SERVICE BRAKES

CONTENTS

BASIC BRAKE SYSTEM .................................................. 35A

ANTI-SKID BRAKING SYSTEM (ABS) <2WD> ......................... 35B

ANTI-SKID BRAKING SYSTEM (ABS) <4WD> ....................... 35C

NOTE
THE GROUPS MARKED BY ARE NOT IN THIS MANUAL
The brake system offers high dependability and durability along with improved braking performance and brake sensitivity.

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master cylinder</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Tandem type (with level sensor)</td>
</tr>
<tr>
<td>I.D. mm</td>
<td>23.8</td>
</tr>
<tr>
<td>Brake booster</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Vacuum type, single</td>
</tr>
<tr>
<td>Effective dia. of power cylinder mm</td>
<td>230</td>
</tr>
<tr>
<td>Boosting ratio</td>
<td>6.0</td>
</tr>
<tr>
<td>Proportioning valve</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Dual type</td>
</tr>
<tr>
<td>Decompression ratio</td>
<td>0.25</td>
</tr>
<tr>
<td>Front brakes</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Floating caliper, 1-piston, ventilated disc</td>
</tr>
<tr>
<td>Disc effective dia. x thickness mm</td>
<td>256 x 24</td>
</tr>
<tr>
<td>Wheel cylinder I.D. mm</td>
<td>60.3</td>
</tr>
<tr>
<td>Pad thickness mm</td>
<td>10.0</td>
</tr>
<tr>
<td>Clearance adjustment</td>
<td>Automatic</td>
</tr>
<tr>
<td>Rear disc brakes</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Floating caliper, 1-piston, solid disc</td>
</tr>
<tr>
<td>Disc effective dia. x thickness mm</td>
<td>262 x 24</td>
</tr>
<tr>
<td>Wheel cylinder I.D. mm</td>
<td>34.9</td>
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<tr>
<td>Pad thickness mm</td>
<td>10.0</td>
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<tr>
<td>Clearance adjustment</td>
<td>Automatic</td>
</tr>
<tr>
<td>Rear drum brakes</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Leading trailing</td>
</tr>
<tr>
<td>Drum I.D. mm</td>
<td>203</td>
</tr>
<tr>
<td>Wheel cylinder I.D. mm</td>
<td>20.6</td>
</tr>
<tr>
<td>Lining thickness mm</td>
<td>4.4</td>
</tr>
<tr>
<td>Clearance adjustment</td>
<td>Automatic</td>
</tr>
<tr>
<td>Brake fluid</td>
<td>DOT3 or DOT4</td>
</tr>
</tbody>
</table>
**CONSTRUCTION DIAGRAM**

**SERVICE SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Items</th>
<th>Standard value</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake pedal height mm</td>
<td>162.8 - 165.8</td>
<td>-</td>
</tr>
<tr>
<td>Brake pedal free play mm</td>
<td>3 - 8</td>
<td>-</td>
</tr>
<tr>
<td>Brake pedal to floor board clearance mm</td>
<td>90 or more</td>
<td>-</td>
</tr>
<tr>
<td>Proportioning valve Split point MPa</td>
<td>Sedan 2.94 ± 0.25</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Wagon 3.43 ± 0.25</td>
<td>-</td>
</tr>
<tr>
<td>Output fluid pressure (Input fluid pressure) MPa</td>
<td>Sedan 4.66 ± 0.39 (9.81)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Wagon 5.80 ± 0.39 (9.81)</td>
<td>-</td>
</tr>
<tr>
<td>Output fluid pressure difference between left and right MPa</td>
<td>-</td>
<td>0.39</td>
</tr>
<tr>
<td>Brake booster push rod protruding length mm</td>
<td>9.65 - 9.90</td>
<td>-</td>
</tr>
<tr>
<td>Front disc brake Pad thickness mm</td>
<td>10.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Disc thickness mm</td>
<td>24.0</td>
<td>22.4</td>
</tr>
<tr>
<td>Disc runout mm</td>
<td>-</td>
<td>0.06</td>
</tr>
<tr>
<td>Drag force (tangential force of wheel mounting bolts) N</td>
<td>69 or less</td>
<td>-</td>
</tr>
</tbody>
</table>
### Basic Brake System

<table>
<thead>
<tr>
<th>Items</th>
<th>Standard Value</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rear Disc Brake</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pad thickness mm</td>
<td>10.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Disc thickness mm</td>
<td>10.0</td>
<td>8.4</td>
</tr>
<tr>
<td>Disc runout mm</td>
<td>-</td>
<td>0.08</td>
</tr>
<tr>
<td>Drag force (tangential force of wheel mounting bolts) N</td>
<td>69 or less</td>
<td>-</td>
</tr>
<tr>
<td><strong>Rear Drum Brake</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lining thickness mm</td>
<td>4.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Drum inside diameter mm</td>
<td>203</td>
<td>205</td>
</tr>
</tbody>
</table>

### Lubricants

<table>
<thead>
<tr>
<th>Items</th>
<th>Specified Lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brake Fluid</strong></td>
<td>DOT3 or DOT4</td>
</tr>
<tr>
<td><strong>Brake Piston Seal</strong></td>
<td>Repair kit grease (orange)</td>
</tr>
<tr>
<td>Slide pin boot and slide pin bush inner surfaces</td>
<td></td>
</tr>
<tr>
<td>Brake piston boot inner surfaces</td>
<td></td>
</tr>
<tr>
<td>Piston boot mounting grooves</td>
<td></td>
</tr>
<tr>
<td>Rear brake shoe and backing plate contact surfaces</td>
<td>Brake grease SAE J310, NLGI No.1</td>
</tr>
<tr>
<td>Shoe assembly and auto adjuster assembly contact surfaces</td>
<td></td>
</tr>
<tr>
<td>Shoe and lever assembly and auto adjuster assembly contact surfaces</td>
<td></td>
</tr>
</tbody>
</table>

### Sealants

<table>
<thead>
<tr>
<th>Items</th>
<th>Specified Sealant</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread part fitting</td>
<td>3M ATD Part No. 8661 or equivalent</td>
<td>Semi-drying sealant</td>
</tr>
<tr>
<td>Vacuum switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Special Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Number</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MB990964</td>
<td>Brake tool set</td>
<td>Pushing-in of the disc brake piston</td>
</tr>
<tr>
<td></td>
<td>MB990520</td>
<td></td>
<td>Installation of drum brake wheel cylinder piston cup</td>
</tr>
<tr>
<td></td>
<td>MB990619</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MB990998</td>
<td>Front hub remover and installer</td>
<td>Provisional holding of the wheel bearing</td>
</tr>
</tbody>
</table>

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BRAKE PEDAL HEIGHT

1. Turn up the carpet, etc under the brake pedal.
2. Measure the brake pedal height as illustrated. If the brake pedal height is not within the standard value, follow the procedure below.

Standard value: 162.8 - 165.8 mm

(1) Disconnect the stop lamp switch connector.
(2) Adjust the brake pedal height by turning the operating rod with pliers (with the operating rod lock nut loosened), until the correct brake pedal height is obtained.
(3) Secure by tightening the lock nut of the operating rod.
(4) Push the stop lamp switch in the direction of the pedal stroke until it stops. (The switch will slide if it is pushed firmly.)
(5) Lift up the pedal until the operating rod is fully extended, and then slide the stop lamp switch back to the required position. Adjust the position of the switch by turning it until the distance shown in the illustration is correct.
(6) Connect the connector of the stop lamp switch.
(7) Check that the stop lamp is not illuminated with the brake pedal unpressed.

3. Return the carpet etc.

BRAKE PEDAL FREE PLAY

With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal down by hand, and confirm that the amount of movement before resistance is met (the free play) is within the standard value range.
Standard value: 3–8 mm
If the free play exceeds the standard value, it is probably due to excessive play between the retaining ring bolt and brake pedal arm. Check for excessive clearance and replace faulty parts as required.

CLEARANCE BETWEEN BRAKE PEDAL AND FLOOR BOARD
1. Turn back the carpet etc. under the brake pedal.
2. Start the engine, depress the brake pedal with approximately 490 N of force, and measure the clearance between the brake pedal and the floorboard.
   Standard value: 90 mm or more
3. If the clearance is outside the standard value, check for air trapped in the brake line, clearance between the lining and the drum and dragging in the parking brake. Adjust and replace defective parts as required.
4. Return the carpet etc.

STOP LAMP SWITCH CHECK
Connect a circuit tester to the stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released. The stop lamp switch is in good condition if there is no continuity when the plunger is pushed in to a depth of within 4 mm from the outer case edge surface, and if there is continuity when it is released.

BRAKE BOOSTER OPERATING TEST
For simple checking of the brake booster operation, carry out the following tests:
1. Run the engine for one or two minutes, and then stop it.
   If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.
2. With the engine stopped, step on the brake pedal several times. Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.

3. With the engine running, step on the brake pedal and then stop the engine. Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective. If the above three tests are okay, the booster performance can be determined as good. If one of the above three tests is not okay at last, the check valve, vacuum hose, or booster will be defective.

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**CHECK VALVE OPERATION CHECK**

1. Remove the vacuum hose. (Refer to P.35A-16.)

   **Caution**
   The check valve should not be removed from the vacuum hose.

2. Check the operation of the check valve by using a vacuum pump.

<table>
<thead>
<tr>
<th>Vacuum pump connection</th>
<th>Accept/reject criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection at the brake booster side (A)</td>
<td>A negative pressure (vacuum) is created and held.</td>
</tr>
<tr>
<td>Connection at the intake manifold side (B)</td>
<td>A negative pressure (vacuum) is not created.</td>
</tr>
</tbody>
</table>

   **Caution**
   If the check valve is defective, replace it as an assembly unit together with the vacuum hose.
PROPORTIONING VALVE FUNCTION TEST

1. Connect two pressure gauges, one each to the input side and output side of the proportioning valve, as shown.
2. Bleed the air in the brake line and the pressure gauge.
3. While gradually depressing the brake pedal, make the following measurements and check to be sure that the measured values are within the allowable range.

(1) Output pressure begins to drop relative to input pressure (split point).

<table>
<thead>
<tr>
<th></th>
<th>Sedan</th>
<th>Wagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard value:</td>
<td>MPa</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.94 ± 0.25</td>
<td>3.43 ± 0.25</td>
</tr>
</tbody>
</table>

(2) Check to be sure that the output fluid pressure is at the standard value when the pedal depression force is increased so that the input fluid pressure is at the values shown in the table below.

<table>
<thead>
<tr>
<th>Output fluid pressure</th>
<th>Sedan</th>
<th>Wagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard value:</td>
<td>MPa</td>
<td></td>
</tr>
<tr>
<td>(Input fluid pressure)</td>
<td>4.66 ± 0.39</td>
<td>5.80 ± 0.39</td>
</tr>
<tr>
<td></td>
<td>(9.81)</td>
<td>(9.81)</td>
</tr>
</tbody>
</table>

(3) Output pressure difference between left and right brake lines.

Limit: 0.39 MPa

4. If the measured pressures are not within the permissible ranges, replace the proportioning valve.

BRAKE FLUID LEVEL SENSOR CHECK

The brake fluid level sensor is in good condition if there is no continuity when the float surface is above “MIN” and if there is continuity when the float surface is below “MIN”.
BLEEDING

Caution
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.
Specified brake fluid: DOT3 or DOT4

MASTER CYLINDER BLEEDING

The master cylinder used has no check valve, so if bleeding is carried out by the following procedure, bleeding of air from the brake pipeline will become easier. (When brake fluid is not contained in the master cylinder.)

1. Fill the reserve tank with brake fluid.
2. Keep the brake pedal depressed.
3. Have another person cover the master cylinder outlet with a finger.
4. With the outlet still closed, release the brake pedal.
5. Repeat steps (2)-(4) three or four times to fill the inside of the master cylinder with brake fluid.

BRAKE PIPE LINE BLEEDING

Bleed the air in the sequence shown in the figure.

DISC BRAKE PAD CHECK AND REPLACEMENT

NOTE
The left side outer brake pad has a wear indicator. The wear indicator contacts the brake disc when the brake pad thickness becomes 2 mm and emit a squealing sound to warn the driver.
1. Check brake pad thickness through caliper body check port.
   Standard value: 10 mm
   Limit: 2.0 mm

**Caution**
1. When the limit is exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.
2. If there is a significant difference in the thickness of the pads on the left and right sides, check the sliding condition of the piston and guide pin.

2. Remove the guide pin. Lift caliper assembly and retain with wires.

**Caution**
Do not wipe off the special grease that is on the guide pin or allow it to contaminate the guide pin.

3. Remove the following parts from caliper support.
   (1) Pad and wear indicator assembly <L.H.>, and pad assembly <R.H.>
   (2) Pad assembly
   (3) Pad liner
   (4) Outer shim

4. In order to measure the brake drag force after pad installation, measure the rotary-sliding resistance of the hub with the pads removed. (Refer to P.35A-19.)
5. Install the pads and the caliper assembly, and then check the brake drag force. (Refer to P.35A-19.)
DISC BRAKE ROTOR CHECK

Caution
When servicing disc brakes, it is necessary to exercise caution to keep the disc brakes within the allowable service values in order to maintain normal brake operation.

Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

<table>
<thead>
<tr>
<th>Inspection items</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Scratches, rust, saturated lining materials and wear | • If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering.  
• If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad). |
| Run-out or drift | Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back. |
| Change in thickness (parallelism) | If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging. |
| Inset or warping (flatness) | Overheating and improper handling while servicing will cause inset or warping. |

THICKNESS CHECK

1. Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm in from the outer edge of the disc.

   **Brake disc thickness**
   
   **Standard value:** 24.0 mm <Front>, 10.0 mm <Rear>  
   **Limit:** 22.4 mm <Front>, 8.4 mm <Rear>

   Thickness variation (at least 8 positions)  
   The difference between any thickness measurements should not be more than 0.015 mm.

2. If the disc is beyond the limits for thickness, remove it and install a new one. If thickness variation exceeds the specification, replace the brake disc or turn rotor with on the car type brake lathe (“MAD, DL-8700PF” or equivalent).
RUN-OUT CHECK

1. Remove the caliper support; then raise the caliper assembly upward and secure by using wire.
2. Inspect the disc surface for grooves, cracks and rust. Clean the disc thoroughly and remove all rust.

3. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

Limit:
- 0.06 mm or less <Front>
- 0.08 mm or less <Rear>

NOTE
Tighten the nuts in order to secure the disc to the hub.

RUN-OUT CORRECTION

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.
   (1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.

   (2) Remove the brake disc, and then place a dial gauge as shown in the illustration; then move the hub in the axial direction and measure the play.

   Limit: 0.05 mm
   If the play is equivalent to or exceeds the limit, disassemble the hub knuckle and check each part.

   (3) If the play does not exceed the limit specification, install the brake disc at a position 180° away from the chalk mark, and then check the run-out of the brake disc once again.

2. If the run-out cannot be corrected by changing the phase of the brake disc, replace the disc or turn rotor with on the car type brake lathe ("MAD, DL-8700PF" or equivalent).
BRAKE LINING THICKNESS CHECK

1. Remove the brake drum.
2. Measure the wear of the brake lining at the place worn the most.

   **Standard value:** 4.4 mm
   **Limit:** 1.0 mm

Replace the shoe and lining assembly if brake lining thickness is less than the limit or if it is not worn evenly. For information concerning the procedures for installation of the shoe and lining assembly, refer to P.35A-24.

**Caution**

1. Whenever the shoe and lining assembly is replaced, replace both R.H. and L.H. assemblies as a set to prevent car from pulling to one side when braking.
2. If there is a significant difference in the thickness of the shoe and lining assemblies on the left and right sides, check the sliding condition of the piston.

BRAKE DRUM INSIDE DIAMETER CHECK

1. Remove the brake drum.
2. Measure the inside diameter of the brake drum at two or more locations.

   **Standard value:** 203 mm
   **Limit:** 205 mm

3. Replace brake drums, shoe and lining assembly when wear exceeds the limit value or is badly imbalanced.

BRAKE LINING AND BRAKE DRUM CONNECTION CHECK

1. Remove the brake drum.
2. Remove the shoe and lining assembly.
   (Refer to P.35A-24.)
3. Chalk inner surface of brake drum and rub with shoe and lining assembly.
4. Replace shoe and lining assembly or brake drums if there are any irregular contact area.

**NOTE**
Clean off chalk after check.
BRAKE PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation
Brake Pedal Adjustment (Refer to P.35A-6.)

Removal steps
1. Stop lamp switch connector
2. Stop lamp switch
3. Snap pin
4. Pin assembly
5. Brake pedal shaft bolt
6. Brake pedal
7. Brake pedal pad
8. Brake pedal return spring
9. Bushing
10. Pipe
11. Pedal support member
MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-10.)
- Brake Pedal Adjustment (Refer to P.35A-6.)

Sealant: 3M ATD Part No.8661 or equivalent

L.H. drive vehicles - 4G6, 6A1
- 7 15 Nm
- 6

L.H. drive vehicles - 4D6
- 4

R.H. drive vehicles - 4G6, 6A1
- 6
- 7 15 Nm

R.H. drive vehicles - 4D6
- 4

Sealant: 3M ATD Part No.8661 or equivalent
Removal steps
1. Brake pipe connection
2. Brake fluid level sensor connector
3. Master cylinder assembly
   ►B◄ Push rod protruding length check and adjustment
4. Vacuum hose <4D6>
5. Vacuum pipe <4D6>
6. Vacuum hose (with built-in check valve)
7. Fitting
8. Snap pin
9. Pin assembly
10. Clevis
11. Vacuum switch connector <4D6>
12. Vacuum switch <4D6>
13. Brake booster
14. Sealer

INSTALLATION SERVICE POINTS

►A◄ VACUUM HOSE CONNECTION
Insert securely and completely until the vacuum hose at the engine side contacts the edge of the hexagonal part of the fitting, and then secure by using the hose clip.

►B◄ PUSH ROD PROTRUDING LENGTH CHECK AND ADJUSTMENT
1. Measure dimension A.
   Standard value: 9.65 - 9.90 mm
2. If the protruding length is not within the standard value range, adjust by changing the push rod length by turning the end of the push rod.
Disassembly steps
1. Reservoir cap assembly
2. Reservoir cap
3. Diaphragm
4. Brake fluid level indicator assembly
5. Float
6. Spring pin
7. Reservoir tank
8. Reservoir seal
9. Piston retainer
10. Primary piston assembly
11. Secondary piston assembly
12. Master cylinder body
DISC BRAKE ASSEMBLY INSTALLATION

1. In order to measure the brake drag torque after pad installation, measure the rotary-sliding resistance of the hub by the following procedure with the pads removed.

   <Front>
   (1) Remove the drive shaft.
   (Refer to GROUP 26 - Front Axle.)
(2) Attach the special tool to the front hub assembly as shown in the illustration, and tighten it to the specified torque.

Tightening torque: 196 - 255 Nm

(3) Use a spring balance to measure the rotary-sliding resistance of the hub in the forward direction.

<Rear>
Use a spring balance to measure the rotary-sliding resistance of the hub in the forward direction.

2. After installing the caliper support to the knuckle, install the pad clips and the pads to the caliper support.

Caution
Do not let any oil, grease or other contamination get onto the friction surfaces of the pads and brake discs.

3. Clean piston and insert into cylinder with special tool.
4. Be careful that the piston boot does not become caught when lowering the caliper assembly, and tighten the guide pin to the specified torque.

Tightening torque: 74 Nm

5. Start the engine and then depress the brake pedal 2-3 times.
7. Turn brake disc forward 10 times.

8. Use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.
9. Calculate the drag force of the disc brake (difference between of values measured in item 8 and item 1.)

Standard value: 69 N or less

10. If the drag force of the disc brake exceeds the standard value, disassemble piston and clean piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.
DISASSEMBLY AND REASSEMBLY

Brake caliper kit

Pad repair kit

Seal and boots repair kit

<table>
<thead>
<tr>
<th>Caliper assembly disassembly steps</th>
<th>Pad assembly disassembly steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Lock pin</td>
<td>2. Lock pin</td>
</tr>
<tr>
<td>3. Bushing</td>
<td>3. Bushing</td>
</tr>
<tr>
<td>4. Caliper support (pad, clip, shim)</td>
<td>4. Caliper support (pad, clip, shim)</td>
</tr>
<tr>
<td>5. Boot</td>
<td>11. Pad and wear indicator assembly</td>
</tr>
<tr>
<td>7. Piston boot</td>
<td>13. Outer shim (coated with rubber)</td>
</tr>
<tr>
<td>9. Piston seal</td>
<td></td>
</tr>
<tr>
<td>10. Caliper body</td>
<td></td>
</tr>
</tbody>
</table>
LUBRICATION POINTS

**Caution**
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4

**Grease:** Repair kit grease

DISASSEMBLY SERVICE POINTS

When disassembling the disc brakes, disassemble both sides (left and right) as a set.
**A** PISTON BOOT/PISTON REMOVAL
Protect caliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

**Caution**
Blow compressed air gently.

**B** PISTON SEAL REMOVAL
1. Remove piston seal with finger tip.

   **Caution**
   Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

   **Specified brake fluid:** DOT3 or DOT4

**REASSEMBLY SERVICE POINT**

**A** LOCK PIN/GUIDE PIN INSTALLATION
Install the guide pin and lock pin as illustrated that each head mark of the guide pin and the lock pin matches the indication mark ("G" or "L") located on the caliper body.

**INSPECTION**
- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.
REAR DRUM BRAKE
REMOVAL AND INSTALLATION

Pre-removal Operation
- Loosening the Parking Brake Cable Adjusting Nut.
- Brake Fluid Draining

Post-installation Operation
- Brake Line Bleeding (Refer to P.35A-10.)
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – On-vehicle Service.)

Removal steps
1. Brake drum
2. Lever return spring
3. Shoe-to-lever spring
4. Adjuster lever
5. Auto adjuster assembly
6. Retainer spring
7. Shoe hold-down cup
8. Shoe hold-down spring
9. Shoe-to-shoe spring
10. Shoe and lining assembly
11. Shoe and lever assembly
12. Retainer
13. Wave washer
14. Parking lever
15. Shoe and lining assembly
16. Shoe hold-down pin
17. Brake pipe connection
18. Snap ring
19. Rear hub assembly
20. Backing plate

Specified grease: Brake grease SAE J310, NLGI No.1
REMOVAL SERVICE POINT

\textbf{A} RETAINER REMOVAL

Use a flat-tipped screwdriver or the like to open up the retainer joint, and remove retainer.

INSTALLATION SERVICE POINTS

\textbf{A} WAVE WASHER INSTALLATION

Install the washer in the direction shown in the illustration.

\textbf{B} RETAINER INSTALLATION

Use pliers or the like to install the retainer or the pin positively.
**WHEEL CYLINDER**

**REMOVAL AND INSTALLATION**

<table>
<thead>
<tr>
<th>Pre-removal Operation</th>
<th>Post-installation Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake Fluid draining</td>
<td>• Brake Fluid Supplying</td>
</tr>
<tr>
<td></td>
<td>• Brake Line Bleeding (Refer to P.35A-10.)</td>
</tr>
</tbody>
</table>

**Removal steps**

1. Brake drum
2. Shoe-to-lever spring
3. Shoe-to-shoe spring
4. Auto adjuster assembly
5. Brake pipe connection
6. Wheel cylinder
7. Bleeder screw
**DISASSEMBLY AND REASSEMBLY**

Disassembly steps
1. Boots
2. Piston assembly
3. Pistons

**REASSEMBLY SERVICE POINT**

**PISTON CUP/PISTON REASSEMBLY**

1. Use alcohol or specified brake fluid to clean the wheel cylinder and the piston.
2. Apply the specified brake fluid to the piston cups and the special tool.

   **Specified brake fluid: DOT3 or DOT4**

3. Set the piston cup on the special tool with the lip of the cup facing up, fit the cup onto the special tool, and then slide it down the outside of the tool into the piston groove.

   **Caution**
   In order to keep the piston cup from becoming twisted or slanted, slide the piston cup down the tool slowly and carefully, without stopping.
INSPECTION

Check the piston and wheel cylinder walls for rust or damage, and if there is any abnormality, replace the entire wheel cylinder assembly.

PROPORTIONING VALVE
REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
• Brake Fluid Supplying
• Brake Line Bleeding (Refer to P.35A-10.)

Removal steps
1. Brake pipe
2. Proportioning valve

INSTALLATION SERVICE POINT
BRAKE PIPE CONNECTION

Connect the pipes to the hydraulic unit as shown in the illustration.
1. Proportioning valve – Rear brake (L.H.)
2. Proportioning valve – Rear brake (R.H.)
3. Proportioning valve – Front brake (R.H.)
4. Proportioning valve – Front brake (L.H.)
5. Proportioning valve – Master cylinder (secondary)
6. Proportioning valve – Master cylinder (primary)
ANTI-SKID BRAKING SYSTEM (ABS) <2WD>

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    ............................. Refer to GROUP 35A
  Stop Lamp Switch Check
    ............................. Refer to GROUP 35A
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    ............................. Refer to GROUP 35A
  Check Valve Operation Check
    ............................. Refer to GROUP 35A
  Proportioning Valve Function Test
    ............................. Refer to GROUP 35A
  Brake Fluid Level Sensor Check
    ............................. Refer to GROUP 35A
  Bleeding ............................ Refer to GROUP 35A
  Disc Brake Pad Check and Replacement
    ............................. Refer to GROUP 35A
  Disc Brake Rotor Check
    ............................. Refer to GROUP 35A
  Brake Lining Thickness Check
    ............................. Refer to GROUP 35A
  Brake Drum Inside Diameter Check
    ............................. Refer to GROUP 35A
  Brake Lining and Brake Drum Connection
    Check ............................. Refer to GROUP 35A
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    Check ............................. 19
  ABS Warning Lamp Relay Continuity
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Master Cylinder ............................................. 24

DISC BRAKE ........ Refer to GROUP 35A

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Wheel Cylinder ........ Refer to GROUP 35A

PROPORTIONING VALVE ............... 25

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WHEEL SPEED SENSOR ............. 28
The ABS consists of components such as the wheel speed sensors, stop lamp switch, hydraulic unit assembly, ABS control unit (ABS-ECU) and the ABS warning lamp. If a problem occurs in the system, the malfunctioning components can be identified and the trouble symptoms will be memorized by the diagnosis function. In addition, reading of diagnosis codes and service data and actuator testing are possible by using the MUT-II.

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master cylinder</td>
<td>Type: Tandem type (with level sensor)</td>
</tr>
<tr>
<td></td>
<td>I.D. mm: 25.4</td>
</tr>
<tr>
<td>Brake booster</td>
<td>Type: Vacuum type, tandem</td>
</tr>
<tr>
<td></td>
<td>Effective dia. of power cylinder mm: 180 + 205</td>
</tr>
<tr>
<td></td>
<td>Boosting ratio: 6.5</td>
</tr>
<tr>
<td>Proportioning valve</td>
<td>Type: Dual type</td>
</tr>
<tr>
<td></td>
<td>Decompression ratio: 0.25</td>
</tr>
<tr>
<td>Front brakes</td>
<td>Type: Floating caliper, 1-piston, ventilated disc</td>
</tr>
<tr>
<td></td>
<td>Disc effective dia. x thickness mm: 256 x 24</td>
</tr>
<tr>
<td></td>
<td>Wheel cylinder I.D. mm: 60.3</td>
</tr>
<tr>
<td></td>
<td>Pad thickness mm: 10.0</td>
</tr>
<tr>
<td></td>
<td>Clearance adjustment: Automatic</td>
</tr>
<tr>
<td>Rear drum brakes</td>
<td>Type: Leading trailing</td>
</tr>
<tr>
<td></td>
<td>Drum I.D. mm: 203</td>
</tr>
<tr>
<td></td>
<td>Wheel cylinder I.D. mm: 20.6</td>
</tr>
<tr>
<td></td>
<td>Lining thickness mm: 4.4</td>
</tr>
<tr>
<td></td>
<td>Clearance adjustment: Automatic</td>
</tr>
<tr>
<td>Brake fluid</td>
<td>DOT3 or DOT4</td>
</tr>
<tr>
<td>ABS type</td>
<td>4-sensor, 3-channel method</td>
</tr>
<tr>
<td>Speed sensor</td>
<td>Magnet coil type on 4 wheels</td>
</tr>
<tr>
<td>Front ABS rotor teeth</td>
<td>43</td>
</tr>
<tr>
<td>Rear ABS rotor teeth</td>
<td>43</td>
</tr>
</tbody>
</table>
CONSTRUCTION DIAGRAM

<L.H. drive vehicles>

1. ABS relay
2. ABS warning lamp
3. Stop lamp switch
4. ABS rotor
5. Wheel-speed sensor
6. ABS-ECU
7. Diagnosis connector
8. Hydraulic unit

<R.H. drive vehicles>
### SERVICE SPECIFICATIONS

<table>
<thead>
<tr>
<th>Items</th>
<th>Standard value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel speed sensor internal resistance kΩ</td>
<td>1.0 - 1.5</td>
</tr>
<tr>
<td>Clearance between the wheel speed sensor mounting surface and the ABS toothed rotor mm</td>
<td>28.2 - 28.5</td>
</tr>
<tr>
<td>Wheel speed sensor insulation resistance kΩ</td>
<td>100 or more</td>
</tr>
</tbody>
</table>

### LUBRICANTS

<table>
<thead>
<tr>
<th>Items</th>
<th>Specified lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake fluid</td>
<td>DOT3 or DOT4</td>
</tr>
</tbody>
</table>

### SPECIAL TOOLS

<table>
<thead>
<tr>
<th>Tool</th>
<th>Number</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MB991502</td>
<td>MUT-II sub assembly</td>
<td>For checking of ABS (Diagnosis code display when using the MUT-II)</td>
</tr>
<tr>
<td></td>
<td>MB991529</td>
<td>Diagnosis code check harness</td>
<td>For checking of ABS (Diagnosis code display when using the ABS warning lamp)</td>
</tr>
</tbody>
</table>
TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING
Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

NOTES WITH REGARD TO DIAGNOSIS
The phenomena listed in the following table are not abnormal.

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Explanation of phenomenon</th>
</tr>
</thead>
<tbody>
<tr>
<td>System check sound</td>
<td>When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment, but this is because the system operation check is being performed, and is not an abnormality.</td>
</tr>
</tbody>
</table>
| ABS operation sound               | 1. Sound of the motor inside the ABS hydraulic unit operation. (whine)  
2. Sound is the generated along with vibration of the brake pedal. (scraping)  
3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release.  
   (Thump: suspension; squeak: tyres) |
| ABS operation (Long braking distance) | For road surfaces such as snow-covered roads and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed and not being too overconfident. |

Diagnosis detection condition can vary depending on the diagnosis code. Make sure that checking requirements listed in the “Comment” are satisfied when checking the trouble symptom again.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK
Read a diagnosis code by the MUT-II or ABS warning lamp.  
(Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

ERASING DIAGNOSIS CODES
With the MUT-II
Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.
With the ABS Warning Lamp

1. Use the special tool to earth terminal (1) (diagnosis control terminal) of the diagnosis connector. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)
2. Stop the engine.
3. Turn on the stop lamp switch. (Depress the brake.)
4. After carrying out steps 1. to 3., turn the ignition switch to ON. Within 3 seconds after turning the ignition switch to ON, turn off the stop lamp switch (release the brake). Then, turn the stop lamp switch on and off a total of 10 times.

NOTE
If the ABS-ECU function has been stopped because of fail-safe operation, it will not be possible to erase the diagnosis codes.

<table>
<thead>
<tr>
<th>Ignition switch</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop lamp switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS warning lamp</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>ABS-ECU memory</td>
<td>Within 3 seconds</td>
<td>Erasing of ABS-ECU diagnosis codes complete.</td>
</tr>
<tr>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
</tr>
<tr>
<td>1 second</td>
<td>1 second</td>
<td>1 second</td>
</tr>
</tbody>
</table>
### INSPECTION CHART FOR DIAGNOSIS CODES

Inspect according to the inspection chart that is appropriate for the malfunction code.

<table>
<thead>
<tr>
<th>Diagnosis code No.</th>
<th>Inspection item</th>
<th>Diagnosis content</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Front right wheel speed sensor</td>
<td>Open circuit</td>
<td>35B-9</td>
</tr>
<tr>
<td>12</td>
<td>Front left wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Rear right wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Rear left wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Wheel speed sensor</td>
<td>Abnormal output signal</td>
<td>35B-10</td>
</tr>
<tr>
<td>16</td>
<td>Power supply system</td>
<td></td>
<td>35B-10</td>
</tr>
<tr>
<td>21</td>
<td>Front right wheel speed sensor</td>
<td>Short circuit</td>
<td>35B-9</td>
</tr>
<tr>
<td>22</td>
<td>Front left wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Rear right wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Rear left wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Stop lamp switch system</td>
<td></td>
<td>35B-11</td>
</tr>
<tr>
<td>41</td>
<td>Front right solenoid valve</td>
<td></td>
<td>35B-26 (Replace the hydraulic unit.)</td>
</tr>
<tr>
<td>42</td>
<td>Front left solenoid valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Rear right solenoid valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Rear left solenoid valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Valve relay problem (stays on)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Valve relay problem (stays off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Motor relay problem (stays off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Motor relay problem (stays on)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Motor system (seized pump motor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>ABS-ECU</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Inspection Procedure for Diagnosis Codes

<table>
<thead>
<tr>
<th>Code Nos. 11, 12, 13 and 14: Wheel speed sensor (open circuit or short circuit)</th>
<th>Probable Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Nos. 21, 22, 23 and 24: Wheel speed sensor</td>
<td>Malfunction of wheel speed sensor</td>
</tr>
<tr>
<td>Code Nos. 11, 12, 13 and 14 are output if the ABS-ECU detects an open circuit or short-circuit in the (+) wire or (-) wire in any one of the four wheel speed sensors.</td>
<td>Malfunction of wiring harness or connector</td>
</tr>
<tr>
<td>Code Nos. 21, 22, 23 and 24 are output in the following cases.</td>
<td>Malfunction of hydraulic unit</td>
</tr>
<tr>
<td>- When there is no input from any one of the four wheel speed sensors when travelling at several km/h or more, even though open circuit can not be verified.</td>
<td>- Malfunction of wheel speed sensor</td>
</tr>
<tr>
<td>- When a chipped or blocked-up ABS rotor is detected and if the anti-lock system operates continuously because a malfunctioning sensor or a warped ABS rotor is causing sensor output to drop.</td>
<td>- Malfunction of wiring harness or connector</td>
</tr>
<tr>
<td>- Too much gap between the sensor and the rotor</td>
<td>- Malfunction of ABS rotor</td>
</tr>
<tr>
<td>- Malfunction of wheel bearing</td>
<td></td>
</tr>
</tbody>
</table>

### Wheel Speed Sensor Installation Check

**NG**
- Repair

**OK**
- Measure at the ABS-ECU connector A-04.
- Disconnect the connector, and measure at the harness side connector.
- Resistances between 20 and 19, 2 and 1, 22 and 23, 6 and 5
  - OK: 1.0 - 1.5 kΩ

### Wheel Speed Sensor Output Voltage Check

**OK**
- Wheel speed sensor check (Refer to P.35B-19.)

**NG**
- Replace

**OK**
- ABS rotor check (Refer to P.35B-29.)

**NG**
- Replace

**OK**
- Wheel bearing check (Refer to GROUP 26 and GROUP 27 - On-vehicle Service.)

### Check the Following Connectors:

**OK**
- Check the trouble symptom.

**NG**
- Check the harness wire, and repair if necessary.
  - Between each wheel speed sensor and ABS-ECU

**OK**
- Measure at the ABS-ECU connector A-04.

**NG**
- Check the trouble symptom.

**OK**
- Replace the hydraulic unit.
### Code No.15 Wheel speed sensor (abnormal output signal)

<table>
<thead>
<tr>
<th>Probable cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The four vehicle tires are of different sizes</td>
</tr>
<tr>
<td>- Improper installation of wheel speed sensor</td>
</tr>
<tr>
<td>- Malfunction of wheel speed sensor</td>
</tr>
<tr>
<td>- Malfunction of wiring harness or connector</td>
</tr>
<tr>
<td>- Malfunction of ABS rotor</td>
</tr>
<tr>
<td>- Malfunction of wheel bearing</td>
</tr>
<tr>
<td>- Malfunction of hydraulic unit</td>
</tr>
</tbody>
</table>

#### Probable cause

- The four vehicle tires are of different sizes
- Improper installation of wheel speed sensor
- Malfunction of wheel speed sensor
- Malfunction of wiring harness or connector
- Malfunction of ABS rotor
- Malfunction of wheel bearing
- Malfunction of hydraulic unit

#### Are the sizes of all four tires identical?

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equip the vehicle with tires of identical sizes.</td>
<td></td>
</tr>
</tbody>
</table>

#### Check the trouble symptom.

<table>
<thead>
<tr>
<th>NG</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair</td>
<td></td>
</tr>
</tbody>
</table>

#### Wheel speed sensor installation check

<table>
<thead>
<tr>
<th>OK</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair</td>
<td></td>
</tr>
</tbody>
</table>

#### Wheel speed sensor output voltage check (Refer to P.35B-19.)

<table>
<thead>
<tr>
<th>OK</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel speed sensor check (Refer to P.35B-29.)</td>
<td></td>
</tr>
</tbody>
</table>

#### Check the following connector: A-04

<table>
<thead>
<tr>
<th>OK</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair</td>
<td></td>
</tr>
</tbody>
</table>

#### Check the trouble symptom.

<table>
<thead>
<tr>
<th>NG</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair</td>
<td></td>
</tr>
</tbody>
</table>

#### Replace the hydraulic unit.

### Code No.16 ABS-ECU power supply system (abnormal voltage drop or rise)

<table>
<thead>
<tr>
<th>Probable cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Malfunction of battery</td>
</tr>
<tr>
<td>- Malfunction of wiring harness or connector</td>
</tr>
<tr>
<td>- Malfunction of hydraulic unit</td>
</tr>
</tbody>
</table>

#### Probable cause

- Malfunction of battery
- Malfunction of wiring harness or connector
- Malfunction of hydraulic unit

#### Caution

If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output.

Before carrying out the following inspection, check the battery level, and refill it if necessary.

#### Measure at the ABS-ECU connector A-04.

* Disconnect the connector, and measure at the harness side connector.
* Start the engine. Voltage between 4 and body earth
  
<table>
<thead>
<tr>
<th>OK</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery voltage</td>
<td></td>
</tr>
</tbody>
</table>

#### Check the following connector: A-04

<table>
<thead>
<tr>
<th>OK</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair</td>
<td></td>
</tr>
</tbody>
</table>

#### Check the trouble symptom.

<table>
<thead>
<tr>
<th>NG</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair</td>
<td></td>
</tr>
</tbody>
</table>

#### Replace the hydraulic unit.

#### Check the following connectors:

A-04, C-75, C-66 <L.H. drive vehicles>, C-134, C-131

<table>
<thead>
<tr>
<th>OK</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair</td>
<td></td>
</tr>
</tbody>
</table>

#### Check the battery.

<table>
<thead>
<tr>
<th>NG</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check the harness wire, and repair if necessary.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NG</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between each wheel speed sensor and ABS-ECU</td>
<td></td>
</tr>
</tbody>
</table>
## Code No.33 Stop lamp switch system (open circuit or stop lamp stays ON)

This code is output in the following cases:
- If the stop lamp switch is continuously on for 15 minutes or more even though the ABS system is not operating.
- If there is an open circuit in the stop lamp switch input circuit harness.

### Probable cause
- Malfunction of stop lamp switch
- Malfunction of wiring harness or connector
- Malfunction of hydraulic unit

### Repair
- OK
- NG

#### NG
- Replace the hydraulic unit.
- Check the harness wire, and repair if necessary.
  - Between fusible link No.1 and ABS-ECU

#### OK
- Stop lamp switch installation check
  - OK
  - NG
    - Repair
- Stop lamp switch check (Refer to GROUP 35A - Brake Pedal.)
  - OK
  - NG
    - Replace
- Check the following connectors:
  - A-04, C-75, C-65
  - C-12 <R.H. drive vehicles>, C-142, C-134, C-02, C-65, C-75, A-04
  - OK
  - NG
    - Repair
- Check the trouble symptom.
  - NG
  - Repair

### ABS WARNING LAMP INSPECTION

Check that the ABS warning lamp illuminates as follows.

1. When the ignition key is turned to “ON”, the ABS warning lamp illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to “START”, the ABS warning lamp remains illuminated.
3. When the ignition key is turned from “START” back to “ON”, the ABS warning lamp illuminates for approximately 3 seconds and then switches off.

**NOTE**
The ABS warning lamp may remain on until the vehicle reaches a speed of several km/h. This is limited to cases where diagnosis code Nos.21 - 24 and 55 have been recorded because of a previous problem occurring. In this case, the ABS-ECU keeps the warning lamp illuminated until the problem corresponding to that diagnosis code can be detected.

4. If the illumination is other than the above, check the diagnosis codes.
# INSPECTION CHART FOR TROUBLE SYMPTOMS

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

<table>
<thead>
<tr>
<th>Trouble symptoms</th>
<th>Inspection procedure No.</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication between the MUT-II and the whole system is not possible.</td>
<td>1</td>
<td>35B-12</td>
</tr>
<tr>
<td>Communication between the MUT-II and the ABS-ECU is not possible.</td>
<td>2</td>
<td>35B-13</td>
</tr>
<tr>
<td>When the ignition key is turned to “ON” (engine stopped), the ABS warning lamp does not illuminate.</td>
<td>3</td>
<td>35B-14</td>
</tr>
<tr>
<td>Even after the engine is started, the ABS warning lamp remains illuminated.</td>
<td>4</td>
<td>35B-15</td>
</tr>
<tr>
<td>Faulty ABS operation</td>
<td>5</td>
<td>35B-16</td>
</tr>
</tbody>
</table>

## Caution

1. If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.
2. During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

## INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

### Inspection Procedure 1

**Communication between the MUT-II and the whole system is not possible.**

- The cause may be a malfunction of the power supply circuit or the earth circuit of the diagnosis connector.
  - Malfunction of diagnosis connector
  - Malfunction of wiring harness or connector

#### Probable cause

<table>
<thead>
<tr>
<th>Probable cause</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Malfunction of diagnosis connector</td>
</tr>
<tr>
<td>Malfunction of wiring harness or connector</td>
</tr>
</tbody>
</table>

#### Measure at the diagnosis connector C-20.

- **OK:** Battery voltage
- **NG:** Check the following connectors: 
  - <L.H. drive vehicles>
    - C-20, C-66, C-63, C-132, C-141
  - <R.H. drive vehicles>
    - C-20, C-66, C-62, C-14

#### Check the trouble symptom.

- **OK:** Replace the MUT-II.
- **NG:** Check the harness wire, and repair if necessary.

---

**Continuity between 4 and body earth, and between 5 and body earth.**

- **OK:** Continuity
- **NG:** Check the following connector: C-20

---

**Voltage between 16 and body earth.**

- **OK:** Battery voltage
- **NG:** Check the following connectors: 
  - <L.H. drive vehicles>
    - C-20, C-66, C-63, C-132, C-141
  - <R.H. drive vehicles>
    - C-20, C-66, C-62, C-14

---

**Measure at the diagnosis connector C-20.**

- **OK:** Continuity
- **NG:** Check the harness wire, and repair if necessary.

---

**Check the trouble symptom.**

- **OK:** Repair
- **NG:** Replace the MUT-II.

---

**Check the harness wire, and repair if necessary.**

- **OK:** Repair
- **NG:** Replace the MUT-II.
Inspection Procedure 2

Communication between MUT-II and the ABS-ECU is not possible.

The cause may be an open circuit in the ABS-ECU power supply circuit or an open circuit in the diagnosis output circuit.

<table>
<thead>
<tr>
<th>Probable cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Blown fuse</td>
</tr>
<tr>
<td>• Malfunction of wiring harness or connector</td>
</tr>
<tr>
<td>• Malfunction of hydraulic unit</td>
</tr>
</tbody>
</table>

Measure at the diagnosis connector C-20 and the ABS-ECU connector A-04.
- Disconnect the connector, and measure at the harness side connector.
- Continuity between the following terminals
  ABS-ECU side - Diagnosis connector side
  14 - 1
  7 - 7
OK: Continuity

NG

Check the following connectors:
- PETROL-POWERED VEHICLES
  C-51, C-49, C-83, C-66, C-20
- DIESEL-POWERED VEHICLES
  C-51, C-56, C-83, C-66, C-20

OK

NG

Check the trouble symptom.

Repair

Check the harness wire, and repair if necessary.
- Between ABS-ECU and diagnosis connector

Measure at the ABS-ECU connector A-04.
- Disconnect the connector, and measure at the harness side connector.
- Ignition switch: ON
- Voltage between 4 and body earth
OK: Battery voltage

OK

NG

Check the following connectors:
- A-04, C-75, C-66 <L.H. drive vehicles>, C-134, C-131

OK

NG

Check the trouble symptom.

Repair

Check the harness wire, and repair if necessary.
- Between ABS-ECU and harness wire

Measure at the ABS-ECU connector A-04.
- Disconnect the connector, and measure at the harness side connector.
- Continuity between 8 and body earth, between 11 and body earth and between 24 and body earth
OK: Continuity

OK

NG

Check the following connector: A-04

OK

NG

Check the trouble symptom.

Repair

Check the harness wire, and repair if necessary.
- Between ABS-ECU and harness wire

Check the following connectors:
- PETROL-POWERED VEHICLES
  C-51, C-49, C-83, C-66, C-20
- DIESEL-POWERED VEHICLES
  C-51, C-56, C-83, C-66, C-20

OK

NG

Check the trouble symptom.

Repair

Replace the hydraulic unit.
**Inspection Procedure 3**

When the ignition key is turned to “ON” (engine stopped), the ABS warning lamp does not illuminate.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Blown fuse</td>
<td>Replace the ABS warning lamp bulb.</td>
</tr>
<tr>
<td>- Burnt out ABS warning lamp bulb</td>
<td></td>
</tr>
<tr>
<td>- Malfunction of ABS warning lamp relay</td>
<td></td>
</tr>
<tr>
<td>- Malfunction of wiring harness or connector</td>
<td></td>
</tr>
<tr>
<td>- Malfunction of hydraulic unit</td>
<td></td>
</tr>
<tr>
<td>The cause may be an open circuit in the lamp power supply circuit, a blown lamp, a malfunction of the ABS warning lamp relay or an open circuit between the ABS warning lamp and the earth.</td>
<td></td>
</tr>
</tbody>
</table>

**Fuse check**

Multi-purpose fuse No.13

- OK
- NG

Refer to GROUP 00 - Inspection Service Points for Blown Fuse.

**Measure at the connector C-50.**
- Disconnect the connector, and measure at the combination meter side connector.
- Ignition switch: ON
- ABS warning lamp condition when terminal 2 <LHD> or terminal 7 <RHD> is earthed.
  - OK: Illuminates
  - NG

**ABS warning lamp relay check (Refer to P.35B-21.)**

- OK
- NG

Replace the ABS warning lamp relay.

**Disconnect the ABS warning lamp relay connector A-05X and ABS-ECU connector A-04, and measure at the harness side connector of ABS warning lamp relay.**

- OK: Battery voltage

**Check the following connector: A-05X**

- NG

Check the trouble symptom.

**Check the following connectors:**

D-01, D-03, C-135, C-131

**Interconnects**

- OK
- NG

Check the trouble symptom.

**Check the harness wire, and repair if necessary.**

- Between ABS warning lamp and ABS warning lamp relay
- Between ABS warning lamp relay and earth

**OK**

Disconnect the connector, and measure at the combination meter side connector.
- NG

Check whether the ABS warning lamp bulb is burnt out.

**Repair**

**OK**

Check the trouble symptom.

**OK**

Check the following connectors:

D-01, D-03, C-135, C-131

**NG**

Repair

**OK**

Check the trouble symptom.

**OK**

Disconnect the connector A-05X, and measure at the harness side connector of ABS warning lamp relay.

- OK: Battery voltage

**NG**

Check the trouble symptom.

**NG**

Check the harness wire, and repair if necessary.

- Between ABS warning lamp and ABS warning lamp relay
- Between ABS warning lamp relay and earth

**NG**

Check the following connectors:

D-01, D-03, C-135, C-131

**OK**

Check the trouble symptom.

**OK**

Disconnect the connector, and measure at the combination meter side connector.

- NG

Check whether the ABS warning lamp bulb is burnt out.

**NG**

Replace the ABS warning lamp bulb.
Inspection Procedure 4

Even after the engine is started, the ABS warning lamp remains illuminated.

<table>
<thead>
<tr>
<th>Probable cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Malfunction of combination meter</td>
</tr>
<tr>
<td>• Malfunction of ABS warning lamp relay</td>
</tr>
<tr>
<td>• Malfunction of wiring harness (short circuit)</td>
</tr>
<tr>
<td>• Malfunction of hydraulic unit</td>
</tr>
</tbody>
</table>

The cause is probably a short-circuit in the ABS warning lamp illumination circuit.

NOTE
This trouble symptom is limited to cases where communication with the MUT-II is possible (ABS-ECU power supply is normal) and the diagnosis code is a normal diagnosis code.

Does the ABS warning lamp stay illuminated when the connector C-50 is disconnected and the ignition switch is turned to ON?

OK

YES: Replace the combination meter.

NO

NG: Replace the ABS warning lamp relay.

ABS warning lamp relay check (Refer to P.35B-21.)

OK

Check the following connectors: A-05X, A-04

OK

Check the trouble symptom.  

NG

Repair

NG

Check the harness wire, and repair if necessary.

- Between ABS warning lamp and ABS warning lamp relay
- Between ABS warning lamp relay and ABS-ECU

NG

Replace the hydraulic unit.

OK

Between ABS warning lamp and ABS warning lamp relay

OK: Battery voltage

NO: VCC between 2 and body earth

NG

置换组合仪表。
## Inspection Procedure 5

### Faulty ABS operation

This varies depending on the driving conditions and the road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.

<table>
<thead>
<tr>
<th>Probable cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Improper installation of wheel speed sensor</td>
</tr>
<tr>
<td>- Malfunction of wiring harness or connector</td>
</tr>
<tr>
<td>- Malfunction of wheel speed sensor</td>
</tr>
<tr>
<td>- Malfunction of ABS rotor</td>
</tr>
<tr>
<td>- Foreign material adhering to wheel speed sensor</td>
</tr>
<tr>
<td>- Malfunction of wheel bearing</td>
</tr>
<tr>
<td>- Malfunction of hydraulic unit</td>
</tr>
</tbody>
</table>

### Wheel speed sensor installation check

- **OK**: Check the trouble symptom.
- **NG**: Repair

### Wheel speed sensor output voltage check (Refer to P.35B-19.)

- **OK**: Check the trouble symptom.
- **NG**: Measure at the ABS-ECU connector A-04.
  - Disconnect the connector, and measure at the harness side connector.
  - Resistances between 20 and 19, 2 and 1, 22 and 23, 6 and 5
  - **OK**: 1.0 - 1.5 kΩ
  - (The sensor harness and connector should be moved while these inspections are carried out.)

### ABS rotor check (Refer to P.35B-29.)

- **OK**: Check the trouble symptom.
- **NG**: Repair

### Wheel bearing check (Refer to GROUP 26 and GROUP 27 - On-vehicle Service.)

- **OK**: Check the trouble symptom.
- **NG**: Repair

### Check the following connectors:

- **L.H. drive vehicles**: A-09, C-115, C-75, A-39, C-74, E-14, E-13, E-11, C-123, E-12
- **R.H. drive vehicles**: A-09, A-41, A-39, C-115, C-75, E-14, E-13, E-11, C-121, E-12

### Wheel speed sensor output voltage check (Refer to P.35B-19.)

- **OK**: Check the trouble symptom.
- **NG**: Repair

### Wheel speed sensor output voltage check

- **OK**: Check the trouble symptom.
- **NG**: Repair

### Wheel speed sensor check (Refer to P.35B-29.)

- **OK**: Check the trouble symptom.
- **NG**: Repair

### Check the following connector:

- **OK**: Check the trouble symptom.
- **NG**: Repair

### Replace the hydraulic unit.
DATA LIST REFERENCE TABLE

The following items can be read by the MUT-II from the ABS-ECU input data.

1. When the system is normal

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Check item</th>
<th>Checking requirements</th>
<th>Normal value</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Front-right wheel speed sensor</td>
<td>Perform a test run</td>
<td>Vehicle speeds displayed on the speedometer and MUT-II are identical.</td>
</tr>
<tr>
<td>12</td>
<td>Front-left wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Rear-right wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Rear-left wheel speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>ABS-ECU power supply voltage</td>
<td>Ignition switch power supply voltage and valve monitor voltage</td>
<td>9.2 - 17.5 V</td>
</tr>
<tr>
<td>33</td>
<td>Stop lamp switch</td>
<td>Depress the brake pedal.</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Release the brake pedal.</td>
<td>OFF</td>
</tr>
</tbody>
</table>

2. When the ABS-ECU shut off ABS operation.

When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.

NOTE
1. If the ABS-ECU runs down, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. If the vehicle speed during actuator testing exceeds 10 km/h, forced actuation will be canceled.
3. During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.

ACTUATOR TEST SPECIFICATIONS

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Solenoid valves and pump motors in the hydraulic unit</th>
<th>(simple inspection mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Solenoid valve for front-left wheel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Solenoid valve for front-right wheel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Solenoid valve for rear-left wheel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Solenoid valve for rear-right wheel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE
A: Hydraulic pressure increase
B: Hydraulic pressure holds
C: Hydraulic pressure decrease
CHECK AT ABS-ECU

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltage between each terminal and earth.
2. The terminal layout is shown in the illustration below.

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Check item</th>
<th>Checking requirements</th>
<th>Normal condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>ABS-ECU power supply</td>
<td>Ignition switch: ON</td>
<td>Battery voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ignition switch: START</td>
<td>0 V</td>
</tr>
<tr>
<td>7</td>
<td>MUT-II</td>
<td>When the MUT-II is connected</td>
<td>Serial communication with MUT-II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When the MUT-II is not connected</td>
<td>1 V or less</td>
</tr>
<tr>
<td>9</td>
<td>Solenoid valve power supply</td>
<td>Always</td>
<td>Battery voltage</td>
</tr>
<tr>
<td>14</td>
<td>Diagnosis changeover input</td>
<td>When the MUT-II is connected</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When the MUT-II is not connected</td>
<td>Approx. 12 V</td>
</tr>
<tr>
<td>16</td>
<td>ABS valve transistor output</td>
<td>Ignition switch: ON</td>
<td>When the lamp is switched off</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When the lamp is illuminated</td>
<td>Battery voltage</td>
</tr>
<tr>
<td>18</td>
<td>Stop lamp switch input</td>
<td>Ignition switch: ON</td>
<td>Stop lamp switch: ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stop lamp switch: OFF</td>
<td>Battery voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 V or less</td>
</tr>
<tr>
<td>25</td>
<td>Motor power supply</td>
<td>Always</td>
<td>Battery voltage</td>
</tr>
</tbody>
</table>

RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

1. Turn the ignition switch off and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Check them between the terminals indicated in the table below.
3. The terminal layouts are shown in the illustrations below.

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal</th>
<th>Normal condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>Wheel speed sensor (front left)</td>
<td>1.0 - 1.5 kΩ</td>
</tr>
<tr>
<td>5 - 6</td>
<td>Wheel speed sensor (rear left)</td>
<td>1.0 - 1.5 kΩ</td>
</tr>
<tr>
<td>19 - 20</td>
<td>Wheel speed sensor (front right)</td>
<td>1.0 - 1.5 kΩ</td>
</tr>
</tbody>
</table>
### ON-VEHICLE SERVICE

**WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK**

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ABS-ECU connector, and then use the special tool (inspection harness for connector pin contact pressure) to measure the output voltage at the harness-side connector.
3. Rotate the wheel to be measured at approximately 1/2 - 1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

<table>
<thead>
<tr>
<th>Wheel speed sensor</th>
<th>Front left</th>
<th>Front right</th>
<th>Rear left</th>
<th>Rear right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal No.</td>
<td>1</td>
<td>19</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>20</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>

**Output voltage**

- **When measuring with a circuit tester:**
  - 42 mV or more

- **When measuring with an oscilloscope:**
  - 120 mV p-p or more

4. If the output voltage is lower than the above values, the reason could be as follow:
   - Faulty wheel speed sensor.
   - So replace the wheel speed sensor.
Inspecting Waveforms With An Oscilloscope

Use the following method to observe the output voltage waveform from each wheel sensor with an oscilloscope.

- Start the engine, and rotate the front wheels by engaging 1st gear (vehicles with manual transmission) or D range (vehicles with automatic transmission). Turn the rear wheels manually so that they rotate at a constant speed.

**NOTE**
1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The waveform measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

### Points In Waveform Measurement

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable causes</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too small or zero waveform amplitude</td>
<td>Faulty wheel speed sensor</td>
<td>Replace sensor</td>
</tr>
<tr>
<td>Waveform amplitude fluctuates excessively</td>
<td>Axle hub eccentric or with large runout</td>
<td>Replace hub</td>
</tr>
<tr>
<td>(this is no problem if the minimum amplitude is 100 mV or more)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noisy or disturbed waveform</td>
<td>Open circuit in sensor</td>
<td>Replace sensor</td>
</tr>
<tr>
<td></td>
<td>Open circuit in harness</td>
<td>Correct harness</td>
</tr>
<tr>
<td></td>
<td>Incorrectly mounted wheel speed sensor</td>
<td>Mount correctly</td>
</tr>
<tr>
<td></td>
<td>Rotor with missing or damaged teeth</td>
<td>Replace rotor</td>
</tr>
</tbody>
</table>

**Caution**

Because the wheel speed sensor cables move together with the front and rear suspension, they vibrate greatly when driving over poor road surfaces. As a result, the sensor harnesses should also be shaken when monitoring of output waveforms of the wheel speed sensors in order to simulate conditions such as driving over poor road surfaces.
ABS WARNING LAMP RELAY CONTINUITY CHECK

<table>
<thead>
<tr>
<th>Battery voltage</th>
<th>Terminal No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Power is not supplied</td>
<td>○</td>
</tr>
<tr>
<td>Power is supplied</td>
<td>○</td>
</tr>
</tbody>
</table>

<Diagram of ABS warning lamp relay setup>
HYDRAULIC UNIT CHECK

Turn the ignition switch off before connecting or disconnecting the MUT-II.

1. Jack up the vehicle and support the vehicle with rigid racks placed at the specified jack-up points or place the wheels which are checked on the rollers of the braking force tester. 

Caution
1. The roller of the braking force tester and the tyre should be dry during testing.
2. When testing the front brakes, apply the parking brake, and when testing the rear brakes, stop the front wheels by chocking them.

2. Release the parking brake, and feel the drag force (drag torque) on each road wheel. When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II.
4. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.
5. Use the MUT-II to force-drive the actuator.

NOTE
1. During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.
2. When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.

6. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed. When using the braking force tester, depress the brake pedal until the braking force is at the following values, and check that the braking force decreases when the actuator is force-driven.

<table>
<thead>
<tr>
<th>Front wheel</th>
<th>785 - 981 N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear wheel</td>
<td>588 - 784 N</td>
</tr>
</tbody>
</table>

The result should be as shown in the following diagram.

7. If the result of inspection is abnormal, correct according to the “Diagnosis Table” (Refer to P.35B-23).
8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.
## Diagnosis Table

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Judgement - Normal</th>
<th>Judgement - Abnormal</th>
<th>Probable cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>(1) Depress brake pedal to lock wheel. (2) Using the MUT-II, select the</td>
<td>Brake force released for 3 seconds after locking.</td>
<td>Wheel does not lock when brake pedal is depressed.</td>
<td>Clogged brake line other than</td>
<td>Check and clean brake line</td>
</tr>
<tr>
<td></td>
<td>wheel to be checked and force the actuator to operate. (3) Turn the</td>
<td></td>
<td></td>
<td>hydraulic unit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>selected wheel manually to check the change of brake force.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>select the wheel to be checked and force the actuator to operate. (3)</td>
<td></td>
<td></td>
<td>Clogged hydraulic circuit in hydraulic unit</td>
<td>Replace hydraulic unit assembly</td>
</tr>
<tr>
<td></td>
<td>Turn the selected wheel manually to check the change of brake force.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>wheel manually to check the change of brake force.</td>
<td>Brake force is not released</td>
<td>Incorrect hydraulic unit brake tube connection</td>
<td>Connect correctly</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Hydraulic unit solenoid valve not functioning correctly</td>
<td></td>
<td></td>
<td></td>
<td>Replace hydraulic unit assembly</td>
</tr>
</tbody>
</table>

### REMEDY FOR A FLAT BATTERY

When booster cables are used to start the engine when the battery is completely flat and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent, the engine may misfire, and driving might not be possible.

This happens because ABS consumes a great amount of current for its self-check function; the remedy is to either allow the battery to recharge sufficiently, or to remove the fusible link for ABS circuit, thus disabling the anti-skid brake system. The ABS warning lamp will illuminate when the fusible link (for ABS) is removed.

After the battery has sufficiently recharged, install the fusible link (for ABS) and restart the engine; then check to be sure the ABS warning lamp is not illuminated.
MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION
Refer to GROUP 35A.

MASTER CYLINDER

DISASSEMBLY AND REASSEMBLY

Disassembly steps
1. Reservoir cap assembly
2. Reservoir cap
3. Diaphragm
4. Filter
5. Brake fluid level indicator assembly
6. Float
7. Spring pin
8. Reservoir tank
9. Reservoir seal
10. Pin
11. Piston retainer
12. Primary piston assembly
13. Secondary piston assembly
14. Master cylinder body

INSPECTION
- Check the inner surface of master cylinder body for rust or pitting.
- Check the primary and secondary pistons for rust, scoring, wear, damage or wear.
- Check the diaphragm for cracks and wear.
**PROPORTIONING VALVE**

**REMOVAL AND INSTALLATION**

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**Pre-removal Operation**  
Brake Fluid Draining

**Post-installation Operation**  
- Brake Fluid Supplying  
- Brake Line Bleeding (Refer to GROUP 35A - On-vehicle Service.)

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**Flared brake line nuts**  
15 Nm

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**Removal steps**

1. Brake pipe  
2. Proportioning valve

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**INSTALLATION SERVICE POINT**

**A BRAKE PIPE CONNECTION**  
Connect the pipes to the hydraulic unit as shown in the illustration.  
1. Proportioning valve – Rear brake (L.H.)  
2. Proportioning valve – Rear brake (R.H.)  
3. Proportioning valve – Hydraulic unit  
4. Proportioning valve – Hydraulic unit
HYDRAULIC UNIT
REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding
  (Refer to GROUP 35A - On-vehicle Service.)
- Brake Pedal Adjustment
  (Refer to GROUP 35A - On-vehicle Service.)

Removal steps
1. Harness connector
2. Brake pipe connection
3. Hydraulic unit and ABS-ECU
4. Hydraulic unit bracket assembly
REMOVAL SERVICE POINT

A) HARNESS CONNECTOR REMOVAL
Raise the locking lever as shown in the illustration, and then disconnect the harness connector.

B) HYDRAULIC UNIT ASSEMBLY REMOVAL

Caution
1. The hydraulic unit assembly is heavy, and so care should be taken when removing it.
2. The hydraulic unit assembly is not to be disassembled; its nuts and bolts should absolutely not be loosened.
3. The hydraulic unit assembly must not be dropped or otherwise subjected to impact shocks.
4. The hydraulic unit assembly must not be turned upside down or laid on its side.

INSTALLATION SERVICE POINT

A) BRAKE PIPE CONNECTION
Connect the pipes to the hydraulic unit assembly as shown in the illustration.
1. To the proportioning valve (RH)
2. To the proportioning valve (LH)
3. From the master cylinder (Primary)
4. From the master cylinder (Secondary)
5. To the front brake (RH)
6. To the front brake (LH)
WHEEL SPEED SENSOR
REMOVAL AND INSTALLATION

Post-installation Operation
Wheel Speed Sensor Output Voltage Check
(Refer to P.35B-19.)

Front speed sensor removal steps
- Splash Shield Removal (Refer to GROUP 42 - Fender.)
  1. Front speed sensor
  2. Front ABS rotor (Refer to GROUP 26 - Drive Shaft.)

Rear speed sensor removal steps
  3. Rear speed sensor
  4. Rear ABS rotor (Refer to GROUP 27 - Rear Axle Hub.)

NOTE
The front rotor is integrated with the drive shaft and is not disassembled.

REMOVAL SERVICE POINT

Caution
Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them by striking against other parts.
INSTALLATION SERVICE POINT

FRONT SPEED SENSOR/REAR SPEED SENSOR INSTALLATION

The clearance between the wheel speed sensor and the ABS rotor’s toothed surface is not adjustable, but measure the distance between the sensor installation surface and the ABS rotor’s toothed surface.

Standard value: 28.2 - 28.5 mm

INSPECTION 35200840227

SPEED SENSOR

1. Check whether any metallic foreign material has adhered to the pole piece at the speed sensor tip, and if so, remove it.
   Also check whether the pole piece is damaged, and if so, replace it with a new one.
   NOTE
   The pole piece can become magnetized because of the magnet but into the speed sensor, with the result that metallic foreign material easily adheres to it. Moreover, the pole piece may not be able to function to correctly sense the wheel rotation speed if it is damaged.

2. Measure the resistance between the speed sensor terminals.
   Standard value: 1.0 - 1.5 kΩ
   If the internal resistance of the speed sensor is not within the standard value, replace with a new speed sensor.

3. Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.
   NOTE
   When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.
SPEED SENSOR INSULATION INSPECTION
1. Remove all connections from the speed sensor, and then measure the resistance between terminals 1 and 2 and the body of the speed sensor.
   **Standard value: 100 kΩ or more**
2. If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

ABS TOOTHED ROTOR
Check whether ABS rotor teeth are broken or deformed, and, if so, replace the ABS rotor.