

BRAKES

SECTION 5A4 ANTI-LOCK BRAKE SYSTEM (ABS)

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GENERAL DESCRIPTION

Service Precaution

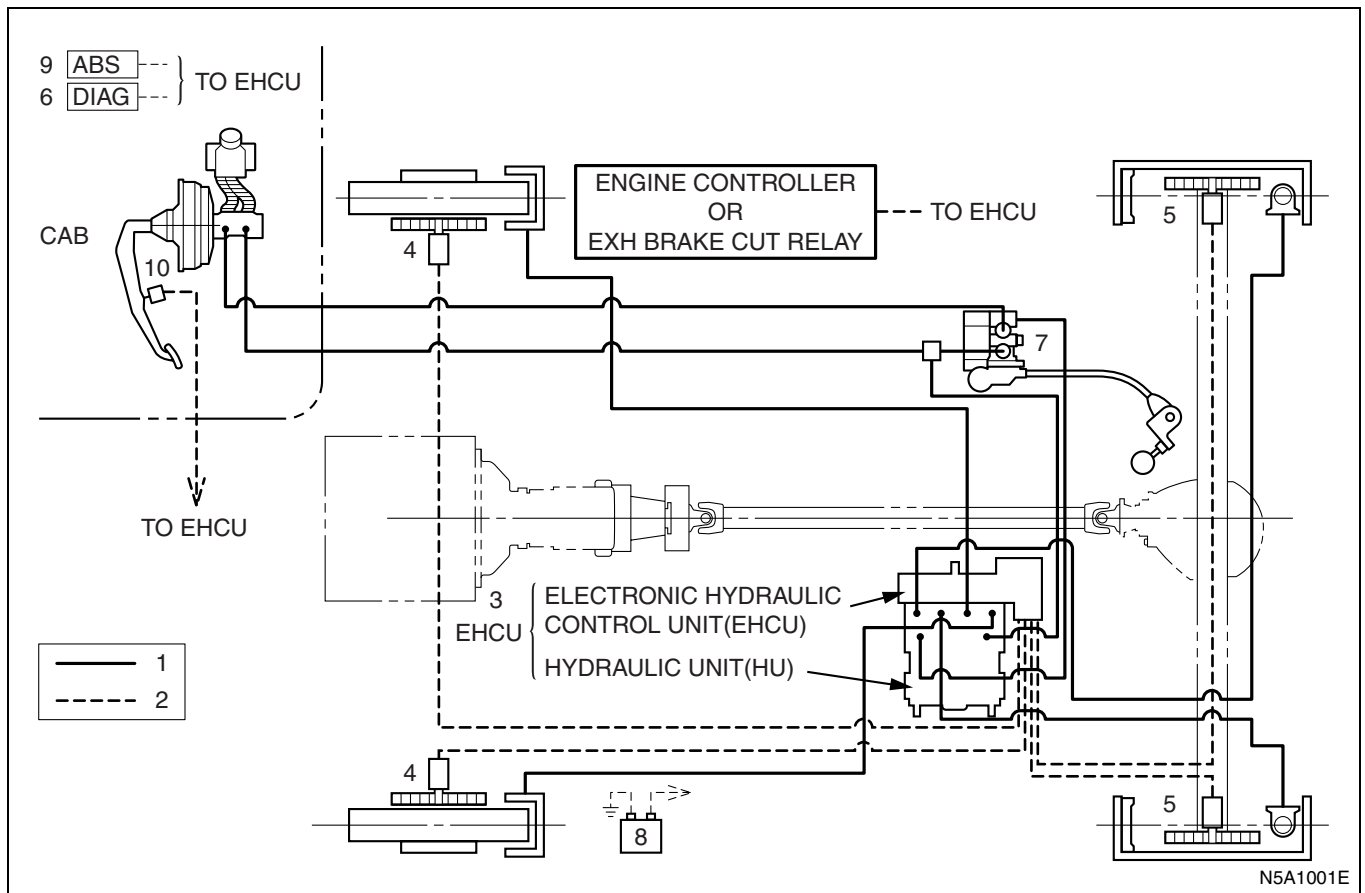
Caution:

Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The Anti-lock Brake System (ABS) works on all four wheels. A combination of wheel speed sensor and Electronic Hydraulic Control Unit (EHCUC) can determine when a wheel is about to stop turning and adjust brake pressure to maintain best braking.

This system helps the drive maintain greater control of the vehicle under heavy braking conditions.



Legend

- | | |
|--|--|
| 1. Hydraulic Line | 7. Load Sensing Proportioning Valve (LSPV) |
| 2. Electronic Line | 8. Battery |
| 3. Electronic Hydraulic Control Unit (EHCUC) | 9. ABS Warning Light |
| 4. Front Wheel Speed Sensor | 10. Brake Switch |
| 5. Rear Wheel Speed Sensor | |
| 6. Diagnosis Connector | |

5A4-4 ANTI-LOCK BRAKE SYSTEM (ABS)

System Components

The Anti-lock Brake System consists of a Electronic Hydraulic Control Unit (EHCU), four Wheel Speed Sensors and Warning Light.

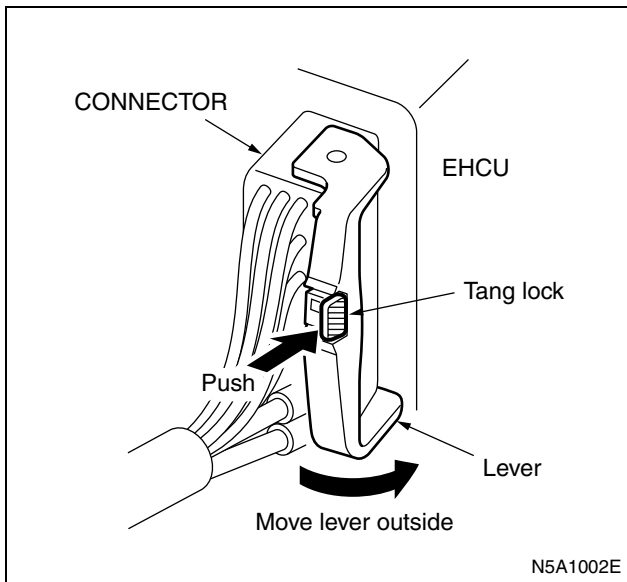
Electronic Hydraulic Control Unit (EHCU)

The EHCU consists of Electronic Brake Control Module (EBCM) and Hydraulic Unit (HU).

The EHCU is located at the frame side, in front of rear spring bracket.

The EHCU consists of ABS control circuits, fault detector, and a fail-safe. It drives the hydraulic unit according to the signal from each sensor, cancelling ABS to return to normal braking when a malfunction has occurred in the ABS.

The EHCU is self-diagnosing function which can indicate faulty circuits during diagnosis.



Notice:

When disconnecting harness connector from EHCU, push the tang lock of the connector and release the tang lock. Then move the lever.

Hydraulic Unit (HU)

It consists of a Motor, Plunger Pump, Solenoid Valves and Check Valve.

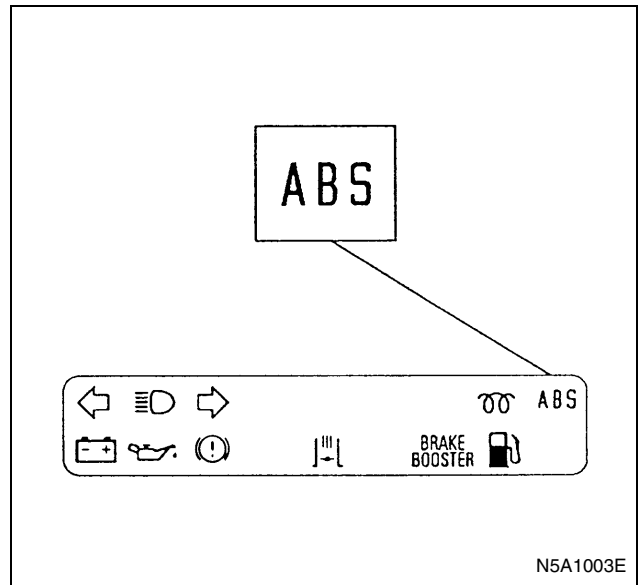
Solenoid Valves: Reduces or holds the caliper fluid pressure for each front brake or both rear brakes according to the signal sent from the EHCU.

Reservoir: Temporarily holds the brake fluid that returns from the front and rear wheel brake so that pressure of front wheel brake can be reduced smoothly.

Plunger Pump: Feeds the brake fluid held in the reservoir to the master cylinder.

Motor: Drives the pump according to the signal from EHCU. **Check Valve:** Controls the brake fluid flow.

ABS Warning Light



Vehicles equipped with the Anti-lock Brake System has an amber "ABS" warning light in the instrument panel. The "ABS" warning light will illuminate if a malfunction in the Anti-lock Brake System is detected by the Electronic Hydraulic Control Unit (EHCU). In case of an electronic malfunction, the EHCU will turn "ON" the "ABS" warning light and disable the Anti-lock braking function.

The "ABS" light will turn "ON" for 2 seconds after the ignition switch is to the "ON" position, and then will go out. If the "ABS" light comes "ON" and stays "ON" while driving, the Anti-lock Brake System should be inspected for a malfunction according to the diagnosis procedure.

Wheel Speed Sensor

It consists of a sensor and a rotor. The sensor is attached to the knuckle on the front wheels and to the bracket on the brake back plate on the rear wheels.

The front speed sensor is coil type and rear is Hall IC type.

The sensor rotors press-fitted to front and rear wheel hubs output pulse frequency depending on wheel rotation.

The speed sensors find vehicle speed from its frequency.

Normal and Anti-lock Braking

Under normal driving conditions, the Anti-lock Brake System functions the same as a standard power assisted brake system. However, with the detection of wheel lock-up, a slight bump or kick-back will be felt in the brake pedal. This pedal "bump" will be followed by a series of short pedal pulsations which occurs in rapid succession. The brake pedal pulsation will continue ANTI-LOCK BRAKE SYSTEM (ABS) 5A4-7 until there is no longer a need for the anti-lock function or until the vehicle is stopped. A slight ticking or popping noise may be heard during brake applications when the Anti-lock features is being used.

When the Anti-lock feature is being used, the brake pedal may rise even as the brakes are being applied. This is also normal. Maintaining a consist force on the pedal will provide the shortest stopping distance.

Brake Pedal Travel

Vehicles equipped with the Anti-lock Brake System may be stopped by applying normal force to the brake pedal. Although there is no need to push the pedal beyond the point where it stops or holds the vehicle, by applying more force the pedal will continue to travel toward the floor.

This extra brake pedal travel is normal.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

ABS

Anti-lock Brake System

CKT

Circuit

DLC

Data Link Connector

DTC

Diagnostic Trouble Code

DVM

Digital Volt Meter (High Impedance Multimeter)

EHC

Electronic Hydraulic Control Unit

FL

Front Left

FR

Front Right

GEN

Generator

HU

Hydraulic Unit

MV

Millivolts

RL

Rear Left

RR

Rear Right

RPS

Revolution per Second

SW

Switch

VDC

Volts DC

VAC

Volts AC

W/L

Warning Light

WSS

Wheel Speed Sensor

GENERAL DIAGNOSIS

General Information

ABS malfunction can be classified into two types, those which can be detected by the ABS warning light and those which can be detected as a vehicle abnormality by the driver.

In either case, locate the fault in accordance with the "BASIC DIAGNOSTIC FLOWCHART" and repair.

Please refer to Section 5A HYDRAULIC BRAKES for the diagnosis of mechanical troubles such as brake noise, brake judder (brake pedal or vehicle vibration felt when braking), uneven braking, and parking brake trouble.

ABS Service Precautions

Required Tools and Items:

- Box Wrench
- Brake Fluid
- Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

High Impedance Multimeter: 5-8840-0285-0 (J-39200)

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Anti-lock Brake System interfaces directly with the Electronic Hydraulic Control Unit (EHCUC) which is a control computer that is similar in some regards to the Engine Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However, care must be taken to avoid overloading any of the EHCUC circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter 5-8840-0285-0 (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the "ON" position. Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the "OFF" position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Anti-lock Brake System and/or other vehicle systems. Failure to observe these precautions may result in Anti-lock Brake System damage.

- If welding work is to be performed on the vehicle using an electric arc welder, the EHCUC connector should be disconnected before the welding operation begins.
- The EHCUC connector should never be connected or disconnected with the ignition "ON".

- The EHCUC is not separately serviceable and must be replaced as assemblies. Do not disassemble any component which is designated as non-serviceable in this Section.
- If only rear wheels are rotated using jacks or drum tester, the system will diagnose a speed sensor malfunction and the "ABS" warning light will illuminate. But actually no trouble exists. After inspection stop the engine once and re-start it, then make sure that the "ABS" warning light does not illuminate.

Note on Intermittents

As with virtually any electronic system, it is difficult to identify an intermittent failure. In such a case duplicating the system malfunction during a test drive or a good description of vehicle behavior from the customer may be helpful in locating a "most likely" failed component or circuit. The symptom diagnosis chart may also be useful in isolating the failure. Most intermittent problems are caused by faulty electrical connections or wiring. When an intermittent failure is encountered, check suspect circuits for:

- Suspected harness damage.
- Poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.

Test Driving ABS Complaint Vehicles

In case that there has been an malfunction in the lighting pattern of "ABS" warning light, the fault can be located in accordance with the "DIAGNOSIS BY "ABS" WARNING LIGHT ILLUMINATION PATTERN". In case of such trouble as can be detected by the driver as a vehicle symptom, however, it is necessary to give a test drive following the test procedure mentioned below, thereby reproducing the symptom for trouble diagnosis on a symptom basis:

1. Start the engine and make sure that the "ABS" W/L goes OFF. If the W/L remains ON, it means that the Diagnostic Trouble Code (DTC) is stored. Therefore, read the code and locate the fault.
2. Start the vehicle and accelerate to about 30 km/h (19 mph) or more.
3. Slowly brake and stop the vehicle completely.
4. Then restart the vehicle and accelerate to about 40 km/h (25 mph) or more.
5. Brake at a time so as to actuate the ABS and stop the vehicle.
6. Be cautious of abnormality during the test. If the W/L is actuated while driving, read the DTC and locate the fault.
7. If the abnormality is not reproduced by the test, make best efforts to reproduce the situation reported by the customer.

8. If the abnormality has been detected, repair in accordance with the "SYMPTOM DIAGNOSIS".

Notice:

- Be sure to give a test drive on a wide, even road with little traffic.
- If an abnormality is detected, be sure to suspend the test and start trouble diagnosis at once.

"ABS" Warning Light

When ABS trouble occurs and actuates when possible the "ABS" warning light, the trouble code corresponding to the trouble is stored in the EHCUC.

Only the ordinary brake system is available when the ABS is turned OFF. When the "ABS" warning light is actuated, if the starter switch is set ON after setting it OFF

once, the EHCUC checks up on the entire system and, if there is no abnormality, judges ABS to work currently and the warning light works normally even though the trouble code is stored.

Notice:

Illumination of the "ABS" warning light indicates that anti-lock braking is no longer available. Power assisted braking without anti-lock control is still available.

Normal Operation
"ABS" Warning Light

When the ignition is first moved from "OFF" to "ON", the amber "ABS" warning light will turn "ON" for 2 seconds and will turn "OFF".

Basic Diagnostic Flow Chart

Step	Action	Value(s)	YES	NO
1	1. Customer complaint. 2. Questioning to customer. 3. Basic inspection (Refer to "Basic inspection procedure"). Using Tech 2?	—	Go to Step 2	Go to Step 3
2	Make sure of DTC by TROUBLE CODE. Is EHCUC including DTC?	—	Go to Step 5	Go to Step 4
3	Check if the DTC is stored. Is EHCUC including DTC?	—	Go to Step 5	Go to Step 4
4	Test drive. Is W/L lit?	—	Go to Step 5	Trouble diagnosis based on symptom (Refer to "SYMPTOM DIAGNOSIS") Go to Step 5
5	1. Repair of faulty part. 2. Elimination of DTC. 3. Inspection of "ABS" W/L illumination pattern with ignition SW "ON". 4. Test drive. Does the DTC repeat?	—	Repeat the diagnosis of the symptom or DTC appears again Go to Step 1	Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Finished	—

5A4-8 ANTI-LOCK BRAKE SYSTEM (ABS)

Basic Inspection Procedure

1. Basic Inspection of Service Brake

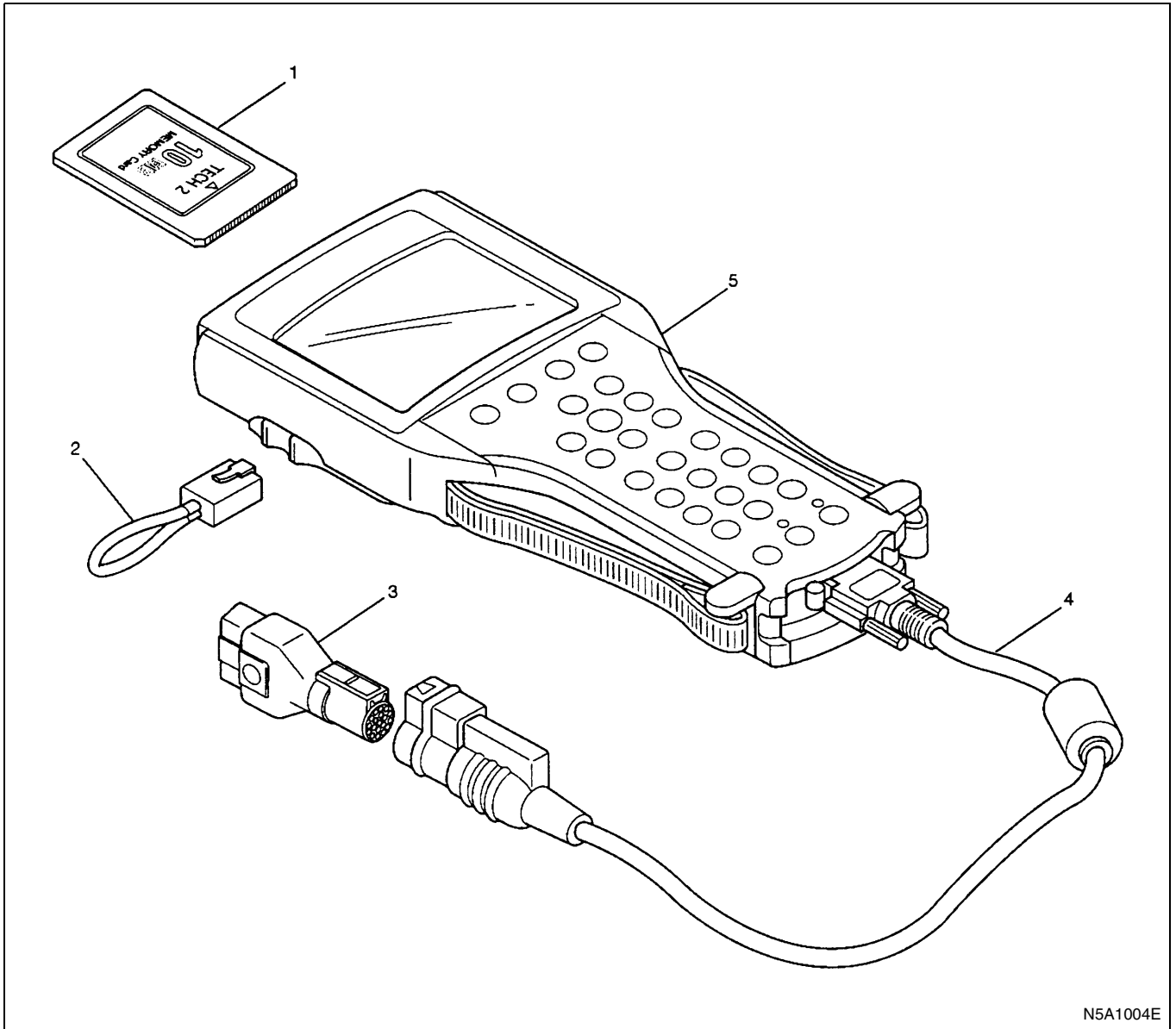
Step	Action	Value(s)	YES	NO
1	Is the fluid level normal?	—	Go to Step 2	Replenish with fluid. Go to Step 2
2	Does brake fluid leak from brake parts?	—	Repair. Go to Step 3	Go to Step 3
3	Is the booster functioning normal?	—	Go to Step 4	Repair. Go to Step 4
4	Is the pad and rotor normal?	—	Go to Step 5	Repair. Go to Step 5
5	Reconnect all components and ensure all components are properly mounted. Was this step finished?	—	Finished	—

2. Ground Inspection

Step	Action	Value(s)	YES	NO
1	Are ABS-related ground points ok?	—	Go to Step 2	Repair. Go to Step 2
2	Reconnect all components and ensure all components are properly mounted. Was this step finished?	—	Finished	—

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



Legend

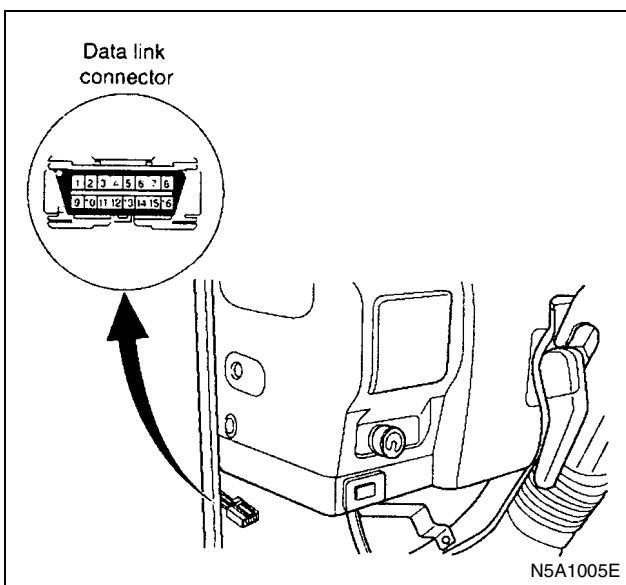
- | | |
|-------------------------------|--------------|
| 1. PCMCIA Card | 4. DLC Cable |
| 2. RS 232 Loop Back Connector | 5. Tech 2 |
| 3. SAE 16/19 Adapter | |

Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volt.
2. After connecting and/or installing the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge. (except 2003 year model)
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press "F1: Clear DTC Info".

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
1. The Isuzu System PCMCIA card (1) inserts into the Tech 2 (5).
 2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
 3. Connect the DLC cable to the Tech 2 (5).
 4. Make sure the vehicle ignition is off.
 5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and verify the Tech 2 power up display.

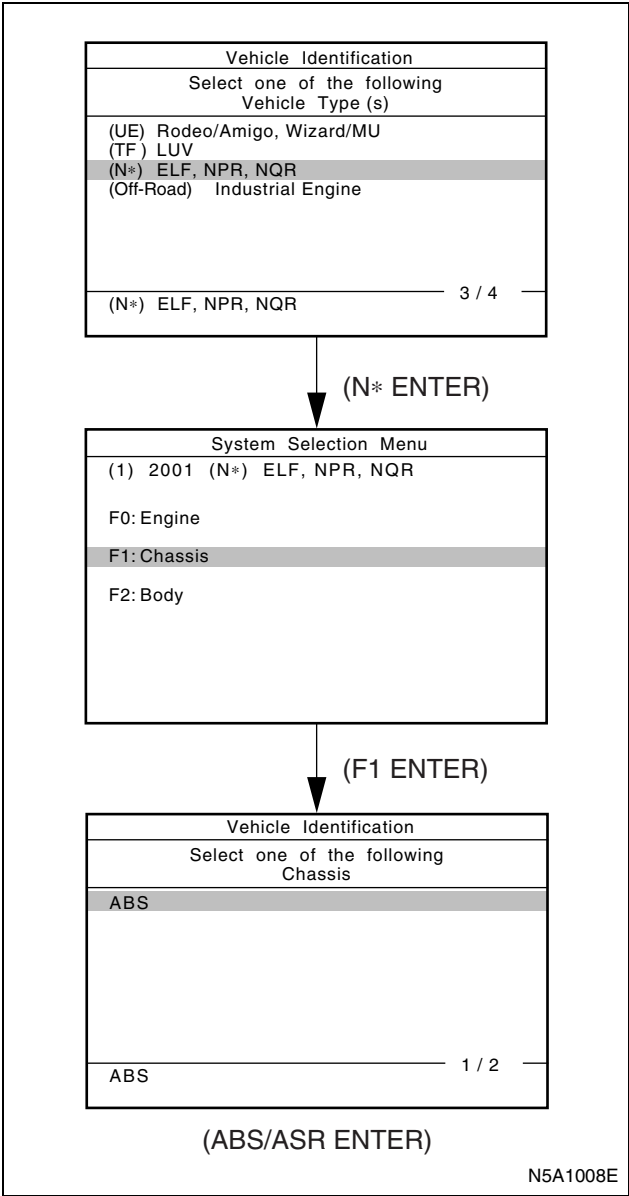
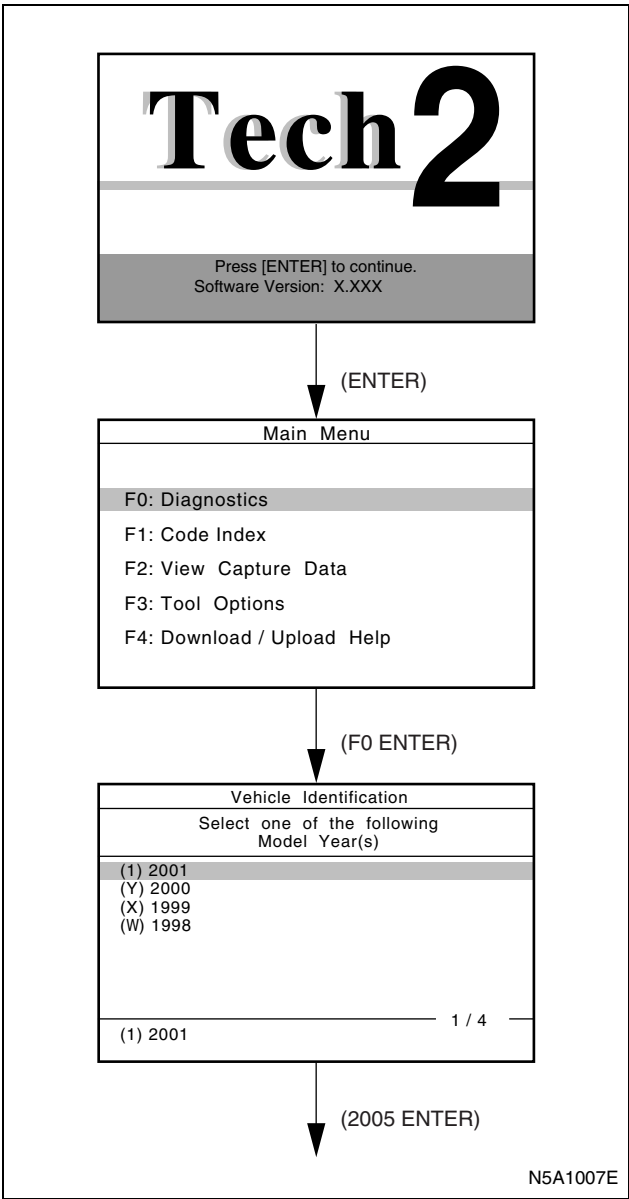


Notice:

The RS232 Loop back connector is only to use for diagnosis of Tech 2. Refer to user guide of the Tech 2.

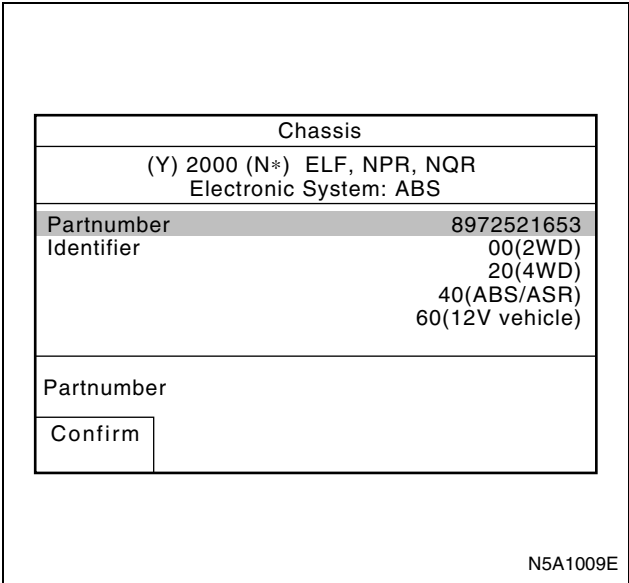
Operating Procedure (For Example)

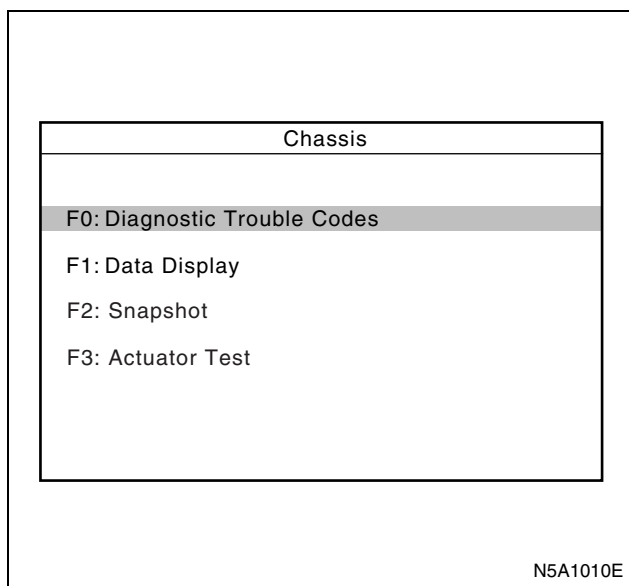
The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



Menu

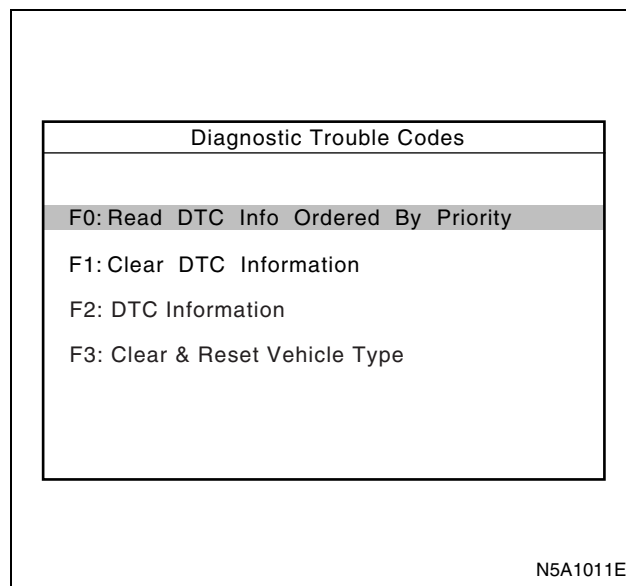
- The following table shows which functions are used for the available equipment versions.



DTC Modes

There are two options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears.

- DTC Info
- Clear Info



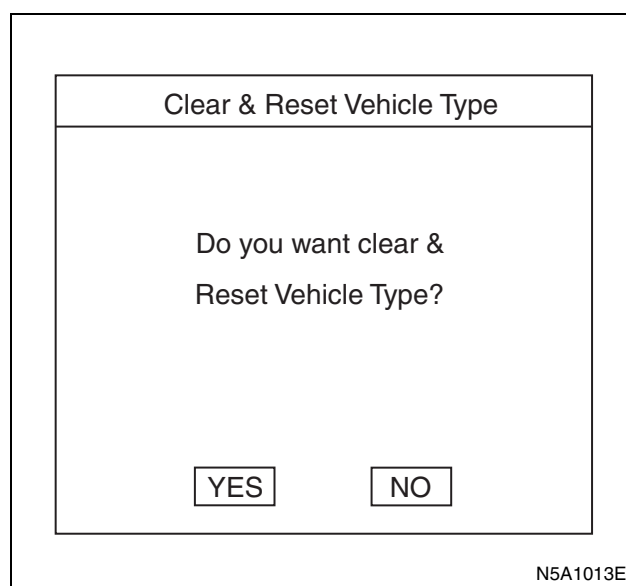
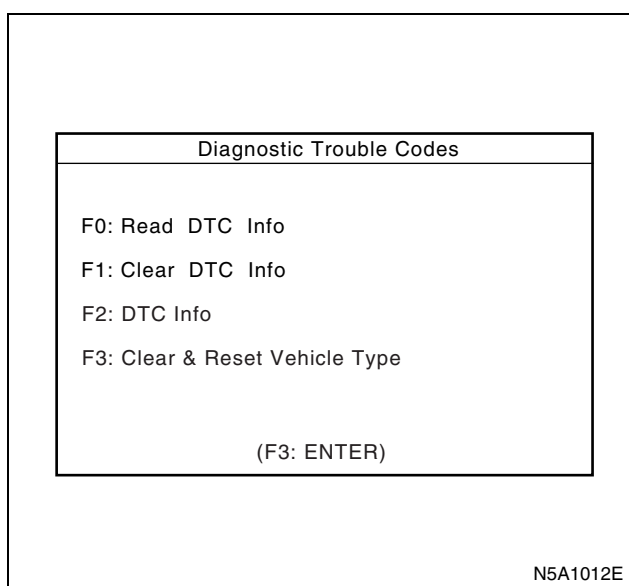
The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are two choices. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.

When CODE "13" is Displayed (Vehicle Type Error)

Step	Action	Value(s)	YES	NO
1	Check harness. Is it okay?	—	Erase vehicle type with Tech 2 and reread harness information.	Replace the harness.



YES: Clear vehicle type and reread vehicle harness information.

NO: Return

DTC Status

Current Diagnostic Trouble Codes

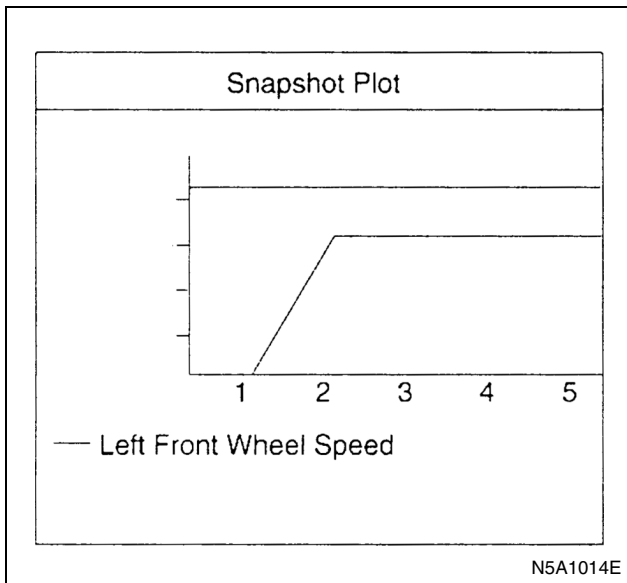
This selection will display all DTCs that have failed during the present ignition cycle.

History Diagnostic Trouble Codes

This selection will display only DTCs that are stored in the EHCU's history memory.

Plotting Snapshot Graph

This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. This test can check ABS performance and defect by graphing wheel speed differences between right and left sides, and front and rear sides obtained from the ABS data list menu.

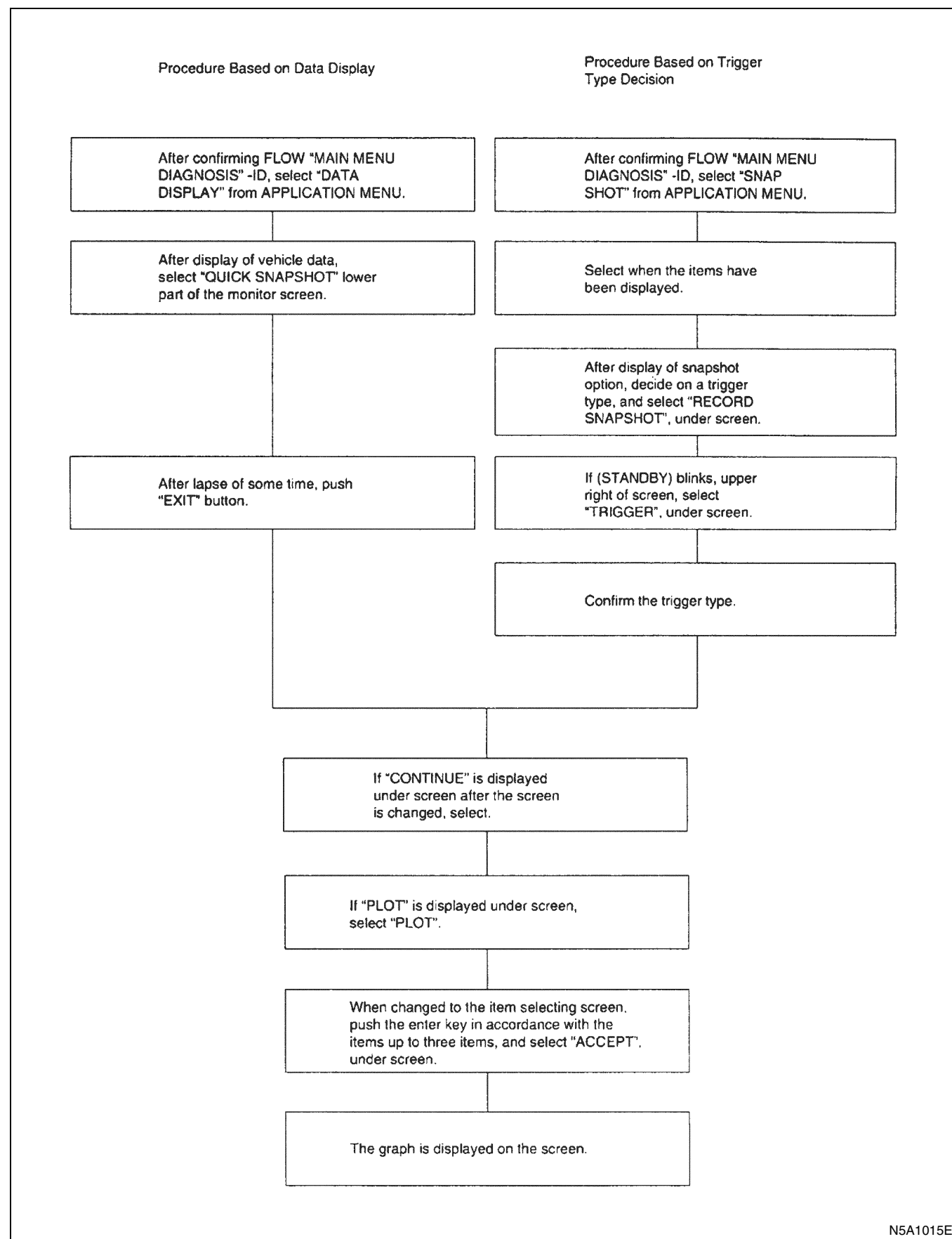


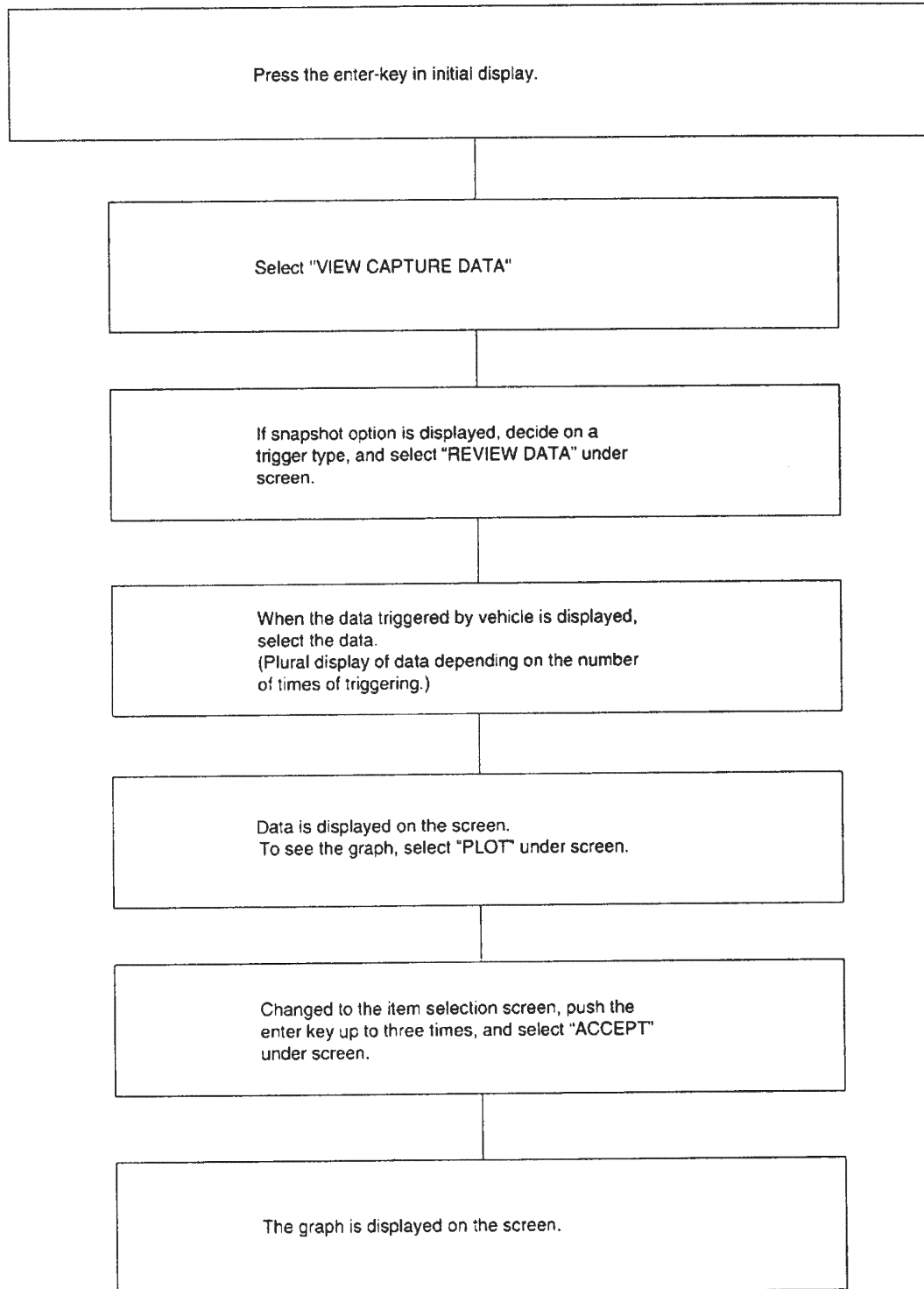
For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.

You can replay the snapshot data as needed.

Therefore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting Graph after Obtaining Vehicle Information)



Flow Chart for Snapshot Replay (Plotting Graph)

Tech 2 Data Display

Use the Tech 2 data Values only after the ABS Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing.

ABS Data

Ignition SW is "ON" position.

(For example)

F1: ABS DATA

Left Front Wheel Speed	2 mph
Right Front Wheel Speed	2 mph
Left Rear Wheel Speed	2 mph
Right Rear Wheel Speed	2 mph
Brake Switch Status	OFF
ABS Lamp Command	OFF
ABS Pump Motor	OFF
LR Release Valve Command	OFF
LR Hold Valve Command	OFF
RR Release Valve Command	OFF
RR Hold Valve Command	OFF
LF Release Valve Command	OFF
LF Hold Valve Command	OFF
RF Release Valve Command	OFF
RF Hold Valve Command	OFF
LR Release Valve Feed back	OFF
LR Hold Valve Feed back	OFF
RR Release Valve Feed back	OFF
RR Hold Valve Feed back	OFF
LF Release Valve Feed back	OFF
LF Hold Valve Feed back	OFF
RF Hold Valve Feed back	OFF
RF Release Valve Feed back	OFF
Battery Voltage	12~16V

Select
Items

DTC

Quick
Snapshot

More

N5A1017E

Special Function

There are 12 different menus available for this test. The state of each circuit can be tested by using these menus. Especially when DTC cannot be detected, a faulty circuit can be diagnosed by testing each circuit by means of these menus.

Even when DTC has been detected, the circuit tests using these menus could help discriminate between a mechanical trouble and an electrical trouble.

In all cases test condition; Engine stops with the key turned to the "ON" position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.

- Engine: Stop
- Ignition SW: ON
- Brake Pedal: ON-OFF-ON

If the Ignition SW was turned OFF or communication was lost, make sure to apply the brake pedal ON-OFF-ON once again and then continue the test.

Actuator Test

F0: ABS Relay Test
 F1: Return Pump Relay Test
 F2: Front Left Solenoid Valve Test
 F3: Front Right Solenoid Valve Test
 F4: Rear Left Solenoid Valve Test
 F5: Rear Right Solenoid Valve Test
 F6: ABS Check Light Test
 F7: Exhaust Brake Cut Test

N5A1018E

ABS Warning Lamp

Test condition: Engine stops with the key turned to the "ON" position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.

- The circuit is normal if the warning light in the meter panel comes on and goes out in accordance with Tech 2's instruction.

Actuator Test

F0: ABS Relay Test
 F1: Return Pump Relay Test
 F2: Front Left Solenoid Valve Test
 F3: Front Right Solenoid Valve Test
 F4: Rear Left Solenoid Valve Test
 F5: Rear Right Solenoid Valve Test

 F7: Exhaust Brake Cut Test

N5A1019E

ABS Relay

Test condition: Engine stops with the key turned to the “ON” position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.
Make sure of the working sound of the ABS relay.
The circuit is normal if the working sound of the ABS relay is made in accordance with Tech 2’s instruction.

Actuator Test

F1: Return Pump Relay Test
F2: Front Left Solenoid Valve Test
F3: Front Right Solenoid Valve Test
F4: Rear Left Solenoid Valve Test
F5: Rear Right Solenoid Valve Test
F6: ABS Check Light Test
F7: Exhaust Brake Cut Test

N5A1020E

ABS Motor

Test condition: Engine stops with the key turned to the “ON” position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.
Make sure of the working sound of the ABS motor.
The circuit is normal if the working sound of the ABS motor is made in accordance with Tech 2’s instruction.

Actuator Test

F0: ABS Relay Test

F2: Front Left Solenoid Valve Test
F3: Front Right Solenoid Valve Test
F4: Rear Left Solenoid Valve Test
F5: Rear Right Solenoid Valve Test
F6: ABS Check Light Test
F7: Exhaust Brake Cut Test

N5A1021E

Exhaust Brake Cut Relay

Test condition: Engine stops with the key turned to the “ON” position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.
Make sure of the working sound of the exhaust brake cut relay.
The circuit is normal if the working sound of the exhaust brake cut relay is made in accordance with Tech 2’s instruction.

Actuator Test

F0: ABS Relay Test
F1: Return Pump Relay Test
F2: Front Left Solenoid Valve Test
F3: Front Right Solenoid Valve Test
F4: Rear Left Solenoid Valve Test
F5: Rear Right Solenoid Valve Test
F6: ABS Check Light Test

N5A1022E

Hold Valve Test

Purpose: The purpose of this test is to detect brake pipe and valve line harness wire wrong connections and valve trouble.
This test will help you confirm the result of your repair service including the removal/reinstallation of brake pipe, valve line harness and valve.

Actuator Test

F0: ABS Relay Test
F1: Return Pump Relay Test

F3: Front Right Solenoid Valve Test
F4: Rear Left Solenoid Valve Test
F5: Rear Right Solenoid Valve Test
F6: ABS Check Light Test
F7: Exhaust Brake Cut Test

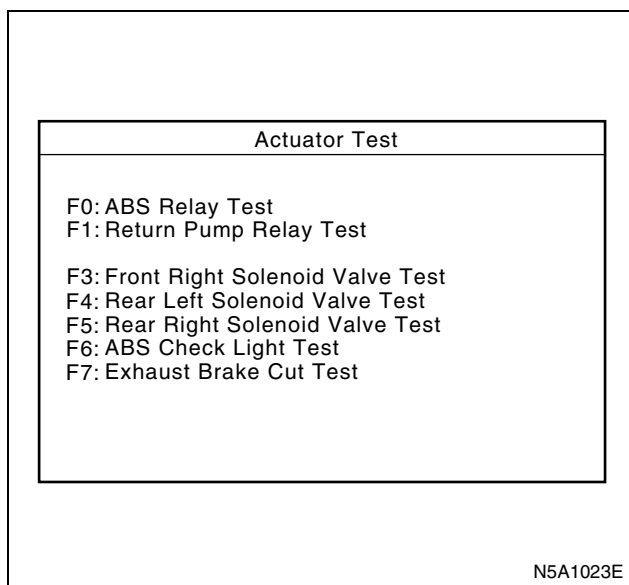
N5A1023E

5A4-18 ANTI-LOCK BRAKE SYSTEM (ABS)

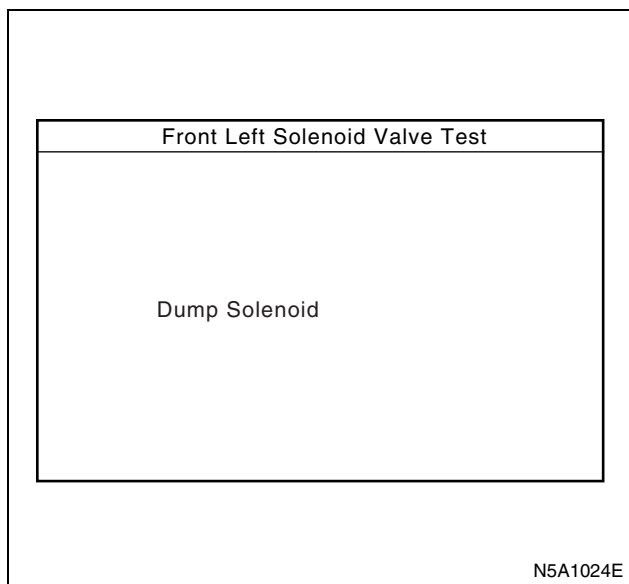
Test conditions: The ignition key is the "ON" position with the four wheels lifted up. The brake pedal is stepped on, released and stepped on again with the parking brake released.

Test procedure:

1. Connect Tech 2 with the vehicle, and select Special Function from the menus.
2. Select a Hold Valve Menu from the Special Function Menus.



Select a ISO Solenoid from the Front Left Solenoid Valve Test Function Menus.



3. Press the Hold Valve "ON" Soft Key with the brake pedal stepped on.
4. Release the brake pedal.
5. Make sure that the Hold Valve "ON" aimed at by Tech 2 and the wheel locked position are the same. If different, check brake pipe, valve line harness wiring and H/UNIT. Repair is needed if abnormality is found.

6. Conduct Step 2 through Step 5 above on all the four wheels.

Caution:

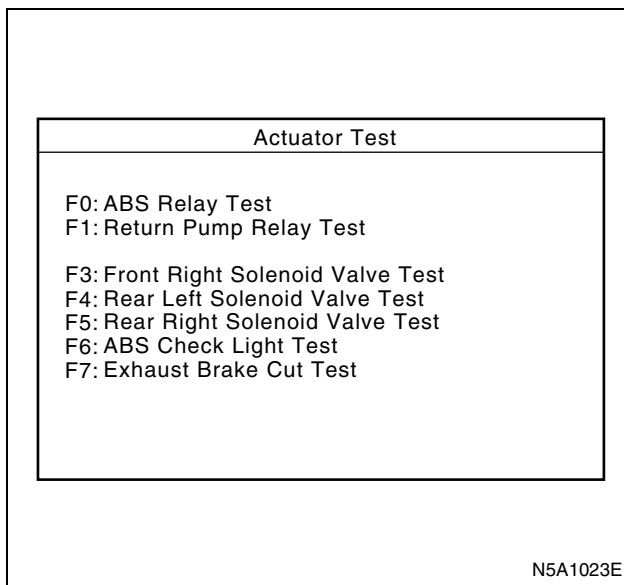
When conducting this test, please observe the following cautions.

1. Do not start the engine without fail.
2. Lift up the vehicle at the level floor.
 - Secure a clearance from the floor surface enough to allow the lifted tire to rotate.
3. Maintain the lift up.
4. Wipe the floor surface to remove water and oil so that the surface may become unslippery.
5. Do not load the vehicle.
 - When lifting up the vehicle, be sure to observe the lifting up points. Refer to vehicle lifting points in Section 0A GENERAL INFORMATION.

Release Valve Test

Purpose: The purpose of this test is to detect brake pipe and valve line harness wire wrong connections and valve trouble.

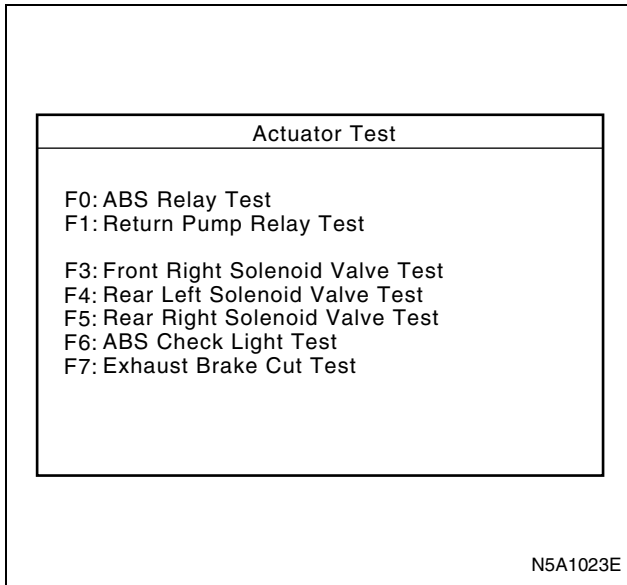
This test will help you confirm the result of your repair service including the removal/reinstallation of brake pipe, valve line harness and valve.



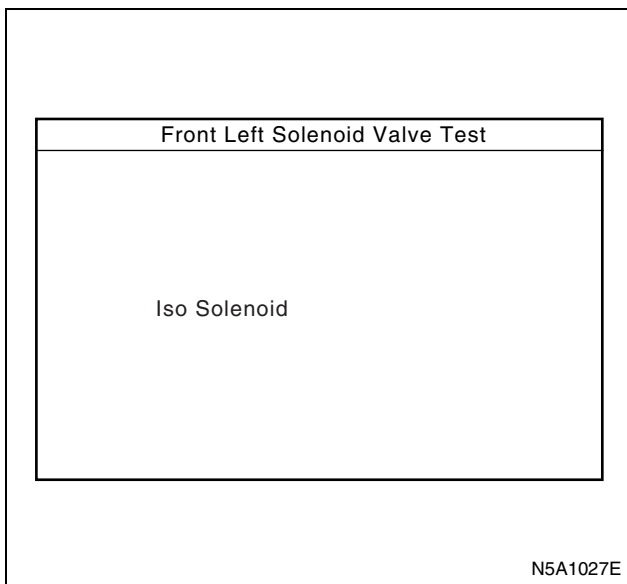
Test conditions: The ignition key is in the "ON" position with the four wheels lifted up. The brake pedal is stepped on, released and stepped on again with the parking brake released.

Test procedure:

1. Connect Tech 2 with the vehicle, and select Special Function from the menus.
2. Select a Release Valve Menu from the Special Function Menus.



Select a Dump Solenoid from the Front Left Solenoid Valve Test Function Menus.



4. Wipe the floor surface to remove water and oil so that the surface may become unslippery.
5. Do not load the vehicle.
 - When lifting up the vehicle, be sure to observe the lifting up points. Refer to vehicle lifting points in Section 0A GENERAL INFORMATION.

3. Press the Release Valve "ON" Soft Key with the brake pedal stepped on.
4. Make sure that the Release Valve "ON" aimed at by Tech 2 and the wheel released position are the same. If different, check brake pipe, valve line harness wiring and H/UNIT. Repair is needed if abnormality is found.
5. Conduct Step 2 through Step 4 above on all the four wheels.

Caution:

When conducting this test, please observe the following cautions.

1. Do not start the engine without fail.
2. Lift up the vehicle at the level floor.
 - Secure a clearance from the floor surface enough to allow the lifted tire to rotate.
3. Maintain the lift up.

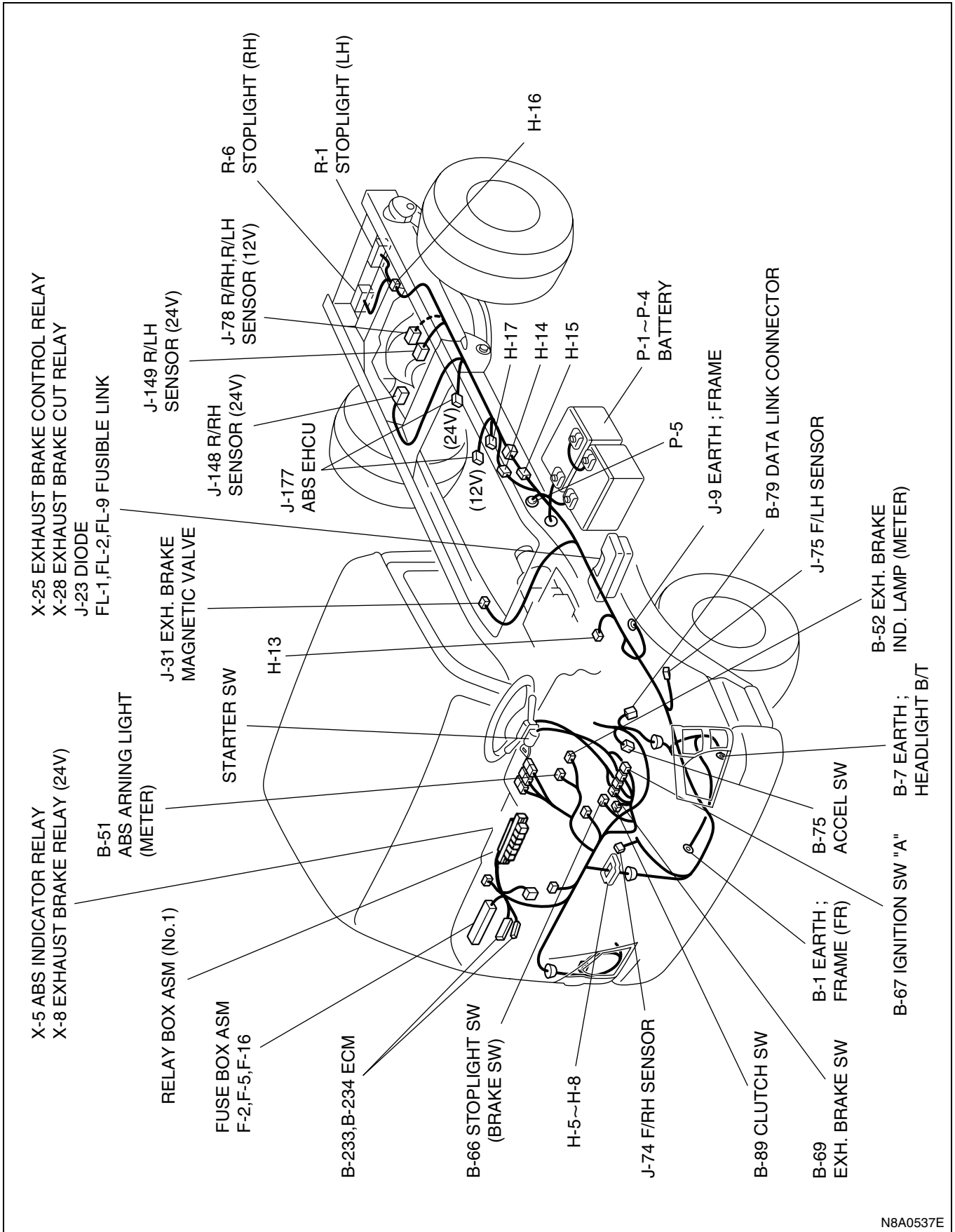
5A4-20 ANTI-LOCK BRAKE SYSTEM (ABS)

EHCUC Connector Pin-out Checks

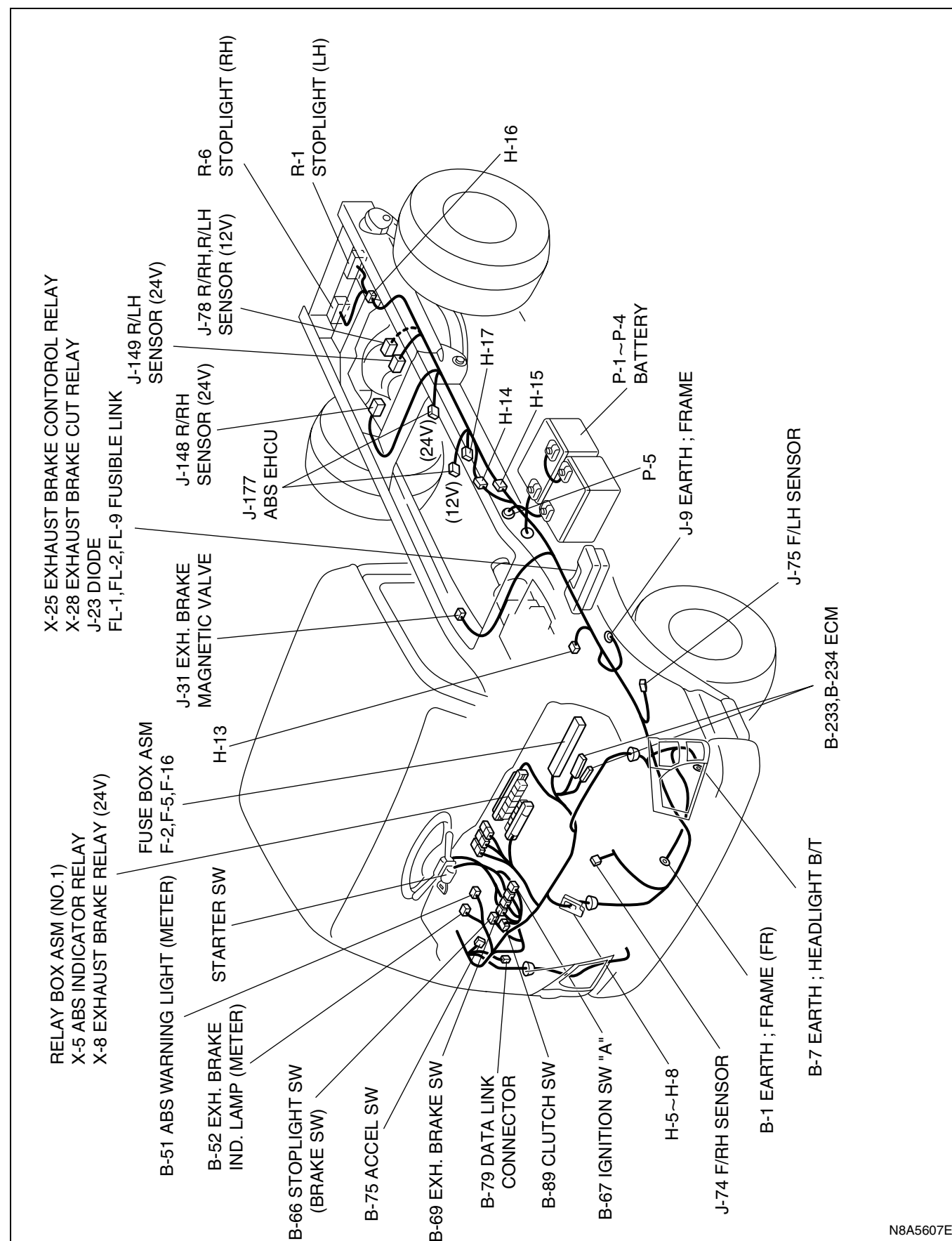
- Disconnect EHCUC.
- Perform checks with high impedance digital multimeter 5-8840-0285-0 (J-39200) or equivalent.

No.	Circuit to be Tested	Key Switch Position	Multimeter Scale/Range	Measure between Pin	Nominal Value (24 V Battery Vehicle)	Note
1	EHCUC Power Circuit	OFF	VDC	3(+) — 1(-)	0 — 0.3 V	
		ON	VDC	3(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	2(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	24(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
2	EHCUC Ground Circuit	OFF	Ω	1(+) — GND	Less than 0.01 Ω	
		OFF	Ω	23(+) — GND	Less than 0.01 Ω	
3	EXHIN Circuit	ON	VDC	7(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	Engine Run
4	EXHOUT Circuit	ON	VDC	8(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	8(+) — 1(-)	0 — 0.3 V	
5	Brake Switch Signal Circuit	OFF	VDC	16(+) — 1(-)	0 — 0.3 V	Apply Brake Pedal
		OFF	VDC	16(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
6	ABS W/L Circuit	ON	VDC	6(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	6(+) — 1(-)	0 — 0.3 V	
7	FL Speed Sensor	OFF	k Ω	10(+) — 11(-)	1 — 2 k Ω	Turn Wheel at 0.5 RPS
		OFF	k Ω	10(+) — 1(-)	More than 1000 k Ω	
		OFF	VDC	10(+) — 11(-)	More than 200 mV	
8	FR Speed Sensor	OFF	k Ω	32(+) — 33(-)	1 — 2 k Ω	Turn Wheel at 0.5 RPS
		OFF	k Ω	32(+) — 1(-)	More than 1000 k Ω	
		OFF	VDC	32(+) — 33(-)	More than 200 mV	

Parts Location
For LHD Model

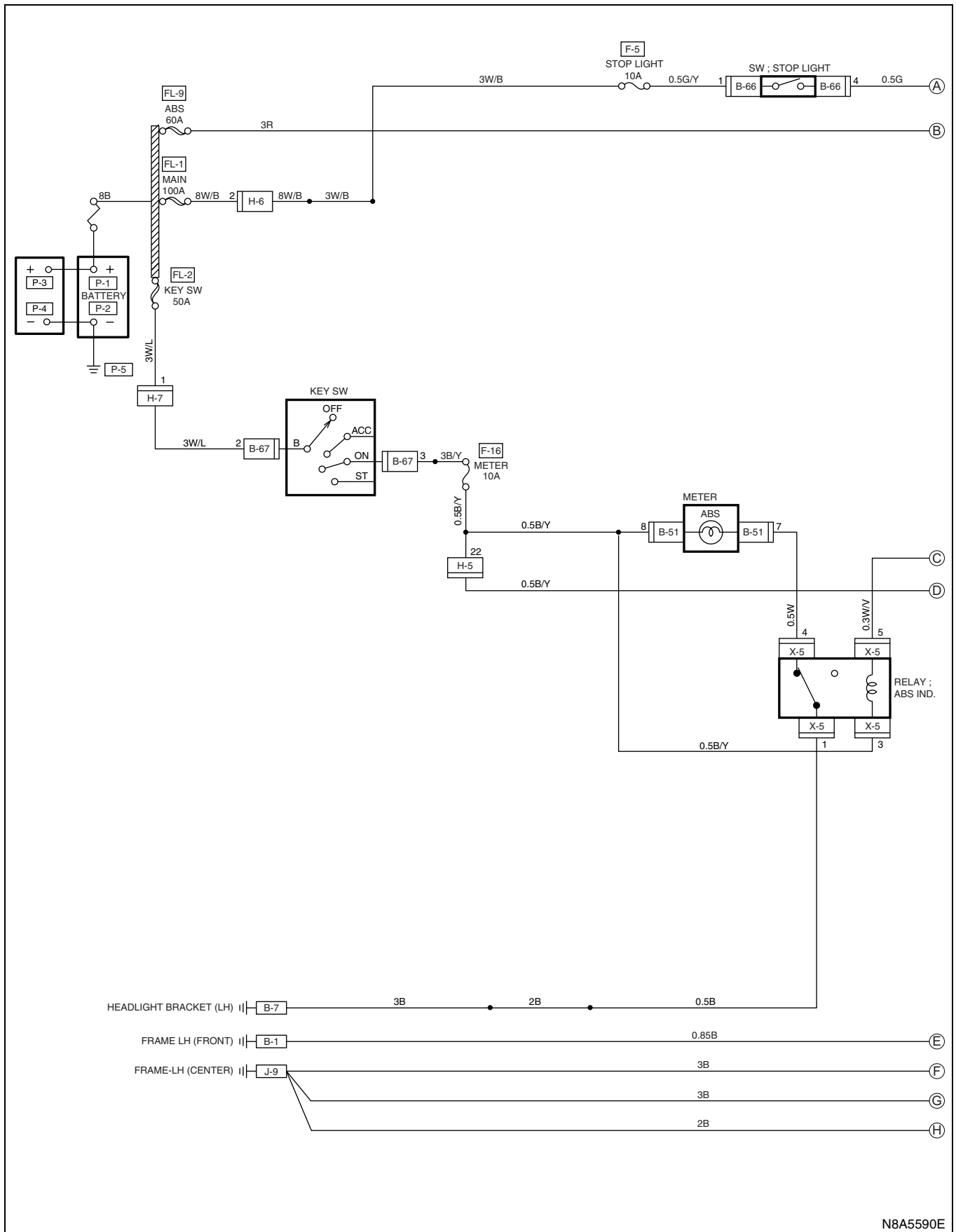


For RHD Model

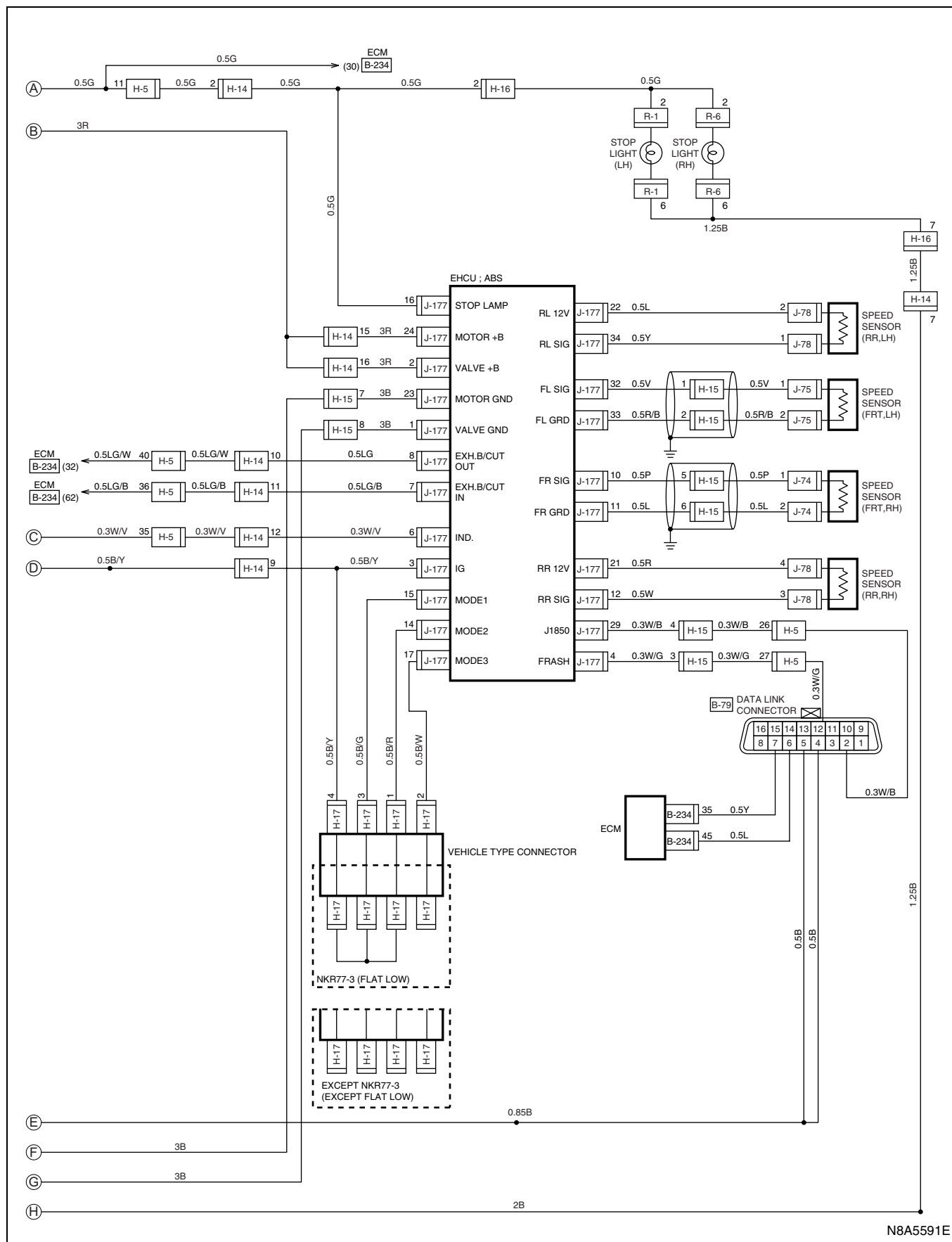


Circuit Diagram

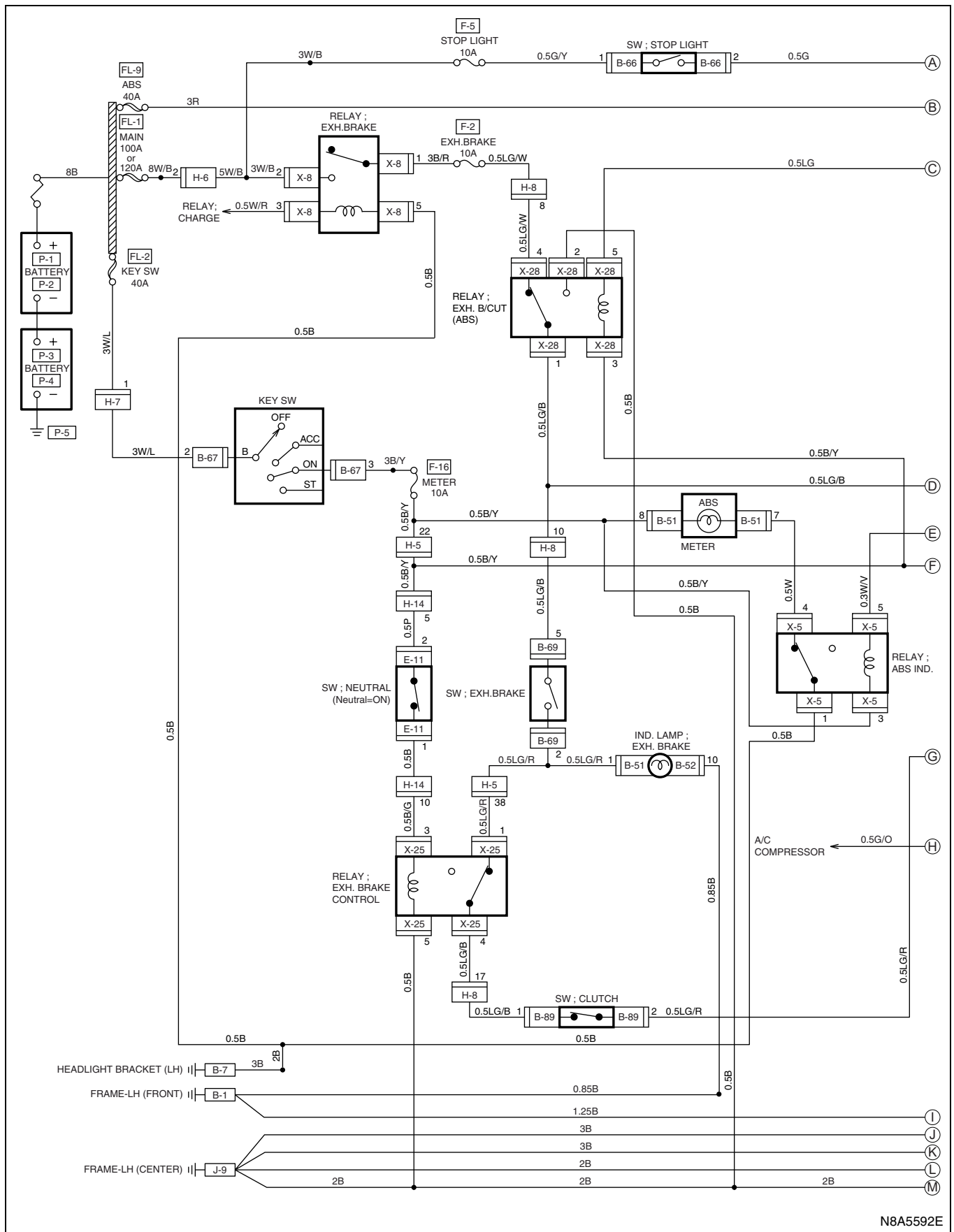
12 Volt (4JH1 Engine)



5A4-24 ANTI-LOCK BRAKE SYSTEM (ABS)

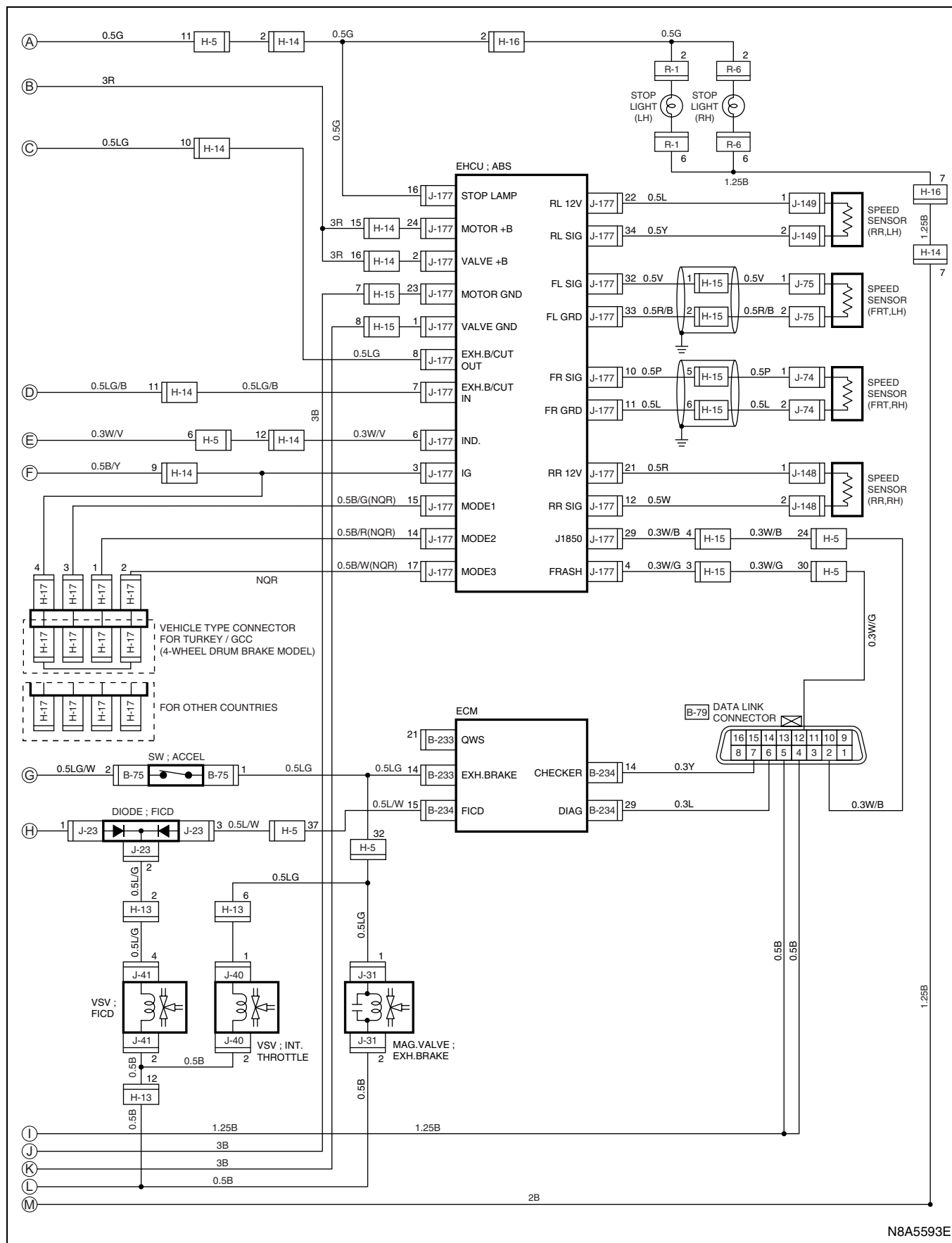


24 Volt (4HE1 Engine, Single Cab Model)



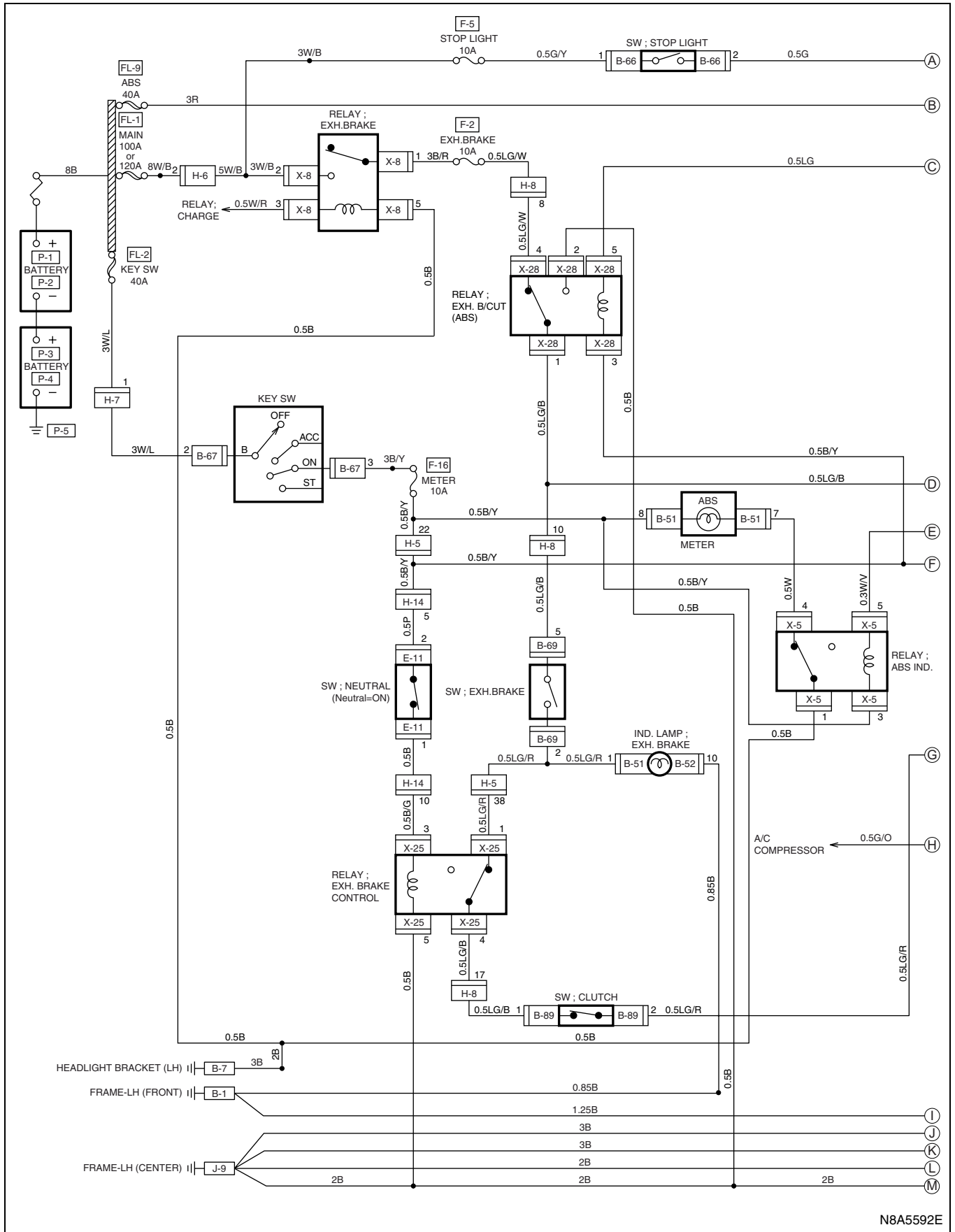
N8A5592E

5A4-26 ANTI-LOCK BRAKE SYSTEM (ABS)

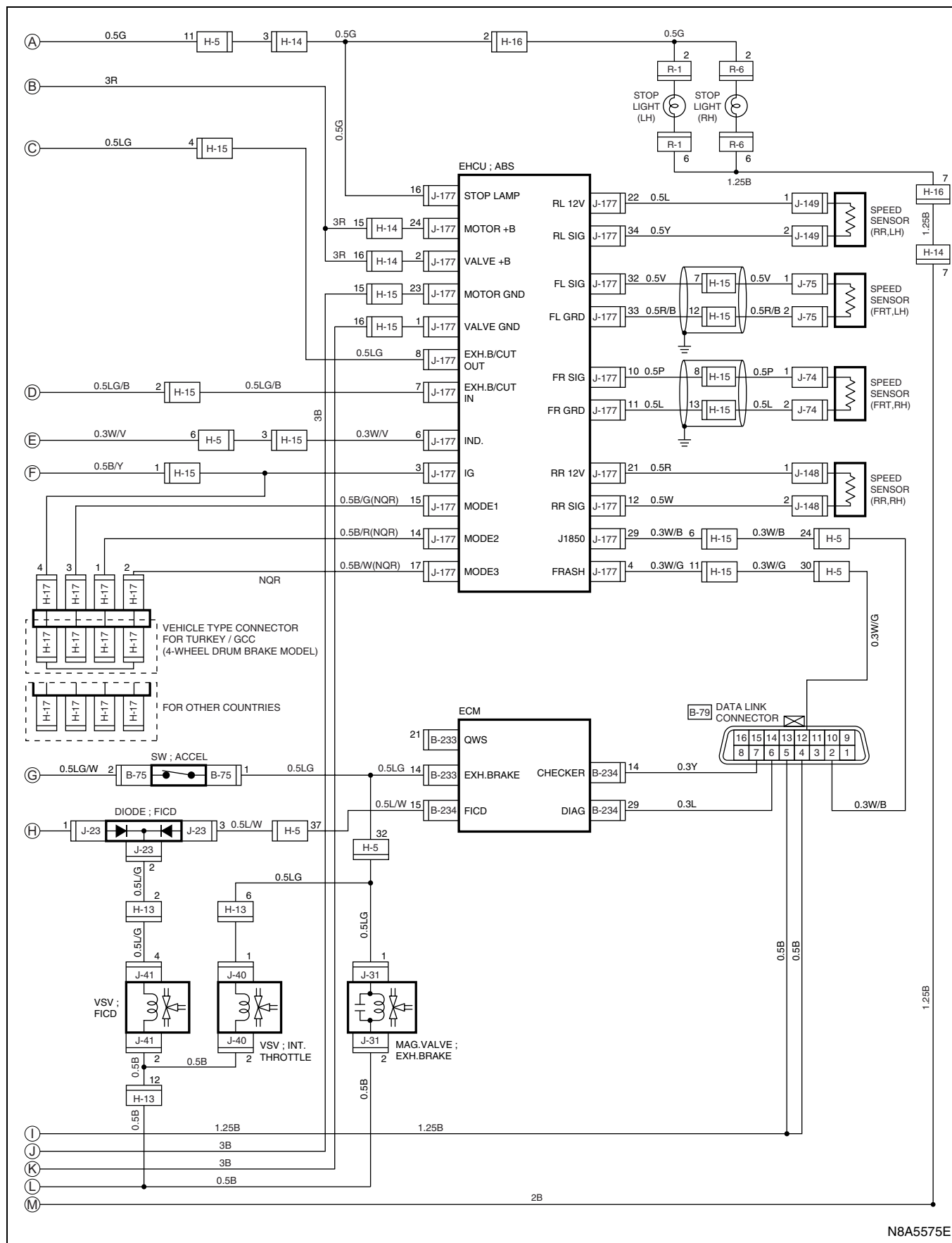


N8A5593E

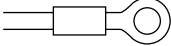
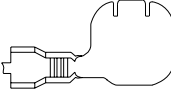
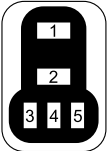
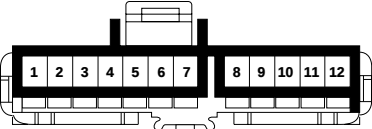
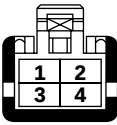
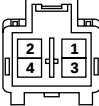
24 Volt (4HE1 Engine, Crew Cab Model)

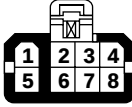
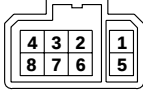
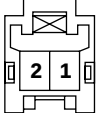
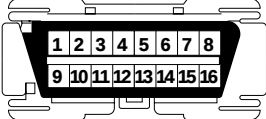
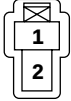
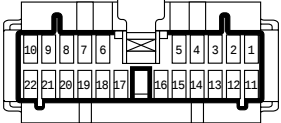


5A4-28 ANTI-LOCK BRAKE SYSTEM (ABS)

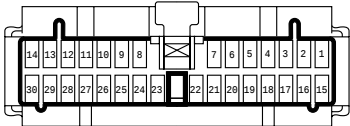
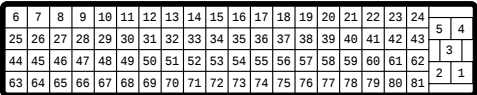
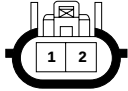
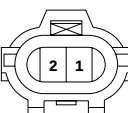
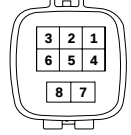
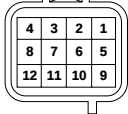
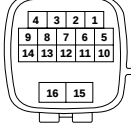
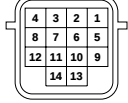
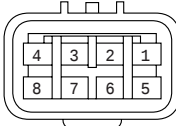


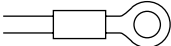
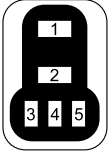
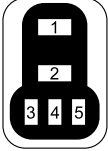
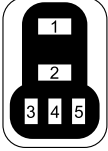
Connector List

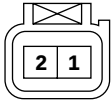
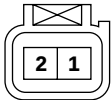
No.	Connector Face
B-1	 000-001
B-7	 000-012
X-5	 005-006
B-51	 014-001
B-52	 012-005
B-66	 004-010
B-67	 004-001
B-67	 004-002

No.	Connector Face
B-69	 008-001
B-69	 008-002
B-75	 002-022
B-75	 002-023
B-79	 016-005
B-89	 002-009
B-89	 002-010
B-233 (24 V)	 022-002

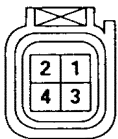
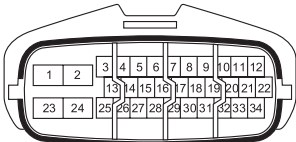
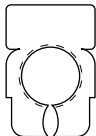
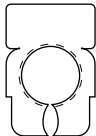
5A4-30 ANTI-LOCK BRAKE SYSTEM (ABS)

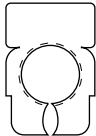
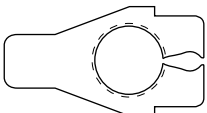
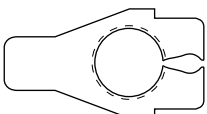
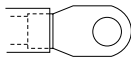
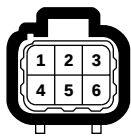
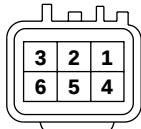
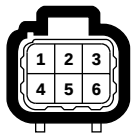
No.	Connector Face	No.	Connector Face
B-234 (24 V)	 030-002	H-14 (24 V)	 016-003
B-234 (12 V)	 121-001	H-14 (24 V)	 016-004
E-11	 002-001	H-15 (12 V)	 008-023
E-11	 002-002	H-15 (12 V)	 008-024
H-13	 012-001	H-15 (24 V)	 016-003
H-13	 012-002	H-15 (24 V)	 016-004
H-14 (12 V)	 014-004	H-16	 008-003
H-14 (12 V)	 014-005	H-16	 008-004

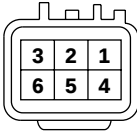
No.	Connector Face
H-17	 004-011
J-9	 000-001
X-8 (24 V)	 005-006
X-25 (24 V)	 005-006
X-28	 005-006
J-23	 004-009
J-31	 002-011
J-31	 002-012

No.	Connector Face
J-40	 002-015
J-41	 002-015
J-74	 002-011
J-74	 002-012
J-75	 002-011
J-75	 002-012
J-148	 002-011
J-148	 002-012

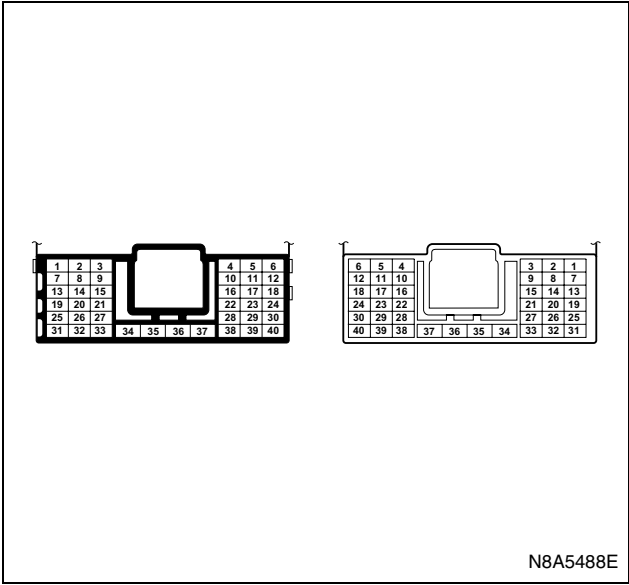
5A4-32 ANTI-LOCK BRAKE SYSTEM (ABS)

No.	Connector Face
J-149 (24 V)	 002-011
J-149 (24 V)	 002-012
J-78 (12 V)	 004-018
J-78 (12 V)	 004-011
J-177	 034-001
P-1 (12 V)	 000-003
P-2	 000-004
P-1 (24 V)	 000-004

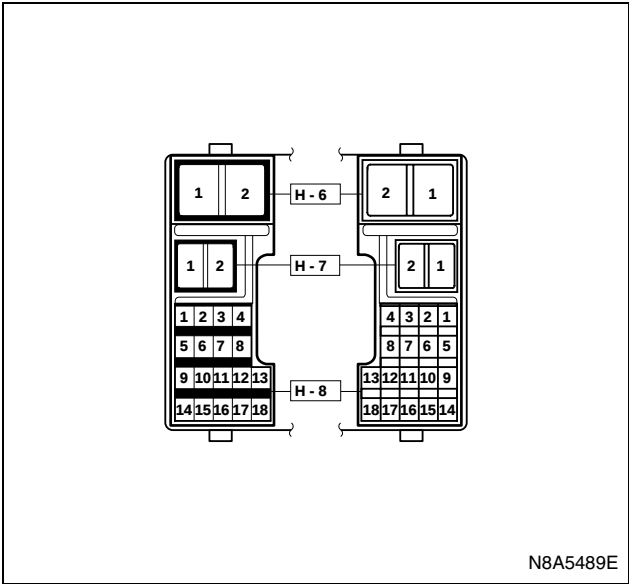
No.	Connector Face
P-4	 000-004
P-2 (24 V)	 000-006
P-3	 000-006
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002
R-1	 006-004
R-1	 006-005
R-6	 006-004

No.	Connector Face
R-6	 006-005

H-5



H-6, H-7, H-8



SYMPTOM DIAGNOSIS

Symptom Diagnosis

The symptoms that cannot be indicated by the warning light can be divided in the following five categories:

1. ABS works frequently but vehicle does not decelerate.
2. Uneven braking occurs while ABS works.
3. The wheels lock during braking.
4. Brake pedal feel is abnormal.
5. ABS operating sound (from Hydraulic Unit) is heard while not braking.

These are all attributable to problems which cannot be detected by EHCUC self-diagnosis. Use the customer complaint and a test to determine which symptom is present. Then follow the appropriate flow chart listed below.

No.	Symptom	Diagnostic Flow Charts	
		Without Tech 2	With Tech 2
1	ABS works frequently but vehicle does not decelerate.	Chart A-1	Chart TA-1
2	Uneven braking occurs while ABS works.	Chart A-2	Chart TA-2
3	The wheels are locked.	Chart A-3	Chart TA-3
4	ABS operating sound (from Hydraulic Unit) is heard while not braking.	Chart A-4	Chart TA-4

Chart A-1 ABS Works Frequently But Vehicle Does Not Decelerate

Step	Action	Value(s)	YES	NO
1	Inspect the tires. Are tire sizes as specified? Isn't there any abnormal wear?	—	Go to Step 2	Repair tires. Go to Step 2
2	Is braking force distribution normal between the front and rear of the vehicle?	—	Go to Step 3	Repair brake parts. Go to Step 7
3	Are axle parts installed normally?	—	Go to Step 4	Repair axle parts. Go to Step 7
4	Is there play in each wheel speed sensor?	—	Go to Step 5	Repair wheel speed sensor. Go to Step 7
5	Is there damage, or powdered iron sticking to each wheel speed sensor/sensor rotor?	—	Go to Step 6	Replace sensor or sensor rotor. Go to Step 7
6	Is the output of each wheel speed sensor normal? (Refer to chart C-1-1 to C-1-4 or TC-1)	—	Replace EHCUC. Go to Step 7	Replace wheel speed sensor or repair harness. Go to Step 7
7	Reconnect all components and ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

Chart TA-1 ABS Works Frequently But Vehicle Does Not Decelerate (Use Tech 2)

Step	Action	Value(s)	YES	NO
1	Return to Chart A-1. Was the Chart A-1 from Step 1 to Step 4 finished?	—	Go to Step 2	Repair tires. Go to Step 1
2	1. Connect Tech 2. 2. Confirm the output from each wheel sensor on DATA DISPLAY. Is the minimum vehicle speed output from each sensor stable at 4 km/h (3 mph) or less?	—	Go to Step 3	Replace wheel speed sensor. Go to Step 4
3	Return to Chart A-1. Was the Chart A-1 finished?	—	Go to Step 4	Go to Step 3
4	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the “Basic diagnostic flow chart”.	—

Chart A-2 Uneven Braking Occurs While ABS Works

Step	Action	Value(s)	YES	NO
1	Is there play in each sensor?	—	Go to Step 2	Repair. Go to Step 5
2	Damage or powdered iron sticking to each sensor/sensor rotor?	—	Go to Step 3	Repair. Go to Step 5
3	Is the output of each sensor normal? (Refer to chart C-1-1 to C-1-4 or TC-1)	—	Go to Step 4	Replace sensor or repair harness. Go to Step 5
4	Is brake pipe connecting order correct?	—	Replace EHC. Go to Step 5	Reconnect brake pipe correctly. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the “Basic diagnostic flow chart”.	—

Chart TA-2 Uneven Braking Occurs While ABS Works (Use Tech 2)

Step	Action	Value(s)	YES	NO
1	1. Connect Tech 2. 2. WHEEL SENSORS make sure of the output conditions of each sensor. Is the output of each sensor normal?	—	Go to Step 2	Replace wheel speed sensor. Go to Step 3
2	Check the brake pipe connecting. Is brake pipe connecting order correct?	—	Replace EHCU. Go to Step 4	Repair brake pipe. Go to Step 4
3	Check the wheel speed sensor and repair if necessary (Refer to chart C-1-1 to C-1-4 or TC-1). Is each chart complete?	—	Go to Step 4	Go to Step 3
4	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

Chart A-3, TA-3 The Wheels Are Locked

Step	Action	Value(s)	YES	NO
1	Is ABS working?	—	Go to Step 2	Go to Step 4
2	Is vehicle speed under 10 km/h (6 mph)?	—	Go to Step 3	Normal.
3	Is sensor output normal? (Chart C-1-1 to C-1-4 or TC-1)	—	Go to Step 4	Replace sensor or repair harness. Go to Step 5
4	Is hydraulic unit grounded properly?	—	Replace hydraulic unit. Go to Step 5	Correct. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

Chart A-4, TA-4 Braking Sound (from Hydraulic Unit) Is Heard While Not Braking

Step	Action	Value(s)	YES	NO
1	Is this the first time the vehicle is being driven after starting the engine?	—	It is self checking sound. Normal.	Go to Step 2
2	Is vehicle speed under 10 km/h (6 mph)?	—	It is self checking sound. Normal.	Go to Step 3
3	Check for the following condition: • At the time of shift down or clutch operation. • At the time of low μ drive (ice or snow road) or rough road drive. • At the time of high-speed turn. • At the time of passing curb. • At the time of operating electrical equipment switches. • At the time of racing the engine. Did it occur under any one condition above?	—	ABS may sometime be actuated even when brake pedal is not applied.	Go to Step 4
4	Is there play in each sensor/wheel speed sensor rotor?	—	Go to Step 5	Repair. Go to Step 7
5	Damage or powdered iron sticking to each sensor/wheel speed sensor rotor?	—	Repair. Go to Step 7	Go to Step 6
6	Is each sensor output normal? (Refer to chart C-1-1 to C-1-4 or TC-1).	—	Check harness/connector for suspected disconnection. If no disconnection is found, replace EHCU. Go to Step 7	Repair. Go to Step 7
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

DIAGNOSTIC TROUBLE CODES

Diagnostic Trouble Codes

Choose and trace an appropriate flowchart by the numbers listed below to find fault and repair.

Code		Diagnosis	Item (except Wiring)	Chart No.
Flash out	Serial Communications			
12	—	Normal	—	—
13	C0213	Vehicle Type Error	EHCUC	1
14	C0214	EHCUC Abnormality	EHCUC	2
15	C0215	Low Power Voltage	EHCUC	3
25	C0225	Exhaust Brake Cut Circuit Abnormality	Relay or EHCUC	4
33	C0233	Motor Drive Circuit Abnormality	EHCUC	5
34	C0234	Abnormal Motor Rotation	EHCUC	6
41	C0241	Solenoid Valve Power Supply Abnormality	EHCUC	7
43	C0243	Solenoid Valve Circuit Abnormality	EHCUC	8
45	C0245	Solenoid Valve Circuit Abnormality		
51	C0251	FL Speed Sensor Circuit Abnormality	Sensor, EHCUC	9
52	C0252	FR Speed Sensor Circuit Abnormality		10
53	C0253	RL Speed Sensor Circuit Abnormality		11
54	C0254	RR Speed Sensor Circuit Abnormality		12
61	C0261	Abnormal FL Speed Sensor Signal		13
62	C0262	Abnormal FR Speed Sensor Signal		14
63	C0263	Abnormal RL Speed Sensor Signal		15
64	C0264	Abnormal RR Speed Sensor Signal		16

* Important: DTC 20 (Reference Voltage High) cannot be indicated by Tech 2. DTC 20 can be indicated and confirmed by flashing using Diagnosis Switch.

DIAGNOSIS BY “ABS” WARNING LIGHT ILLUMINATION PATTERN

Diagnosis by “ABS” Warning Light Illumination Pattern

In the event that there is abnormality in the “ABS” warning light illumination pattern while the key is in the ON position or if the warning light is actuated during driving, trouble should be diagnosed on a illumination pattern basis as follows:

No.	Condition	“ABS” Warning Light Illumination Pattern	Diagnostic
1	Warning light is actuated normally	Warning light ON OFF START ON OFF Starter SW ON OFF N5A1061E	Normal
2	Warning light is not lit	Warning light ON OFF START ON OFF Starter SW ON OFF N5A1062E	Warning light lighting circuit trouble → Go to Chart B-1

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No.	Condition	"ABS" Warning Light Illumination Pattern	Diagnostic
3	Warning light is actuated while driving	Warning light Starter SW During driving N5A1063E	Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.

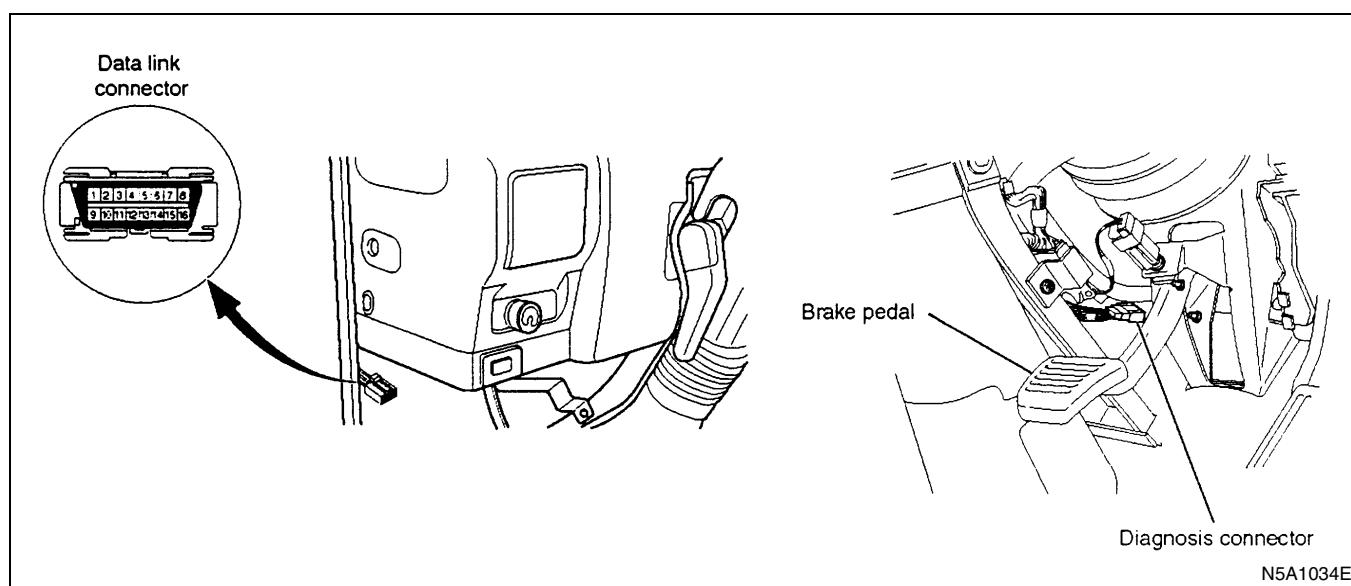
Diagnostic Trouble Codes (DTCs)

When the warning light in the meter remains ON, the EHCUC stores the fault identification and disables the ABS.

1. How to start DTC display:

- Confirm that the vehicle has come to a complete stop (with the wheels standing still) and that the brake pedal is not depressed.
(Unless these two conditions are satisfied, DTC display cannot be started.)
- With the key switch OFF and short B-79 diagnosis connector terminal 12 to ground.
Then turn the key switch ON.
- DTCs can be displayed also by Tech 2.

The DLC (for Tech 2) Is Located Behind The Driver Side Lower Cluster Panel

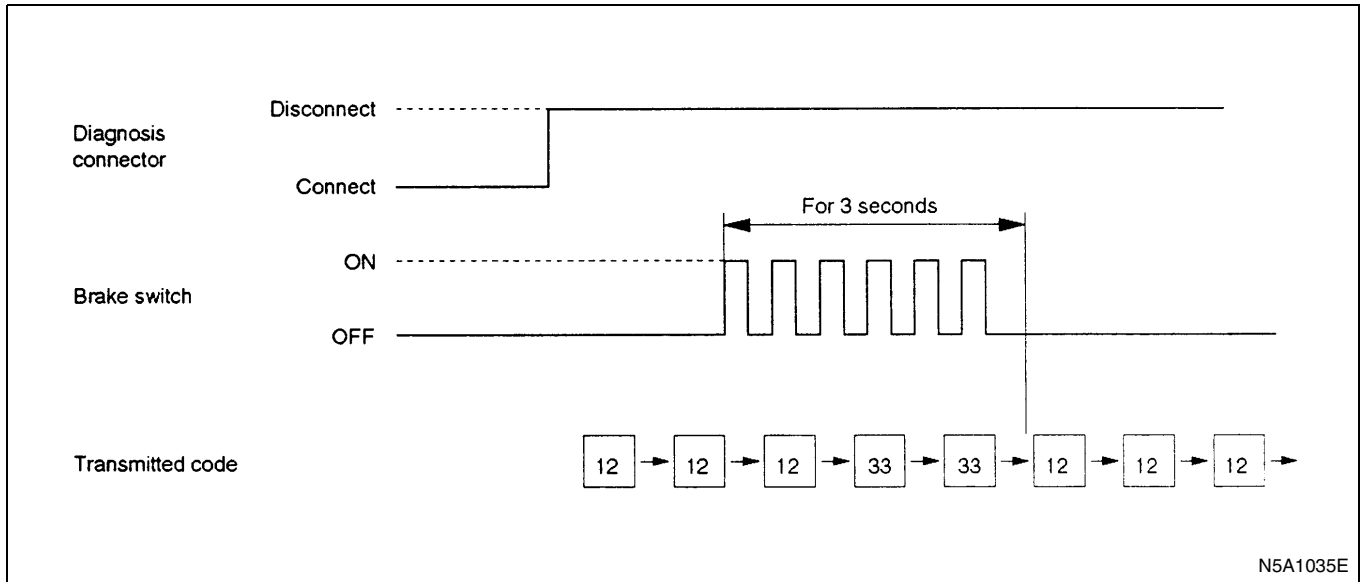


2. DTC display:

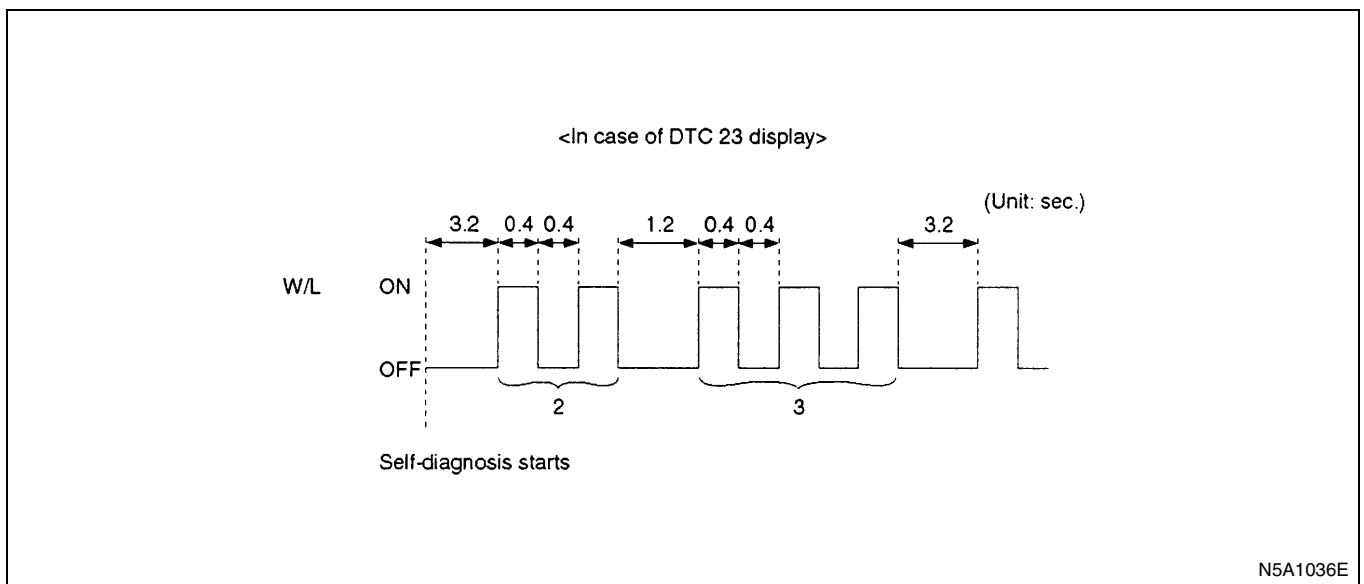
- DTC is displayed by blinking warning light.
- Double-digit display.
- First, normal DTC 12 is displayed three times and then any other DTCs are displayed three times. (If no other DTCs have been stored, the display of DTC 12 will be repeated.)

3. How to erase code:

- Conduct brake switch ON/OFF operation 6 or more times within 3 seconds of self-diagnosis startup.
- The code cannot be erased if more than 3 seconds have passed since self-diagnosis startup, or if self-diagnosis has started with brake switched on (brake pedal depressed).
- DTCs can be erased also by Tech 2.



4. An example of DTC display Display of DTC 23

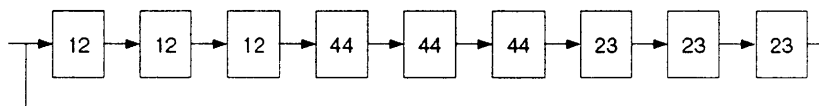


After displaying DTC 12 three times, one DTC after another is displayed, starting with the most recent one. (However, display is discontinued after about 5 minutes.)

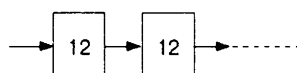
The DTC 12 is displayed repeatedly. (display is discontinued after about 5 minutes)

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<In case there are two or more DTCs: 44 & 23>



<In case no DTC has been stored>

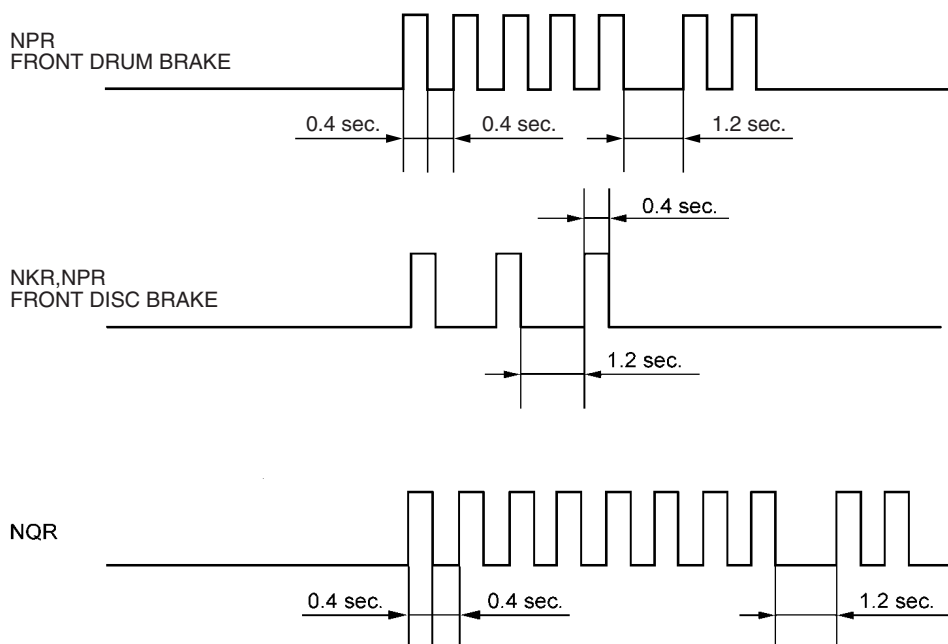


N5A1037E

5. How to display vehicle model:

- 1) Turn the key switch OFF.
- 2) Short the diagnosis connector terminal 12 to ground.
- 3) Slightly push the brake pedal.
- 4) Turn the key switch ON.
- 5) ABS warning light illuminates.
- 6) Illuminating number of times indicates the vehicle model.

Vehicle model	Illuminating number of times
NKR, NPR FRONT DISC BRAKE	1
NQR	8
NPR FRONT DRUM BRAKE	5



N5A1038E

Chart B-1-1 With the key in the ON position (Before starting the engine). Warning light (W/L) is not activated.

Step	Action	Value(s)	YES	NO
1	Is W/L fuse F-16 blown out?	—	Go to Step 5	Go to Step 2
2	Is W/L bulb burnt out?	—	Go to Step 6	Go to Step 3
3	1. Turn the key off. 2. Disconnect EHCU connectors. 3. Turn the key on. 4. Using DVM, measure the voltage between J-177 EHCU connector terminals 6 and 1. Does the DVM display a voltage within the specified value?	12V: 9.5 — 16.5 V 24V: 16.5 — 34 V	Go to Step 4	Go to Step 7
4	Check the continuity between J-177 EHCU connector terminal 1 and body ground. Is there continuity?	—	Go to Step 9	Go to Step 8
5	Replace the fuse. Is action complete?	—	Go to Step 10	—
6	Replace the W/L bulb. Is action complete?	—	Go to Step 10	—
7	Locate and repair open circuit, poor connection or short circuit in the ignition feed circuit. Is action complete?	—	Go to Step 10	—
8	Locate and repair open circuit, poor connection or short circuit in the ground circuit. Is action complete?	—	Go to Step 10	—
9	1. Check the harness for suspected disconnection. 2. If no fault found, replace the EHCU. Is action complete?	—	Go to Step 10	—
10	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

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Chart 1 (DTC13/C0213) Vehicle Type Error

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCUC connector. 2. Turn the key on. 3. Measure the voltage at terminal 14, 15, and 17.	NQR: All terminal battery voltage NKR, NPR FRONT DISC BRAKE: All terminal 0 V NPR FRONT DRUM BRAKE: Terminal 14, 15: 0 V Terminal 17: battery voltage	Go to Step 2	Go to Step 5
2	1. Turn the key off and connect EHCUC. 2. Connect the Tech 2. 3. Clear the vehicle type. 4. Does the warning light turn off?	—	Go to Step 3	Replace the EHCUC. Go to Step 3
3	Confirm the vehicle type. Is the vehicle type okay?	—	Go to Step 4	Replace the EHCUC. Go to Step 3
4	Clear the DTC.	—	Troubleshooting completed.	—
5	Repair harness. Does the warning light turn off?	—	Go to Step 3	Replace the EHCUC. Go to Step 3

Chart 2 (DTC14/C0214) EHCUC Abnormality

Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect the EHCUC connector. 3. Measure continuity between the body ground and J-177 connector terminal 1, 23. Is there continuity?	—	Go to Step 2	Go to Step 3
2	1. Connect the EHCUC connector. 2. Clear DTC. 3. Turn the key from off to on and perform diagnosis procedure. Does the DTC repeat?	—	Go to Step 4	Go to Step 5
3	Repair the open/short circuit or malfunction at connection of connector. Is this step completed?	—	Go to Step 5	—
4	Replace the EHCUC. Is this step completed?	—	Go to Step 5	—
5	1. Install all parts. Verify each part is properly installed. 2. Clear DTC. Is this step completed?	—	Go to "Basic diagnostic flow chart".	—

Chart 3 (DTC15/C0215) EHCUC Voltage Out of Range

Step	Action	Value(s)	YES	NO
1	Is the battery voltage okay?	—	Go to Step 2	Go to Step 5
2	1. Turn the key off. 2. Disconnect the EHCUC connector. 3. Start the engine. 4. Measure voltage between J-177 connector terminal 2 and J-177 connector terminal 1, 23. Is the voltage within the specified value? 5. Measure voltage between J-177 connector terminal 24 and J-177 connector terminal 1, 23.	12 V vehicle: 10 — 16 V 24 V vehicle: 17 — 33.5 V	Go to Step 3	Go to Step 6
3	Locate the malfunction of connection in the circuit. Is the circuit malfunction specified?	—	Go to Step 4	Go to Step 8
4	Repair the malfunction and perform diagnosis procedure. Does the DTC repeat?	—	Go to Step 7	Go to Step 8
5	Charge or replace the battery. Is this step completed?	—	Go to Step 8	—
6	Repair open/short circuit or malfunction at connection of connector between J-177 connector terminal 2 or 24 and fusible link FL- 9. Is this step completed?	—	Go to Step 8	—
7	Replace the EHCUC. Is this step completed?	—	Go to Step 8	—
8	1. Install all parts. Verify each part is properly installed. 2. Clear DTC. Is this step completed?	—	Go to "Basic diagnostic flow chart".	—

Chart 4 (DTC25/C0225) Exhaust Brake Cut Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCUC connector. 2. Start the engine. 3. Measure voltage between EHCUC terminals 8 and 1. Is the voltage within the specified value?	12 V vehicle: More than 5 V 24 V vehicle: More than 10 V	Go to Step 2	Go to Step 4
2	Measure voltage between EHCUC terminals 7 and 1. Is the voltage within the specified value?	12 V vehicle: More than 5 V 24 V vehicle: More than 10 V	Go to Step 3	Go to Step 6
3	Short EHCUC terminal 8 to 1. Is the voltage at EHCUC terminal 7 less than 1.5 V?	—	Replace the EHCUC.	Replace the exhaust brake cut relay.
4	Measure resistance of the exhaust brake cut relay coil.	12 V vehicle: 60 — 120 ohms 24 V vehicle: 210 — 310 ohms	Go to Step 5	Replace the exhaust brake cut relay.
5	Measure voltage at coil power side of relay box connector. (key at on position) Is the voltage within the specified value?	12 V vehicle: 10 — 16 V 24 V vehicle: 20 — 32 V	Check harness between EHCUC terminal 8 and exhaust brake cut relay. Repair as necessary.	Repair harness and/or power line.
6	Turn the exhaust brake switch on. Does the exhaust brake indicator light turn on?	—	Repair harness of EHCUC terminal 7.	Go to exhaust brake diagnosis procedure.

Chart 5 (DTC33/C0233) Motor Drive Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCUC connector. 2. Measure voltage between EHCUC terminals 24 and 23. Is the voltage within the specified value?	12 V vehicle: 10 — 16 V 24 V vehicle: 20 — 32 V	Go to Step 2	Go to Step 3
2	Measure continuity between EHCUC terminals 23 and 1. Is there continuity?	—	Replace the EHCUC.	Repair the harness.
3	Check the ABS fusible link (12 V: 60 A, 24 V: 40 A). Is it okay?	—	Repair the harness.	Replace the ABS fusible link (12 V: 60 A, 24 V: 40 A)

Chart 6 (DTC 34/C0234) Abnormal Motor Rotation

- Replace EHCUC.

Chart 7 (DTC41/C0241) Solenoid Valve Power Supply Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCU connector. 2. Measure voltage between EHCU terminals 2 and 1. Is the voltage within the specified value?	12 V vehicle: 10 — 16 V 24 V vehicle: 20 — 32 V	Replace the EHCU.	Go to Step 2
2	Check the ABS fusible link (12 V: 60 A, 24 V: 40 A). Is it okay?	—	Repair the harness.	Replace the ABS fusible link (12 V: 60 A, 24 V: 40 A).

Chart 8 (DTC 43, 45/C0243, C0245) Solenoid Valve Circuit Abnormality

- Replace EHCU.

Chart 9 (DTC51/C0251) FL Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCU connector. 2. Measure resistance between EHCU terminals 32 and 33. Is the resistance within the specified value?	1 — 2 k ohms	Replace the EHCU.	Go to Step 2
2	1. Disconnect the FL speed sensor connector. 2. Measure the FL speed sensor resistance. Is the resistance within the specified value?	1 — 2 k ohms	Repair the harness.	Replace the FL speed sensor.

Chart 10 (DTC52/C0252) FR Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCU connector. 2. Measure resistance between EHCU terminals 10 and 11. Is the resistance within the specified value?	1 — 2 k ohms	Replace the EHCU.	Go to Step 2
2	1. Disconnect the FR speed sensor connector. 2. Measure the FR speed sensor resistance. Is the resistance within the specified value?	1 — 2 k ohms	Repair the harness.	Replace the FR speed sensor.

Chart 11 (DTC53/C0253) RL Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect EHCUC connector J-177 and RL speed sensor connector J-149 (J-78). 3. Check the continuity between connector J-177 terminal 34 and sensor connector J-149 (J-78) terminal 2 (1). Is there continuity?	—	Go to Step 2	Go to Step 7
2	Check the continuity between connector J-177 terminal 34 and connector J-177 terminal 1. Is there continuity?	—	Go to Step 7	Go to Step 3
3	Check the continuity between connector J-177 terminal 22 and sensor connector J-149 (J-78) terminal 1 (2). Is there continuity?	—	Go to Step 4	Go to Step 7
4	Check the continuity between connector J-177 terminal 22 and connector J-177 terminal 1. Is there continuity?	—	Go to Step 7	Go to Step 5
5	1. Connect the connector J-177 with EHCUC. 2. Turn the key on. 3. Using DVM, measure the voltage between connector J-149 (J-78) terminal 1 (2) (vehicle side) and ground. Does the DVM display a voltage within the specified value?	9 — 16 V	Go to Step 6	Go to Step 7
6	Check the RL sensor output. (Refer to Chart C-1-3) Does the DTC repeat?	—	Go to Step 8	Go to Step 9
7	Repair open circuit, poor connection and/or short circuit between the EHCUC connectors and speed sensor connectors. Is this step complete?	—	Go to Step 9	—
8	Replace EHCUC. Is this step complete?	—	Go to Step 9	—
9	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

Chart 12 (DTC54/C0254) RR Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect EHCUC connector J-177 and RL speed sensor connector J-148 (J-78). 3. Check the continuity between connector J-177 terminal 12 and sensor connector J-148 (J-78) terminal 1 (3). Is there continuity?	—	Go to Step 2	Go to Step 7
2	Check the continuity between connector J-177 terminal 12 and connector J-177 terminal 1. Is there continuity?	—	Go to Step 7	Go to Step 3
3	Check the continuity between connector J-177 terminal 21 and sensor connector J-148 (J-78) terminal 2 (4). Is there continuity?	—	Go to Step 4	Go to Step 7
4	Check the continuity between connector J-177 terminal 21 and connector J-177 terminal 1. Is there continuity?	—	Go to Step 7	Go to Step 5
5	1. Connect the connector J-177 with EHCUC. 2. Turn the key on. 3. Using DVM, measure the voltage between connector J-148 (J-78) terminal 2 (4) (vehicle side) and ground. Does the DVM display a voltage within the specified value?	9 — 16 V	Go to Step 6	Go to Step 7
6	Check the RL sensor output. (Refer to Chart C-1-4) Does the DTC repeat?	—	Go to Step 8	Go to Step 9
7	Repair open circuit, poor connection and/or short circuit between the EHCUC connectors and speed sensor connectors. Is this step complete?	—	Go to Step 9	—
8	Replace EHCUC. Is this step complete?	—	Go to Step 9	—
9	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

Chart 13 (DTC61/C0261) Abnormal FL Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the FL wheel bearing?	—	Go to Step 12	Go to Step 4
4	Is there play in the FL speed sensor/sensor rotor?	—	Go to Step 13	Go to Step 5
5	Is there powdered iron sticking to FL speed sensor/sensor rotor?	—	Go to Step 14	Go to Step 6
6	Check the FL speed sensor. (Refer to Chart C-1-1 or TC-1) Is the FL sensor output normal?	—	Go to Step 7	Go to Step 10
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 15	Go to Step 8
8	Using DVM, measure the resistance between J-177 EHCUC connector terminal 33 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 9	Go to Step 11
9	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 20	Go to Step 18
10	Is there damage or indentation in the speed sensor?	—	Go to Step 16	Go to Step 17
11	1. Disconnect FL sensor connector. 2. Using DVM, measure the resistance between J-75 sensor connector terminal 2 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 19	Go to Step 16
12	Adjust wheel bearing preload. Is action complete?	—	Go to Step 21	—
13	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
14	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
15	Replace sensor rotor. Is action complete?	—	Go to Step 21	—

Step	Action	Value(s)	YES	NO
16	Replace FL speed sensor. Is action complete?	—	Go to Step 21	—
17	Check the FL speed sensor circuit. Refer to Chart 9. Is action complete?	—	Verify repair	—
18	Check for a poor connection and an open circuit on the harness between EHCUC and sensor connectors. Refer to "Note on Intermittents" described in earlier this section. Is action complete?	—	Go to Step 21	—
19	1. Locate open circuit, poor connection or short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 21	Go to Step 21
20	Replace EHCUC. Is action complete?	—	Go to Step 21	—
21	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

Chart 14 (DTC62/C0262) Abnormal FR Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the FR wheel bearing?	—	Go to Step 12	Go to Step 4
4	Is there play in the FR speed sensor/sensor rotor?	—	Go to Step 13	Go to Step 5
5	Is there powdered iron sticking to FR speed sensor/sensor rotor?	—	Go to Step 14	Go to Step 6
6	Check the FR speed sensor. (Refer to Chart C-1-2 or TC-1) Is the FR sensor output normal?	—	Go to Step 7	Go to Step 10
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 15	Go to Step 8

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Step	Action	Value(s)	YES	NO
8	Using DVM, measure the resistance between J-177 EHCUC connector terminal 11 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 9	Go to Step 11
9	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 20	Go to Step 18
10	Is there damage or indentation in the speed sensor?	—	Go to Step 16	Go to Step 17
11	1. Disconnect FR sensor connector. 2. Using DVM, measure the resistance between J-74 sensor connector terminal 2 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 19	Go to Step 16
12	Adjust wheel bearing preload. Is action complete?	—	Go to Step 21	—
13	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
14	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
15	Replace sensor rotor. Is action complete?	—	Go to Step 21	—
16	Replace FR speed sensor. Is action complete?	—	Go to Step 21	—
17	Check the FR speed sensor circuit. Refer to Chart 10. Is action complete?	—	Verify repair	—
18	Check for a poor connection and an open circuit on the harness between EHCUC and sensor connectors. Refer to "Note on Intermittents" described in earlier this section. Is action complete?	—	Go to Step 21	—
19	1. Locate open circuit, poor connection or short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 21	Go to Step 21
20	Replace EHCUC. Is action complete?	—	Go to Step 21	—

Step	Action	Value(s)	YES	NO
21	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to “Basic diagnostic flow chart”.	—

Chart 15 (DTC63/C0263) Abnormal RL Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the RL wheel bearing?	—	Go to Step 10	Go to Step 4
4	Is there play in the RL speed sensor/sensor rotor?	—	Go to Step 11	Go to Step 5
5	Is there powdered iron sticking to RL speed sensor/sensor rotor?	—	Go to Step 12	Go to Step 6
6	Check the RL speed sensor. (Refer to Chart C-1-3 or TC-1) Is the RL sensor output normal?	—	Go to Step 7	Go to Step 9
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 13	Go to Step 8
8	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 17	Go to Step 16
9	Is there damage or indentation in the speed sensor?	—	Go to Step 14	Go to Step 15
10	Adjust wheel bearing preload. Is action complete?	—	Go to Step 18	—
11	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—
12	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—
13	Replace sensor rotor. Is action complete?	—	Go to Step 18	—
14	Replace RL speed sensor. Is action complete?	—	Go to Step 18	—
15	Check the RL speed sensor circuit. Refer to Chart 11. Is action complete?	—	Verify repair	—

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Step	Action	Value(s)	YES	NO
16	Check for a poor connection and an open circuit on the harness between EHCUC and sensor connectors. Refer to "Note on Intermittents" described in earlier this section. Is action complete?	—	Go to Step 18	—
17	Replace EHCUC. Is action complete?	—	Go to Step 18	—
18	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

Chart 16 (DTC64/C0264) Abnormal RR Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the RR wheel bearing?	—	Go to Step 10	Go to Step 4
4	Is there play in the RR speed sensor/sensor rotor?	—	Go to Step 11	Go to Step 5
5	Is there powdered iron sticking to RR speed sensor/sensor rotor?	—	Go to Step 12	Go to Step 6
6	Check the RR speed sensor. (Refer to Chart C-1-4 or TC-1) Is the RR sensor output normal?	—	Go to Step 7	Go to Step 9
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 13	Go to Step 8
8	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 17	Go to Step 16
9	Is there damage or indentation in the speed sensor?	—	Go to Step 14	Go to Step 15
10	Adjust wheel bearing preload. Is action complete?	—	Go to Step 18	—
11	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—
12	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—

Step	Action	Value(s)	YES	NO
13	Replace sensor rotor. Is action complete?	—	Go to Step 18	—
14	Replace RR speed sensor. Is action complete?	—	Go to Step 18	—
15	Check the RR speed sensor circuit. Refer to Chart 12. Is action complete?	—	Verify repair	—
16	Check for a poor connection and an open circuit on the harness between EHCU and sensor connectors. Refer to “Note on Intermittents” described in earlier this section. Is action complete?	—	Go to Step 18	—
17	Replace EHCU. Is action complete?	—	Go to Step 18	—
18	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to “Basic diagnostic flow chart”.	—

UNIT INSPECTION PROCEDURE

Unit Inspection Procedure

This section describes the following inspection procedures referred to during “SYMPTOM DIAGNOSIS” and “DIAGNOSS BY ‘ABS’ WARNING LIGHT ILLUMINATION PATTERN”:

	without Tech 2	with Tech 2
Speed Sensor Output Inspection	Chart C-1-1 to C-1-4	Chart TC-1

Chart C-1-1 FL Speed Sensor Output Inspection Procedure

Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Measure the AC voltage between J-177 EHCUC connector terminals 32 and 33 while turning FL wheel at a speed of 0.5 RPS. Does the DVM display a voltage within the specified value?	200 mV or more	Go to Step 5	Go to Step 2
2	1. Disconnect FL sensor connector. 2. Using DVM, measure the resistance between J-75 sensor connector terminals 1 and 2. Does the DVM display a resistance within the specified value?	1.0 — 2.0 k ohms	Go to Step 4	Go to Step 3
3	1. Locate open circuit, poor connection or short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 5	—
4	Replace FL sensor. Is action complete?	—	Go to Step 5	—
5	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to “Basic diagnostic flow chart”.	—

Chart C-1-2 FR Speed Sensor Output Inspection Procedure

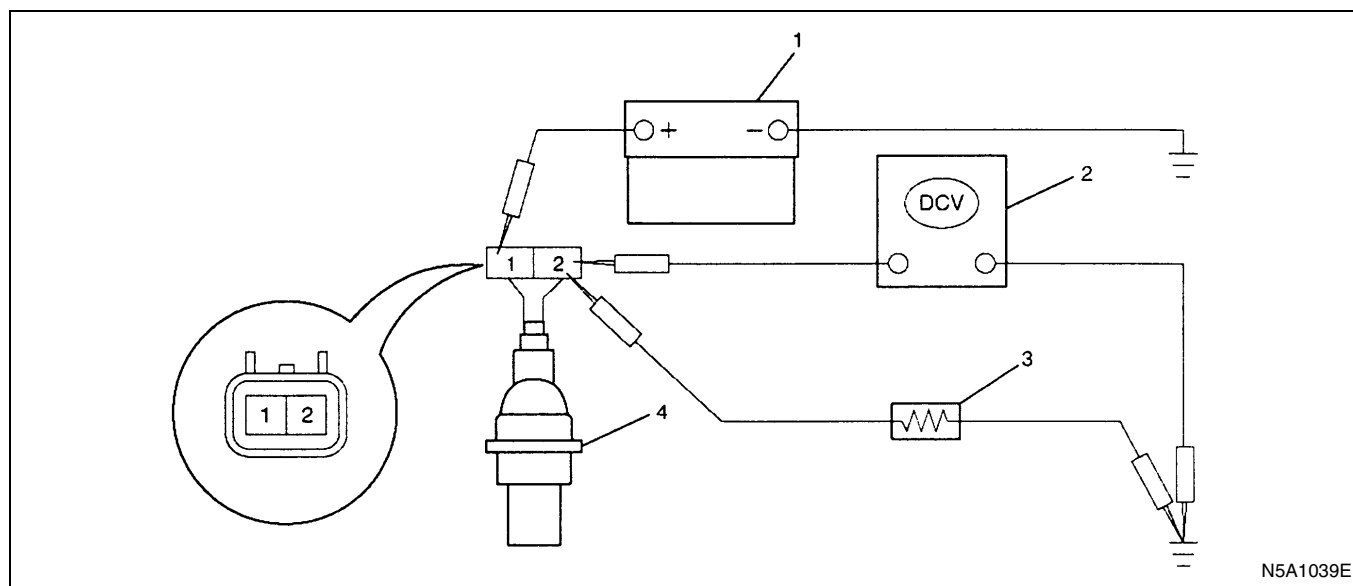
Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Measure the AC voltage between J-177 EHCUC connector terminals 10 and 11 while turning FR wheel at a speed of 0.5 RPS. Does the DVM display a voltage within the specified value?	200 mV or more	Go to Step 5	Go to Step 2
2	1. Disconnect FR sensor connector. 2. Using DVM, measure the resistance between J-74 sensor connector terminals 1 and 2. Does the DVM display a resistance within the specified value?	1.0 — 2.0 k ohms	Go to Step 4	Go to Step 3
3	1. Locate open circuit, poor connection or short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 5	—
4	Replace FR sensor. Is action complete?	—	Go to Step 5	—
5	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

Chart C-1-3 RL Speed Sensor Output Inspection Procedure

Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Connect a 120 ohms resistor between J-177 EHCUC connector terminal 22 and ground. Apply voltage of 12 V to EHCUC connector terminal 22. 5. Using DVM, measure the DC voltage between J-177 connector terminal 22 and ground while turning RL wheel at a speed of 0.5 RPS. Does the DVM display a voltage within the specified value?	0.2 — 4.5 V	Go to Step 5	Go to Step 2

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Step	Action	Value(s)	YES	NO
2	1. Turn the key off. 2. Disconnect RL sensor connector. 3. Connect a 120 ohms resistor between sensor connector terminal 2 (sensor side) and ground. 4. Apply 12 V voltage at sensor connector terminal 1 (sensor side). 5. Using DVM, measure the DC voltage between sensor connector terminal 2 (sensor side) and ground while turning RL wheel at a speed of 0.5 RPS. Does the DVM display a voltage within the specified value?	0.2 — 4.5 V	Go to Step 3	Go to Step 4
3	1. Locate open circuit, poor connection short circuit on the harness between EHCU and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 5	—
4	Replace RL sensor. Is action complete?	—	Go to Step 5	—
5	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—



Legend

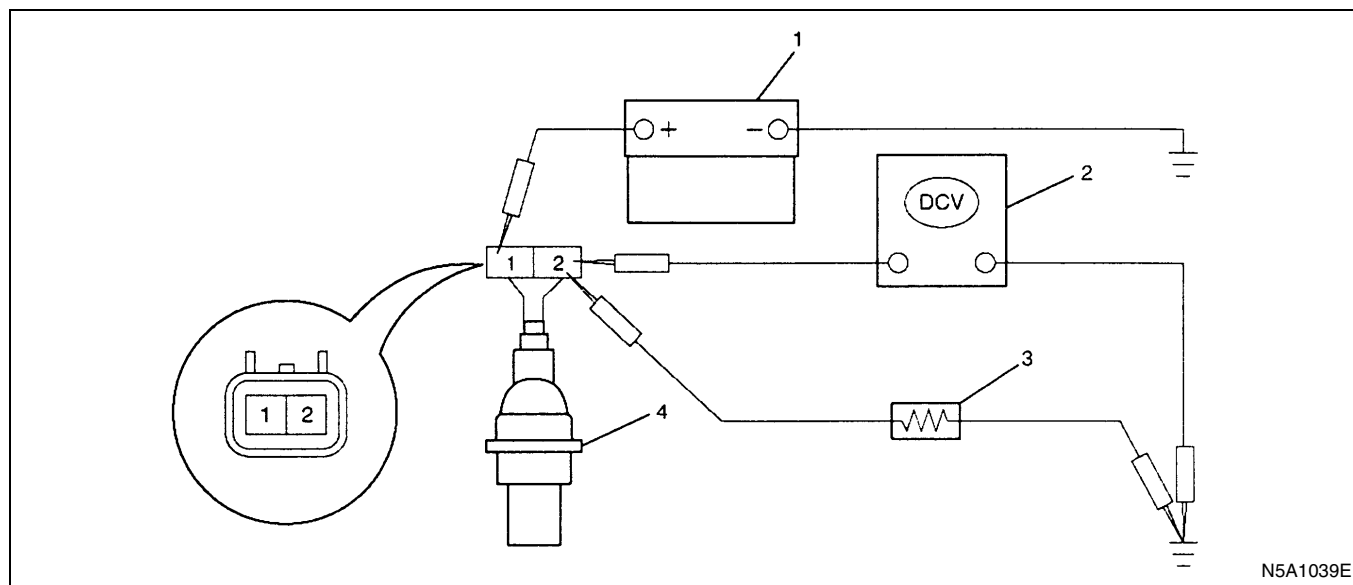
1. Battery
2. DVM

3. Resistor
4. Speed Sensor

Chart C-1-4 RR Speed Sensor Output Inspection Procedure

Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Connect a 120 ohms resistor between J-177 EHCUC connector terminal 21 and ground. 5. Using DVM, measure the DC voltage between J-177 connector terminal 21 and ground while turning RR wheel at a speed of 0.5 RPS. Does the DVM display a voltage within the specified value?	0.2 — 4.5 V	Go to Step 5	Go to Step 2
2	1. Turn the key off. 2. Disconnect RR sensor connector. 3. Connect a 120 ohms resistor between sensor connector terminal 2 (sensor side) and ground. 4. Apply 12 V voltage at sensor connector terminal 1 (sensor side). 5. Using DVM, measure the DC voltage between sensor connector terminal 2 (sensor side) and ground while turning RR wheel at a speed of 0.5 RPS. Does the DVM display a voltage within the specified value?	0.2 — 4.5 V	Go to Step 3	Go to Step 4
3	1. Locate open circuit, poor connection short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 5	—
4	Replace RR sensor. Is action complete?	—	Go to Step 5	—
5	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

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Legend

1. Battery
2. DVM

3. Resistor
4. Speed Sensor

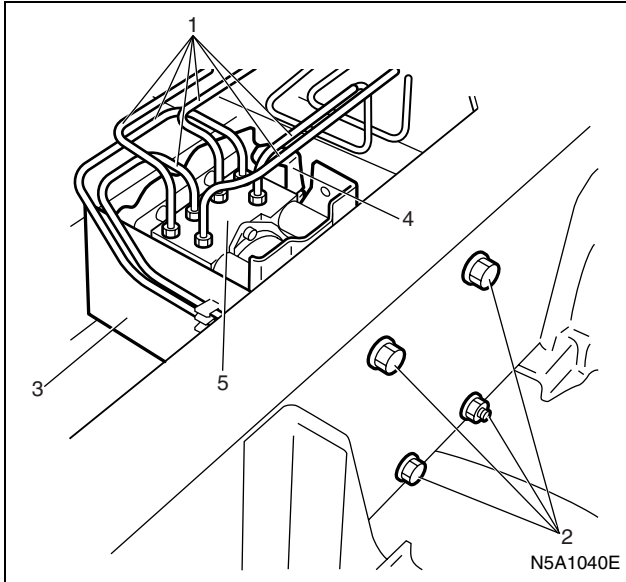
Chart TC-1 Sensor Output Inspection Procedure (Use Tech 2)

Step	Action	Value(s)	YES	NO
1	1. Connect Tech 2. 2. Check the minimum speed of each sensor by WHEEL SENSORS. Is sensor speed within the specified value?	More than 4 km/h (3 mph)	Go to Step 2	Go to Step 6
2	Check the sensor harness for suspected disconnection (check while shaking harness/connector). Is the sensor harness connection normal?	—	Replace speed sensor. Go to Step 3	Repair. Go to Step 2
3	Check the minimum speed of each sensor by WHEEL SENSORS. Is sensor speed within the specified value?	More than 4 km/h (3 mph)	Go to Step 4	Go to Step 6
4	Check the sensor rotor. Is the sensor rotor normal?	—	Go to Step 5	Replace sensor rotor. Go to Step 5
5	Check the minimum speed of each sensor by WHEEL SENSORS. Is sensor speed within the specified value?	More than 4 km/h (3 mph)	Repair harness or connector between EHCU and speed sensor. Go to Step 6	Go to Step 6
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

ON-VEHICLE SERVICE

Electronic Hydraulic Control Unit (EHCUC)

Removal



Legend

1. Brake Pipe
2. EHCUC Bracket Fix Bolt & Nut
3. EHCUC Bracket
4. Harness Connector
5. EHCUC

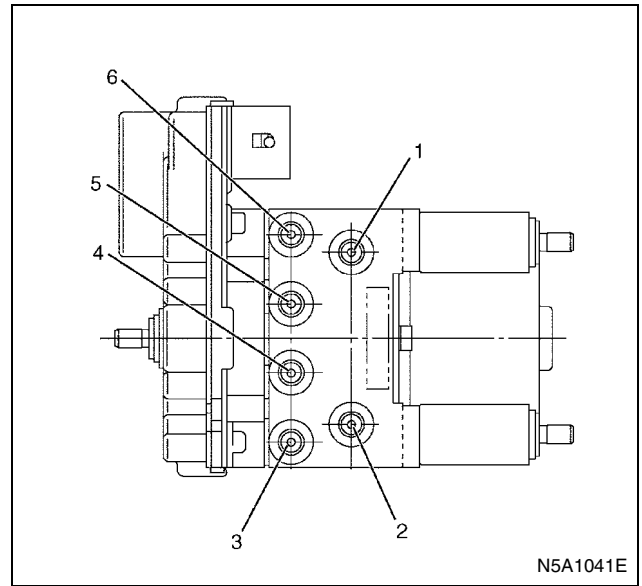
1. Disconnect battery ground cable.
2. Disconnect brake pipes.
3. Remove EHCUC bracket fix bolts & nut.
4. Remove EHCUC bracket.
5. Remove EHCUC.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

Notice:

- If welding work is to be performed on the vehicle using an electric arc welder, the EHCUC should be removed from the vehicle before the welding operation begins.
- Do not put a radio equipment etc, that emits strong radio wave near the EHCUC.
- Do not wet the control unit. If wetted, wipe off water immediately and dry it fully.
- Never loosen any screw on the control unit.
- Do not paint the control unit.
- Prevent possible electrostatic discharge damage.
- Do not touch the control unit pin type terminal with a metallic tip of a screwdriver or tester.
- Do not apply voltage to the terminal.

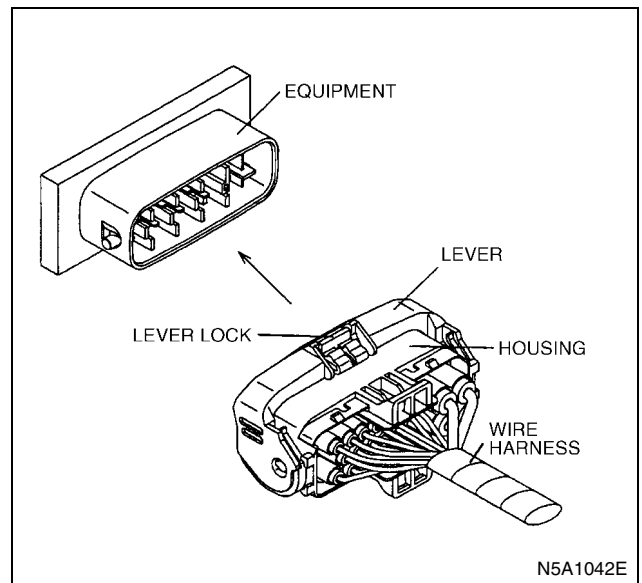


Legend

1. Master Cylinder (front)
2. Master Cylinder (rear)
3. Rear Right Wheel Cylinder
4. Rear Left Wheel Cylinder
5. Front Right Wheel Cylinder
6. Front Left Wheel Cylinder

Methods of Matching and Taking Off Connectors

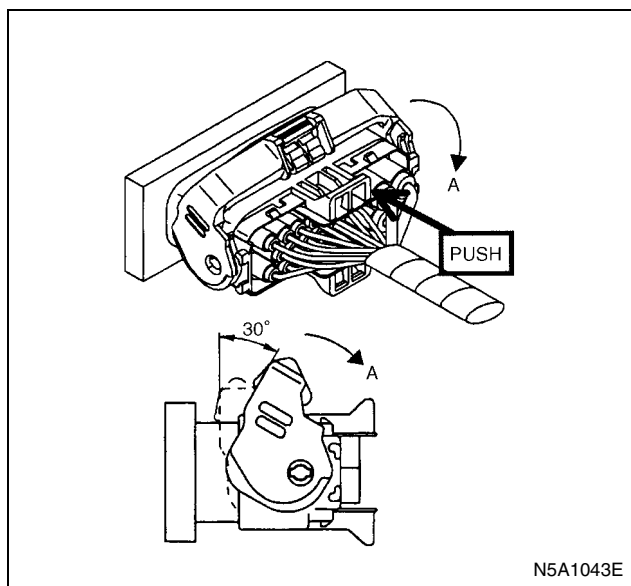
Before Matching



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Semi Matching

Wire harness side connector should be inserted to equipment side, then lever folds up about 30°.

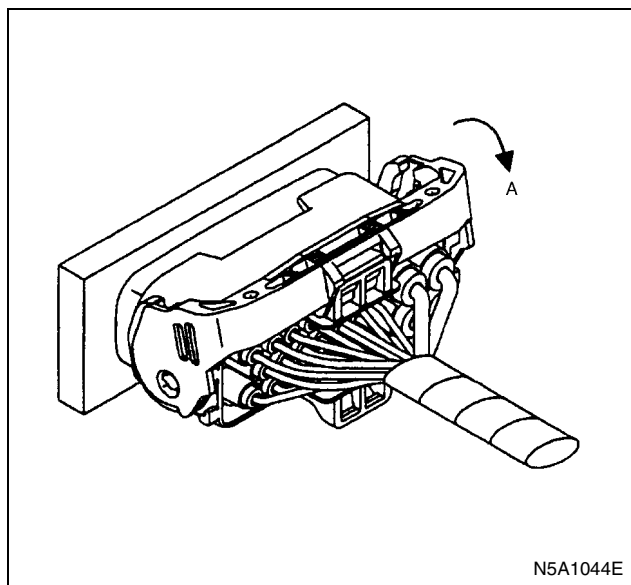


Notice:

Check the lever folding up.

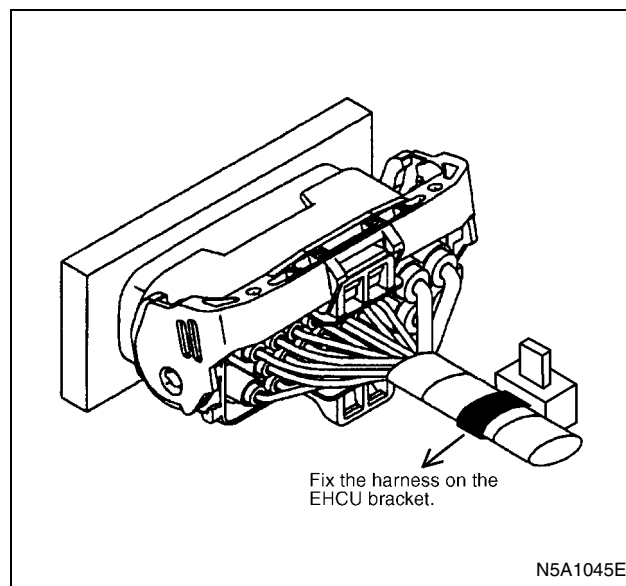
Matching

Turn the lever to direction A and fix the lever lock to the housing.



Finished Matching

On a vehicle in which the harness is clamped onto the EHCU bracket, clamp the harness after matching the connectors.

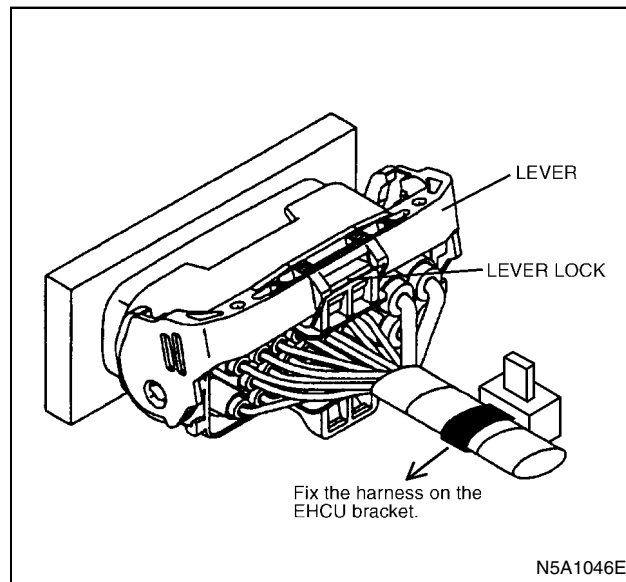


Notice:

Check the lever lock is fixed to housing certainly. The lever or housing can be broken by turned to direction A without the lever folding up (30°).

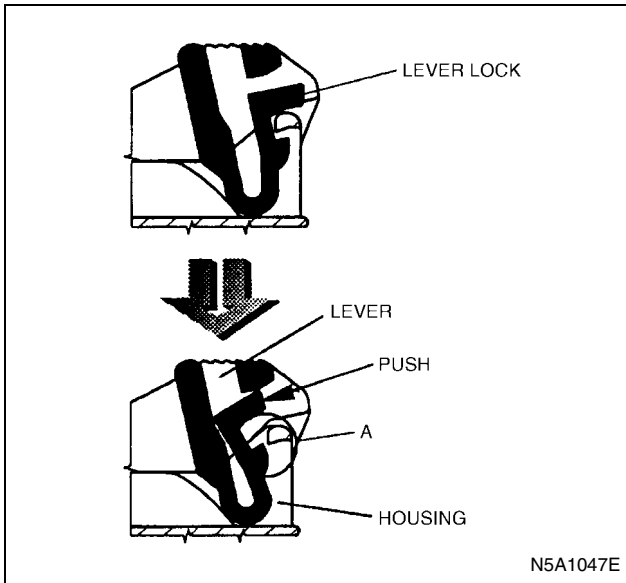
Condition of Matching

On a vehicle in which the harness is clamped onto the EHCU bracket, loosen the before taking off the connectors.



Release of Lock

Push lever lock down until the condition it can be released.



Notice:

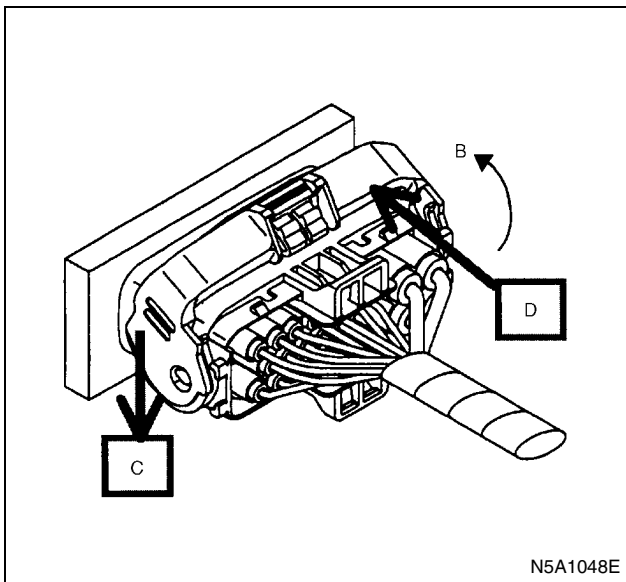
Check division A can be released.

Taking Off

Turn the lever to direction B.

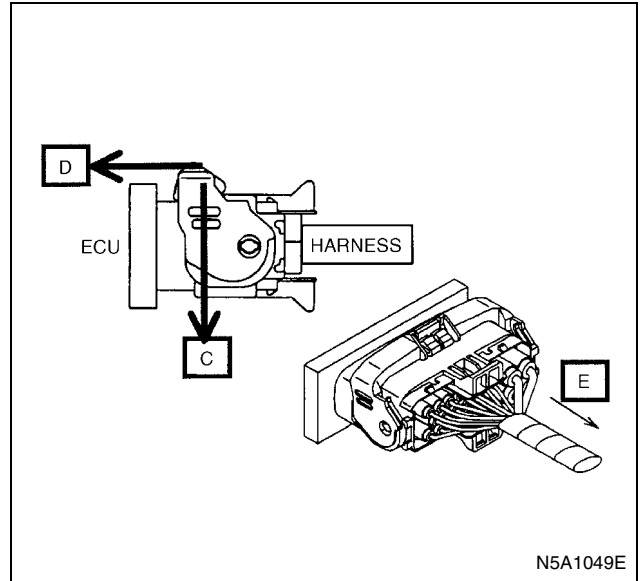
When you feel the lever heavy in your hand (after turning about 40 degrees), turn the lever in the direction of C.

The lever will not turn and the connector may fail if force is applied in the direction of D.



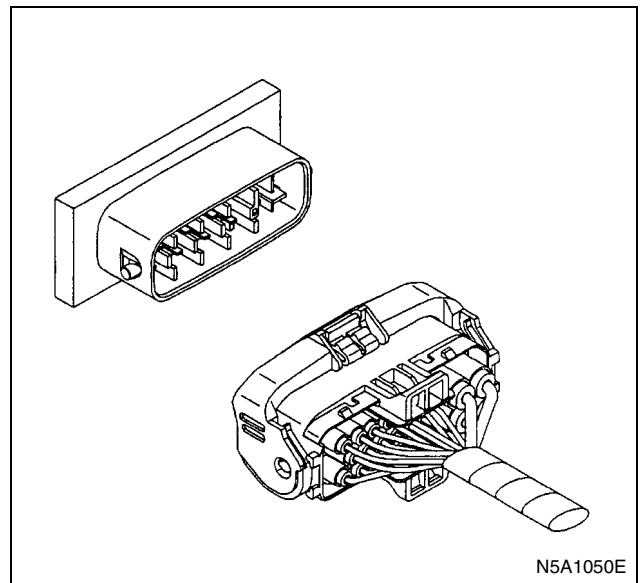
Notice:

The lockarm can be broken by being turned to direction B in case of incomplete locking.

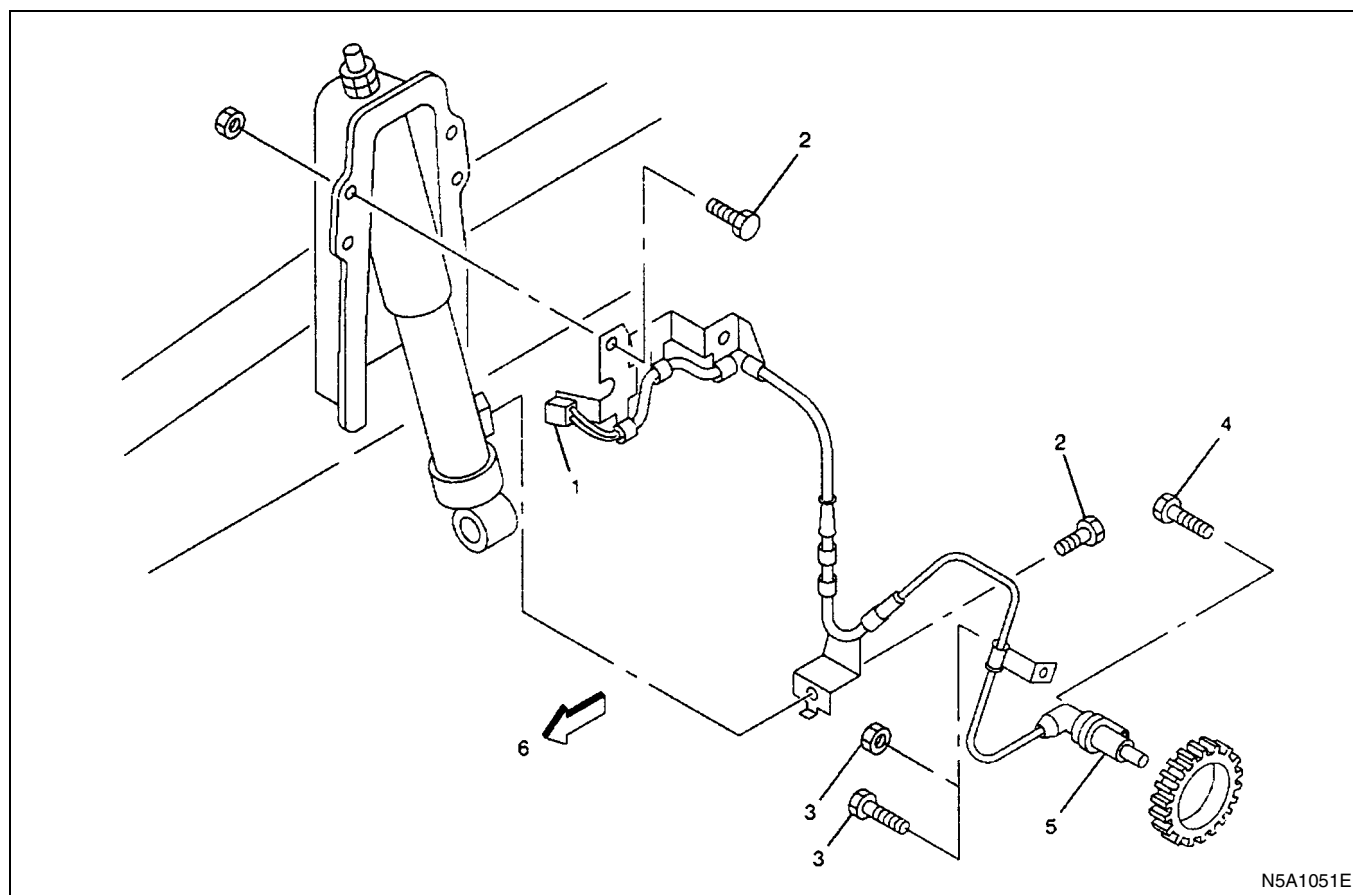


Check the lever is turned certainly and take connector off to direction E.

Finished Taking Off



Front Speed Sensor Components



N5A1051E

Legend

- | | |
|--|-----------------------|
| 1. Speed Sensor Connector | 4. Sensor Fixing Bolt |
| 2. Sensor Cable Fixing Bolt | 5. Speed Sensor |
| 3. Sensor Cable Fixing Bolt (Front Disc Brake model) | 6. Front |
| Sensor Cable Fixing Nut (Front Drum Brake model) | |

Removal

1. Remove speed sensor connector.
2. Remove sensor cable fixing bolts and/or nut.
3. Remove the speed sensor fixing bolt.
4. Remove speed sensor.

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage; replace speed sensor if necessary.
3. Check the speed sensor cable for short or open circuit, and replace with a new one if necessary. To check for cable short or open, bend or stretch the cable while checking for continuity.

Installation

1. Install speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install speed sensor fixing bolt and tighten the fixing bolt to the specified torque.

Tighten:

Bolt to 22 N·m (2.2 kg·m/16 lb·ft)

3. Install speed sensor cable fixing bolts and tighten the fixing bolt to the specified torque.

Tighten:

Bolts (2) to 22 N·m (2.2 kg·m/16 lb·ft)

Bolts (3) to 45 N·m (4.6 kg·m/33 lb·ft)

Nut (3) to 15 N·m (1.5 kg·m/11 lb·ft)

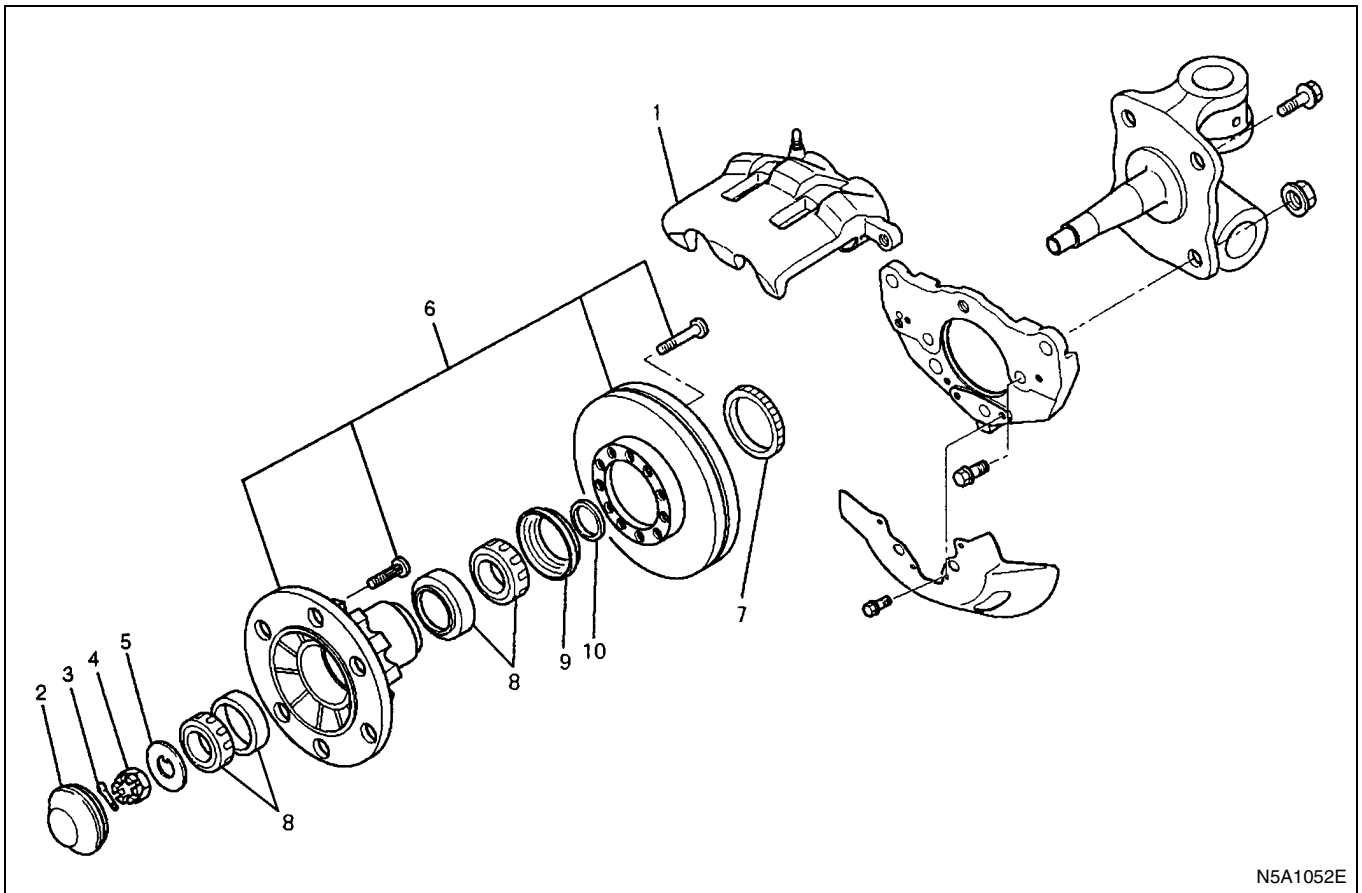
Notice:

Confirm that a white or yellow line marked on the cable is not twisted when connecting the speed sensor cable.

4. Connect speed sensor connector.

Front Speed Sensor Rotor

Components



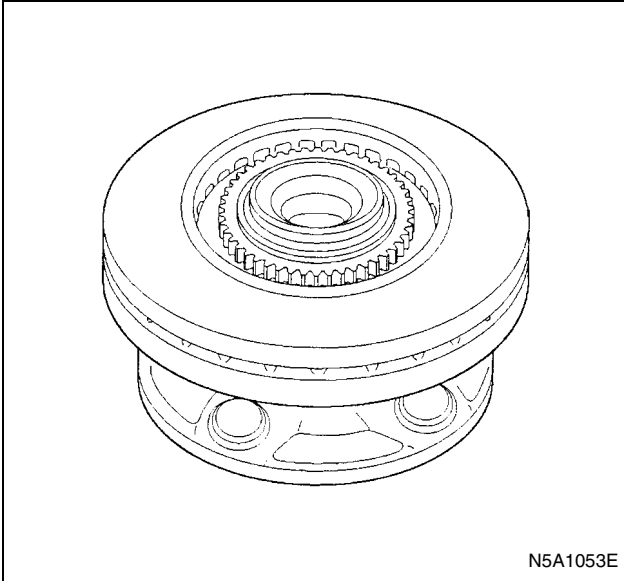
N5A1052E

Legend

- | | |
|------------------------|------------------------------------|
| 1. Disc Brake Assembly | 6. Hub and Disc Assembly |
| 2. Hub Cap | 7. Speed Sensor Rotor |
| 3. Cotter Pin | 8. Inner Bearing and Outer Bearing |
| 4. Hub Nut | 9. Oil Seal |
| 5. Washer | 10. Spacer |

Removal

1. Remove disc brake assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
2. Remove hub cap.
3. Remove cotter pin and hub nut.
4. Remove washer.
5. Remove hub and disc assembly.



6. Remove speed sensor rotor.
7. Remove inner bearing, oil seal spacer.

Inspection and Repair

1. Check the speed sensor rotor for damage including tooth chipping, and if damaged, replace the speed sensor rotor.

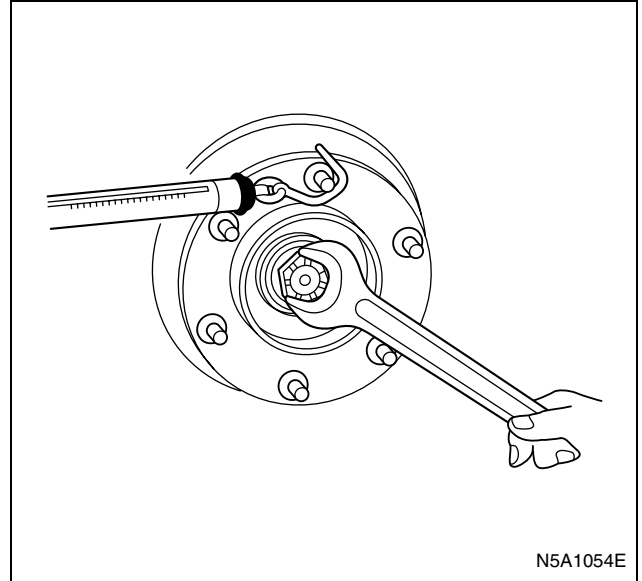
Installation

1. Using a bench press, install speed sensor rotor.
2. Install spacer onto the knuckle spindle.
3. Apply grease into the outer and inner bearings and install bearings in the hub.
4. Install oil seal into hub and disc assembly and install hub and disc assembly on to the knuckle spindle.

Preload Adjustment

Adjust the wheel bearing as follows:

1. Tighten the nut until you are unable to manually rotate the hub and disc assembly.
2. Loosen the nut.
3. Attach a spring balancer to one stud. Gradually re-tighten the nut until the hub and disc assembly bearing is adjusted to the specified preload.
 - Hub bearing preload
 New Hub Bearing: 9.8 — 24.5 N (1 — 2.5 kg/ 2.2 — 5.5 lb)
 Reused Hub Bearing: 4.9 — 19.6 N (0.5 — 2 kg/1.1 — 4.4 lb)

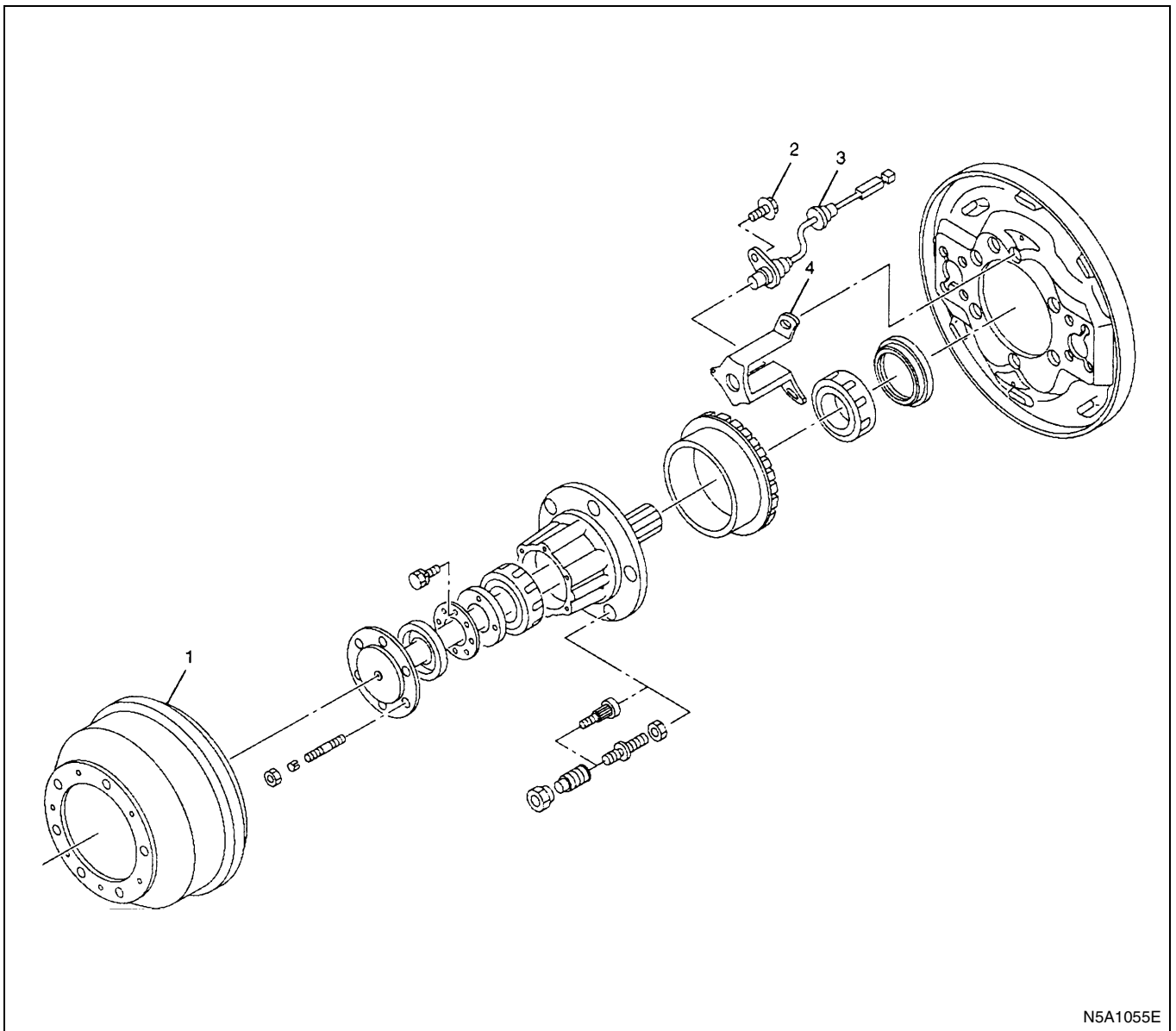


4. Install a cotter pin through the nut and knuckle and bend it over.
 - If the notch in the nut does not line up with the cotter pin hole in the knuckle, tighten the nut until it does. Do not loosen the nut to line up a notch and the knuckle hole.
5. Apply grease into the hub cap and install it.
 - 0.4 N (40 g/0.09 lb)
6. Install the disc brake assembly and tighten two bolts to the specified torque.

Tighten:

Bolts to 221 N·m (22.5 kg·m/163 lb·ft)

Rear Speed Sensor Components

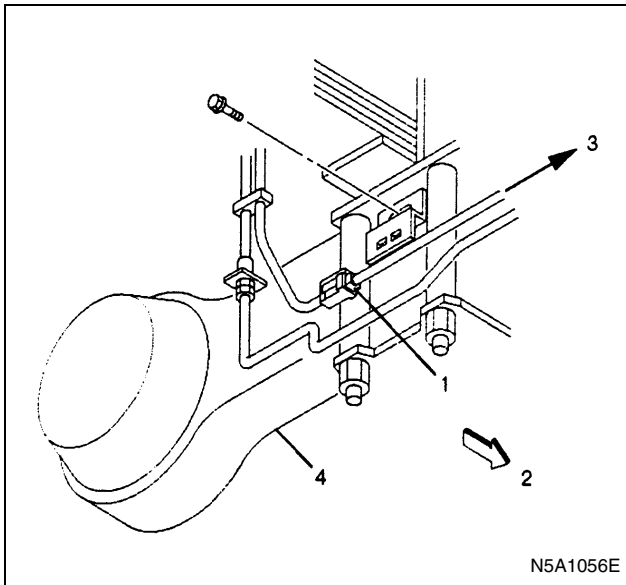


N5A1055E

Legend

- | | |
|-----------------------------|-------------------------|
| 1. Brake Drum | 3. Speed Sensor |
| 2. Speed Sensor Fixing Bolt | 4. Speed Sensor Bracket |

Removal



Tighten:

Bolt to 18 N·m (1.8 kg·m/13 lb·ft)

4. Install brake drum and tighten bolts to the specified torque.

Tighten:

Bolts to 13 N·m (1.3 kg·m/9.5 lb·ft)

5. Connect speed sensor connector.

Notice:

Confirm that the harness is not twisted when connecting the speed sensor connector.

Legend

1. Speed Sensor Connector
2. Front
3. Speed Sensor
4. Rear Axle

1. Disconnect speed sensor connector.
2. Remove brake drum.
3. Remove speed sensor fixing bolt.
4. Remove speed sensor.
5. Remove speed sensor bracket.

Inspection and Repair

1. Check the speed sensor for presence of foreign materials; remove any dirt, etc.
2. Check the speed sensor for damage, and replace the speed sensor if necessary.
3. Check the speed sensor harness for a short or an open, and replace with a new one if necessary. To check for harness short or open, bend or stretch the cable while checking for continuity.

Installation

1. Install speed sensor bracket and tighten the nut to the specified torque.

Tighten:

Nut to

GVW Range 12,000 lbs. and 14,500 lbs. model:

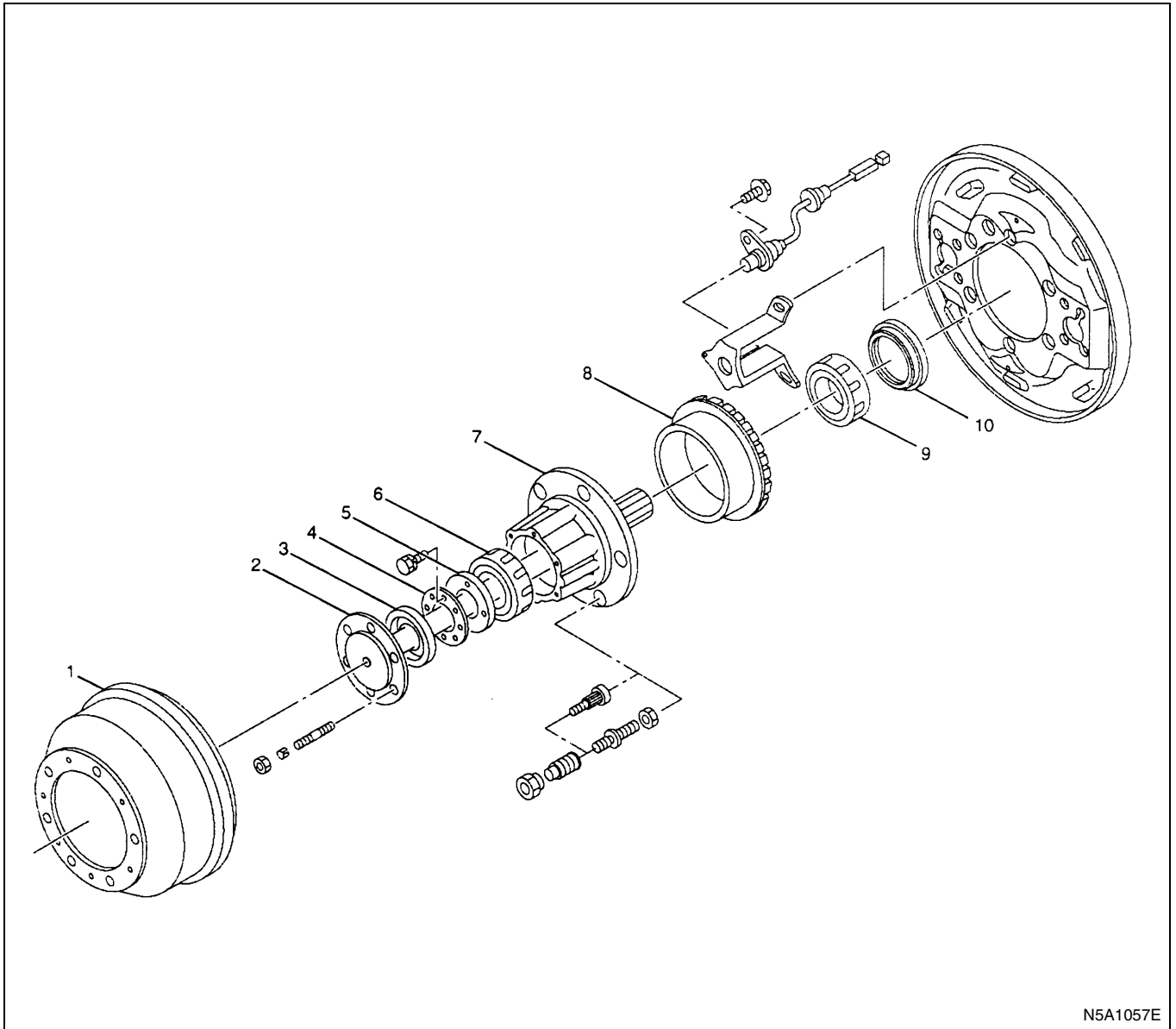
108 N·m (11 kg·m/80 lb·ft)

GVW Range 17,950 lbs. model:

157 N·m (16 kg·m/116 lb·ft)

2. Install the speed sensor and take care not to hit the speed sensor during installation.
3. Install the speed sensor fixing bolt and tighten it to the specified torque.

Rear Speed Sensor Rotor Components



N5A1057E

Legend

- | | |
|-------------------|-----------------------|
| 1. Brake Drum | 6. Outer Bearing |
| 2. Axle Shaft | 7. Rear Hub |
| 3. Outer Oil Seal | 8. Speed Sensor Rotor |
| 4. Lock Washer | 9. Inner Bearing |
| 5. Bearing Nut | 10. Inner Oil Seal |

Removal

1. Remove brake drum.
2. Remove axle shaft.
3. Remove outer oil seal, using a screwdriver.
4. Remove lock washer.
5. Remove bearing nut with a hub bearing nut wrench.
6. Remove hub assembly from axle case.
7. Remove outer bearing from hub assembly.

8. Remove speed sensor rotor from hub assembly.

9. Remove inner bearing and inner oil seal from axle case.

Inspection and Repair

1. Check the speed sensor rotor for damage including tooth chipping. If damaged, replace speed sensor rotor.

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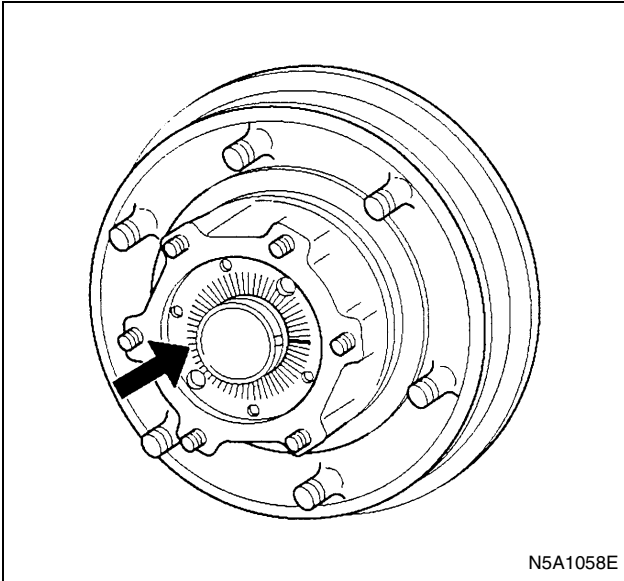
Installation

1. Using a bench press, install speed sensor rotor.

Notice:

Do not reuse the sensor rotor.

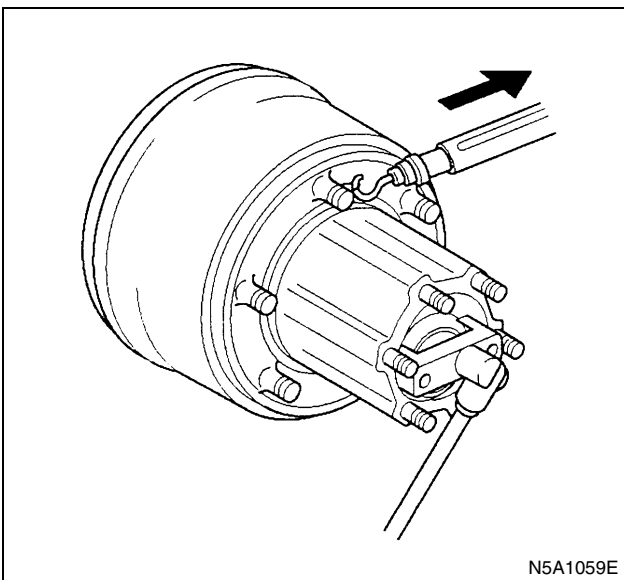
2. Install spacer on to the axle case.
3. Apply grease into the outer and inner bearings and install bearings in the hub.
4. Install outer oil seal into hub.
5. Install hub assembly onto the axle case.



6. Set the lock nut with the notched line facing out.

Preload Adjustment

- 1) Turn the hub to the left and right several times to establish bearing conformity.
- 2) Use the bearing nut wrench to tighten the bearing nut until the hub can not be manually rotated.
- 3) Loosen the bearing nut until hub rotates easily.



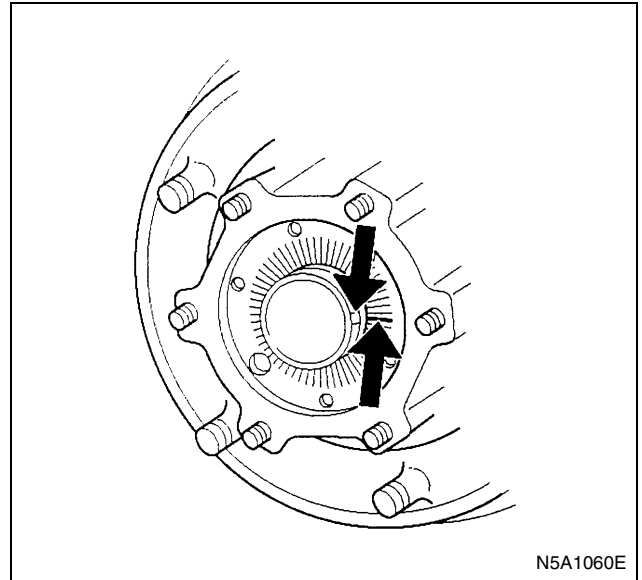
- 4) Set the spring balancer to the wheel pin in the position shown in the illustration.

- 5) Measure the hub bearing preload by carefully pulling on the spring balancer and noting the indicator reading.

Hub Bearing Preload (At Wheel Pin):

42 — 52 N (4.3 — 5.3 kg/9.4 — 11.6 lb)

- 6) Rotate the hub several times to the right and left.
- 7) Measure the bearing preload a second time.



- 8) Align the axle case groove with the closest bearing nut slit.

Notice:

If it is difficult to align the axle case and bearing nut, slightly tighten the bearing nut.

7. Install the lock washer with the lock washer tabs inserted to the axle case grooves. Install the lock bolts to prevent the bearing nut from loosening. Check that the lock washer tabs are inserted to the axle case grooves.
8. Apply grease to the outer oil seal lip inner and outer circumferences and install outer oil seal.
9. Clean the axle shaft. Apply gear oil to the axle shaft spline. Insert the axle shaft into the axle case. Take care not to damage the oil seal.
10. Tighten the axle shaft nuts to the specified torque a little at a time.

Tighten:

Nuts to 46 N·m (4.7 kg·m/34 lb·ft)

11. Install brake drum.