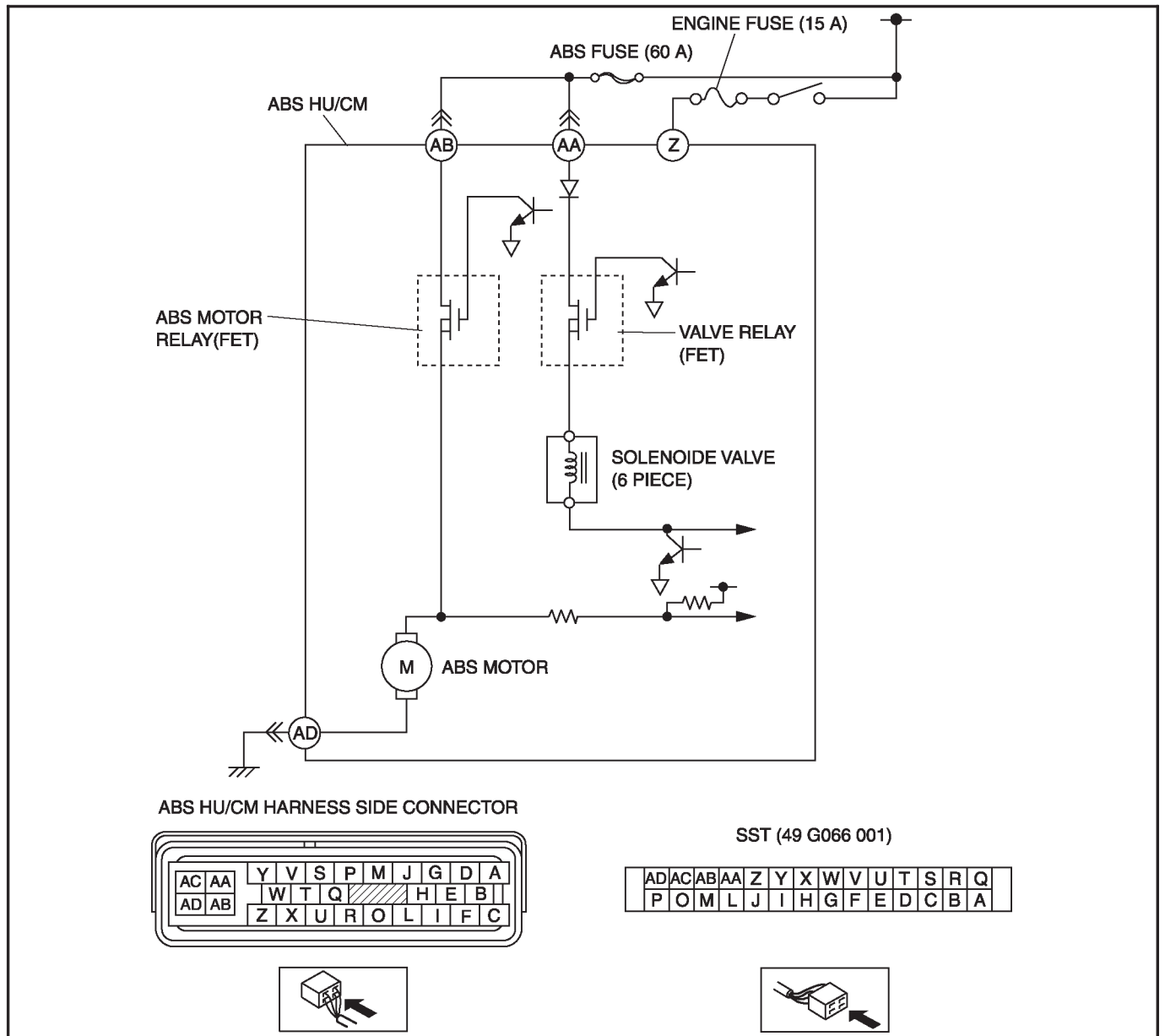
DTC C1095 (54), C1096 (53)

Caution

- When attaching the tester lead to the ABS HU/CM or the ABS HU/CM harness connector, the SST (49 G066 001) must be used. (See ABS HU/CM INSPECTION.)

DTC B1095 (54), C1096 (53)		Motor relay, ABS motor
DETECTION CONDITION	- C1095 (54): ABS motor is stuck OFF when vehicle is started or during ABS operation, ABS motor ON is commanded. - C1096 (53): ABS motor is stuck ON when vehicle is started or during ABS operation, ABS motor OFF is commanded.	
POSSIBLE CAUSE	- Open circuit, or short power or short to ground of motor relay and/or ABS motor in ABS HU/CM - Stuck motor relay and/or ABS motor - Open circuit of ABS motor power supply - Open circuit of ABS motor ground	

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)



Diagnostic procedure

STEP	INSPECTION		ACTION
1	VERIFY OTHER DTC HAS RECORDED • If any of DTC C1186 (51) and/or C1266 (52) also stored?	Yes	Go to applicable DTC inspection.
		No	Go to next step.
2	INSPECT ABS FUSE CONDITION • Is ABS fuse (60 A) okay?	Yes	Go to next step.
		No	Replace fuse, then go to Step 5.
3	INSPECT MOTOR RELAY POWER SUPPLY CIRCUIT FOR OPEN • Turn ignition key (engine key) to OFF. • Disconnect ABS HU/CM connector. • Connect SST (adapter harness) to ABS HU/CM connector (harness side) with ABS HU/CM disconnected. • Turn ignition key (engine key) to ON (engine OFF). • Measure voltage between ABS HU/CM terminal AB (harness side) and ground. • Is voltage B+?	Yes	Go to next step.
		No	Repair or replace harness for open circuit between battery positive terminal and ABS HU/CM terminal AB, then go to Step 5.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION		ACTION
4	INSPECT ABS HU/CM GROUND CIRCUIT FOR OPEN CIRCUIT - Turn ignition key (engine key) to OFF. - Inspect continuity between ABS HU/CM terminal AD of SST and ground. - Is there continuity?	Yes	Go to next step.
		No	Repair or replace harness for open circuit between ABS HU/CM terminal AD and ground, then go to next step.
5	VERIFY TROUBLESHOOTING COMPLETED - Make sure to connect all disconnected connectors. - Clear DTC from memory. (See Clearing DTCs Procedures) - Start engine and drive vehicle at 10 km/h {6.2 mph} or above. - Gradually slow down and stop vehicle. - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
6	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

DTC C1140 (30)

DTC C1140 (30)		ABS HU/CM (pump)
DETECTION CONDITION	Left and right front wheels, or left and/or right rear wheel(s) lock is detected during ABS operation.	
POSSIBLE CAUSE	Stuck ABS pump in ABS HU/CM	

Diagnostic procedure

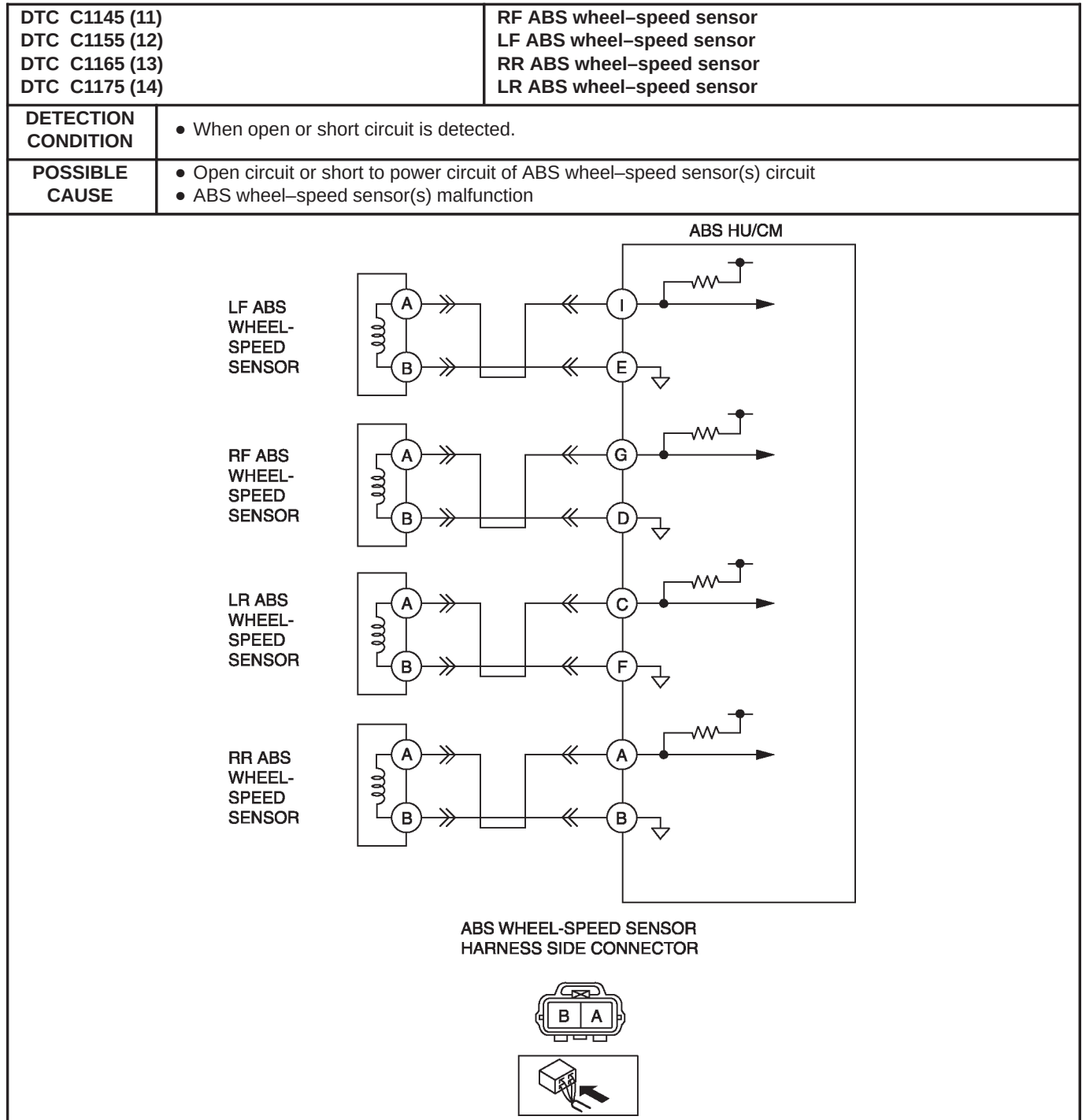
STEP	INSPECTION		ACTION
1	INSPECT ABS HU/CM OPERATION - Perform ABS HU/CM system inspection. (See System Inspection) - Is it okay?	Yes	Go to next step.
		No	Replace ABS HU/CM, then go to Step 4.
2	INSPECT CONVENTIONAL BRAKE OPERATION - Inspect brake fluid level. - Start engine. - Perform a road test to verify conventional vehicle braking performance. - Is there a concern.	Yes	Inspect conventional brake line, then go to Step 4.
		No	Go to next step.
3	INSPECT REAR BRAKE DRAGGING - Turn ignition key (engine key) to OFF. - Jack up vehicle and support it with safety stand. - Release parking brake. - Turn rear wheel by hand and inspect for rear brake-drag. - Is rear brake dragging?	Yes	Repair parking brake system, then go to next step.
		No	Go to next step.
4	VERIFY TROUBLESHOOTING COMPLETED - Clear DTC from memory. (See Clearing DTCs Procedures) - Start engine and drive vehicle at 10 km/h {6.2 mph} or above at least 1 min. - Gradually slow down and stop vehicle. - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
5	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

DTC C1145 (11), C1155 (12), C1165 (13), C1175 (14)

Caution

- When attaching the tester lead to the ABS HU/CM or the ABS HU/CM harness connector, the SST (49 G066 001) must be used. (See ABS HU/CM INSPECTION.)



ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

Diagnostic procedure

STEP	INSPECTION	ACTION	
1	INSPECT ABS WHEEL-SPEED SENSOR CIRCUIT FOR OPEN CIRCUIT • Turn ignition key (engine key) to OFF. • Disconnect ABS HU/CM connector. • Connect SST (adapter harness) to ABS HU/CM connector (harness side) with ABS HU/CM disconnected. • Measure resistance between suspected sensor terminals of SST. — RF ABS wheel-speed sensor: G-D — LF ABS wheel-speed sensor: I-E — RR ABS wheel-speed sensor: A-B — LR ABS wheel-speed sensor: C-F • Is resistance within 1.3–1.7 kilohm?	Yes	Go to next step.
		No	Go to Step 3.
2	INSPECT ABS WHEEL-SPEED SENSOR CIRCUIT FOR SHORT TO POWER • Turn ignition key (engine key) to ON (engine OFF). • Inspect voltage between suspected sensor terminal(s) of SST (adapter harness) and ground(s). — RF ABS wheel-speed sensor: G, D — LF ABS wheel-speed sensor: I, E — RR ABS wheel-speed sensor: A, B — LR ABS wheel-speed sensor: C, F • Is voltage B+?	Yes	Repair or replace harness for short to power circuit between ABS HU/CM and ABS wheel-speed sensor(s), then go to Step 5.
		No	Go to Step 5.
3	INSPECT ABS WHEEL-SPEED SENSOR • Turn ignition key (engine key) to OFF. • Disconnect suspected sensor connector(s) and inspect resistance between sensor terminals (part side). • Is resistance within 1.3–1.7 kilohm?	Yes	Go to next step.
		No	Replace ABS wheel-speed sensor, then go to Step 5.
4	INSPECT ABS HU/CM TO ABS WHEEL-SPEED SENSOR CIRCUIT FOR OPEN CIRCUIT • Inspect continuity between suspected sensor terminal(s) of SST and ABS wheel-speed sensor connector. (vehicle harness side) — RF ABS wheel-speed sensor (+): G-A — RF ABS wheel-speed sensor (-): D-B — LF ABS wheel-speed sensor (+): I-A — LF ABS wheel-speed sensor (-): E-B — RR ABS wheel-speed sensor (+): A-A — RR ABS wheel-speed sensor (-): B-B — LR ABS wheel-speed sensor (+): C-A — LR ABS wheel-speed sensor (-): F-B • Is there continuity?	Yes	Repair or replace poor connections of ABS HU/CM connector and/or ABS wheel-speed sensor connector(s), then go to next step.
		No	Repair or replace harness for open circuits between ABS HU/CM and ABS wheel-speed sensor(s), then go to next step.
5	VERIFY TROUBLESHOOTING COMPLETED • Make sure to reconnect all disconnected connectors. • Clear DTC from memory (See Clearing DTCs Procedures) • Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
6	VERIFY AFTER REPAIR PROCEDURE • Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

DTC C1148 (41), C1158 (42), C1168 (43), C1178 (44), C1233 (46), C1234 (45), C1235 (47), C1236 (48)

Caution

- When attaching the tester lead to the ABS HU/CM or the ABS HU/CM harness connector, the SST (49 G066 001) must be used. (See ABS HU/CM INSPECTION.)

DTC C1148 (41), C1234 (45) DTC C1158 (42), C1233 (46) DTC C1168 (43), C1235 (47) DTC C1178 (44), C1236 (48)	RF ABS wheel-speed sensor/sensor rotor LF ABS wheel-speed sensor/sensor rotor RR ABS wheel-speed sensor/sensor rotor LR ABS wheel-speed sensor/sensor rotor
DETECTION CONDITION	- C1148 (41), C1158 (42), C1168 (43), C1178 (44): ABS wheel-speed signal is out of specification when just after vehicle has started to move. - C1234 (45), C1233 (46), C1235 (47), C1236 (48): ABS wheel-speed signal malfunction (distortion/ sudden change) is detected during driving.
POSSIBLE CAUSE	- Short to ground circuit of ABS wheel-speed sensor(s) circuit - ABS wheel-speed sensor(s) malfunction - Damaged ABS sensor rotor(s) - Incorrect clearance between ABS sensor and sensor rotor
ABS WHEEL-SPEED SENSOR HARNESS SIDE CONNECTOR	

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

Diagnostic procedure

STEP	INSPECTION	ACTION	
1	VERIFY CURRENT INPUT SIGNAL STATUS OF CONCERN IS INTERMITTENT OR CONSTANT • Turn ignition key (engine key) to OFF. • Connect SST (WDS or equivalent) to DLC. • Start engine and drive vehicle. • Access LF_WSPD, LR_WSPD, RF_WSPD and RR_WSPD PID using SST (WDS or equivalent) • Are PIDs display vehicle speed and 4 PIDs equal?	Yes	Go to Step 5.
		No	Go to next step.
2	INSPECT ABS WHEEL-SPEED SENSOR CIRCUIT FOR SHORT TO GROUND • Turn ignition key (engine key) to OFF. • Disconnect ABS HU/CM connector. • Connect SST (adapter harness) to ABS HU/CM connector (harness side) with ABS HU/CM disconnected. • Inspect continuity between suspected sensor terminal(s) of SST (adapter harness) and ground(s). — RF ABS wheel-speed sensor: G — LF ABS wheel-speed sensor: I — RR ABS wheel-speed sensor: A — LR ABS wheel-speed sensor: C • Is there continuity?	Yes	Go to next step.
		No	Go to Step 4.
3	INSPECT ABS WHEEL-SPEED SENSOR FOR SHORT TO GROUND • With ignition key (engine key) at OFF, disconnected suspected sensor connector(s), inspect continuity between suspected sensor terminal(s) A (part side) and ground(s). • Is there continuity?	Yes	Replace ABS wheel-speed sensor(s), then go to Step 8.
		No	Repair or replace harness (short to ground) between ABS HU/CM and ABS wheel-speed sensor connector(s), then go to Step 8.
4	INSPECT SENSOR ROTOR CLEARANCE • Jack up vehicle and support it with safety stands. • Remove suspected wheel(s). • Inspect clearance between sensor and rotor. • Is clearance within 0.3–1.1 mm {0.012–0.043 in}?	Yes	Go to Step 8.
		No	Replace ABS wheel-speed sensor(s), then go to Step 8.
5	INSPECT ABS WHEEL-SPEED SENSOR OUTPUT PULSE • Start engine and drive vehicle. • Inspect output voltage pattern using an oscilloscope. NORMAL MALFUNCTION	Yes	Go to Step 8.
		No	Go to next step.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

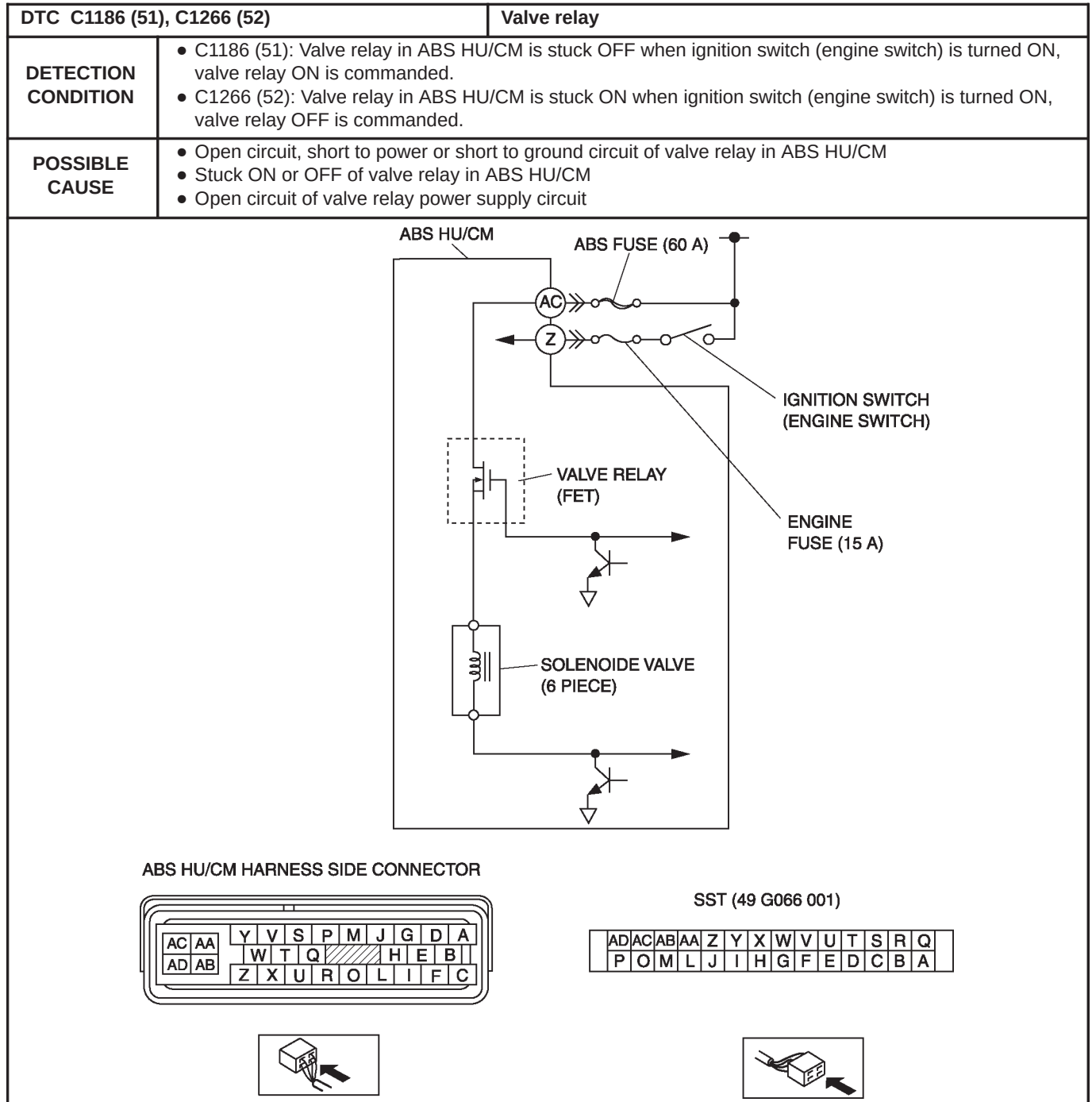
STEP	INSPECTION	ACTION	
6	INSPECT SENSOR ROTOR FOR DAMAGE - Jack up vehicle and support it with safety stands. - Remove suspected wheel(s). - Visually inspect sensor rotor for missing, deformed and obstructed teeth. Number of teeth: 44 - Is sensor rotor okay?	Yes	Go to next step.
		No	Replace rotor, then go to Step 8.
7	INSPECT SENSOR ROTOR CLEARANCE - Inspect clearance between sensor and rotor. - Is clearance within 0.3–1.1 mm {0.012–0.043 in}?	Yes	Go to next step.
		No	Replace ABS wheel–speed sensor(s), then go to next step.
8	VERIFY TROUBLESHOOTING COMPLETED - Make sure to reconnect all disconnected connectors. - Clear DTC from memory (See Clearing DTCs Procedures) - Start engine and drive vehicle at 10 kmh {6.2 mph} or above. - Gradually slow down vehicle and stop. - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
9	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

DTC C1186 (51), C1266 (52)

Caution

- When attaching the tester lead to the ABS HU/CM or the ABS HU/CM harness connector, the SST (49 G066 001) must be used. (See ABS HU/CM INSPECTION.)



ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

Diagnostic procedure

STEP	INSPECTION		ACTION
1	INSPECT ABS FUSE CONDITION Is ABS fuse (60 A) okay?	Yes	Go to next step.
		No	Replace fuse, then go to Step 3.
2	INSPECT FAIL-SAFE RELAY POWER SUPPLY CIRCUIT FOR OPEN CIRCUIT - Turn ignition key (engine key) to OFF. - Disconnect ABS HU/CM connector. - Connect SST (adapter harness) to ABS HU/CM connector (harness side) with ABS HU/CM disconnected. - Turn ignition key (engine key) to ON (engine OFF). - Measure voltage between terminal AC of SST (adapter harness) and ground. - Is voltage B+?	Yes	Go to next step.
		No	Repair or replace harness for open circuit between battery positive terminal and ABS HU/CM terminal AC, then go to next step.
3	VERIFY TROUBLESHOOTING COMPLETED - Make sure to reconnect all disconnected connectors. - Clear DTC from memory (See Clearing DTCs Procedures) - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
4	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

DTC C1194 (24), C1198 (25), C1202 (26), C1206 (27), C1210 (22), C1214 (23)

DTC C1202 (26) DTC C1206 (27) DTC C1210 (22) DTC C1214 (23) DTC C1194 (24) DTC C1198 (25)		R outlet solenoid valve R inlet solenoid valve RF outlet solenoid valve RF inlet solenoid valve LF outlet solenoid valve LF inlet solenoid valve
DETECTION CONDITION	- Solenoid monitor signal is not output in response to solenoid ON command. - Solenoid monitor signal is output in response to solenoid OFF command.	
POSSIBLE CAUSE	- Open circuit, short to power or short to ground of solenoid valve circuit in ABS HU/CM - Stuck solenoid valve in ABS HU/CM	
The diagram illustrates the electrical circuit for the ABS solenoid valves. It starts with the ABS HU/CM (Hydraulic Unit/Control Module) connected to a common ground. The circuit branches into two main paths: one through the ABS FUSE (60 A) and another through the IGNITION SWITCH (ENGINE SWITCH) and ENGINE FUSE (15 A). Both paths lead to the VALVE RELAY (FET), which is shown in a dashed box. The output of the valve relay is connected to a series of six solenoid coils, each represented by a coil symbol and a diode symbol. These coils are connected to the SOLENOID VALVE, which is shown as a vertical stack of six solenoid units. The diagram also shows the connection to the ABS FUSE (60 A) and the ENGINE FUSE (15 A).		

Diagnostic Procedure

STEP	INSPECTION	ACTION	
1	VERIFY CURRENT STATUS OF MALFUNCTION - Clear DTC from memory (See Clearing DTCs Procedures) - Start engine and drive vehicle at 10 kmh {6.2 mph} or above at least 1 min. - Gradually slow down vehicle and stop. - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
2	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

DTC C1414 (64)

DTC C1414 (64)	ABS HU/CM unit mismatched installation
DETECTION CONDITION	When G sensor signal input for more than 400 ms to 4x2 vehicle-type ABS HU/CM.
POSSIBLE CAUSE	- Mismatched installation of ABS HU/CM 4x2 vehicle type ABS HU/CM is mismatched installed on 4x4 vehicle.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

Diagnostic procedure

STEP	INSPECTION		ACTION
1	INSPECT ABS HU/CM FOR MISMATCHED INSTALLATION - Verify ABS HU/CM part number. - Has a ABS HU/CM with the correct part number been installed?	Yes	Go to next step.
		No	Replace with correct ABS HU/CM part number, then go to next step.
2	VERIFY CURRENT STATUS OF MALFUNCTION - Clear DTC from memory (See Clearing DTCs Procedures) - Is same DTC present?	Yes	Replace ABS HU/CM
		No	Go to next step.
6	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

DTC C1510 (32), C1511 (33), C1512 (34), C1513 (35)

DTC C1510 (32)	RF solenoid valve, ABS motor or RF ABS wheel-speed sensor/ sensor rotor LF solenoid valve, ABS motor or LF ABS wheel-speed sensor/ sensor rotor R solenoid valve, ABS motor or RR ABS wheel-speed sensor/ sensor rotor R solenoid valve, ABS motor or LR ABS wheel-speed sensor/ sensor rotor
DTC C1511 (33)	
DTC C1512 (34)	
DTC C1513 (35)	
DETECTION CONDITION	Wheel lock is detected during ABS operation (pressure reduction inoperative).
POSSIBLE CAUSE	- Low electrical power supply - Malfunction of solenoid valve in ABS HU/CM - Malfunction of ABS wheel-speed sensor - Damaged ABS sensor rotor - Stuck ABS motor in ABS HU/CM - Malfunction of hydraulic unit of ABS HU/CM

Diagnostic procedure

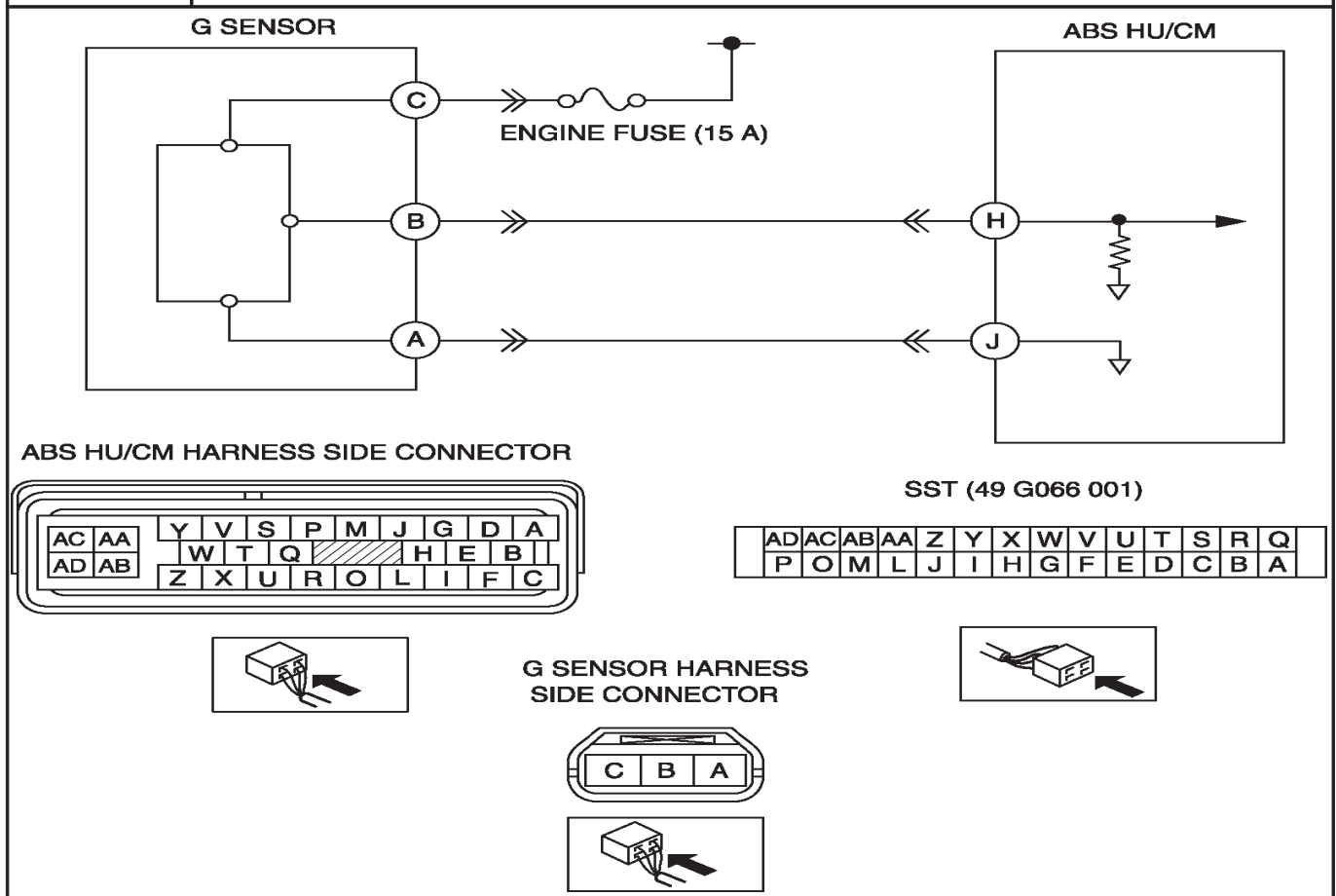
STEP	INSPECTION		ACTION
1	VERIFY OTHER DTC HAS RECORDED Is DTC B1318 (63) also stored?	Yes	Go to DTC B1318 (63) inspection.
		No	Go to next step.
2	VERIFY OTHER DTC HAS RECORDED Is any of DTC C1202 (26), C1206 (27), C1214 (22), C1210 (23), C1198 (24) and/or C1194 (25) also stored?	Yes	Go to applicable DTC inspection.
		No	Go to next step.
3	VERIFY OTHER DTC HAS RECORDED Is any of DTC C1145 (11), C1148 (41), C1155 (12), C1158 (42), C1165 (13), C1168 (43), C1175 (14), C1178 (44), C1233 (46), C1234 (45), C1235 (47) and/or C1236 (48) also stored?	Yes	Go to applicable DTC inspection.
		No	Go to next step.
4	VERIFY OTHER DTC HAS RECORDED Is any of DTC C1095 (54) and/or C1096 (53) also stored?	Yes	Go to applicable DTC inspection.
		No	Go to next step.
5	INSPECT ABS HU/CM OPERATION - Perform ABS HU/CM system inspection. (See System Inspection) - Is it okay?	Yes	Go to next step.
		No	Replace ABS HU/CM, then go to next step.

ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION		ACTION
6	VERIFY CURRENT STATUS OF MALFUNCTION - Clear DTC from memory (See Clearing DTCs Procedures) - Start engine and drive vehicle at 10 kmh {6.2 mph} or above at least 1 min. - Gradually slow down vehicle and stop. - Is same DTC present?	Yes	Replace ABS HU/CM.
		No	Go to next step.
7	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

DTC C1949 (03), C1950 (04)

DTC C1949 (03), C1950 (04)		G sensor
DETECTION CONDITION	- C1949 (03): - Monitor voltage of G sensor is detected at 4.5 V or more, or 0.5 V or less. - Monitor voltage difference of 0.4 V or more within 1 cycle is detected 8 times in 1 second. - C1950 (04): - G sensor 0-point correction value is default or more - Output voltage value from G sensor remains absolutely unchanged - Difference between estimated G force calculated from steering sensor and value output from G sensor exceeds specification	
POSSIBLE CAUSE	- Malfunction of fuse (ENGINE 15 A) - Open circuit in harness between G sensor terminal C and ignition switch (engine switch) - Open, short to power, or short to ground circuit in harness between ABS HU/CM terminal H and G sensor terminal B - Open circuit in harness between ABS HU/CM terminal J and G sensor terminal A - Malfunction of G sensor	



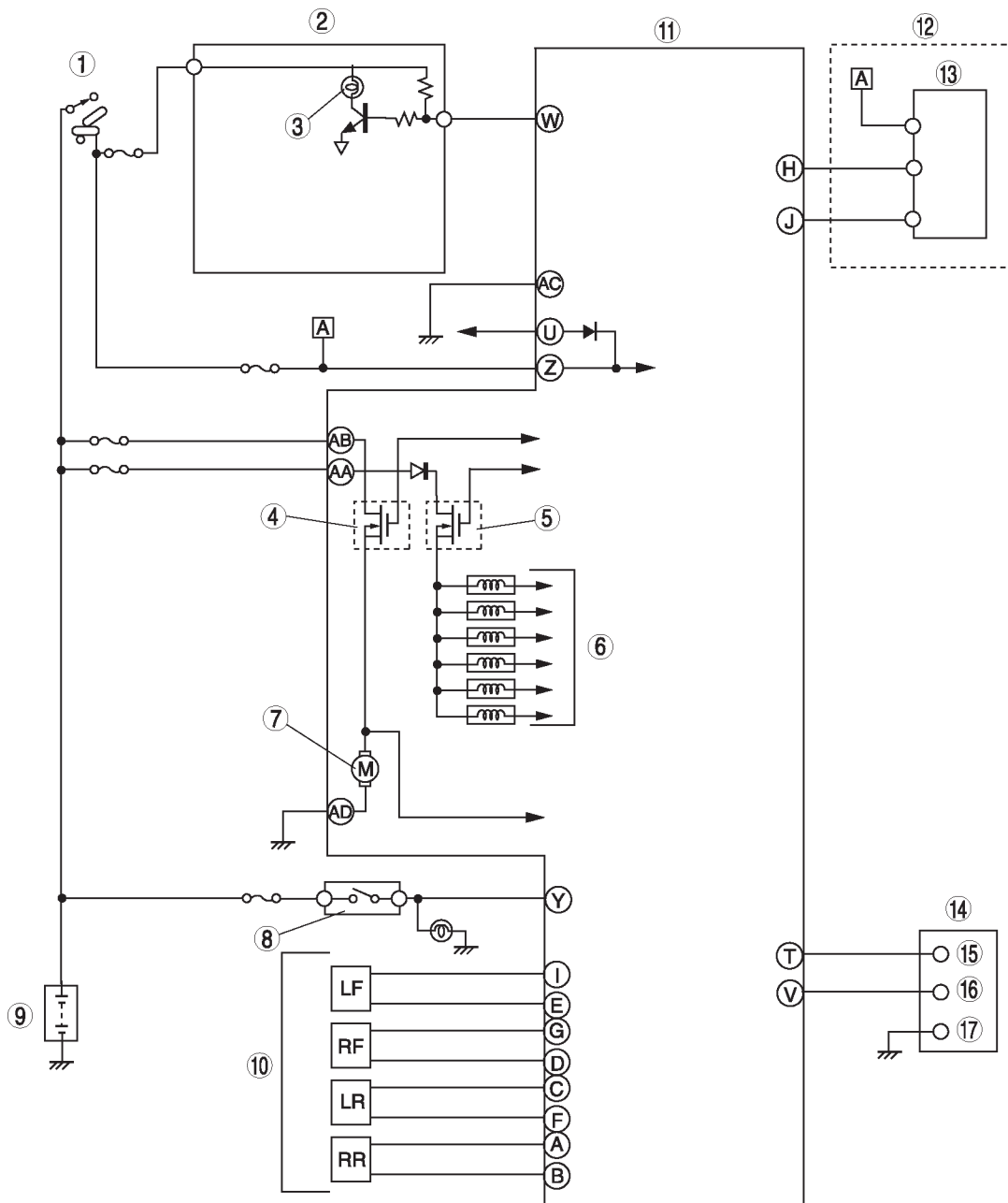
ON-BOARD DIAGNOSTIC (ANTILOCK BRAKE SYSTEM)

Diagnostic procedure

STEP	INSPECTION		ACTION
1	INSPECT ENGINE FUSE CONDITION Is ENGINE fuse (15 A) okay?	Yes	Go to next step.
		No	Replace fuse, then go to Step 8.
2	INSPECT G SENSOR POWER SUPPLY CIRCUIT FOR OPEN CIRCUIT - Turn ignition switch (engine switch) to ON (engine OFF). - Measure voltage between G sensor terminal C (harness side) and ground. - Is voltage B+?	Yes	Go to next step.
		No	Repair or replace harness for open circuit between G sensor terminal C and ignition switch, then go to Step 8.
3	INSPECT G SENSOR GROUND CIRCUIT FOR OPEN CIRCUIT - Turn ignition switch (engine switch) to OFF. - Disconnect ABS HU/CM and G sensor connectors. - Inspect continuity between ABS HU/CM terminal J (harness side) and G sensor terminal A (harness side). - Is there continuity?	Yes	Go to next step.
		No	Repair or replace harness for open circuit between ABS HU/CM terminal J and G sensor terminal A, then go to Step 8.
4	INSPECT G SENSOR SIGNAL CIRCUIT FOR OPEN CIRCUIT - Inspect continuity between ABS HU/CM terminal H (harness side) and G sensor terminal B (harness side). - Is there continuity?	Yes	Go to next step.
		No	Repair or replace harness for open circuit between ABS HU/CM terminal H and G sensor terminal B, then go to Step 8.
5	INSPECT G SENSOR SIGNAL CIRCUIT FOR SHORT TO POWER - Turn ignition switch (engine switch) to ON (engine OFF). - Measure voltage between ABS HU/CM terminal H (harness side) and ground. - Is voltage B+?	Yes	Repair or replace harness for short to power between ABS HU/CM terminal H and G sensor terminal B, then go to Step 8.
		No	Go to next step.
6	INSPECT G SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND - Turn ignition switch (engine switch) to OFF. - Inspect continuity between ABS HU/CM terminal H (harness side) and ground. - Is there continuity?	Yes	Repair or replace harness for short to ground circuit between ABS HU/CM terminal H and G sensor terminal B, then go to Step 8.
		No	Go to next step.
7	INSPECT G SENSOR Inspect G sensor. (See G SENSOR INSPECTION)	Yes	Go to next step.
		No	Replace G sensor, then go to next step.
8	VERIFY TROUBLESHOOTING COMPLETED - Clear DTC from memory (See Clearing DTCs Procedures) - Is same DTC present?	Yes	Replace ABS HU/CM, then go to next step.
		No	Go to next step.
9	VERIFY AFTER REPAIR PROCEDURE Is there any other DTC present?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

ABS SYSTEM DIAGRAM



1	Ignition switch (engine switch)
2	Instrument cluster
3	ABS warning light
4	ABS motor relay (FET)
5	Valve relay (FET)
6	Solenoid valve
7	ABS motor
8	Brake switch
9	Battery

10	ABS wheel-speed sensor
11	ABS HU/CM
12	4x4 only
13	G sensor
14	DLC
15	KLN
16	TBS
17	GND

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

FOREWORD

- (1) Before performing the steps in Symptom Troubleshooting, perform the On-board Diagnostic Inspection. To check the DTC, follow the DTC Inspection steps.

PRECAUTION

When inspecting or servicing the ABS, note the following points:

- (1) The ABS warning light illuminates even when the system is normal.

Cases	Remedy	ABS control when warning light illuminates
Under the following conditions: When the rear wheels are jacked up, stuck, or placed on a chassis roller, and only the rear wheels' ABS wheel speed sensors are spun for more than 20 seconds	After turning ignition switch (engine switch) off, vehicle is driven at speed greater than 10 kmh {6.2 mph} and normal operation is confirmed.	If ABS is operating, stop control after operation. If ABS is not operating, stop control immediately.
Parking brake is not fully released while driving.		
Brake drag.		
Sudden acceleration/deceleration.		
Left/right or front/rear tires are different. (Size, radius, tire pressure, or wear is other than that listed on tire label.)		
Battery voltage at ABS HU/CM ignition terminal Z drops below about 9 to 10 V. (*)	Battery voltage rises above about 10 V.	Operate control.

* : If battery voltage drops **below about 9 to 10 V** while vehicle speed is **greater than 6 kmh {3.7 mph}**, ABS HU/CM records **DTC B1318 (DTC 63)**.

- (2) Precautions during servicing of ABS

The ABS is composed of electrical and mechanical parts. It is necessary to categorize malfunctions as being either electrical or hydraulic when performing troubleshooting.

- Malfunction in electrical system

- The ABS control module (ABS HU/CM) has an on-board diagnostic function. With this function, the ABS warning light will turn on when there is a problem in the electrical system. Also, past and present malfunctions are recorded in the ABS HU/CM. This function can find malfunctions that do not occur during periodic inspections. Turn the ignition switch (engine switch) to ON position, shorting the TBS terminal of the data link connector and the body ground, or connecting the **SST** (WDS or equivalent) to the DLC, and **approximately 5 seconds** later the stored malfunctions will be displayed in the order of occurrence. To find out the causes of ABS malfunctions, use these on-board diagnostic results.
- If a malfunction occurred in the past but is now normal, the cause is likely a temporary poor connection of the harness. The ABS HU/CM usually operates normally. Be careful when searching for the cause of malfunction.
- After repair, it is necessary to erase the DTC from the ABS HU/CM memory. Also, if the ABS related parts have been replaced, verify that the no DTC has been displayed after repairs.
- After repairing the ABS wheel-speed sensor or ABS sensor rotor, or after replacing the ABS HU/CM (ABS motor or ABS motor relay or solenoid valve), the ABS warning light may not go off even when the ignition switch (engine switch) is turned to ON position. IN this case, drive the vehicle at a speed of more than **10 kmh {6.2 mph}**, make sure the ABS warning light goes off, and then erase the DTC.
- When repairing, if the ABS related connectors are disconnected and the ignition switch (engine switch) is turned to ON position, the ABS HU/CM will mistakenly detect a fault and record it as a malfunction.
- To protect the ABS HU/CM, make sure the ignition is off before connecting or disconnecting the ABS HU/CM connector.

- Malfunctions in hydraulic system

- Symptoms in a hydraulic system malfunction are similar to those in a conventional brake malfunction. However, it is necessary to determine if the malfunction is in an ABS component or the conventional brake system.
- The ABS hydraulic unit contains delicate mechanical parts. If foreign materials get into the component, the ABS may fail to operate. Also, it will likely become extremely difficult to find the location of the malfunction in the event that the brakes operate but the ABS does not. Make sure foreign materials do not get inside when servicing the ABS (e.g. brake fluid replacement, pipe removal).

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

SYMPTOM TROUBLESHOOTING

Verify the symptom, and perform troubleshooting according to the appropriate number.

No.	Symptom
1	ABS warning light does not illuminate with ignition switch (engine switch) on.
2	ABS warning light stays on for more than 4 seconds with ignition switch (engine switch) on.
3	There is a malfunction in the system even though ABS warning light indicates that the system is normal.

Quick Diagnostic Chart

X: Applicable

Possible factor											
Troubleshooting item		ABS HU/CM	Instrument cluster	ABS warning light circuit	Battery	Charging system	ABS HU/CM power supply (Terminal Z)	ABS HU/CM GND (Terminal AC)	Instrument cluster power supply (Terminal 1J)	Conventional brake	Brake pipe routing
1	ABS warning light does not illuminate with ignition switch (engine switch) on.	X	X	X					X		
2	ABS warning light stays on for more than 4 seconds with ignition switch (engine switch) on.	X	X	X	X	X	X	X			
3	There is a malfunction in system even though ABS warning light indicates that the system is normal.	X								X	X

NO.1 ABS WARNING LIGHT DOES NOT ILLUMINATE WITH IGNITION SWITCH (ENGINE SWITCH) ON

- When performing an asterisked (*) troubleshooting inspection, shake the wiring harness and connectors while performing the inspection to discover whether poor contact points are the cause of any intermittent malfunctions. If there is a problem, check to make sure connectors, terminals, and wiring harness are connected correctly and undamaged.

1	Air bag system warning light does not illuminate when ignition switch is turned to ON position.
[TROUBLESHOOTING HINTS]	
ABS warning light circuit open or shorted to ground	

Diagnostic procedure

STEP	INSPECTION	ACTION
1	CHECK TO SEE WHETHER MALFUNCTION IS IN COMMON POWER SUPPLY FOR ABS WARNING LIGHT OR OTHER WARNING LIGHTS Does either of the following warning lights illuminate when ignition switch (engine switch) is turned to ON position? - Air bag system warning light - Generator warning light	Yes Go to step 4.
		No Go to next step.
2	INSPECT INSTRUMENT CLUSTER POWER SUPPLY FUSE Is instrument cluster ignition power supply fuse okay?	Yes Go to next step.
		No Check for a short to ground on blown fuse circuit. Repair or replace if necessary. Install appropriate amperage fuse.

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION	ACTION	
*3	INSPECT WIRING HARNESS BETWEEN INSTRUMENT CLUSTER POWER SUPPLY AND INSTRUMENT CLUSTER FOR CONTINUITY Turn ignition switch (engine switch) to ON position. Measure voltage at instrument cluster connector terminal 1J. Is voltage approximately 12 V ?	Yes	Inspect warning light circuits in instrument cluster (open circuit in instrument cluster).
		No	Repair wiring harness between fuse block and instrument cluster (Terminal 1J).
4	CHECK FOR OPEN CIRCUIT IN ABS HU/CM Does ABS warning light illuminate when the ignition switch (engine switch) is at ON position and the ABS HU/CM is disconnected?	Yes	Go to next step.
		No	Go to step 6.
5	CONFIRM THAT MALFUNCTION SYMPTOMS DO NOT REOCCUR AFTER ABS HU/CM IS CONNECTED Reconnect ABS HU/CM. Does ABS warning light illuminate when the ignition switch (engine switch) is at ON position?	Yes	Temporary poor connection at ABS HU/CM connector Terminal W. Inspect ABS HU/CM connector and Terminal W.
		No	
6	INSPECT ABS WARNING LIGHT BULB Remove instrument cluster. Inspect ABS warning light bulb. Is it okay?	Yes	Go to next step.
		No	Replace ABS warning light bulb.
*7	CHECK TO SEE WHETHER MALFUNCTION (LACK OF CONTINUITY) IS IN WIRING HARNESS (BETWEEN INSTRUMENT CLUSTER AND ABS HU/CM) OR INSTRUMENT CLUSTER Caution • Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Disconnect ABS HU/CM connector and instrument cluster connectors. Is there continuity between instrument cluster connector terminal 2B and ABS HU/CM connector terminal W?	Yes	Replace instrument cluster (open circuit in instrument cluster).
		No	Repair wiring harness between instrument cluster and ABS HU/CM (Terminal W).

NO.2 ABS WARNING LIGHT STAYS ON FOR MORE THAN 4 SECONDS WITH IGNITION SWITCH (ENGINE SWITCH) ON

Using SST (WDS or equivalent)

- When performing an asterisked (*) troubleshooting inspection, shake the wiring harness and connectors while performing the inspection to discover whether poor contact points are the cause of any intermittent malfunctions. If there is a problem, check to make sure connectors, terminals, and wiring harness are connected correctly and undamaged.

2	ABS warning stays on for more than 4 seconds with ignition switch (engine switch) on.
[TROUBLESHOOTING HINTS] • ABS HU/CM detects ABS system malfunction • ABS HU/CM detects low voltage in power supply (ABS HU/CM ignition terminal Z voltage is below about 9 to 10 V) • ABS HU/CM does not operate • ABS warning light circuit open or shorted to high voltage (approximately 12 V)	

Diagnostic procedure

STEP	INSPECTION	ACTION	
1	INSPECT ABS HU/CM IGNITION POWER SUPPLY FUSE Is ABS HU/CM power supply fuse okay?	Yes	Go to next step.
		No	Check for a short to ground on blown fuse circuit. Repair or replace if necessary. Install appropriate amperage fuse.

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION	ACTION	
2	INSPECT WIRING HARNESS BETWEEN ABS HU/CM AND DLC (DATA LINK CONNECTOR) FOR CONTINUITY OR SHORTS Perform DTC inspection. Is error message displayed regarding communication between ABS HU/CM and SST (WDS or equivalent)?	Yes	If a communication error message is displayed even after inspecting according to procedures displayed on the SST (WDS or equivalent), go to Step 6.
		No	Go to next step.
3	CHECK FOR DTCS IN ABS HU/CM Have DTCs been recorded in memory?	Yes	Perform inspection using appropriate DTC.
		No	Go to next step.
4	INSPECT PID/DATA IN ABS HU/CM Inspect the following items using SST (WDS or equivalent). • ABS_LAMP (ABS warning light) • ABS_VOLT (power supply voltage) Is ABS_LAMP ON after more than 4 seconds with ignition switch (engine switch) to ON position.	Yes	Go to next step.
		No	ABS system is normal.
5	INSPECT ABS HU/CM IGNITION POWER SUPPLY SYSTEM (TERMINAL Z) Check the voltage for PID/DATA monitor ABS_VOLT item. Specification: above 10 V Is voltage within specification?	Yes	Go to Step 16.
		No	Go to next step.
6	INSPECT BATTERY Is battery voltage normal?	Yes	If a communication error message is displayed on SST (WDS or equivalent) in Step 2 inspection, go to next step. If a communication error message is not displayed on SST (WDS or equivalent) in Step 2 inspection, go to Step 9.
		No	Perform inspection of battery and charging system.
7	VERIFY THAT ABS HU/CM IS CONNECTED Is ABS HU/CM securely connected?	Yes	Go to Step 9.
		No	Connect ABS HU/CM connector securely, then go to next step.
8	CONFIRM THAT MALFUNCTION SYMPTOMS DO NOT REOCCUR AFTER ABS HU/CM IS CONNECTED Does ABS warning light go out after more than 4 seconds with ignition switch (engine switch) at ON position?	Yes	Temporary poor connection in ABS HU/CM connector. Inspect connector and terminal.
		No	Go to next step.
*9	VERIFY THAT ABS HU/CM CONNECTOR TERMINALS Z AND AC ARE CONNECTED Does malfunction symptom reoccur when ABS HU/CM connector terminals Z and AC are shaken while the ignition switch (engine switch) is at ON position?	Yes	Connect ABS HU/CM connector terminals Z and AC securely, then go to next step.
		No	Go to Step 11.
10	CONFIRM THAT MALFUNCTION SYMPTOMS DO NOT REOCCUR AFTER ABS HU/CM CONNECTOR TERMINALS Z AND AC ARE CONNECTED Does ABS warning light go out after more than 4 seconds with ignition switch (engine switch) at ON position?	Yes	Temporary poor connection at terminal. Inspect ABS HU/CM connector and terminal.
		No	Go to next step.

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION	ACTION	
*11	INSPECT WIRING HARNESS BETWEEN FUSE BLOCK AND ABS HU/CM (TERMINAL Z) FOR CONTINUITY Caution Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Turn ignition switch (engine switch) to LOCK position. Disconnect ABS HU/CM connector. Is voltage approximately 12 V at ABS HU/CM terminal Z?	Yes	Go to next step.
		No	Repair wiring harness between fuse block and ABS HU/CM (Terminal Z).
*12	INSPECT WIRING HARNESS BETWEEN ABS HU/CM (TERMINAL AC) AND GROUND FOR CONTINUITY Caution Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Is there continuity between ABS HU/CM connector terminal AC and ground?	Yes	If a communication error message is displayed on SST (WDS or equivalent) in Step 2 inspection, go to next step. If a communication error message is not displayed on SST (WDS or equivalent) in Step 2 inspection, recheck malfunction symptoms.
		No	Repair wiring harness between ABS HU/CM (terminal AC) and ground.
*13	INSPECT WIRING HARNESS BETWEEN ABS HU/CM AND DLC (DATA LINK CONNECTOR) FOR CONTINUITY Caution Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Is there continuity between ABS HU/CM connector terminal T and data link connector (DLC)?	Yes	Go to next step.
		No	Repair wiring harness between ABS HU/CM (Terminal T) and data link connector (DLC).
*14	INSPECT WIRING HARNESS BETWEEN ABS HU/CM AND DLC (DATA LINK CONNECTOR) FOR SHORT TO B+ Caution Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Turn ignition switch (engine switch) to ON position. Is voltage approximately 12 V at ABS HU/CM connector terminal T?	Yes	Repair wiring harness between ABS HU/CM (Terminal T) and data link connector (DLC).
		No	Go to next step.
*15	INSPECT WIRING HARNESS BETWEEN ABS HU/CM AND DLC (DATA LINK CONNECTOR) FOR SHORT TO GROUND Caution Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Is there continuity between ABS HU/CM connector terminal T and ground?	Yes	Repair wiring harness between ABS HU/CM (Terminal T) and data link connector (DLC).
		No	Replace ABS HU/CM (communication circuit or ABS HU/CM power supply circuit malfunction in ABS HU/CM).
16	VERIFY THAT ABS HU/CM CONNECTOR TERMINAL W IS CONNECTED Does malfunction symptom happen again when ABS HU/CM connector terminal W is shaken while the ignition switch (engine switch) is ON position?	Yes	Connect ABS HU/CM connector terminal W securely, then go to next step.
		No	Go to Step 18.

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION		ACTION
17	CONFIRM THAT MALFUNCTION SYMPTOMS DO NOT REOCCUR AFTER ABS HU/CM CONNECTOR TERMINAL W IS CONNECTED Does ABS warning light go out after more than 4 seconds with ignition switch (engine switch) to ON position?	Yes	Temporary poor connection at terminal. Inspect ABS HU/CM connector and terminal.
		No	Go to next step.
*18	CHECK TO SEE WHETHER MALFUNCTION IS IN INSTRUMENT CLUSTER (SHORT TO GROUND) OR ELSEWHERE Disconnect all instrument cluster connectors. Is there continuity between instrument cluster connector terminal 2B and ground?	Yes	Go to next step.
		No	Replace instrument cluster (short to ground circuit in instrument cluster).
*19	INSPECT WIRING HARNESS BETWEEN INSTRUMENT CLUSTER AND ABS HU/CM FOR SHORT TO GROUND Disconnect ABS HU/CM Is there continuity between instrument cluster connector terminal 2B and ground?	Yes	Repair wiring harness between ABS HU/CM (Terminal W) and instrument cluster.
		No	Replace ABS HU/CM (short to ground or B+ circuit in ABS HU/CM).

Without using SST (WDS or equivalent)

- When performing an asterisked (*) troubleshooting inspection, shake the wiring harness and connectors while performing the inspection to discover whether poor contact points are the cause of any intermittent malfunctions. If there is a problem, check to make sure connectors, terminals, and wiring harness are connected correctly and undamaged.

2	ABS warning stays on for more than 4 seconds with ignition switch (engine switch) on.
[TROUBLESHOOTING HINTS] - ABS HU/CM detects ABS system malfunction - ABS HU/CM detects low voltage in power supply (ABS HU/CM ignition terminal Z voltage is below 10 V) - ABS HU/CM does not operate - ABS warning light circuit open or shorted to high voltage (approximately 12 V)	

Diagnostic procedure

STEP	INSPECTION		ACTION
1	INSPECT ABS HU/CM IGNITION POWER SUPPLY FUSE Is ABS HU/CM power supply fuse okay?	Yes	Go to next step.
		No	Check for a short to ground on blown fuse circuit. Repair or replace if necessary. Install appropriate amperage fuse.
2	CHECK FOR DTCS IN ABS HU/CM Have DTCs been recorded in memory?	Yes	Perform inspection using appropriate DTC.
		No	Go to next step.
3	INSPECT BATTERY Is battery voltage normal?	Yes	Go to next step.
		No	Perform inspection of battery and charging system.
4	VERIFY THAT ABS HU/CM IS CONNECTED Is ABS HU/CM securely connected?	Yes	Go to Step 6.
		No	Connect ABS HU/CM connector securely, then go to next step.
5	VERIFY THAT MALFUNCTION SYMPTOMS DO NOT REOCCUR AFTER ABS HU/CM IS CONNECTED Does ABS warning light go out after more than 4 seconds with ignition switch (engine switch) at ON position?	Yes	Temporary poor connection in ABS HU/CM connector. Inspect connector and terminal.
		No	Go to next step.
*6	VERIFY THAT ABS HU/CM CONNECTOR TERMINALS W, AC AND Z ARE CONNECTED Does malfunction symptom happen again when ABS HU/CM connector terminals W, AC and Z are shaken while the ignition switch (engine switch) is at ON position?	Yes	Connect ABS HU/CM connector terminals W, AC and Z securely, then go to next step.
		No	Go to Step 8.

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

STEP	INSPECTION		ACTION
7	VERIFY THAT MALFUNCTION SYMPTOM OCCURS AFTER ABS HU/CM CONNECTOR TERMINALS W, AC AND Z ARE CONNECTED Does ABS warning light go out after more than 4 seconds with ignition switch (engine switch) at ON position?	Yes	Temporary poor connection at terminal. Inspect ABS HU/CM connector and terminal.
		No	Go to next step.
*8	INSPECT WIRING HARNESS BETWEEN FUSE BLOCK AND ABS HU/CM (TERMINAL Z) FOR CONTINUITY Caution Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Turn ignition switch (engine switch) to LOCK position. Disconnect ABS HU/CM connector. Is voltage approximately 12 V at ABS HU/CM terminal Z?	Yes	Go to next step.
		No	Repair wiring harness between fuse block and ABS HU/CM (Terminal Z).
*9	INSPECT WIRING HARNESS BETWEEN ABS HU/CM (TERMINAL AC) AND GROUND FOR CONTINUITY Caution Attach a wire to the tester lead to avoid damaging the ABS HU/CM terminal. Is there continuity between ABS HU/CM connector terminal AC and ground?	Yes	Go to next step.
		No	Repair wiring harness between ABS HU/CM (terminal AC) and ground.
*10	CHECK TO SEE WHETHER MALFUNCTION (SHORT TO GROUND) IS IN ABS HU/CM AND WIRING HARNESS (BETWEEN INSTRUMENT CLUSTER AND ABS HU/CM) OR INSTRUMENT CLUSTER Turn ignition switch (engine switch) to LOCK position. Disconnect instrument cluster connector. Connect ABS HU/CM connector. Is there continuity between instrument cluster connector terminal 2B and ground?	Yes	Go to next step.
		No	Replace instrument cluster (short to ground circuit in instrument cluster).
*11	INSPECT WIRING HARNESS BETWEEN ABS HU/CM AND INSTRUMENT CLUSTER FOR SHORT TO GROUND Disconnect ABS HU/CM connector. Is there continuity between instrument cluster connector terminal 2B and ground?	Yes	Repair wiring harness between ABS HU/CM (Terminal W) and instrument cluster.
		No	Replace ABS HU/CM (short to ground or B+ circuit in ABS HU/CM).

NO.3 THERE IS A MALFUNCTION IN SYSTEM EVEN THOUGH ABS WARNING LIGHT INDICATES THAT THE SYSTEM IS NORMAL

3	There is a malfunction in the system even though ABS warning light indicates that the system is normal.
[TROUBLESHOOTING HINTS] There is a mechanical malfunction in system.	

Diagnostic procedure

STEP	INSPECTION		ACTION
1	CHECK FOR DTCS IN ABS HU/CM Have DTCS been recorded in memory?	Yes	Perform inspection using appropriate DTC.
		No	Go to next step.

TROUBLESHOOTING (ANTILOCK BRAKE SYSTEM)

2	INSPECT ABS HYDRAULIC UNIT Perform "ABS hydraulic unit system inspection". Is system okay?	Yes	Inspect conventional brake system.
		No	If wheels do not rotate: Replace ABS HU/CM If wheels rotate but order in which wheels rotate is incorrect: Inspect brake pipe passage to ABS HU/CM.