

BRAKE (Including A.B.S)

BR

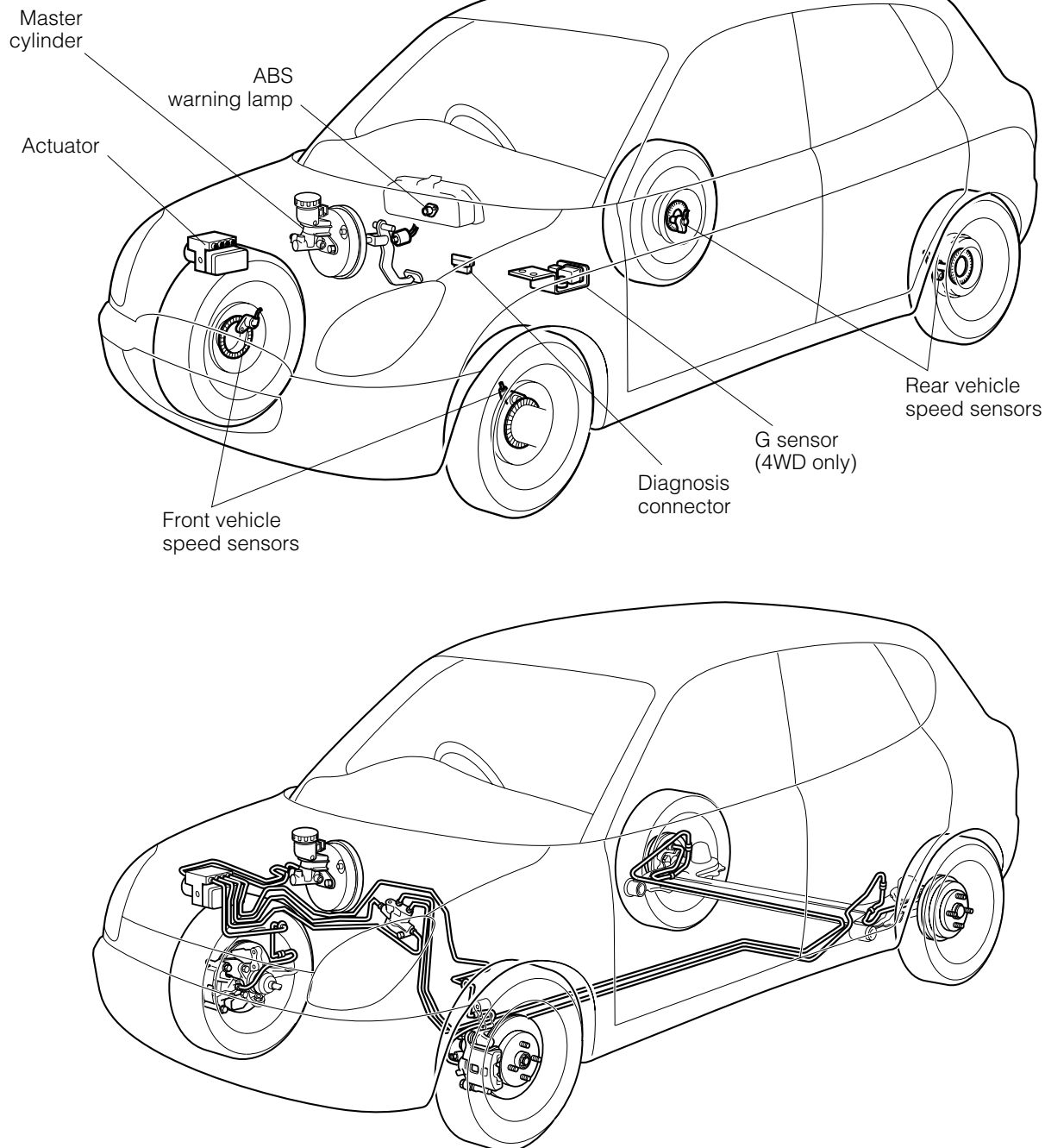
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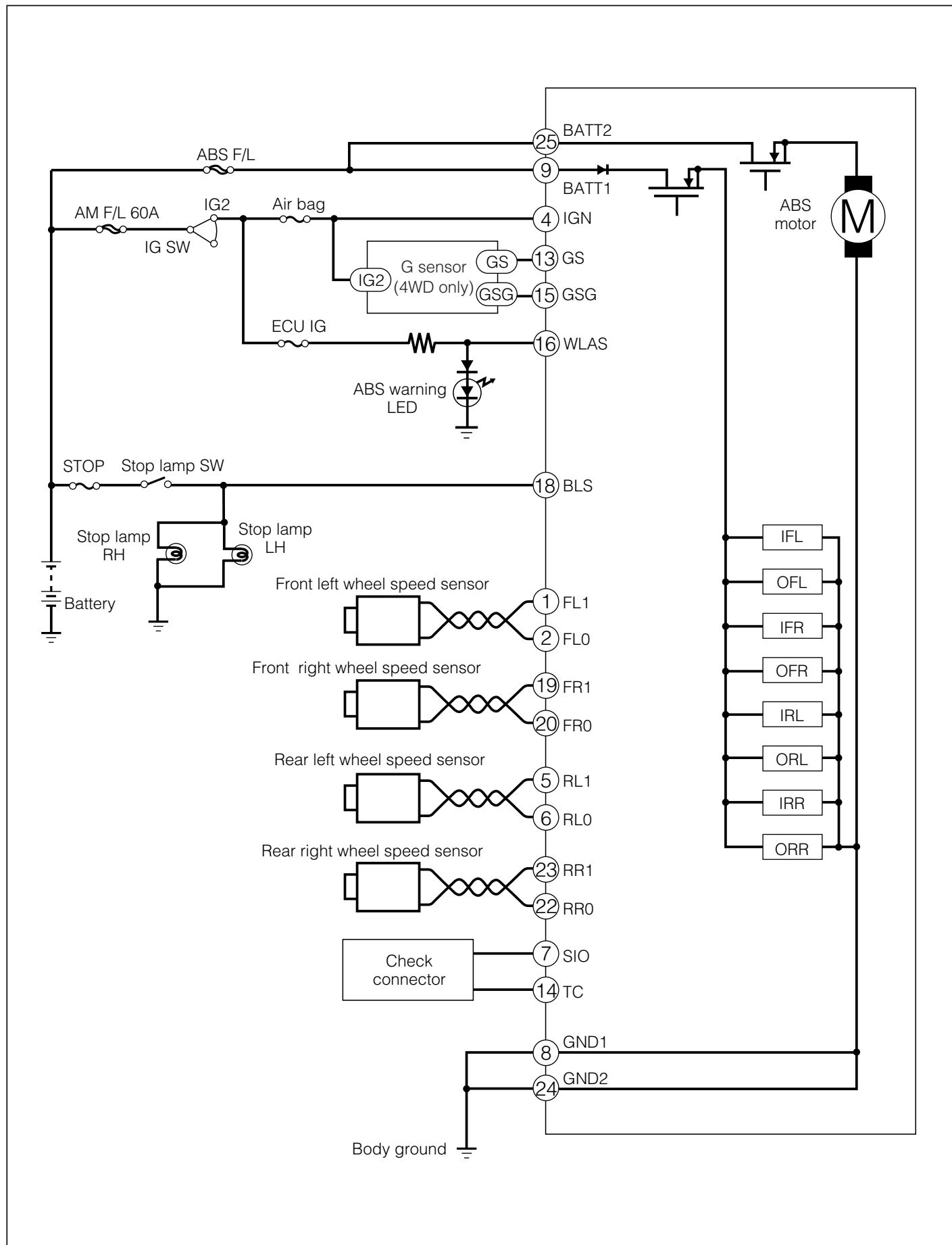
ANTI-LOCK BRAKE SYSTEM

OUTLINE OF SYSTEM

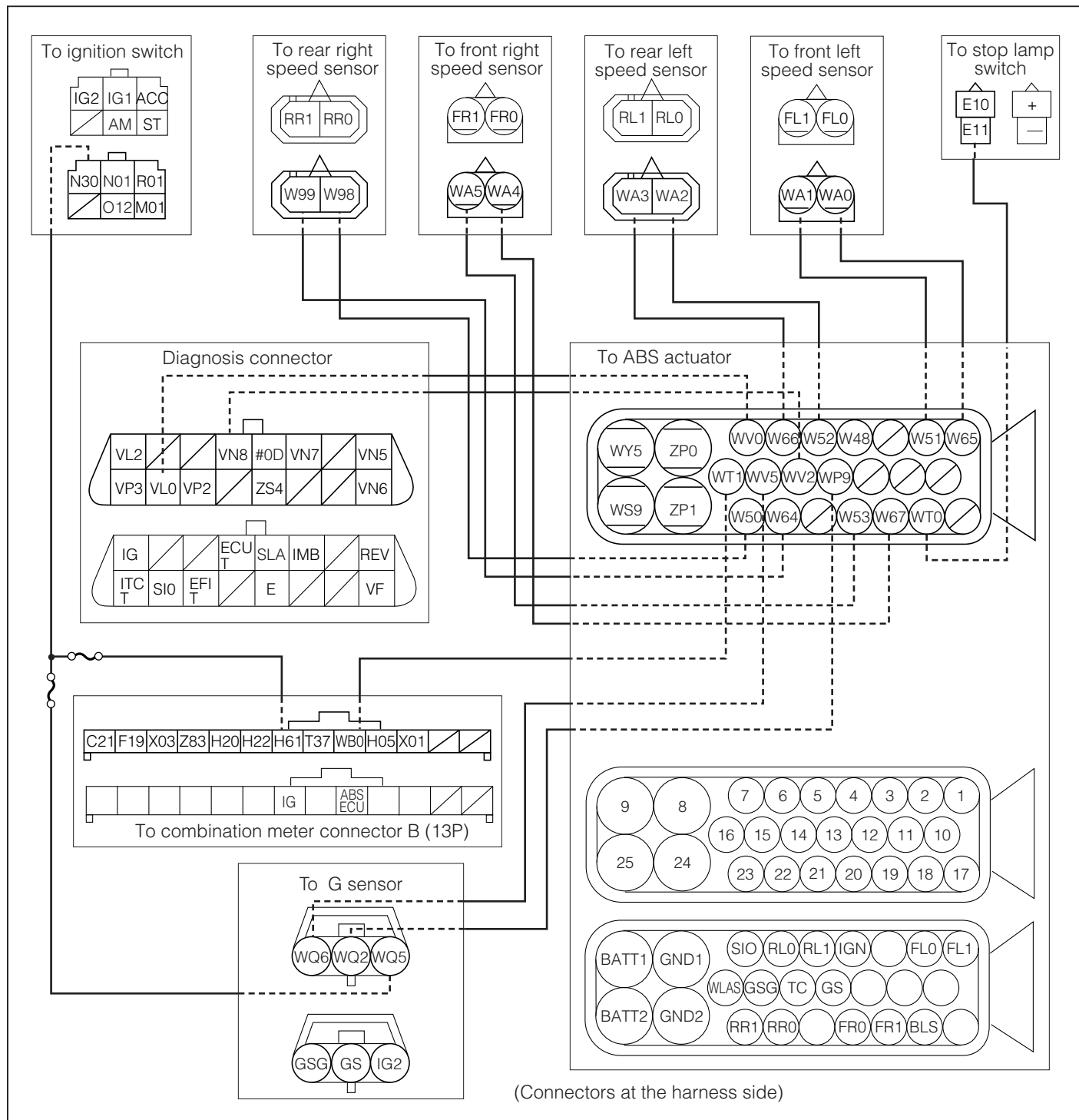
The ABS is a brake system to prevent the wheels from locking which may cause the vehicle to slip. For this purpose, the ABS assures proper braking forces at all times by maintaining the coefficient of friction between the tires and the road surface to an optimum level through controlling the hydraulic pressure of each of the front right, front left and rear wheels. In this way, the controllability or steerability of the steering wheel is assured even under sudden braking/hard braking, except for the case of over-speeding or sharp turning in a corner.



CIRCUIT DIAGRAM



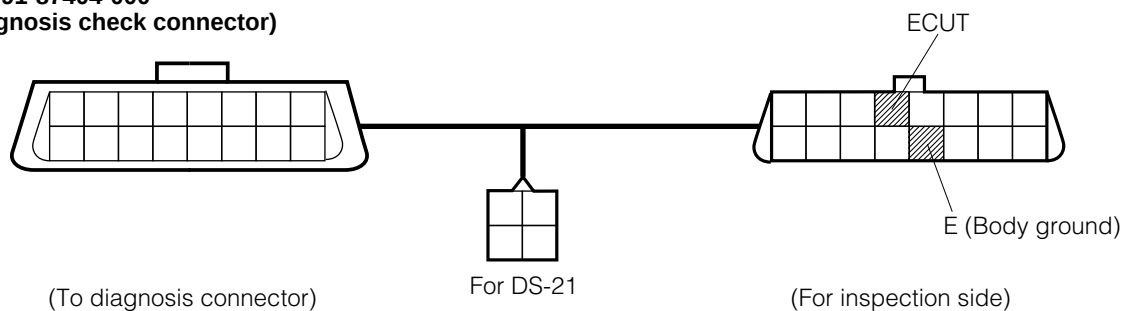
ABS-RELATED CONNECTORS



MABS00003-00003

SST: 09991-87404-000

(For diagnosis check connector)



MABS00000-00004

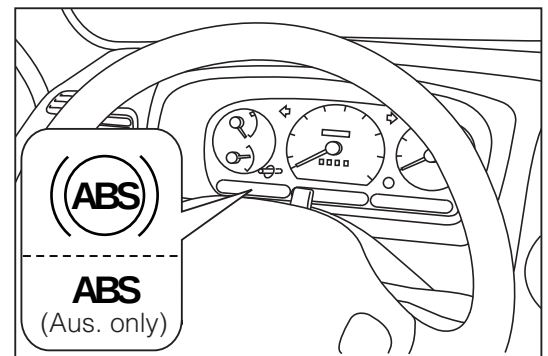
ABS CIRCUIT CONNECTION TABLE

ABS actuator unit			Wheel speed sensor				Stop lamp switch			
No.	Abbreviation code	Terminal of ABS actuator unit to be connected	Front		Rear		Ignition switch			
			Right	Left	Right	Left	ABS fuse			
							Diagnosis check connector			
							Others			
1	FL1 (W51)	Speed sensor (Front left)	○	○						
2	FL0 (W65)	Speed sensor (Front left)	○	○						
4	IGN (W48)	Ignition switch	○				○			
5	RL1 (W66)	Speed sensor (Rear left)	○			○				
6	RL0 (W52)	Speed sensor (Rear left)	○			○				
7	SIO (WV0)	External communication circuit (Diagnosis check connector)	○						○	
8	GND1 (ZP0)	Ground	○							○ Body ground
9	BATT1 (WY5)	ABS fuse	○					○		
13	GS (WP9)	G sensor	○							○ G sensor
14	TC (WV2)	Diagnosis check connector	○						○	
15	GSG (WV5)	G sensor (Ground)	○							○ G sensor
16	WLAS (WT1)	ABS warning lamp	○							○ Combination meter
18	BLS (WT0)	Stop lamp switch	○				○			
19	FR1 (W53)	Speed sensor (Front right)	○	○						
20	FR0 (W65)	Speed sensor (Front right)	○	○						
22	RR0 (W50)	Speed sensor (Rear right)	○			○				
23	RR1 (W64)	Speed sensor (Rear right)	○			○				
24	GND2 (ZP1)	Body ground	○							○ Body ground
25	BATT2 (WS9)	Battery	○					○		

MABS00004-00000

PRECAUTIONS

- The ABS system has a self-diagnosis function. The ECU in the ABS actuator unit memorizes abnormality as diagnosis codes which are occurring at present or occurred in the past.

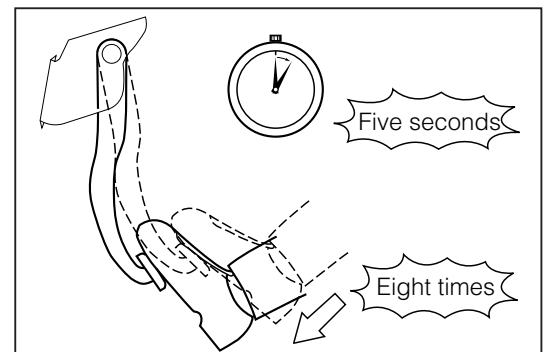


MABS00005-00005

- Memorized diagnosis codes are erased when the brake pedal is depressed eight times or more within predetermined form. Therefore, no diagnosis code will be erased even when the battery power supply is shut off.

NOTE:

- Be sure to perform the sensor check by sensor check function after erasing the diagnosis code.

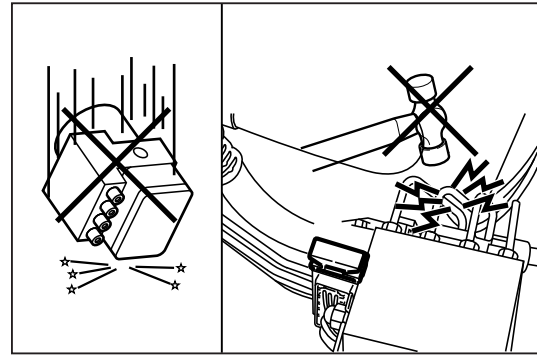


MABS00006-00006

3. The components of the ABS system are precise and delicate. Therefore, never apply any excessive impact during the removal, inspection and installation.

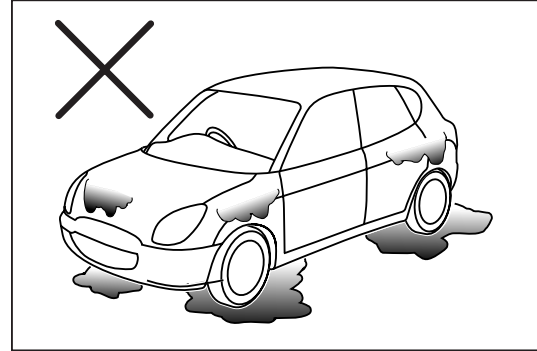
CAUTION:

- Never use components to which an impact has been applied by dropping or hitting with other objects.



MABS00007-00007

4. Never perform the inspection of the ABS system when the vehicle is wet, such as after running in rain or snow and after washing, in order to prevent water or dust, etc. from being admitted into the ABS and related connectors.
5. Never allow water and dust, etc. to enter into the ABS actuator unit and related connectors.
6. Prevent water from coming in contact with the ABS related parts and connectors during washing.

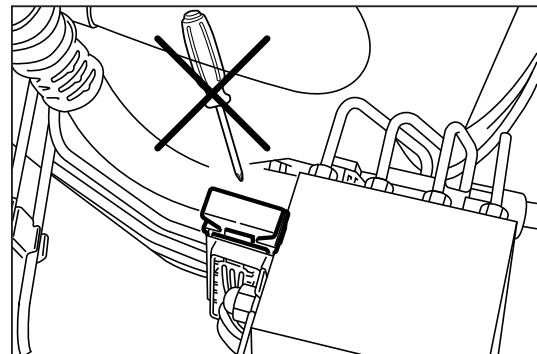


MABS00008-00008

7. Prior to replacing the ABS actuator unit, thoroughly perform the trouble shooting for possible items other than the ABS actuator unit. The ABS actuator unit is a reliable, but an expensive part.
Even when the ABS actuator unit is replaced according to the check results of the trouble shooting and the relevant trouble has been remedied, be sure to reinstall the old ABS actuator unit so as to confirm that the malfunction was obviously caused by the faulty ABS unit.

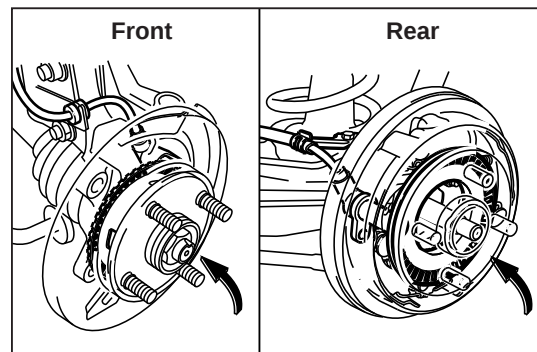
MABS00009-00000

8. Never try to remove the ABS actuator unit cover and touch the screws on the ABS actuator unit proper.
9. Ensure that the components of the brake system are installed properly and that no brake fluid leakage exists before performing the trouble shooting of the ABS.



MABS00010-00009

10. Ensure that no excessive rattle exists on each of the wheel bearings before performing the trouble shooting of the ABS.



MABS00011-00010

11. When installing a wireless installation (Telephone, HAM, CB, etc.):

The ABS actuator unit has been so designed that it is resistant to external influence.

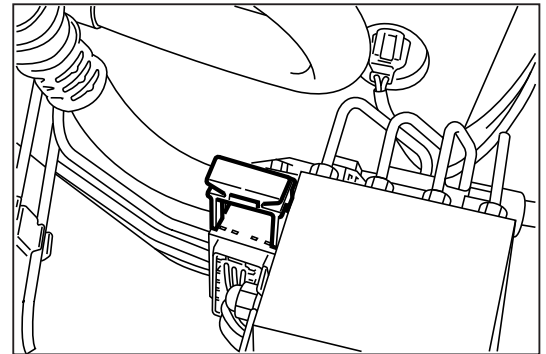
However, if a vehicle is equipped with a wireless installation, such as CB, HAM, telephone and so forth, (even if its output is only 10 Watts) it may affect the ABS actuator unit adversely. Therefore, observe the following precautions.

- Install the antenna at a place as far away as possible from the ABS actuator unit and related harnesses.
- The antenna cord should be kept at least 30 cm from the ABS actuator unit and its related harnesses.
- The antenna cord should not be routed in parallel to ABS related harnesses.
- Adjust the antenna output correctly.
- Never install a wireless installation with a high output into the vehicle.
- Never use or place a handy telephone near the components of the ABS and its related harnesses.

MABS00012-00000

12. When disconnecting or connecting connectors:

- Prevent dust, water and foreign material, etc. from being admitted into the ABS-related connectors when disconnecting or connecting the connectors. Failure to observe this caution may cause serious malfunction, due to lowering the insulation of each terminal.
- Never damage or lose the seal of connectors during disconnection or connection.
- Be sure to confirm the shape of the lock and release the lock properly before disconnecting the connectors.

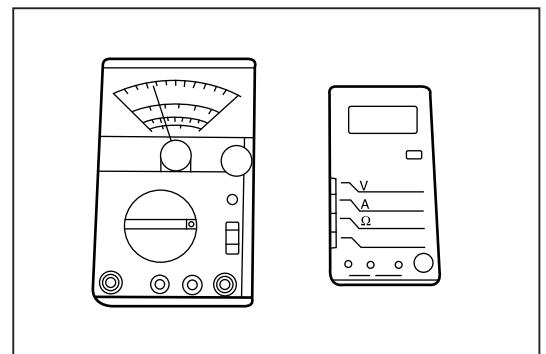


MABS00013-00011

13. Circuit tester

- For trouble shooting, use a volt/ohmmeter whose internal resistance is more than $10\text{ k}\Omega$, whose resolution is 0.1 V or more and $0.5\ \Omega$ or more, and whose accuracy is $0 \pm 2\%$ or more.

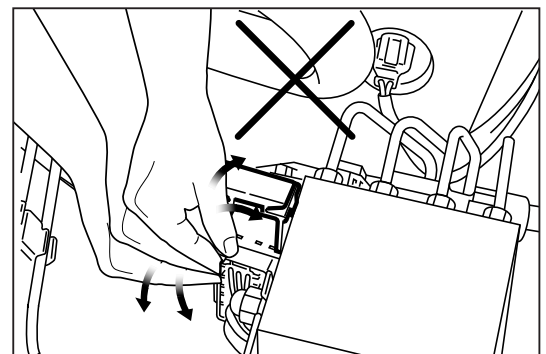
Use of a volt/ohmmeter which has lower specifications than those described above for trouble shooting may lead to wrong diagnosis or mis-judgement.



MABS00014-00012

14. Never deform the terminals of connectors by applying an excessive force when checks are performed by attaching the probe electrodes of the volt/ohmmeter to the terminals.

15. Be sure to disconnect the ground cable from the negative terminal of the battery before disconnecting the connector of the wire harness from the ABS actuator unit. Failure to observe this caution may lead to ABS unit damage.



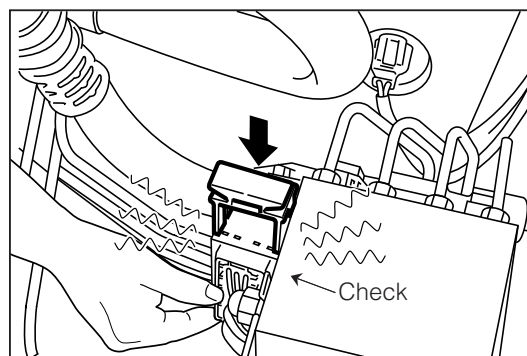
MABS00015-00013

TROUBLE SHOOTING HINTS

Most of troubles related to the electrical system of the ABS are merely caused by poor connections.

Ensure the following points carefully before and during the inspection.

1. Visually inspect that the terminals are not damaged or bent.
2. Ensure that connectors are securely connected and locked.
3. Ensure that the measured continuity or resistance will not be changed when light vibration is applied to the connector or the wire harness connected to the related circuit of presumable parts of trouble.



MABS00016-00014

HOW TO PROCEED TROUBLE SHOOTING

The trouble or malfunction of the brake system mainly originates in the mechanical systems, such as the brake pedal, brake booster, brake master cylinder, P valve, wheel cylinders and brake fluid line, or electrical systems, such as the ABS actuator unit, wheel speed sensors and ABS related wiring harness.

This manual describes mainly trouble shooting of the electrical system of the ABS control systems on the premise that the brake mechanical systems are functioning normally.

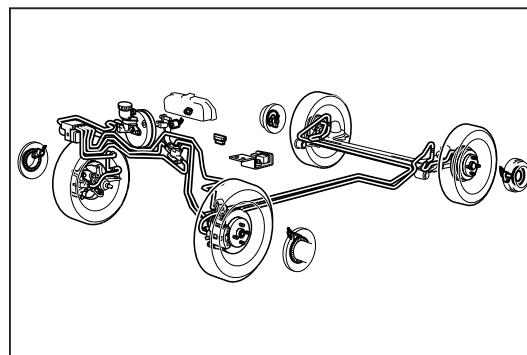
Hence, when the brake system is encountered with any trouble, make sure that the trouble does not originate in the mechanical systems of the brake systems.

To proceed the trouble shooting, first perform the diagnosis check. Then, if any of the diagnosis codes other than the normal codes is outputted, perform the trouble shooting according to the diagnosis codes.

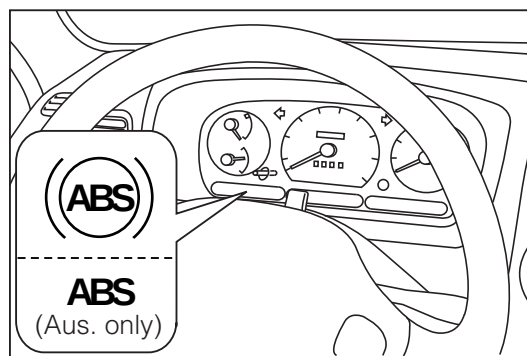
(Refer to page BR-10.)

When no diagnosis code is outputted even if malfunction phenomena exists, perform the trouble shooting according to the malfunction phenomena.

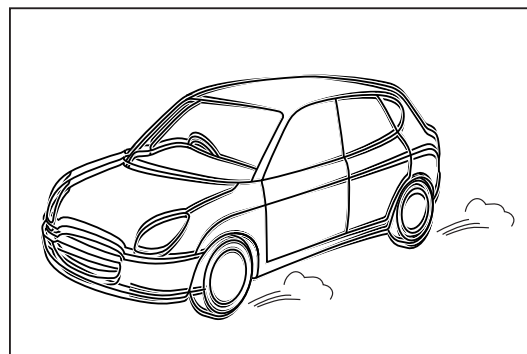
(Refer to page BR-18.)



MABS00017-00015



MABS00018-00016

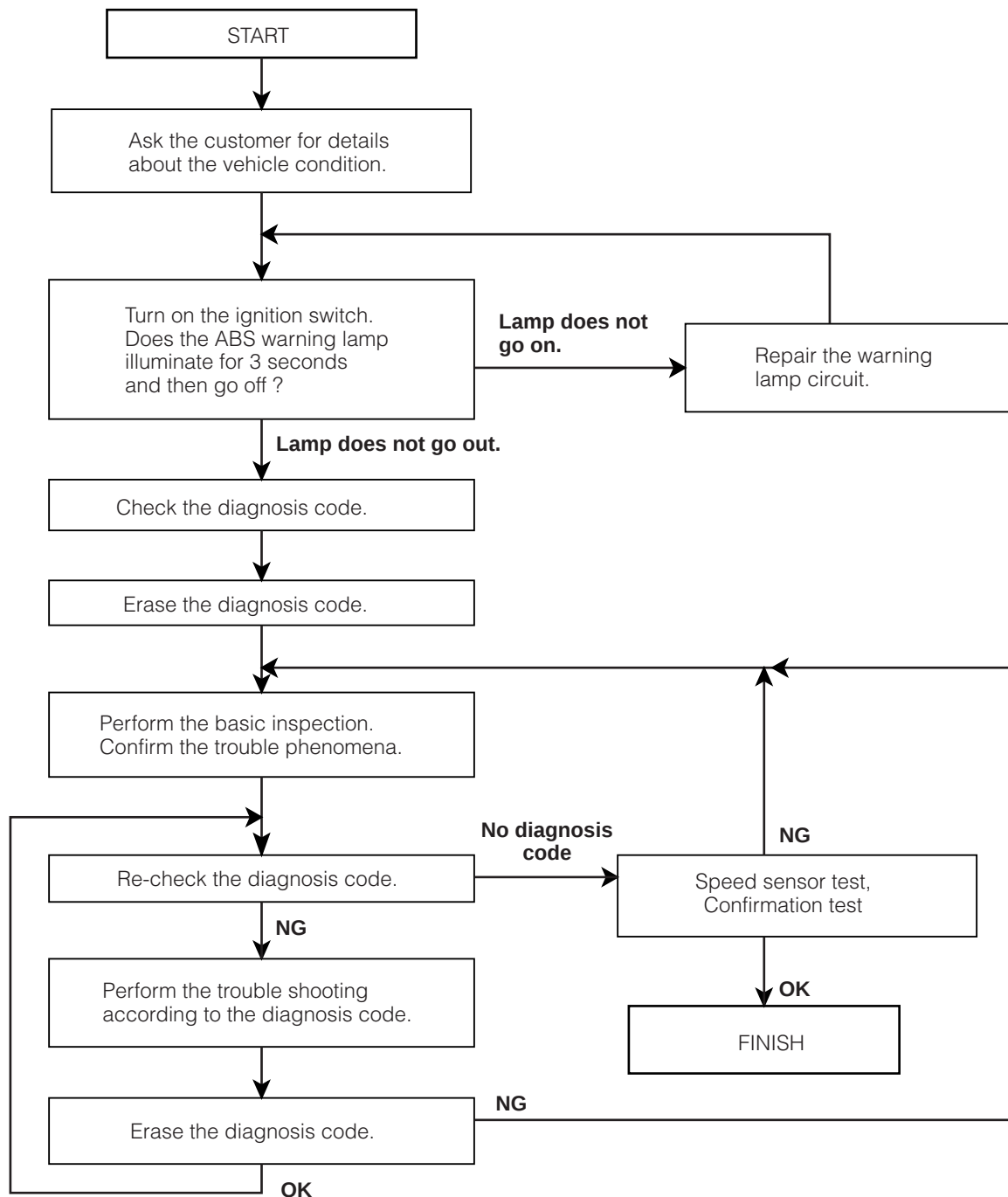


MABS00019-00017

The following diagram shows the basic procedure for the trouble shooting.
Actual approach may differ if you have much experience on this system. However, it is recommended to perform the trouble shooting according to this procedure.

MABS00020-00000

TROUBLE SHOOTING FLOW CHART



MABS00021-00000

DIAGNOSIS CODE CHECK

1. Checking of ABS warning lamp
 - (1) Ensure that the ABS warning lamp will glow for about three seconds after the ignition switch is turned ON, and, then, the warning lamp goes out.

NOTE:

- Proceed to trouble shooting according to the trouble phenomenon if the ABS warning lamp fails to meet the condition above.

2. Output of diagnosis codes

- (1) Connect the following SST to the diagnosis connector.

SST: 09991-87404-000

- (2) Connect the ECUT and E terminals in the SST with the following SST.

SST: 09991-87403-000

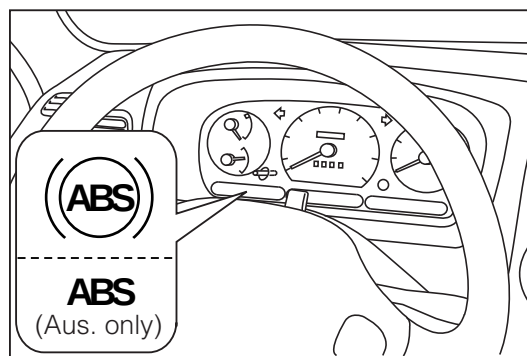
CAUTION:

- Never connect the terminals other than those specified. Even slight contact of the other terminals causes serious malfunction.

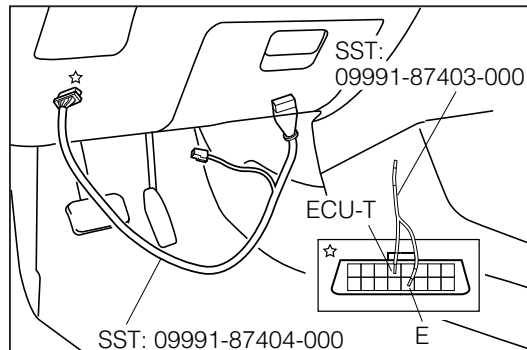
- (3) Turn ON the ignition switch.
- (4) Read out the diagnosis code(s) by observing the number of blinking of the ABS warning lamp.

NOTE:

- When plural malfunction codes are memorized, the code will be outputted starting from a smaller code number at intervals of 2.5 seconds.
- After completion of one cycle, the same codes will be outputted again at intervals of 4 seconds.



MABS00022-00018



MABS00023-00019

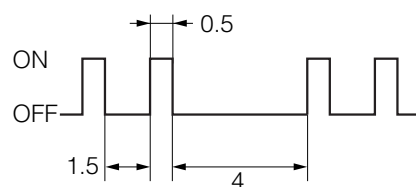
Normal code



Unit: Second

MABS00024-00020

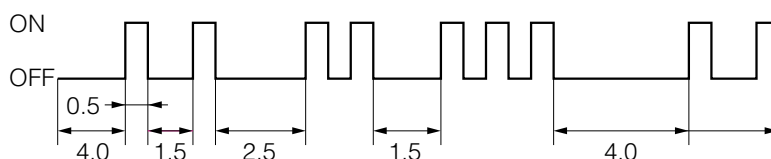
Single code: 11



unit: Second

MABS00025-00021

Plural codes: 11 and 23



unit: Second

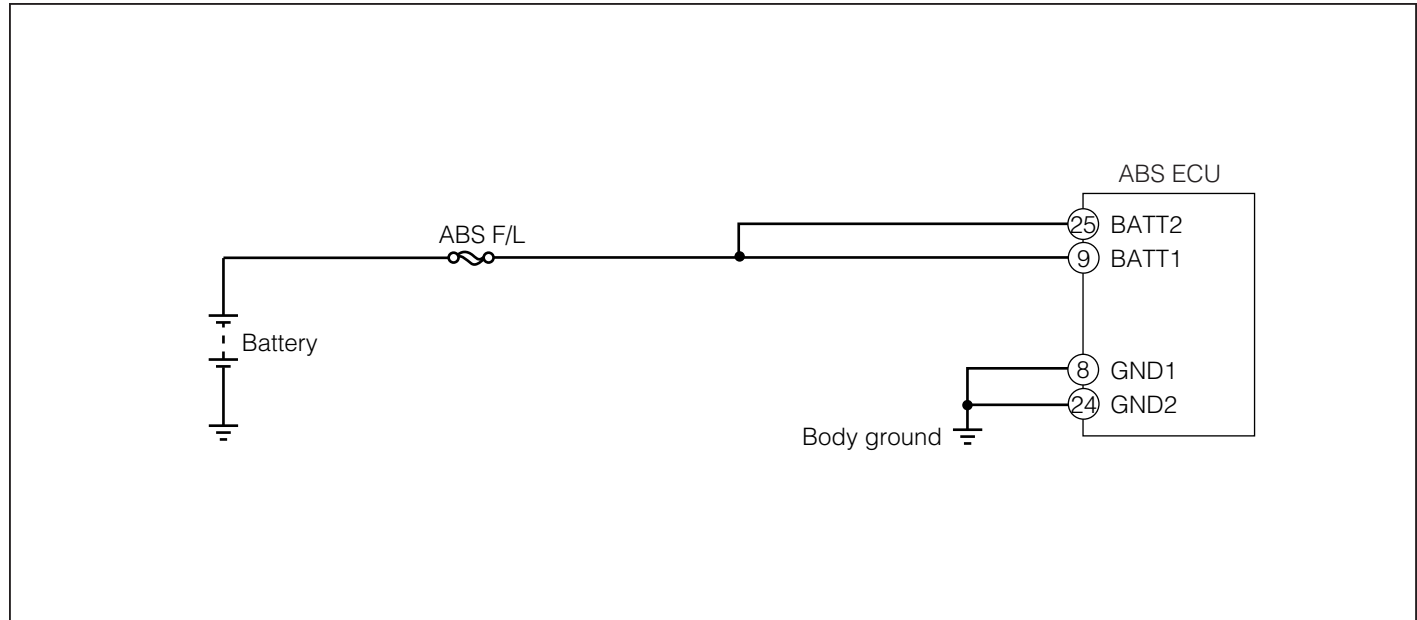
MABS00000-00022

DIAGNOSIS CODE TABLE

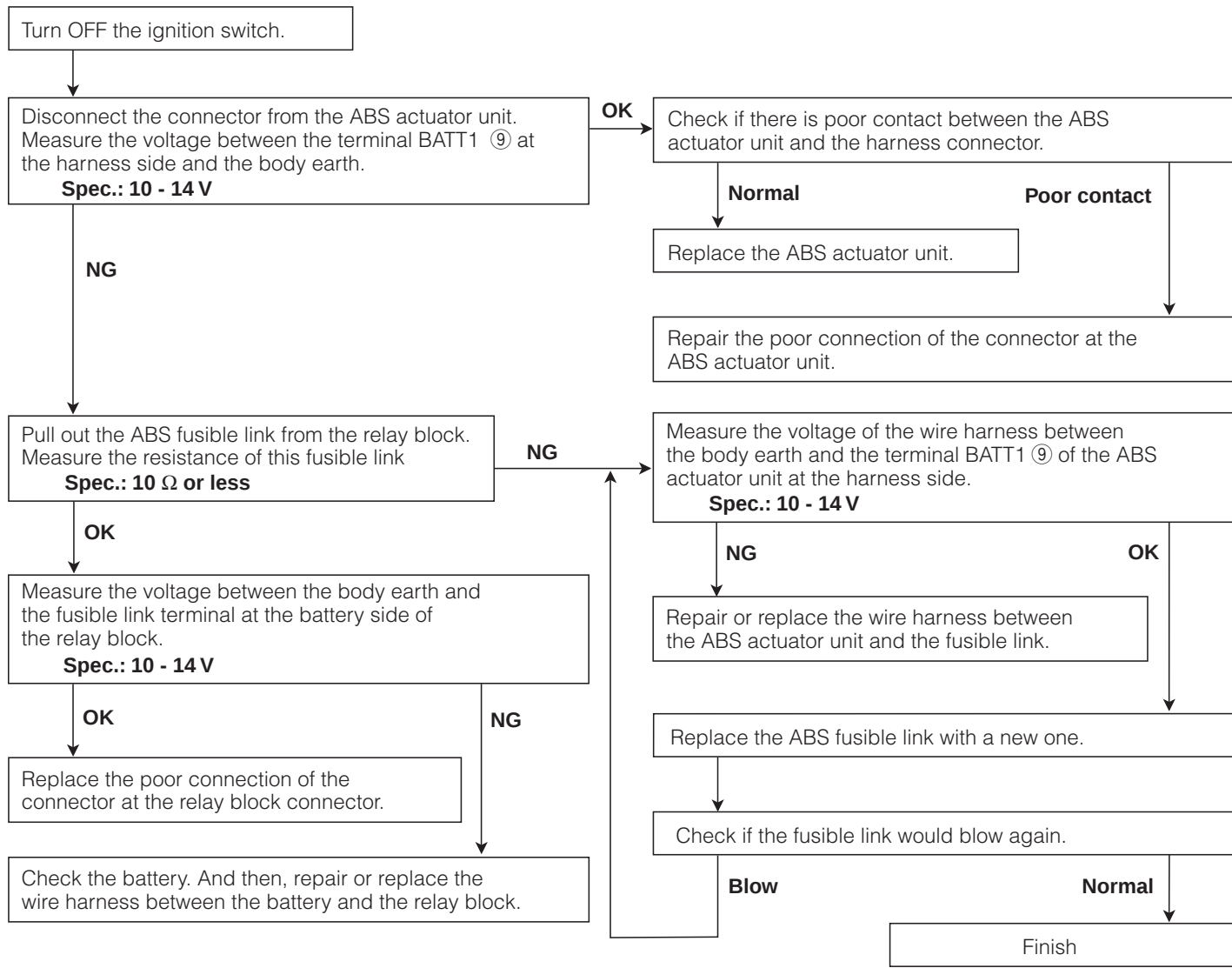
Code No.	Code Warning lamp output	Diagnosis malfunction contents		Refer to page
—		Normal code		
11		Main relay has open wire.		BR-12
12		Main relay is shorted.		Replace the ABS actuator.
13		Motor relay has open wire.		Replace the ABS actuator.
14		Motor relay is shorted.		Replace the ABS actuator.
21		Front right inlet solenoid valve	• Open wire • Short circuit	Replace the ABS actuator.
22		Front right outlet solenoid valve		Replace the ABS actuator.
23		Front left inlet solenoid valve		Replace the ABS actuator.
24		Front left outlet solenoid valve		Replace the ABS actuator.
25		Rear right inlet solenoid valve		Replace the ABS actuator.
26		Rear right outlet solenoid valve		Replace the ABS actuator.
27		Rear left inlet solenoid valve		Replace the ABS actuator.
28		Rear left outlet solenoid valve		Replace the ABS actuator.
31		Front right speed sensor	• Open wire • Short circuit • Abnormal speed sensor signal	BR-13
32		Front left speed sensor		BR-13
33		Rear right speed sensor		BR-13
34		Rear left speed sensor		BR-13
35		Front right speed sensor	• Abnormal speed sensor signal or noise	BR-13
36		Front left speed sensor		BR-13
37		Rear right speed sensor		BR-13
38		Rear left speed sensor		BR-13
41		Abnormal power supply voltage (Low voltage)		BR-15
43		G sensor abnormal (G sensor seized)		BR-16
44		Open wire or Short in G sensor system		BR-16
49		ABS ECU malfunctioning		Replace the ABS actuator.
51		ABS pump motor malfunctioning		Replace the ABS actuator.

<DIAGNOSIS CODE 11>

- Monitoring circuit voltage at time when test pulse is sent to main relay.
- Monitoring the voltage being applied to BATT1 ⑨ and BATT2 ⑫ terminal.



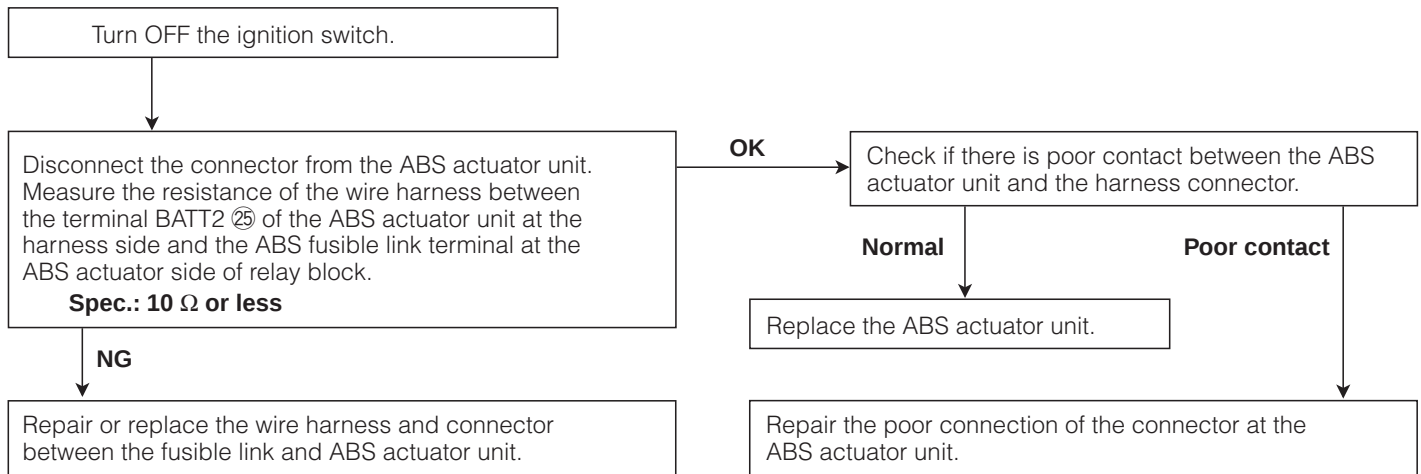
MABS00027-00023



MABS00028-00000

<DIAGNOSIS CODE 13>

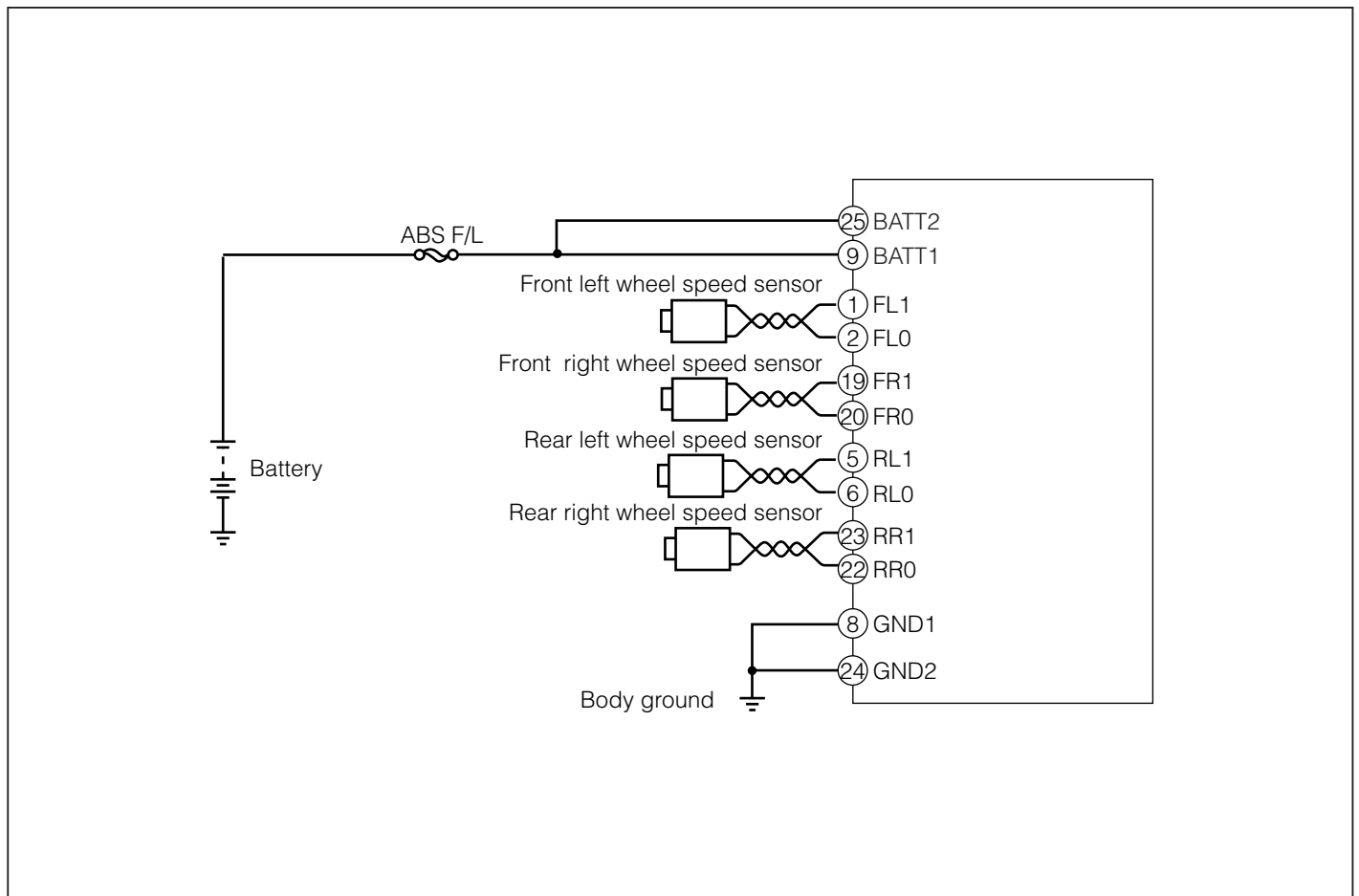
- Monitoring circuit voltage while ABS motor is driving and stopped.



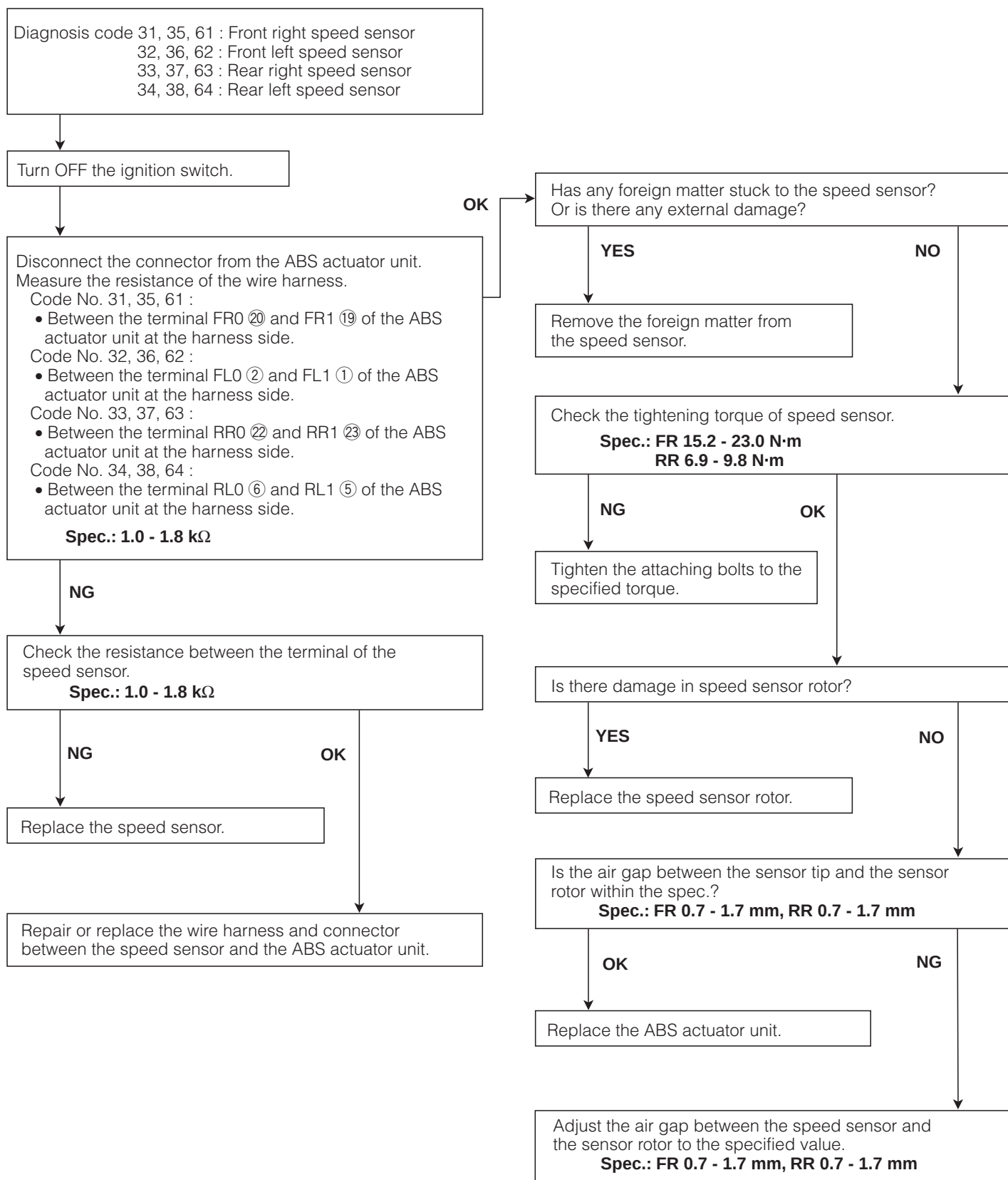
MABS00029-00000

<DIAGNOSIS CODE 31, 32, 33, 34, 35, 36, 37, 38, 61, 62, 63, 64>

- Circuit voltage at time when vehicle stops.
- Output voltage of speed sensor at time of moving-off of vehicle.
- Pressure reduction during ABS control/Length of retention signal. (Solenoid valve operation faulty.)
- Difference in output of speed sensor of each wheel.

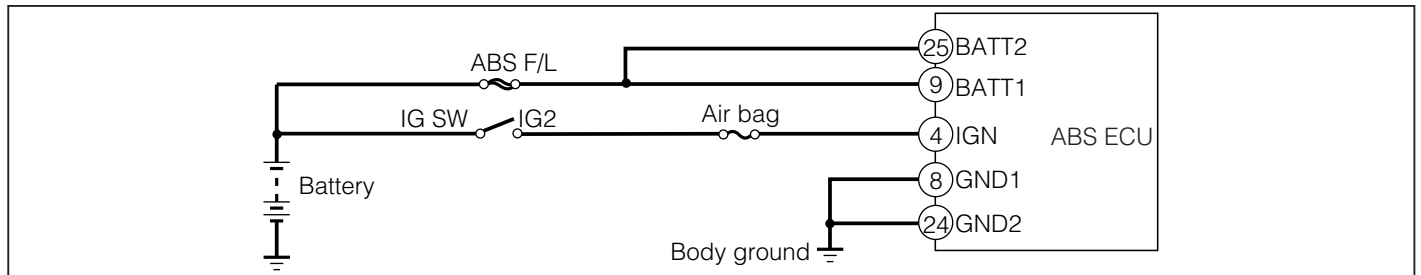


MABS00030-00024



<DIAGNOSIS CODE 41>

- Monitoring input voltage of IGN ④ terminal.



MABS00032-00025

Turn OFF the ignition switch.
Disconnect the connector from the ABS actuator unit.
Turn ON the ignition switch.

Measure the voltage of the wire harness between the terminal IGN ④ and the body earth of the ABS actuator unit at the harness side.

Spec.: 10 - 14 V

OK

Check if there is poor contact between the ABS actuator unit and the harness connector.

Normal

Poor contact

Replace the ABS actuator unit.

Repair the poor connection of the connector at the ABS actuator unit.

NG

Pull out the ECU IG fusible link from the relay block.
Measure the resistance of this fusible link

Spec.: 10 MΩ or more

OK

Turn OFF the ignition switch.
Measure the resistance of the wire harness between the body earth and the terminal IGN ④ of the ABS actuator unit at the harness side.

Spec.: 10 MΩ or more

OK

Replace the ECU IG fuse.
Check if the fuse would blow out again?

NG

Repair or replace the wire harness and connector between the ECU IG fuse and ABS actuator unit.

NG

Measure the voltage between the body earth and the ECU IG fusible link terminal at the battery side of the relay block.

Spec.: 10 - 14 V

OK

Measure the resistance of the wire harness between the terminal of the ECU IG fuse at the secondary side and the IGN ④ terminal of the ABS actuator unit at the harness side.

Spec.: 10 Ω or less

OK

Repair or replace the battery or alternator.

NG

Measure the resistance of the wire harness between the terminal of ECU IG fuse at the ignition switch side and the positive (+) terminal of battery.

Spec.: 10 MΩ or more

NG

Repair or replace the wire harness and connector between the ECU IG fuse and ABS actuator unit.

Repair or replace the wire harness and connector between the ECU IG fuse and ABS actuator unit.

OK

MABS00033-00000

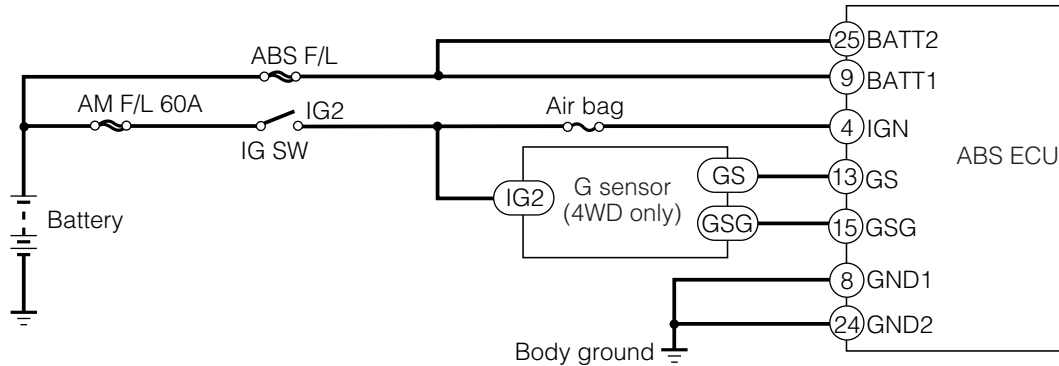
<DIAGNOSIS CODE 43, 44>

- Output condition of diagnosis code No. 43

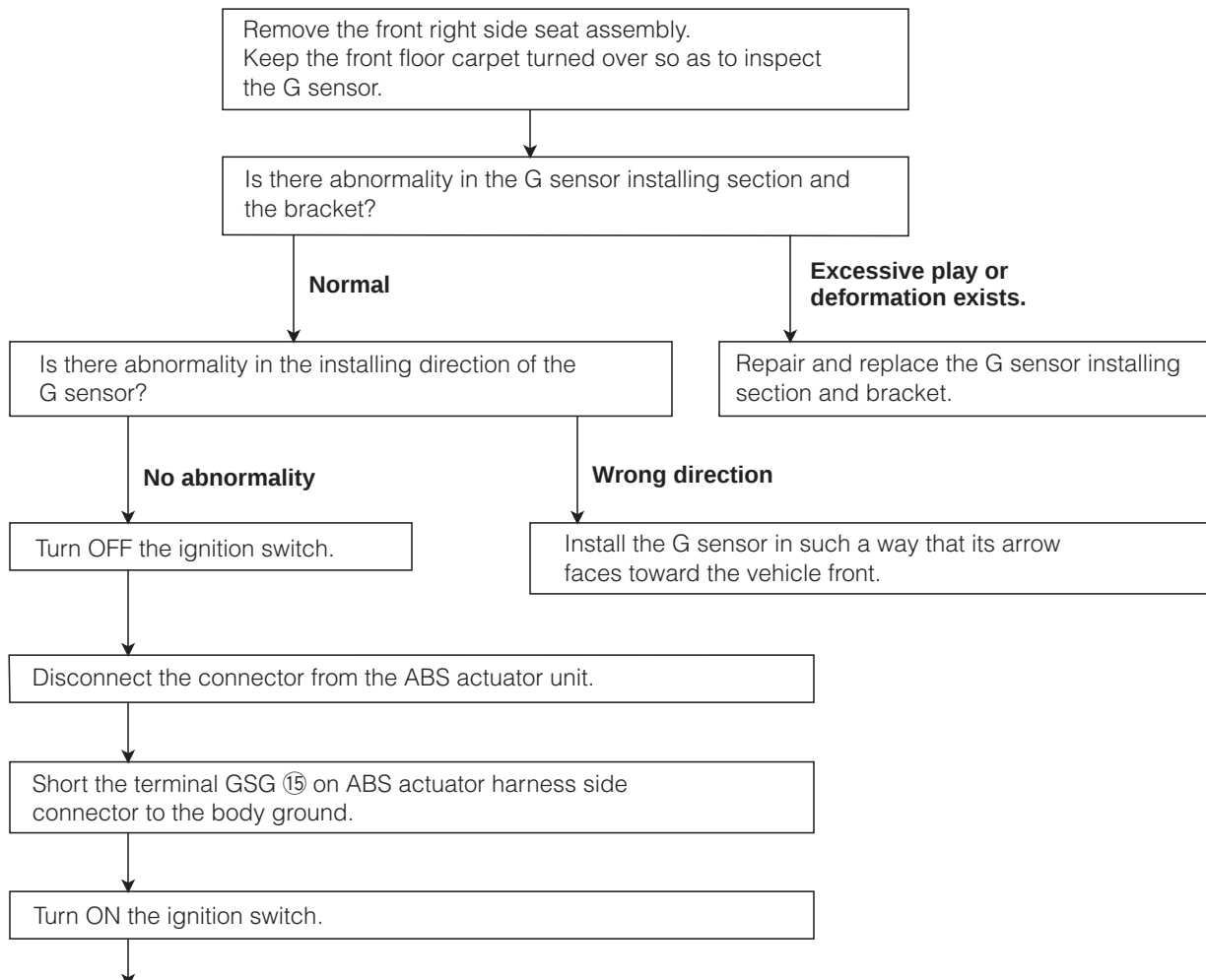
When the output from the G sensor remains unchanged, this code will be outputted. When this code is outputted, check not only the G sensor proper but also its installation condition.

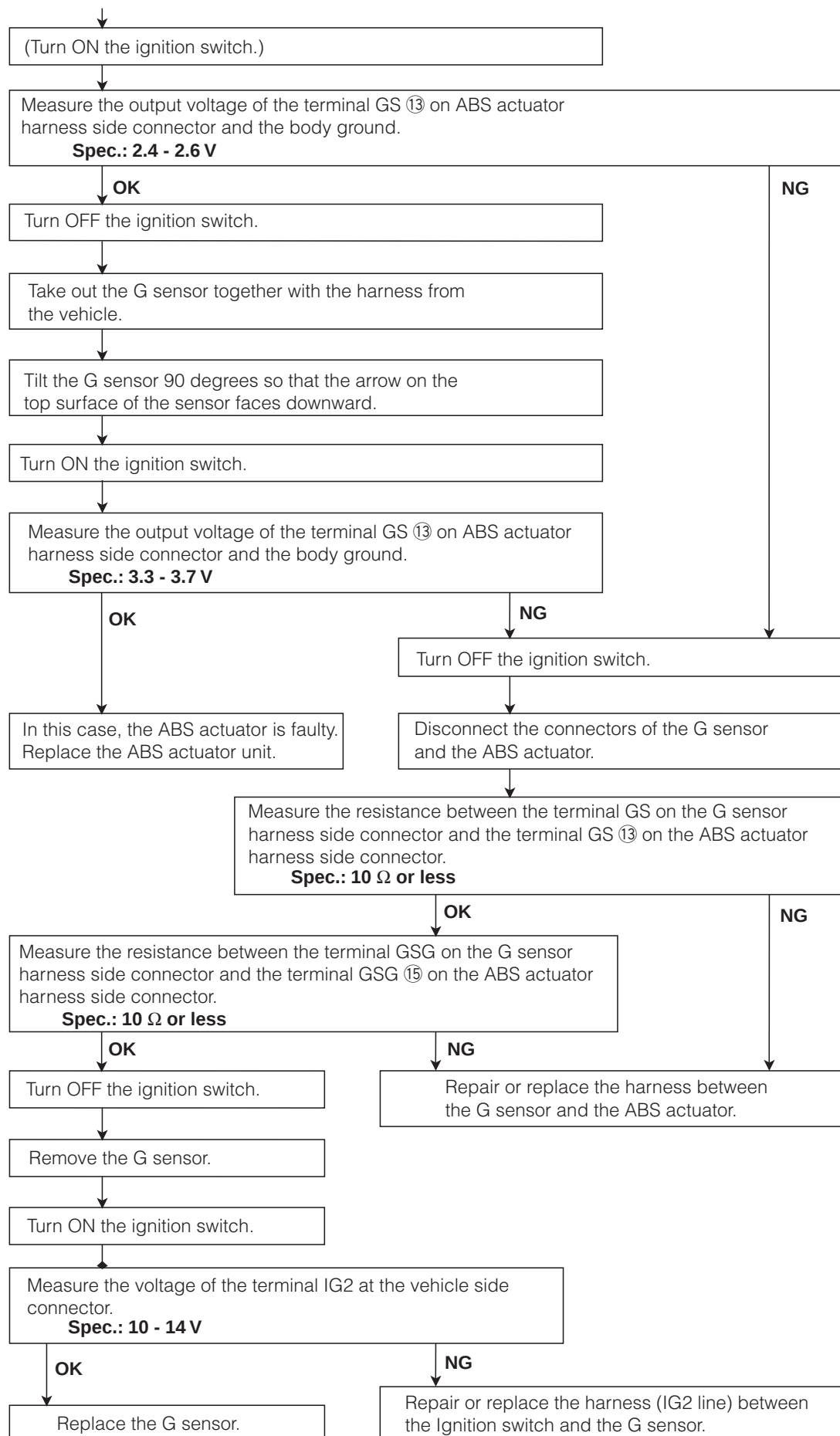
- Output condition of diagnosis code No. 44

When open wire or short circuit detected in the G sensor system, this abnormality code will be outputted. When this code is outputted, check not only the circuit but also the installation of the G sensor.



MABS00034-00026





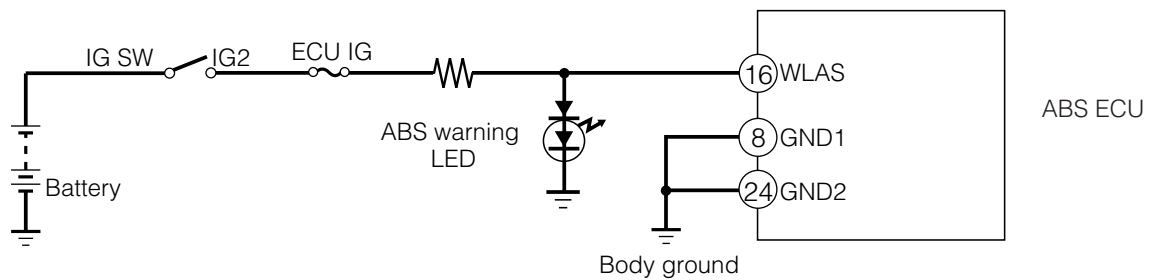
TROUBLE SHOOTING ACCORDING TO TROUBLE PHENOMENA TABLE

TROUBLE PHENOMENA	Refer to page
1. ABS warning lamp remains illuminated even after ignition switch is turned on.	BR-19
2. ABS warning lamp will not glow immediately after ignition switch is turned on.	BR-20
3. ABS warning lamp is illuminated while driving.	BR-21
4. Poor effectiveness	BR-21
5. ABS operates under normal braking.	BR-21
6. ABS operates just before vehicle stops under the normal driving.	BR-21
7. Brake pedal vibrates excessively.	BR-21
8. Wheel locks frequently during ABS operation.	BR-21
9. Brake pedal working travel is too small.	BR-22
10. Brake pedal working travel is too large. (Reserve travel is too small.)	BR-23
11. Diagnosis code will not be erased.	BR-24
12. Unable to communicate with DS-21	BR-25

MABS00036-00000

TROUBLE PHENOMENA TABLE ITEM 1

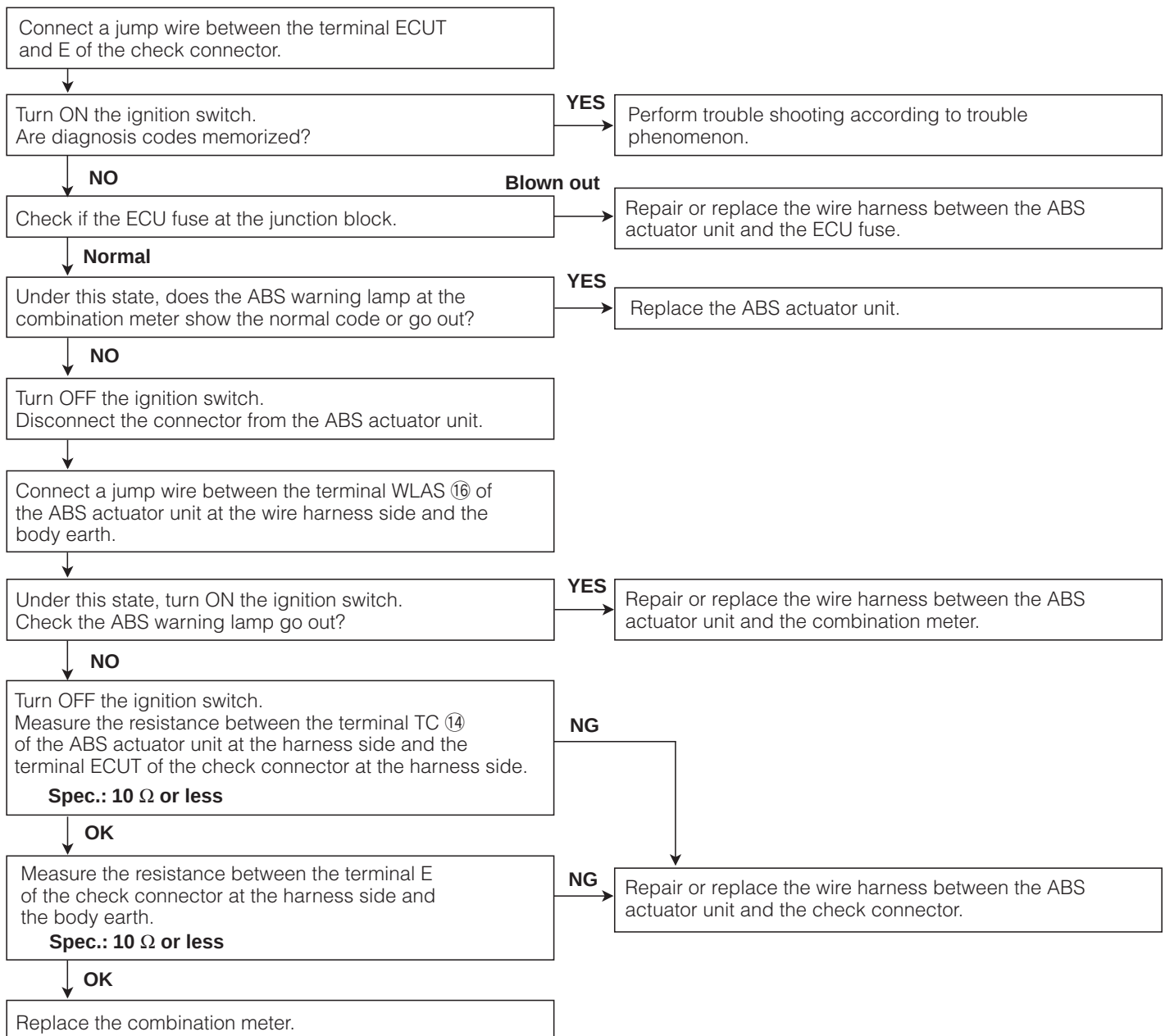
TROUBLE PHENOMENA : ABS warning lamp remains illuminated even after ignition switch is turned on.



MABS00000-00027

Checking point:

1. Wire harness between terminal WLAS ⑯ or ABS actuator unit and combination meter (ABS warning lamp) for open circuit.
2. ABS warning lamp circuit in the combination lamp
3. ABS actuator unit



MABS00037-00000

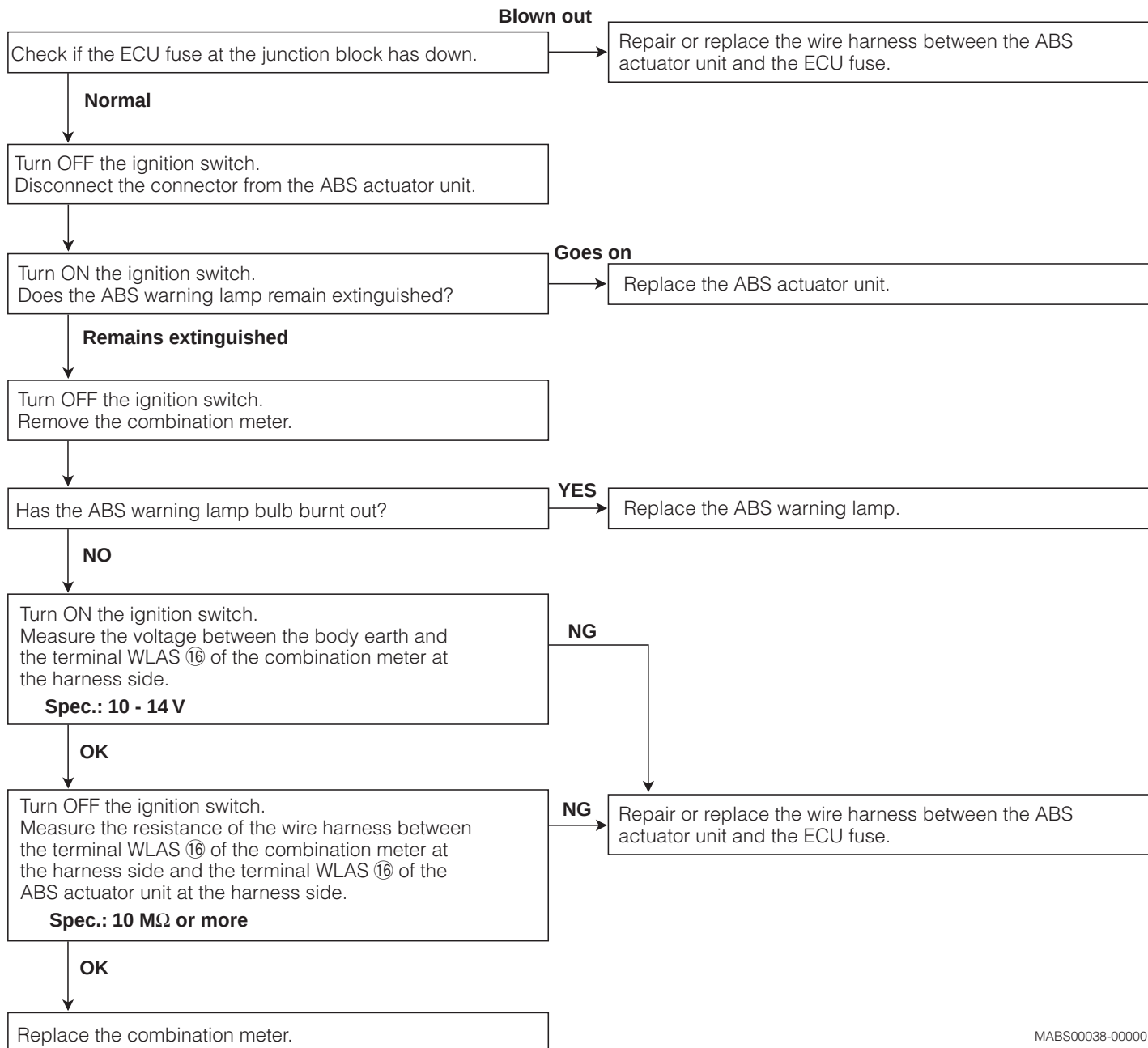
TROUBLE PHENOMENA TABLE ITEM 2

TROUBLE PHENOMENA : ABS warning lamp will not glow immediately after ignition switch is turned on.

MABS00000-00028

Checking point:

1. ABS warning lamp for burnout.
2. Circuit between battery and combination meter for short circuit or open wire.
3. Circuit between WLAS ⑩ terminal or ABS actuator and combination meter for short circuit with positive circuit.
4. ABS warning lamp circuit in the combination meter.
5. ABS actuator unit

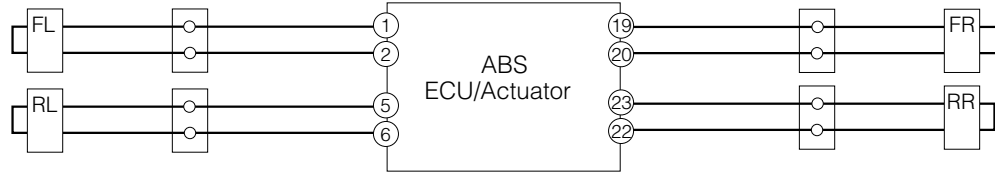


MABS00038-00000

TROUBLE PHENOMENA TABLE ITEM 3, 4, 5, 6, 7, 8

TROUBLE PHENOMENA :

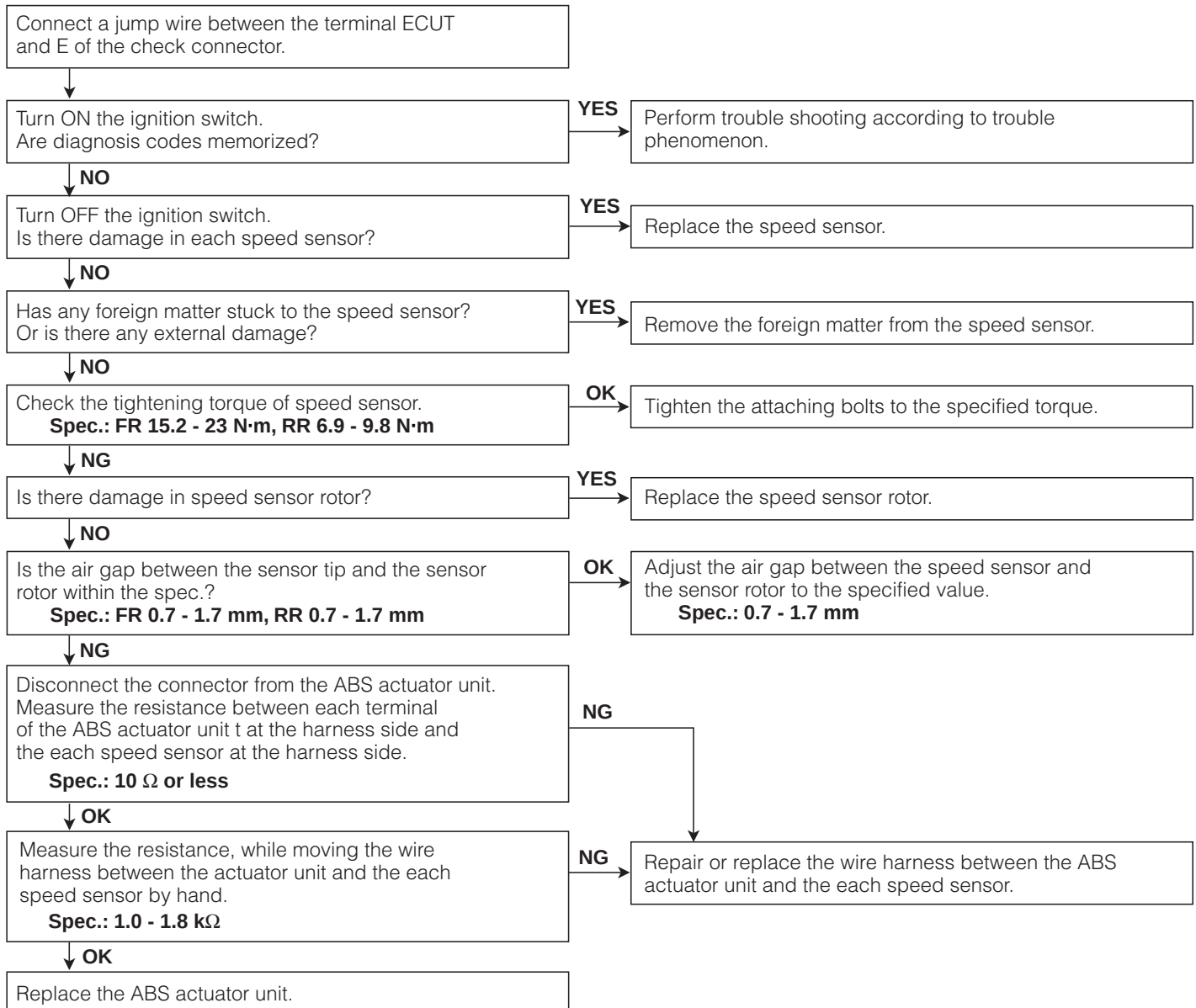
- ABS warning lamp is illuminated while driving.
- Poor effectiveness
- ABS operates under normal braking.
- ABS operates just before vehicle stops under the normal driving.
- Brake pedal vibrates excessively.
- Wheel locks frequently during ABS operation.



MABS00000-00029

Checking point:

1. Wheel speed sensor and related wire harness.
2. ABS actuator unit



MABS00039-00000

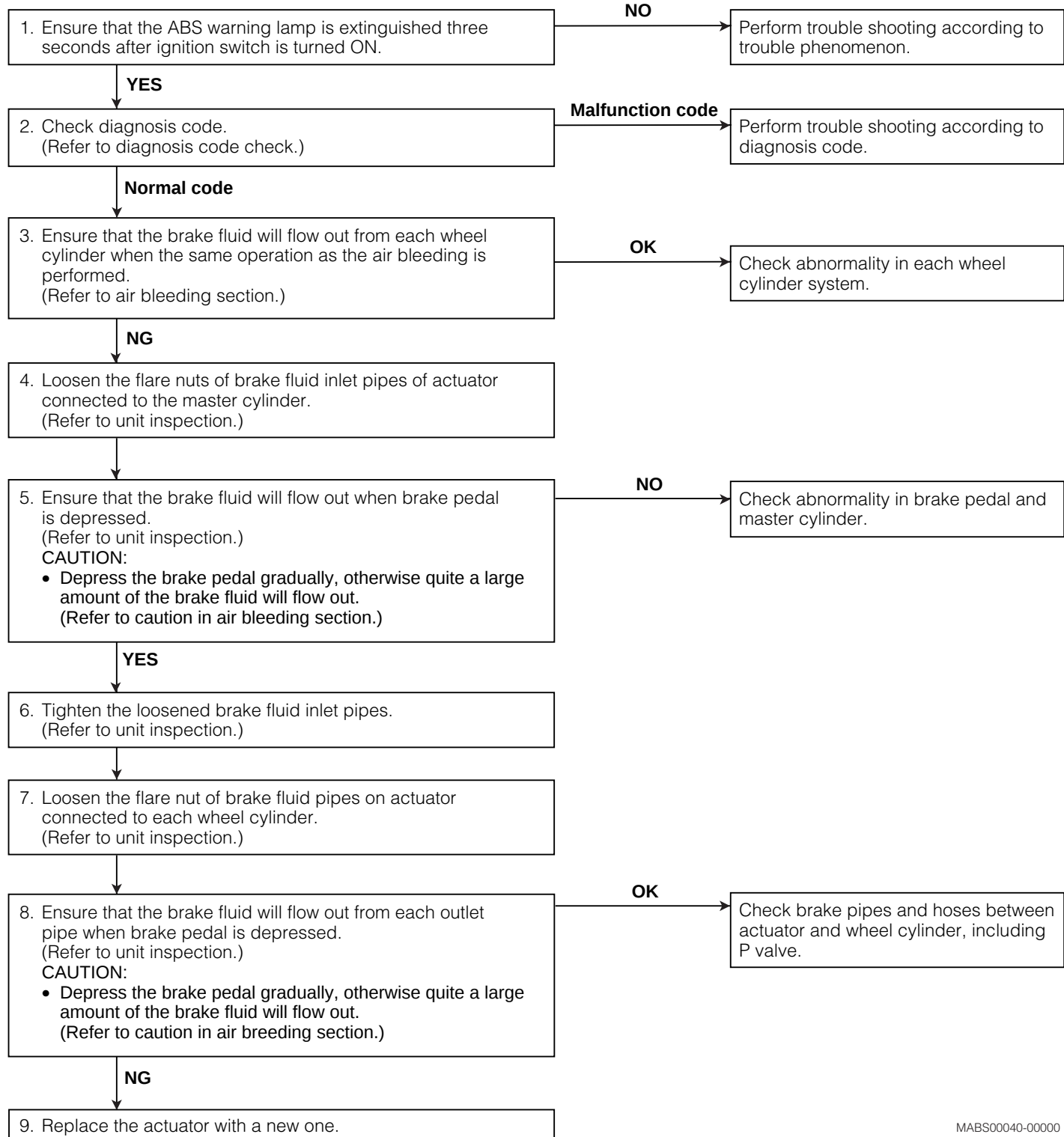
TROUBLE PHENOMENA TABLE ITEM 9

TROUBLE PHENOMENA : Brake pedal working travel is too small.

MABS00000-00030

NOTE:

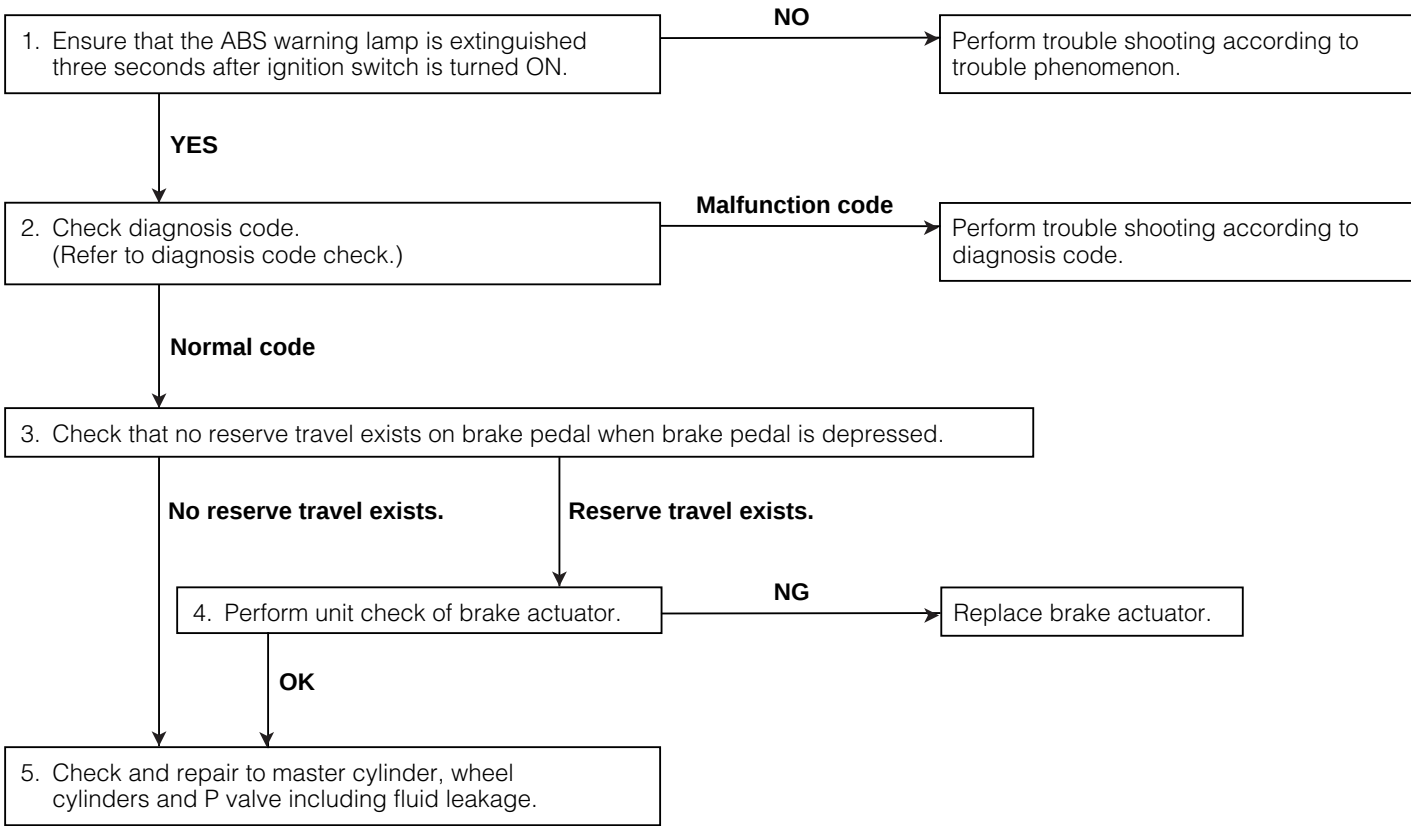
- No consideration has been taken for function of each wheel cylinder in this procedure.



MABS00040-00000

TROUBLE PHENOMENA TABLE ITEM 10
TROUBLE PHENOMENA : Brake pedal working travel is too large. (Reserve travel is too small.)

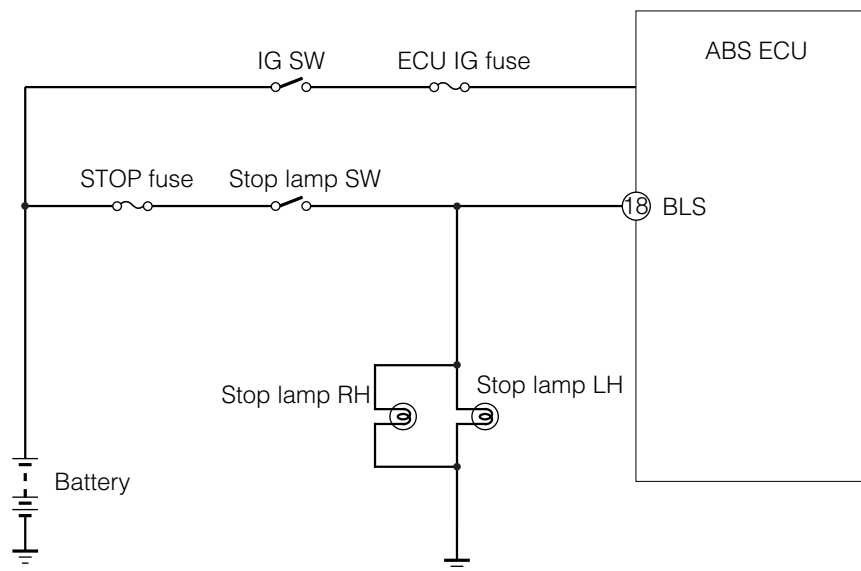
MABS00000-00031



MABS00041-00000

TROUBLE PHENOMENA TABLE ITEM 11

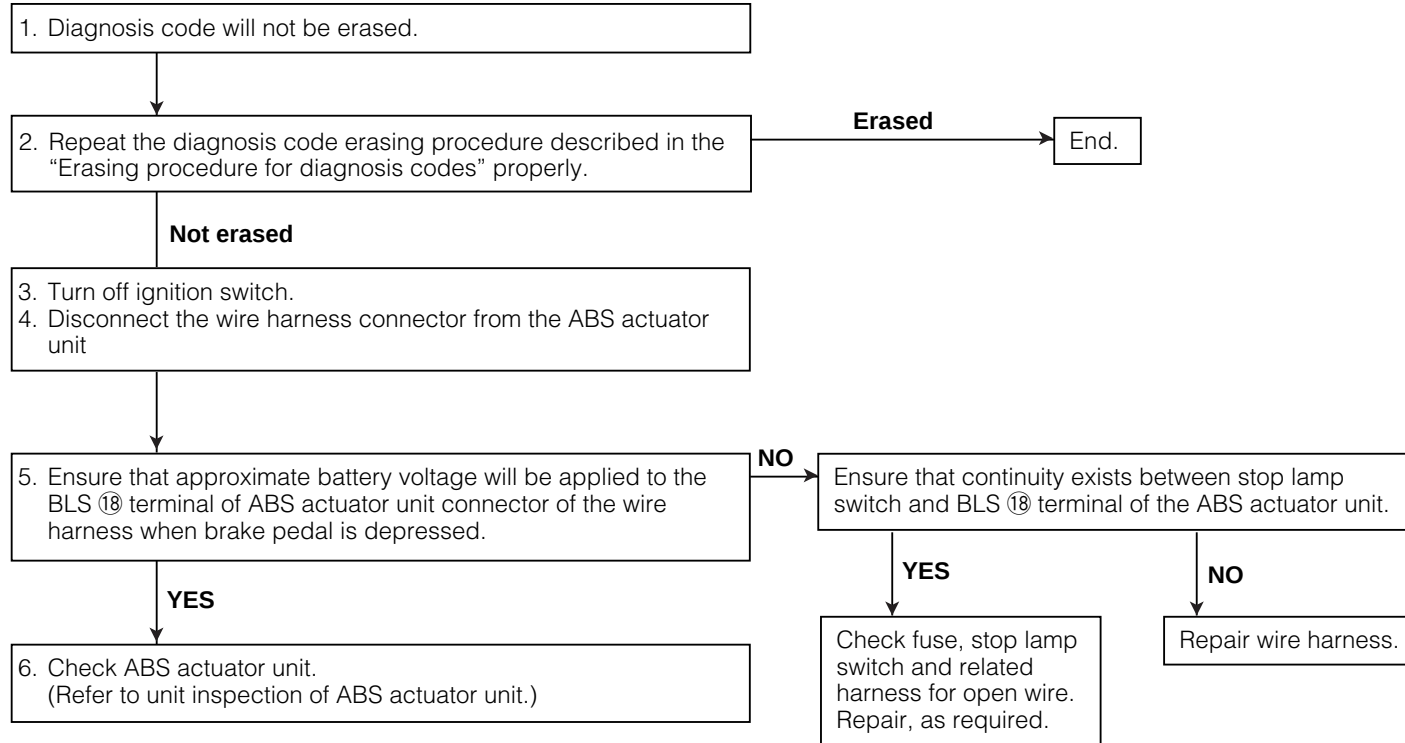
TROUBLE PHENOMENA : Diagnosis code will not be erased.



MABS00000-00032

Checking point:

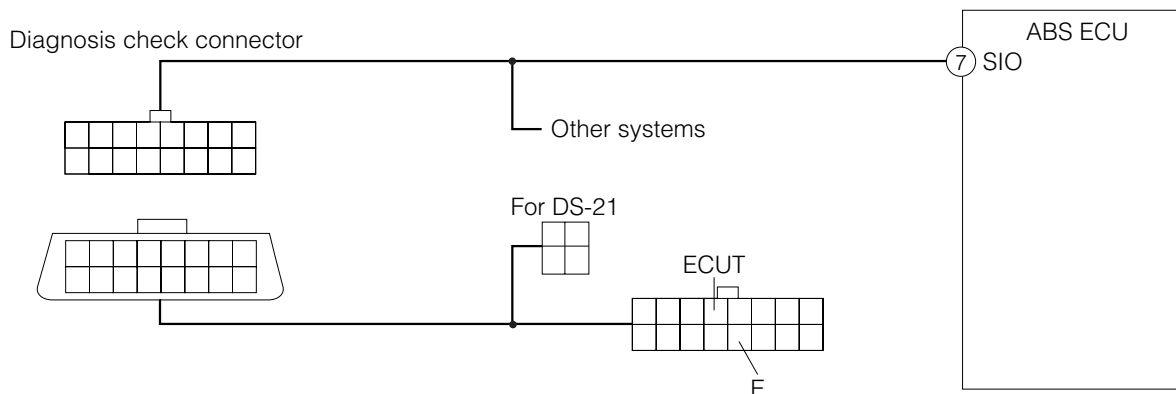
1. Stop lamp switch signal
2. ABS actuator unit



MABS00042-00000

TROUBLE PHENOMENA TABLE ITEM 12

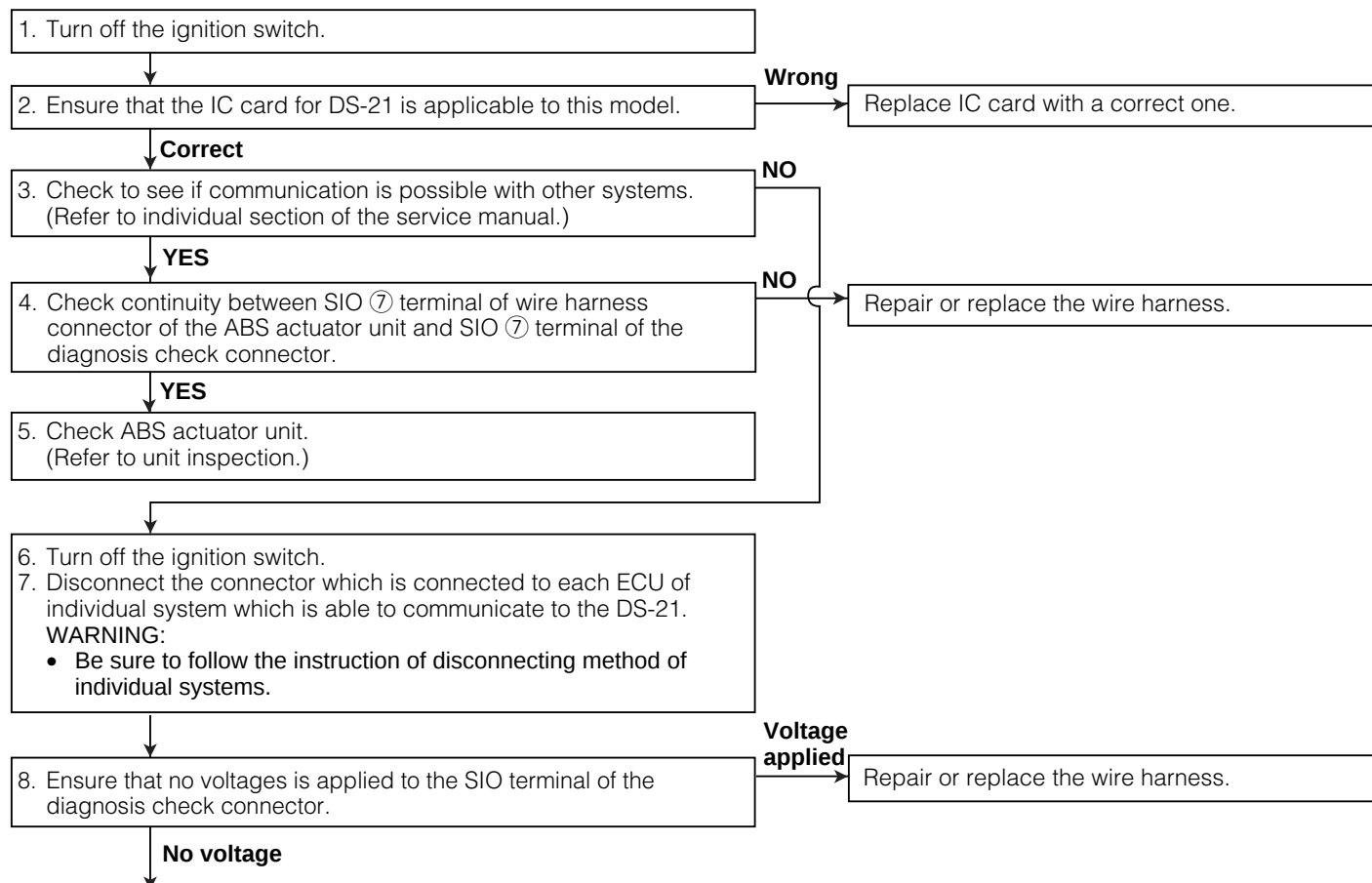
TROUBLE PHENOMENA : Unable to communicate with DS-21

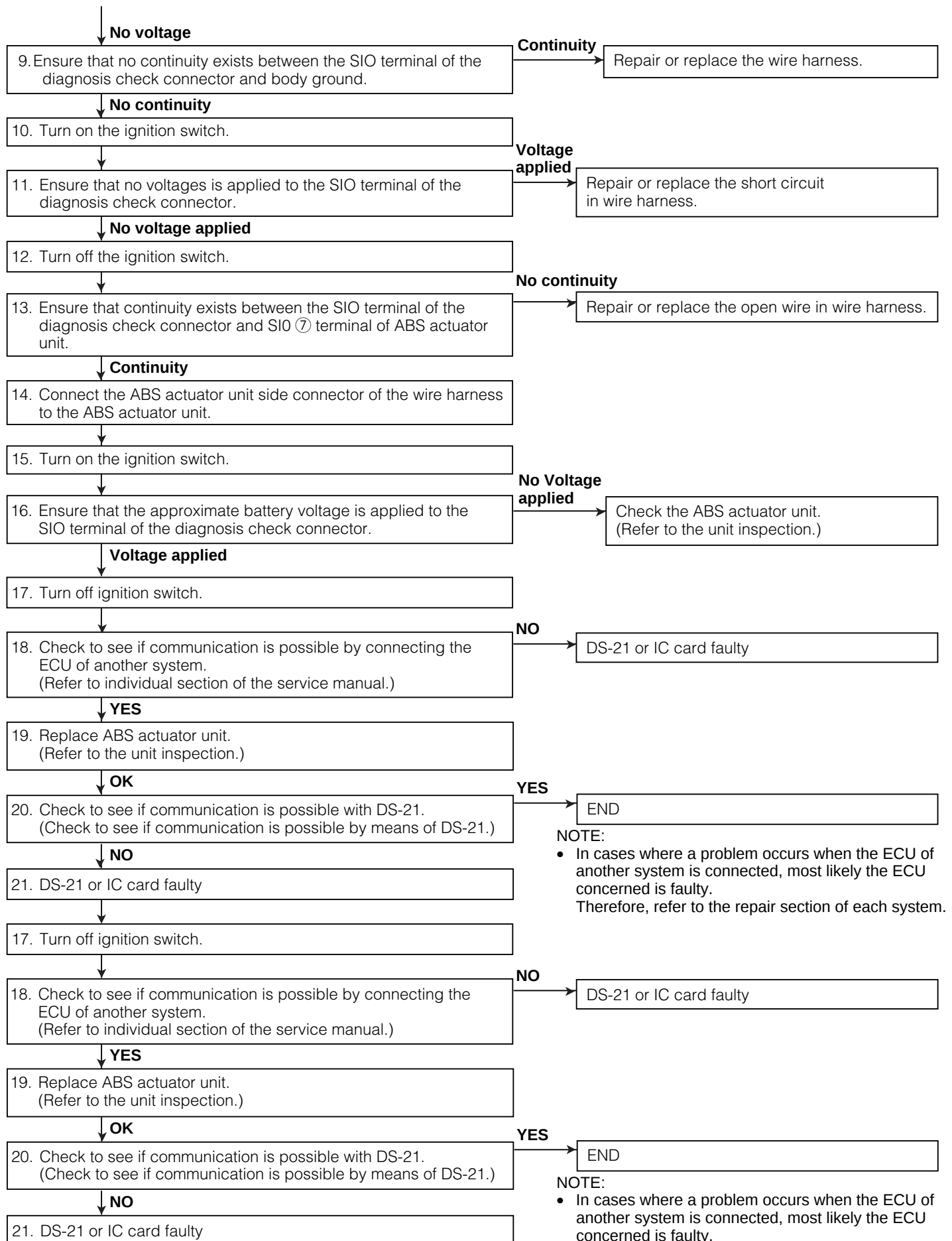


MABS00000-00033

Checking point:

1. Wire harness between terminal SIO ⑦ of ABS actuator unit and diagnosis check connector for open wire or short circuit.
2. Failure of other system.
3. ABS actuator unit.





Erasing procedure for diagnosis codes**NOTE:**

- The diagnosis codes will not be erased even if the battery power supply is shut off.

1. Erasing procedure by brake pedal

(1) Connect the following SST to the diagnosis connector.

SST: 09991-87404-000

(2) Connect the ECUT and E terminals in the SST terminal with the following SST.

SST: 09991-87403-000

CAUTION:

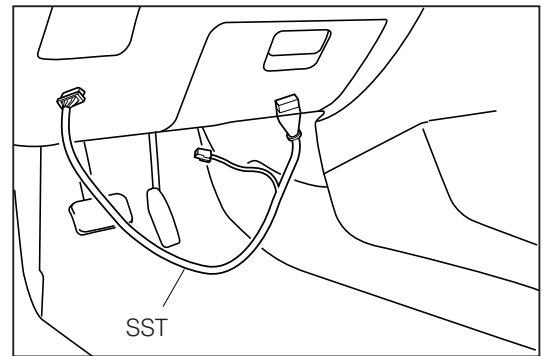
- Never connect the terminals other than those specified, for even slight contact of other terminals may lead to serious malfunction or damage.

(3) Turn ON the ignition switch. (Never start the engine.)

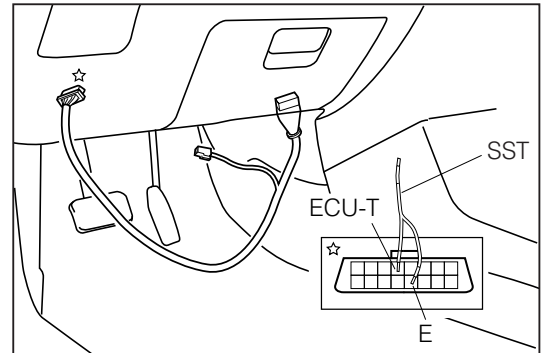
(4) Depress the brake pedal more than 8 times within five seconds in order to repeat the ON/OFF operation of the stop lamp switch immediately after the ignition switch is turned ON.

NOTE:

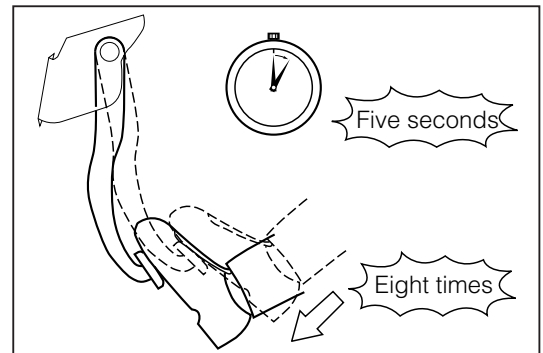
- When no change in ON/OFF state of the stop lamp switch is inputted within three seconds after the ignition switch has been turned ON, or when no change in ON/OFF state of the stop lamp of the second time onward is inputted within one second, the diagnosis code remains indicated and no diagnosis code will be erased.
- If any malfunction persists even after the diagnosis code has been erased, the warning lamp will not go out.
- After the diagnosis code is erased, the mode will automatically move on to the sensor check mode. (Refer to the section under "Wheel speed sensor check by sensor check function.")



MABS00044-00034

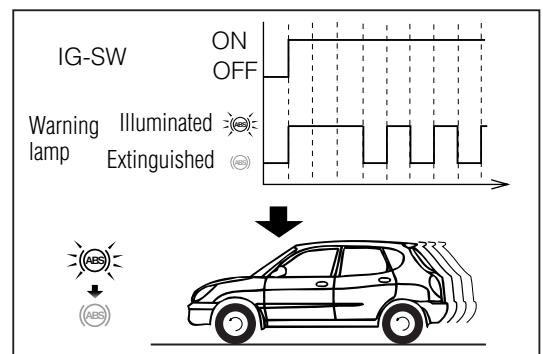


MABS00045-00035



MABS00046-0036

MABS00047-00000



MABS00000-00037

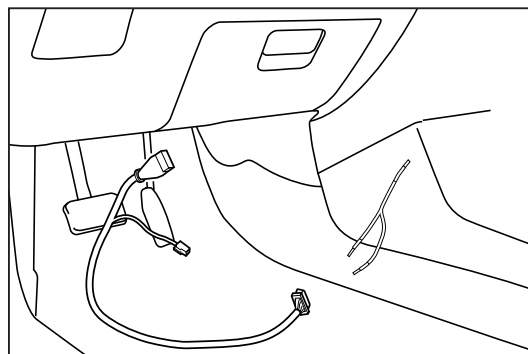
- (5) Turn off the ignition switch.
- (6) Remove the SST (jump wire) from the SST (sub harness).
- (7) Remove the SST from the diagnosis connector.
- (8) Proceed to check the wheel speed sensor by the sensor check function.

NOTE:

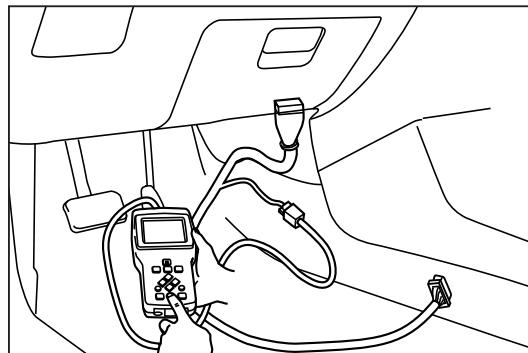
- The wheel speed sensor check function will take place when erasing the diagnosis code or replacing the ABS actuator unit with a new one.

2. Erasing procedure by means of trouble shooting device (DS-21)

Connect the DS-21 to the check connector. Erase diagnosis codes, using the erasing function.



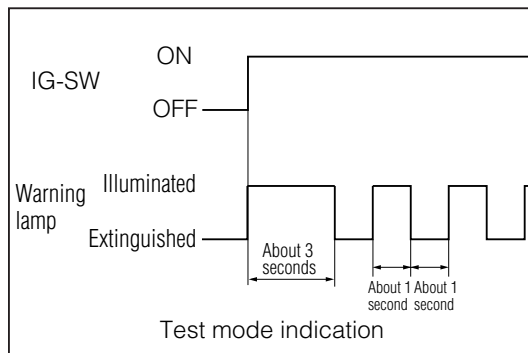
MABS00048-00038



MABS00049-00039

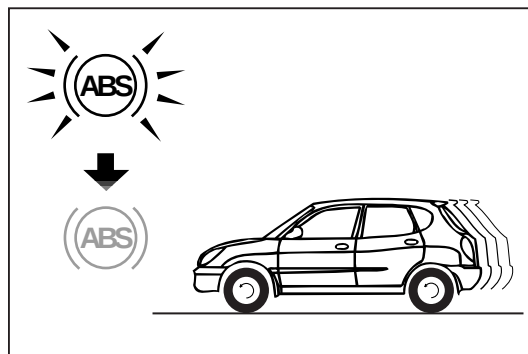
Wheel speed sensor check by sensor check function

1. Turn on the ignition switch.
2. Ensure that the ABS warning lamp starts to blink at intervals of one second after the ABS warning lamp illuminates for 3 seconds.



MABS00050-00040

3. Perform the test driving at speed of more than 7 km/h.
4. Ensure that the ABS warning lamp is turned off.



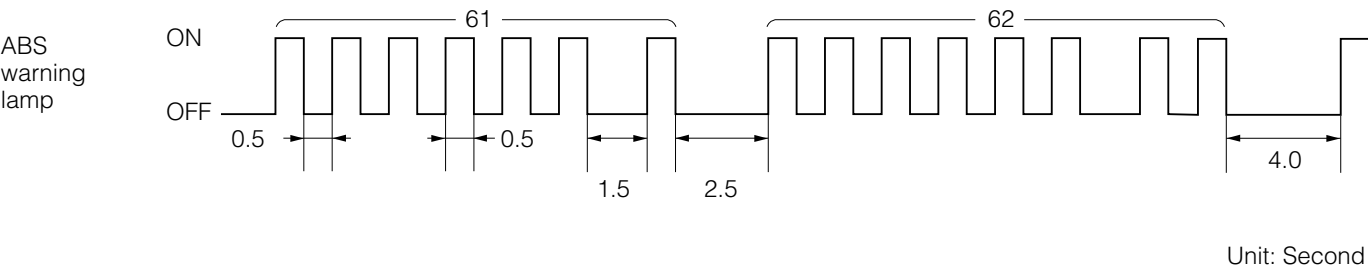
MABS00051-00041

NOTE:

- The ABS warning lamp starts to blink to indicate the malfunction codes by form mentioned below, if any malfunction is found in this check.
- Perform the trouble shooting according to the diagnosis code, if the trouble code is indicates.
- Perform the test driving by speed of 10 km/h in straight direction, if ABS warning lamp is remain illuminated after test driving by speed of 7 km/h. Perform the trouble shooting, if ABS warning lamp is remain illuminated.

MABS00052-00000

<Example of blinking form of the ABS warning lamp>

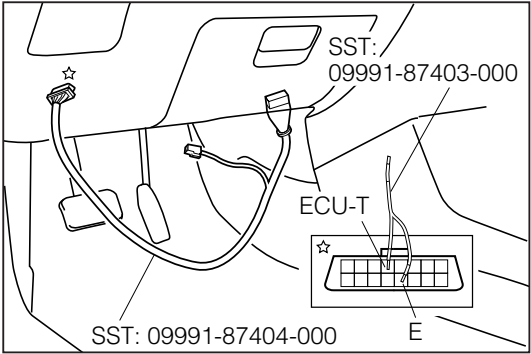


Diagnosis item	Front right speed sensor	Front left speed sensor	Rear right speed sensor	Rear left speed sensor	G sensor (4WD only)
Diagnosis code	61	62	63	64	71
Refer to page	BR-13	BR-13	BR-13	BR-13	BR-16

MABS00000-00042

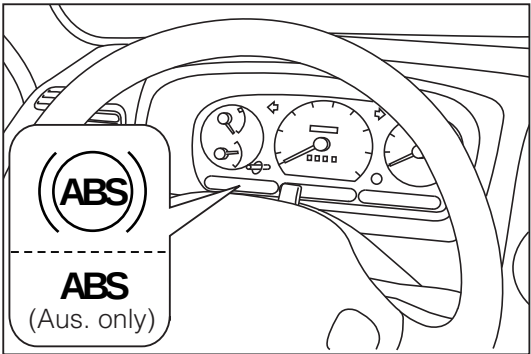
- 5. Turn off the ignition switch.
- 6. Connect the following SST to the diagnosis connector.
SST: 09991-87404-000

Connect the ECU and GND terminals in the SST with the following SST.
SST: 09991-87403-000



MABS00053-00043

- 7. Turn on the ignition switch.
- 8. Read out the diagnosis codes by observing the number of blinking of the ABS warning lamp.



MABS00054-00044

UNIT INSPECTION & REPLACEMENT

CAUTION:

- Be very careful not to deform the terminal in the related connector during the inspection. Failure to observe this caution may lead to system malfunction.

NOTE:

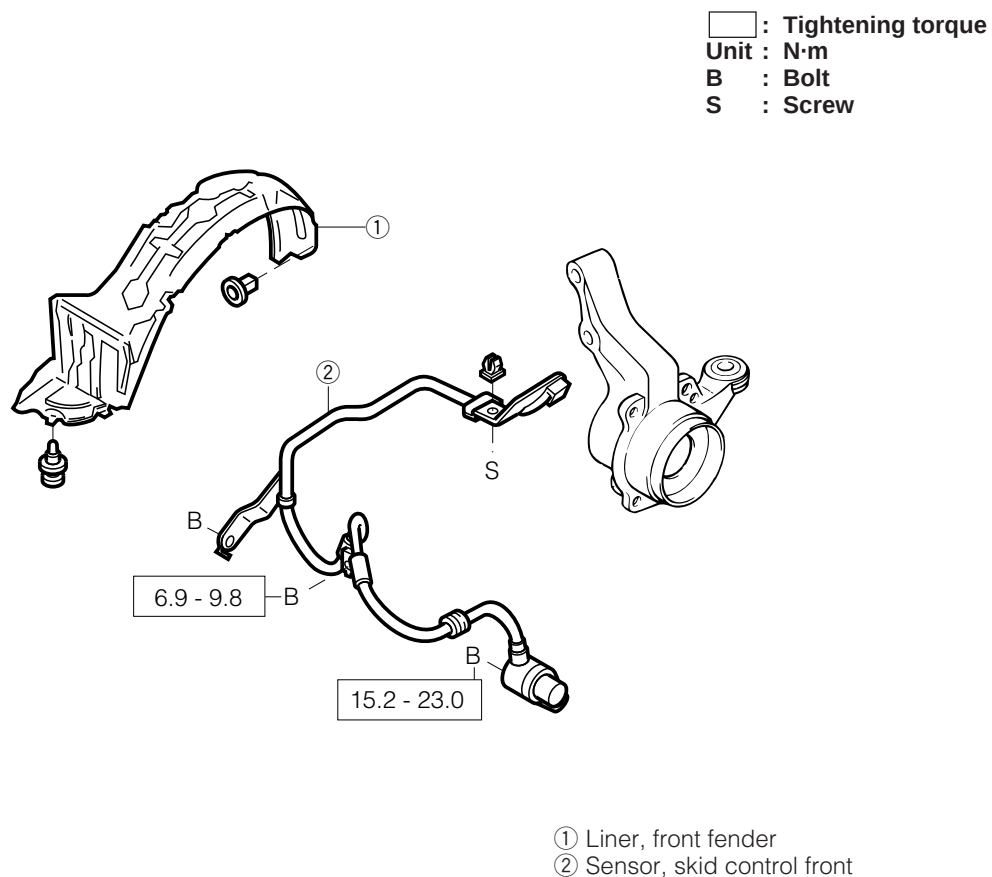
- The inspection of each sensor circuit should be performed by referring to the ABS RELATED CONNECTORS and ABS CIRCUIT CONNECTION TABLE (BR-14, 15).

MABS00055-00000

FRONT SPEED SENSOR

NOTE:

- The check of the speed sensor is basically carried out by the sensor check function.



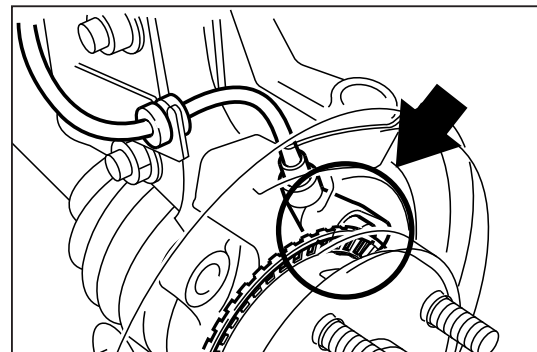
MABS00056-00045

- ### 1. Checking of air gap

Ensure that the air gap between the sensor tip and the sensor rotor is within the specified value.

Air Gap: 1.2 ± 0.5 mm

If the air gap fails to meet the specified air gap, adjust the clearance by adjusting the sensor attaching condition or replace the speed sensor, knuckle or sensor rotor (drive shaft), as required.



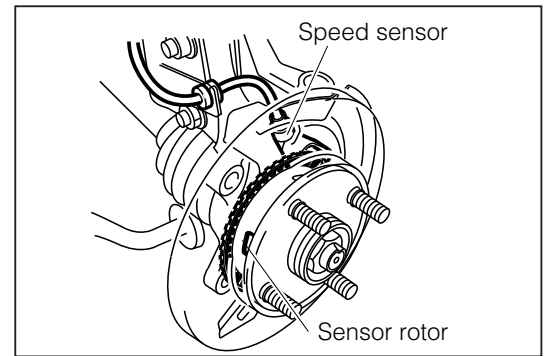
MARS00057-00046

2. Checking of sensor rotor

Inspect the sensor rotor for the following points.

- Ensure that the sensor rotor is pressed into the hub properly, is free from damage and is not contaminated by foreign materials.
- Ensure that the wheel bearing has no excessive play.

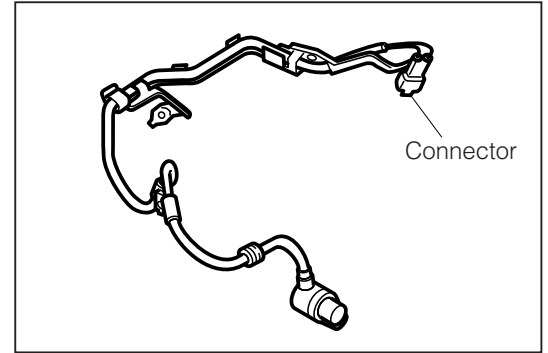
If any trouble exists, clean, repair or replace the sensor rotor (drive shaft) or wheel bearing, as required. (Refer to FS section.)



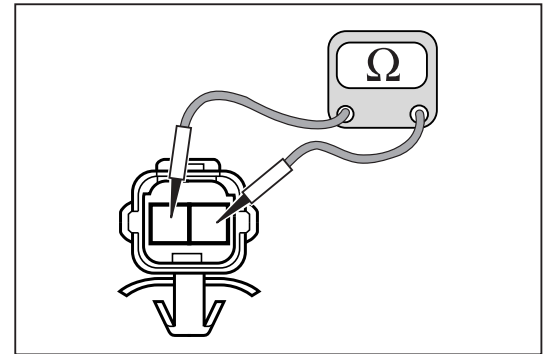
3. Inspection of speed sensor

- (1) Ensure that the front speed sensor resistance is within the specified value, using an ohmmeter.

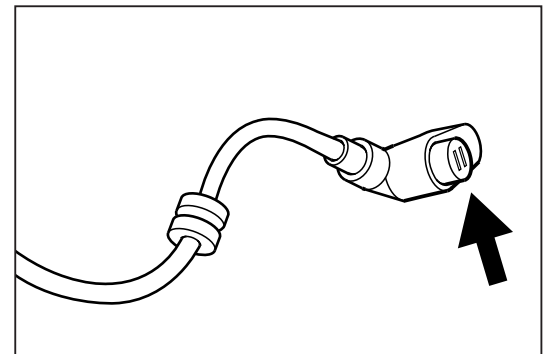
Specified Resistance: $1.4 \pm 0.4 \text{ k}\Omega$ (at 20°C)



If the measured resistance fails to meet the specified value above, replace the speed sensor with a new one.

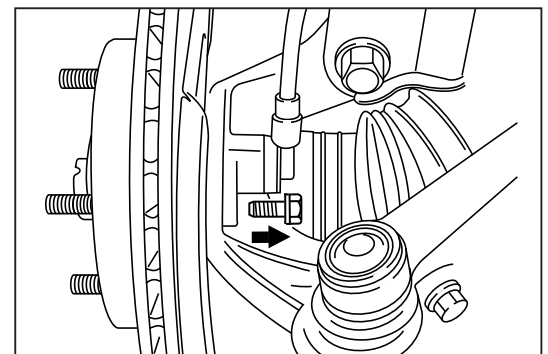


- (2) Ensure that the tips of the speed sensors are free from damage or no contamination with foreign materials. Clean the tips of the speed sensors, if they are contaminated.



4. Removal of front speed sensor

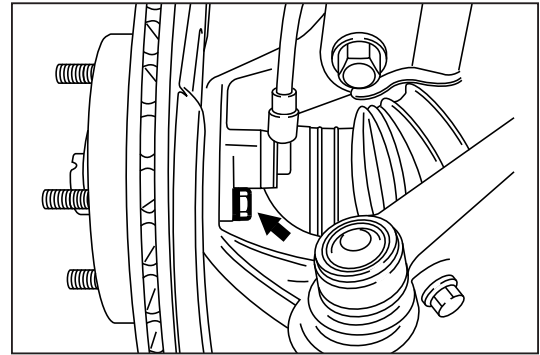
- (1) Remove the fender liner. (Refer to the BO section.)
- (2) Disconnect the wire harness side connector from the sensor connector.
- (3) Remove the wire clamps of the front speed sensor.
- (4) Remove the front speed sensor by removing the attaching bolts.



5. Installation of front speed sensor

CAUTION:

- Be sure to clean the contacting surfaces of the speed sensors and speed sensor before the installation.
- Never twist the speed sensor harness during the installation.



MABS00063-00052

- (1) Install the speed sensor to the vehicle with the attaching bolts and tighten them to the specified tightening torque.

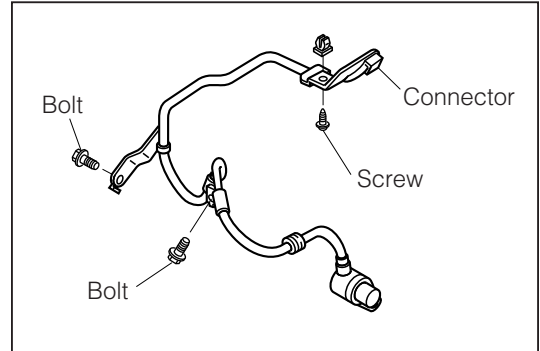
Tightening Torque:

Speed sensor harness clamp to inner fender:

6.9 - 9.8 N·m

Speed sensor to knuckle: 15.2 - 23.0 N·m

- (2) Secure the speed sensor harness by harness clamps.
- (3) Connect the wire harness connector to the connector of the speed sensor.

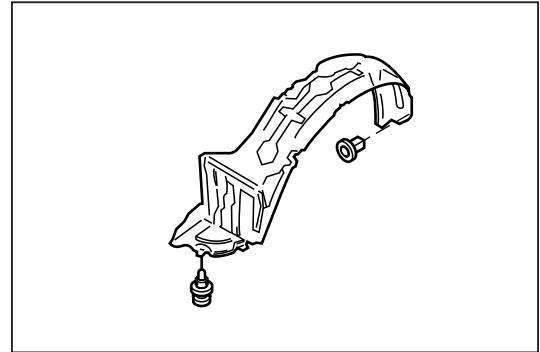


MABS00064-00053

6. Install the fender liner. (Refer to the BO section.)

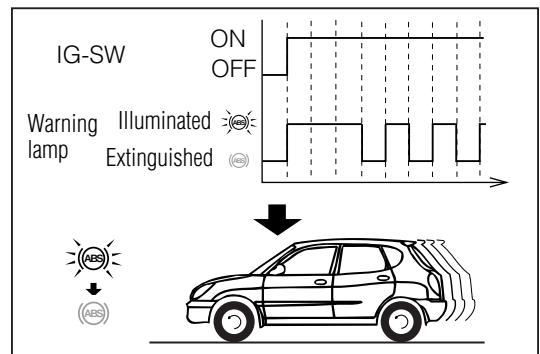
NOTE:

- The check of the speed sensor is basically carried out by the sensor check function.



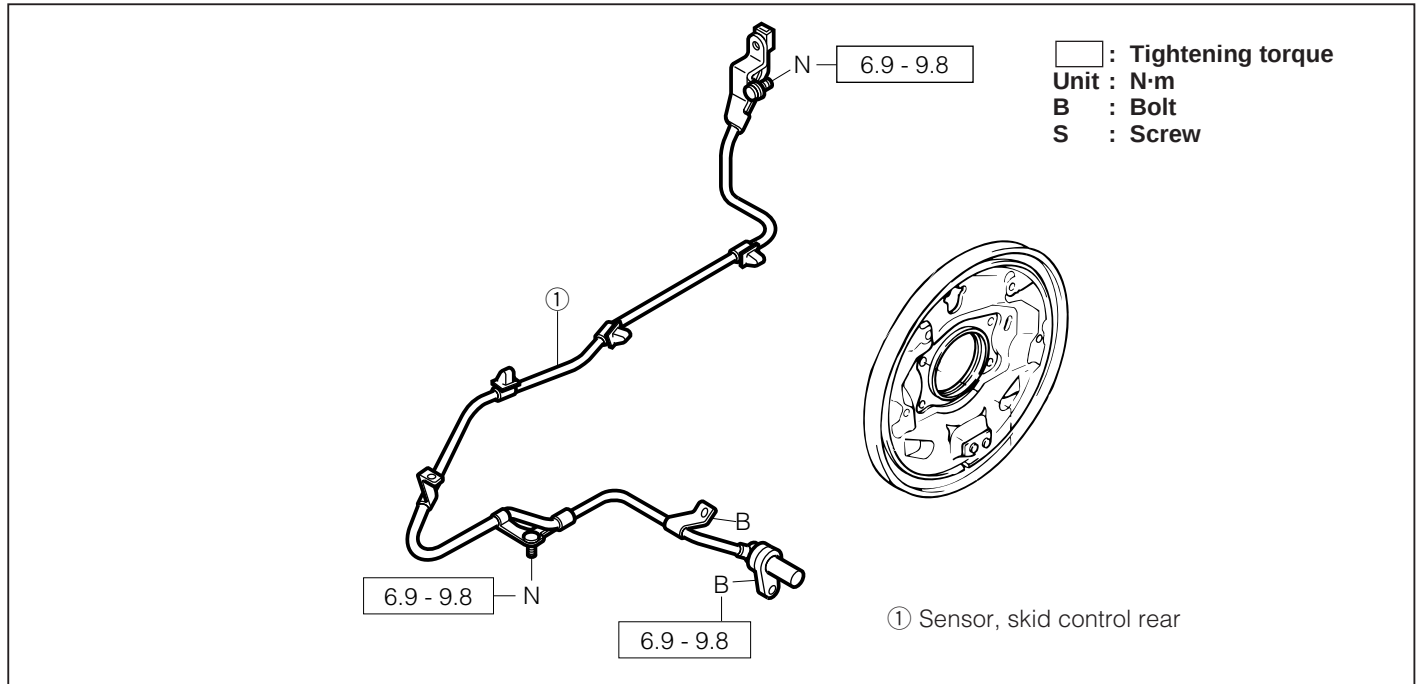
MABS00065-00054

7. Check the speed sensor by performing the sensor check function of the ABS.



MABS00066-00055

REAR SPEED SENSOR



MABS00067-00056

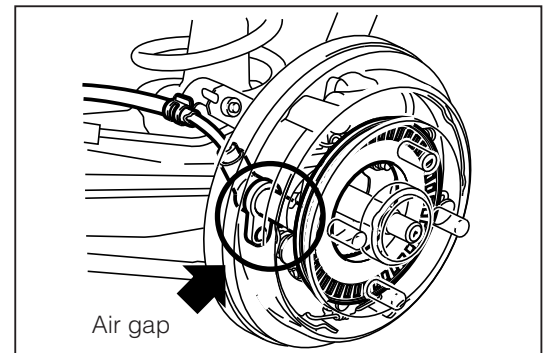
1. Checking of air gap.

- (1) Remove the rear wheel and brake drum. (Refer to the rear brake section.)
- (2) Ensure that the air gap between the sensor tip and the sensor rotor is within the specified value.

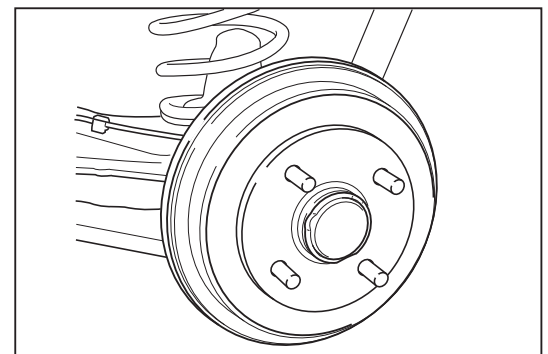
Air Gap: 1.2 ± 0.5 mm

If the air gap fails to meet the specified air gap, adjust the air gap by adjusting the attaching condition of the speed sensor or replace the speed sensor, brake backing plate (refer to the BR section.) or sensor rotor, as required.

- (3) Install the rear wheel and brake drum.



MABS00068-00057



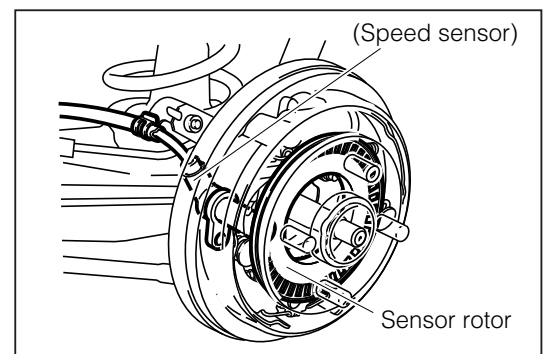
MABS00069-00058

2. Checking of sensor rotor.

- (1) Remove the rear wheel and brake drum. (Refer to the rear brake section.)
- (2) Ensure that the sensor rotor is free from damage and contamination with foreign materials. Also, check that no excessive free play exists on the wheel bearings. (Refer to the RS section)

If any trouble exists, clean, repair or replace the sensor rotor or wheel bearing, as required.

- (3) Install the rear wheel and brake drum. (Refer to rear brake section.)



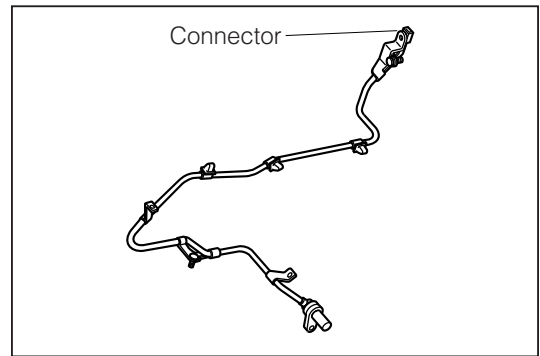
MABS00070-00059

3. Inspection of speed sensor

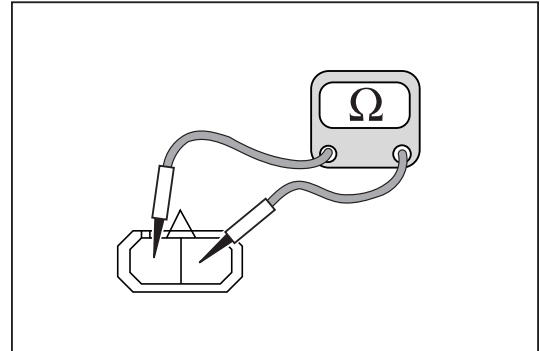
- (1) Ensure that the rear speed sensor resistance is within the specified value, using an ohmmeter.

Specified Resistance: $1.4 \pm 0.4 \text{ k}\Omega$ (at 20°C)

If the measured resistance fails to meet the specified value above, replace the speed sensor with a new one.

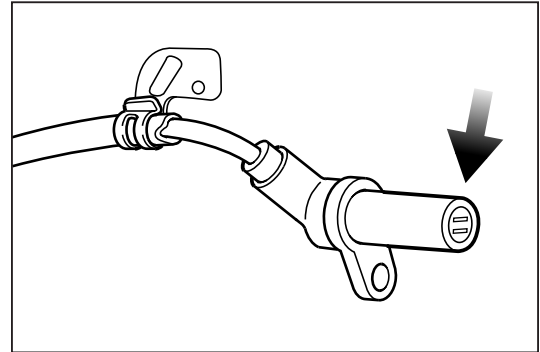


MABS00071-00060



MABS00072-00061

- (2) Ensure that the tips of the speed sensors are free from damage or no contamination with foreign materials. Clean the tips of the speed sensors, if they are contaminated.

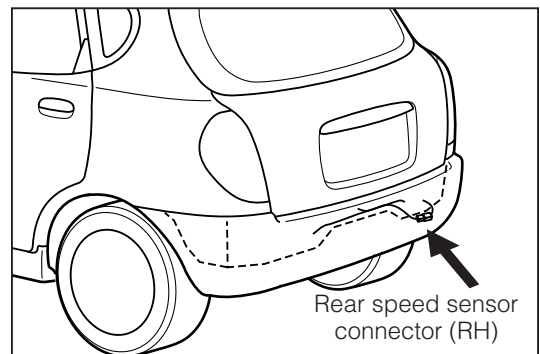


MABS00073-00062

4. Removal of speed sensor

- (1) Rear right speed sensor connector:

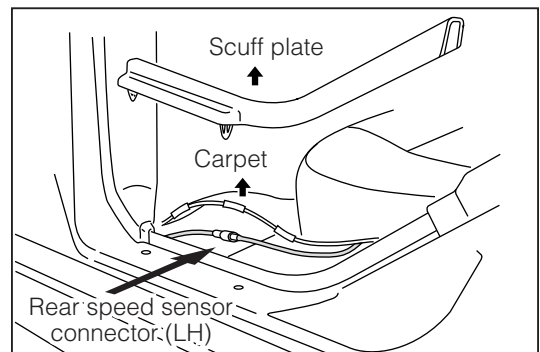
- Jack up the vehicle.
- Disconnect the connector of the rear right speed sensor from the connector of the floor wire No. 2.



MABS00074-00063

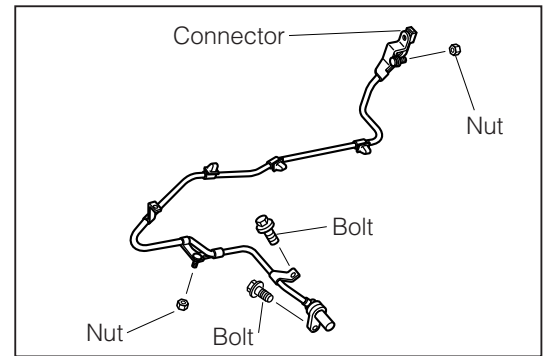
- (2) Rear left speed sensor connector:

- Remove the left side rear door scuff plate.
- Keep the floor carpet turned over.
- Disconnect the connector of the rear left speed sensor from the connector of the floor wire harness.



MABS00075-00064

- (3) Remove the speed sensor by removing the attaching bolts and nuts.



MABS00076-00065

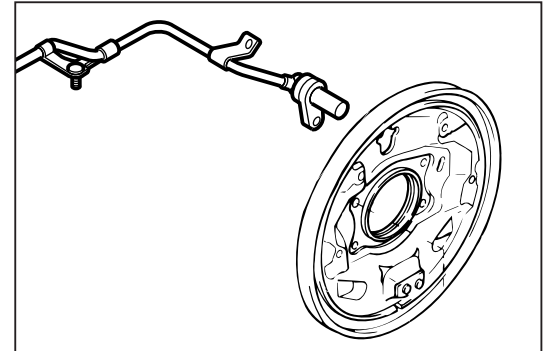
5. Installation of speed sensor

- (1) Clean the attaching surface of the speed sensor and backing plate.
 (2) Install the speed sensor with the attaching bolt and tightening it to the specified tightening torque.

Tightening Torque: 6.9 - 9.8 N·m

CAUTION:

- After the installation, be sure to check that the clearance between the speed sensor and the speed sensor rotor is within the specified value.



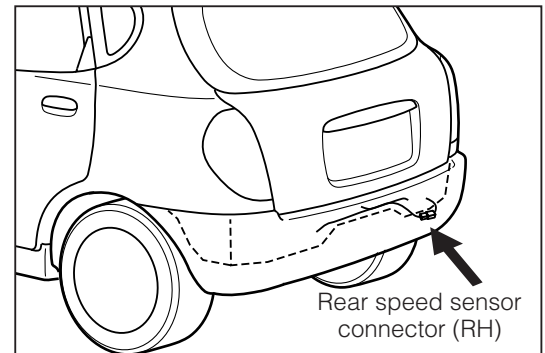
MABS00077-00066

- (3) Install the speed sensor harness with attaching bolts and nuts.

- (4) Ensure that they are installed properly.

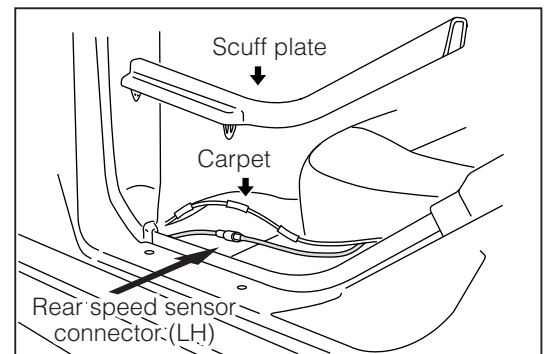
Tightening Torque: 6.9 - 9.8 N·m

- (5) Connect the connector of each speed sensor to the connector of the wire harness.



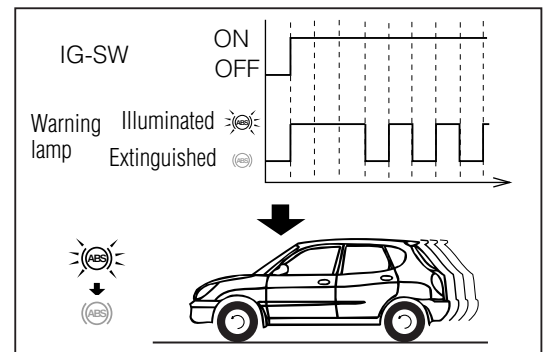
MABS00078-00067

- (6) Install the related parts.



MABS00079-00068

- (7) Check the speed sensor by performing the sensor check function of the ABS.

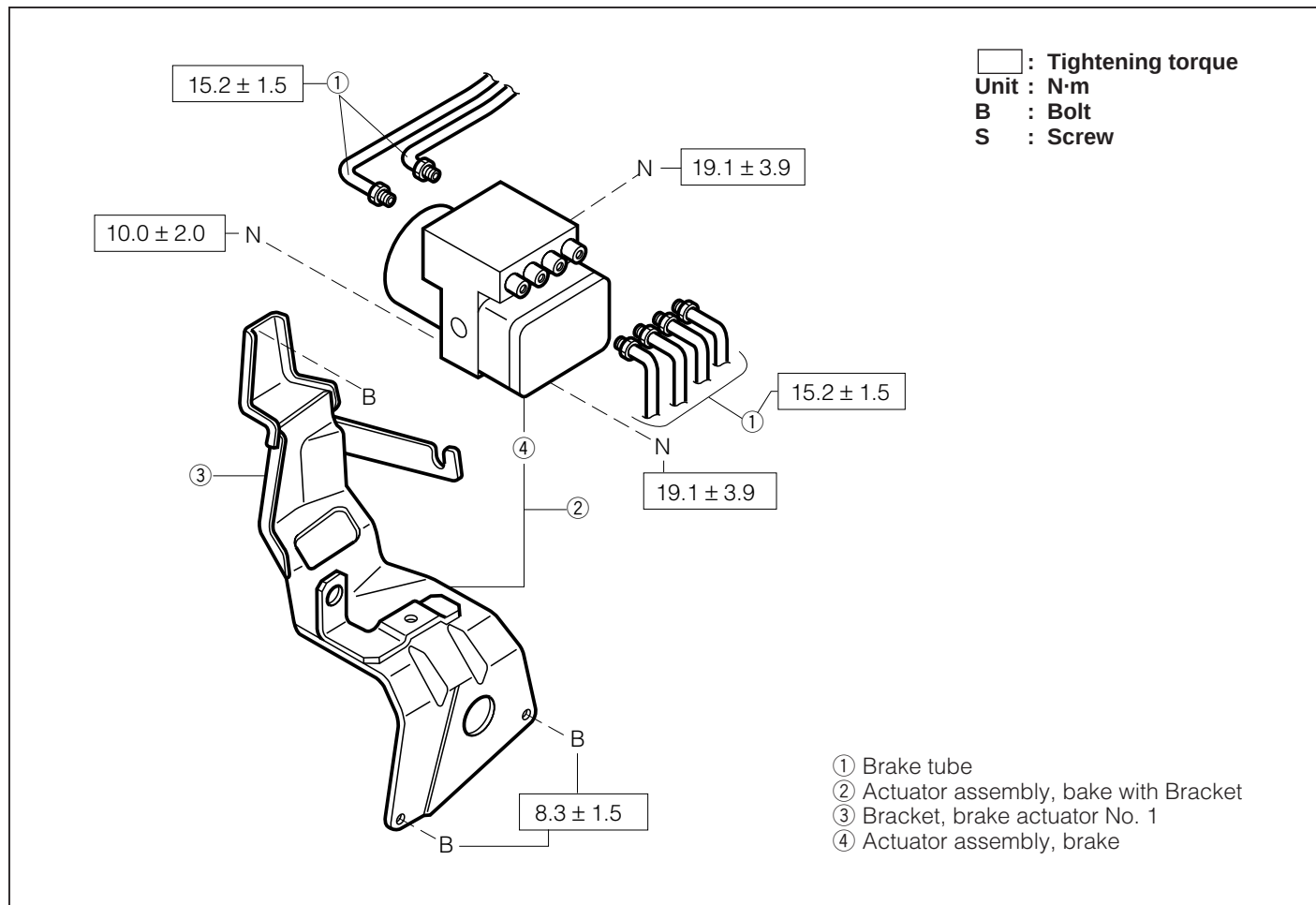


MABS00080-00069

ABS ACTUATOR UNIT

WARNING:

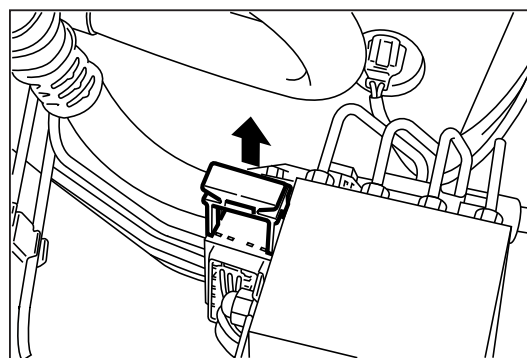
- Be sure to prevent foreign substances from being admitted into the brake actuator. Failure to observe this warning may lead to serious brake malfunction.



MABS00081-00070

- Check of terminal voltage and resistance of ABS actuator unit connector.

- Turn off the ignition switch.
- Pull up the lock of the connector lock lever to unlock the connector from the ABS actuator unit.
- Disconnect the connector of the wire harness from the ABS actuator unit.
- Ensure that the voltage or resistance between respective terminals mentioned below within the specified value by measuring with a circuit tester.



MABS00082-00071

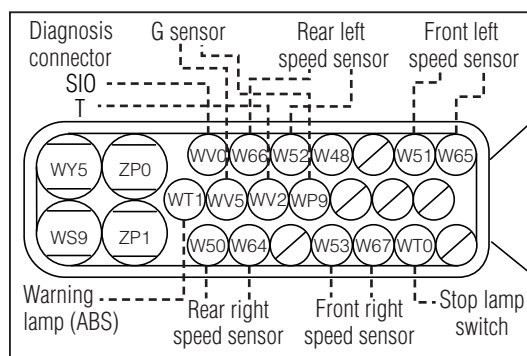
CAUTION:

- Be very careful not to connect the tester probe to terminals other than those specified.

NOTE:

- Refer to page BR-14 under "ABS-RELATED CONNECTORS."

- Connect the connector of the wire harness to the ABS actuator unit and lock the lock lever of connector securely.



MABS00083-00072

2. Check of fluid lines in actuator

CAUTION:

- Be sure to prevent the brake fluid from coming in contact with the painted surface and resin parts, using a piece of cloth or the like. If the brake fluid comes in contact with the painted surface and resin parts, immediately wipe off the brake fluid and wash with fresh water.

- (1) Loosen the brake pipes connected to the actuator from the master cylinder.

- (2) Ensure that the brake fluid will flow out without resistance when the brake pedal is depressed.

CAUTION:

- Be sure to depress the brake pedal gradually, otherwise a quite large amount of brake fluid will splash out.
- If no brake fluid flows out, check the fluid leakage or internal leakage in the brake master cylinder.

- (3) Tighten the flare nuts to the specified tightening torque.

Tightening Torque: $15.2 \pm 1.5 \text{ N}\cdot\text{m}$

- (4) Loosen the brake pipes connected to the actuator from the wheel cylinders.

- (5) Ensure that the brake fluid will flow out without resistance when the brake pedal is depressed.

CAUTION:

- Be sure to depress the brake pedal gradually, otherwise a quite large amount of brake fluid will splash out.
- If no brake fluid flows out, replace the actuator with a new one, after inspecting the P valve for fluid continuity.

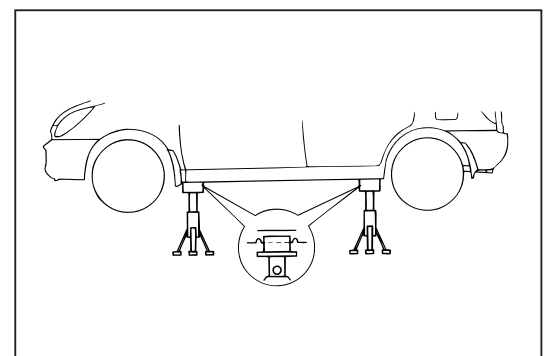
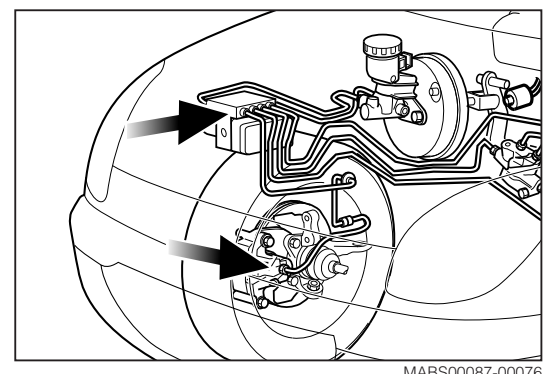
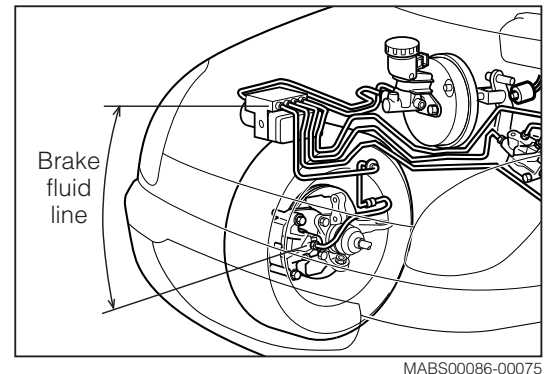
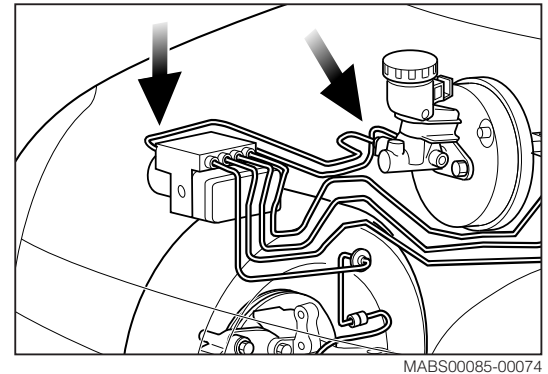
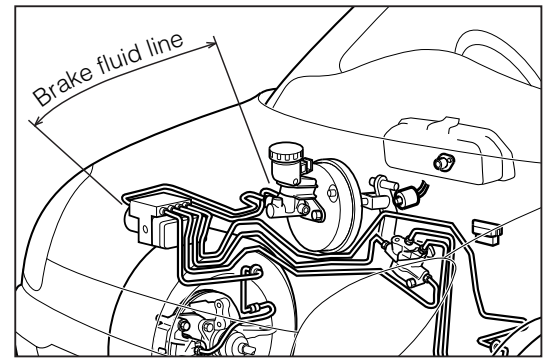
- (6) Tighten the flare nuts to the specified tightening torque.

Tightening Torque: $15.2 \pm 1.5 \text{ N}\cdot\text{m}$

3. Function check of actuator using DS-21

(1) Preparation before inspection

- ① Check the brake system, using a brake tester.
- ② Jack up the vehicle and support it with safety stands.
(Refer to the GI section for supporting position of the safety stand.)
- ③ Release the parking brake.
- ④ Place the shift lever to the neutral position.
- ⑤ Ensure that the wheels turn properly.



(2) Inspection

- ① Turn off the ignition switch.
- ② Connect the following SST to the diagnosis check connector.

SST: 09991-87404-000

- ③ Connect the DS-21 to the SST connector.
- ④ Select the function of the actuator drive in DS-21.

NOTE:

- When selecting the actuator drive, release the security function of DS-21.

- ⑤ Ensure that the wheels turn properly.
- ⑥ Ensure that the wheels will be locked when the brake pedal is depressed.

- ⑦ Ensure that the locked state of the “front side left wheel will be released” and the wheel turns freely. Also ensure that the brake pedal will rise up slightly when the function of “actuating the front side left wheel brake solenoid valve in the actuator” is performed by DS-21.
- ⑧ Perform the remaining inspection one by one, following the steps ① to ⑦ mentioned above.

4. Removal of ABS actuator

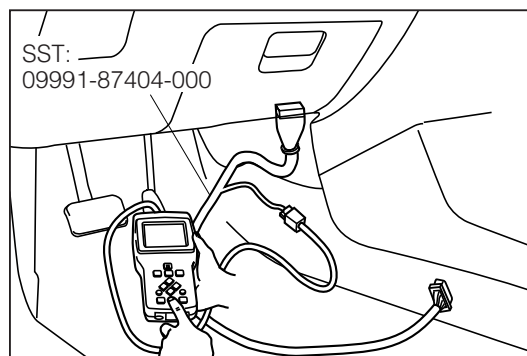
NOTE:

- Refer to the illustration in page BR-34.

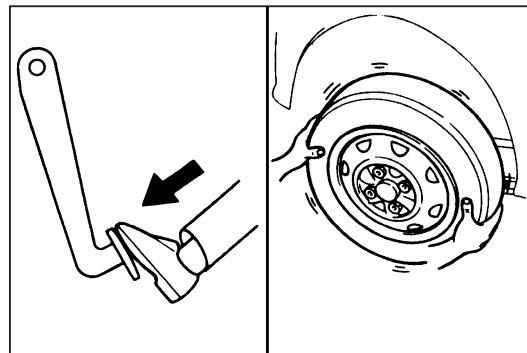
- (1) Drain the brake fluid from the brake system.
- (2) Remove the brake tube clamp.
- (3) Disconnect the brake pipes from the actuator.

CAUTION:

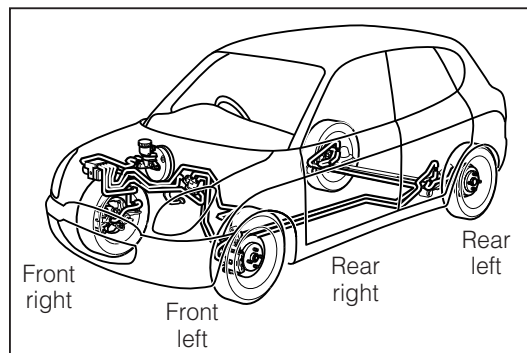
- Prevent dust or other foreign substances from being admitted into the actuator and brake line.
- Failure to observe this caution may lead to serious brake problem.



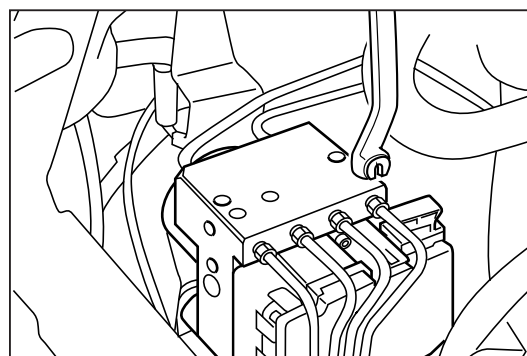
MABS00089-00078



MABS00090-00079



MABS00091-00080



MABS00092-00081

MABS00093-00000

(4) Remove the actuator by removing the attaching nuts.

CAUTION:

- Never deform the brake pipes during the removal of the actuator.

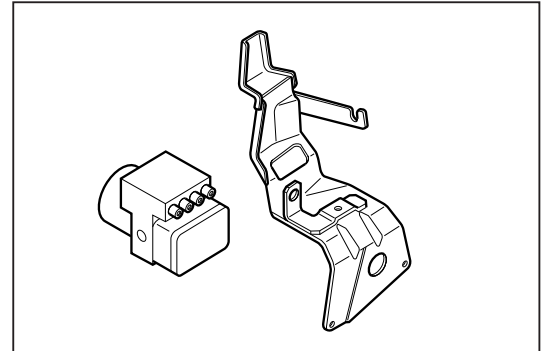
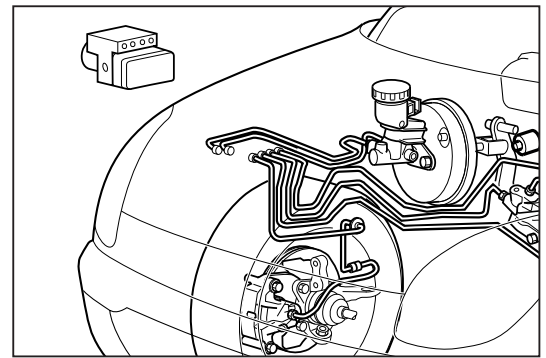
(5) Removal of ABS actuator bracket

- ① Disconnect the brake pipe from the brake pipe clamp.
- ② Disconnect the brake pipe (connected from the front inlet P valve to the actuator) from the P valve.

CAUTION:

- Prevent dust or other foreign substances from being admitted into the brake line.
Failure to observe this caution may lead to serious brake problem.

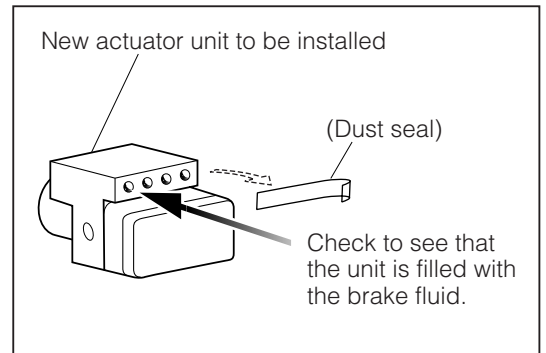
- ③ Remove the ABS actuator bracket with the brake pipe by removing the attaching bolts.



5. Installation of ABS actuator

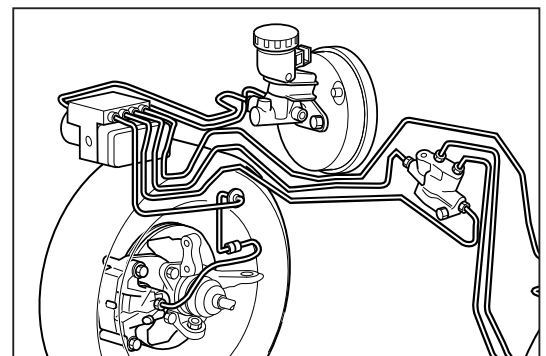
WARNING:

- Before replacing the ABS actuator, be sure to confirm that the actuator in the unit state is filled with the brake fluid.



(1) Installation of ABS actuator bracket

- ① Insert the brake pipe (connected from the P valve to the front inlet of the actuator) in the brake actuator bracket.
- ② Install the ABS actuator bracket by installing the attaching bolts and tighten the attaching bolts to the specified tightening torque evenly.
- ③ Connect the brake pipe to the P valve temporarily by your hand.
- ④ Install the actuator with the attaching nuts and tighten them to the specified tightening torque.



CAUTION:

- Never deform the brake pipes during the installation of the actuator.

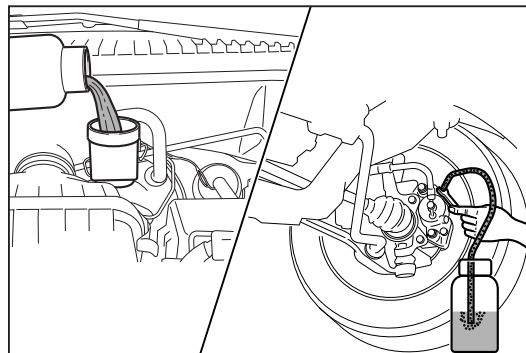
- (2) Connect the brake pipes to the actuator and tighten the flare nuts of the brake pipes which are connected to the actuator and P valve to the specified tightening torque.

CAUTION:

- Prevent dust or other foreign substances from being admitted into the actuator and brake line.
Failure to observe this caution may lead to serious brake problem.

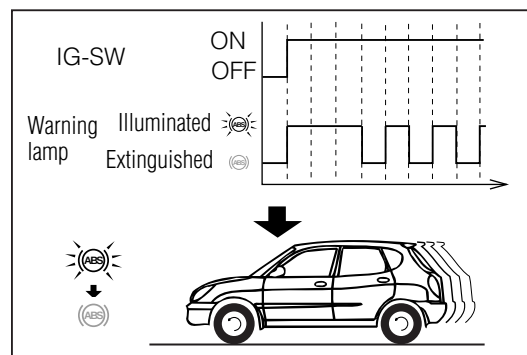
MABS00099-00000

- (3) Fill brake fluid to the brake system and perform the air bleeding.
- (4) Ensure that no brake fluid leakage exists.
- (5) Connect the connector of the wire harness to the ABS actuator unit.



MABS00100-00086

- (6) Perform the speed sensor check by the sensor check function.
(Refer to the "sensor check function" section.)



MABS00101-00087

NOTE:

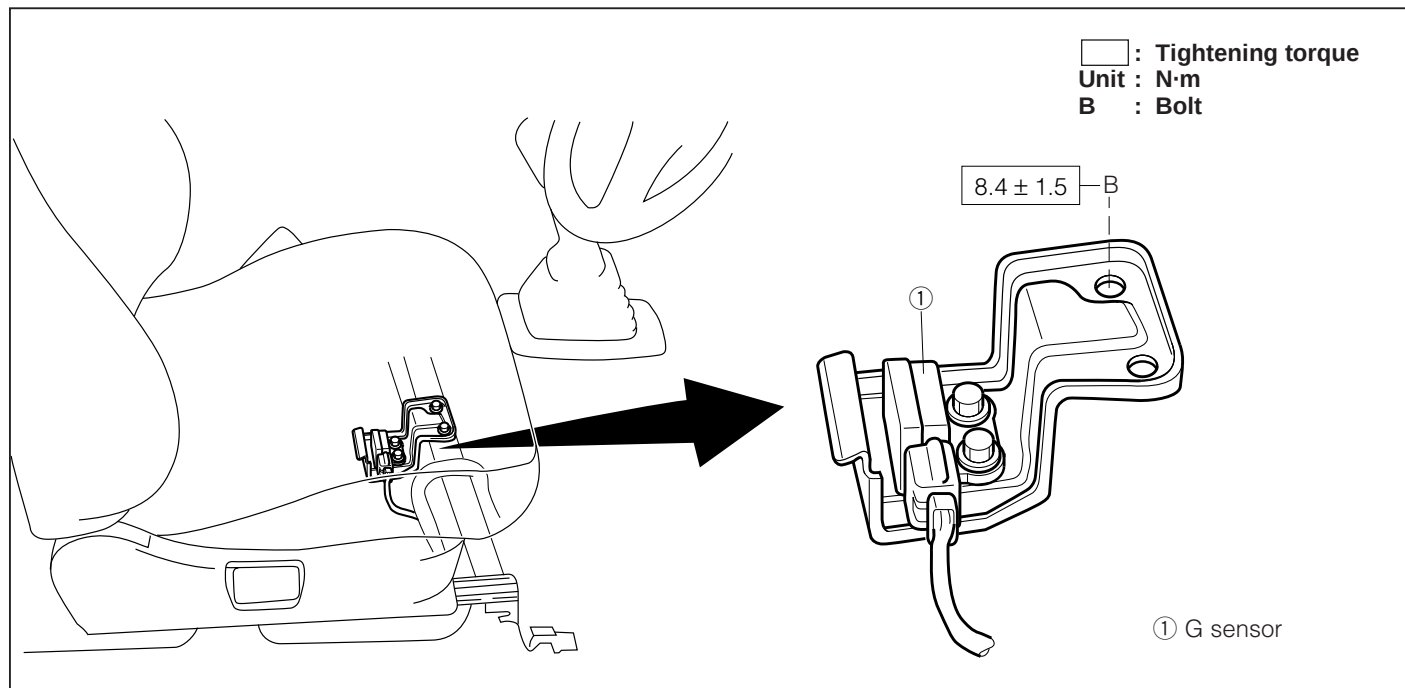
- Resistance values in the following table given below denote values at an ambient temperature of 20°C.
- If any one of resistance or voltage fails to meet the specification in the following table, repair or replace the checking circuit and other related parts properly.
Then, recheck the resistance or voltage.
- Replace the ABS actuator unit with a new one. if diagnosis codes will be memorized (except wheel speed sensors) even when the input voltage and resistance meet following specified value.

MABS00102-00000

Input voltage and resistance of ABS actuator unit.

Terminals	Standard voltage or resistance	Condition	Remedies
① ~ ②	0 volt	Ignition switch turned ON and OFF.	• Front left speed sensor
	$1.4 \pm 0.4 \text{ k}\Omega$	Ignition switch turned OFF.	
④ ~ ⑧ or ②④	0 volt	Ignition switch turned OFF.	• Battery • ECU fuse 10 A • Ignition switch • Related circuit
	Approx. battery voltage	Ignition switch turned ON.	
⑤ ~ ⑥	0 volt	Ignition switch turned ON and OFF.	• Rear left speed sensor
	$1.4 \pm 0.4 \text{ k}\Omega$	Ignition switch turned OFF.	
⑦ ~ ⑧ or ②④	0 volt	Ignition switch turned OFF.	• Open wire or short circuit
		Ignition switch turned ON.	
⑧ ~ Body ground	0 volt	Ignition switch turned OFF.	• Ground circuit
		Ignition switch turned ON.	
⑨ ~ ⑧ or ②④	Approx. battery voltage	At all time	• Battery • ABS F/L 50 A • Related circuit
⑭ ~ ⑧ or ②④	0 volt	Ignition switch turned OFF.	• Open wire or short circuit
		Ignition switch turned ON.	
⑯ ~ ⑧ or ②④	0 volt	Ignition switch turned OFF.	
	Approx. battery voltage	Ignition switch turned ON.	
⑱ ~ ⑧ or ②④	0 volt	The brake pedal is not depressed.	
	Approx. battery voltage	The brake pedal is depressed.	
⑲ ~ ⑳	0 volt	Ignition switch turned ON and OFF.	• Front right speed sensor
	$1.4 \pm 0.4 \text{ k}\Omega$	Ignition switch turned OFF.	
㉒ ~ ㉓	0 volt	Ignition switch turned ON and OFF.	• Rear right speed sensor
	$1.4 \pm 0.4 \text{ k}\Omega$	Ignition switch turned OFF.	
㉔ ~ Body ground	0 volt	At all time	• Open wire or short circuit
㉕ ~ ⑧ or ②④	Approx. battery voltage	At all time	• Battery • ABS F/L 50 A • Related circuit

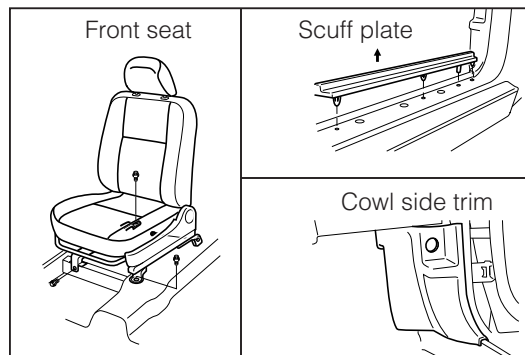
G SENSOR (4WD vehicle)



MABS00104-00088

1. Removal of G sensor

- (1) Remove the front seat (right side).
- (2) Remove the front door scuff plate (right side).
- (3) Remove the cowl side trim (right side).
- (4) Remove the foot rest.
- (5) Keep the carpet turned over.
- (6) Remove the G sensor.



MABS00105-00089

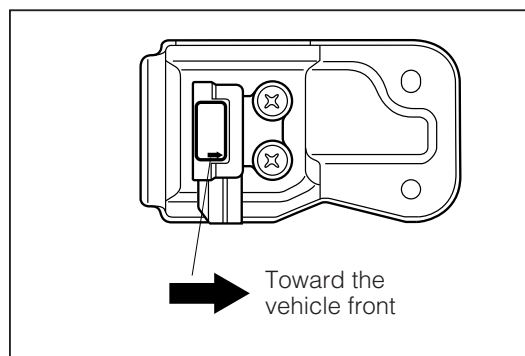
2. Check of G sensor

Perform the G sensor unit check.
 (Refer to page BR-16.)

3. Installation of G sensor

- (1) Install the G sensor in such a way that its arrow faces toward the vehicle front.

Tightening Torque: 8.4 ± 1.5 N·m

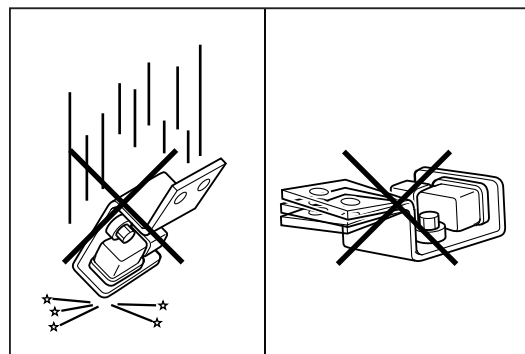


MABS00106-00090

NOTE:

- Never allow the sensor to be subject to any impacts nor drop it.
- Be careful not to deform the bracket for G sensor installation.

- (2) Place the carpet in position.
- (3) Install the foot rest.
- (4) Install the cowl side trim (right side).
- (5) Install the front door scuff plate (right side).
- (6) Install the front seat (right side).



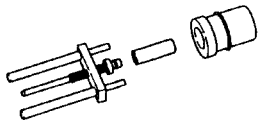
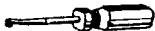
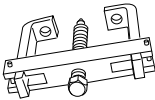
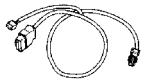
MABS00107-00091

SERVICE SPECIFICATIONS

Brake pedal	Pedal height	RHD	MT:	148.0 ± 5 mm	
			AT:	149.8 ± 5 mm	
		LHD	MT:	143.7 ± 5 mm	
			AT:	148.4 ± 5 mm	
	Free travel			0.5 - 3.0 mm	
	Reserve travel	RHD		74.0 mm or more	
LHD		78.0 mm or more			
Disc brake pad	Thickness	STD		10.0 mm	
		Minimum		1.0 mm	
Disc rotor	Thickness	STD		11.0 mm	
		Minimum		10.0 mm	
	Runout			0.1 mm	
Brake lining	Thickness	STD		3.9 mm	
		Minimum		1.0 mm	
Brake drum	Inner diameter	STD		165.0/180.0 mm (ABS)	
		Minimum		166.0/181.0 mm (ABS)	
Parking brake	Specified number of notches			4 - 7 notches	

MABS00108-00000

SSTs (Special service tools)

Shape	Part number	Part name	Remarks
	09730-87401-000	Brake booster gauge set	
	09737-87003-000	(Gauge)	
	09733-87401-000	(O-ring)	
	09731-87401-000	(Attachment)	
	09703-30010-000	Brake shoe return spring tool	
	09921-00010-000	Spring tension tool	
	09510-87301-000	Front hub & drum puller	
	09991-87403-000	Diagnosis check wire	
	09991-87404-000	Engine control system inspection wire	

MABS00109-00000

TIGHTENING TORQUE

Tightening components	N·m	kgf·m
Brake pedal clevis × Brake push rod (lock nut)	22.6 - 28.4	2.3 - 2.9
Stop lamp switch lock nut	19.4 - 31.6	2.0 - 3.2
Bleeder plug	6.9 - 9.8	0.7 - 1.0
Brake pedal × Brake pedal bracket	15.2 - 22.4	1.5 - 2.3
Brake master cylinder × Brake booster	11.8 - 17.6	1.2 - 1.8
Brake pipe × Brake master cylinder	12.7 - 17.7	1.3 - 1.8
Brake booster × Dash panel	9.8 - 15.7	1.0 - 1.6
Caliper mount bolt	37.3 - 49.0	3.8 - 5.0
Brake hose × Disc brake cylinder assembly	26.5 - 34.3	2.7 - 3.5
Brake backing plate × Rear axle carrier	34.0 - 42.0	3.5 - 4.3
Wheel speed sensor × Brake backing plate	6.4 - 9.3	0.65 - 0.95
Wheel cylinder × Brake backing plate	7.8 - 11.7	0.8 - 1.2
Brake pipe × Wheel cylinder	12.7 - 17.7	1.3 - 1.8
Parking brake cable × Brake backing plate	6.3 - 9.2	0.64 - 0.96
Rear axle hub castle nut	58.8 - 78.5	6.0 - 8.0
Parking brake cable attaching bolts	5.9 - 8.8	0.6 - 0.9
Parking brake handle assembly × Floor panel	14.7 - 21.5	1.5 - 2.2
Proportioning valve × Body	5.9 - 8.8	0.6 - 0.9
Proportioning valve × Brake tube	12.7 - 17.7	1.3 - 1.8
Push rod adjusting nut	17.6 - 24.5	1.8 - 2.5
Speed sensor harness clamp × Inner fender	6.9 - 9.8	0.7 - 1.0
Speed sensor harness clamp × Floor panel	6.9 - 9.8	0.7 - 1.0
Front speed sensor clamp × Fender	6.9 - 9.8	0.7 - 1.0
Front speed sensor × Knuckle	15.2 - 23.0	1.55 - 2.35
Rear speed sensor clamp × Floor panel	6.9 - 9.8	0.7 - 1.0
Rear speed sensor × Rear brake	6.9 - 9.8	0.7 - 1.0
ABS actuator × ABS actuator bracket	10.0 - 2.0	1.02 ± 0.2
Brake pipe × ABS actuator	15.2 ± 1.5	1.55 ± 0.15
ABS actuator bracket × Fender apron	6.8 - 9.8	0.7 - 1.0
Flare nut	15.2 ± 1.5	1.55 ± 0.15
Stop lamp switch	19.6 ± 7.8	2.0 ± 0.8
Brake pedal × Brake pedal bracket	14.7 - 21.6	1.5 - 2.2
Front disc brake assembly × Steering knuckle	31.4 - 41.2	3.2 - 4.2
G sensor bracket × Floor panel	8.4 ± 1.5	0.85 ± 0.15