SECTION HBB
HYBRID BATTERY SYSTEM

CONTENTS

BASIC INSPECTION

DIAGNOSIS AND REPAIR WORKFLOW

Work Flow

INFOID:0000000004212229

DETAILED FLOW

1.VEHICLE BROUGHT TO WORK SHOP

>> GO TO 2.

2.CUSTOMER PROBLEM ANALYSIS

Get the detailed information from the customer about the symptom (the condition and the environment when the incident/malfunction occurred) using the “DIAGNOSTIC WORKSHEET”.

>> GO TO 3.

3.CONNECT CONSULT-III TO THE DATA LINK CONNECTOR

NOTE:
If the display on the CONSULT-III indicates a communication malfunction, inspect the data link connector.

>> GO TO 4.

4.CHECK DTC AND SAVE FREEZE FRAME DATA

1. Check DTC.
2. Perform the following procedure if DTC is displayed.

- Record DTC and freeze frame data.
- Study the relationship between the cause detected by DTC and the symptom described by the customer.

3. Check related service bulletins for information.
4. Clear DTC.

>> GO TO 5.

5.CONDUCT VISUAL INSPECTION

Check the vehicle visually.

>> GO TO 6.

6.CONFIRM THE SYMPTOM

Try to confirm the symptom described by the customer.
DIAGNOSIS WORK SHEET is useful to verify the incident.
Verify relation between the symptom and the condition when the symptom is detected.
NOTE:
If the engine does not start, perform steps 7 to 8 first.

Is the malfunction occur?

YES >> GO TO 8.
NO >> GO TO 7.

7.DUPLICATE CONDITIONS THAT PRODUCE SYMPTOMS

1. Drive the vehicle under the similar conditions to Freeze Frame Data for certain time.
2. Check DTC.

Is DTC detected?

YES >> GO TO 8.
NO >> GO TO 9.

8.PERFORM DIAGNOSIS PROCEDURE

Perform the diagnosis procedure related to displayed DTC.

>> GO TO 12.

9.CHECK HYBRID VEHICLE CONTROL ECU POWER SUPPLY CIRCUIT

Perform the circuit inspection for the hybrid vehicle control ECU power supply circuit.

Is malfunction confirmed?

YES >> GO TO 11.
NO >> GO TO 10.

10.CHECK INTERMITTENT INCIDENT

Perform the trouble diagnosis for intermittent incident.

>> GO TO 11.

11.IDENTIFY PROBLEM

Check the malfunctioning parts

>> GO TO 12.

12.ADJUST AND/OR REPAIR

1. Repair or replace the malfunctioning part.
2. Reconnect parts or connectors disconnected during Diagnosis Procedure again after repair and replacement.

>> GO TO 13.

13.CONDUCT CONFIRMATION TEST

Perform the step again that the DTC or malfunction was confirmed in this procedure.

>> INSPECTION END

Diagnostic Work Sheet

INFOID:0000000004212230

DESCRIPTION

There are many operating conditions that lead to the malfunction of Hybrid vehicle control components. A good grasp of such conditions can make troubleshooting faster and more accurate.
In general, each customer feels differently about a incident. It is important to fully understand the symptoms or conditions for a customer complaint.
Utilize a diagnostic worksheet like the sample in order to organize all the information for troubleshooting.

KEY POINTS

WHAT ..... Vehicle & engine model
WHEN ..... Date, Frequencies
WHERE..... Road conditions
HOW ..... Operating conditions, Weather conditions, Symptoms

SEF907L

WORKSHEET SAMPLE

Customer name MR/MS		
Model & Year		
VIN		
Incident Date		
Manuf.Date		
In Service Date		
Fuel and fuel filler cap		□ Vehicle ran out of fuel causing misfire □ Fuel filler cap was left off or incorrectly screwed on. □ "WARNING RANGE ---mpg" is displayed in the meter.
Symptoms	□ Startability	□ Impossible to "READY" □ Impossible to starting engine □ No combustion □ Partial combustion □ Partial combustion affected by thorottle position □ Partial combustion NOT affected by thorottle position □ Possible but hard to starting engine □ Others [ ]
	□ Idling	□ No fast idle □ Unstable □ High idle □ Low idle □ Others [ ]
	□ Driveability	□ Stumble □ Surge □ Knock □ Lack of power □ Intake backfire □ Exhaust backfire □ Shock at starting engine □ Others [ ]
	SOC status	SOC ; Low(white) Low(blue) Mid High □ Possible to charge SOC at engine running □ Impossible to charge SOC
Incident occurrence		□ Just after delivery □ Recently □ In the morning □ At night □ In the daytime
Frequency		□ All the time □ Under certain conditions □ Sometimes
Weather conditions	Weather	□ Fine □ Raining □ Snowing □ Others [ ]
	Temperature	□ Hot □ Warm □ Cool □ Cold □ Humid °F
Engine conditions		□ Cold □ During warm-up □ After warm-up Engine speed ; 0 2000 4000 6000 8000 rpm
Road conditions		□ In town □ In suburbs □ Highway □ Off road (up/down) □ Slope (up/down)
Driving conditions		□ Not affected □ At starting □ While starting □ At racing □ While accelerating □ While cruising □ While decelerating □ While turning (RH/RL) Vehicle speed ; 0 10 20 30 40 50 60 MPH Shift position □P □R □N □D □B □None (Not displayed)
Malfunction indicator lamp		□ Turned on □ Not turned on
READY operation indicator light		□ Turned on □ Not turned on
Hybrid system warning light		□ Turned on □ Not turned on
Hight voltage battery warning light		□ Turned on □ Not turned on
Charge warning light		□ Turned on □ Not turned on
Brake warning light		□ Turned on □ Not turned on
EPS warning light		□ Turned on □ Not turned on
Master warning light		□ Turned on □ Not turned on
ASCD SET lamp		□ Turned on □ Not turned on □ Flashing (if ASCD CRUISE lamp is turned on)

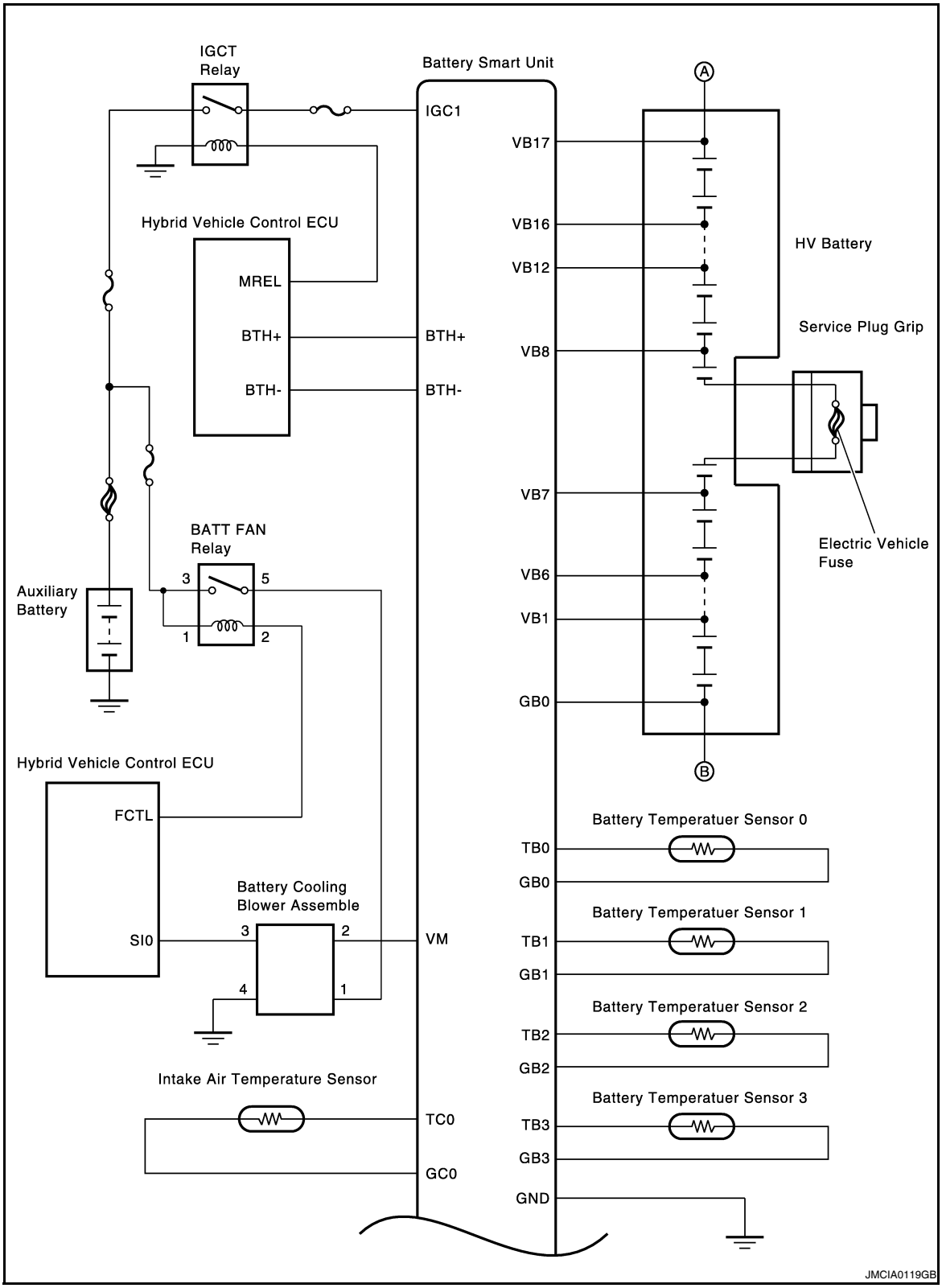
JMCIA0171GB

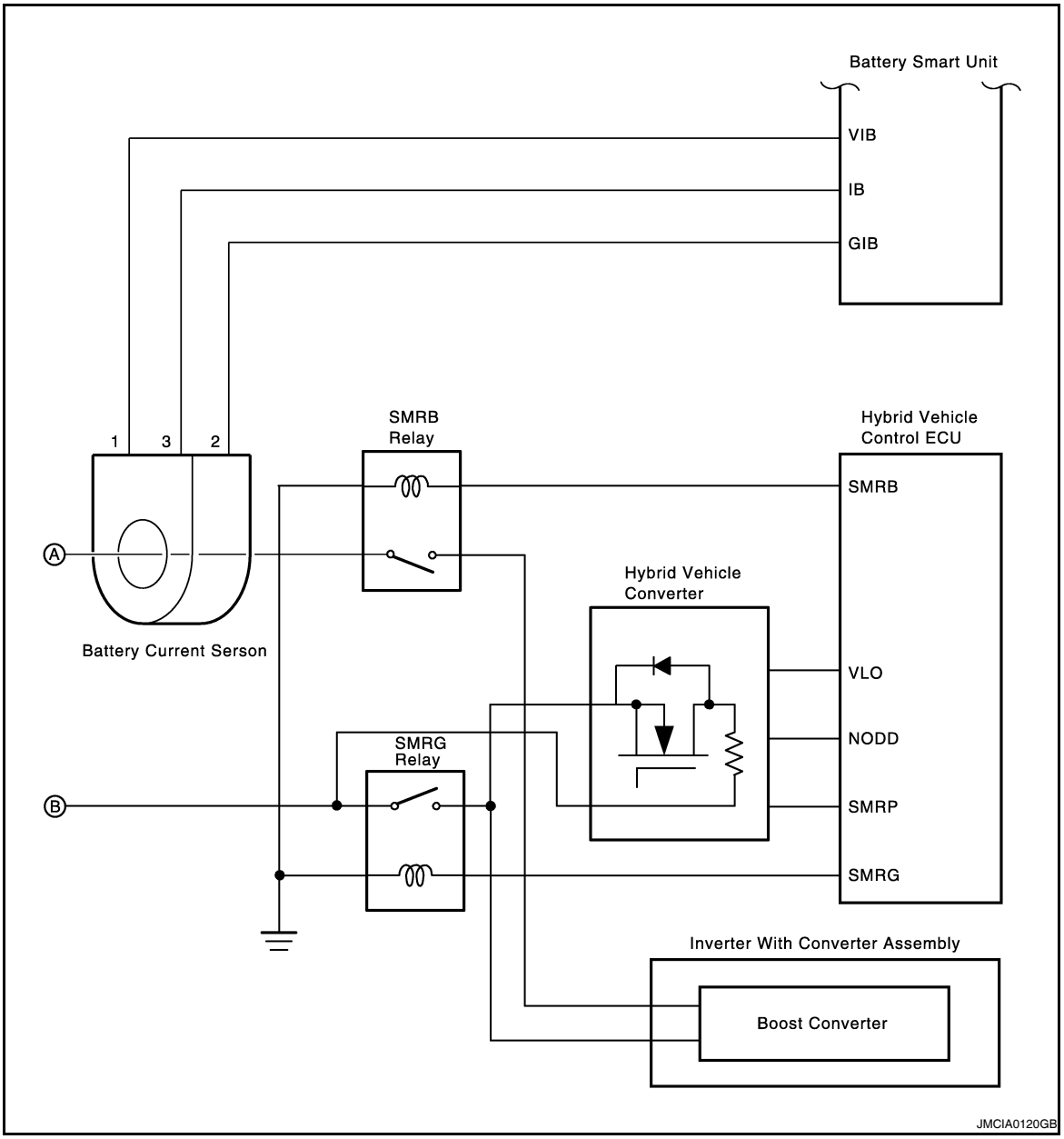
FUNCTION DIAGNOSIS

HYBRID BATTERY SYSTEM

System Diagram

INFOID:0000000004212231





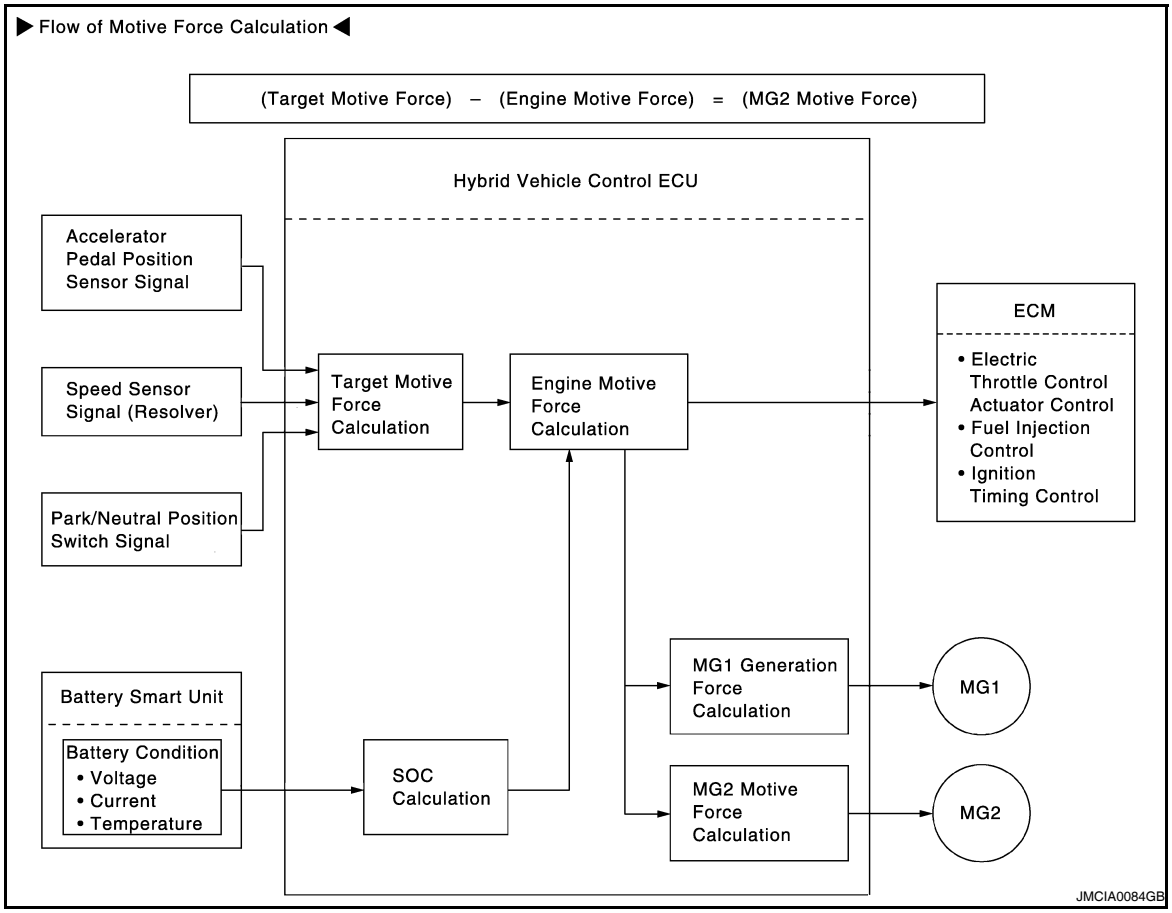
System Description

INFOID:0000000004212232

GENERAL

- The hybrid vehicle control ECU detects the amount of effort applied to the accelerator pedal in accordance with the signals provided by the accelerator pedal position sensor. The hybrid vehicle control ECU receives signals from the speed sensor (resolver) in the MG1 and MG2, and detects the shift position signal from the shift position sensor. The hybrid vehicle control ECU determines the driving conditions of the vehicle in accordance with these pieces of information, and optimally controls the motive forces of MG1, MG2, and the engine. Furthermore, the hybrid vehicle control ECU optimally controls the output and torque of these motive forces in order to realize lower fuel consumption and cleaner exhaust emissions.
- The hybrid vehicle control ECU calculates the engine motive force based on the calculated target motive force, and by taking the SOC and the temperature of the HV battery module into consideration. The value obtained by subtracting the engine motive force from the target motive force is the MG2 motive force.
- The hybrid vehicle control ECU sends the target engine motive force signal and the target engine speed signal to the ECM through CAN communication line. The ECM optimally controls the electric throttle control actuator and sends the actual engine speed signal to the hybrid vehicle control ECU. Furthermore, the hybrid vehicle control ECU appropriately operates MG1 and MG2 in order to realize the required MG2 motive force.

NOTE:
- Inverter water pump is also called water pump with motor and bracket assembly in this service manual.
- Generator is also called MG1 or motor generator No.1 in this service manual.
- Traction motor is also called MG2 or motor generator No.2 drive motor in this service manual.
- Inverter assembly is also called inverter with converter assembly inverter in this service manual.
- Hybrid vehicle converter (DC/DC converter) is also just called DC/DC converter in this service manual.



SYSTEM MONITORING CONTROL

- The hybrid vehicle control ECU constantly monitors the SOC (state of charge) of the HV battery. When the SOC is below the lower level, the hybrid vehicle control ECU increases the power output of the engine to operate MG1, which charges the HV battery. When the engine is stopped, MG1 operates to start the engine, then the engine operates MG1 to charge the HV battery.
- If the SOC is low, or the temperature of the HV battery module, MG1 or MG2 is higher than the specified value, the hybrid vehicle control ECU restricts the motive force applied to the drive wheels until it is restored to the normal value.

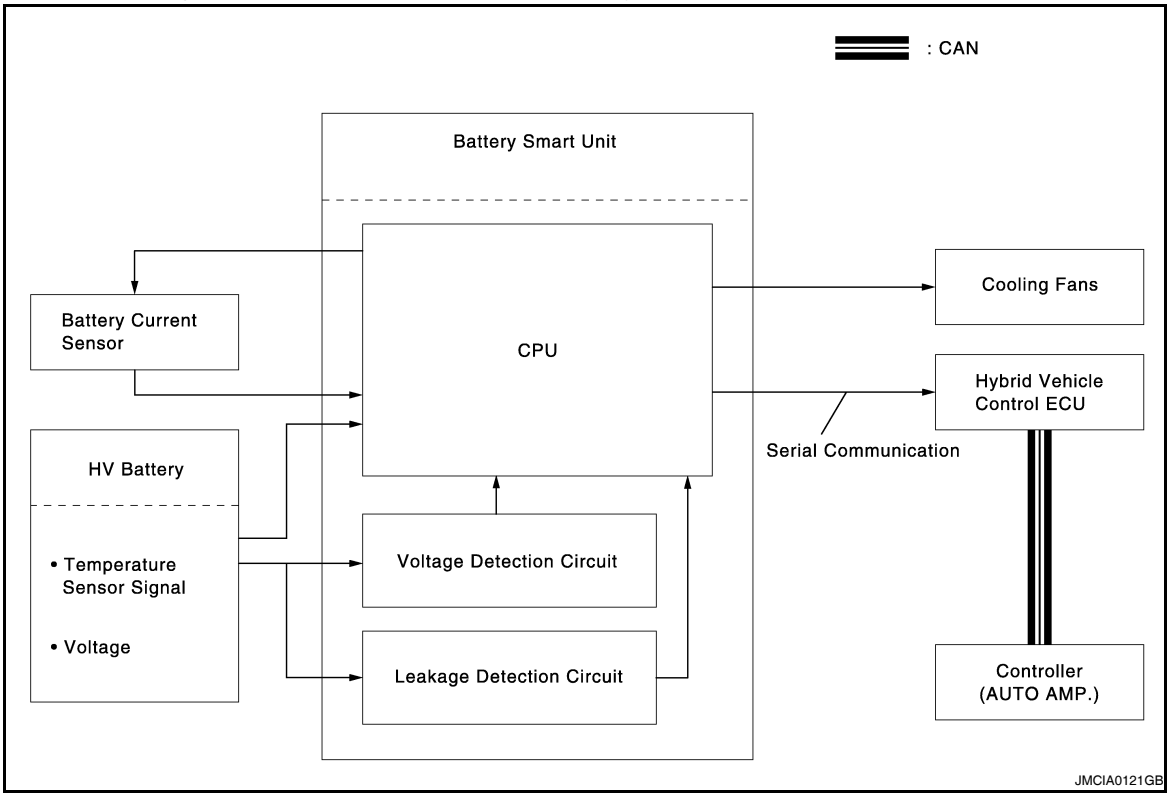
SHUT DOWN CONTROL

The MG1 and MG2 are shut down when the shift position is in the N position. This is because MG1 and MG2 must be stopped electrically as a means of shutting down the motive force, since MG2 is mechanically joined to the front wheels.

BATTERY SMART UNIT CONTROL

- The battery smart unit monitors the HV battery condition signals (voltage, current and temperature), which are needed to determine the charging or discharging values that are calculated by the hybrid vehicle control ECU and transmits them to the hybrid vehicle control ECU via serial communication.
- A leakage detection circuit is provided in the battery smart unit in order to detect any leakage from the HV battery.

- The battery smart unit monitors the voltage of the cooling fan, which is needed by the hybrid vehicle control ECU to effect cooling fan control, and transmit it to the hybrid vehicle control ECU via serial communication.

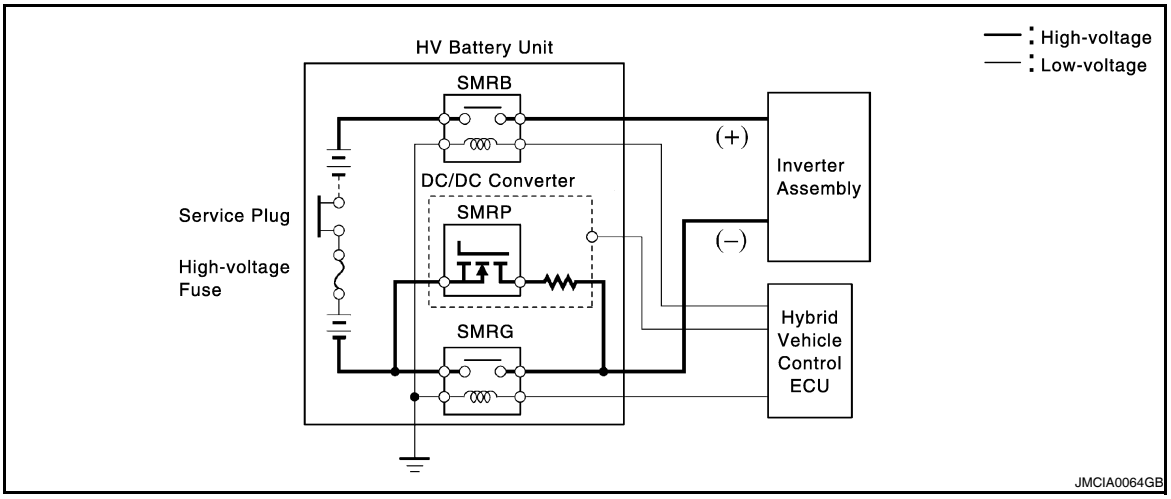


SMR (SYSTEM MAIN RELAY) CONTROL

(1) General

The SMR is a relay that connects and disconnects the power source of the high-voltage circuit upon receiving a command from the hybrid vehicle control ECU.

A total of three relays are used: one (SMRB) at the positive side, and two (SMRP and SMRG) at the negative side. One (SMRP) of the relays at the negative side is a semiconductor relay, which is integrated in the DC/DC converter. The other two are contact point type relays, which are mounted on the junction box in the HV battery module.

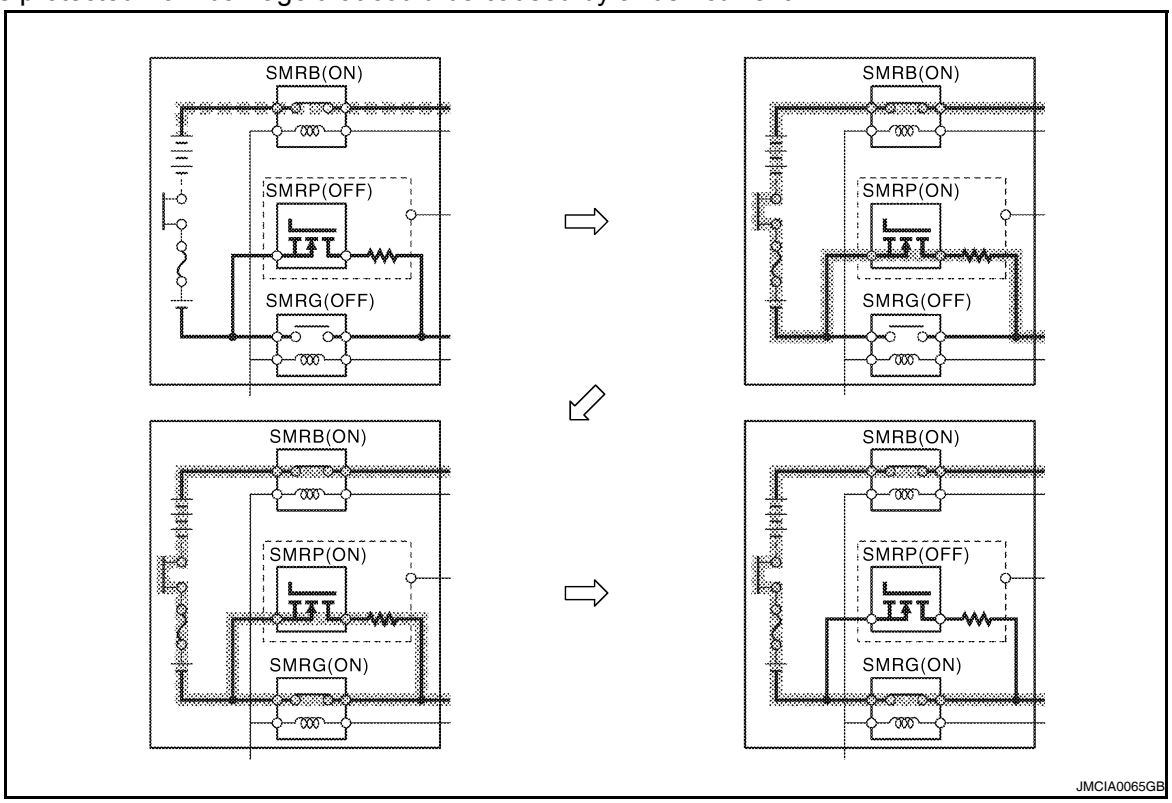


(2) Power is ON

The hybrid vehicle control ECU turns the SMRB ON. After that, it turns the SMRP ON.

After the hybrid vehicle control ECU has turned the SMRG ON, it turns the SMRP OFF.

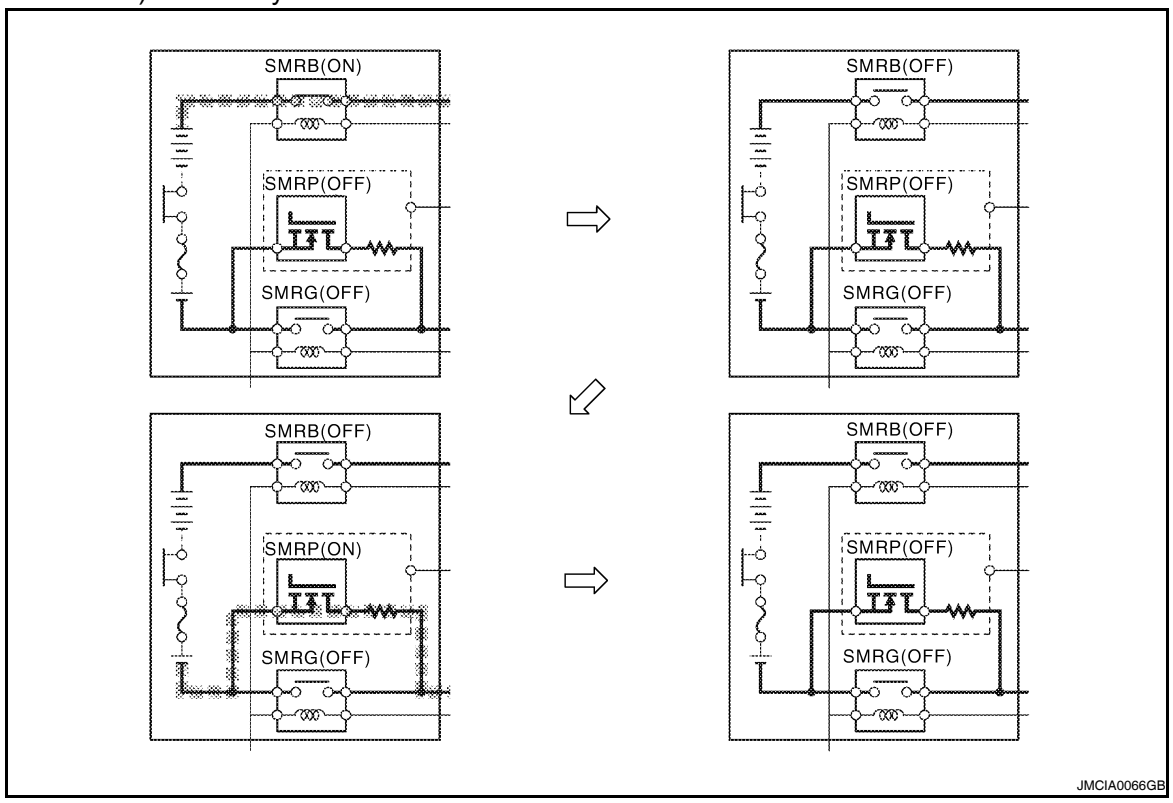
As the controlled current is initially allowed to pass through a resistor in this manner, the contact point in the circuit is protected from damage that could be caused by a rush current.



(3) Power is OFF

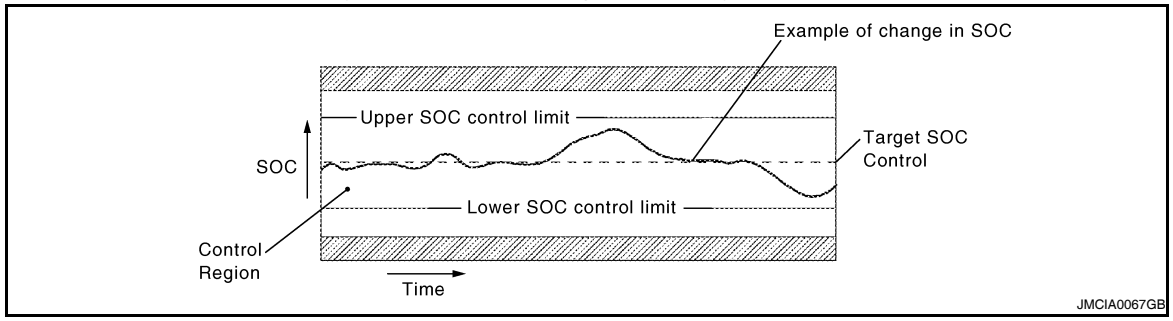
- First, the hybrid vehicle control ECU turns the SMRG OFF. After it has determined whether the contact points of the SMRG are stuck, it turns the SMRB OFF.
- Afterwards, the hybrid vehicle control ECU turns the SMRP ON in order to determine whether the contact points of the SMRB are stuck. Then, it turns the SMRP OFF.

- If the hybrid vehicle control ECU detects that the contact points are stuck, it illuminates the master warning light and indicates “CHECK HYBRID SYSTEM” on the multi-information display, and stores a DTC (Diagnostic Trouble Code) in memory.



SOC CONTROL

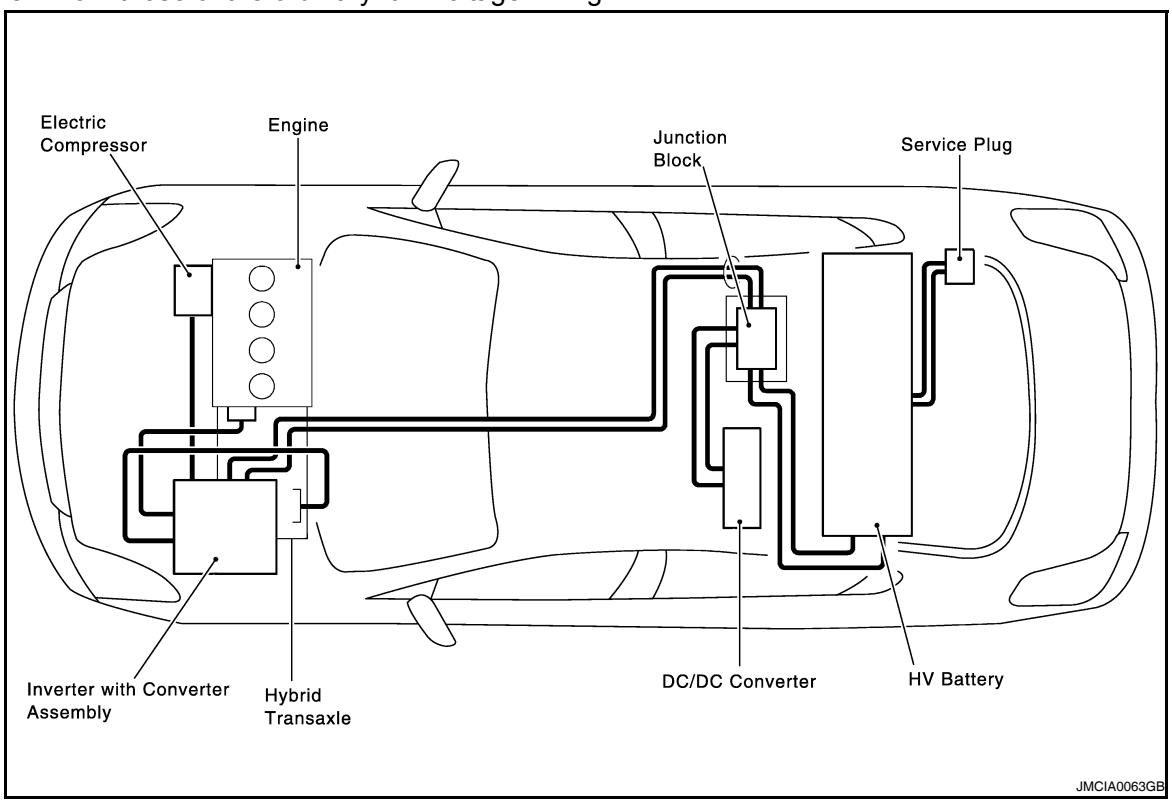
- The hybrid vehicle control ECU calculates the SOC (state of charge) of the HV battery by monitoring its charging and discharging amperages, in order to effect condition control.
- While the vehicle is in motion, the HV battery undergoes repetitive charging/discharging cycles, as it becomes discharged by the MG2 during acceleration and charged by the regenerative brake during deceleration. The hybrid vehicle control ECU calculates the SOC based on charging/discharging levels detected by the current sensor. The hybrid vehicle control ECU performs the charging/discharging control based on the calculated value in order to steady the SOC at its target level anytime.



POWER CABLE

The power cable is a high-voltage, high-amperage cable that connects the HV battery module with the inverter, the inverter with MG1 and MG2, and the inverter with the electric inverter compressor. The power cable starts at the connector of the junction block of the HV battery, which is located behind the rear seat.
It passes under the floor panel, along the side of the floor reinforcement, and connects to the inverter in the engine compartment. The power cable is shielded in order to reduce electromagnetic interference.

For identification purposes, the high-voltage wiring harness and connectors are color-coded orange to distinguish them from those of the ordinary low-voltage wiring.



Component Parts Location

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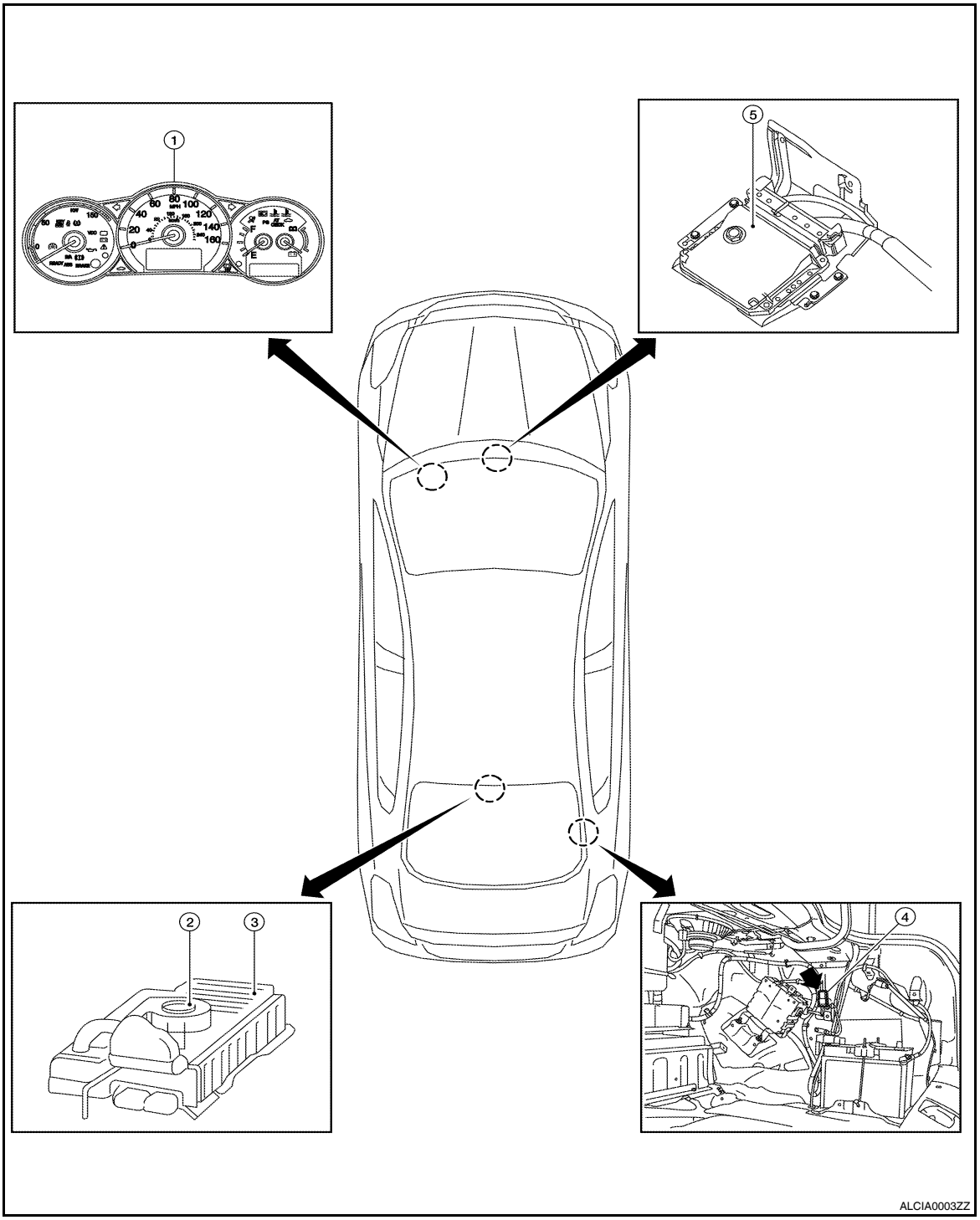
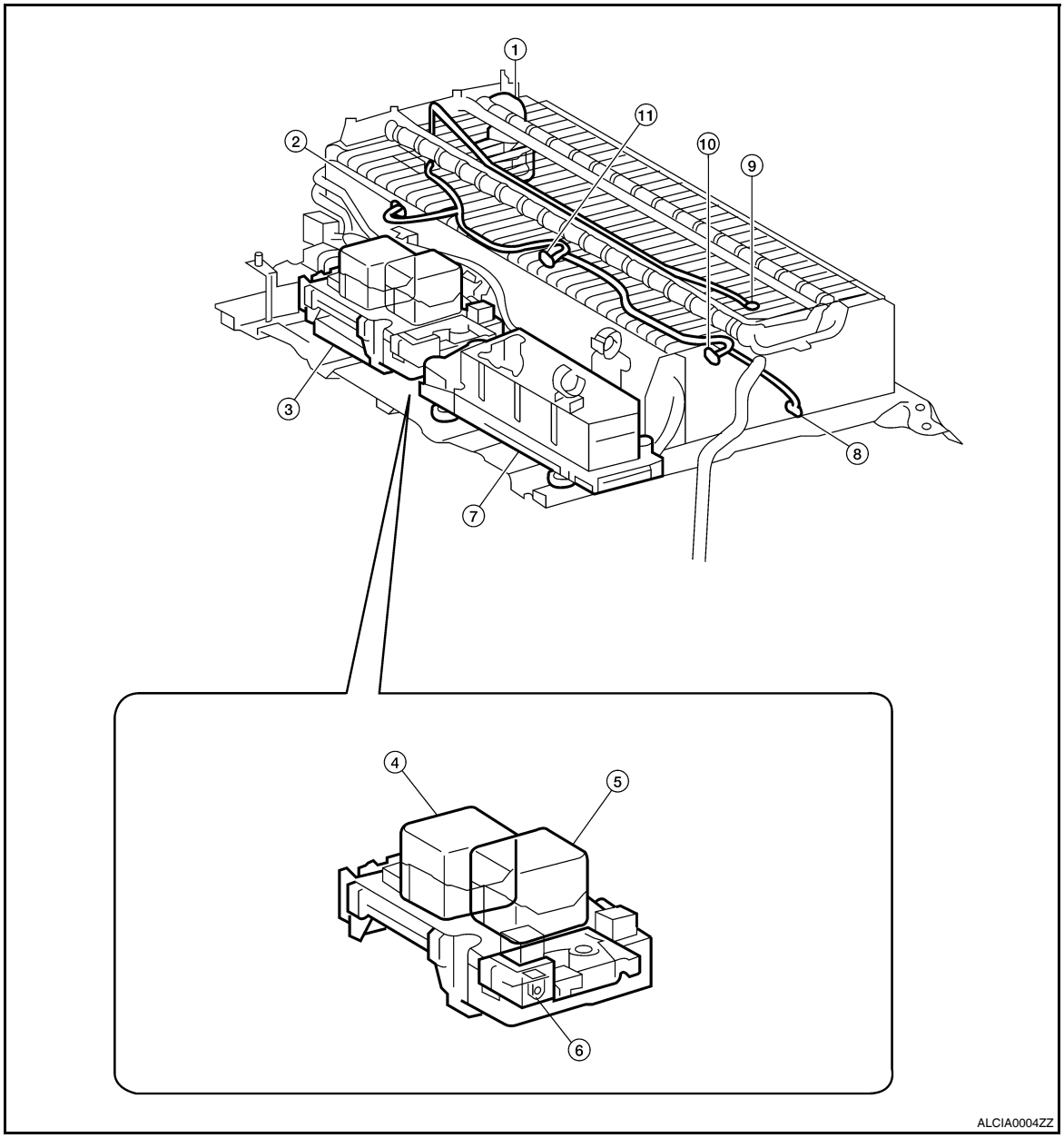


1. Combination meter
2. HV battery cooling fan
3. HV battery pack
4. HV battery cooling fan relay
5. Hybrid vehicle control ECU (located under heater box assembly)

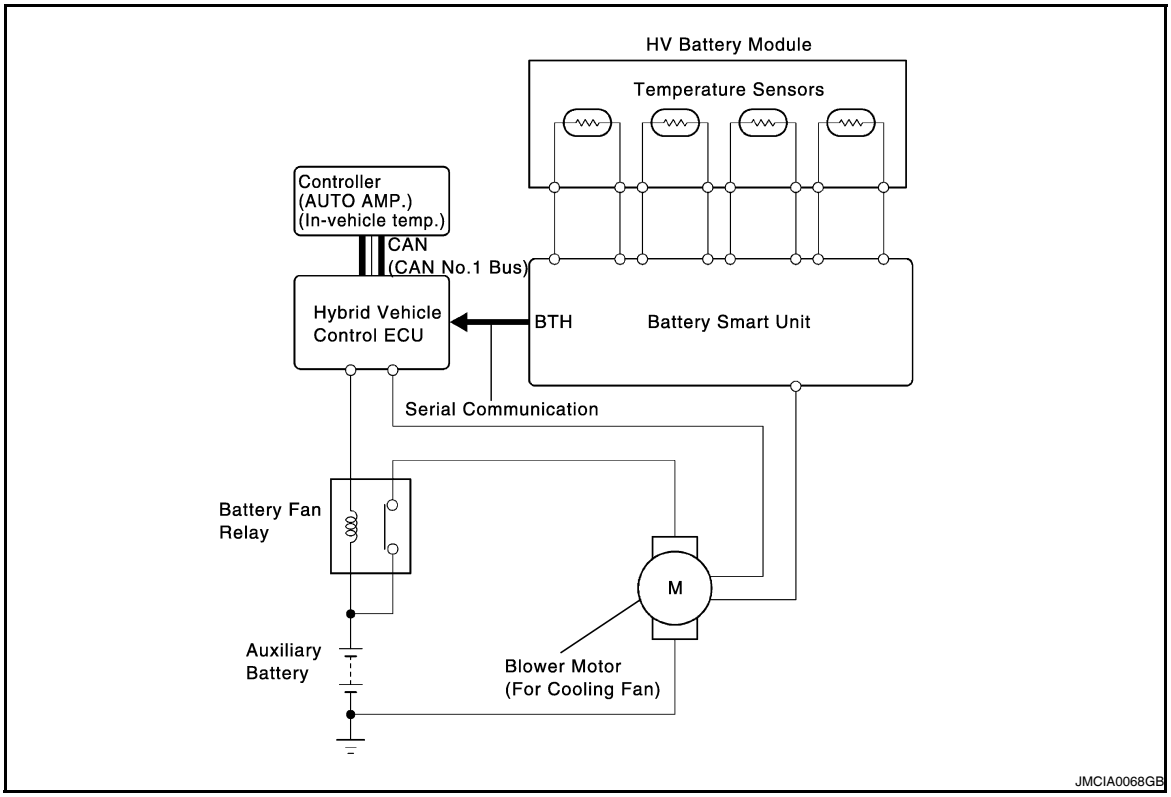


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

COOLING FAN CONTROL FOR HV BATTERY

System Diagram

INFOID:0000000004212234



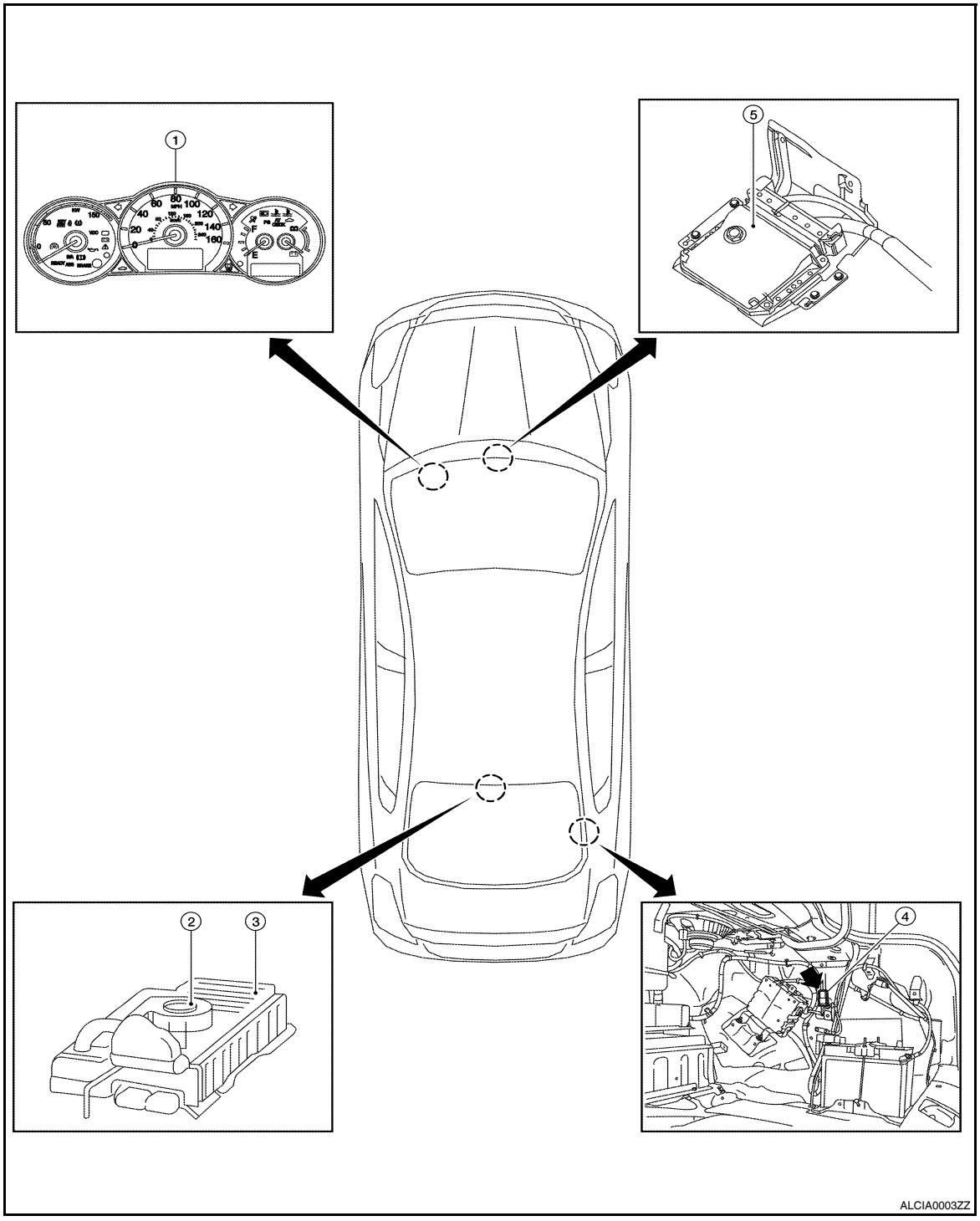
System Description

INFOID:0000000004212235

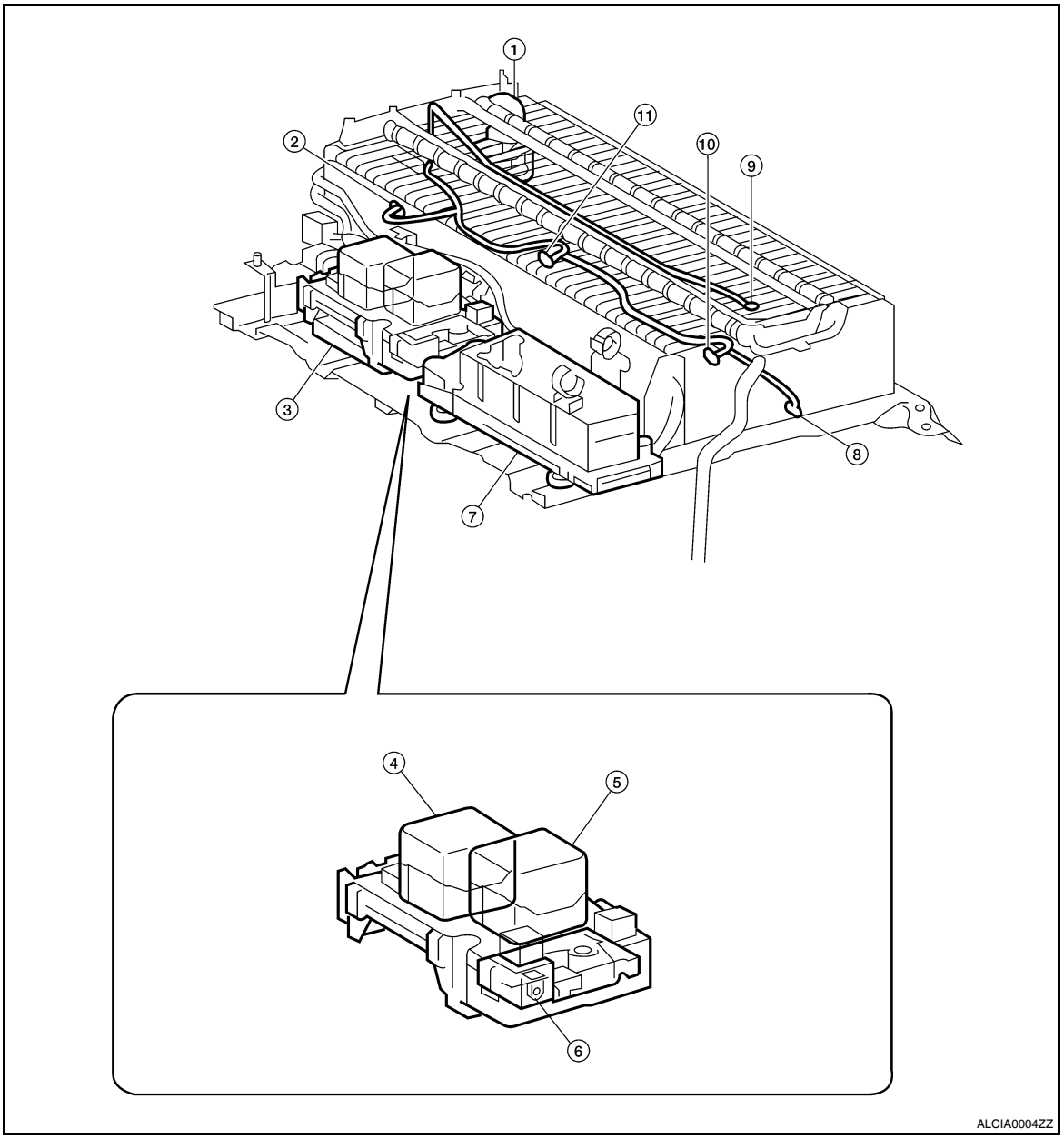
- The HV ECU monitors rises in the battery temperature through the four temperature sensors in the HV battery module. Then, the hybrid vehicle control ECU steplessly actuates the cooling fan under duty cycle control, in order to maintain the temperature of the HV battery module within the specified range.
- While the air conditioning system is operating to cool the cabin, if the HV battery module temperature is within a normal range, the hybrid vehicle control ECU turns the battery cooling fan OFF or changes the fan speed to low speed. The purpose of this control is to give priority to cooling down the cabin, which also provides cooling to the battery module through the intake duct located on the center of the rear package tray trim.

Component Parts Location

INFOID:0000000004212236



1. Combination meter
2. HV battery cooling fan
3. HV battery pack
4. HV battery cooling fan relay
5. Hybrid vehicle control ECU (located under heater box assembly)

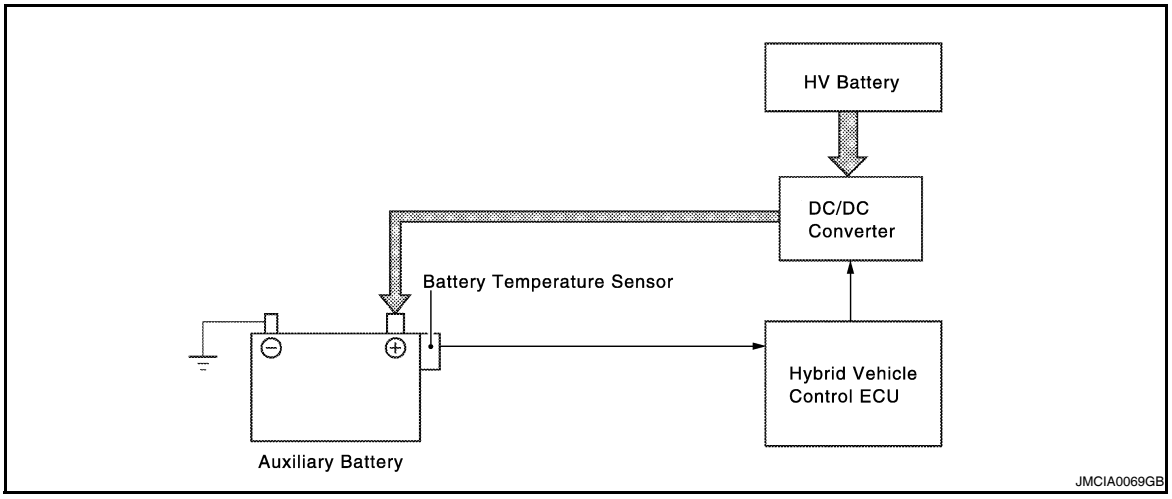


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

AUXILIARY BATTERY CHARGING CONTROL

System Diagram

INFOID:0000000004212237



System Description

INFOID:0000000004212238

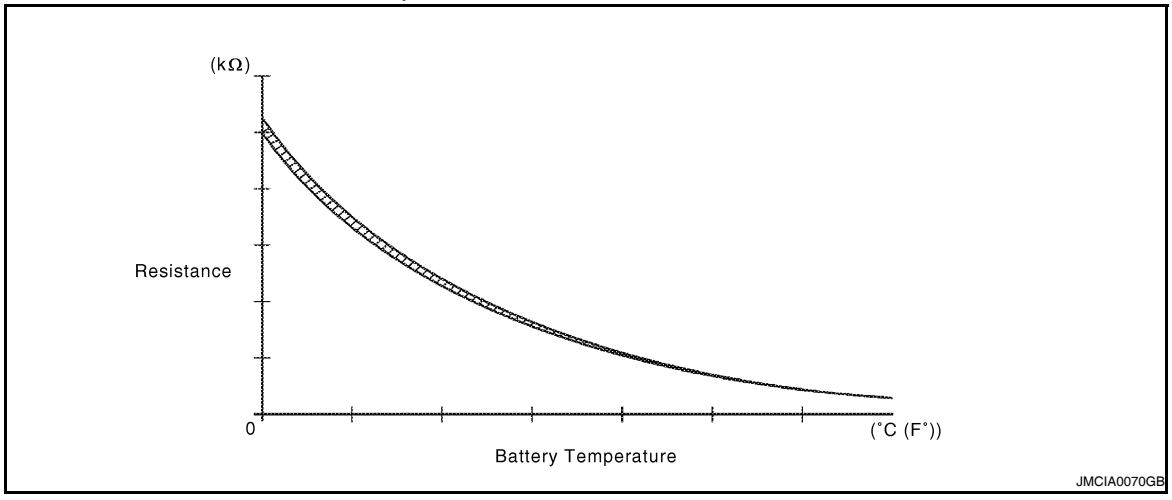
GENERAL

The hybrid vehicle control ECU controls the DC/DC converter in accordance with the signals from the battery temperature sensor of the auxiliary battery, in order to control the charging voltage to the auxiliary battery.

BATTERY TEMPERATURE SENSOR

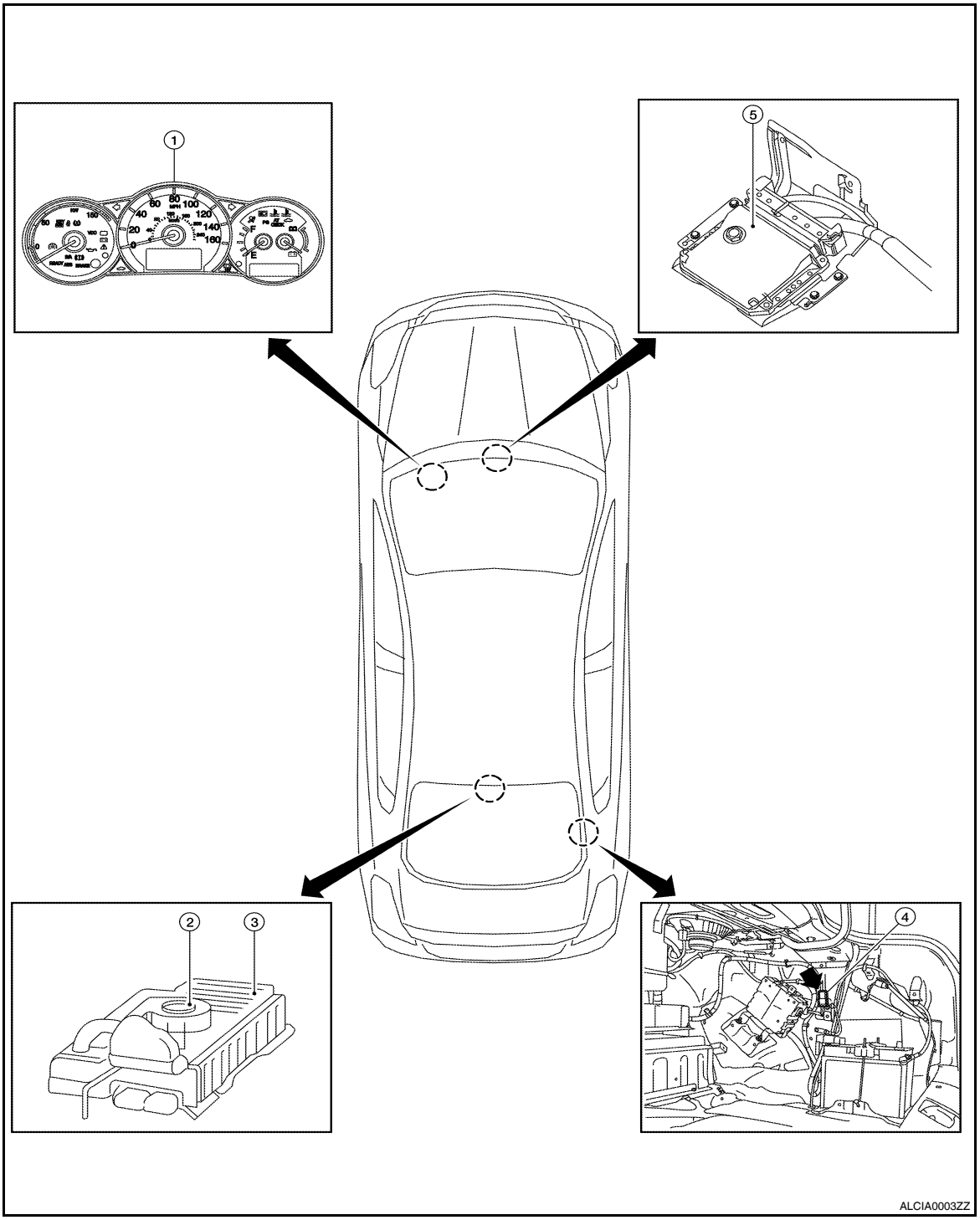
The battery temperature sensor is installed on the battery.

The battery characteristic (battery internal resistance) of taking in current for charging varies according to battery electrolyte temperature. If the electrolyte temperature is too low, the battery internal resistance will increase, resulting in early deterioration. To prevent this, the battery temperature sensor changes its resistance as shown below to detect the temperature.



Component Parts Location

INFOID:0000000004212239



1. Combination meter
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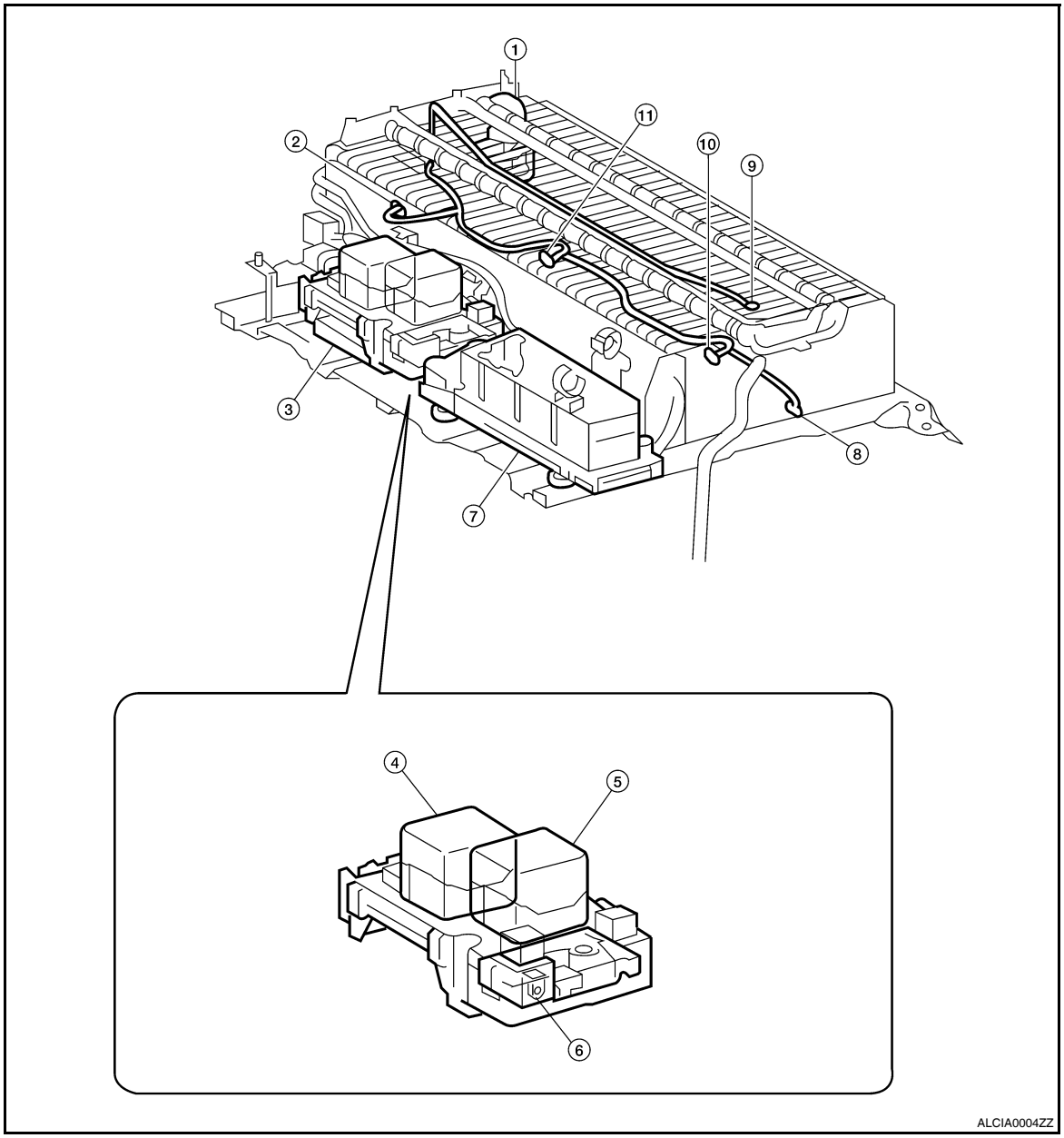
5. Hybrid vehicle control ECU (located under heater box assembly)



1. Service plug grip
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5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
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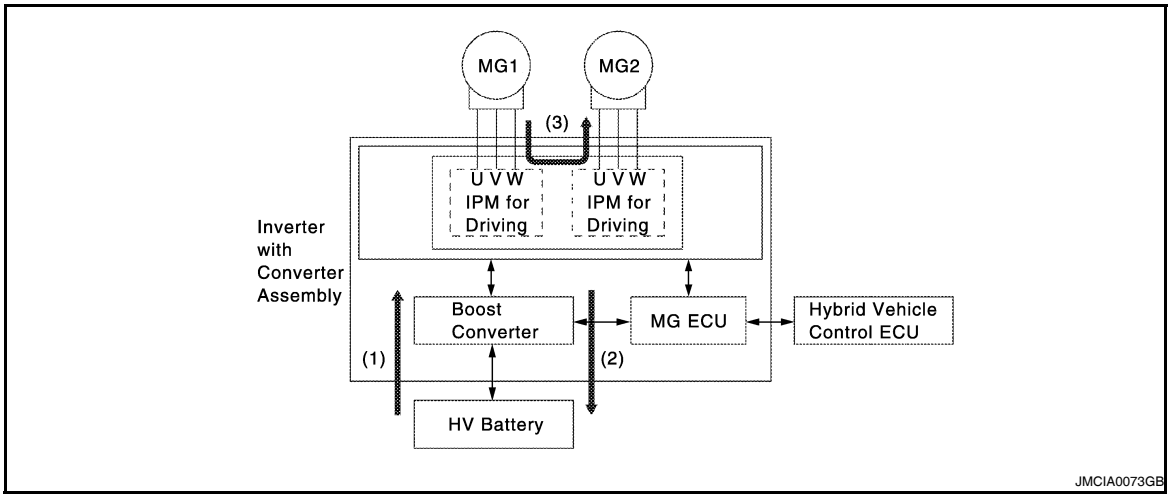
11. Battery temperature sensor 1

INVERTER ASSEMBLY CONTROL

System Diagram

INFOID:0000000004212240



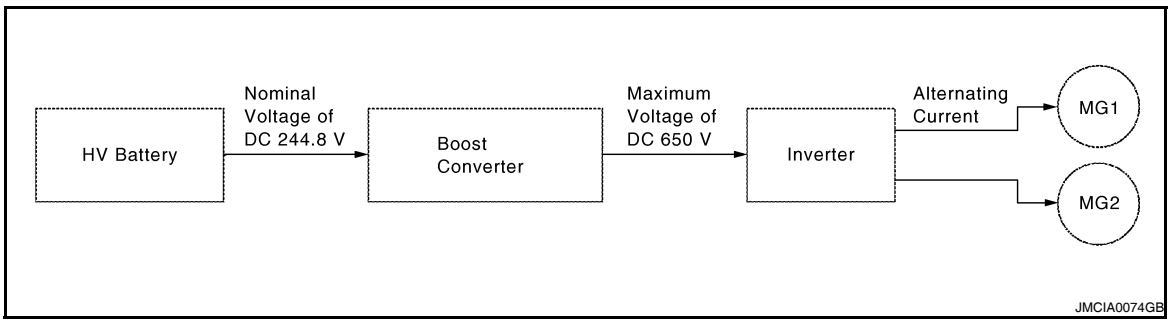
System Description

INFOID:0000000004212241

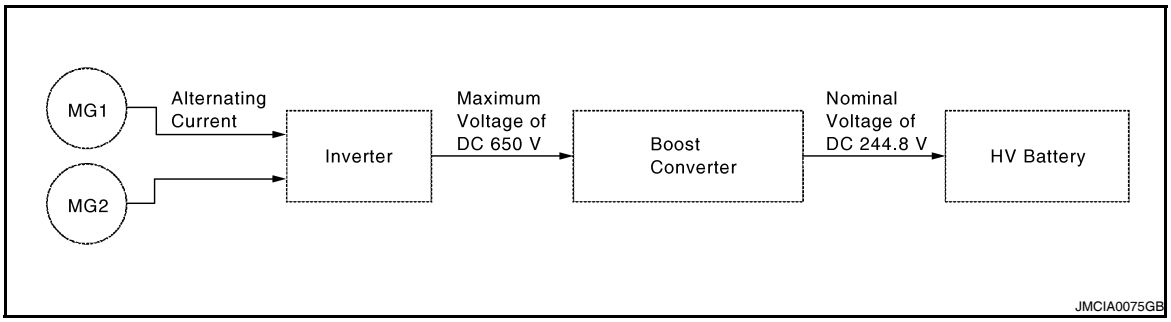
GENERAL

- The inverter converts the direct current from the HV battery into an alternating current for MG1 and MG2, or vice versa, in accordance with the signals provided by the hybrid vehicle control ECU via the MG ECU. In addition, the inverter supplies the alternating current from the MG1 power to the alternating current for MG2. However, the electricity that is supplied by MG1 to MG2 is converted into DC inside the inverter.
- Via the MG ECU, the hybrid vehicle control ECU transmits a signal to the power transistor in the inverter for switching the U, V, and W phases of stator coil of MG1 and MG2 based on the rotor position information sent by MG1 and MG2, and the SOC of the HV battery sent by the battery smart unit.
- When the shift lever is in the N position, or the hybrid vehicle control ECU has received an over-heating, over-current, or fault voltage signal from the inverter, the hybrid vehicle control ECU transmits a shut down control signal to the inverter, in order to disengage the electrical connection to MG1 and MG2.

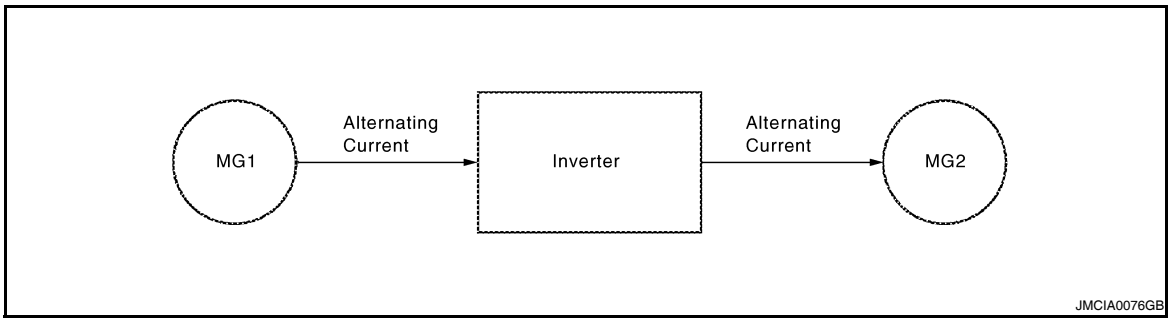
(1) VOLTAGE BOOST CONVERSION FUNCTION



(2) VOLTAGE DROP CONVERSION FUNCTION

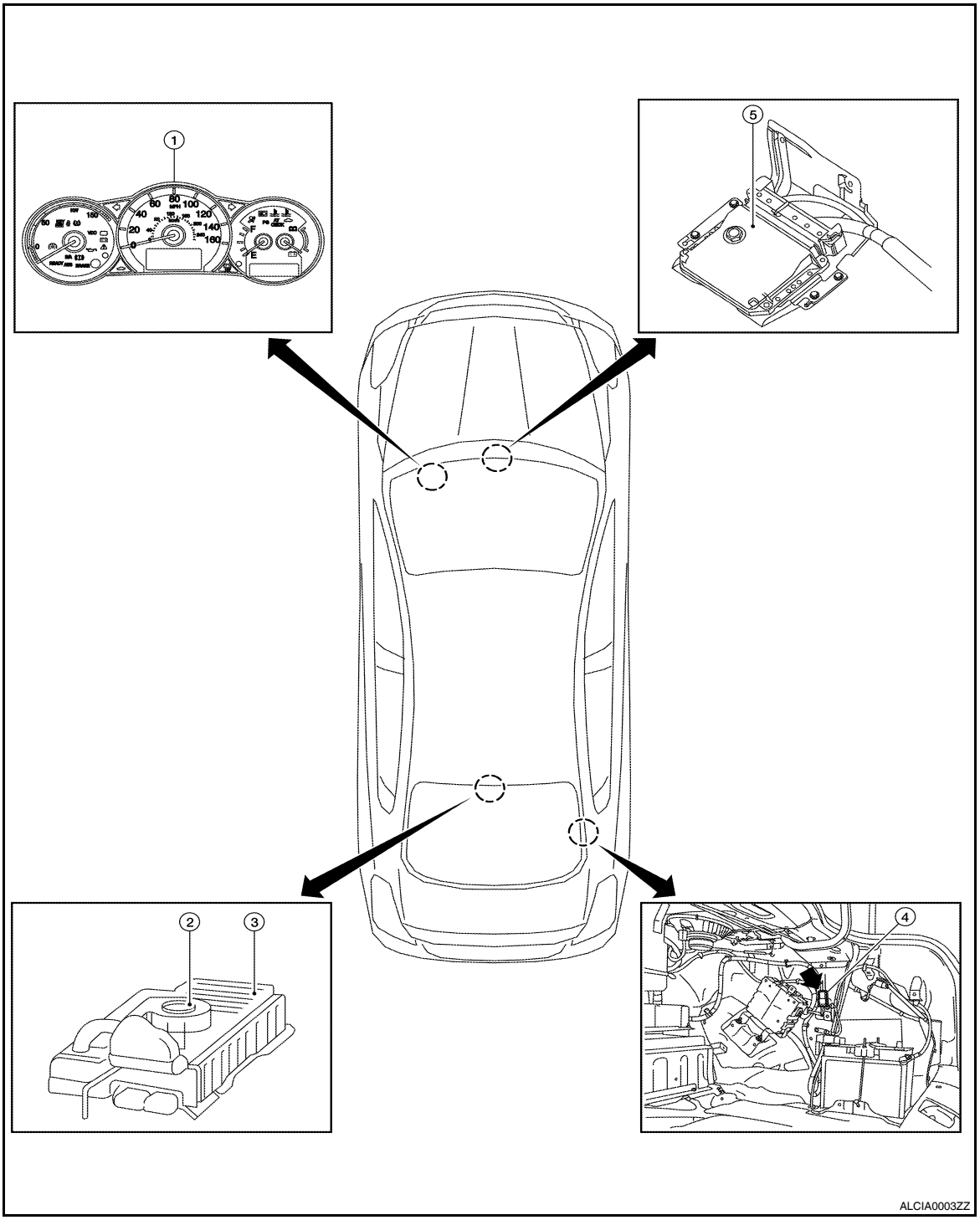


(3) ELECTRICAL POWER SUPPLY FUNCTION



Component Parts Location

INFOID:0000000004212242



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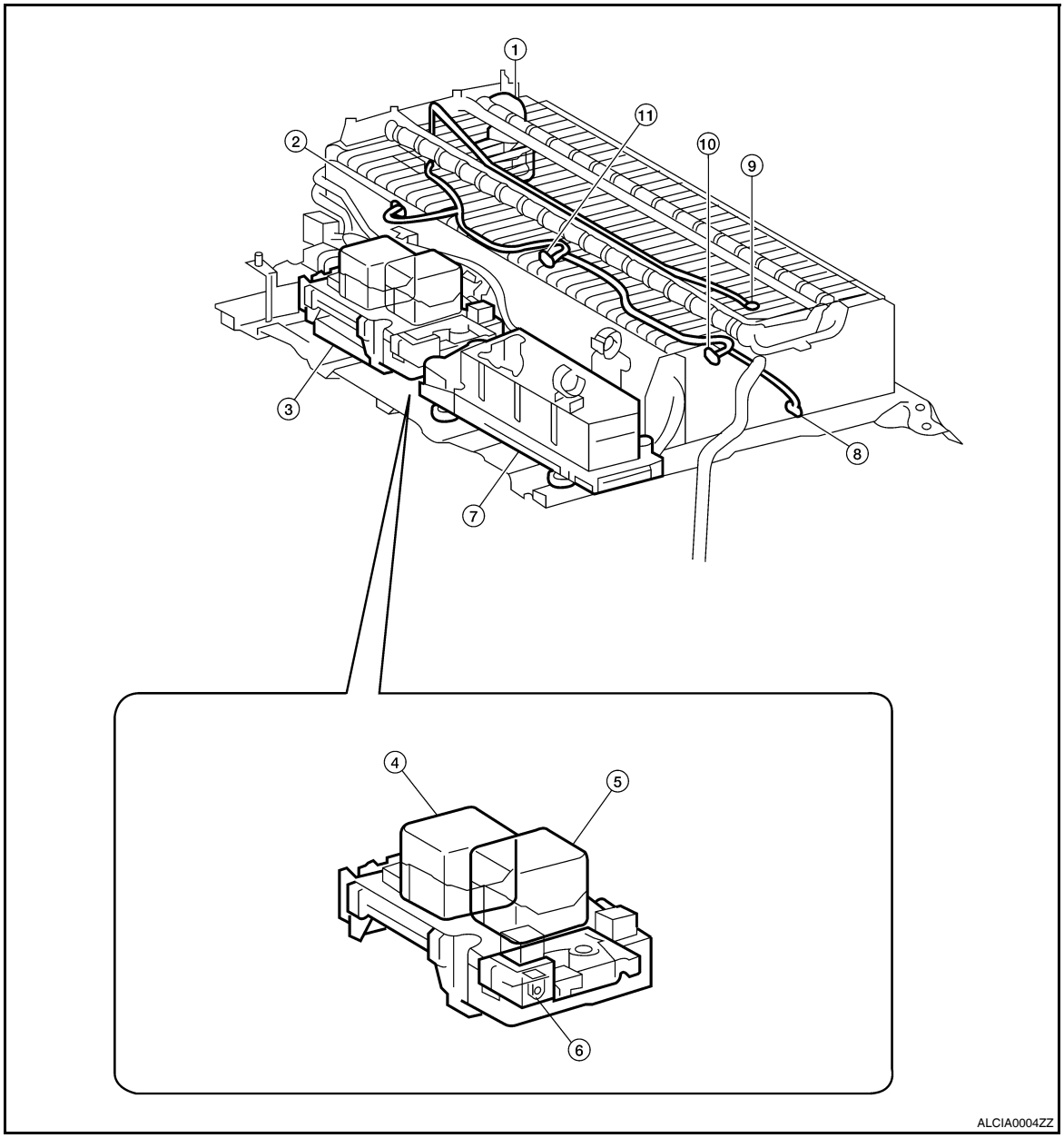
4. HV battery cooling fan relay
5. Hybrid vehicle control ECU (located under heater box assembly)



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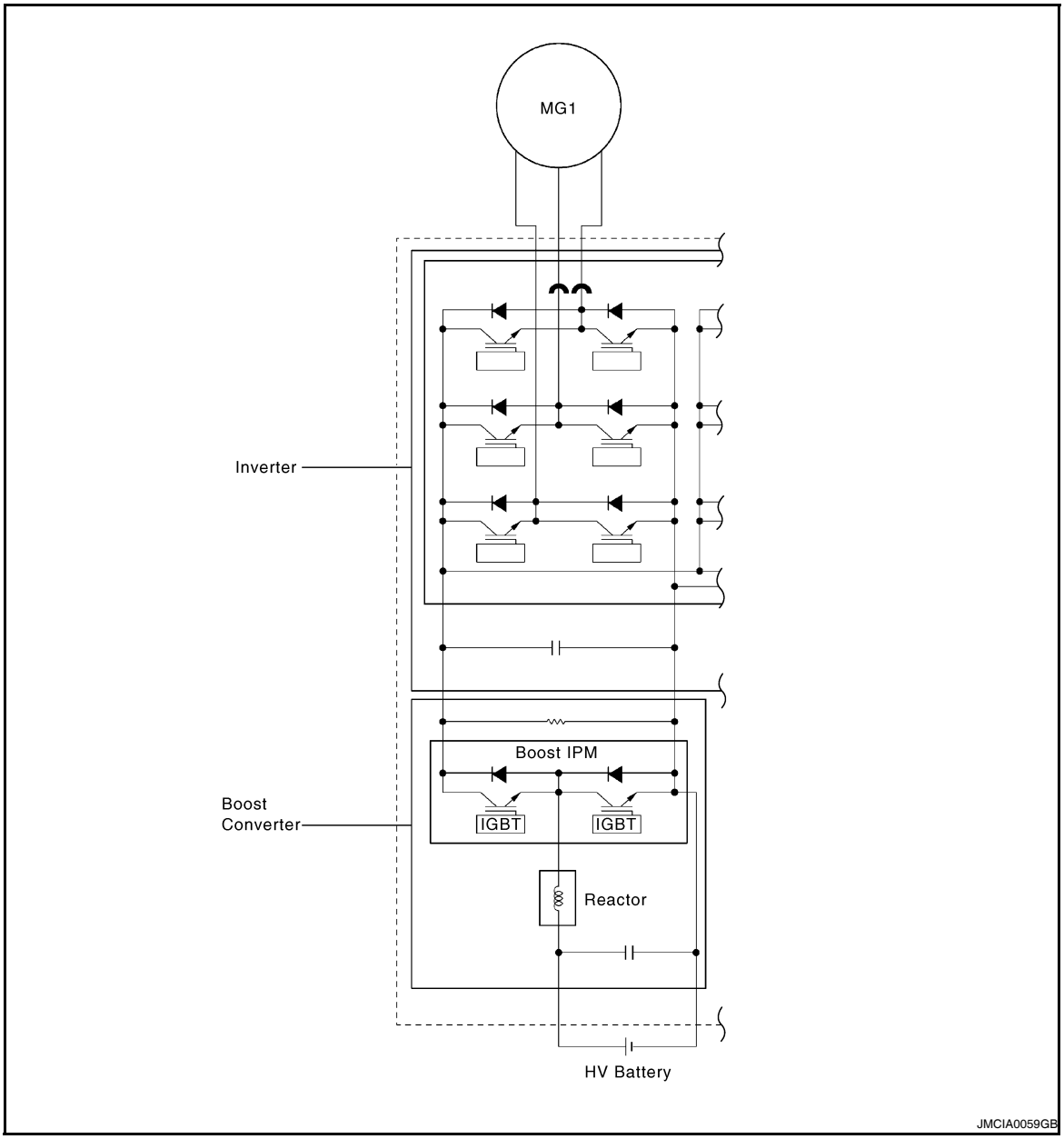
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

BOOST CONVERTER CONTROL

System Diagram

INFOID:0000000004212243



System Description

INFOID:0000000004212244

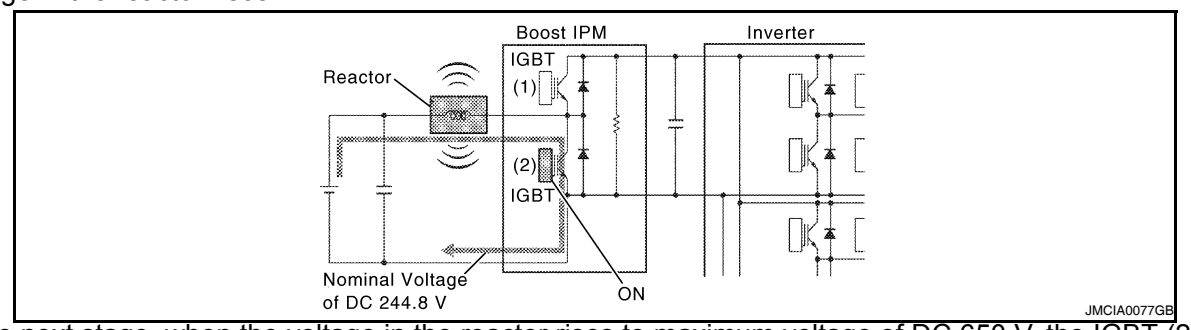
GENERAL

- The boost converter boosts DC 244.8 V, the nominal voltage of the boost converter, up to a maximum voltage of DC 650 V, in accordance with the signals provided by the hybrid vehicle control ECU via the MG ECU.
- The inverter converts the alternating current generated by MG1 or MG2 into a direct current. The boost converter drops the maximum voltage of DC 650 V to DC 244.8 V, the nominal voltage of the boost converter, in accordance with the signals provided by the hybrid vehicle control ECU via the MG ECU.
- The boost converter consists of a boost IPM (Intelligent Power Module) with built-in IGBTs (Insulated Gate Bipolar Transistors) that effect switching control, and a reactor that stores (and charges) electrical power.

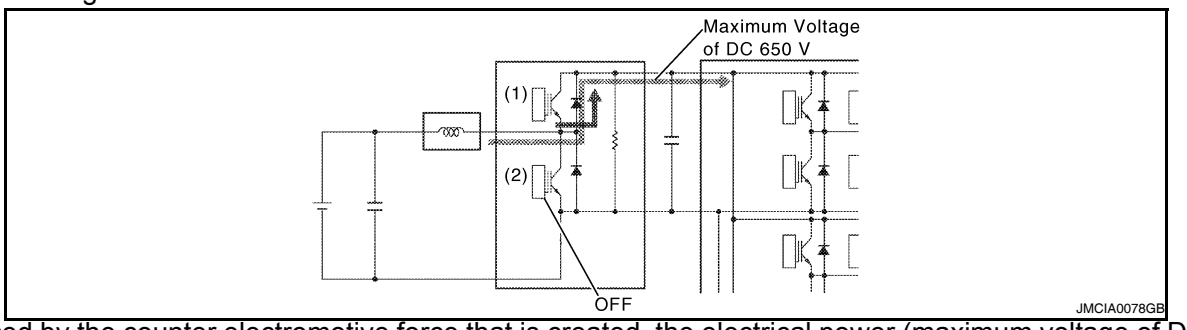
VOLTAGE BOOST CONVERSION FUNCTION

- The function of the boost converter to boost DC 244.8 V, the nominal voltage of the boost converter, to maximum voltage of DC 650 V flows as described below.

- The IGBT (2) turns ON, causing the electrical power of the HV battery to charge the reactor. As a result, the voltage in the reactor rises.



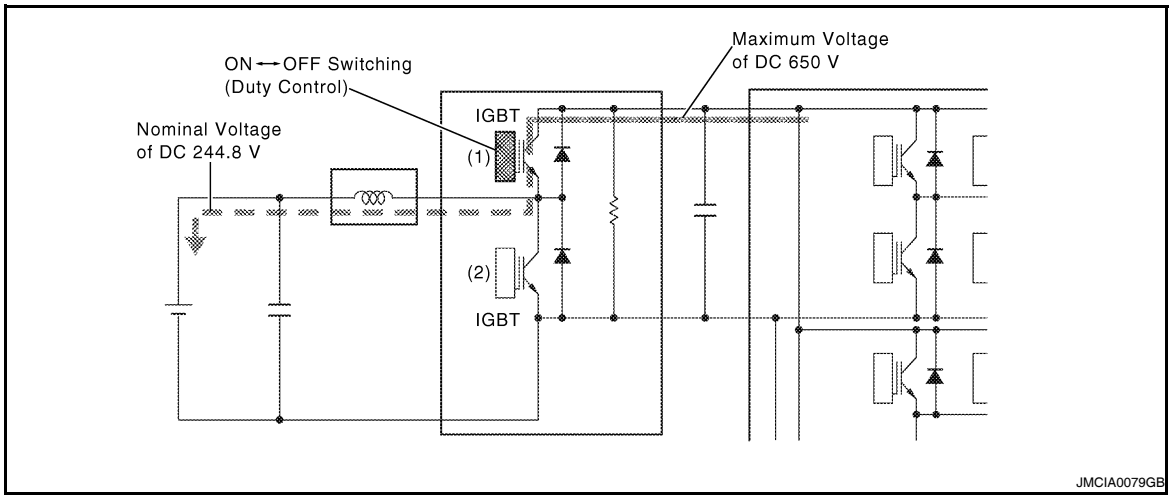
- In the next stage, when the voltage in the reactor rises to maximum voltage of DC 650 V, the IGBT (2) turns OFF, causing a counter electromotive force to be created.



- Induced by the counter electromotive force that is created, the electrical power (maximum voltage of DC 650 V) that is charging the reactor flows into the inverter.

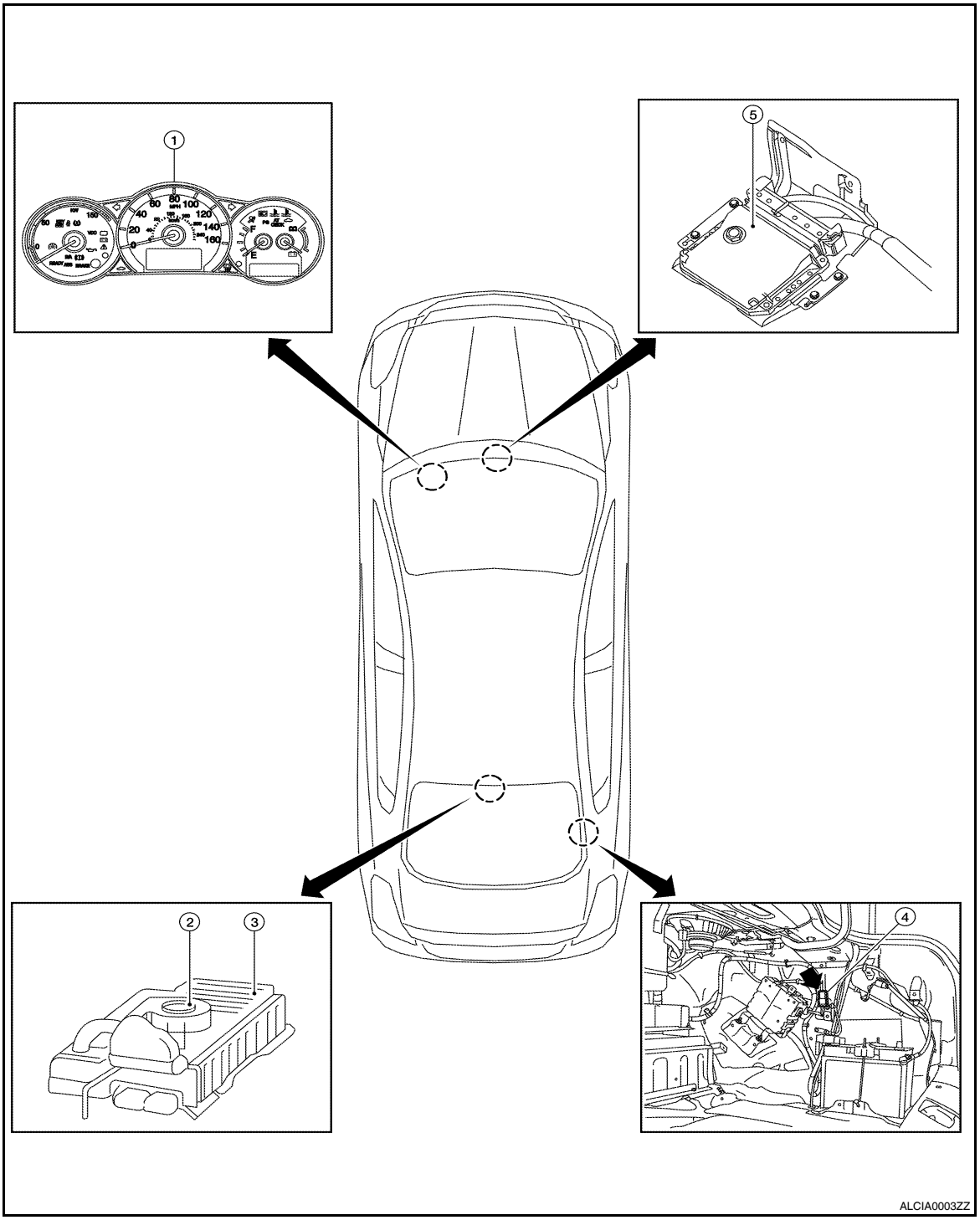
VOLTAGE DROP CONVERSION FUNCTION

The alternating current, which is generated by MG1 or MG2 for the purpose of charging the HV battery, is converted into maximum voltage of DC 650 V by the inverter. Then, a function of the boost converter drops the voltage to DC 244.8 V, the nominal voltage of the boost converter. This is accomplished by the IGBT (1) switching ON and OFF through duty cycle control, which intermittently interrupts the electrical power provided by the inverter.

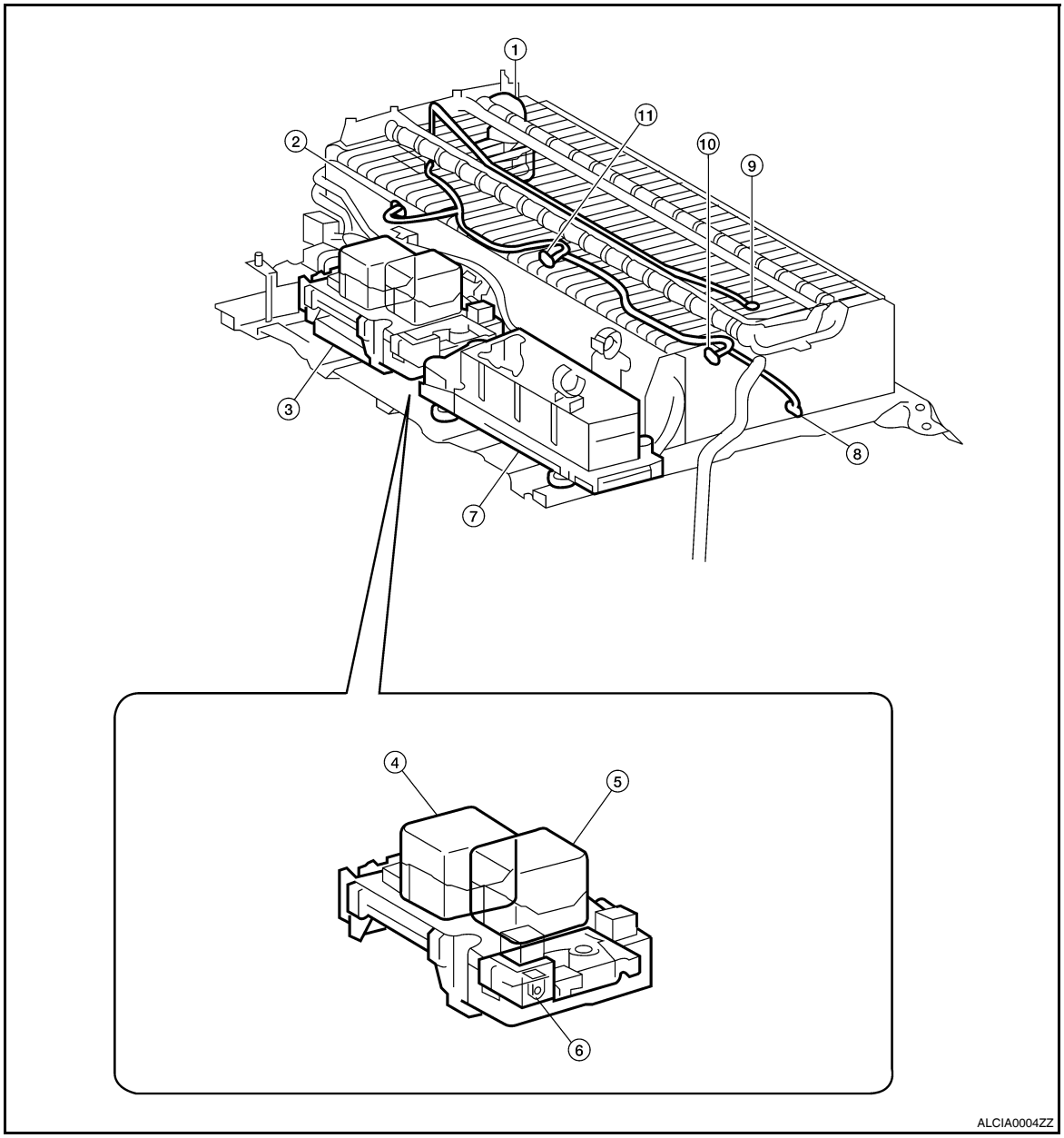


Component Parts Location

INFOID:0000000004212245



1. Combination meter
2. HV battery cooling fan
3. HV battery pack
4. HV battery cooling fan relay
5. Hybrid vehicle control ECU (located under heater box assembly)

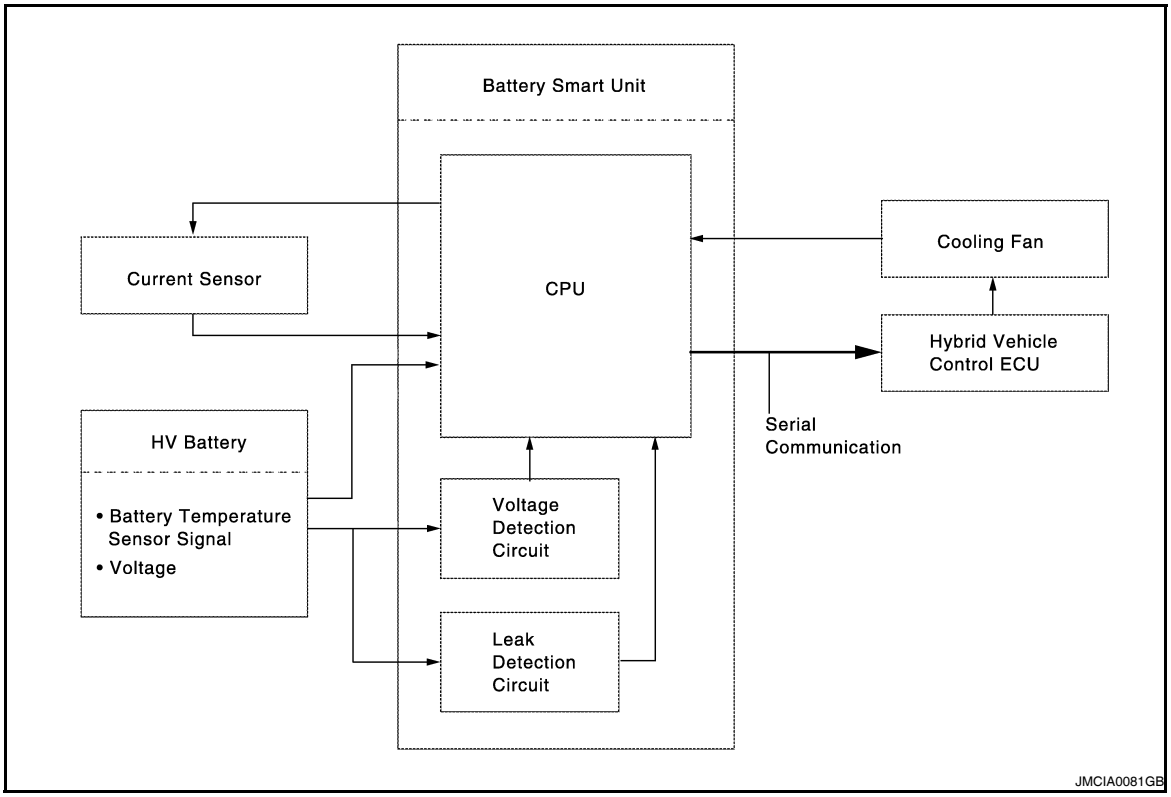


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

BATTERY CONTROL

System Diagram

INFOID:0000000004212246



System Description

INFOID:0000000004212247

BATTERY SMART UNIT

- The battery smart unit detects and transmits the HV battery condition signals (voltages, currents, and temperatures), which are used to determine charging or discharging values, to the hybrid vehicle control ECU.
- The battery smart unit also detects and transmits the cooling fan voltage signals which are necessary to effect cooling fan control, to the hybrid vehicle control ECU.
- A leak detection circuit is provided in the battery smart unit in order to detect any excessive current draw from the HV battery.

HV BATTERY

General

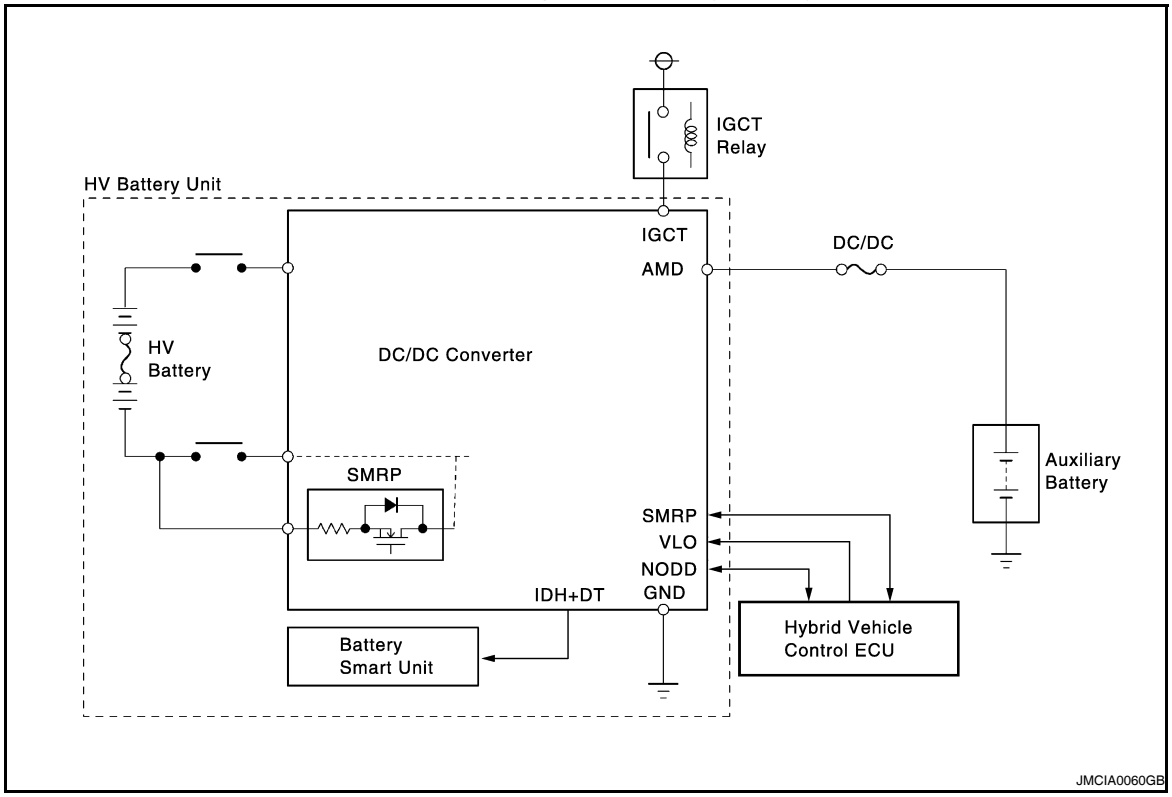
- The ALTIMA Hybrid model uses sealed nickel metal hybrid (Ni-MH) HV batteries. The HV batteries have a high power density, are lightweight and offer longevity to match the characteristics of the Hybrid Vehicle Control System. Because the Hybrid Vehicle Control System effects charge/discharge control to maintain the HV batteries at a constant SOC (state of charge) level while the vehicle is operating normally, it does not need to be recharged externally.
- The HV batteries use nickel-plated, metal container type cells to realize enhanced cooling performance and a compact construction. As a result, high power density, lightweight construction, and longevity have been accomplished at high levels.
- The HV battery unit consists of 34 separate batteries. The batteries each comprise 6 cells and they are connected to each other in series through a bus bar module. The cells of the batteries are connected at two locations in order to reduce the internal resistance and improve efficiency. The HV battery unit, which has a total of 204 cells (6 cells ×34 batteries) and a nominal voltage of 244.8 V (1.2 V ×204 cells), is located in the luggage compartment behind the rear seat.
- A junction block, battery smart unit and DC/DC converter are used. Integrated into the junction block are an SMRG (System Main Relay Ground), SMRB (System Main Relay Battery) and a current sensor.
  The battery smart unit monitors the HV battery. The DC/DC converter supplies power to the auxiliary battery after decreasing the nominal voltage of DC 244.8 V supplied by the HV battery to DC 12 V. Power to the

lights, audio system, air conditioning system (except the electric inverter compressor) and ECUs is supplied by the auxiliary battery.
The battery smart unit, junction block, and DC/DC converter are located in the battery front side carrier, which is in the same housing as the HV battery unit. This realizes a compact package.

- An air-cooling method, which uses a dedicated cooling fan to cool the HV battery with air from inside the cabin, is employed. A dedicated cooling fan is also provided for the DC/DC converter. Thus, highly efficient air-cooling has been achieved.
- A service plug that shuts off the circuit is provided in the middle of the HV battery modules (between No.15 and No.16 batteries). Before servicing any portion of the high-voltage circuit, be sure to remove the service plug.

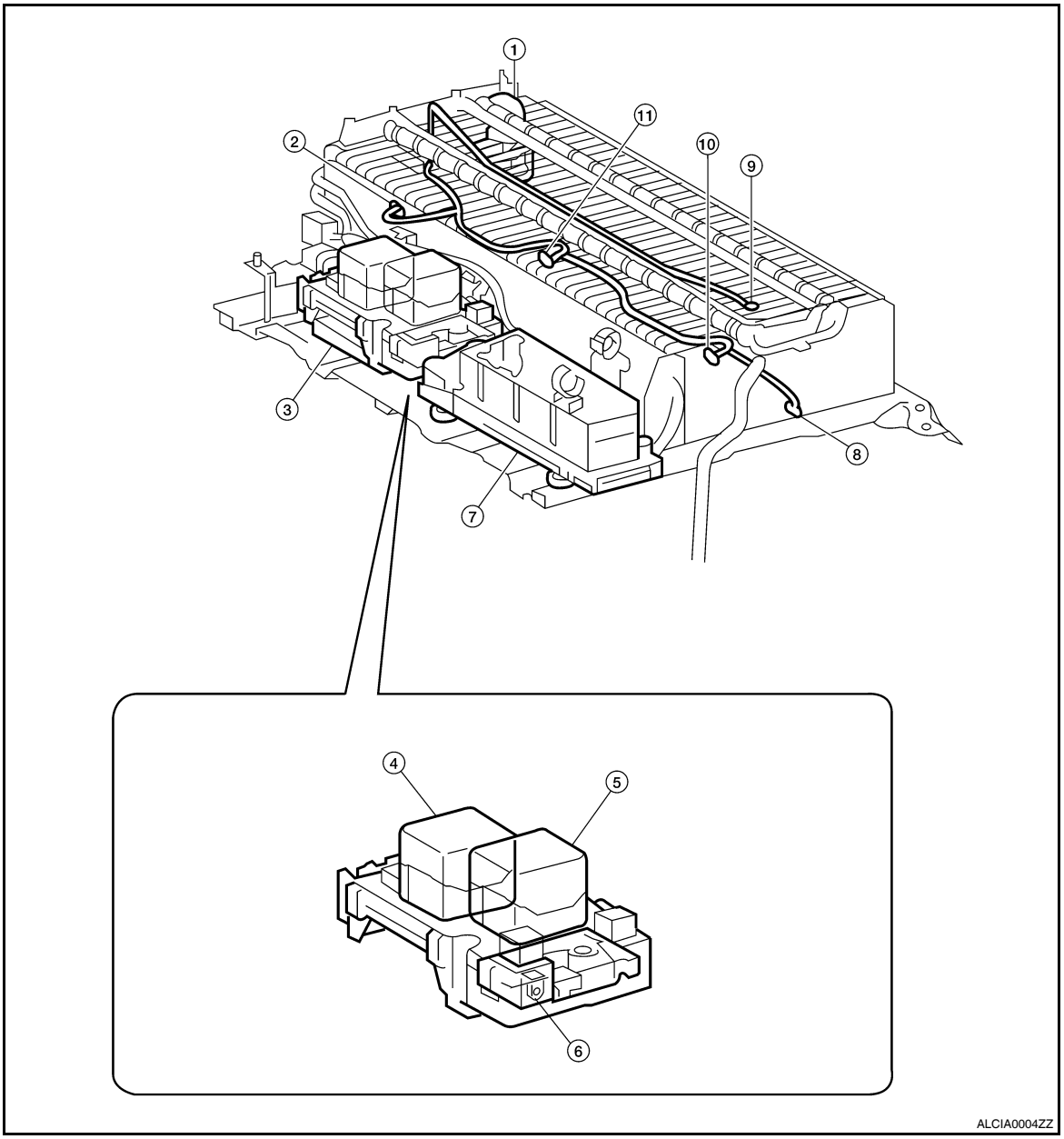
DC/DC Converter

The power source for auxiliary equipment of the vehicle such as the lights, audio system, and the air conditioning system (except electric inverter compressor), as well as the ECUs, is based on a DC 12 V system. Because the HV battery outputs the nominal voltage of DC 244.8 V, the converter is used to transform the voltage from DC 244.8 V to DC 12 V in order to recharge the auxiliary battery.



Junction Block

A junction block, in which an SMRG and SMRB are integrated, is used.



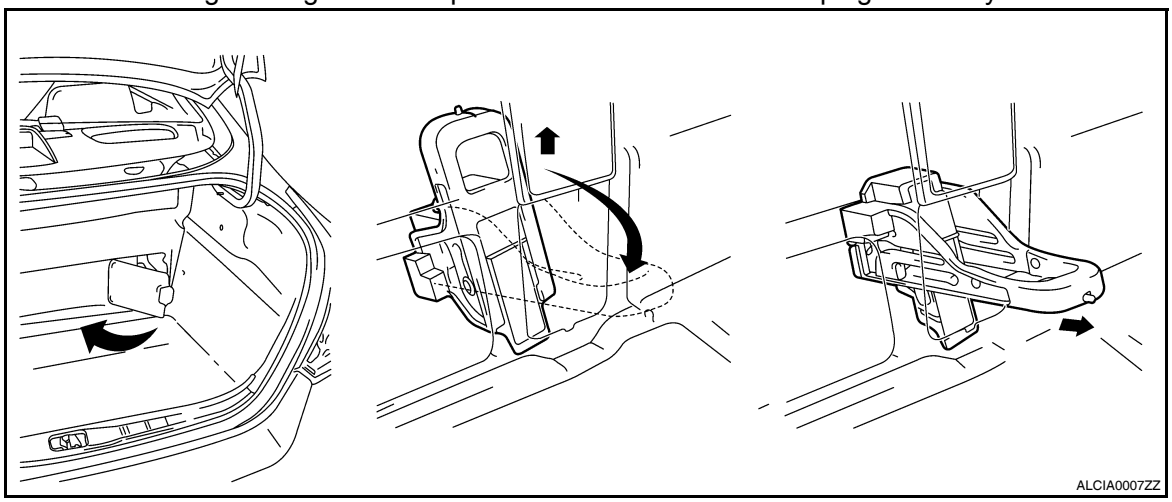
1. Service plug
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. HV converter
8. battery temperature sensor 3
9. Intake temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

Service Plug

By removing the service plug before performing any inspection or service, the high-voltage circuit is shut off at the intermediate position of the HV battery, thus ensuring safety during service.

The service plug assembly contains a reed switch for interlock. Lifting the clip lock up turns OFF the lead switch, which shuts off the SMR. However, to ensure safety, make sure to turn OFF the ignition switch before removing the service plug.

The main fuse for the high-voltage circuit is provided inside of the service plug assembly.



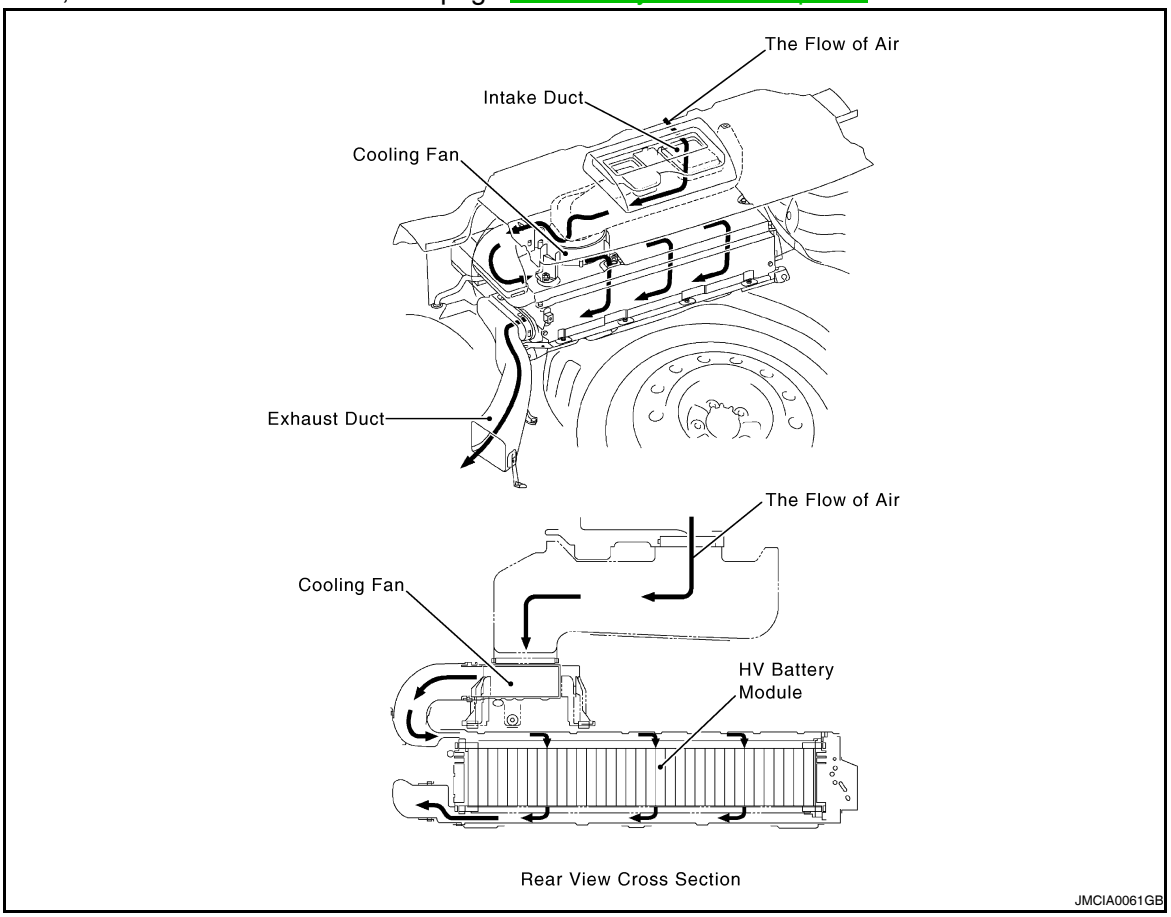
NOTE:
After the service, please do not start the system until the service plug is connected.

HV BATTERY AND DC/DC CONVERTER COOLING SYSTEM

HV Battery Cooling System

- A dedicated cooling system is used to ensure that the HV battery performs properly, despite it generating significant heat during the repetitive charge and discharge cycles.
  This cooling system employs an air-cooling method, which uses the dedicated cooling fan to cool the HV battery with air from inside the cabin.
- The air from inside the cabin, which is introduced through the intake duct located on the rear package tray trim, flows downwards through the battery module, reducing the temperature of the battery module, and is emitted from the vehicle through the exhaust duct.
- The hybrid vehicle control ECU controls the operation of the cooling fan for the HV battery. The hybrid vehicle control ECU receives the signals from the battery temperature sensor, which is built into the HV battery, via the battery smart unit. Then, it controls the cooling fan in order to control the battery module temperature appropriately.

For details, refer to THS ECU Control on page HBB-7, "System Description".



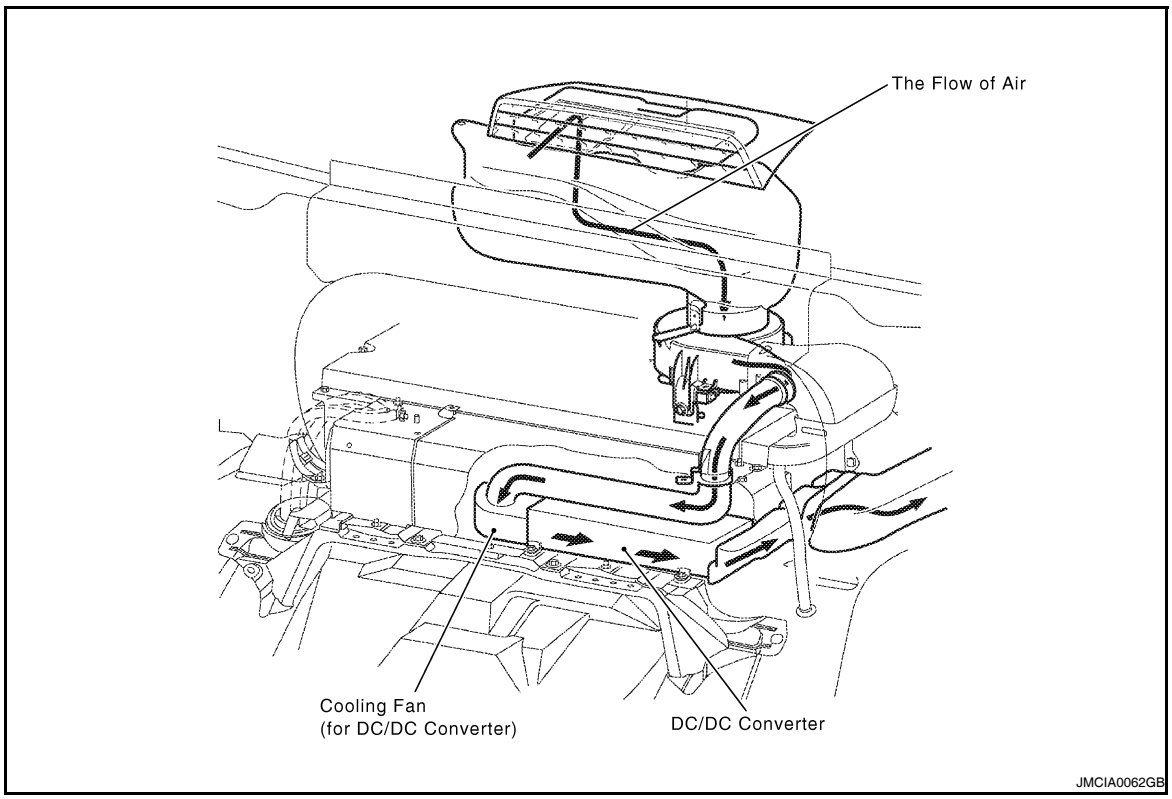
HV battery cooling fan specifications

Fan Type	Sirocco Fan
Motor Type	DC Motor (without Brush)

DC/DC Converter Cooling System

As with as the HV battery cooling system, the DC/DC converter cooling system uses a dedicated cooling fan to cool the converter. Air from inside the cabin is introduced through the intake duct located on the rear pack-

age tray trim. In addition, the converter itself is equipped with cooling fins. Thus, excellent air-cooling performance is achieved.

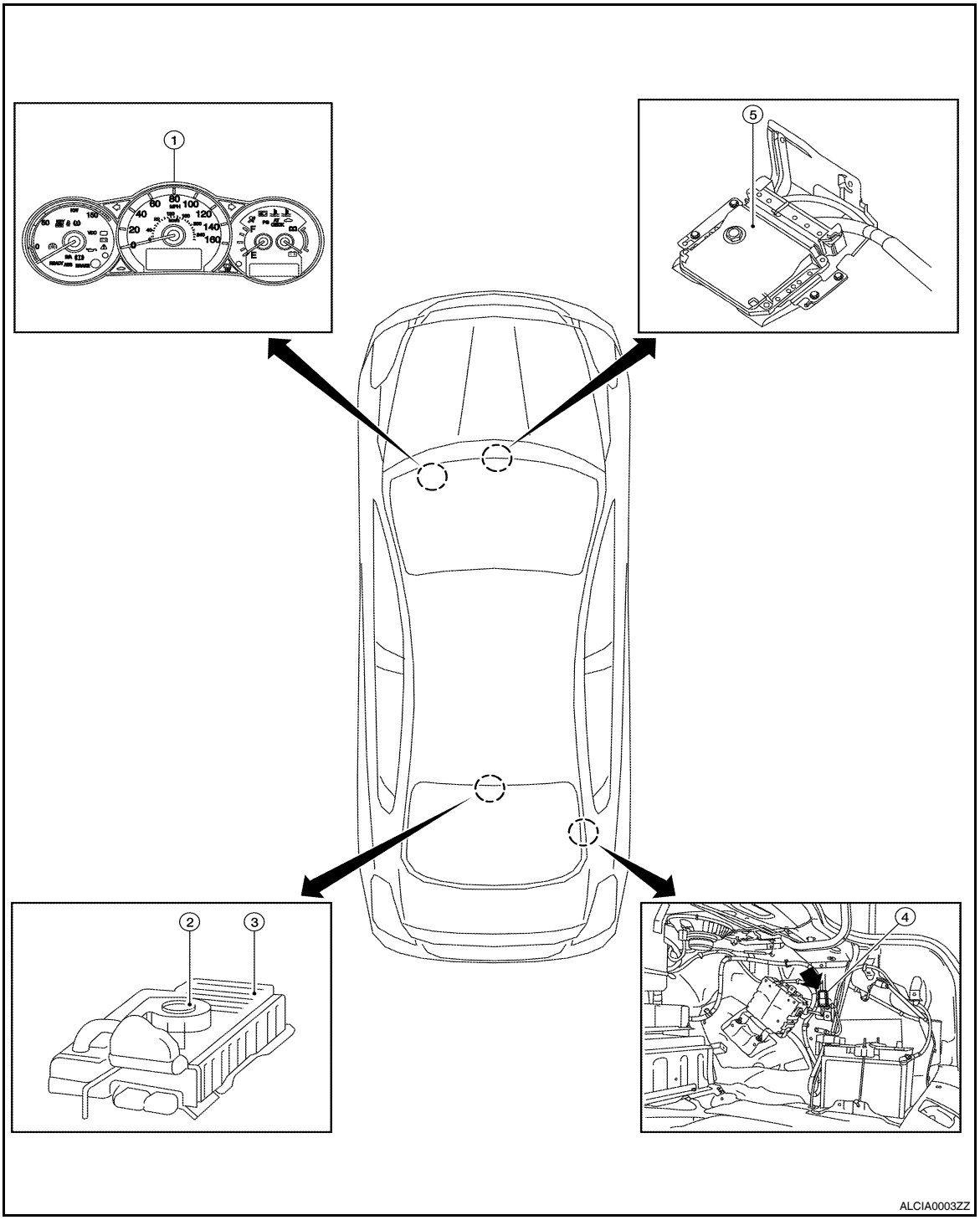


DC/DC converter cooling fan specifications

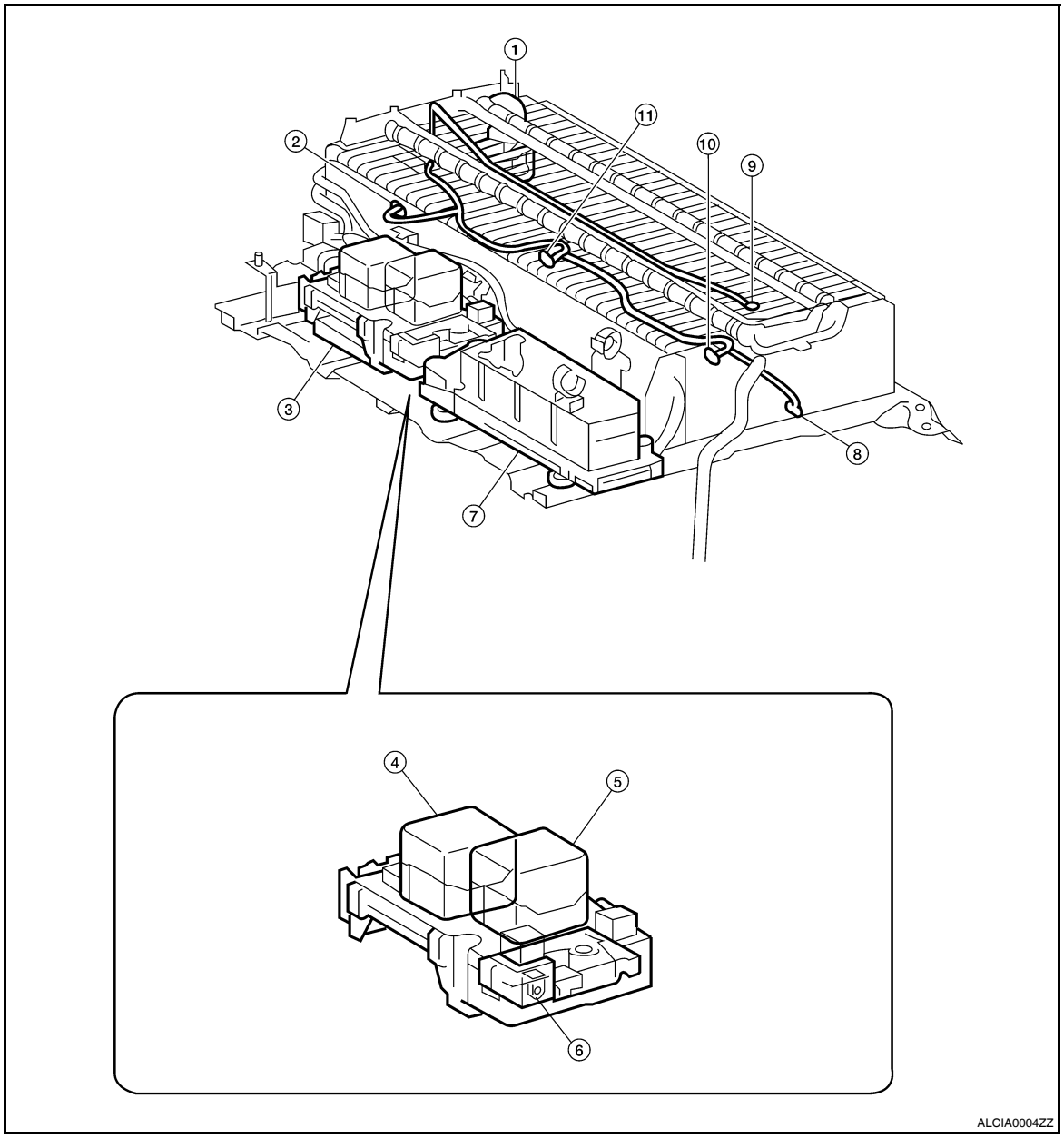
Type	Sirocco Fan
Motor Type	DC Motor (without Brush)

Component Parts Location

INFOID:0000000004212248



1. Combination meter
2. HV battery cooling fan
3. HV battery pack
4. HV battery cooling fan relay
5. Hybrid vehicle control ECU (located under heater box assembly)



1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

COMPONENT DIAGNOSIS

P0A1F-123

Description

INFOID:0000000004212249

The hybrid vehicle control ECU alerts the driver and performs fail safe control based on error signals sent from the battery smart unit.

DTC Logic

INFOID:0000000004212250

DTC DETECTION LOGIC

If the battery smart unit detects an internal malfunction in the unit itself, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A1F	123	Battery energy control module	Reception of an error signal from the battery smart unit	• Battery smart unit • Auxiliary battery • Wire harness or connector • Fuse (No. 69)

Diagnosis Procedure

INFOID:0000000004212251

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.
- After completing repairs, restart the system [turn ignition switch ON (READY)] and recheck for DTCs.

>> GO TO 2.

2.CHECK AUXILIARY BATTERY

1. Turn ignition switch OFF.
2. Measure the voltage between the terminals of the auxiliary battery.

Standard voltage: 11 to 14 V

OK or NG

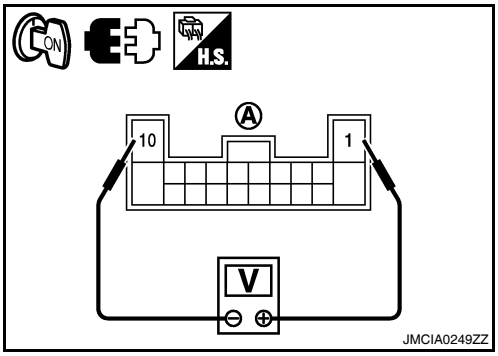
OK >> GO TO 3.
NG >> Charge or replace auxiliary battery.

3.CHECK HARNESS AND CONNECTOR (IGCT VOLTAGE)

CAUTION:
Be sure to wear insulated gloves.

1. Remove the service plug grip (Refer to HBB-92, "Precautions for Inspecting the Hybrid Control System").
2. Remove the battery smart unit (Refer to HBB-101, "Removal and Installation").
   NOTE:
   Do not disconnect the battery smart unit harness connectors.
3. Disconnect battery smart unit harness connector B130.
4. Turn ignition switch ON.

5. Measure the voltage according to the value(s) in the table below.



Battery Smart Unit (A)		Battery Smart Unit (A)		Voltage
Connector	Terminal	Connector	Terminal	
B130	1 (IGCT [LH6])	B130	10 (GND)	9 to 14 V

OK or NG

OK >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NG >> GO TO 4.

4. CHECK FUSE

1. Turn ignition switch OFF.
2. Remove 10A fuse (No. 69) from the high voltage fuse and fusible link box.
3. Measure the resistance of the fuse.

Standard resistance: Below 1Ω

OK or NG

OK >> GO TO 5.
NG >> Replace fuse.

5. CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - IGCT RELAY)

CAUTION:
Be sure to wear insulated gloves.

1. Install the 10A fuse (No. 69) to the high voltage fuse and fusible link box.
2. Remove the IGCT relay high voltage fuse and fusible link box.
3. Measure the resistance according to the value(s) in the table below.

Check for open

Battery Smart Unit		High voltage fuse and fusible link box		Resistance
Connector	Terminal	Connector	Terminal	
B130	1 (IGCT [LH6])	—	5	Below 1Ω

OK or NG

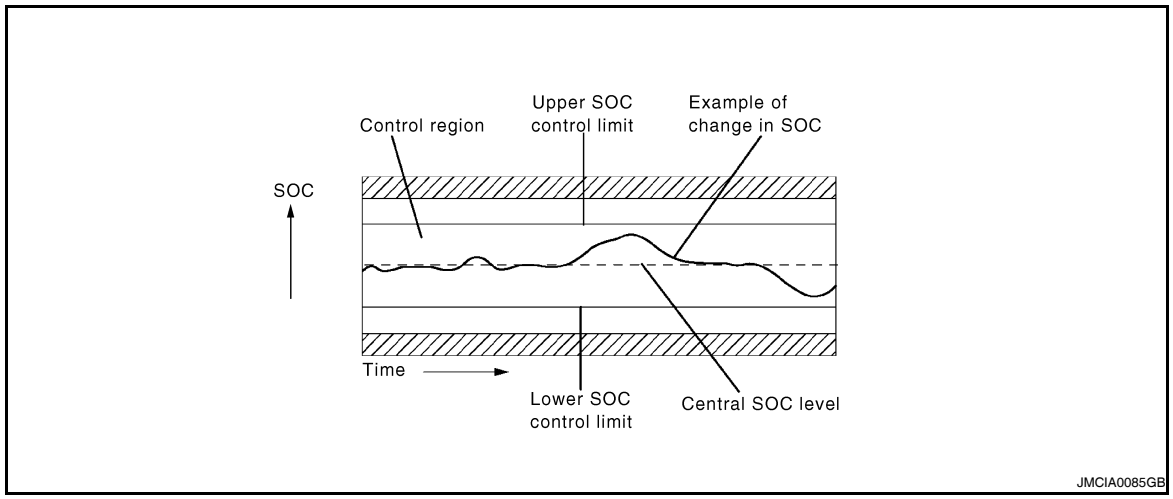
OK >> Check and repair power source circuit.
NG >> Repair or replace harness or connector.

P0A7F-123

Description

INFOID:0000000004212252

The battery smart unit and the hybrid vehicle control ECU calculate the SOC (state of charge) of the HV battery based on the accumulated amperage in the HV battery. The battery smart unit sends a signal indicating the condition of the HV battery to the hybrid vehicle control ECU. The hybrid vehicle control ECU then calculates the SOC based on this information and controls HV battery charge and discharge according to the driving conditions.



DTC Logic

INFOID:0000000004212253

DTC DETECTION LOGIC

The battery smart unit calculates the resistance of the HV battery using amperage and voltage, and uses this resistance to determine the extent of deterioration of the HV battery. If the battery smart unit detects that the resistance of the HV battery has exceeded the standard, it determines that a malfunction has occurred. In addition, the battery smart unit monitors the SOC, and if the difference between the maximum and minimum SOC values exceeds the standard, it determines that a malfunction has occurred. When either of the DTC detection conditions is met, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A7F	123	Hybrid battery pack deterioration	• Internal resistance of HV battery is higher than the standard (1 trip detection) • Difference in the capacity between battery block is larger than the standard (2 trip detection)	• HV battery • Battery smart unit

NOTE:
P0A7F cannot be set unless the vehicle is driven for approximately 10 minutes after clearing the DTCs.
(For 2 trip detection, turn ignition switch OFF and perform a road test again after the first road test.)

Diagnosis Procedure

INFOID:0000000004212254

1.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 2.

2.READ VALUE ON CONSULT-III

1. Ensure the safety of the areas in front and at the back of the vehicle.
2. Turn ignition switch ON (READY).
3. Select “V1 BATT BLOCK” to “V17 BATT BLOCK” in “DATA MONITOR” mode with CONSULT-III.

4. Fully warm up the engine and turn the air conditioning off.
5. Firmly depress the brake pedal with your left foot.
6. Move the shift lever to the D position.
7. Record each monitor item (V1 to V17 BATT BLOCK) while fully depressing the accelerator pedal.
8. Compare the battery block voltages (V1 to V17 BATT BLOCK) between the even and odd number groups in each combination shown in the table below.

Even number group	Odd number group	Battery block voltages to be compared
V1 BATT BLOCK	V2 BATT BLOCK	VB1 ←→ VB2
V3 BATT BLOCK	V4 BATT BLOCK	VB2 ←→ VB4
V5 BATT BLOCK	V6 BATT BLOCK	VB5 ←→ VB6
V7 BATT BLOCK	V8 BATT BLOCK	VB7 ←→ VB8
V9 BATT BLOCK	V10 BATT BLOCK	VB9 ←→ VB10
V11 BATT BLOCK	V12 BATT BLOCK	VB11 ←→ VB12
V13 BATT BLOCK	V14 BATT BLOCK	VB13 ←→ VB14
V15 BATT BLOCK	V16 BATT BLOCK	VB15 ←→ VB16
V17 BATT BLOCK	V16 BATT BLOCK	VB17 ←→ VB16

9. Check the voltage difference in the all 9 combinations.

The difference in voltage of all combinations is 0.3 V or more.

YES or NO

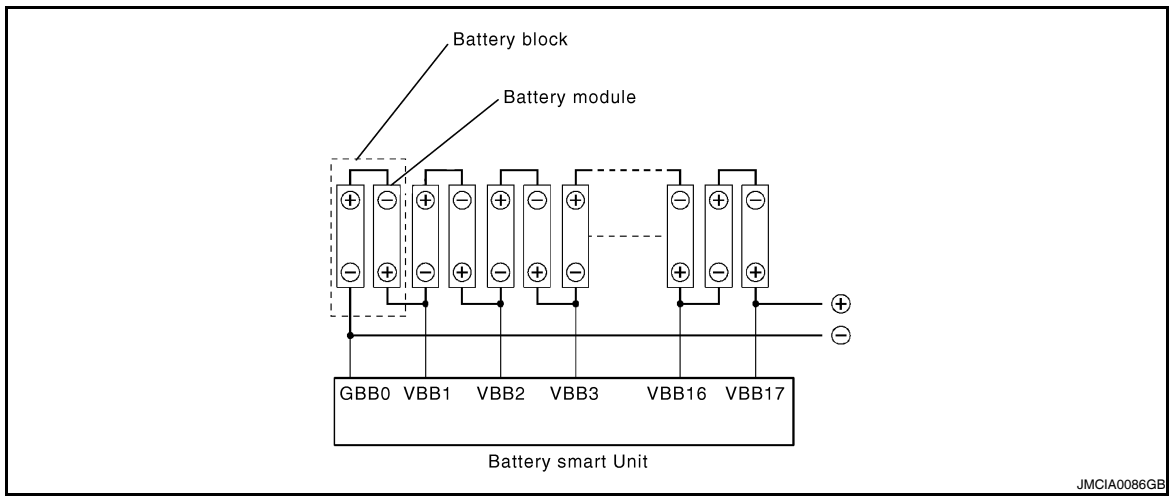
YES >> Replace battery smart unit (Refer to HBB-101, "Removal and Installation").
NO >> Replace HV battery (Refer to HBB-97, "Removal and Installation").

P0A80-123

Description

INFOID:0000000004212255

The hybrid vehicle control ECU controls the SOC (state of charge) of the HV battery at a constant level while driving. The HV battery is composed of 34 modules, and each module consists of six 1.2 V cells in series. The battery smart unit monitors battery block voltage at 17 locations. Each battery block is composed of 2 modules in a set.



DTC Logic

INFOID:0000000004212256

DTC DETECTION LOGIC

The battery smart unit, which monitors the voltage of the battery blocks, determines that a malfunction has occurred if a voltage difference between the battery blocks exceeds the standard. When the DTC detection condition is satisfied, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A80	123	Replace hybrid battery pack	Difference in voltage between battery blocks is larger than the standard (2 trip detection)	• HV battery • Battery smart unit

NOTE:
P0A80-123 cannot be set unless the vehicle is driven for approximately 10 minutes after clearing the DTCs. (Turn ignition switch OFF and perform a road test again after the first road test because this DTC is a 2 trip detection DTC.)

Diagnosis Procedure

INFOID:0000000004212257

1.CHECK FOR DTCS (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 2.

2.READ VALUE ON CONSULT-III

1. Ensure the safety of the areas in front and at the back of the vehicle.
2. Turn ignition switch ON (READY).
3. Select “V1 BATT BLOCK” to “V17 BATT BLOCK” in “DATA MONITOR” mode with CONSULT-III.
4. Fully warm up the engine and turn the air conditioning off.
5. Firmly depress the brake pedal with your left foot.
6. Move the shift lever to the D position.
7. Record each monitor item (V1 to V17 BATT BLOCK) while fully depressing the accelerator pedal.
8. Compare the battery block voltages (V1 to V17 BATT BLOCK) between the even and odd number groups in each combination shown in the table below.

Even number group	Odd number group	Battery block voltages to be compared
V1 BATT BLOCK	V2 BATT BLOCK	VB1 ←→ VB2
V3 BATT BLOCK	V4 BATT BLOCK	VB3 ←→ VB4
V5 BATT BLOCK	V6 BATT BLOCK	VB5 ←→ VB6
V7 BATT BLOCK	V8 BATT BLOCK	VB7 ←→ VB8
V9 BATT BLOCK	V10 BATT BLOCK	VB9 ←→ VB10
V11 BATT BLOCK	V12 BATT BLOCK	VB11 ←→ VB12
V13 BATT BLOCK	V14 BATT BLOCK	VB13 ←→ VB14
V15 BATT BLOCK	V16 BATT BLOCK	VB15 ←→ VB16
V17 BATT BLOCK	V16 BATT BLOCK	VB17 ←→ VB16

9. Check the voltage difference in the all 9 combinations.

The difference in voltage of all combinations is 0.3 V or more.

YES or NO

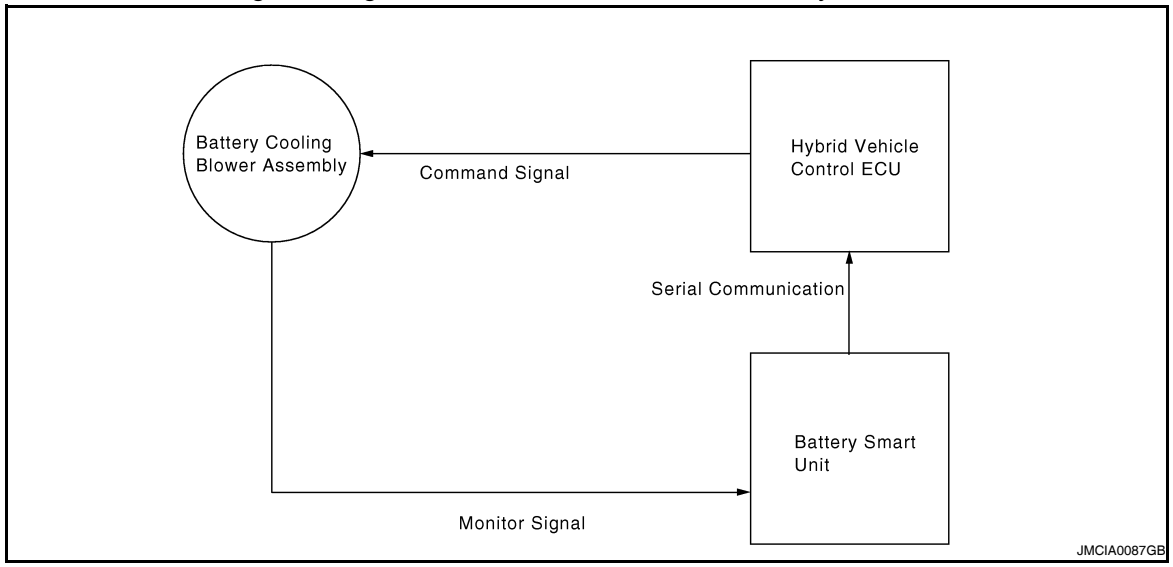
YES >> Replace battery smart unit (Refer to HBB-101, "Removal and Installation").
NO >> Replace HV battery (Refer to HBB-97, "Removal and Installation").

P0A82-123

Description

INFOID:0000000004212258

The speed of the battery cooling blower assembly is controlled by the hybrid vehicle control ECU. Battery cooling blower assembly power is supplied when the FCTL terminal of the hybrid vehicle control ECU turns ON the battery blower relay. The hybrid vehicle control ECU sends command signals (SI) to the battery cooling blower assembly to get the fan speed corresponding to the HV battery temperature.
Information about the voltage applied to the battery cooling blower assembly (VM) is sent to the hybrid vehicle control ECU as a monitor signal using serial communication via the battery smart unit.



DTC Logic

INFOID:0000000004212259

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A82	123	Hybrid battery pack cooling fan 1	The speed of the battery cooling blower assembly is not within the specified range (1 trip detection)	• Battery cooling blower assembly • Battery smart unit • HV battery intake duct • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004212260

1.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

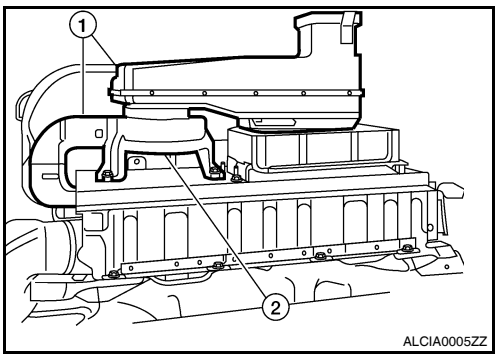
YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 2.

2.CHECK DUCT AND BLOWER

1. Turn ignition switch OFF.
2. Check that the intake ducts (1) and battery cooling blower (2) are not disconnected, damaged, or clogged with foreign objects, and that the acoustical materials have not peeled.

Refer to HBB-97, "Removal and Installation".

The ducts and blower are not disconnected, damaged, or clogged with foreign objects and the acoustical materials have not peeled.



OK or NG

OK >> GO TO 3.
NG >> Correct the problem

3. CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HYBRID VEHICLE CONTROL ECU)

1. Disconnect the battery cooling blower assembly harness connector.
2. Disconnect the hybrid vehicle control ECU harness connector E66.
3. Measure the resistance according to the value(s) in the table below.

Battery cooling blower assembly		Ground	Resistance
Connector	Terminal		
B128	3 (SIO)	Ground	10 kΩ or higher

Hybrid vehicle control ECU		Ground	Resistance
Connector	Terminal		
E66	105 (SIO)	Ground	10 kΩ or higher

OK or NG

OK >> GO TO 4.
NG >> Repair or replace harness or connector.

4. CHECK HYBRID VEHICLE CONTROL ECU (GROUND SHORT CHECK)

1. Remove the hybrid vehicle control ECU (Refer to HBC-644, "Removal and Installation").
2. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Hybrid vehicle control ECU		Resistance
Connector	Terminal	Connector	Terminal	
E66	105 (SIO)	E66	181 (EC)	10 kΩ or higher
			183 (E1)	
		E65	10 (EO2)	
			11 (EO1)	
			12 (E12)	

OK or NG

OK >> GO TO 5.
NG >> Replace hybrid vehicle control ECU.

5. READ VALUE ON CONSULT-III

1. Connect the battery cooling blower assembly connector.
2. Connect the hybrid vehicle control ECU harness connectors E65, E66.
3. Turn ignition switch ON.
4. Select “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III.
   NOTE:
   Before performing “ACTIVE TEST”, check “COOLING FAN MODE1” in “DATA MONITOR” mode. If “COOLING FAN MODE1” indicates 1 to 6, it is not necessary to perform “ACTIVE TEST”.
5. Select each air volume mode (1 to 6) in “COOLING FAN SPD” to operate the battery cooling blower assembly.

6. While the cooling fan is operating, compare the value indicated by “VMF FAN VOLT 1” with the voltage value that was actually measured at the battery cooling blower assembly connector.

Battery cooling blower assembly		Battery cooling blower assembly		Condition
Connector	Terminal	Connector	Terminal	
B128	2 (VMO)	B128	4 (GNDO)	There is no difference between the value indicated by “VMF FAN VOLT 1” and the voltage value that was actually measured at the battery cooling blower assembly connector.

Difference of voltage is 1 V or less.

OK or NG

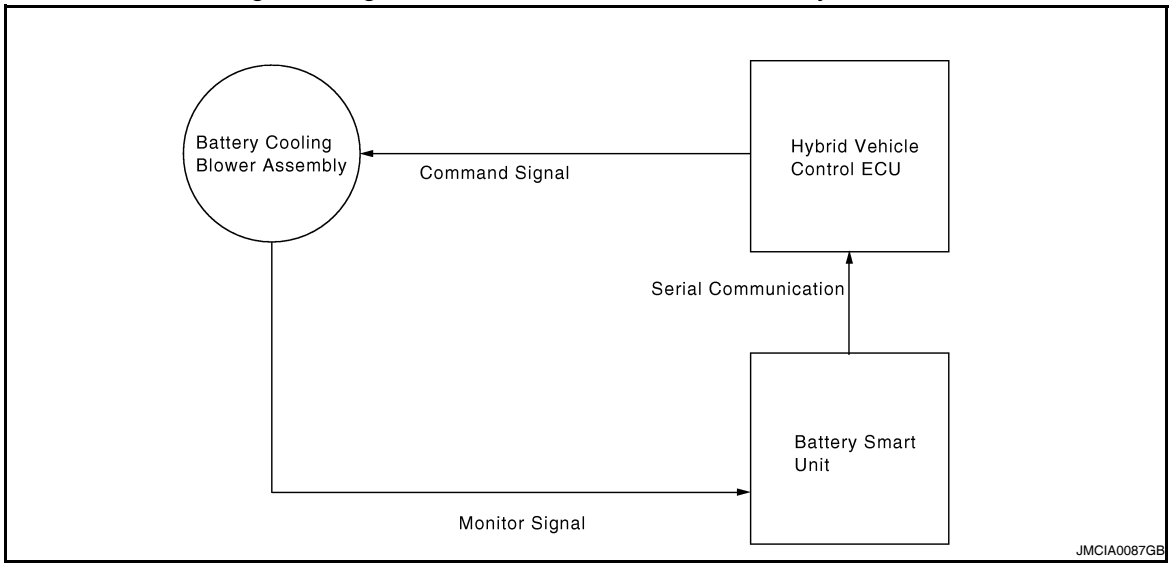
OK >> Replace battery cooling blower assembly. (Refer to HBB-106, "Removal and Installation").
NG >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").

P0A84-123

Description

INFOID:0000000004212261

The speed of the battery cooling blower assembly is controlled by the hybrid vehicle control ECU. Battery cooling blower assembly power is supplied when the FCTL terminal of the hybrid vehicle control ECU turns ON the battery blower relay. The hybrid vehicle control ECU sends command signals (SI) to the battery cooling blower assembly to get the fan speed corresponding to the HV battery temperature.
Information about the voltage applied to the battery cooling blower assembly (VM) is sent to the hybrid vehicle control ECU as a monitor signal using serial communication via the battery smart unit.



DTC Logic

INFOID:0000000004212262

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A84	123	Hybrid battery pack cooling fan 1	When the output voltage of the battery cooling blower assembly (VM) is too low compared to the target control voltage range (1 trip detection)	• Wire harness or connector • Fuse • Battery blower relay • Battery cooling blower assembly • Battery smart unit • Hybrid vehicle control ECU • HV battery

Diagnosis Procedure

INFOID:0000000004212263

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks.
- After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3. PERFORM ACTIVE TEST USING CONSULT-III

1. Select “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III.
   NOTE:
   Before performing “ACTIVE TEST”, check “COOLING FAN MODE1” in “DATA MONITOR” mode.
   If “COOLING FAN MODE1” indicates 1 to 6, it is not necessary to perform “ACTIVE TEST”.
2. Select air volume mode 6 in “COOLING FAN SPD” to operate the battery cooling blower assembly.
3. Check that the fan operates and air is sucked into the inlet duct of the package tray trim panel assembly.
   NOTE:
   The cooling fan may not stop even when turning the cooling fan off in the “COOLING FAN SPD”.
   This is due to HV system control and not a malfunction.

The fan operates

OK or NG

OK >> GO TO 15.
NG >> GO TO 4.

4. CHECK FUSE

1. Turn ignition switch OFF.
2. Measure the resistance of 15A fuse (No.64).

Standard resistance: Below 1Ω

OK or NG

OK >> GO TO 8.
NG >> GO TO 5.

5. REPLACE FUSE

Replace fuse.

>> GO TO 6.

6. CHECK HARNESS AND CONNECTOR (FUSE - BODY GROUND)

1. Remove 15A fuse (No.64) from the high voltage fuse and fusible link box.
2. Remove HV battery fan relay from the high voltage fuse and fusible link box.
3. Measure the resistance according to the value(s) in the table below.

high voltage fuse and fusible link box		Ground	Resistance
Connector	Terminal		
2	Fuse (No. 64)	Ground	10 kΩ or higher
3 or 1	HV battery fan relay		

NOTE:
When taking measurements with an electrical tester, do not apply excessive force to the tester probes to avoid damaging the fuse holder or terminals.

OK or NG

OK >> GO TO 7.
NG >> Repair or replace harness or connector.

7. CHECK HARNESS AND CONNECTOR (BATTERY COOLING BLOWER - BODY GROUND)

1. Disconnect the battery cooling blower assembly connector. Refer to HBB-106, "Removal and Installation".
2. Measure the resistance according to the value(s) in the table below.

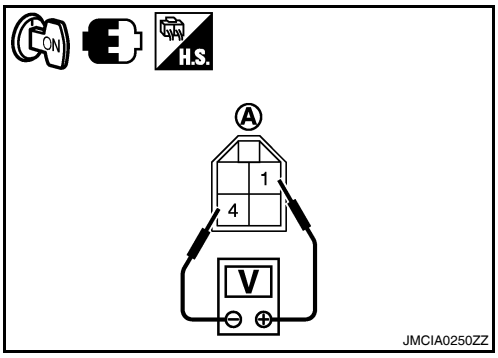
Battery cooling blower assembly		Ground	Resistance
Connector	Terminal		
B128	1 (IGO)	Ground	10 kΩ or higher

OK or NG

OK >> Replace battery cooling blower assembly (Refer to HBB-106, "Removal and Installation").
NG >> Repair or replace harness or connector.

8. CHECK HARNESS AND CONNECTOR (VOLTAGE)

1. Turn switch ON.
2. Measure the voltage according to the value(s) in the table below.



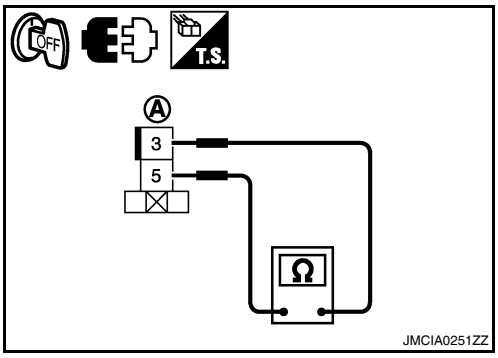
Battery cooling blower assembly (A)		Battery cooling blower assembly (A)		Voltage
Connector	Terminal	Connector	Terminal	
B128	1 (IGO)	B128	4 (GNDO)	10 to 14V

OK or NG

OK >> GO TO 15.
NG >> GO TO 9.

9. INSPECT RELAY (BATTERY FAN)

1. Turn ignition switch OFF.
2. Remove HV battery fan relay from the high voltage fuse and fusible link box.
3. Measure the resistance according to the value(s) in the table below.



HV battery fan relay (A)		HV battery fan relay (A)		Resistance
Connector	Terminal	Connector	Terminal	
B111	3	B111	5	10 kΩ or higher
	3		5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

OK or NG

OK >> GO TO 10.
NG >> Replace HV battery fan relay.

10. CHECK HARNESS AND CONNECTOR (BATT FAN FUSE - HV BATTERY FAN RELAY)

Measure the resistance according to the value(s) in the table below.

high voltage fuse and fusible link box		high voltage fuse and fusible link box		Resistance
Connector	Terminal	Connector	Terminal	
—	Fuse (No. 64)	HV battery fan relay	1	Below 1 Ω
			3	

NOTE:
When taking measurements with an electrical tester, do not apply excessive force to the tester probes to avoid damaging the fuse holder or terminals.

OK or NG

OK >> GO TO 11.
NG >> Repair or replace harness or connector.

11. CHECK HARNESS AND CONNECTOR (HV BATTERY FAN RELAY - HYBRID VEHICLE CONTROL ECU)

1. Disconnect the hybrid vehicle control ECU harness connector E66.

2. Measure the resistance according to the value(s) in the table below.

high voltage fuse and fusible link box		Hybrid vehicle control ECU		Resistance
Connector	Terminal	Connector	Terminal	
HV battery fan relay	2	E66	186 (FCTL)	Below 1 Ω

NOTE:
When taking measurements with an electrical tester, do not apply excessive force to the tester probes to avoid damaging the fuse holder or terminals.

3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

high voltage fuse and fusible link box		Ground	Voltage
Connector	Terminal		
HV battery fan relay	2	Ground	Below 1 V

Hybrid vehicle control ECU		Ground	Voltage
Connector	Terminal		
E66	186 (FCTL)	Ground	Below 1 V

NOTE:
When taking measurements with an electrical tester, do not apply excessive force to the tester probes to avoid damaging the fuse holder or terminals.

OK or NG

OK >> GO TO 12.
NG >> Repair or replace harness or connector.

12. CHECK HARNESS AND CONNECTOR (HV BATTERY FAN RELAY - BATTERY COOLING BLOWER)

Measure the resistance according to the value(s) in the table below.

HV battery fan relay		Battery cooling blower assembly		Resistance
Connector	Terminal	Connector	Terminal	
B111	5	B128	1 (IGO)	Below 1 Ω

NOTE:
When taking measurements with an electrical tester, do not apply excessive force to the tester probes to avoid damaging the fuse holder or terminals.

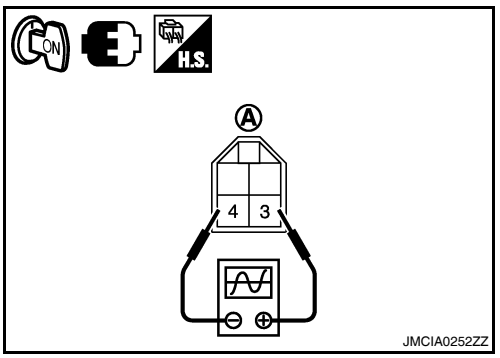
OK or NG

OK >> Repair or replace harness or connector.
NG >> Replace the hybrid vehicle control ECU (Refer to HBC-644, "Removal and Installation").

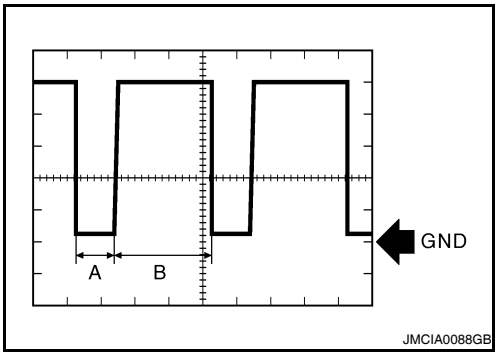
13. CHECK WAVEFORM

1. Install the 15A fuse to the high voltage fuse and fusible link box.
2. Connect the battery cooling blower assembly connector.
3. Connect an oscilloscope between connector terminals 3 (SI0) and 4 (GNDO) of the battery cooling blower assembly.
4. Turn ignition switch ON.
5. Select “COOLING FAN SPD” in “ACTINE TEST” mode with CONSULT-III.
6. Select air volume mode 1 to 6 in “COOLING FAN SPD” to operate the battery cooling blower assembly.

7. Measure the waveform.



Item	Contents
Cooling blower assembly terminal (A)	3 (SIO) and 4 (GNDO)
Equipment Setting	1 V/DIV., 500 us/DIV.
Condition	Ignition switch ON or READY



NOTE:
- A and B in the DUTY waveform shown in the illustration vary depending on the cooling fan mode.
- The actual duty command value is influenced by variance in fan motors and the change of power supply voltage.

OK or NG

OK >> Replace battery cooling blower assembly (Refer to HBB-106, "Removal and Installation").
NG >> GO TO 14.

14. CHECK HARNESS AND CONNECTOR (BATTERY COOLING BLOWER - HYBRID VEHICLE CONTROL ECU)

1. Turn ignition switch OFF.
2. Disconnect the battery cooling blower assembly connector.
3. Disconnect the hybrid vehicle control ECU harness connector E66.
4. Measure the resistance according to the value(s) in the table below.

Battery cooling blower assembly		Hybrid vehicle control ECU		Resistance
Connector	Terminal	Connector	Terminal	
B128	3 (SIO)	E66	105 (SIO)	Below 1 Ω

Battery cooling blower assembly		Ground	Resistance
Connector	Terminal		
B128	3 (SIO)	Ground	10 kΩ or higher

Hybrid vehicle control ECU		Ground	Resistance
Connector	Terminal		
E66	105 (SIO)	Ground	10 kΩ or higher

OK or NG

OK >> Replace the hybrid vehicle control ECU (Refer to HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

15. CHECK BATTERY COOLING BLOWER ASSEMBLY (VOLTAGE)

1. Turn ignition switch ON.
2. Select “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III.

NOTE:

Check “COOLING FAN 1” in the “DATA MODE” using the CONSULT-III. If the “COOLING FAN 1” is 1 to 6, it is not necessary to perform the “ACTIVE TEST”.

3. Select each air volume mode (1 to 6) in “COOLING FAN SPD” to operate the battery cooling blower assembly.
4. While the cooling fan is operating, compare the value indicated by “VMF FAN VOLT 1” with the voltage value that was actually measured at the battery cooling blower assembly connector.

Battery cooling blower assembly		Battery cooling blower assembly		Condition
Connector	Terminal	Connector	Terminal	
B128	2 (VMO)	B128	4 (GNDO)	There is no difference between the value indicated by “VMF FAN VOLT 1” and the voltage value that was actually measured at the battery cooling blower assembly connector.

Difference of voltage is 1 V or less

OK or NG

OK >> GO TO 16.
NG >> Replace battery cooling blower assembly (Refer to HBB-106, "Removal and Installation").

16. CHECK AND CONNECTOR (BATTERY COOLING BLOWER - BATTERY SMART UNIT)

CAUTION:
Be sure to wear insulated gloves.

1. Remove the service plug grip (Refer to GI-24, "Precautions For High-Voltage System").
2. Remove the battery smart unit (Refer to HBB-101, "Removal and Installation").
3. Disconnect the battery smart unit harness connector B130.
4. Measure the resistance according to the value(s) in the table below.

Check for open

Battery cooling blower assembly		Battery smart unit		Resistance
Connector	Terminal	Connector	Terminal	
B128	2 (VMO)	B130	9 (VM)	Below 1 Ω

Check for short

Battery cooling blower assembly		Ground	Resistance
Connector	Terminal		
B128	2 (VMO)	Ground	10 kΩ or higher

Battery smart unit		Ground	Resistance
Connector	Terminal		
B130	9 (VM)	Ground	10 kΩ or higher

OK or NG

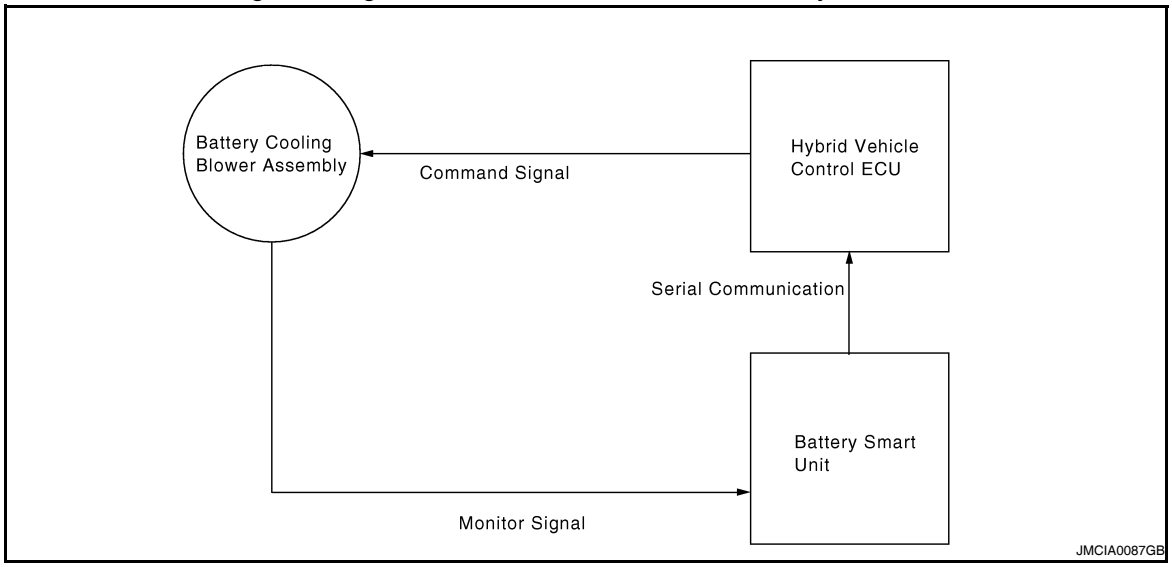
OK >> Replace battery smart unit (Refer to HBB-101, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A85-123

Description

INFOID:0000000004212264

The speed of the battery cooling blower assembly is controlled by the hybrid vehicle control ECU. Battery cooling blower assembly power is supplied when the FCTL terminal of the hybrid vehicle control ECU turns ON the battery blower relay. The hybrid vehicle control ECU sends command signals (SI) to the battery cooling blower assembly to get the fan speed corresponding to the HV battery temperature.
Information about the voltage applied to the battery cooling blower assembly (VM) is sent to the hybrid vehicle control ECU as a monitor signal using serial communication via the battery smart unit.



DTC Logic

INFOID:0000000004212265

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A85	123	Hybrid battery pack cooling fan 1	When the output voltage of the battery cooling blower assembly (VM) is too high compared to the target control voltage range (1 trip detection)	• Wire harness or connector • Battery cooling blower assembly • Battery smart unit • HV battery

Diagnosis Procedure

INFOID:0000000004212266

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

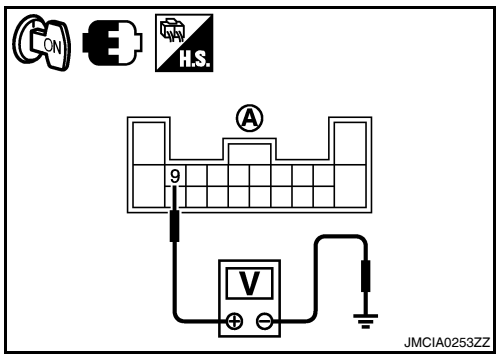
Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3. CHECK HARNESS AND CONNECTOR (VOLTAGE)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Remove the service plug grip (Refer to GI-24, "Precautions For High-Voltage System").
3. Remove the battery smart unit (Refer to HBB-101, "Removal and Installation").
   NOTE:
   Do not disconnect the battery smart unit connectors.
4. Turn ignition switch ON.
5. Select “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III.
   NOTE:
   Before performing “ACTIVE TEST”, check “COOLING FAN 1” indication in “DATA MONITOR” mode. If “COOLING FAN 1” indicates 1 to 6, it is not necessary to perform the “ACTIVE TEST”.
6. Select each air volume mode (1 to 6) in “COOLING FAN SPD” to operate the battery cooling blower assembly.
7. Measure the voltage according to the value(s) in the table below while the cooling fan is operating.



Battery smart unit (A)		Ground	Voltage
Connector	Terminal		
B130	9 (VM)	Ground	Below 5 V

OK or NG

OK >> GO TO 6.
NG >> GO TO 4.

4. CHECK HARNESS AND CONNECTOR (BATTERY COOLING BLOWER - BATTERY SMART UNIT)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Disconnect battery smart unit harness connector B130.
3. Measure the resistance according to the value(s) in the table below.

Battery cooling blower assembly		Ground	Resistance
Connector	Terminal		
B128	2 (VMO)	Other terminal	10 kΩ or higher

Battery smart unit		Ground	Resistance
Connector	Terminal		
B130	9 (VM)	Other terminal	10 kΩ or higher

OK or NG

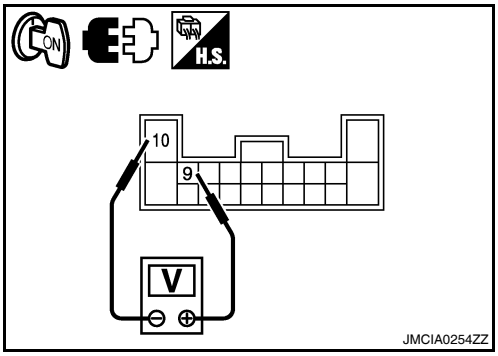
OK >> GO TO 5.
NG >> Repair or replace harness or connector.

5. CHECK BATTERY SMART UNIT (VOLTAGE)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch ON.

2. Measure the voltage according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Voltage
Connector	Terminal	Connector	Terminal	
B130	9 (VM)	B130	10 (GND)	Below 5 V

OK or NG

OK >> Replace battery cooling blower assembly (Refer to HBB-106, "Removal and Installation").

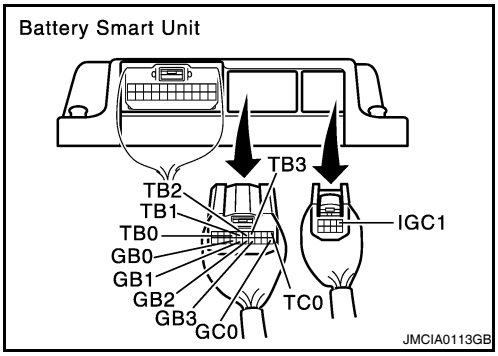
NG >> Replace battery smart unit (Refer to HBB-101, "Removal and Installation").

6. CHECK HV BATTERY (BATTERY TEMPERATURE SENSOR AND INTAKE AIR TEMPERATURE SENSOR)

CAUTION:

Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Disconnect the battery smart unit harness connectors.
3. Measure the resistance according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Resistance
Connector	Terminal	Connector	Terminal	
—	TB0	B130	1 (IGCT [LH6])	10 kΩ or higher
	GB0			
	TB1			
	GB1			
	TB2			
	GB2			
	TB3			
	GB3			
	TC0			
	GC0			

OK or NG

OK >> Replace battery smart unit (Refer to HBB-101, "Removal and Installation").

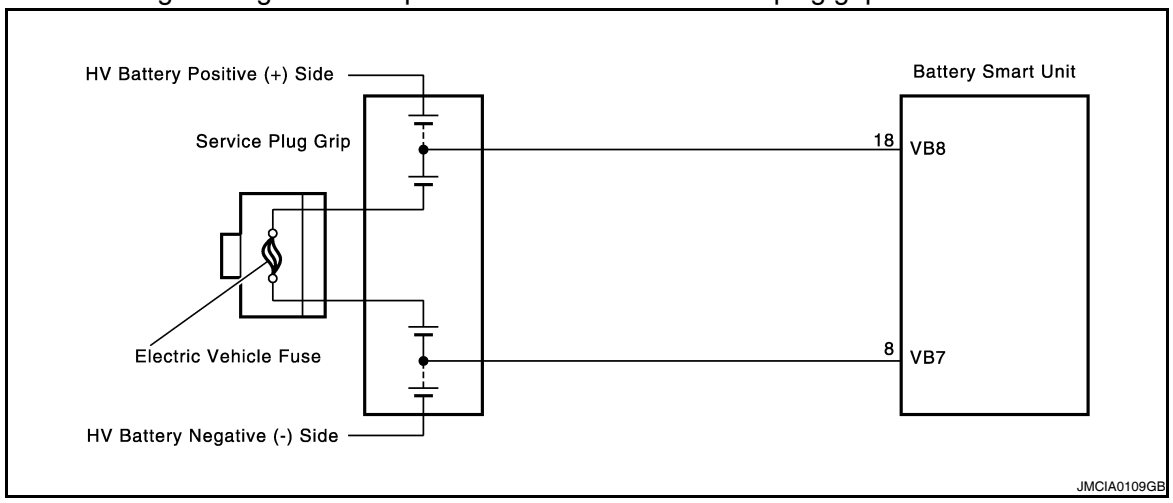
NG >> Replace HV battery (Refer to HBB-97, "Removal and Installation").

P0A95-123

Description

INFOID:0000000004212267

The main fuse for high-voltage circuit is provided inside of the service plug grip.



DTC Logic

INFOID:0000000004212268

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A95	123	High voltage fuse	Voltage between VB7 and VB8 terminals is below the standard despite the interlock switch being engaged (1 trip detection)	• Service plug grip • HV battery • Battery smart unit

Diagnosis Procedure

INFOID:0000000004212269

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3.CHECK FOR DTC (DTCS OTHER THAN P0A95-123)

1. Turn ignition switch ON.
2. Check DTC.

Are DTCs other than P0A95-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 4.

4. INSPECT SERVICE PLUG GRIP

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Remove the service plug grip (Refer to GI-24, "Precautions For High-Voltage System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.
3. Measure the resistance between the terminals of the service plug grip.

Standard resistance: Below 1Ω

OK or NG

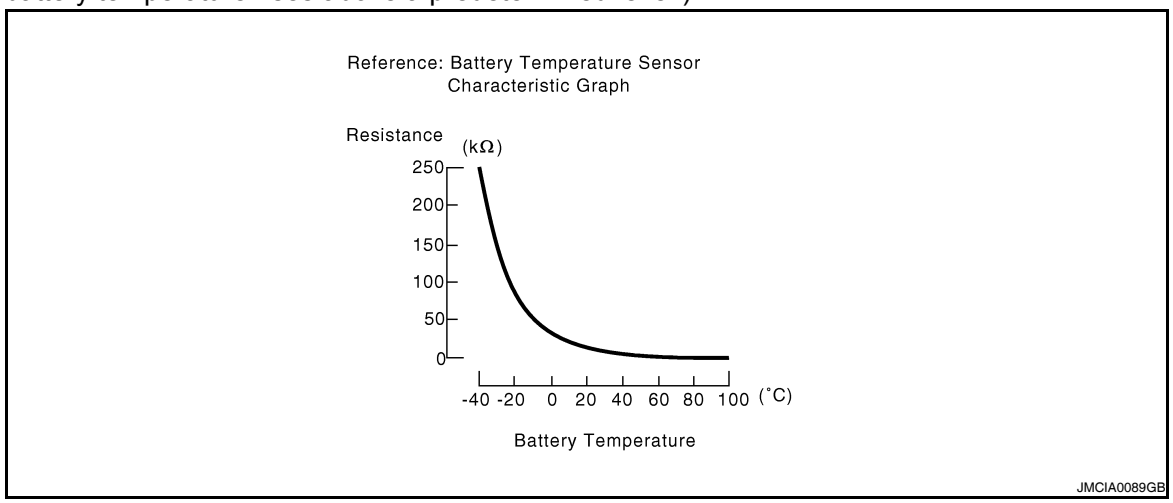
OK >> Replace HV battery (Refer to HBB-97, "Removal and Installation").
NG >> Replace service plug grip (Refer to GI-24, "Precautions For High-Voltage System").

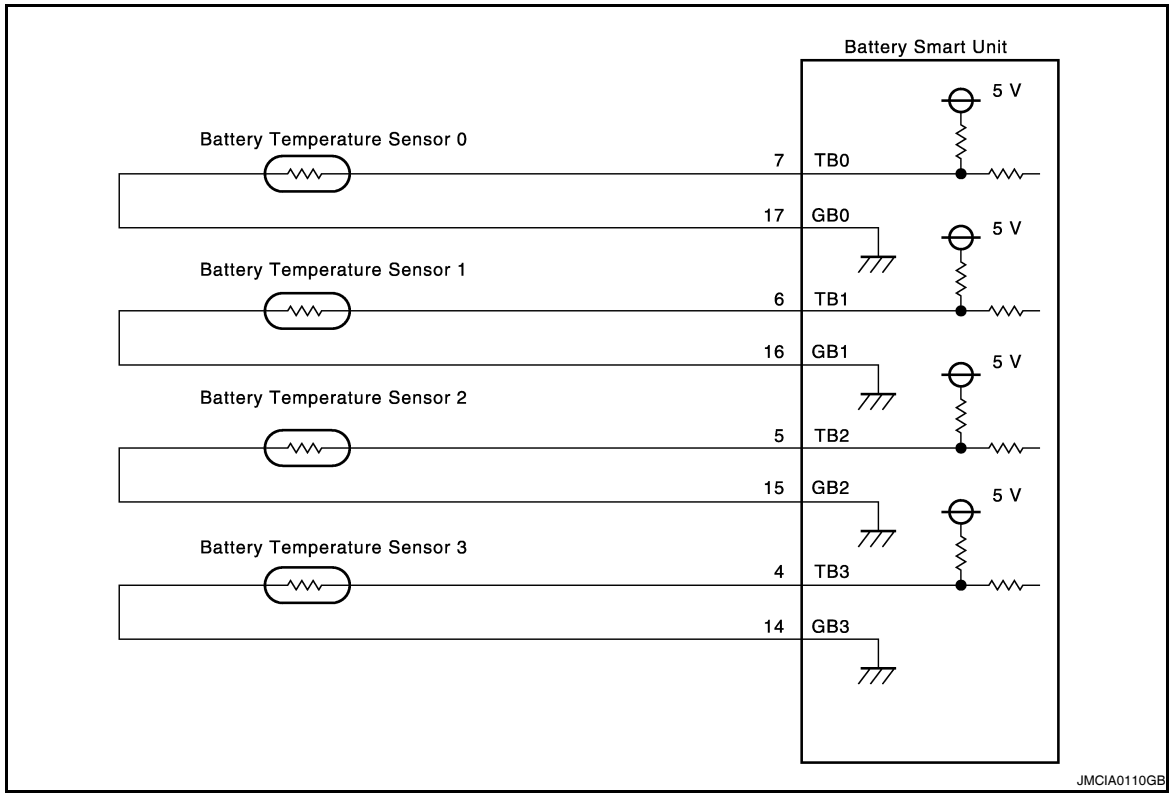
P0A9C-123

Description

INFOID:0000000004212270

The battery temperature sensors are provided at 4 locations on the bottom of the HV battery. The resistance of the thermistor, which is built into each battery temperature sensor, varies in accordance with changes in the HV battery temperature. The lower the battery temperature, the higher the thermistor resistance. Conversely, the higher the temperature, the lower the resistance. The battery smart unit uses the battery temperature sensors to detect the HV battery temperature, and sends the detected values to the hybrid vehicle control ECU. Based on these results, the hybrid vehicle control ECU controls the blower fan. (The blower fan starts when the HV battery temperature rises above a predetermined level.)





DTC Logic

INFOID:0000000004212271

DTC DETECTION LOGIC

If the temperature indicated by the battery temperature sensor is lower than the standard level (open), or is higher than the standard level (short), the battery smart unit interprets this as a sensor malfunction. If the bat-

tery smart unit detects that the HV battery temperature is out of its normal range or its value is abnormal, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A9C	123	Hybrid battery temperature sensor “A”	When the battery temperature sensor performance is abnormal (1 trip detection/2 trip detection)	• HV battery (Battery temperature sensor) • Battery smart unit

Diagnosis Procedure

INFOID:0000000004212272

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

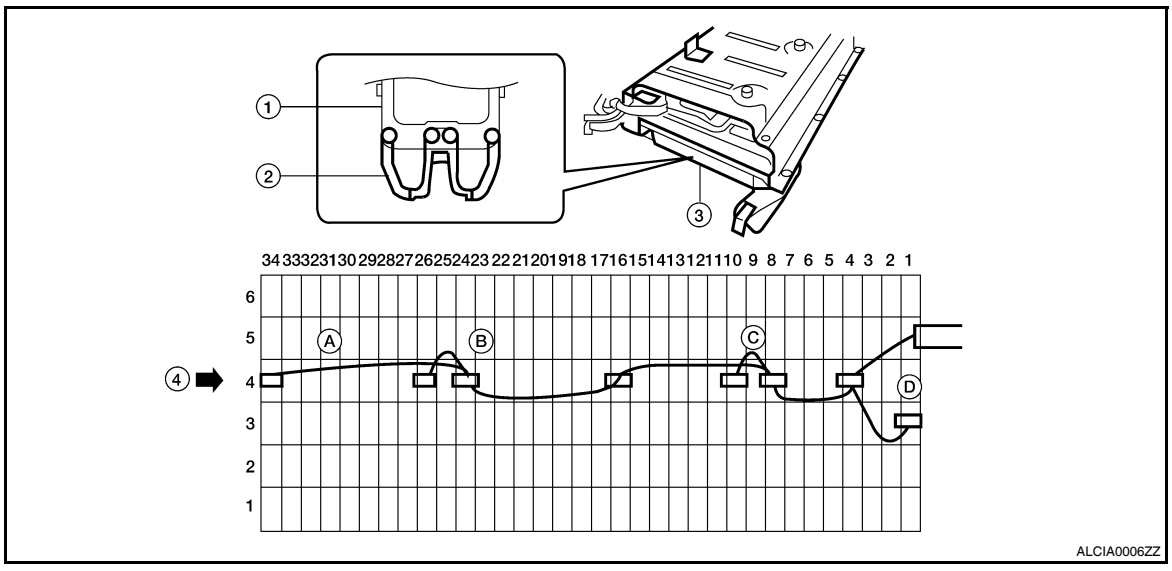
Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3.CHECK BATTERY TEMPERATURE SENSOR (BATTERY TEMPERATURE SENSOR 0 TO 3)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Remove the HV battery assembly. (Refer to HBB-97, "Removal and Installation").
3. Visually check the installation of the battery temperature sensors (0 to 3) through the exhaust duct installation hole.



1. HV battery module
2. Battery temperature sensor
3. Exhaust duct (installation slot)
4-A. Battery temperature sensor 3
4-B. Battery temperature sensor 2
4-C. Battery temperature sensor 1
4-D. Battery temperature sensor 0

The battery temperature sensors (0 to 3) are securely installed.

NOTE:
Do not poke the battery temperature sensors with a stick or other objects when checking. Doing so may damage the sensors.

OK or NG

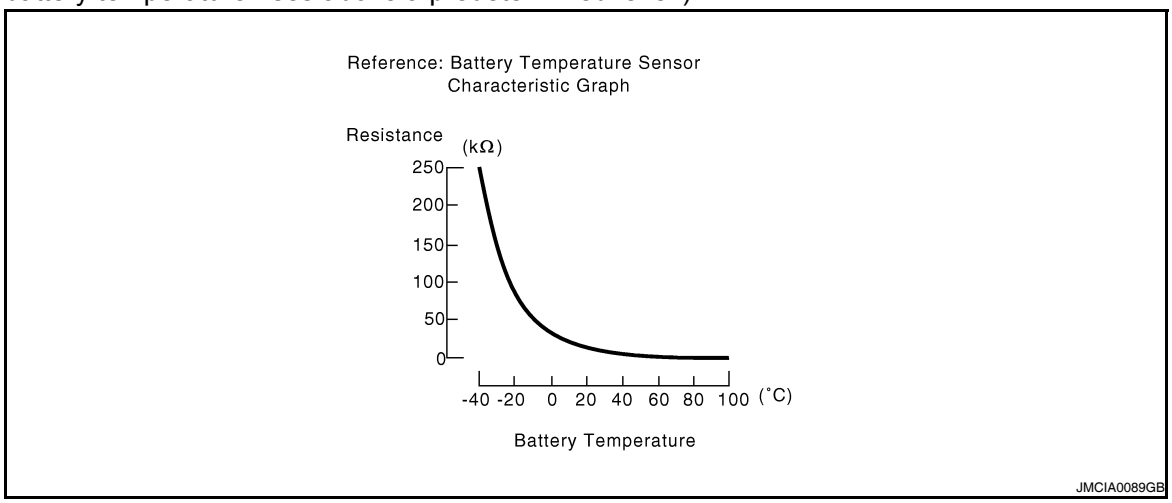
OK >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NG >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").

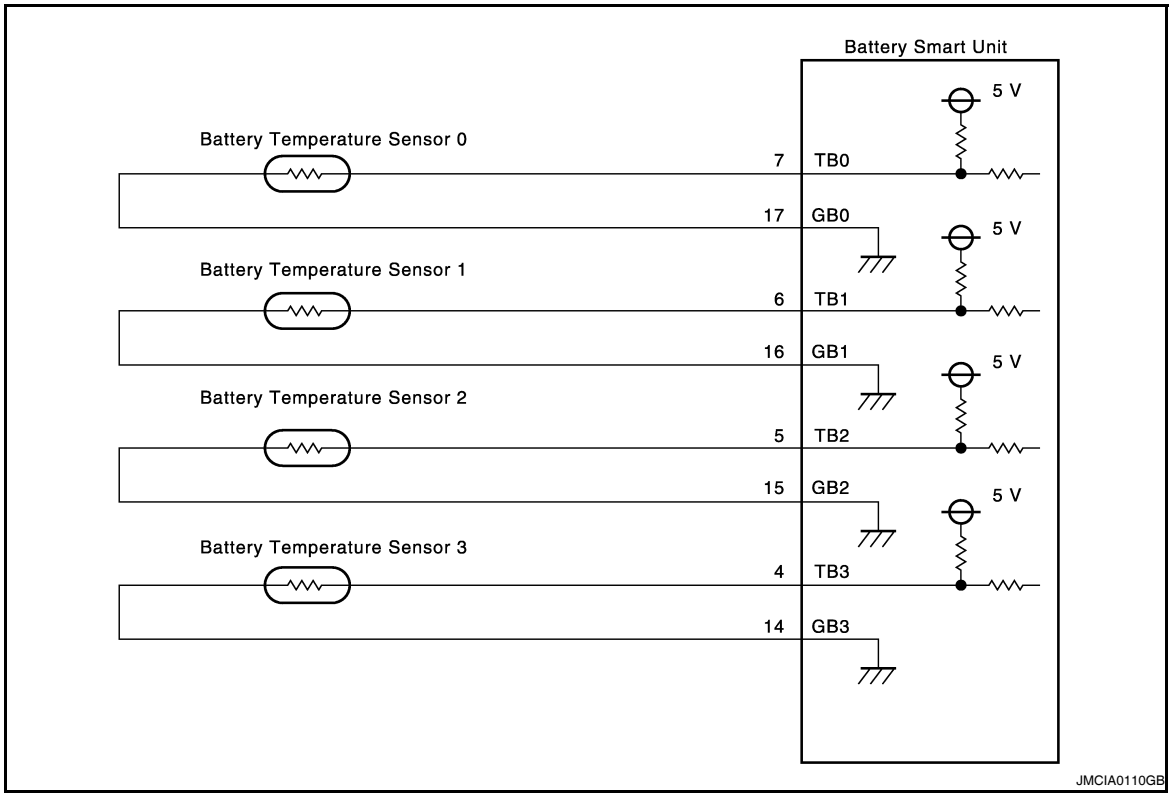
P0A9D-123, P0A9E-123

Description

INFOID:0000000004212273

The battery temperature sensors are provided at 4 locations on the bottom of the HV battery. The resistance of the thermistor, which is built into each battery temperature sensor, varies in accordance with changes in the HV battery temperature. The lower the battery temperature, the higher the thermistor resistance. Conversely, the higher the temperature, the lower the resistance. The battery smart unit uses the battery temperature sensors to detect the HV battery temperature, and sends the detected values to the hybrid vehicle control ECU. Based on these results, the hybrid vehicle control ECU controls the blower fan. (The blower fan starts when the HV battery temperature rises above a predetermined level.)





DTC Logic

INFOID:0000000004212274

DTC DETECTION LOGIC

If the temperature indicated by the battery temperature sensor is lower than the standard level (open), or is higher than the standard level (short), the battery smart unit interprets this as a sensor malfunction. If the bat-

tery smart unit detects that the HV battery temperature is out of its normal range or its value is abnormal, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A9D	123	Hybrid Battery Temperature Sensor “A” Circuit Low	When the temperature indicated by the battery temperature sensor is lower than a predetermined limit (open circuit) or is higher than a predetermined limit (short circuit) (1 trip detection)	• HV battery (Battery temperature sensor) • Battery smart unit
P0A9E	123	Hybrid Battery Temperature Sensor “A” Circuit High		

NOTE:
After confirming that a DTC is output, check “BATT TEMP 1 to 4” in “DATA MONITOR” mode with CONSULT-III.

Displayed Temperature	Malfunction
-45°C (-49°F) or less	Open or +B short circuit
95°C (203°F) or more	GND short

Diagnosis Procedure

INFOID:0000000004212275

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3.CHECK CONNECTOR CONNECTION CONDITION (BATTERY TEMPERATURE SENSOR)

CAUTION:
Be sure to wear insulated gloves.
1. Turn ignition switch OFF.
2. Remove the service plug grip (Refer to GI-24, "Precautions For High-Voltage System").
3. Remove the HV relay assembly (Refer to HBB-105, "Removal and Installation").
4. Check the battery smart unit harness connectors connection.

The connectors are connected securely and there are no contact problems.

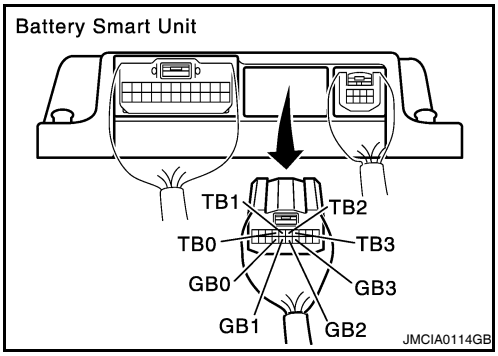
OK or NG

OK >> GO TO 4.
NG >> Connect securely.

4.CHECK HV BATTERY (BATTERY TEMPERATURE SENSOR)

CAUTION:
Be sure to wear insulated gloves.
1. Remove the battery smart unit (Refer to HBB-101, "Removal and Installation").
2. Disconnect the battery smart unit harness connectors.

3. For the malfunctioning battery temperature sensor(s), measure the resistance according to the value(s) in the table below.



Thermistor No.	Battery smart unit		Battery smart unit		Resistance
	Connector	Terminal	Connector	Terminal	
0	—	TB0	—	GB0	26.7 to 27.9 kΩ [at 0°C (32°F)] 9.9 to 10.1 kΩ [at 25°C (77°F)] 5.7 to 6.0 kΩ [at 40°C (104°F)]
1		TB1		GB1	
2		TB2		GB2	
3		TB3		GB3	

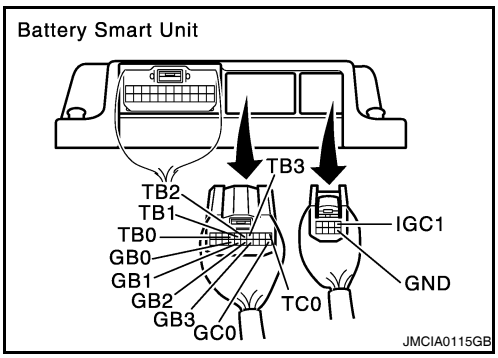
OK or NG

OK >> GO TO 5.
NG >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").

5. CHECK HV BATTERY (BATTERY TEMPERATURE SENSOR AND INTAKE AIR TEMPERATURE SENSOR)

CAUTION:
Be sure to wear insulated gloves.

1. Disconnect the battery smart unit connectors.
2. Measure the resistance according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Resistance
Connector	Terminal	Connector	Terminal	
—	TB0	—	IGCT	10 kΩ or higher
	GB0			
	TB1			
	GB1			
	TB2			
	GB2			
	TB3			
	GB3			
	TC0			
	GC0			
	TB0		GND	
	TB1			
	TB2			
	TB3			
	TC0			

OK or NG

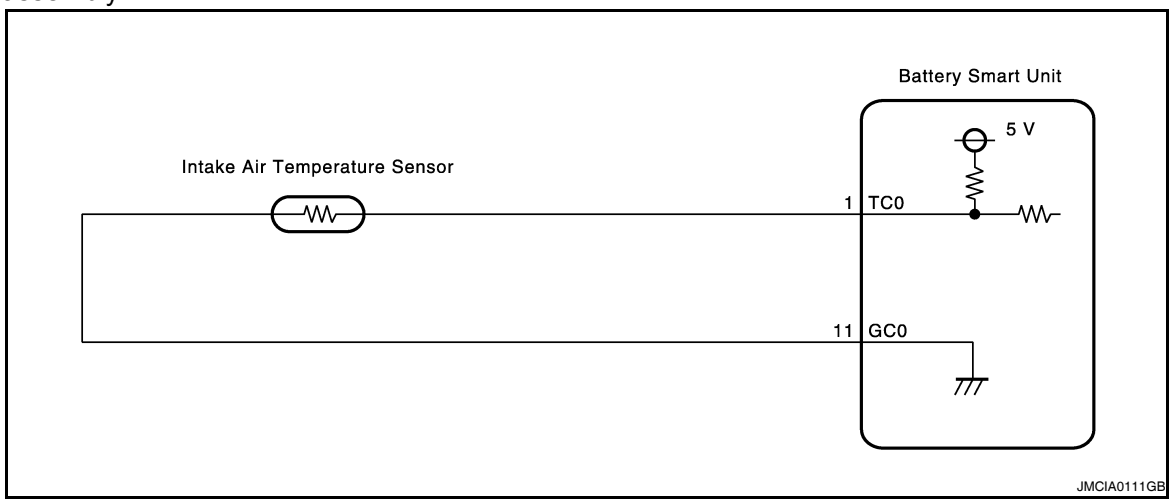
OK >> Replace battery smart unit (Refer to HBB-101, "Removal and Installation").
NG >> Replace HV battery (Refer to HBB-97, "Removal and Installation").

P0AAC-123

Description

INFOID:0000000004212276

The intake air temperature sensor (battery) is mounted on the HV battery. The resistance of the sensor varies in accordance with changes in the intake air temperature. The characteristics of the intake air temperature sensor are the same as those of the battery temperature sensor (Refer to HBB-60, "Description"). The battery smart unit uses signals from the intake air temperature sensor to control the air volume of the battery cooling blower assembly.



DTC Logic

INFOID:0000000004212277

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AAC	123	Hybrid battery pack air temperature sensor A circuit	When the temperature indicated by the intake air temperature sensor is lower than a predetermined limit (open circuit) or is higher than a predetermined limit (short circuit)	• HV battery (Intake air temperature sensor) • Battery smart unit

NOTE:
After confirming that DTC P0AAC-123 is output, check “BATT INSIDE AIR” in “DATA MONITOR” mode with” CONSULT-III.

Displayed Temperature	Malfunction
-45°C (-49°F) or less	Open or +B short circuit
95°C (203°F) or more	GND short

Diagnosis Procedure

INFOID:0000000004212278

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3. CHECK CONNECTOR CONNECTION CONDITION (INTAKE AIR TEMPERATURE SENSOR)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Remove the service plug grip. (Refer to GI-24, "Precautions For High-Voltage System").
3. Remove the HV relay assembly. (Refer to HBB-105, "Removal and Installation").
4. Check the battery smart unit harness connectors connection.

The connectors are connected securely and there are no contact problems.

NOTE:
The intake air temperature sensor is not available separately. If it requires replacement, replace the HV battery.

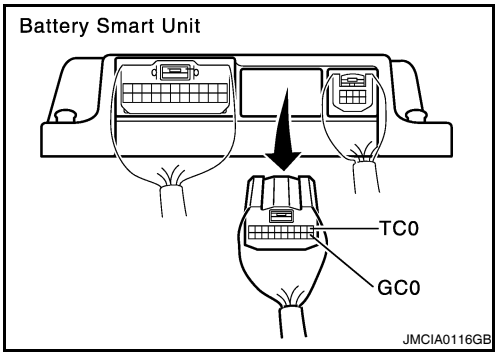
OK or NG

OK >> GO TO 4.
NG >> Connect securely.

4. CHECK HV BATTERY (INTAKE AIR TEMPERATURE SENSOR)

CAUTION:
Be sure to wear insulated gloves.

1. Remove the battery smart unit (Refer to HBB-101, "Removal and Installation").
2. Disconnect the battery smart unit harness connector.
3. Measure the resistance according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Resistance
Connector	Terminal	Connector	Terminal	
—	TC0	—	GC0	26.7 to 27.9 kΩ at 0°C (32°F)
				9.9 to 10.1 kΩ at 25°C (77°F)
				5.7 to 6.0 kΩ at 40°C (104°F)

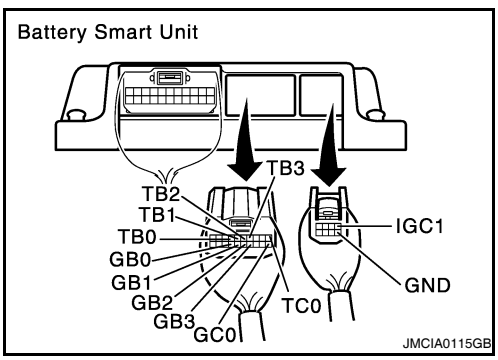
OK or NG

OK >> GO TO 5.
NG >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").

5. CHECK HV BATTERY (BATTERY TEMPERATURE SENSOR AND INTAKE AIR TEMPERATURE SENSOR)

CAUTION:
Be sure to wear insulated gloves.

1. Disconnect the battery smart unit connectors.
2. Measure the resistance according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Resistance
Connector	Terminal	Connector	Terminal	
—	TB0	—	IGCT	10 kΩ or higher
	GB0			
	TB1			
	GB1			
	TB2			
	GB2			
	TB3			
	GB3			
	TC0			
	GC0			
	TB0		GND	
	TB1			
	TB2			
	TB3			
	TC0			

OK or NG

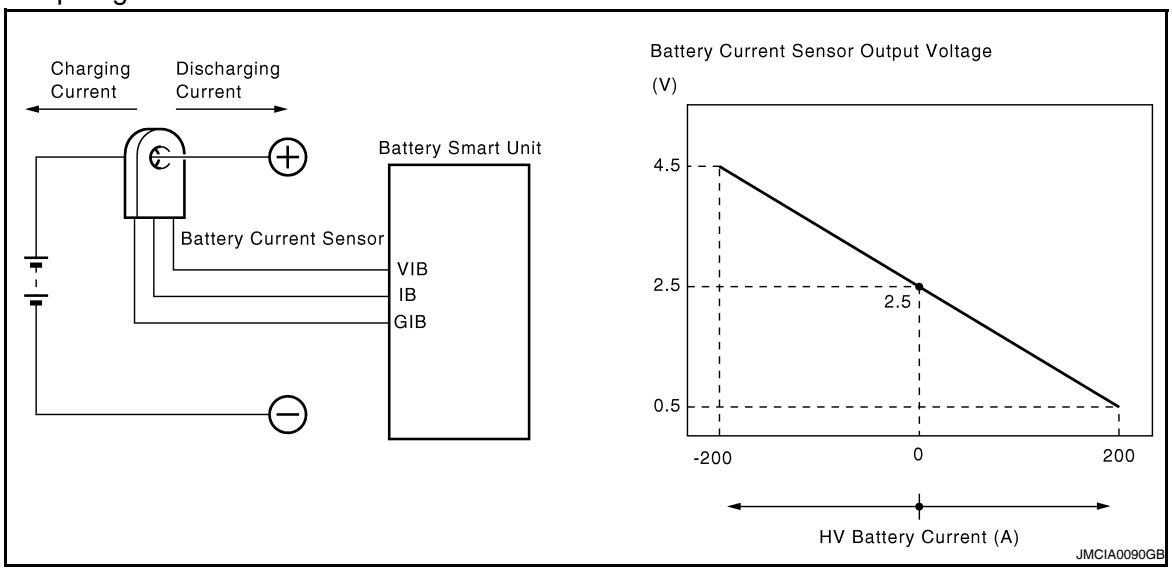
OK >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NG >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").

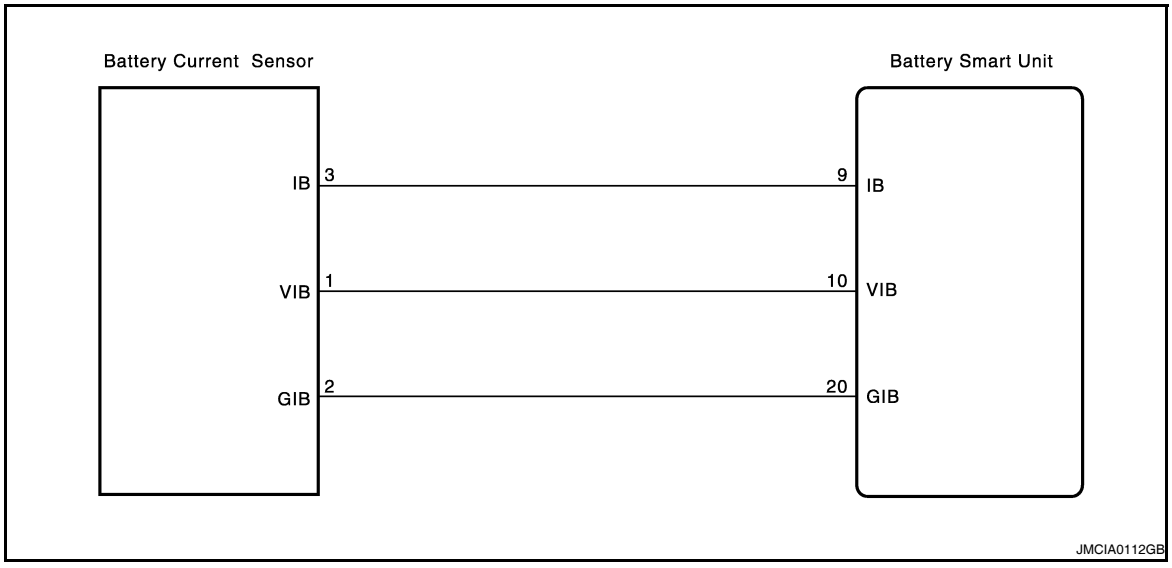
P0ABF-123, P0AC1-123, P0AC2-123

Description

INFOID:0000000004212279

The battery current sensor, which is mounted on the positive cable side of the HV battery, detects the amperage that flows to and from the HV battery. The battery smart unit receives a voltage of between 0 and 5 V that is in proportion to the amperage flowing in the cable. This voltage goes into the IB terminal from the battery current sensor. A battery current sensor output voltage below 2.5 V indicates that the HV battery is being charged, and a voltage above 2.5 V indicates that the HV battery is being discharged. The hybrid vehicle control ECU determines the amount of either charge or discharge amperage that is being received by the HV battery based on the signals that are input to terminal IB of the battery smart unit from the battery current sensor. The hybrid vehicle control ECU also calculates the SOC (state of charge) of the HV battery based on the accumulated amperage.





DTC Logic

INFOID:0000000004212280

DTC DETECTION LOGIC

If the battery smart unit detects a malfunction in the battery current sensor, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0ABF	123	Hybrid battery pack current sensor circuit	When the battery current sensor output is too low or high due to VIB/GIB failure	• HV relay assembly (battery current sensor) • Battery smart unit • Wire harness or connector
P0AC1	123	Hybrid battery pack current sensor circuit low	When the battery current sensor output is too low or high due to IB failure	
P0AC2	123	Hybrid battery pack current sensor circuit high		

Diagnosis Procedure

INFOID:0000000004212281

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

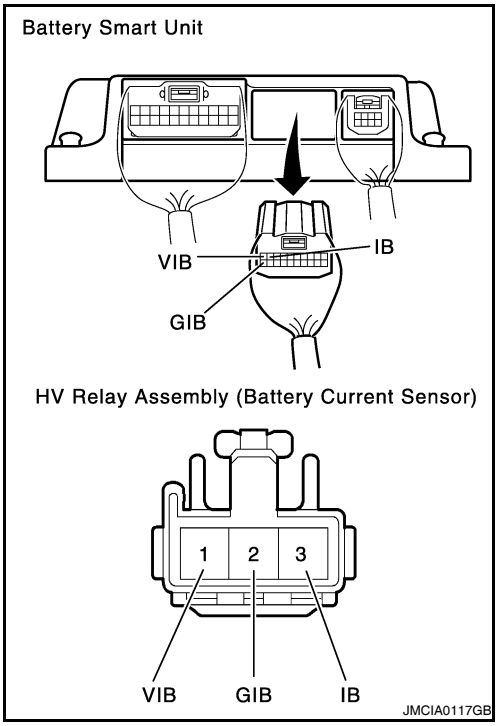
YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3.CHECK HARNESS AND CONNECTOR (SMARAT BATTERY UNIT - BATTERY CURRENT SENSOR)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Remove the service plug grip (Refer to GI-24, "Precautions For High-Voltage System").
3. Remove the HV relay assembly (Refer to HBB-105, "Removal and Installation").
4. Disconnect the battery smart unit harness connector.

5. Measure the resistance according to the value(s) in the table below.



Battery smart unit		HV relay assembly (Battery current sensor)		Resistance
Connector	Terminal	Connector	Terminal	
—	IB	—	IB	Below 1Ω
	GIB		GIB	
	VIB		VIB	

Battery smart unit		Ground	Resistance
Connector	Terminal		
—	IB	Ground	10 kΩ or higher
	GIB		
	VIB		

HV relay assembly (Battery current sensor)		Ground	Resistance
Connector	Terminal		
—	IB	Ground	10 kΩ or higher
	GIB		
	VIB		

NOTE:
The wire harness is not available separately. If it cannot be repaired, replace the HV battery.

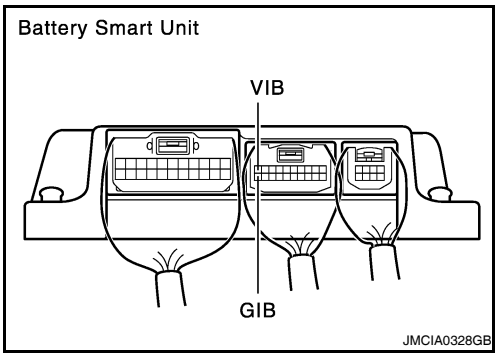
OK or NG

OK >> GO TO 4.
NG >> Repair or replace harness or connector.

4. CHECK BATTERY SMART UNIT (VIB VOLTAGE)

CAUTION:
Be sure to wear insulated gloves.

1. Connect the battery smart unit harness connector.
2. Install the battery carrier. (Refer to HBB-105, "Removal and Installation").
3. Connect the auxiliary battery positive terminal cable of the frame wire. (Refer to HBC-648, "Removal and Installation").
4. Turn ignition switch ON.
5. Measure the voltage according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Voltage
Connector	Terminal	Connector	Terminal	
—	VIB	—	GIB	4.6 to 5.4V

NOTE:
If ignition switch is turned ON with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be set.

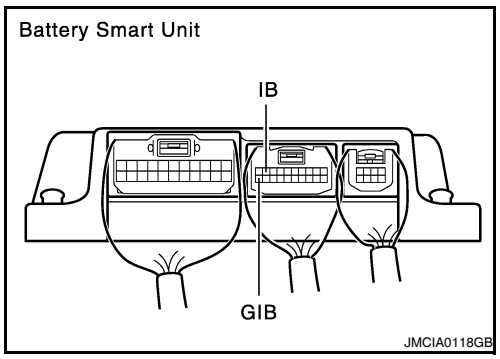
OK or NG

OK >> GO TO 5.
NG >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").

5. CHECK BATTERY SMART UNIT (IB VOLTAGE)

CAUTION:
Be sure to wear insulated gloves.

1. Connect the HV relay assembly (battery current sensor) connector.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Voltage
Connector	Terminal	Connector	Terminal	
—	IB	—	GIB	2.46 to 2.54V

NOTE:
If igniting switch is turned ON with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be set.

OK or NG

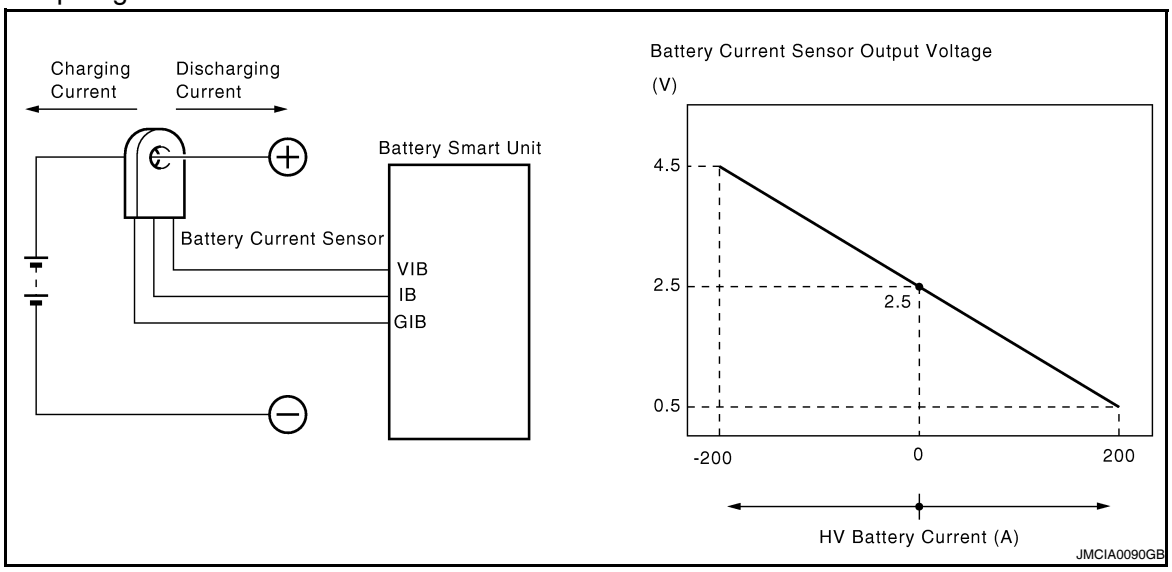
OK >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NG >> Replace HV relay assembly. (Refer to HBB-105, "Removal and Installation").

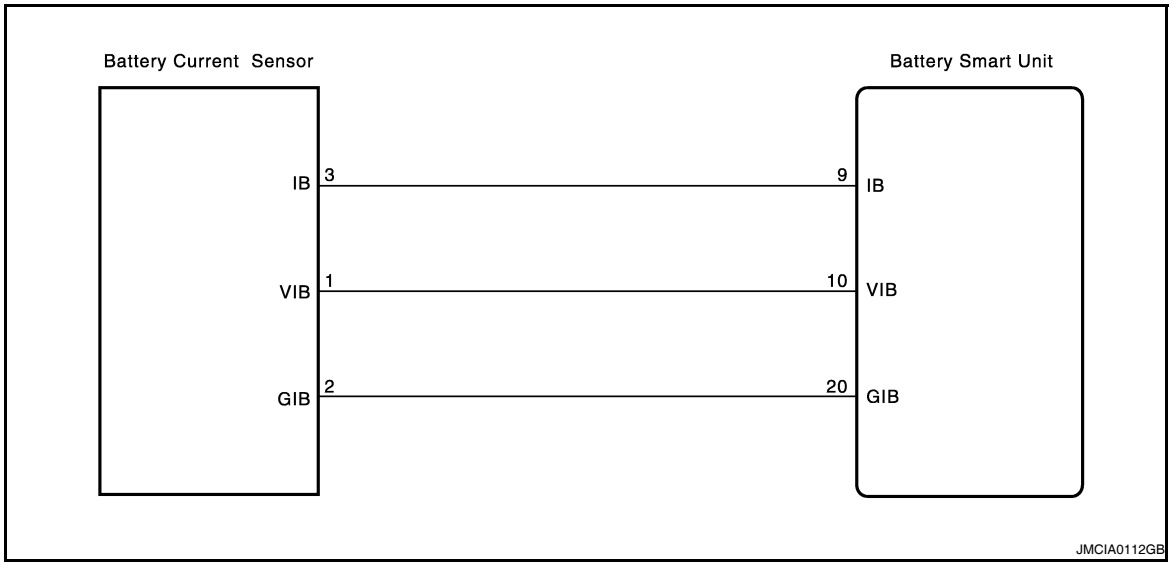
P0AC0-123

Description

INFOID:0000000004212282

The battery current sensor, which is mounted on the positive cable side of the HV battery, detects the amperage that flows to and from the HV battery. The battery smart unit receives a voltage of between 0 and 5 V that is in proportion to the amperage flowing in the cable. This voltage goes into the IB terminal from the battery current sensor. A battery current sensor output voltage below 2.5 V indicates that the HV battery is being charged, and a voltage above 2.5 V indicates that the HV battery is being discharged. The hybrid vehicle control ECU determines the amount of either charge or discharge amperage that is being received by the HV battery based on the signals that are input to terminal IB of the battery smart unit from the battery current sensor. The hybrid vehicle control ECU also calculates the SOC (state of charge) of the HV battery based on the accumulated amperage.





DTC Logic

INFOID:0000000004212283

DTC DETECTION LOGIC

If the battery smart unit detects malfunction in the battery current sensor, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AC0	123	Hybrid battery pack current sensor circuit range/performance	The battery current sensor output characteristic is abnormal (offset / constant output) (1 trip detection/2 trip detection)	• HV relay assembly (battery current sensor) • Battery smart unit

Diagnosis Procedure

INFOID:0000000004212284

1.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 2.

2.REPLACE HV RELAY ASSEMBLY

Refer to HBB-105, "Removal and Installation".

>> GO TO 3.

3.CLEAR DTC

1. Turn ignition switch ON.
2. Clear DTC.
3. Perform a road test.
   NOTE:
   Turn ignition switch OFF and perform a road test again after the first road test for 2 trip detection.

>> GO TO 4.

4.RECONFIRM DTC OUTPUT

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0AC0-123 detected?

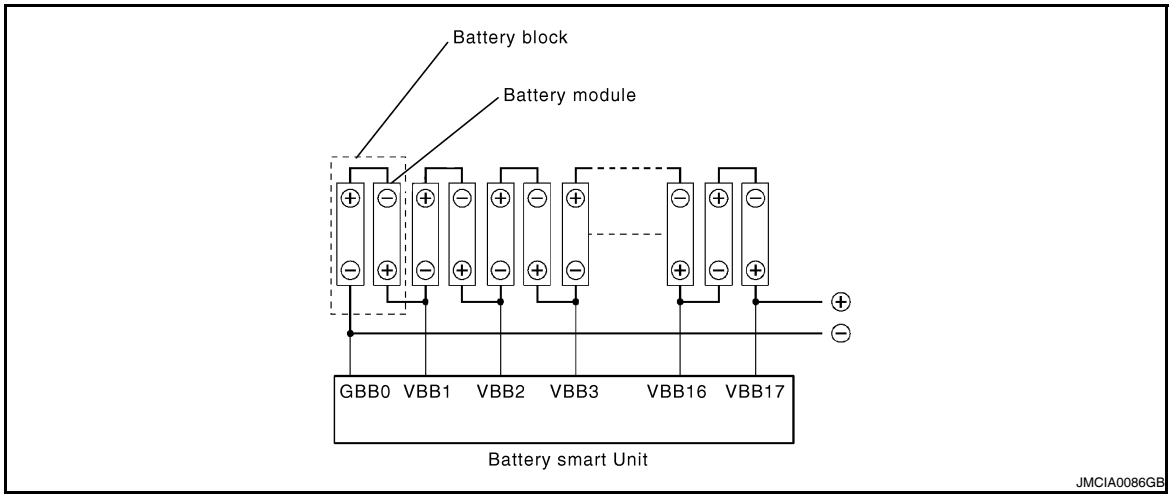
YES >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NO >> Completed.

P0AFA-123

Description

INFOID:0000000004212285

The hybrid vehicle control ECU controls the SOC (state of charge) of the HV battery at a constant level while driving. The HV battery is composed of 34 modules, and each module consists of six 1.2 V cells in series. The battery smart unit monitors battery block voltage at 17 locations. Each battery block is composed of 2 modules in a set.



DTC Logic

INFOID:0000000004212286

DTC DETECTION LOGIC

The battery smart unit monitors a voltage of the battery blocks to detect an open malfunction in internal battery voltage sensor circuits of the battery smart unit and the wire harness between each battery block and battery smart unit. If a voltage at one of the battery blocks is below a standard level or of all the battery blocks is within a specified range, the battery smart unit judges that there is an open in the internal sensor circuit(s) or wire harness. The hybrid vehicle control ECU then illuminates the MIL and sets a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AFA	123	Hybrid battery system voltage low	Any of the battery block voltages become less than 2.0 V (open). (1 trip detection)	• Battery smart unit • HV battery

Diagnosis Procedure

INFOID:0000000004212287

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CHECK FOR DTC (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 3.

3. CHECK CONNECTOR CONNECTION CONDITION (BATTERY SMART UNIT)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Remove the service plug grip (Refer to GI-24, "Precautions For High-Voltage System").
3. Remove the HV relay assembly (Refer to HBB-105, "Removal and Installation").
4. Check the battery smart unit harness connectors connection.

The connectors are connected securely and there are no contact problems.

OK or NG

OK >> GO TO 4.
NG >> Connect securely.

4. REPLACE BATTERY SMART UNIT

Refer to HBB-101, "Removal and Installation".

>> GO TO 5.

5. CLEAR DTC

1. Turn ignition switch ON.
2. Clear DTC.

>> GO TO 6.

6. RECONFIRM DTC OUTPUT

1. Check DTC.

Is DTC P0AFA-123 detected?

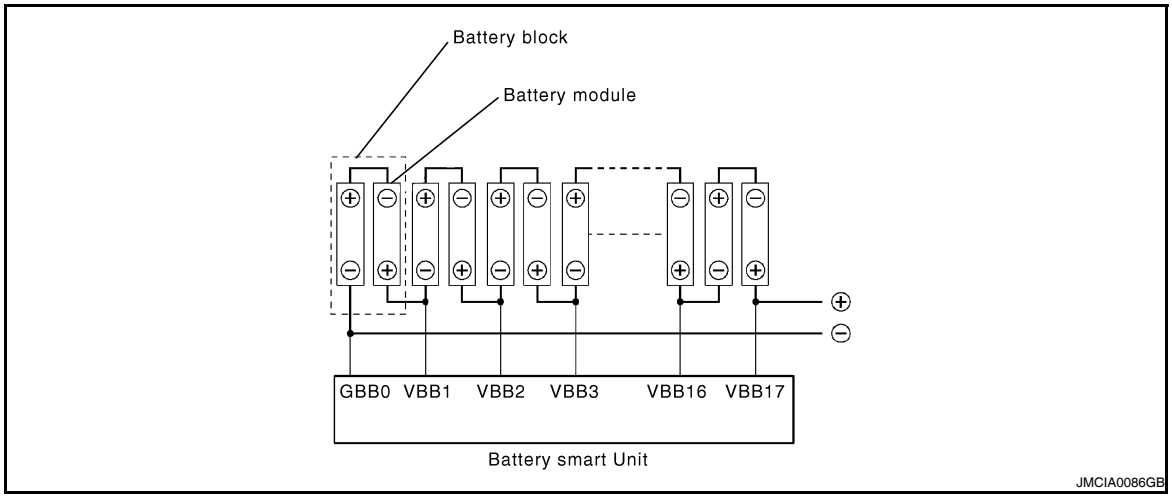
YES >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").
NO >> Completed.

P3011-123, P3012-123, P3013-123, P3014-123, P3015-123, P3016-123

Description

INFOID:0000000004212288

The hybrid vehicle control ECU controls the SOC (state of charge) of the HV battery at a constant level while driving. The HV battery is composed of 34 modules, and each module consists of six 1.2 V cells in series. The battery smart unit monitors battery block voltage at 17 locations. Each battery block is composed of 2 modules in a set.



DTC Logic

INFOID:0000000004212289

DTC DETECTION LOGIC

If there is an abnormal internal resistance or electromotive voltage in the battery blocks, the battery smart unit determines that a malfunction has occurred. When the malfunction detection condition is satisfied, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3011	123	Battery block 1 becomes weak	Presence of a malfunctioning block is determined based on each battery block voltage (1 trip detection).	• HV battery • Battery smart unit
P3012	123	Battery block 2 becomes weak		
P3013	123	Battery block 3 becomes weak		
P3014	123	Battery block 4 becomes weak		
P3015	123	Battery block 5 becomes weak		
P3016	123	Battery block 6 becomes weak		
P3017	123	Battery block 7 becomes weak		
P3018	123	Battery block 8 becomes weak		
P3019	123	Battery block 9 becomes weak		
P3020	123	Battery block 10 becomes weak		
P3021	123	Battery block 11 becomes weak		
P3022	123	Battery block 12 becomes weak		
P3023	123	Battery block 13 becomes weak		
P3024	123	Battery block 14 becomes weak		
P3025	123	Battery block 15 becomes weak		
P3026	123	Battery block 16 becomes weak		
P3027	123	Battery block 17 becomes weak		

NOTE:
DTCs from P3011-123 to P3027-123 cannot be set unless the vehicle is driven for approximately 10 minutes after clearing the DTCs.

Diagnosis Procedure

INFOID:0000000004212290

1.CHECK FOR DTCS (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 2.

2.READ VALUE ON CONSULT-III

1. Ensure the safety of the areas in front and at the back of the vehicle.
2. Turn ignition switch ON (READY).
3. Select “V1 to V17 BATT BLOCK” in “DATA MONITOR” mode with CONSULT-III.
4. Fully warm up the engine and turn the air conditioning off.
5. Firmly depress the brake pedal with your left foot.
6. Move the shift lever to the D position.
7. Record each battery block voltage while fully depressing the accelerator pedal.
8. Compare the battery block voltages (V1 to V17 BATT BLOCK) between the even and odd number groups in each combination shown in the table below.

Even number group	Odd number group	Battery block voltages to be compared
V1 BATT BLOCK	V2 BATT BLOCK	VB1 ←→ VB2
V3 BATT BLOCK	V4 BATT BLOCK	VB3 ←→ VB4
V5 BATT BLOCK	V6 BATT BLOCK	VB5 ←→ VB6
V7 BATT BLOCK	V8 BATT BLOCK	VB7 ←→ VB8
V9 BATT BLOCK	V10 BATT BLOCK	VB9 ←→ VB10
V11 BATT BLOCK	V12 BATT BLOCK	VB11 ←→ VB12
V13 BATT BLOCK	V14 BATT BLOCK	VB13 ←→ VB14
V15 BATT BLOCK	V16 BATT BLOCK	VB15 ←→ VB16
V17 BATT BLOCK	V16 BATT BLOCK	VB17 ←→ VB16

9. Check the voltage difference in the all 9 combinations.

The difference in voltage of all combinations is 0.3 V or more.

YES or NO

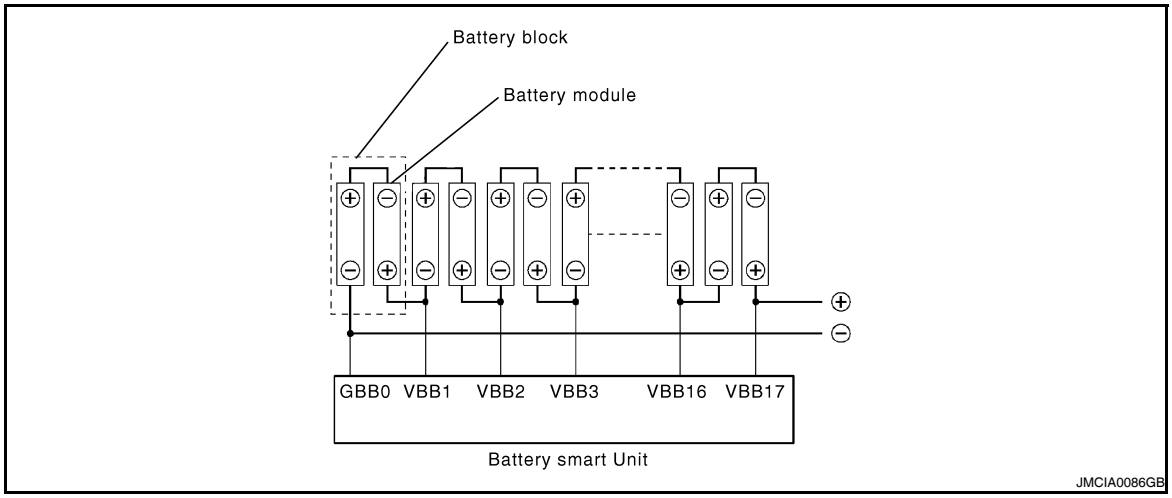
YES >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NO >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").

P3017-123, P3018-123, P3019-123, P3120-123, P3021-123, P3022-123

Description

INFOID:0000000004212291

The hybrid vehicle control ECU controls the SOC (state of charge) of the HV battery at a constant level while driving. The HV battery is composed of 34 modules, and each module consists of six 1.2 V cells in series. The battery smart unit monitors battery block voltage at 17 locations. Each battery block is composed of 2 modules in a set.



DTC Logic

INFOID:0000000004212292

DTC DETECTION LOGIC

If there is an abnormal internal resistance or electromotive voltage in the battery blocks, the battery smart unit determines that a malfunction has occurred. When the malfunction detection condition is satisfied, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3011	123	Battery block 1 becomes weak	Presence of a malfunctioning block is determined based on each battery block voltage (1 trip detection).	• HV battery • Battery smart unit
P3012	123	Battery block 2 becomes weak		
P3013	123	Battery block 3 becomes weak		
P3014	123	Battery block 4 becomes weak		
P3015	123	Battery block 5 becomes weak		
P3016	123	Battery block 6 becomes weak		
P3017	123	Battery block 7 becomes weak		
P3018	123	Battery block 8 becomes weak		
P3019	123	Battery block 9 becomes weak		
P3020	123	Battery block 10 becomes weak		
P3021	123	Battery block 11 becomes weak		
P3022	123	Battery block 12 becomes weak		
P3023	123	Battery block 13 becomes weak		
P3024	123	Battery block 14 becomes weak		
P3025	123	Battery block 15 becomes weak		
P3026	123	Battery block 16 becomes weak		
P3027	123	Battery block 17 becomes weak		

NOTE:
DTCs from P3011-123 to P3027-123 cannot be set unless the vehicle is driven for approximately 10 minutes after clearing the DTCs.

Diagnosis Procedure

INFOID:0000000004212293

1. CHECK FOR DTCS (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 2.

2. READ VALUE ON CONSULT-III

1. Ensure the safety of the areas in front and at the back of the vehicle.
2. Turn ignition switch ON (READY).
3. Select “V1 to V17 BATT BLOCK” in “DATA MONITOR” mode with CONSULT-III.
4. Fully warm up the engine and turn the air conditioning off.
5. Firmly depress the brake pedal with your left foot.
6. Move the shift lever to the D position.
7. Record each battery block voltage while fully depressing the accelerator pedal.
8. Compare the battery block voltages (V1 to V17 BATT BLOCK) between the even and odd number groups in each combination shown in the table below.

Even number group	Odd number group	Battery block voltages to be compared
V1 BATT BLOCK	V2 BATT BLOCK	VB1 ←→ VB2
V3 BATT BLOCK	V4 BATT BLOCK	VB3 ←→ VB4
V5 BATT BLOCK	V6 BATT BLOCK	VB5 ←→ VB6
V7 BATT BLOCK	V8 BATT BLOCK	VB7 ←→ VB8
V9 BATT BLOCK	V10 BATT BLOCK	VB9 ←→ VB10
V11 BATT BLOCK	V12 BATT BLOCK	VB11 ←→ VB12
V13 BATT BLOCK	V14 BATT BLOCK	VB13 ←→ VB14
V15 BATT BLOCK	V16 BATT BLOCK	VB15 ←→ VB16
V17 BATT BLOCK	V16 BATT BLOCK	VB17 ←→ VB16

9. Check the voltage difference in the all 9 combinations.

The difference in voltage of all combinations is 0.3 V or more.

YES or NO

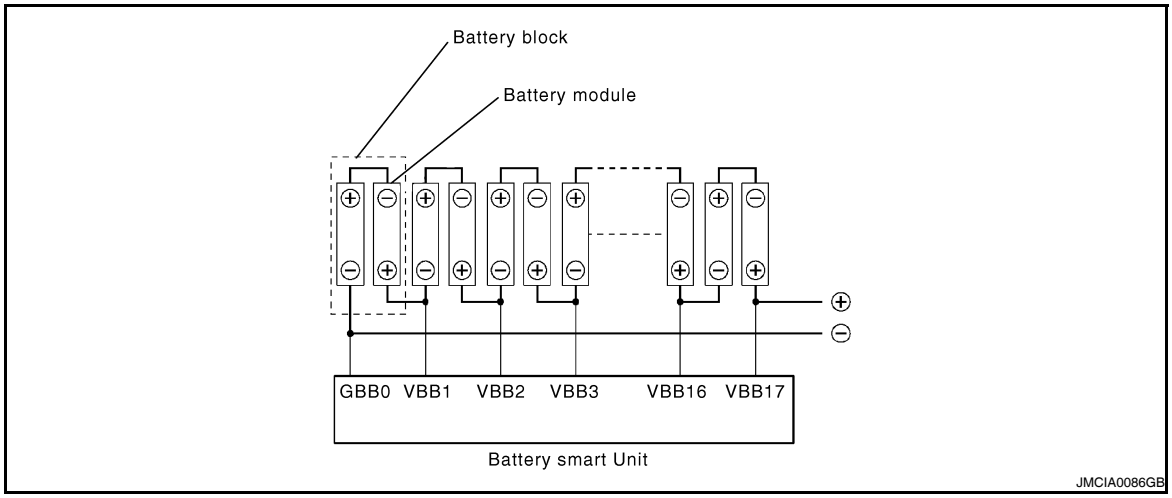
YES >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NO >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").

P3023-123, P3024-123, P3025-123, P3026-123, P3027-123

Description

INFOID:0000000004212294

The hybrid vehicle control ECU controls the SOC (state of charge) of the HV battery at a constant level while driving. The HV battery is composed of 34 modules, and each module consists of six 1.2 V cells in series. The battery smart unit monitors battery block voltage at 17 locations. Each battery block is composed of 2 modules in a set.



DTC Logic

INFOID:0000000004212295

DTC DETECTION LOGIC

If there is an abnormal internal resistance or electromotive voltage in the battery blocks, the battery smart unit determines that a malfunction has occurred. When the malfunction detection condition is satisfied, the hybrid vehicle control ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3011	123	Battery block 1 becomes weak	Presence of a malfunctioning block is determined based on each battery block voltage (1 trip detection).	• HV battery • Battery smart unit
P3012	123	Battery block 2 becomes weak		
P3013	123	Battery block 3 becomes weak		
P3014	123	Battery block 4 becomes weak		
P3015	123	Battery block 5 becomes weak		
P3016	123	Battery block 6 becomes weak		
P3017	123	Battery block 7 becomes weak		
P3018	123	Battery block 8 becomes weak		
P3019	123	Battery block 9 becomes weak		
P3020	123	Battery block 10 becomes weak		
P3021	123	Battery block 11 becomes weak		
P3022	123	Battery block 12 becomes weak		
P3023	123	Battery block 13 becomes weak		
P3024	123	Battery block 14 becomes weak		
P3025	123	Battery block 15 becomes weak		
P3026	123	Battery block 16 becomes weak		
P3027	123	Battery block 17 becomes weak		

NOTE:
DTCs from P3011-123 to P3027-123 cannot be set unless the vehicle is driven for approximately 10 minutes after clearing the DTCs.

Diagnosis Procedure

INFOID:0000000004212296

1.CHECK FOR DTCS (DTC P0A1F-123 IS OUTPUT)

1. Turn ignition switch ON.
2. Check DTC.

Is DTC P0A1F-123 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> GO TO 2.

2.READ VALUE ON CONSULT-III

1. Ensure the safety of the areas in front and at the back of the vehicle.
2. Turn ignition switch ON (READY).
3. Select “V1 to V17 BATT BLOCK” in “DATA MONITOR” mode with CONSULT-III.
4. Fully warm up the engine and turn the air conditioning off.
5. Firmly depress the brake pedal with your left foot.
6. Move the shift lever to the D position.
7. Record each battery block voltage while fully depressing the accelerator pedal.
8. Compare the battery block voltages (V1 to V17 BATT BLOCK) between the even and odd number groups in each combination shown in the table below.

Even number group	Odd number group	Battery block voltages to be compared
V1 BATT BLOCK	V2 BATT BLOCK	VB1 ←→ VB2
V3 BATT BLOCK	V4 BATT BLOCK	VB3 ←→ VB4
V5 BATT BLOCK	V6 BATT BLOCK	VB5 ←→ VB6
V7 BATT BLOCK	V8 BATT BLOCK	VB7 ←→ VB8
V9 BATT BLOCK	V10 BATT BLOCK	VB9 ←→ VB10
V11 BATT BLOCK	V12 BATT BLOCK	VB11 ←→ VB12
V13 BATT BLOCK	V14 BATT BLOCK	VB13←→ VB14
V15 BATT BLOCK	V16 BATT BLOCK	VB15 ←→ VB16
V17 BATT BLOCK	V16 BATT BLOCK	VB17 ←→ VB16

9. Check the voltage difference in the all 9 combinations.

The difference in voltage of all combinations is 0.3 V or more.

YES or NO

YES >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").
NO >> Replace HV battery. (Refer to HBB-97, "Removal and Installation").

U029A-123

Description

INFOID:0000000004212297

The battery smart unit detects the HV battery conditions (voltage, current, and temperature) and the battery cooling fan voltages, and sends the detected information to the hybrid vehicle control ECU via serial communication.

DTC Logic

INFOID:0000000004212298

DTC DETECTION LOGIC

If the battery smart unit detects malfunction in serial communication with hybrid vehicle control ECU, it illuminates the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
U029A	123	Battery observation communication circuit malfunction	Problem with serial communication between the battery smart unit and hybrid vehicle control ECU (1 trip)	• Wire harness or connector • Hybrid vehicle control ECU • Battery smart unit

Diagnosis Procedure

INFOID:0000000004212299

1.PRECONDITIONING

- Before inspecting the high-voltage system, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

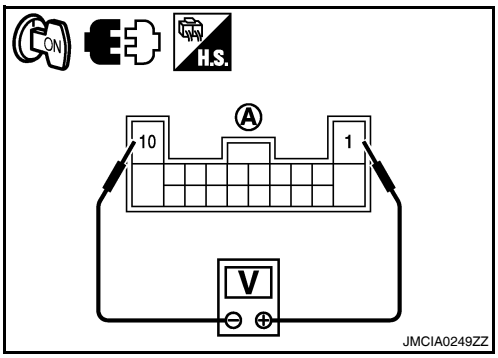
2.CHECK HARNESS AND CONNECTOR (VOLTAGE)

CAUTION:

Be sure to wear insulated gloves.

1. Remove the service plug grip (Refer to GI-24, "Precautions For High-Voltage System").
2. Remove the battery smart unit (Refer to HBB-101, "Removal and Installation").
3. Disconnect the battery smart unit harness connector B130.
4. Turn ignition switch ON.
5. Measure the voltage according to the value(s) in the table below.

Battery smart unit		Battery smart unit		Voltage
Connector	Terminal	Connector	Terminal	
B130	1 (IGCT [LH6])	B130	10	9 to 14V



OK or NG

OK >> GO TO 3.
NG >> GO TO 5.

3.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY SMART UNIT)

CAUTION:

Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Disconnect the hybrid vehicle control ECU harness connector B66.
3. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Battery smart unit		Resistance
Connector	Terminal	Connector	Terminal	
B66	133 (BTH+)	B130	13 (BTH+)	Below 1Ω
B66	150 (BTH–)	B130	12 (BTH–)	

Hybrid vehicle control ECU		Ground	Resistance
Connector	Terminal		
B66	133 (BTH+)	Ground	10 kΩ or higher
B66	150 (BTH–)		

Battery smart unit		Ground	Resistance
Connector	Terminal		
B130	133 (BTH+)	Ground	10 kΩ or higher
B130	150 (BTH–)		

4. Turn ignition switch ON.
5. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Connector	Terminal		
B66	133 (BTH+)	Ground	Below 1V
B66	150 (BTH–)		

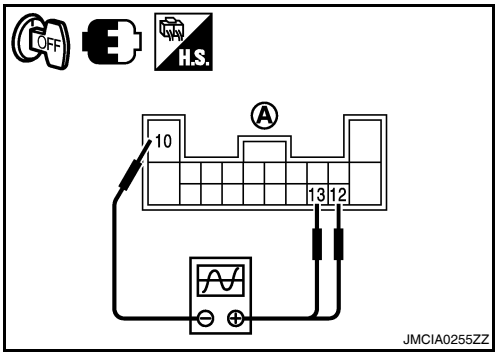
OK or NG

OK >> GO TO 4.
NG >> Repair or replace harness or connector.

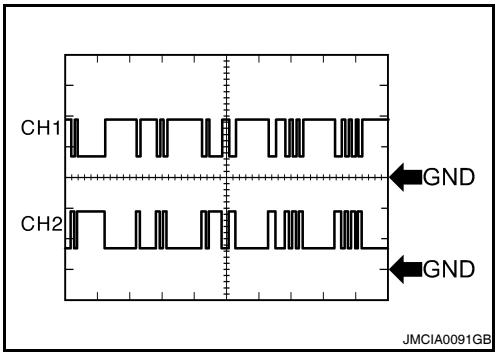
4. CHECK WAVEFORM

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Connect the hybrid vehicle control ECU harness connector B66.
3. Connect the battery smart unit harness connector B130.
4. Connect an oscilloscope between the battery smart unit terminals specified in the table below, and measure the waveform.



Item	Contents
Battery smart unit terminal (A)	CH1: 13 (BTH+) - 10 (GND) CH2: 12 (BTH–) - 10 (GND)
Equipment Setting	2 V/DIV., 500 μs/DIV.
Condition	Ignition switch ON



OK or NG

OK >> Replace hybrid vehicle control ECU. (Refer to HBC-644, "Removal and Installation").
NG >> Replace battery smart unit. (Refer to HBB-101, "Removal and Installation").

5.CHECK FUSE

1. Turn ignition switch OFF.
2. Remove 10A fuse (No. 69) from the high voltage fuse and fusible link box.
3. Measure the resistance of the fuse.

Standard resistance: Below 1Ω

OK or NG

OK >> GO TO 6.
NG >> Replace fuse.

6.CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX)

CAUTION:
Be sure to wear insulated gloves.

1. Install the 10A fuse to the high voltage fuse and fusible link box.
2. Remove the IGCT relay from the high voltage fuse and fusible link box.
3. Disconnect the battery smart unit harness connector B130.
4. Measure the resistance according to the value(s) in the table below.

Battery smart unit		High voltage fuse and fusible link box		Resistance
Connector	Terminal	Connector	Terminal	
B130	1 (IGCT [LH6])	—	IGCT relay	Below 1 Ω

OK or NG

OK >> Check and repair power source circuit.
NG >> Repair or replace harness or connector.

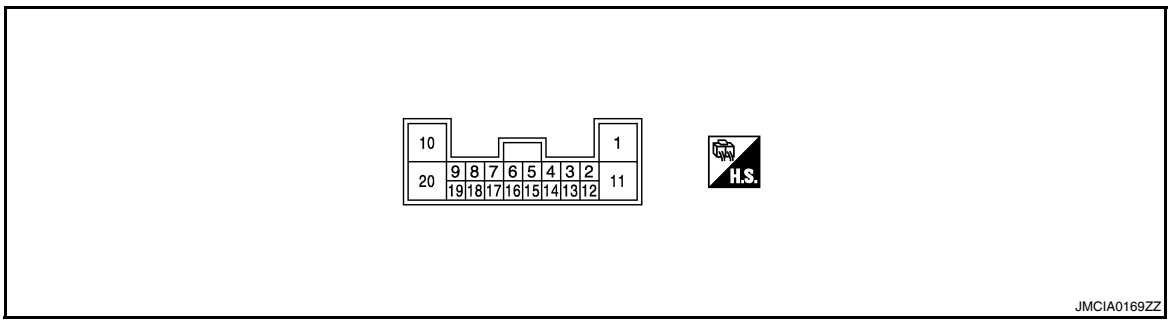
ECU DIAGNOSIS

BATTERY SMART UNIT

Reference Value

INFOID:0000000004212300

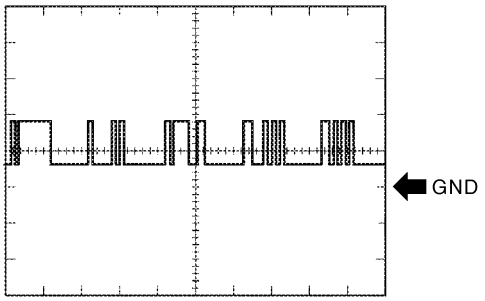
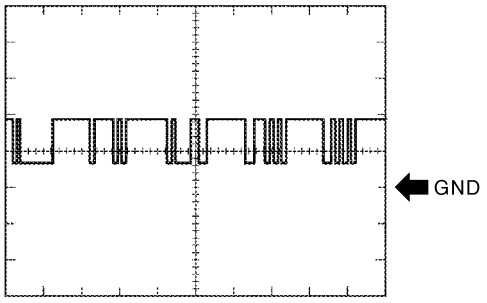
TERMINAL LAYOUT



PHYSICAL VALUES

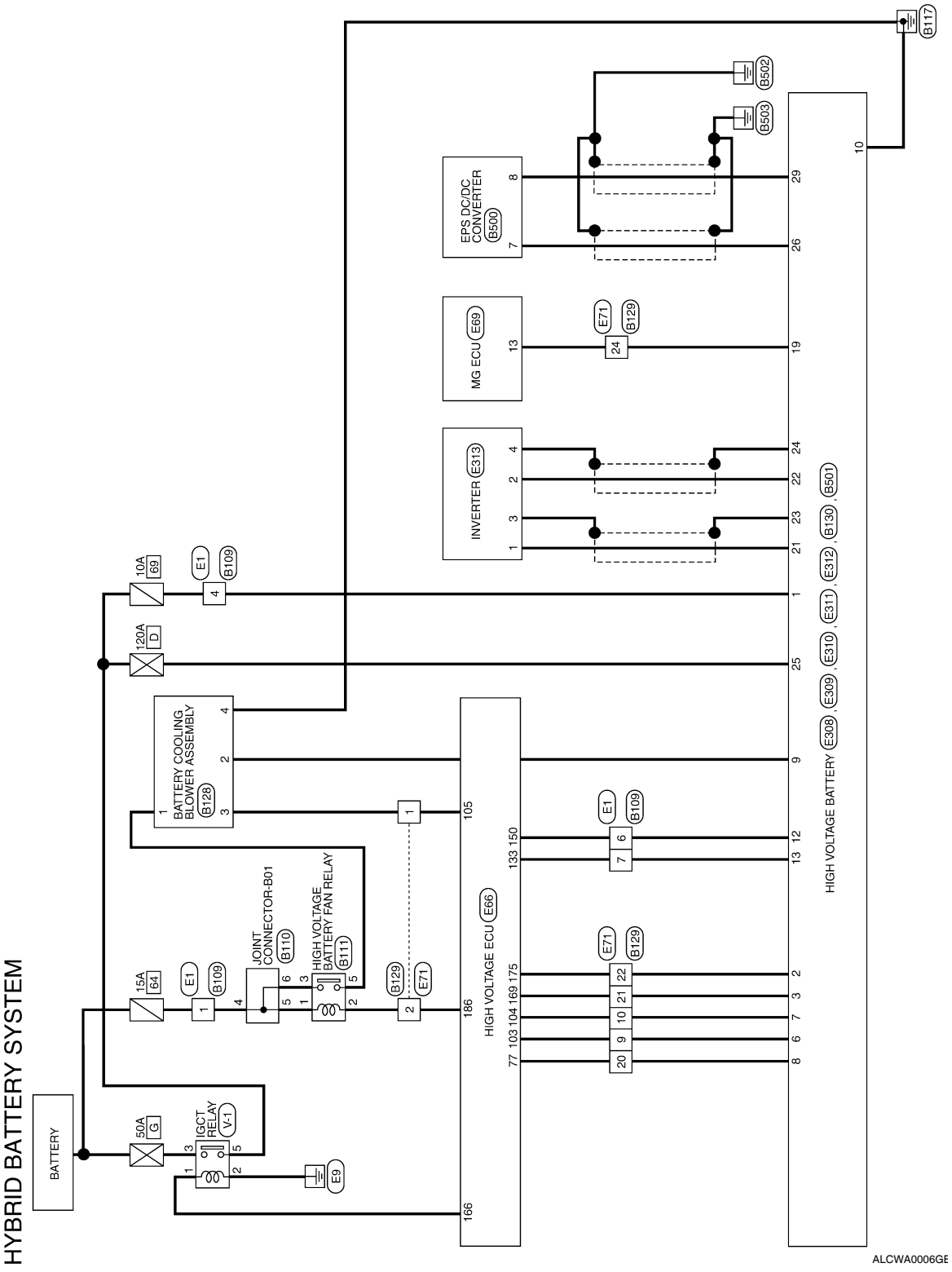
NOTE:
- Do not measure voltage or waveform directly at the sealed side of the inverter with converter assembly connectors. Doing so may damage the connectors because these connectors are waterproof.
- Oscilloscope waveform samples are provided here for informational purposes. Noise and fluttering waveforms have been omitted.

Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
1	10	R/W	Control signal	Input	**[Ignition switch: READY]**	9 - 14 V
9	10	B/Y	Cooling fan monitor signal	Input	**[Ignition switch: ON]** • Cooling fan: Activated	0 - 5 V
10	Ground	B	Battery smart unit battery	—	**[Ignition switch: ON]**	0 V

Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	—		Signal name	Input/ Output		
12	10	B/R	Serial communication	Input/ Output	**[Ignition switch: ON]**	The waveform will vary depending on the content of the digital communication (digital signal).  JMCIA0031GB
13	10	BR/W	Serial communication	Input/ Output	**[Ignition switch: ON]**	The waveform will vary depending on the content of the digital communication (digital signal).  JMCIA0030GB

Wiring Diagram

INFOID:0000000004212301



HYBRID BATTERY SYSTEM CONNECTORS

Connector No.	E1
Connector Name	WIRE TO WIRE
Connector Color	WHITE

H.S.

4	3		2	1
10	9	8	7	6	5

Terminal No.	Color of Wire	Signal Name
1	G/R	–
4	R/W	–
6	B/R	–
7	BR/W	–

Connector No.	E66
Connector Name	HIGH VOLTAGE ECU
Connector Color	BLACK

H.S.

168	167	166	165	164	163	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61
						94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78
174	173	172	171	170	169	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95
180	179	178	177	176	175	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
						145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129
186	185	184	183	182	181	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146

Terminal No.	Color of Wire	Signal Name
77	L/B	SMRP
103	GR	NODD
104	G/R	VLO
105	Y/R	SIO
133	L/R	BTH+
150	L/G	BTH-
166	BR/Y	MREL (SSOFF)
169	W/B	SMRB
175	Y/B	SMRG
186	GR/R	FCTL

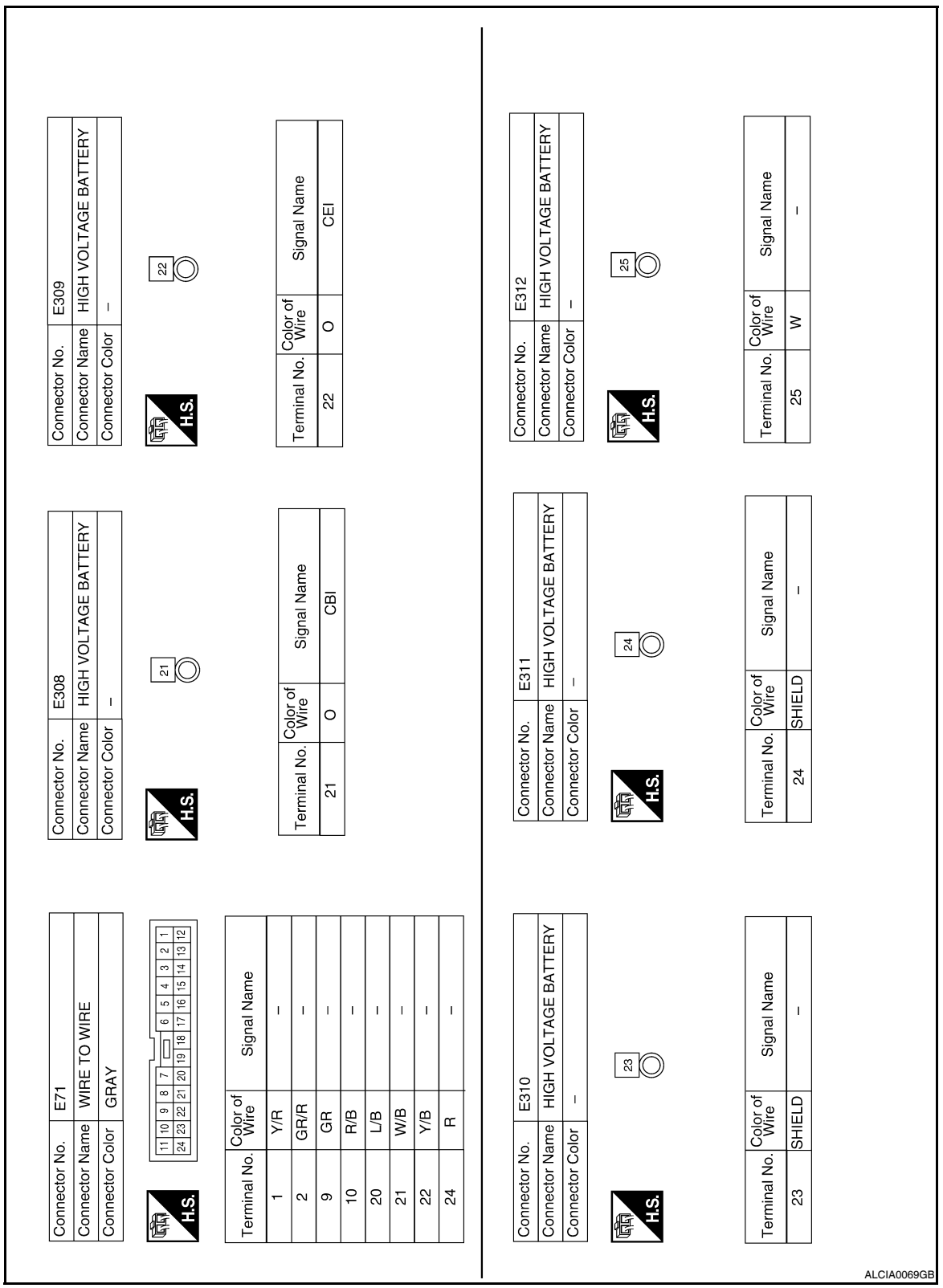
Connector No.	E69
Connector Name	MG ECU
Connector Color	BLACK

H.S.

13	12	11	10	9		8	7	6	5	2	1
22	21	20	19	18		17	16	15	14		
31	30	29	28		27	26	25	24	23	4	3
40	39	38	37		36	35	34	33	32		

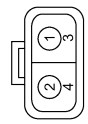
Terminal No.	Color of Wire	Signal Name
13	R	ILKO

ALCIA0068GB


Connector No. E71
Connector Name WIRE TO WIRE
Connector Color GRAY
H.S.
11 10 9 8 7 6 5 4 3 2 1
24 23 22 21 20 19 18 17 16 15 14 13 12
Terminal No. Color of Wire Signal Name
1 Y/R –
2 GR/R –
9 GR –
10 R/B –
20 L/B –
21 W/B –
22 Y/B –
24 R –
Connector No. E308
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
21
Terminal No. Color of Wire Signal Name
21 O CBI
Connector No. E309
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
22
Terminal No. Color of Wire Signal Name
22 O CEI
Connector No. E310
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
23
Terminal No. Color of Wire Signal Name
23 SHIELD –
Connector No. E311
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
24
Terminal No. Color of Wire Signal Name
24 SHIELD –
Connector No. E312
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
25
Terminal No. Color of Wire Signal Name
25 W –
ALCIA0069GB

Connector No.	E313
Connector Name	INVERTER
Connector Color	WHITE

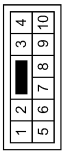
H.S.



Terminal No.	Color of Wire	Signal Name
1	O	HIGH VOLTAGE (+)
2	O	HIGH VOLTAGE (-)
3	SHIELD	–
4	SHIELD	–

Connector No.	B109
Connector Name	WIRE TO WIRE
Connector Color	WHITE

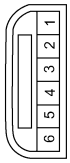
H.S.



Terminal No.	Color of Wire	Signal Name
1	G/R	–
4	R/W	–
6	B/R	–
7	BR/W	–

Connector No.	B110
Connector Name	JOINT CONNECTOR-B01
Connector Color	WHITE

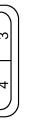
H.S.



Terminal No.	Color of Wire	Signal Name
4	G/R	–
5	G/R	–
6	G/R	–

Connector No.	B111
Connector Name	HIGH VOLTAGE BATTERY FAN RELAY
Connector Color	BLUE

H.S.



Terminal No.	Color of Wire	Signal Name
1	G/R	–
2	GR/R	–
3	G/R	–
5	Y/R	–

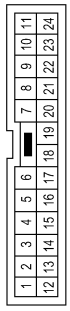
Connector No.	B128
Connector Name	BATTERY COOLING BLOWER ASSEMBLY
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	Y/R	–
2	B/Y	–
3	Y/R	–
4	B	–

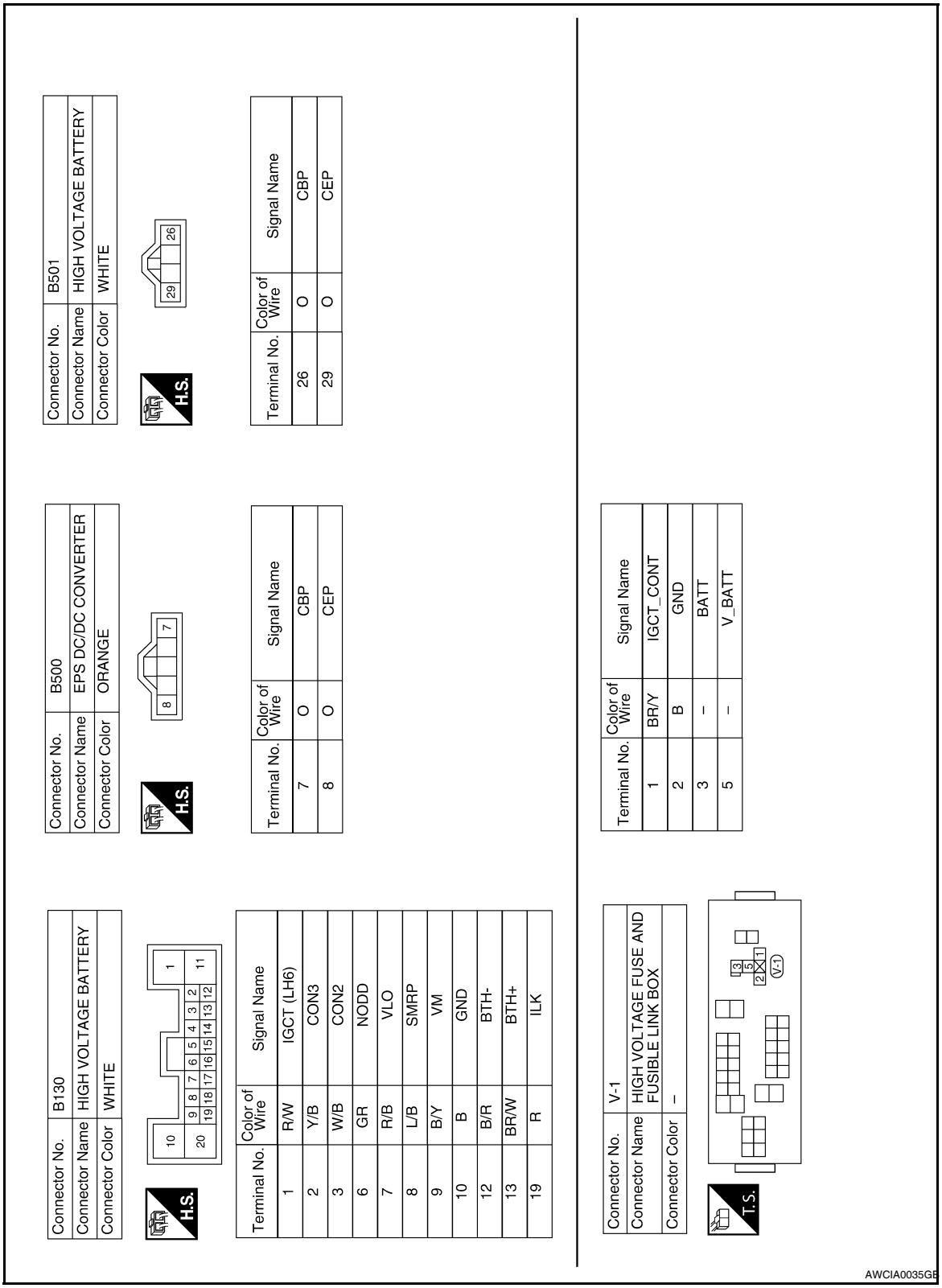
Connector No.	B129
Connector Name	WIRE TO WIRE
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1	Y/R	–
2	GR/R	–
9	GR	–
10	R/B	–
20	L/B	–
21	W/B	–
22	Y/B	–
24	R	–

AWCIA0034GB



DTC Index

INFOID:0000000004212302

×:Applicable —: Not applicable

DTC	CONSULT-III		GST display	FRZF information data	Hybrid system warning light	High voltage battery warning light	Charge warning light	MIL	Trip	Reference page
	INF code	Item								
P0A1F	123	HV BAT SMART/UNIT	x	—	x	—	—	x	1	HBB-37
P0A7F	123	HV BAT DETERIORATE	x	—	x	—	—	x	1 or 2	HBB-39
P0A80	123	HV BAT MICRO SHORT	x	—	x	—	—	x	2	HBB-41
P0A82	123	HV BAT FAN CHARA	—	—	x	—	—	—	1	HBB-43
P0A84	123	HV BAT FAN LOW	—	—	x	—	—	—	1	HBB-46
P0A85	123	HV BAT FAN HIGH	—	—	x	—	—	—	1	HBB-52
P0A95	123	HV BAT SDSW/FUSE	—	—	x	—	—	—	1	HBB-55
P0A9C	123	HV BAT TMP/SEN FRE	x	—	x	—	—	x	1 or 2	HBB-57
P0A9D	123	HV BAT TMP/SEN GND	x	—	x	—	—	x	1	HBB-60
P0A9E	123	HV BAT TMP/SEN OPN	x	—	x	—	—	x	1	HBB-60
P0AAC	123	HV BAT INT/TMP/SEN	—	—	x	—	—	—	1	HBB-63
P0ABF	123	HV BAT CUR/SEN SHO	x	—	x	—	—	x	1	HBB-66
P0AC0	123	HV BAT CUR/SEN FRE	x	—	x	—	—	x	1	HBB-70
P0AC1	123	HV BAT CUR/SEN GND	x	—	x	—	—	x	1	HBB-66
P0AC2	123	HV BAT CUR/SEN OPN	x	—	x	—	—	x	1	HBB-66
P0AFA	123	HV BAT VOL/SEN OPN	x	—	x	—	—	x	1	HBB-72
P3011	123	HV BAT BLO1 WEAK	x	—	x	—	—	x	1	HBB-74
P3012	123	HV BAT BLO2 WEAK	x	—	x	—	—	x	1	HBB-74
P3013	123	HV BAT BLO3 WEAK	x	—	x	—	—	x	1	HBB-74
P3014	123	HV BAT BLO4 WEAK	x	—	x	—	—	x	1	HBB-74
P3015	123	HV BAT BLO5 WEAK	x	—	x	—	—	x	1	HBB-74
P3016	123	HV BAT BLO6 WEAK	x	—	x	—	—	x	1	HBB-74
P3017	123	HV BAT BLO7 WEAK	x	—	x	—	—	x	1	HBB-76
P3018	123	HV BAT BLO8 WEAK	x	—	x	—	—	x	1	HBB-76
P3019	123	HV BAT BLO9 WEAK	x	—	x	—	—	x	1	HBB-76
P3020	123	HV BAT BLO10 WEAK	x	—	x	—	—	x	1	HBB-76
P3021	123	HV BAT BLO11 WEAK	x	—	x	—	—	x	1	HBB-76
P3022	123	HV BAT BLO12 WEAK	x	—	x	—	—	x	1	HBB-76
P3023	123	HV BAT BLO13 WEAK	x	—	x	—	—	x	1	HBB-78
P3024	123	HV BAT BLO14 WEAK	x	—	x	—	—	x	1	HBB-78
P3025	123	HV BAT BLO15 WEAK	x	—	x	—	—	x	1	HBB-78
P3026	123	HV BAT BLO16 WEAK	x	—	x	—	—	x	1	HBB-78
P3027	123	HV BAT BLO17 WEAK	x	—	x	—	—	x	1	HBB-78
U029A	123	HV BAT COMMUNICATE	x	—	x	—	—	x	1	HBB-80

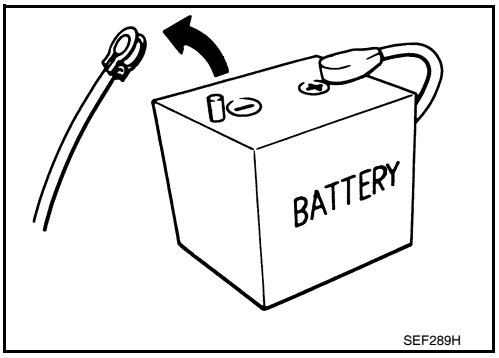
PRECAUTION

PRECAUTIONS

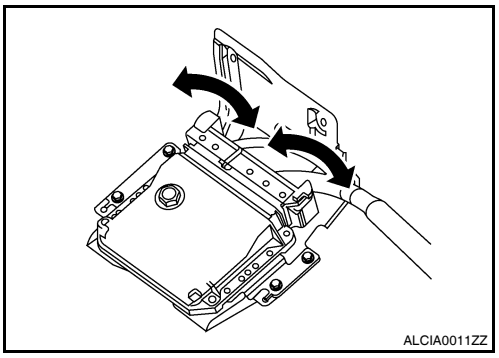
General Precautions

INFOID:0000000004212303

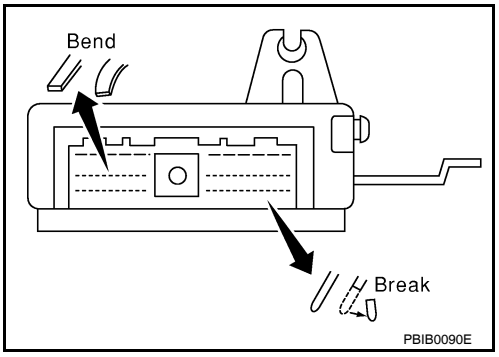
- **Always use a 12-volt battery as power source.**
- **Do not attempt to disconnect battery cables while engine is running.**
- **Do not disassemble ECUs.**
- **If the battery is disconnected, the following emission-related diagnostic information will be lost within 3 minutes.**
- **Diagnostic trouble codes**
- **Freeze frame data**



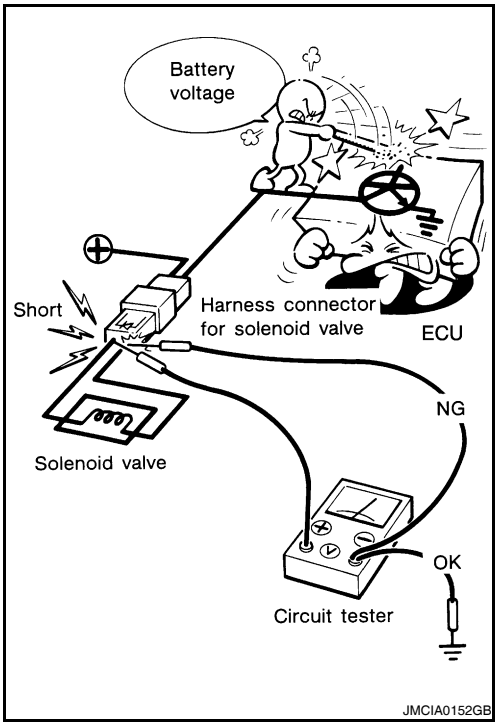
- **When connecting the hybrid vehicle control ECU harness connector, fasten it securely with a lever as far as it will go as shown.**



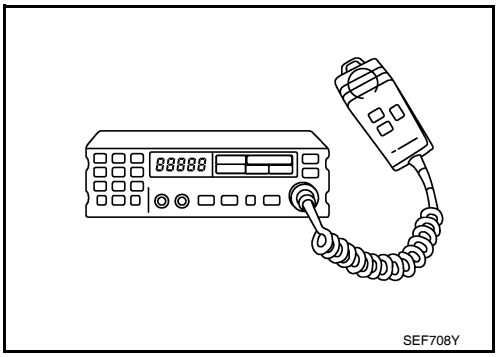
- **When connecting or disconnecting pin connectors into or from the hybrid vehicle control ECU, take care not to damage pin terminals (bend or break).**
  Make sure that there are not any bends or breaks on the hybrid vehicle control ECU pin terminal, when connecting pin connectors.
- **Securely connect the hybrid vehicle control ECU harness connectors.**
  A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- **Keep hybrid vehicle control system harness at least 10 cm (4 in) away from adjacent harness, to prevent hybrid vehicle control system malfunctions due to receiving external noise, degraded operation of ICs, etc.**
- **Keep hybrid vehicle control system parts and harness dry.**



- **When measuring ECU signals with a circuit tester, never allow the two tester probes to contact.**
  Accidental contact of probes will cause a short circuit and damage the ECU power transistor.



- **When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on installation location.**
- **Keep the antenna as far as possible from the electronic control units.**
- **Keep the antenna feeder line more than 20 cm (8 in) away from the harness of electronic controls.**
  Do not let them run parallel for a long distance.
- **Adjust the antenna and feeder line so that the standing-wave radio can be kept smaller.**
- **Be sure to ground the radio to vehicle body.**



Precautions For High-Voltage System

INFOID:0000000004212304

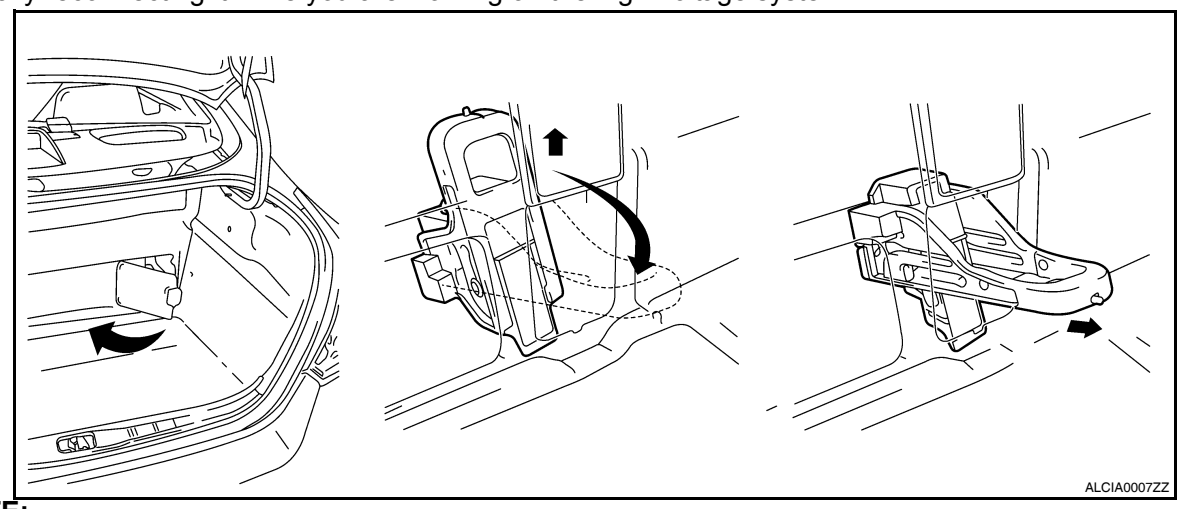
Refer to GI-24, "Precautions For High-Voltage System".

Precautions for Inspecting the Hybrid Control System

INFOID:0000000004212305

- Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions, such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. Make sure to turn ignition switch OFF before removing the service

plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.



NOTE:
Turning ignition switch ON (READY) with the service plug grip removed could cause a malfunction. Do not turn ignition switch ON (READY) unless instructed by the service manual.
ON (READY): The condition which the ready indicator lamp illuminates and vehicle is ready to be driven.

- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

NOTE:
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

- Turn ignition switch OFF, wear insulated gloves, and disconnect the negative terminal of the auxiliary battery before touching any of the orange-colored wires of the high-voltage system.
- Turn ignition switch OFF before performing any resistance checks.
- Turn ignition switch OFF before disconnecting or reconnecting any connectors.

Precautions for the Hybrid Control System Activation

INFOID:0000000004212306

- When the auxiliary battery has been disconnected and reconnected, attempting to turn ignition switch ON (READY) may not start the system (the system may not enter the READY-on state) on the first attempt. If so, turn ignition switch OFF and reattempt to turn ignition switch ON (READY).

Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:0000000004212307

The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER”, used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. This system includes seat belt switch inputs and dual stage front air bag modules. The SRS system uses the seat belt switches to determine the front air bag deployment, and may only deploy one front air bag, depending on the severity of a collision and whether the front occupants are belted or unbelted.
Information necessary to service the system safely is included in the SR and SB section of this Service Manual.

WARNING:

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.**
- **Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SR section.**
- **Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.**

Necessary for Steering Wheel Rotation After Battery Disconnect

INFOID:0000000004466792

NOTE:
- Before removing and installing any control units, first turn the push-button ignition switch to the LOCK position, then disconnect both 12-volt battery cables.
- After finishing work, confirm that all control unit connectors are connected properly, then re-connect both 12-volt battery cables.
- Always use CONSULT-III to perform self-diagnosis as a part of each function inspection after finishing work. If a DTC is detected, perform trouble diagnosis according to self-diagnosis results.

This vehicle is equipped with a push-button ignition switch and a steering lock unit.
If the 12-volt battery is disconnected or discharged, the steering wheel will lock and cannot be turned.
If turning the steering wheel is required with the 12-volt battery disconnected or discharged, follow the procedure below before starting the repair operation.

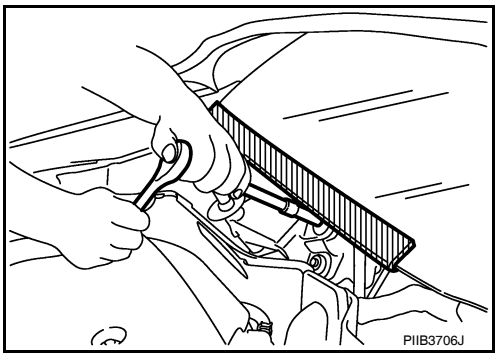
OPERATION PROCEDURE

1. Connect both 12-volt battery cables.
   NOTE:
   Supply power using jumper cables if 12-volt battery is discharged.
2. Carry the Intelligent Key or insert it to the key slot and turn the push-button ignition switch to ACC position. (At this time, the steering lock will be released.)
3. Disconnect both 12-volt battery cables. The steering lock will remain released with both 12-volt battery cables disconnected and the steering wheel can be turned.
4. Perform the necessary repair operation.
5. When the repair work is completed, re-connect both 12-volt battery cables. With the brake pedal released, turn the push-button ignition switch from ACC position to ON position, then to LOCK position. (The steering wheel will lock when the push-button ignition switch is turned to LOCK position.)
6. Perform self-diagnosis check of all control units using CONSULT-III.

Precaution for Procedure without Cowl Top Cover

INFOID:0000000004212308

When performing the procedure after removing cowl top cover, cover the lower end of windshield with urethane, etc.

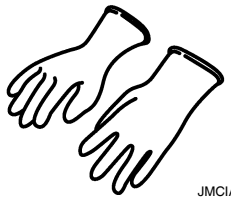


PREPARATION

PREPARATION

Commercial Service Tools

INFOID:0000000004212310

Tool name (Kent-Moore No.)	Description
Insulation gloves  JMCIA0149ZZ	Guaranteed insulation performance for 1000V/300A

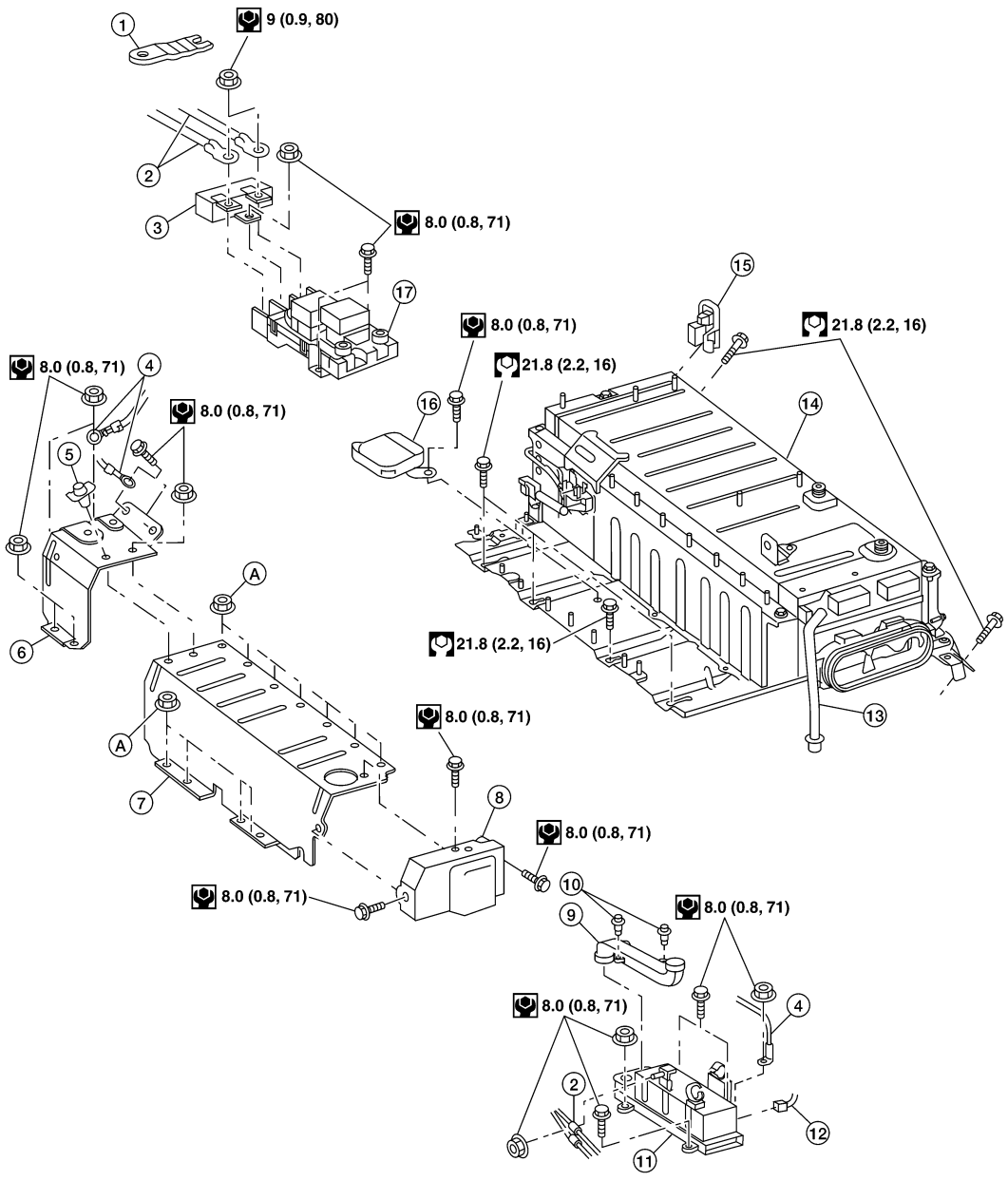
REMOVAL AND INSTALLATION

HV BATTERY ASSEMBLY

Exploded View

INFOID:0000000004212311

SEC. 295



1. Battery shield contact
2. HV wire
3. Filter noise capacitor
4. Ground wire
5. Lock
6. RH cover
7. LH cover
8. Side cover
9. Duct
10. Clip
11. HV vehicle converter
12. Connector
13. Vent hose
14. HV battery assembly
15. Service plug grip
16. Battery smart unit
17. HV relay assembly
A. Refer to installation.

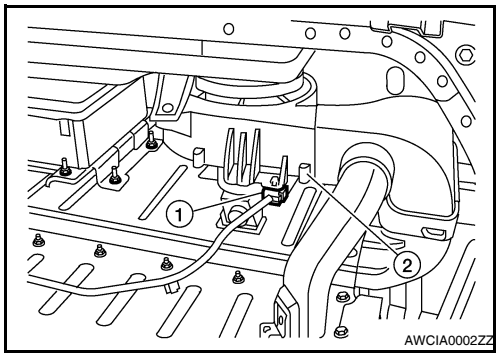
Removal and Installation

INFOID:0000000004212312

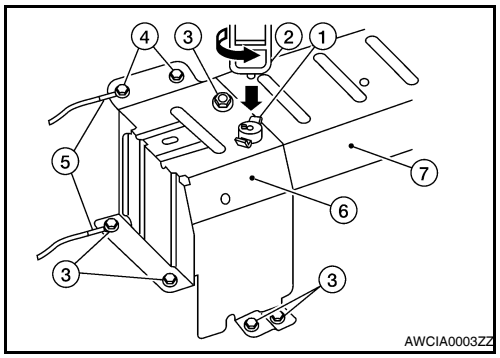
CAUTION:
- **Do not tilt the HV battery more than 30° for extremely long time.**
- **Do not tilt the HV battery more than 60°.**

REMOVAL

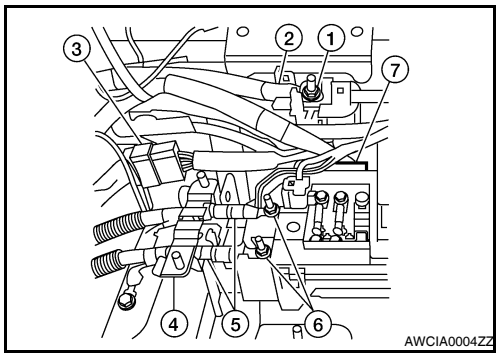
1. Remove the rear seat. Refer to SE-22, "Removal and Installation".
2. Remove the rear parcel shelf. Refer to INT-19, "Removal and Installation".
3. Remove the trunk room trim. Refer to INT-27, "Removal and Installation".
4. Remove the inlet and outlet cooling ducts. Refer to HBB-106, "Removal and Installation".
5. Disconnect the connector (1) from the HV battery blower motor (2).
6. Remove the HV battery blower motor harness clips and HV battery blower motor harness from the HV battery.



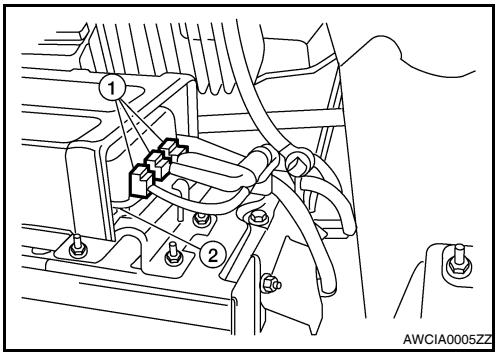
7. Remove the lock (1) from the RH cover (6) on the HV battery assembly (7) using the service plug grip (2).
8. Remove the nuts (3), bolts (4) and ground wires (5) from the RH cover (6).
9. Remove the RH cover (6) from the HV battery assembly (7).



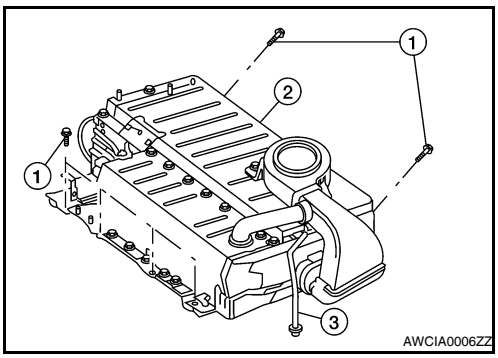
10. Remove the terminal cover and 12 volt terminal nut (1), then remove the terminal cable (2) and 12 volt harness from the HV battery assembly.
11. Remove the battery shield contact (4), HV wire nuts (6) and HV wires (5) from the HV battery assembly.
12. Disconnect the body harness connector (3) from the HV battery assembly.
13. Disconnect the EPS DC/DC converter connector (7) from the HV battery assembly.
14. Remove the harnesses from the HV battery assembly.



15. Disconnect the electrical connectors (1) from the EPS DC/DC converter (2).
16. Remove the harness clips and harness from the HV battery assembly.



17. Disconnect the vent hose (3) from the vehicle.
18. Remove the HV battery bolts (1) from the HV battery assembly (2).
19. Remove the HV battery assembly from the vehicle.



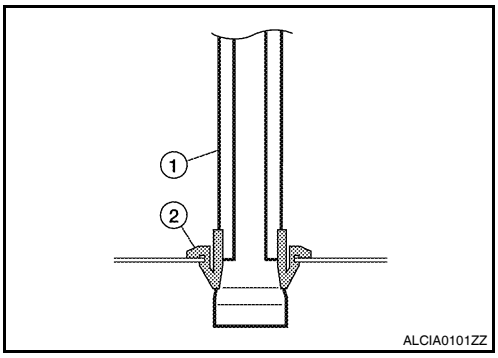
20. If necessary, remove the following components from the HV battery assembly.
    - The HV battery blower motor and cooling ducts. Refer to HBB-106, "Removal and Installation".
    - The EPS DC/DC converter. Refer to STC-60, "Removal and Installation".
    - The HV relay assembly. Refer to HBB-105, "Removal and Installation".
    - The battery smart unit. Refer to HBB-101, "Removal and Installation".
    - The HV vehicle converter. Refer to HBB-103, "Removal and Installation".

INSTALLATION

Installation is in the reverse order of removal.

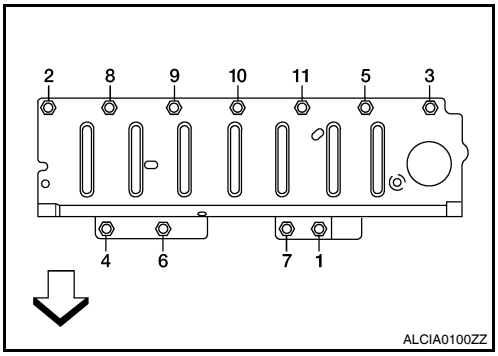
NOTE:

- When connecting the vent hose (1), make sure that there is no clearance between the grommet (2) and body after installing the grommet.

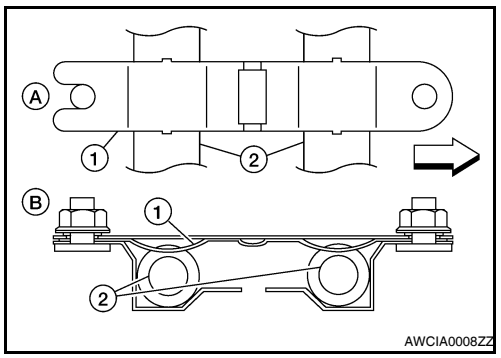


- When installing the LH cover, tighten the nuts to the specified torque in the order shown.

- ⇐: Front



- When installing the battery shield contact (1), position as shown.
  - ⇐: Front
  - Top view (A)
  - Side view (B)
  - HV wires (2)



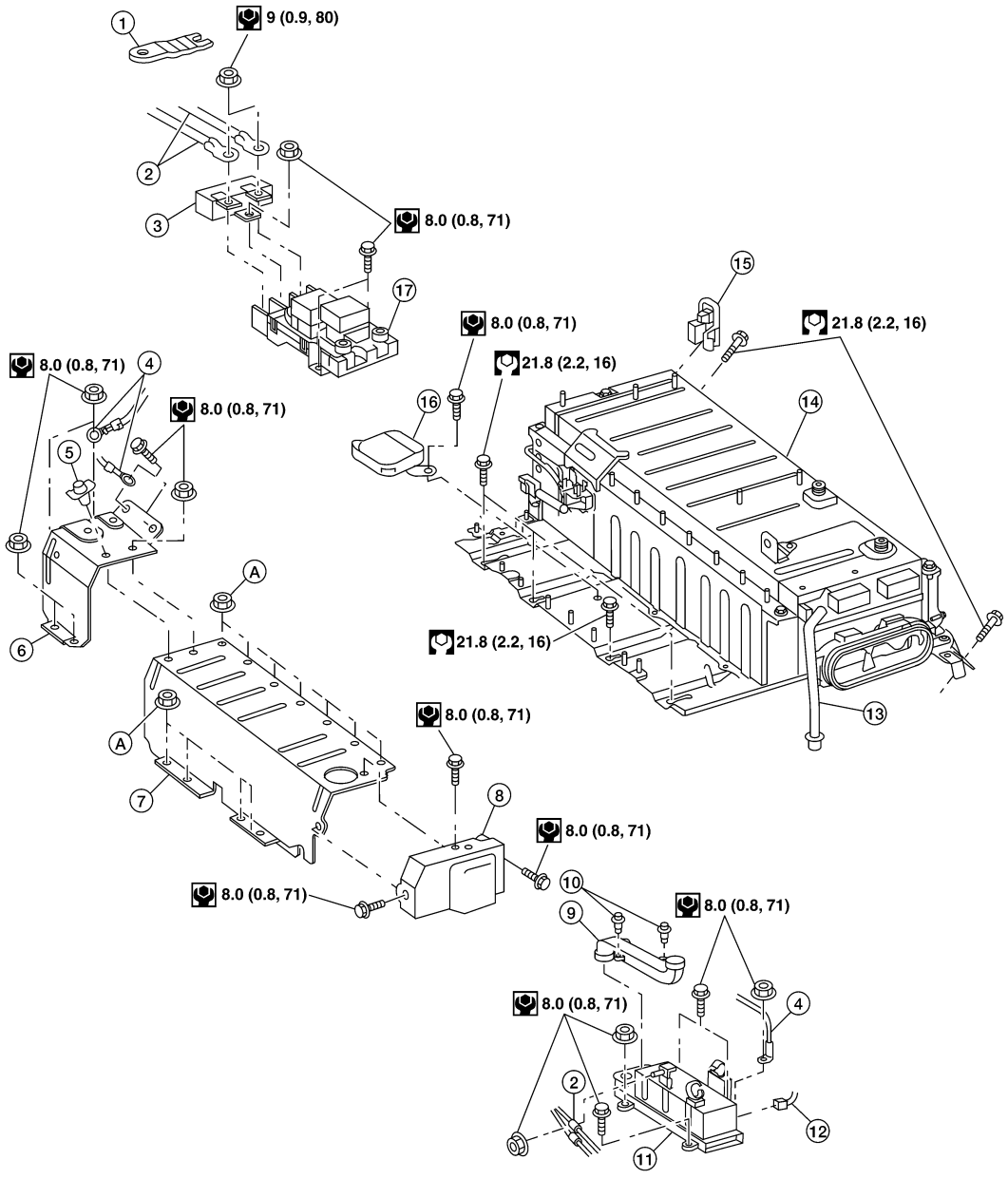
- When installing the lock to the RH cover, push the lock into the hole and ensure it is locked.

BATTERY SMART UNIT

Exploded View

INFOID:0000000004212313

SEC. 295



ALCIA0097GB

1. Battery shield contact
2. HV wire
3. Filter noise capacitor
4. Ground wire
5. Lock
6. RH cover
7. LH cover
8. Side cover
9. Duct

10. Clip
11. HV vehicle converter
12. Connector
13. Vent hose
14. HV battery assembly
15. Service plug grip
16. Battery smart unit
17. HV relay assembly
A. Refer to installation.

Removal and Installation

INFOID:0000000004212314

REMOVAL

1. Remove the HV relay assembly from the HV battery assembly. Refer to HBB-105, "Removal and Installation".
2. Remove the bolt from the battery smart unit.
3. Disconnect the connectors from the battery smart unit and remove it from the HV battery assembly.

INSTALLATION

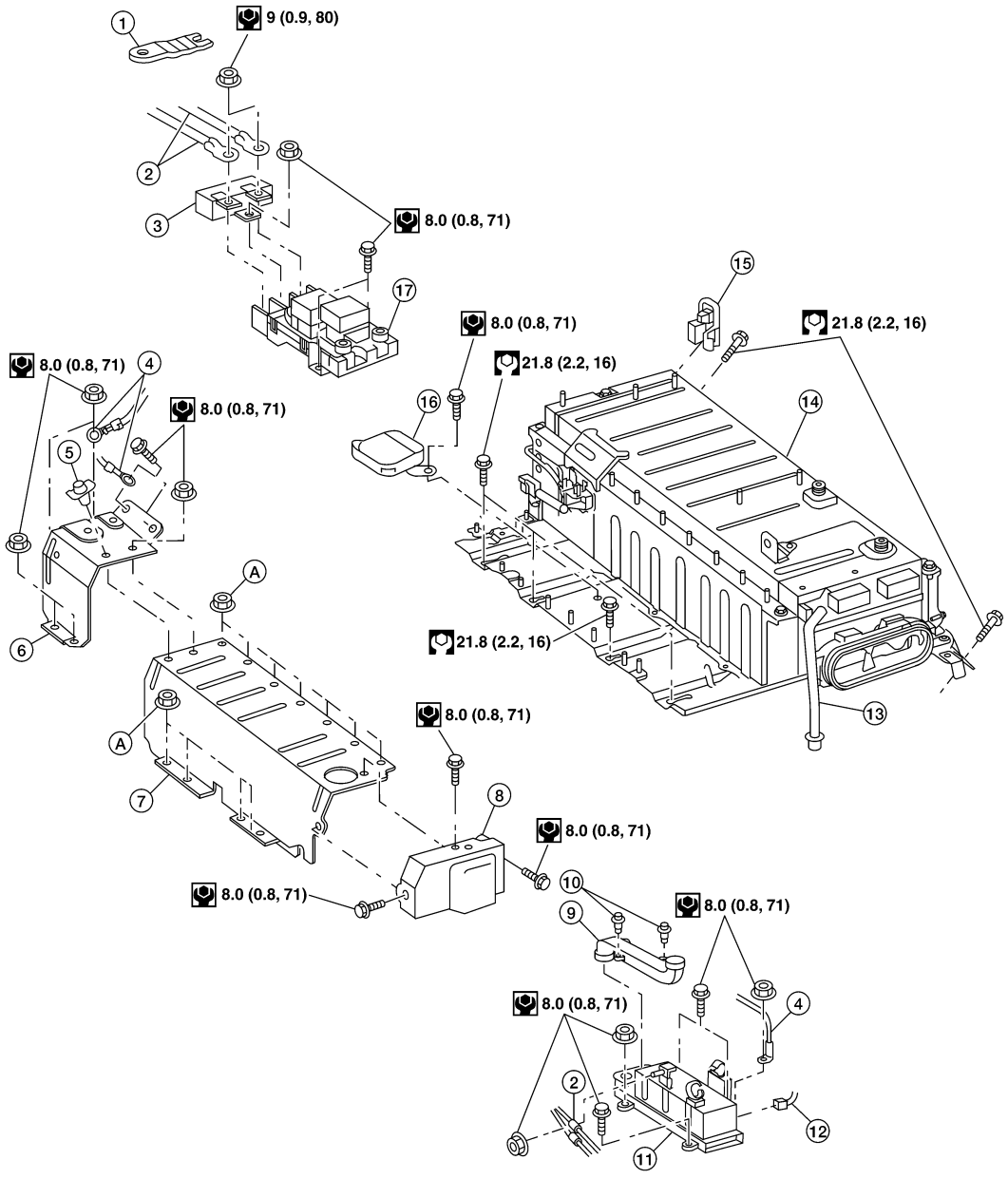
Installation is in the reverse order of removal.

HV VEHICLE CONVERTER

Exploded View

INFOID:0000000004212315

SEC. 295



ALCIA0097GB

1. Battery shield contact
2. HV wire
3. Filter noise capacitor
4. Ground wire
5. Lock
6. RH cover
7. LH cover
8. Side cover
9. Duct

10. Clip
11. HV vehicle converter
12. Connector
13. Vent hose
14. HV battery assembly
15. Service plug grip
16. Battery smart unit
17. HV relay assembly
A. Refer to installation.

Removal and Installation

INFOID:0000000004212316

REMOVAL

1. Disconnect the connectors from the HV relay assembly. Refer to HBB-105, "Removal and Installation".
2. Remove the HV wire nut and HV wire from the HV vehicle converter.
3. Remove the ground wire nut and ground wire from the HV vehicle converter.
4. Remove the HV vehicle converter.
   1. Remove the HV vehicle converter nut and bolts from the HV vehicle converter.
   2. Disconnect the connector from the back of the HV vehicle converter.
   3. Remove the HV vehicle converter.
5. Remove the clips and duct from the HV vehicle converter.

INSTALLATION

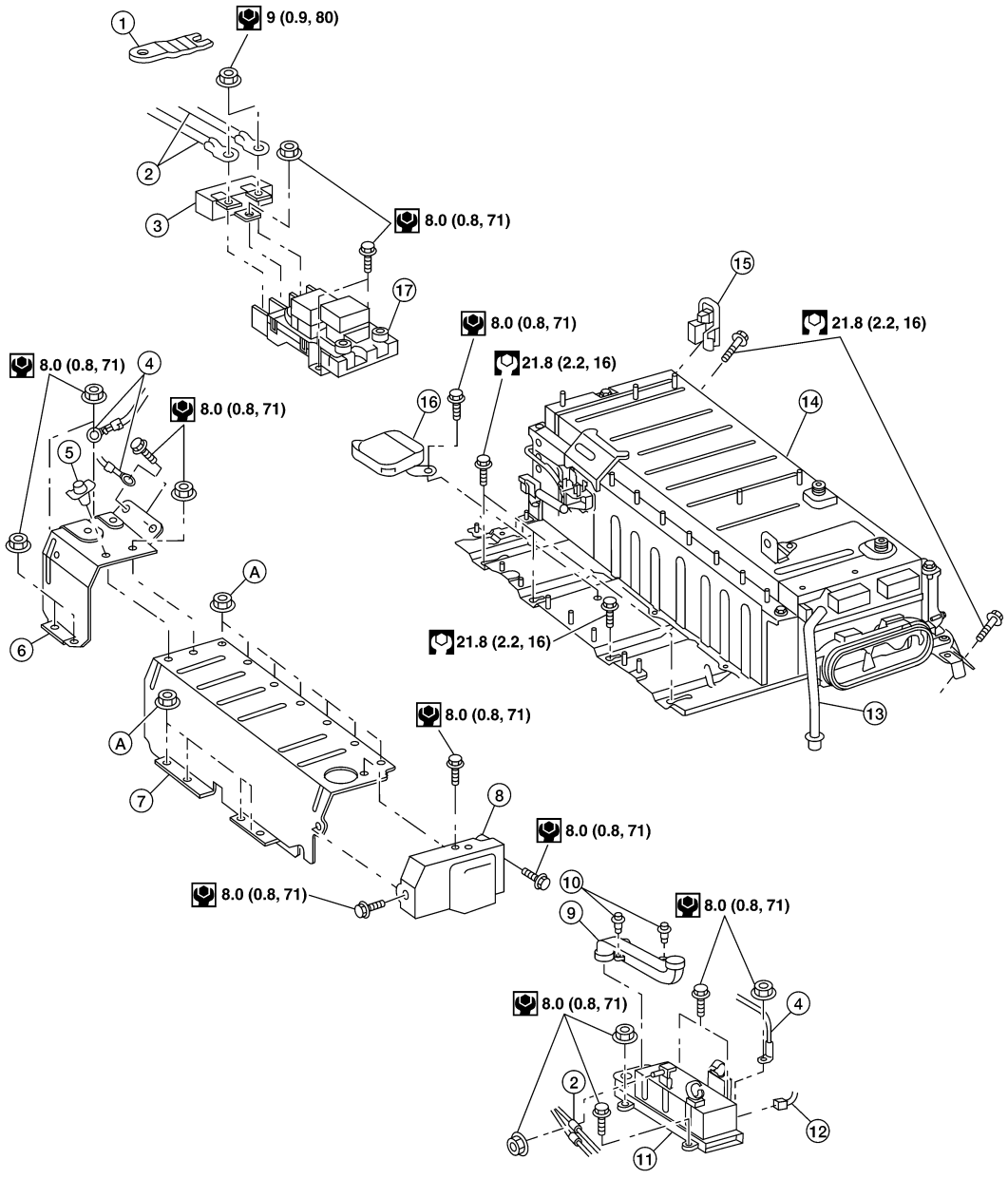
Installation is in the reverse order of removal.

HV RELAY ASSEMBLY

Exploded View

INFOID:0000000004212317

SEC. 295



1. Battery shield contact
2. HV wire
3. Filter noise capacitor
4. Ground wire
5. Lock
6. RH cover
7. LH cover
8. Side cover
9. Duct

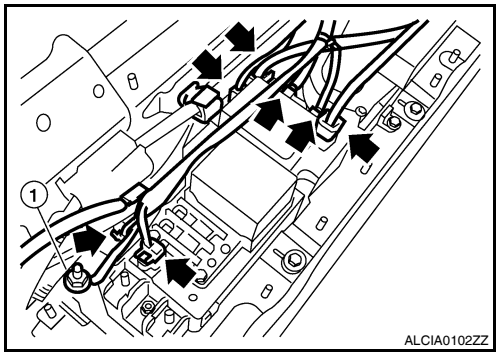
10. Clip
11. HV vehicle converter
12. Connector
13. Vent hose
14. HV battery assembly
15. Service plug grip
16. Battery smart unit
17. HV relay assembly
A. Refer to installation.

Removal and Installation

INFOID:0000000004212318

REMOVAL

1. Remove the HV wires from the HV battery assembly. Refer to HBC-648, "Removal and Installation".
2. Remove the side cover and LH cover from the HV battery assembly.
3. Remove the filter noise capacitor.
4. Disconnect ground wire (1), and the connectors from the HV relay assembly.
5. Remove the bolts and the HV relay assembly from the HV battery assembly.



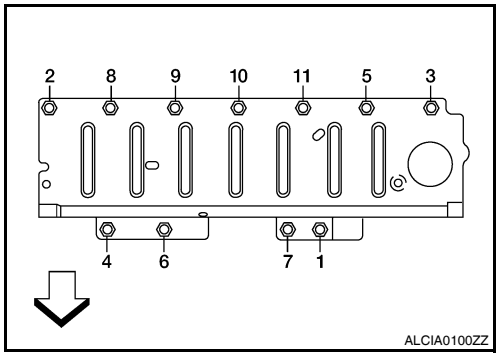
INSTALLATION

Installation is in the reverse order of removal.

- When installing the LH cover, tighten the nuts to the specified torque in the order shown.

LH cover nuts : 8.0 N·m (0.8 kg-m, 71 in-lb)

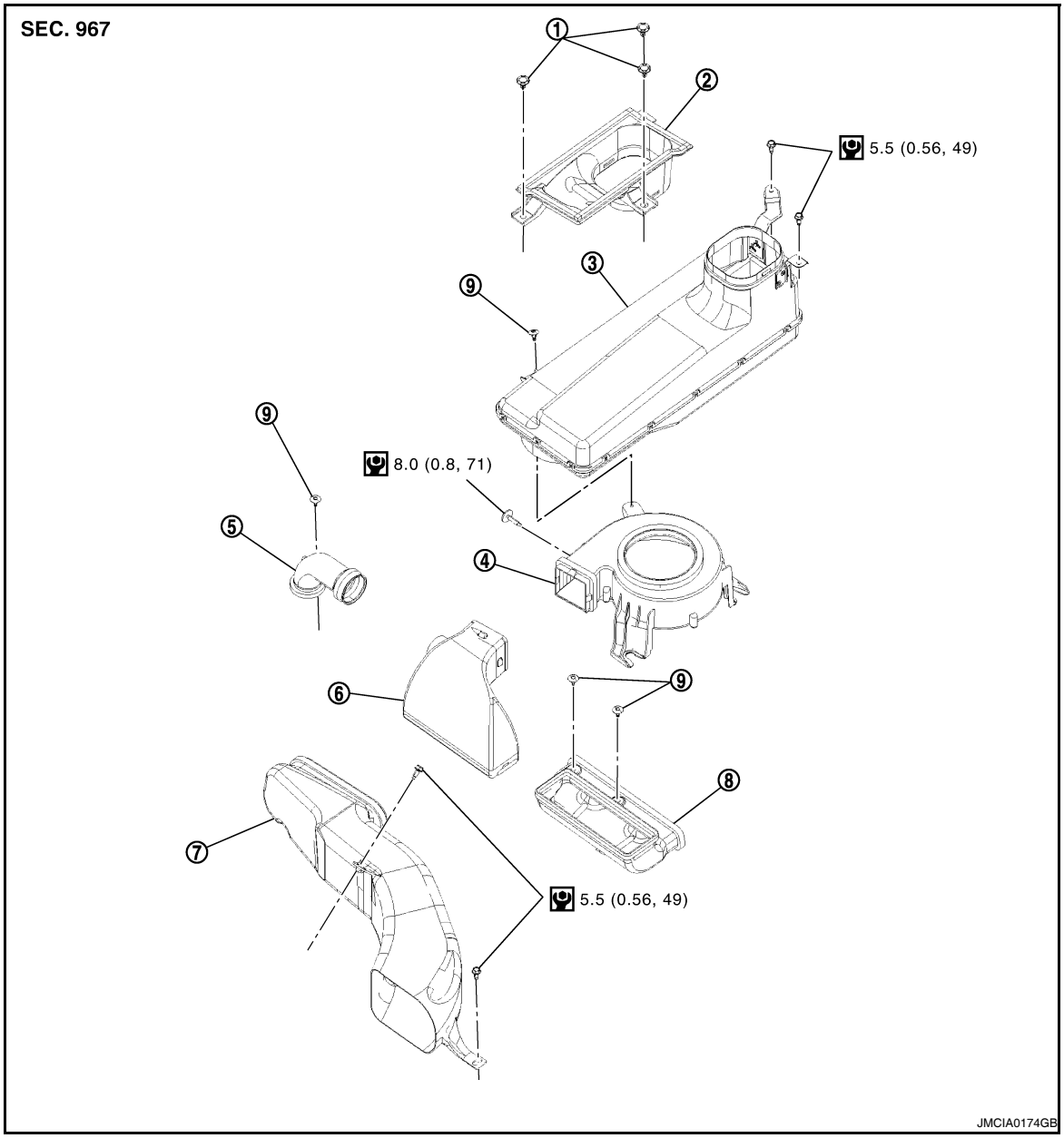
- ⇐: Front



HV BATTERY BLOWER MOTOR

Exploded View

INFOID:0000000004212319



1. Clip A
2. Upper inlet duct
3. Lower inlet duct
4. HV battery blower motor
5. Front duct
6. Rear upper duct
7. Outlet duct
8. Rear lower duct
9. Clip B

Removal and Installation

INFOID:0000000004212320

REMOVAL

1. Remove the rear seat. Refer to SE-22, "Removal and Installation".
2. Remove the rear parcel shelf finisher. Refer to INT-19, "Removal and Installation".
3. Remove the trunk room trim. Refer to INT-27, "Removal and Installation".
4. Remove the upper and lower inlet duct clips and bolts.
5. Remove the upper and lower inlet duct from the package shelf and HV battery blower motor.

6. Remove the front duct clip and remove the front duct from the rear upper duct and HV battery assembly.
7. Separate the rear upper duct from the rear lower duct and remove the rear upper duct from the HV battery blower motor.
8. Disconnect the HV battery blower motor harness connector from the HV battery blower motor.
9. Remove the HV battery blower motor from the HV battery assembly.

INSTALLATION

Installation is in the reverse order of removal.

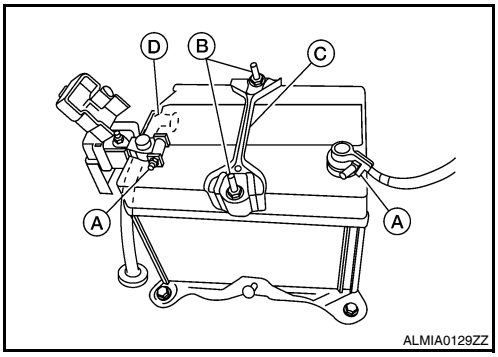
AUXILIARY BATTERY

Removal and Installation

INFOID:0000000004513180

REMOVAL

1. Remove trunk side finisher (RH). Refer to INT-26, "Exploded View".
2. Loosen 12-volt battery terminal nuts (A), and disconnect both 12-volt battery terminals.
   CAUTION:
   When disconnecting, disconnect the 12-volt battery negative terminal first.
3. Remove the 12-volt battery ventilation tube (D).
4. Remove 12-volt battery frame nuts (B) and 12-volt battery frame (C).
5. Remove 12-volt battery.



INSTALLATION

Installation is the reverse order of removal.

CAUTION:
When connecting, connect the 12-volt battery positive terminal first.

Battery frame nut	**: 3.92 N·m (0.4 kg-m, 35 in-lb)**
Battery terminal nut	**: 5.4 N·m (0.55 kg-m, 48 in-lb)**

Reset electronic systems as necessary. Refer to PG-3, "Special Repair Requirement".