SECTION HBC
HYBRID CONTROL SYSTEM

CONTENTS

BASIC INSPECTION

DIAGNOSIS AND REPAIR WORKFLOW

Work Flow

INFOID:0000000004211725

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 WORK SHEET”.

>> 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.
DIAGNOSTIC 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:0000000004211726

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 an 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

WORK SHEET 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)

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INSPECTION AND ADJUSTMENT

ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT

ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Precaution for replacing hybrid vehicle control ECU

INFOID:0000000004211727

When replacing the hybrid vehicle control ECU, never remove the waterproof sheet.

NOTE:

The hybrid vehicle control ECU is covered with a waterproof sheet. If the waterproof sheet is peeled off, the labels on the hybrid vehicle control ECU will be removed together with the waterproof sheet. Consequently important data printed on the label for warranty procedure will be lost.

ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement

INFOID:0000000004211728

1. PERFORM INITIALIZATION OF NATS SYSTEM AND REGISTRATION OF ALL NATS IGNITION KEY IDS

Refer to SEC-9, "ECM RE-COMMUNICATING FUNCTION : Special Repair Requirement".

>> END

FUNCTION DIAGNOSIS

HYBRID CONTROL SYSTEM

System Diagram

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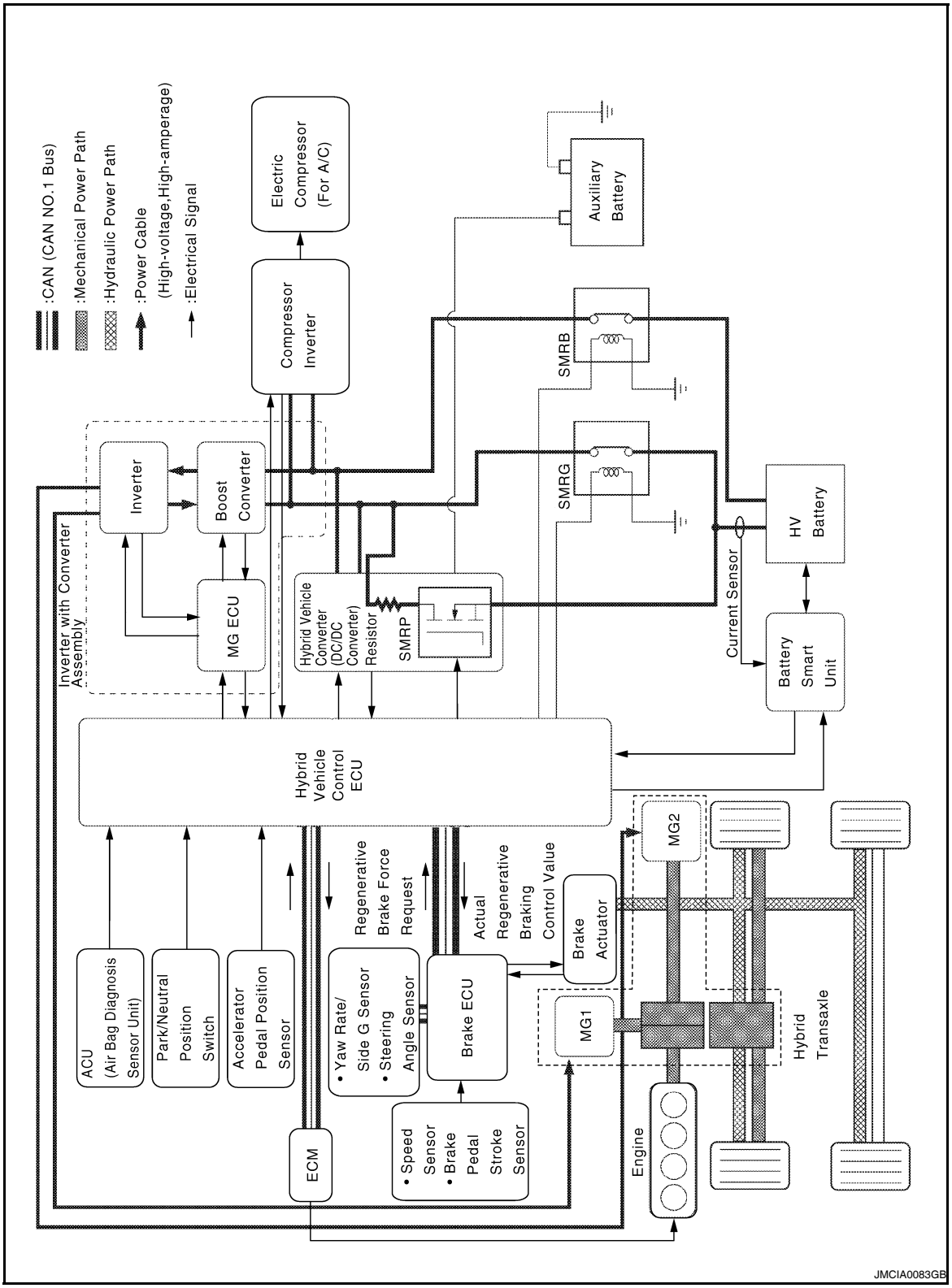


System Description

INFOID:0000000004211730

DESCRIPTION

General

The Hybrid Vehicle Control system optimally effects cooperative control of a QR25DE engine and a high-speed, high-output MG2 through a hybrid transaxle that provides excellent transmission performance.
Furthermore, it uses a variable-voltage system consisting of a high-output HV battery with a nominal voltage of DC 244.8 V, and a boost converter that boosts the operating voltage of the system to a maximum voltage of DC 650 V.

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 in this service manual.
- Inverter assembly is also called inverter with converter assembly in this service manual.
- Hybrid vehicle converter (DC/DC converter) is also just called DC/DC converter in this service manual.

Driving Performance

This system uses a variable-voltage system that consists of a boost converter to boost the operating voltage to a maximum voltage of DC 650 V. It is able to drive the MG1 (Motor Generator No.1) and MG2 (Motor Generator No.2) at a high voltage, and minimizes the electrical loss associated with the supply of electric power at a smaller current. Thus, it is able to operate the MG1 and MG2 at high speeds and high outputs.
A high driving force is achieved through the synergy effect of the high-speed, high-output MG2 and the high-efficiency QR25DE engine.

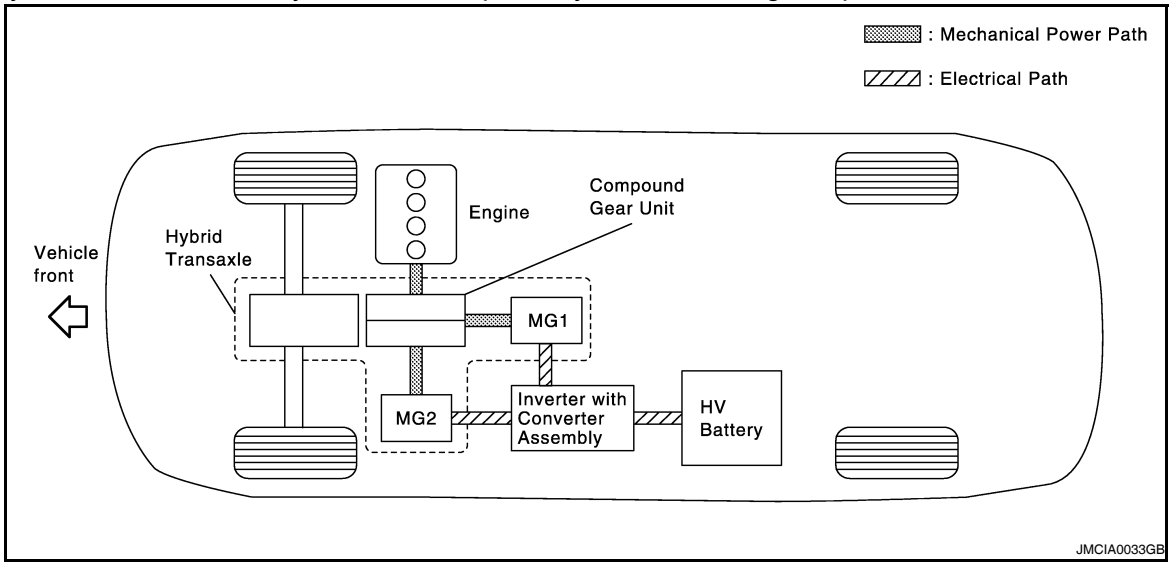
Fuel Economy Performance

- By optimizing the internal construction of MG2, this system realizes a high level of regenerative capability, thus realizing a high level of fuel economy performance.
- This system stops the engine while the vehicle is idling, and stops the engine as much as possible under conditions in which the operating efficiency of the engine is poor, allowing the vehicle to operate using only MG2. Under the conditions in which the operating efficiency of the engine is favorable, the engine operates to drive the vehicle using MG1 while generating electricity. Thus, this system effects the input-output control of driving energy in a highly efficient manner to realize a high level of fuel economy.

FEATURES

General

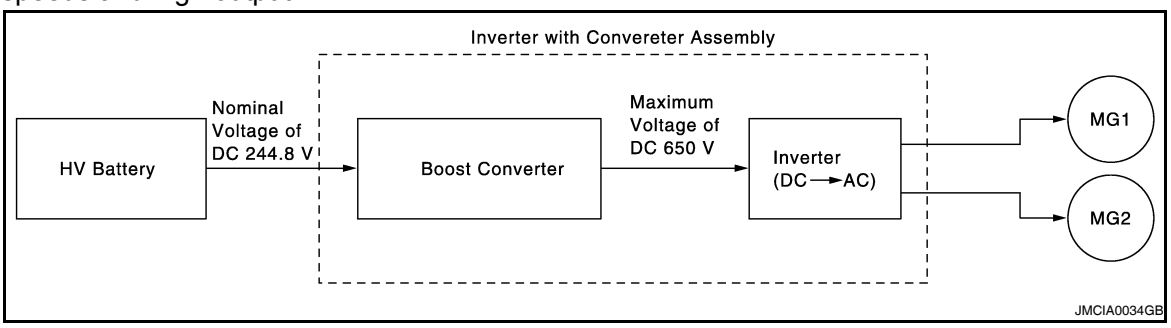
- The Hybrid Vehicle Control System offers the following representative features:
- Uses a variable-voltage system in which a boost converter boosts the operating voltage of the system to a maximum voltage of DC 650 V and an inverter converts the direct current into an alternating current, which supplies the system voltage to MG1 and MG2.
- A motor speed reduction planetary gear unit, whose purpose is to reduce motor speed, is used to enable the high-speed, high-output MG2 to adapt optimally to the power split planetary gear unit in the hybrid transaxle.
- The Hybrid Vehicle Control System consists primarily of the following components:



Variable-Voltage System

In the Hybrid Vehicle Control System, a boost converter is used inside the inverter assembly. The boost converter boosts the system operating voltage to a maximum voltage of DC 650 V and the inverter converts direct current into alternating current, in order to drive MG1 and MG2 at a high voltage as well as minimize the elec-

trical loss associated with the electric power supply at a smaller current. Thus, MG1 and MG2 can be operated at high speeds and high output.

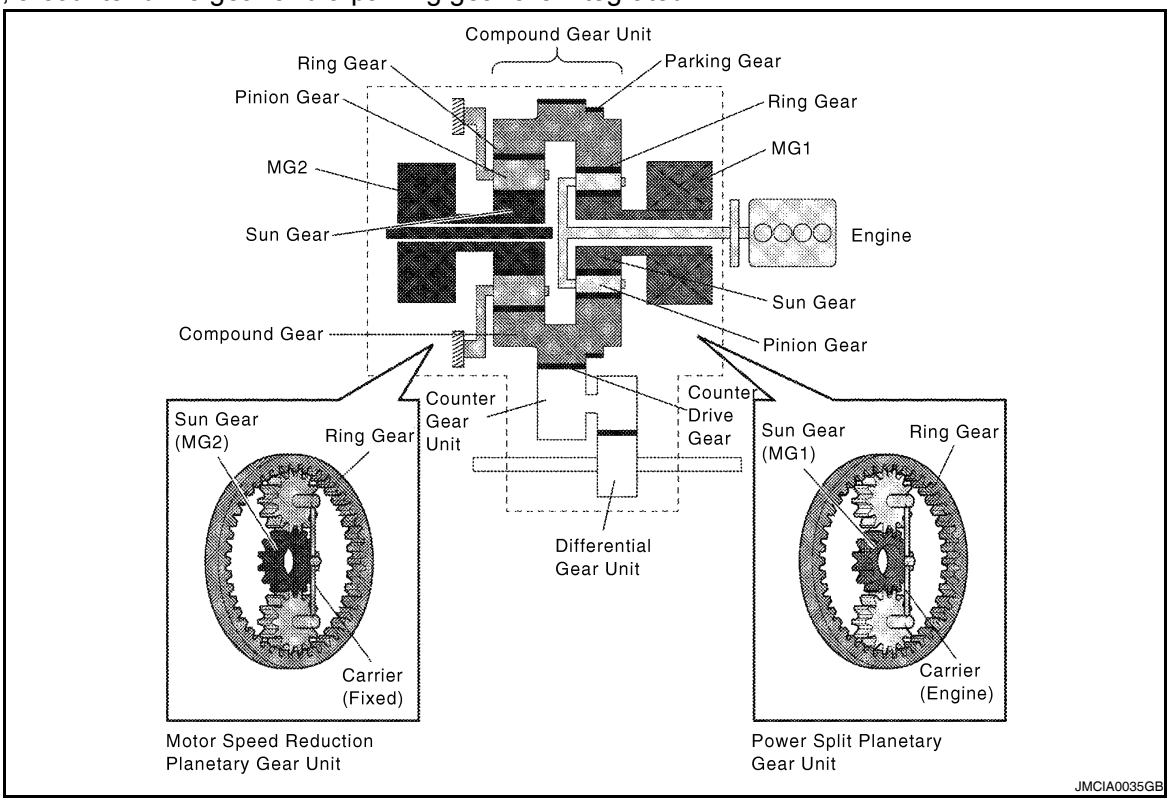


Clutch-Less System

A clutch-less system is used to mechanically link the front wheels and MG2 via gears. To disengage the motive force in the neutral position, the shift position sensor outputs an N position signal to turn OFF all the power transistors in the inverter (which controls MG1 and MG2). As a result, the operation of MG1 and MG2 shuts down, thus rendering the motive force at the wheels to zero.

Hybrid Transaxle

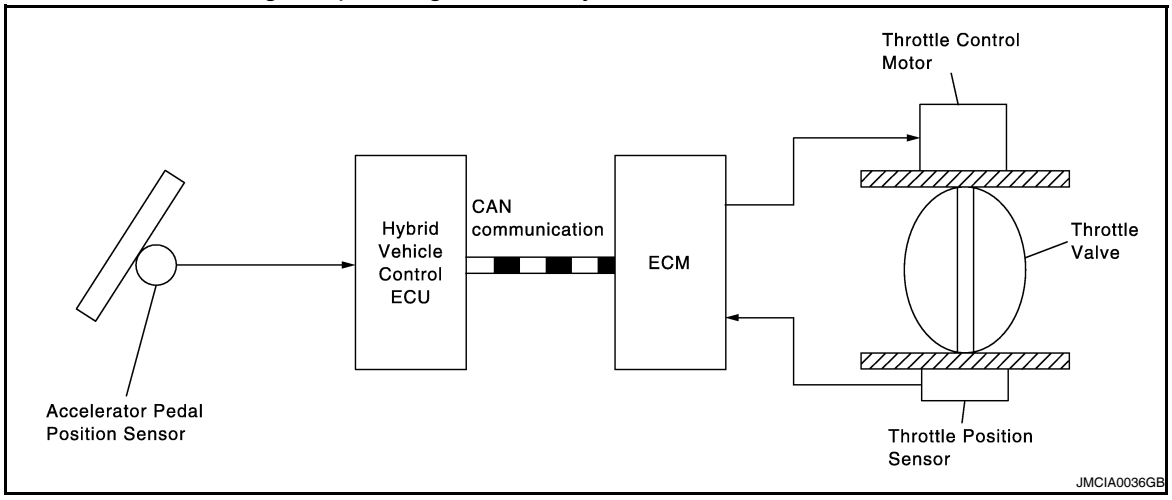
- This system drives the vehicle by combining the motive forces of the engine and the MG2 in an optimal manner in accordance with the driving conditions of the vehicle. In this system, the engine power forms the basis. The power split planetary gear unit in the hybrid transaxle splits the engine power two ways: one to drive the wheels, and the other to drive MG1, so that it can function as a generator.
- This hybrid transaxle consists primarily of MG1, MG2, a compound gear unit (which consists of a motor speed reduction planetary gear unit and a power split planetary gear unit), a counter gear unit and a differential gear unit.
- The engine, MG1 and MG2 are mechanically joined via the compound gear unit.
- The compound gear unit contains a motor speed reduction planetary gear unit and a power split planetary gear unit. The motor speed reduction planetary gear unit reduces the rotational speed of MG2, and the power split planetary gear unit splits the motive force of the engine two ways: one to drive the wheels, and the other to drive MG1, so that it can function as a generator.
- In the motor speed reduction planetary gear unit, the sun gear is coupled to the output shaft of MG2, and the carrier is fixed. Furthermore, the compound gear unit uses a compound gear, in which two planetary ring gears, a counter drive gear and a parking gear are integrated.



Link-Less

The Electric Throttle Control Actuator is used. This is a link-less system that does not use an accelerator cable. Instead, it uses an accelerator pedal position sensor and a throttle position sensor to detect the accelerator pedal position and the throttle position.

The hybrid vehicle ECU calculates the target engine speed and the required engine motive force in accordance with the signals provided by the accelerator pedal position sensor, vehicle driving conditions, and the SOC (state of charge) of the hybrid vehicle battery. The hybrid vehicle ECU sends the results of this calculation to the ECM via the CAN communication line. The ECM optimally controls the electric throttle control actuator and sends the actual engine speed signal to the hybrid vehicle ECU.



Regenerative Brake

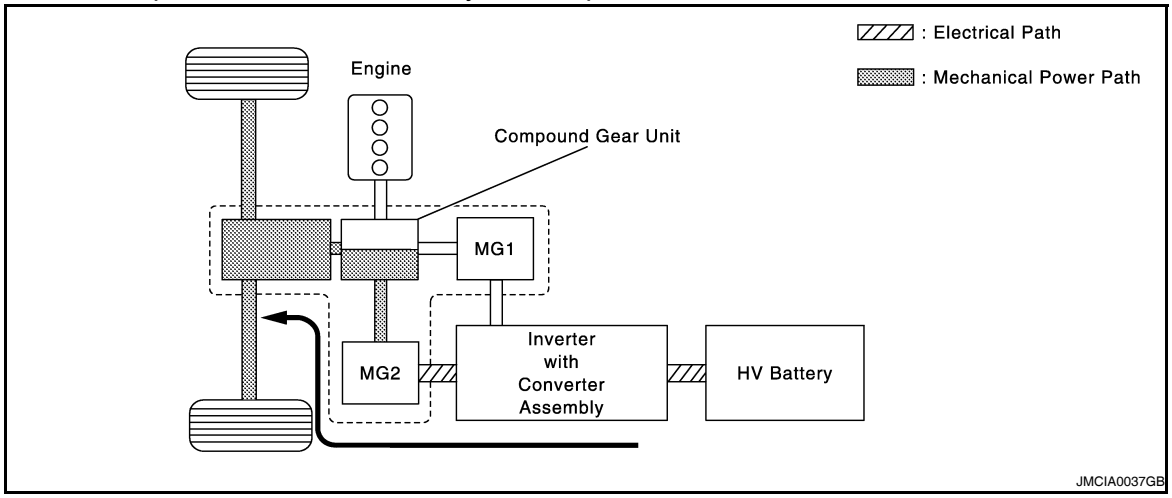
The regenerative brake function operates MG2 as a generator while the vehicle is decelerating or braking and stores this electrical energy in the HV battery.

Basic Operation

This system generates a motive force in combination with the engine, MG1 and MG2 in accordance with the driving conditions. Representative examples of the various combinations are described below.

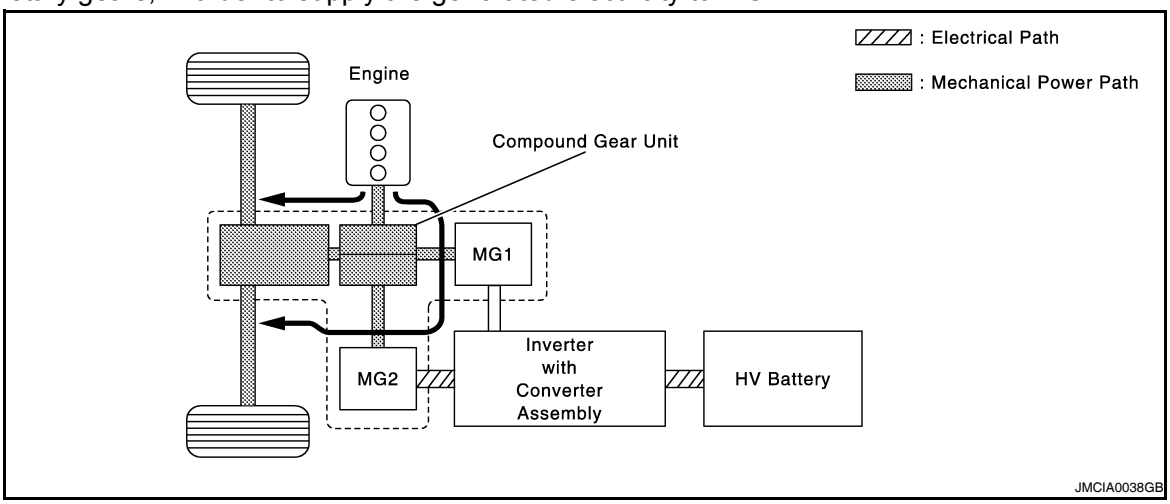
Starting (Drive by MG2)

Supply of electrical power from the HV battery to MG2 provides force to drive the front wheels.



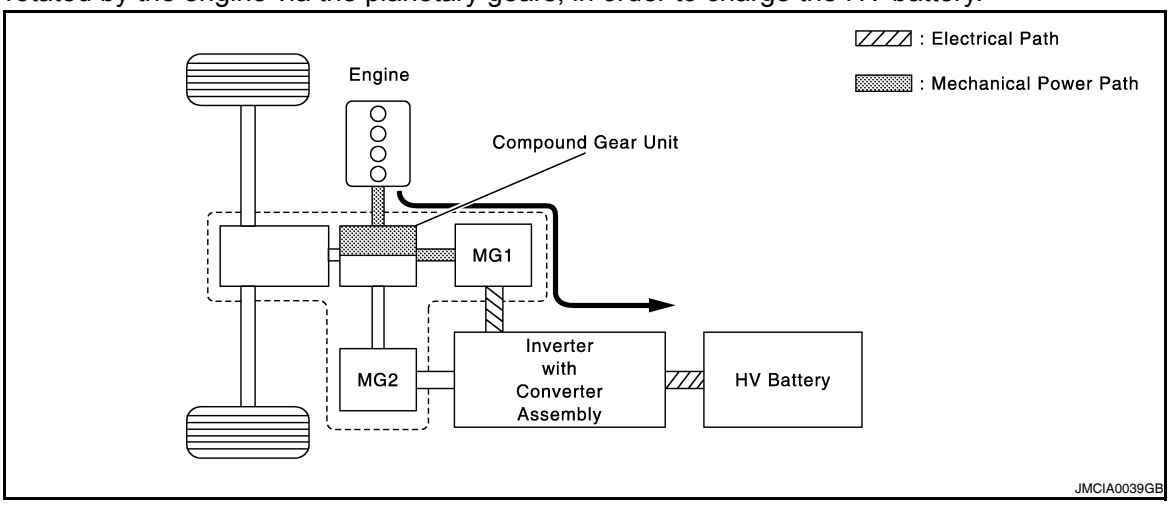
During Acceleration with Engine

While the front wheels are being driven by the engine via the planetary gears, MG1 is driven by the engine via the planetary gears, in order to supply the generated electricity to MG2.



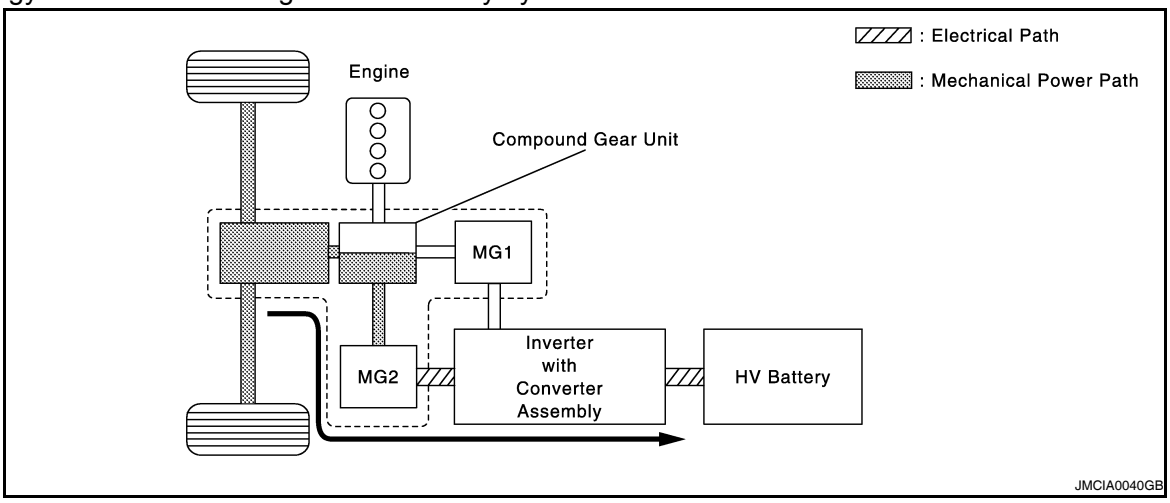
Charge The HV Battery

MG1 is rotated by the engine via the planetary gears, in order to charge the HV battery.



During Deceleration Driving

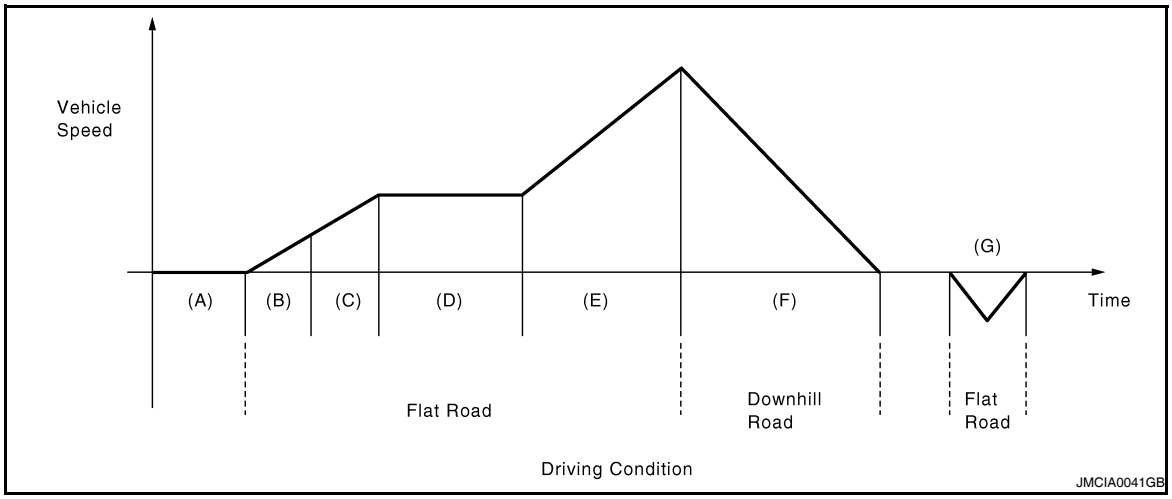
When the vehicle is decelerating, kinetic energy from the front wheels is recovered and converted into electrical energy and used to recharge the HV battery by means of MG2.



SYSTEM OPERATION

General

- The Hybrid Vehicle Control System uses two sources of motive force, the engine and MG2, and uses MG1 as a generator. The system optimally combines these forces in accordance with the various driving conditions.
- The hybrid vehicle ECU constantly monitors the SOC condition, the HV battery temperature, the coolant temperature, and the electrical load condition. If any one of the monitored items fails to satisfy the requirements when the READY indicator is ON and the shift lever is in the “P” position, or the vehicle is driven in reverse, the hybrid vehicle ECU to starts the engine to drive MG1, and then charges the HV battery.
- The Hybrid Vehicle Control System drives the vehicle by optimally combining the operations of the engine, MG1, and MG2 in accordance with the driving conditions listed below.
  The vehicle conditions listed below are examples of typical vehicle driving conditions.

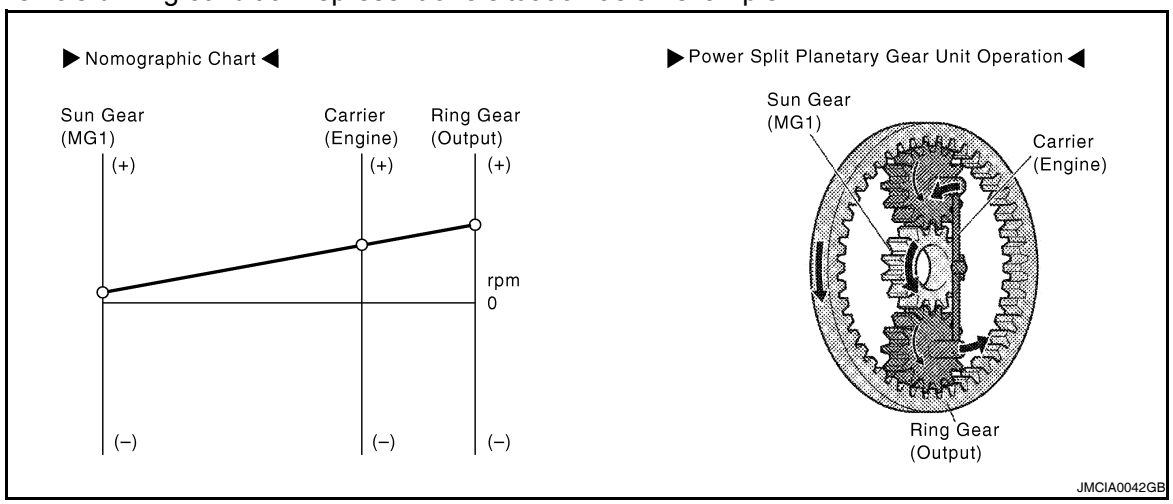


A. READY ON State
B. Starting with MG2
C. Driving with MG2 and Engine
D. During Low Load and Constant-Speed Cruising
E. During Full Throttle Acceleration
F. During Deceleration Driving
G. During Reverse Driving

How to Read a Nomographic Chart

- The nomographic chart below gives a visual representation of the planetary gear's rotational direction, rotational speed, and torque balance.
- In the nomographic chart, a straight line is used to represent the relationship between the rotational speeds of the 3 gears in the power split planetary gear unit. The rotational speed of each gear is indicated by the distance from the 0 rpm point. Due to the structure of the power split planetary gear unit, the relationship between the rotational speeds of the 3 gears is always expressed by a straight line.
- The relationship between the gear rotation directions and the torque that acts on each gear is as described below.
  Due to the structure of this hybrid transaxle, the MG2 motive force acts on the ring gear via the motor speed reduction planetary gear unit. The following illustrations of the power split planetary gear unit operation, represent the rotational direction, rotational speed and torque condition that act on the ring gear.

- The following nomographic charts and the illustrations of the power split planetary gear unit operation for each vehicle driving condition represent one situation as an example.



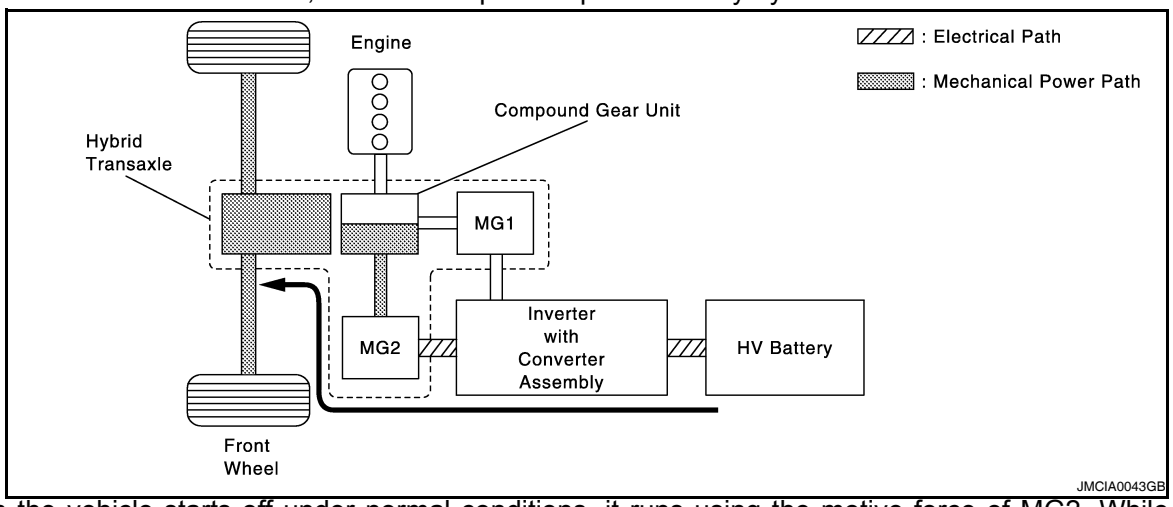
Condition of power split planetary gear unit

	Sun Gear (MG1)	Carrier (Engine)	Ring Gear (Output)
Rotational Direction	+	+	+
Torque Condition	-	+	-

Normal Driving (During Low Load and Constant-speed Cruising)

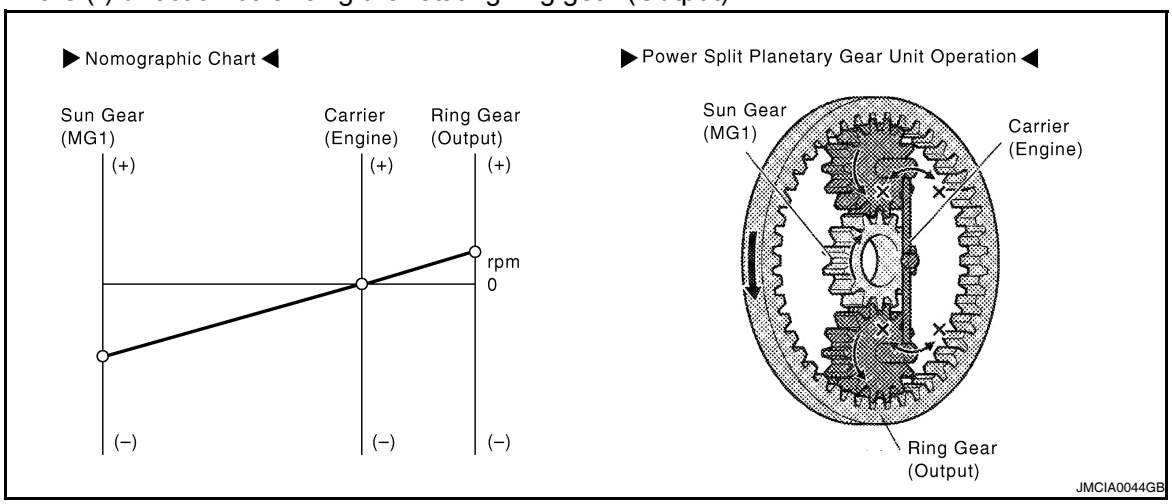
(B): Starting with MG2

- When the vehicle is started off, the vehicle operates powered only by the MG2.



- When the vehicle starts off under normal conditions, it runs using the motive force of MG2. While driving under this condition, the rotational speed of the carrier is 0 rpm due to the engine being inactive. In addition,

since MG1 does not generate any torque, no torque acts on the sun gear. However, the sun gear rotates freely in the (-) direction balancing the rotating ring gear (Output).

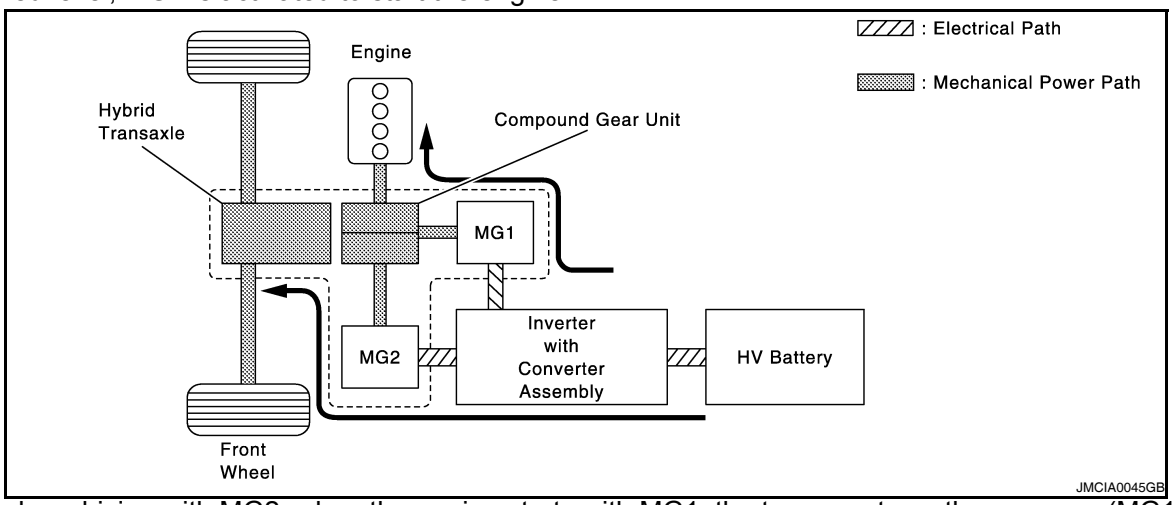


Condition of power split planetary gear unit

	Sun Gear (MG1)	Carrier (Engine)	Ring Gear (Output)
Rotational Direction	-	0	+
Torque Condition	0	0	+

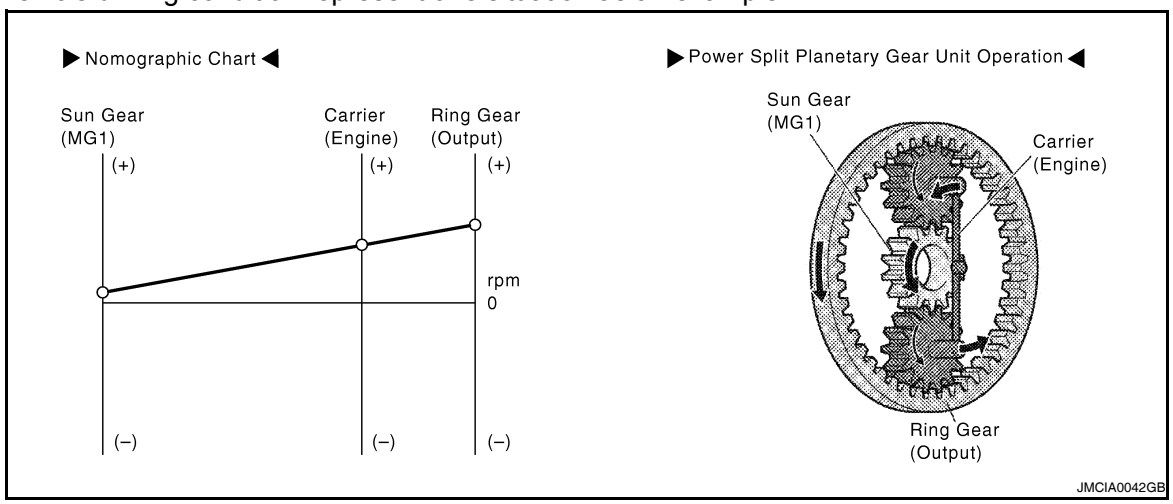
(C): Driving with MG2 and Starting Engine

- If the required drive torque increases when driving with MG2 only, MG1 is activated to start the engine. In addition, if any one of the items monitored by the hybrid vehicle control ECU such as the SOC condition, the battery temperature, the engine coolant temperature or the electrical load condition deviates from the specified level, MG1 is activated to start the engine.



- Only when driving with MG2, when the engine starts with MG1, the torque acts on the sun gear (MG1) in the (+) direction, the carrier (Engine) rotates in the (+) direction in reaction to the torque transmitted by the sun gear. The ring gear rotates in the (+) direction in reaction to the carrier rotation.

- The following nomographic charts and the illustrations of the power split planetary gear unit operation for each vehicle driving condition represent one situation as an example.

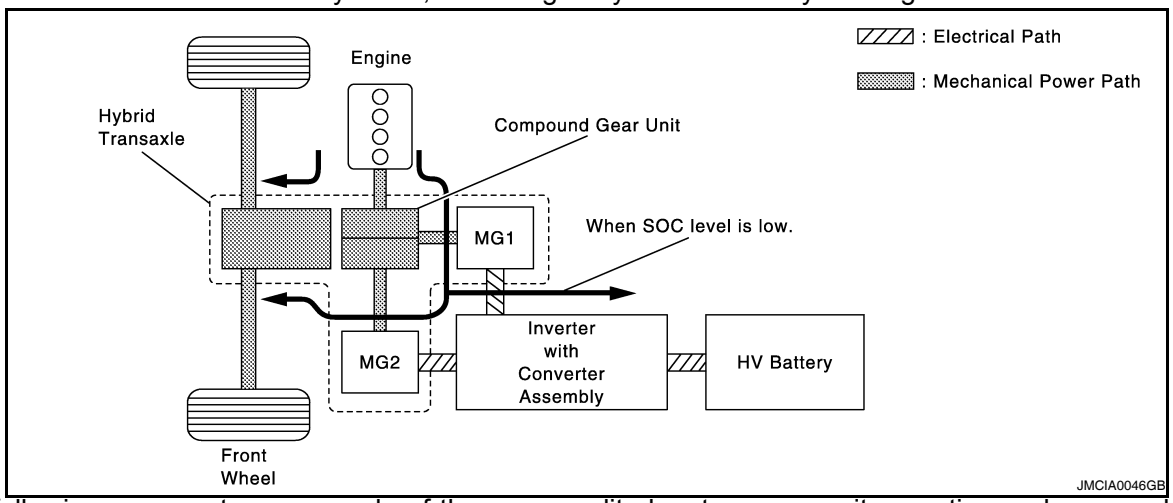


Condition of power split planetary gear unit

	Sun Gear (MG1)	Carrier (Engine)	Ring Gear (Output)
Rotational Direction	+	+	+
Torque Condition	+	-	+

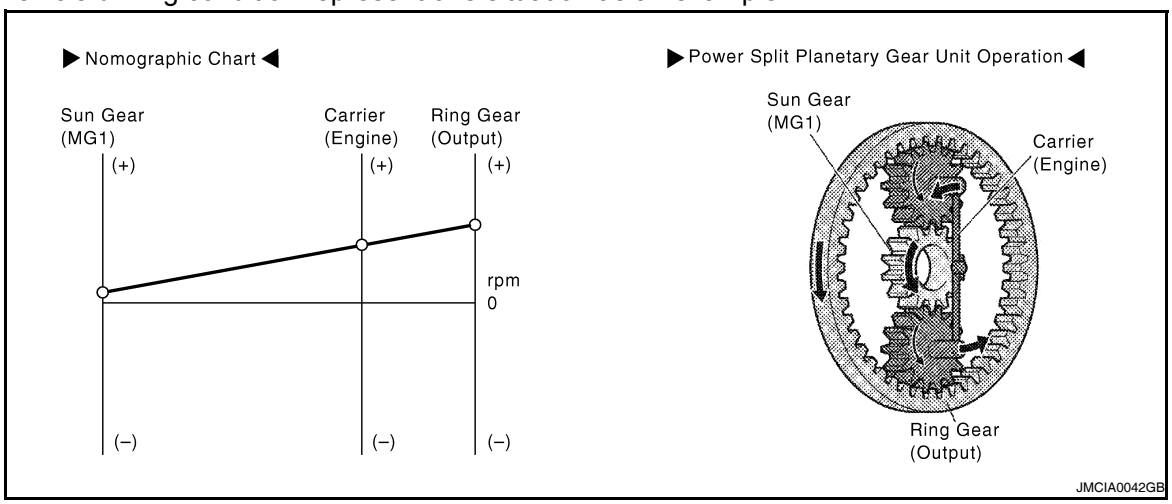
(D): During Low Load and Constant-Speed Cruising

- When the vehicle is driving under low load and constant-speed cruising conditions, the motive force of the engine is transmitted by the planetary gears. Some of this motive force is output directly, and the remaining motive force is used for generating electricity through MG1. Through the use of the electrical path of an inverter, this electrical power is transmitted to MG2 to be output as the motive force of MG2.
  If the SOC level of the HV battery is low, it is charged by MG1 driven by the engine.



- The following represents an example of the power split planetary gear unit operation under normal driving conditions. The sun gear, carrier and ring gear rotate in the (+) direction. The torque from the engine acts on the carrier (Engine) in the (+) direction, causing the sun gear and ring gear to react in the (-) direction.
  MG1 generates electricity by harnessing the (-) torque that acts on the sun gear.

- The following nomographic charts and the illustrations of the power split planetary gear unit operation for each vehicle driving condition represent one situation as an example.

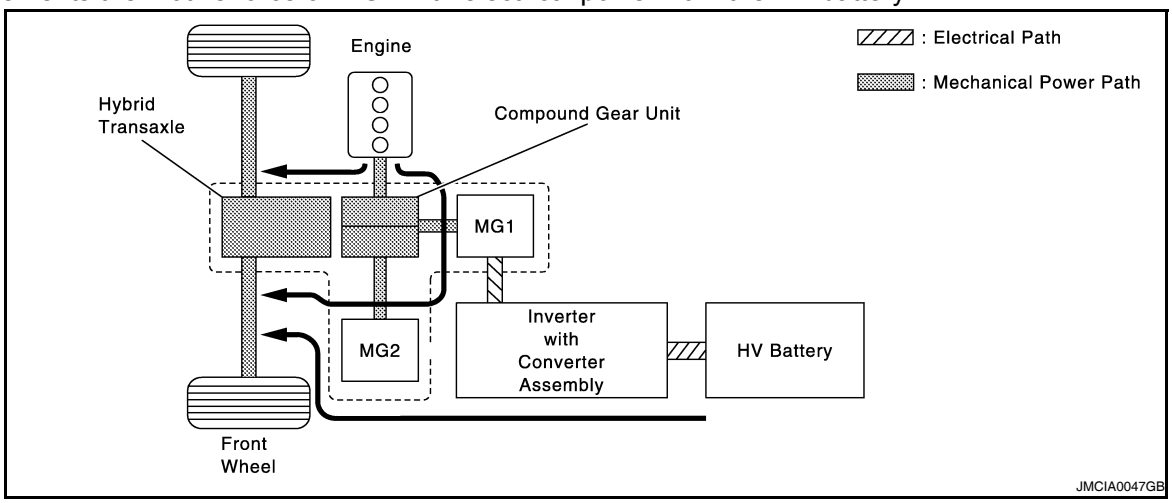


Condition of power split planetary gear unit

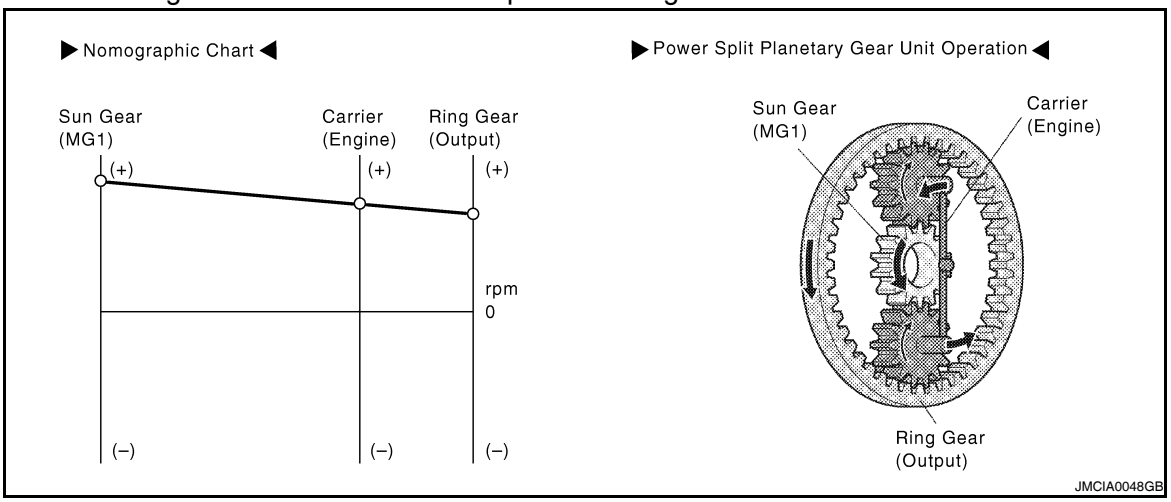
	Sun Gear (MG1)	Carrier (Engine)	Ring Gear (Output)
Rotational Direction	+	+	+
Torque Condition	-	+	-

(E): During Full Throttle Acceleration

- When the vehicle driving condition changes from low load cruising to full-throttle acceleration, the system supplements the motive force of MG2 with electrical power from the HV battery.



- When more engine power is required, in order to increase the engine speed, the rotation speeds of the related gears change as follows. The directions in which the torque acts on each gear are the same as those described in “During Low Load and Constant-speed Cruising”.



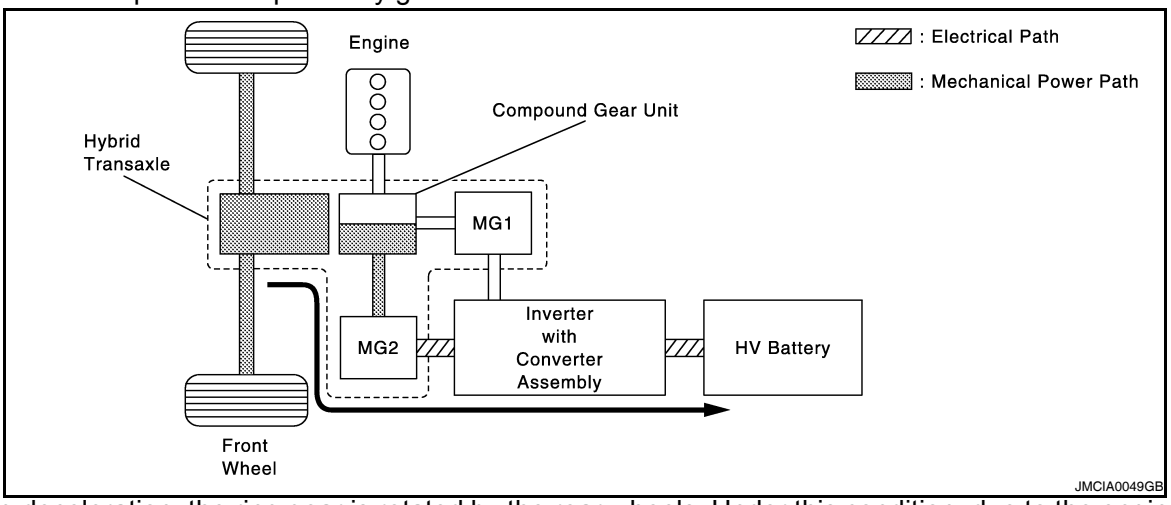
Condition of power split planetary gear unit

	Sun Gear (MG1)	Carrier (Engine)	Ring Gear (Output)
Rotational Direction	+	+	+
Torque Condition	-	+	+

(F): During Deceleration Driving

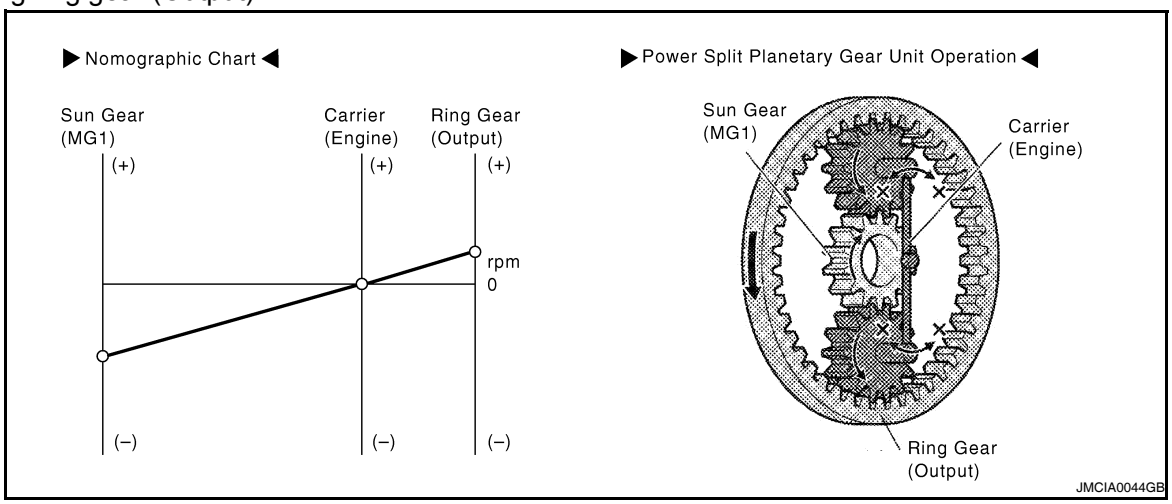
Deceleration in “D” Range

- While the vehicle is decelerated with the shift lever in the D position, the engine is turned OFF and the motive force changes to zero. At this time, the wheels drive MG2, causing MG2 to operate as a generator, charging the HV batteries.
- If the vehicle decelerates from a higher speed, the engine maintains a predetermined speed without stopping, in order to protect the planetary gear unit.



- During deceleration, the ring gear is rotated by the rear wheels. Under this condition, due to the engine being inactive, the rotational speed of the carrier is 0 rpm. In addition, since MG1 does not generate any torque, no

torque acts on the sun gear. However, the sun gear (MG1) rotates freely in the (-) direction balancing the rotating ring gear (Output).

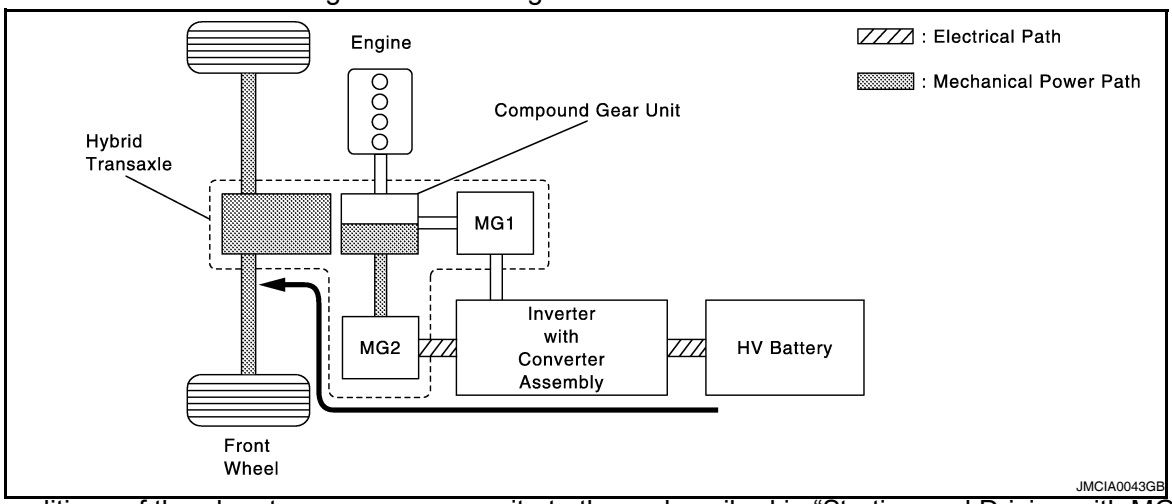


Condition of power split planetary gear unit

	Sun Gear (MG1)	Carrier (Engine)	Ring Gear (Output)
Rotational Direction	-	0	+
Torque Condition	0	0	0

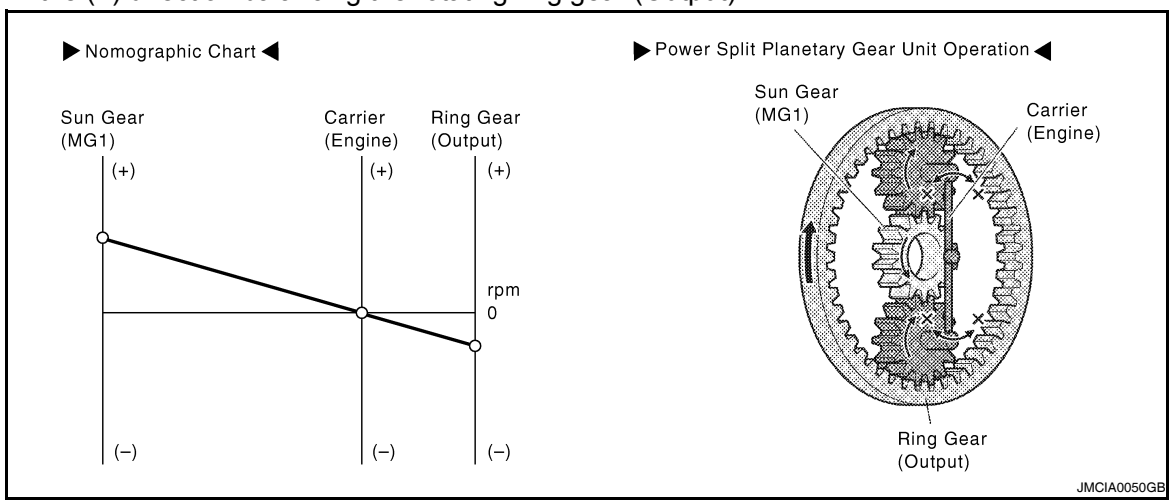
(G): During Reverse Driving

- When the vehicle is being driven in reverse, the required power is supplied by MG2. At this time, MG2 rotates in the opposite direction, the engine remains stopped, and MG1 rotates in the normal direction without generating any electricity.
- During reverse driving, when any of the SOC condition, battery temperature, engine coolant temperature and electrical load condition reaches a specified level, the engine may start. The following illustration represents the condition when the engine is not driving.



- The conditions of the planetary gear are opposite to those described in “Starting and Driving with MG2”.

Due to the engine being inactive, the rotational speed of the carrier is 0 rpm but the sun gear (MG1) rotates freely in the (+) direction balancing the rotating ring gear (Output).

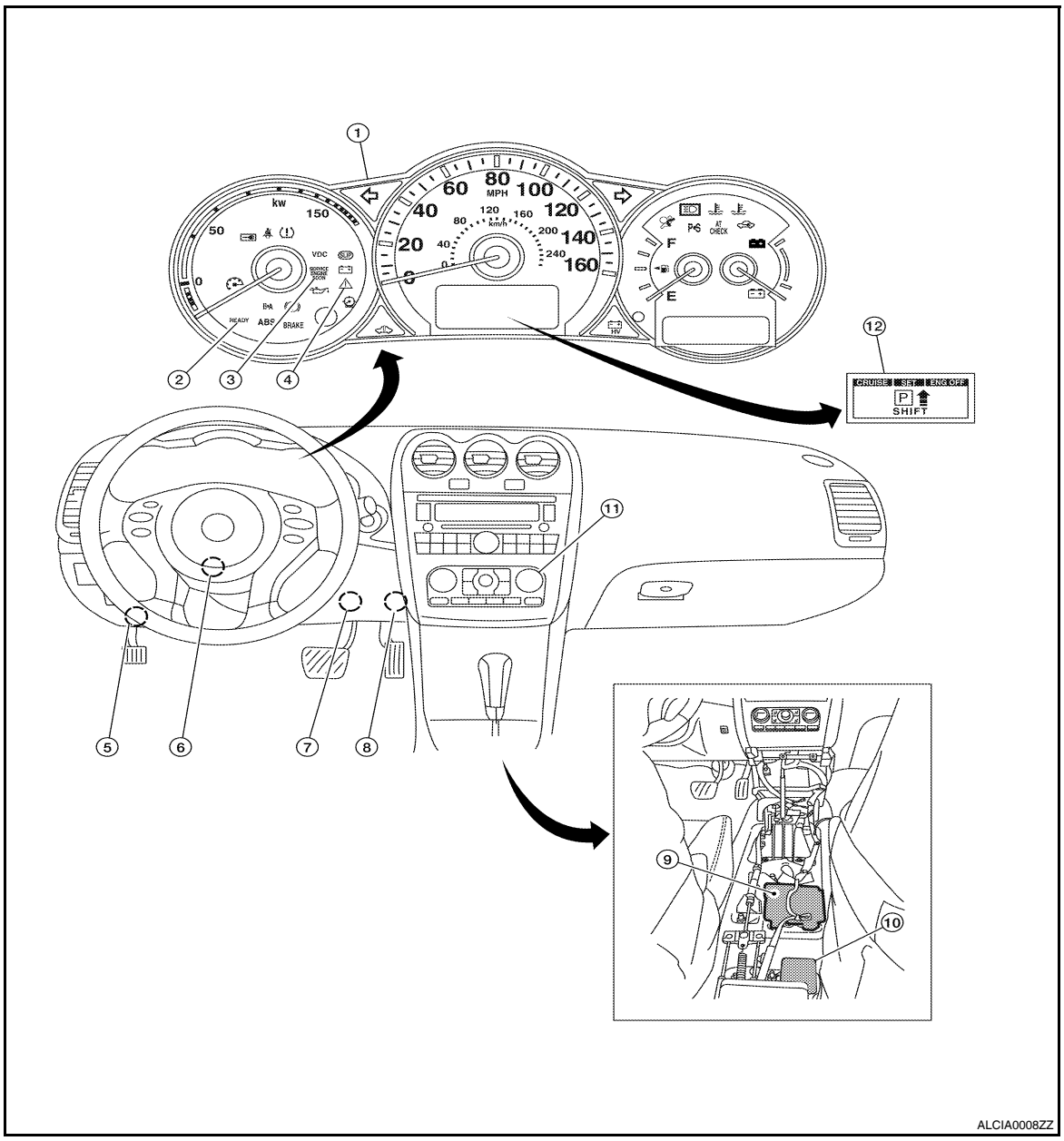


Condition of power split planetary gear unit

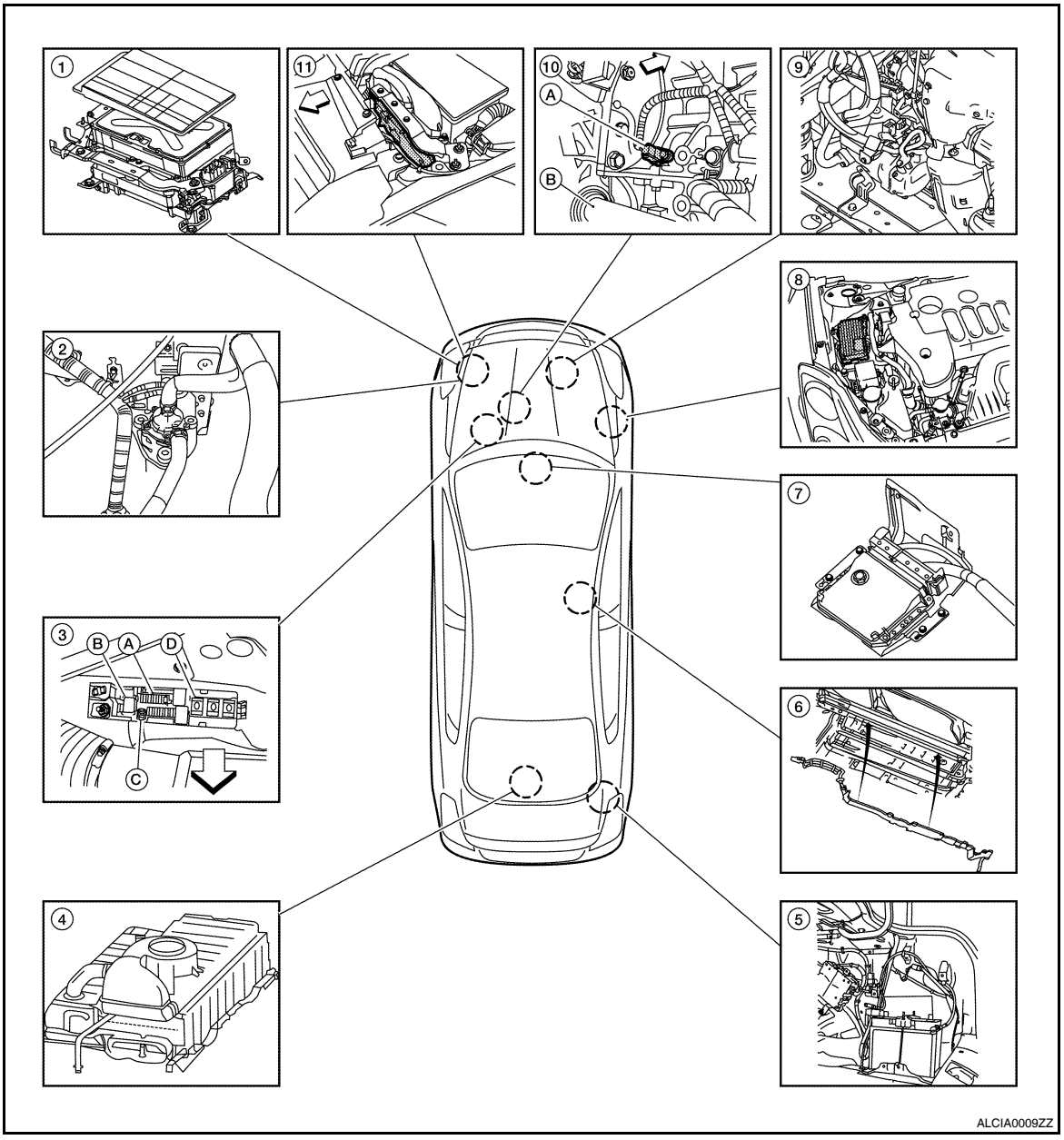
	Sun Gear (MG1)	Carrier (Engine)	Ring Gear (Output)
Rotational Direction	+	0	-
Torque Condition	0	0	-

Component Parts Location

INFOID:0000000004211731

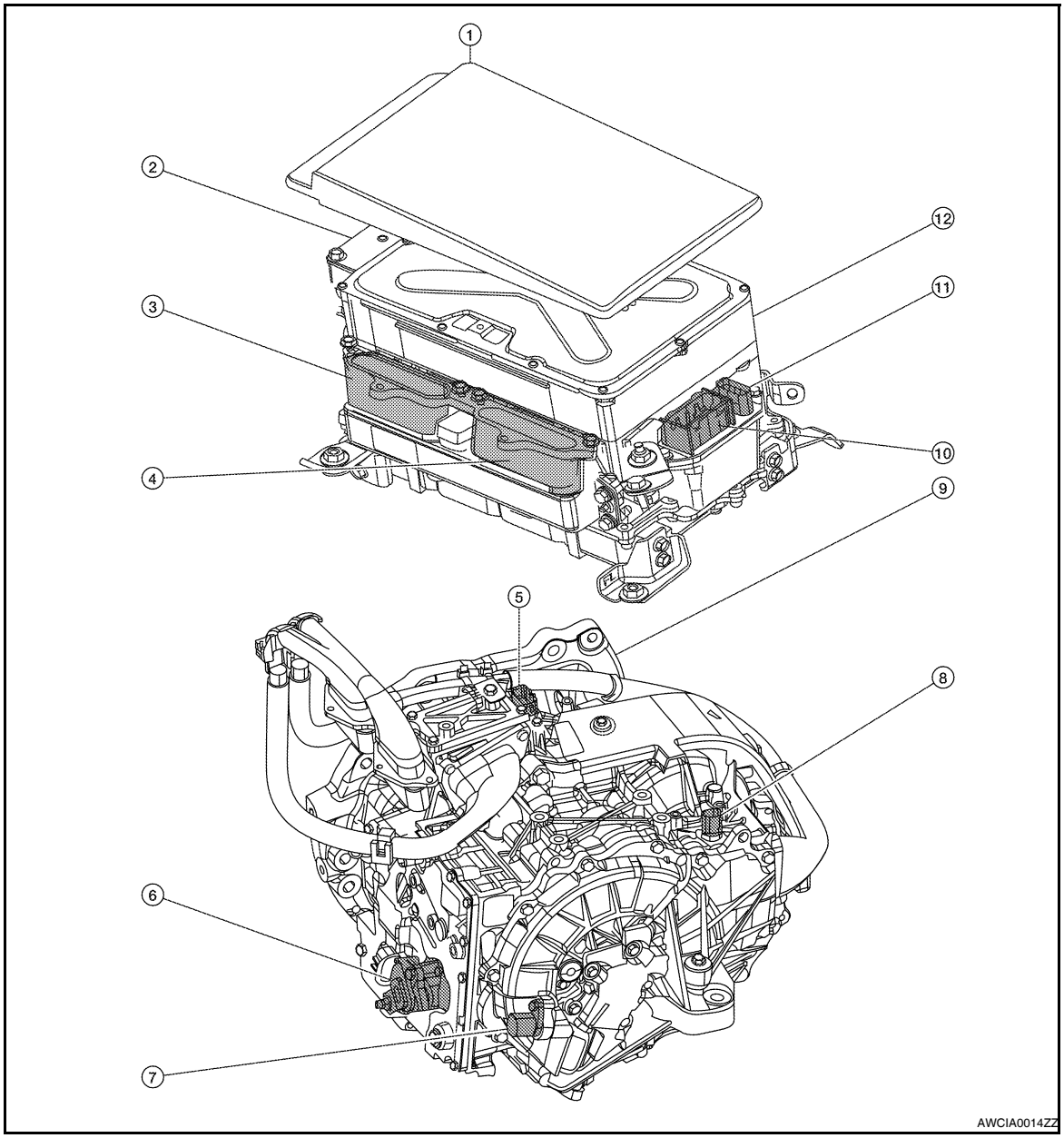


1. Combination meter
2. READY operation indicator light
3. Malfunction indicator light
4. Master warning light
5. Data link connector
6. Steering angle sensor
7. Stop lamp switch
8. Accelerator pedal position sensor
9. ACU (Air bag diagnosis sensor unit)
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator

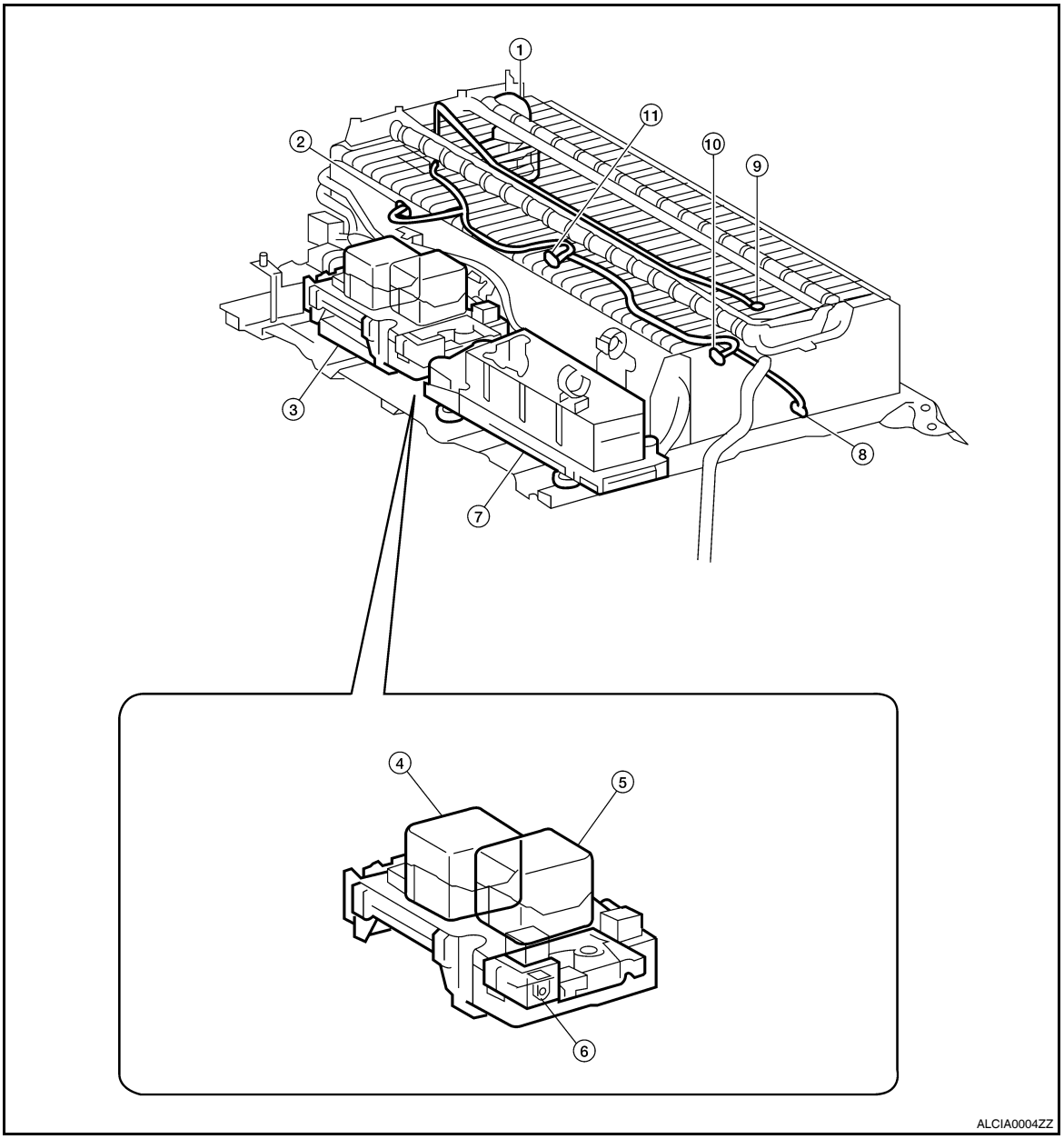


1. Inverter with converter assembly
2. Water pump with motor & bracket assembly
3. High voltage fuse and fusible link box
   A: HV CONT MAIN fuse 10A
   B: IGCT relay
   C: IGCT fusible link 50A
   D: DC/DC fusible link 120A
4. HV battery
5. Auxiliary battery
6. Frame wire
7. Hybrid vehicle control ECU (located under heater box assembly)
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

⇦ Vehicle front



1. Cover
2. Compressor fuse cover
3. MG1 connector
4. MG2 connector
5. Generator resolver and generator temperature sensor
6. Park/Neutral position (PNP) switch
7. Motor resolver
8. Motor temperature sensor
9. Hybrid transaxle (MG1, MG2, motor speed reduction planetary gear unit, power split planetary gear unit)
10. Inverter with converter assembly connector (MG ECU)
11. Inverter with converter assembly connector (Resolver)
12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

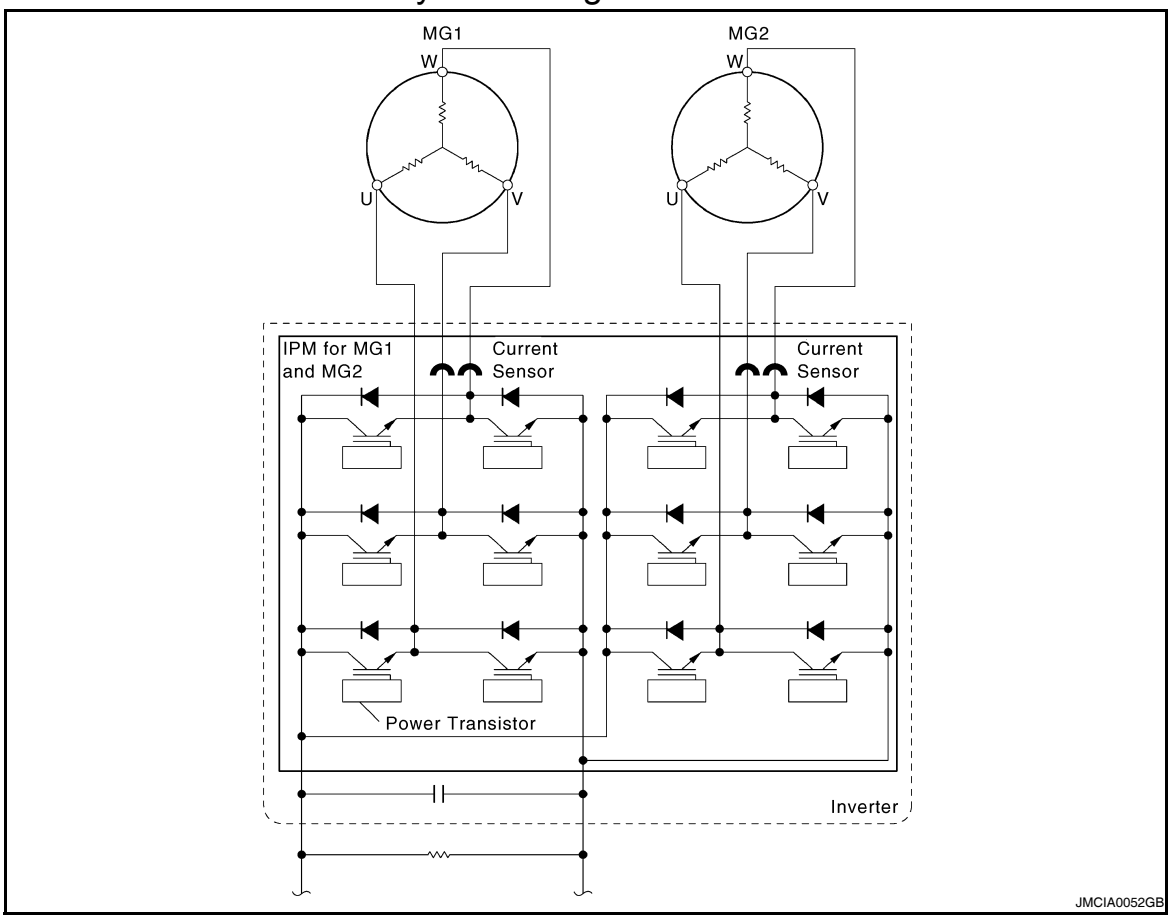


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

HYBRID TRANSAXLE
MOTOR AND GENERATOR

MOTOR AND GENERATOR : System Diagram

INFOID:0000000004211732



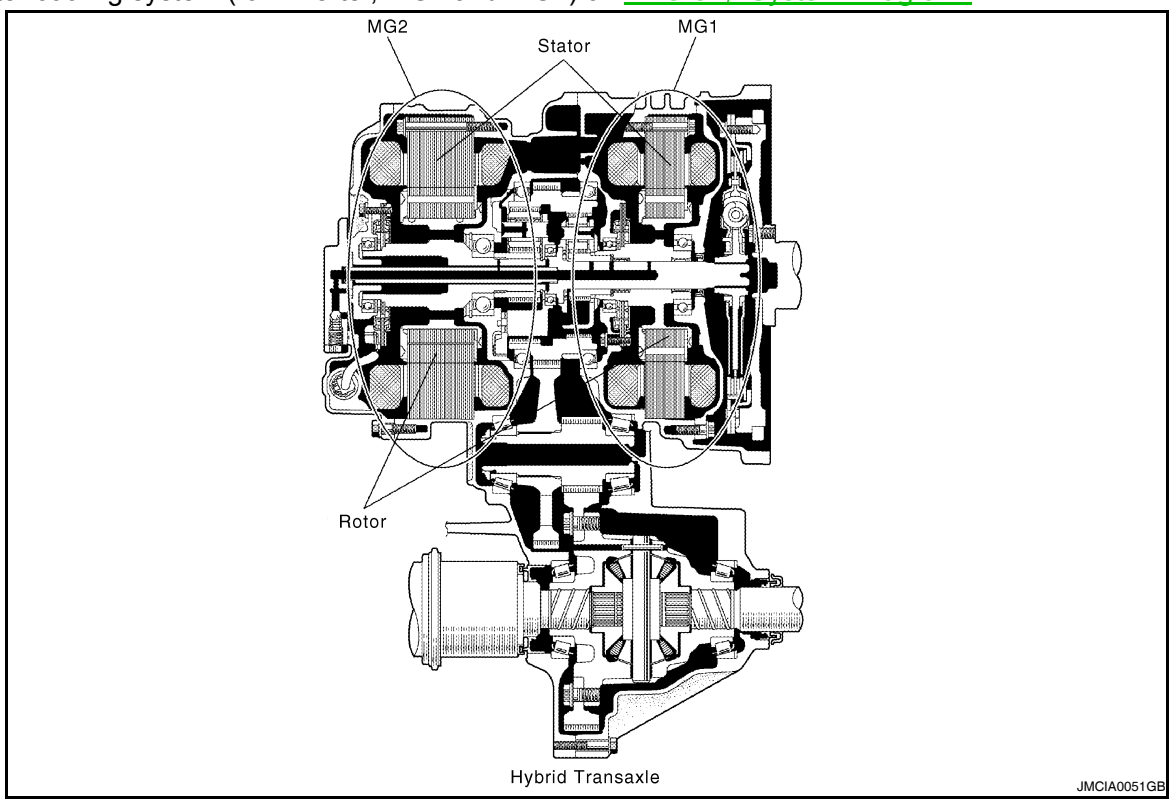
MOTOR AND GENERATOR : System Description

INFOID:0000000004211733

GENERAL

- Serving as the source of supplemental motive force that provides power assistance to the engine as needed, the electric motor helps the vehicle achieve excellent dynamic performance, including smooth start-offs and acceleration. When the regenerative brake is activated, MG2 (Motor Generator No.2) converts the vehicle's kinetic energy into electrical energy, which is then stored in the HV battery.
- MG1 (Motor Generator No.1) recharges the HV battery and supplies electrical power to drive MG2. In addition, by regulating the amount of electrical power generated (thus varying the generator's rpm), MG1 effectively controls the continuously variable transmission function of the hybrid transaxle. MG1 also serves as the starter to start the engine.
- Both the MG1 and MG2 are compact, lightweight, and highly efficient alternating current permanent magnet synchronous type.
- Both the MG1 and MG2 use a rotor containing a V-shaped, high-magnetic force permanent magnet that maximizes the generation of reduction torque. They use a stator made of a low core-loss electromagnetic steel sheet and a high voltage resistant winding wire. Through these measures, the MG1 and MG2 have realized high output and torque in a compact construction.

- A inverter cooling system via water pump for the MG1 and MG2 has been added. For details, refer to the inverter cooling system (for Inverter, MG1 and MG2) on HBC-51, "System Diagram".



MG1 Specifications

Type	Permanent magnet motor
Function	Generate, engine starter
Maximum system voltage*	DC 650 V
Inverter cooling system	Water-cooled

MG2 Specifications

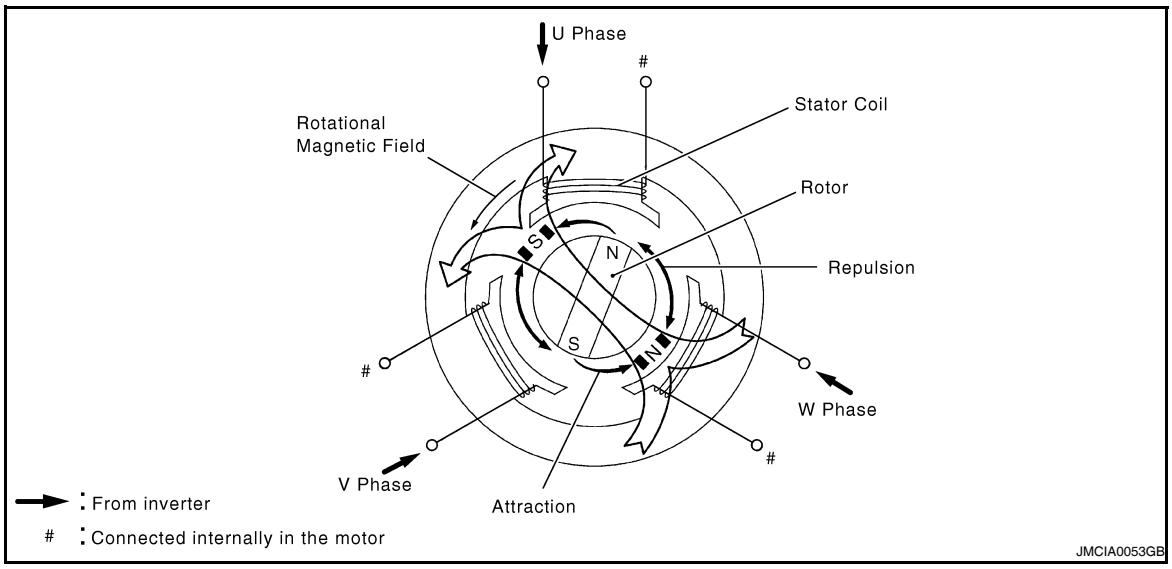
Type	Permanent Magnet Motor
Function	Generate, Drive Front Wheels
Maximum System Voltage*	DC 650 V
Maximum Output	105 kW (141 HP)
Maximum Torque	270 N·m (199 ft-lbf)
Inverter Cooling System	Water-cooled

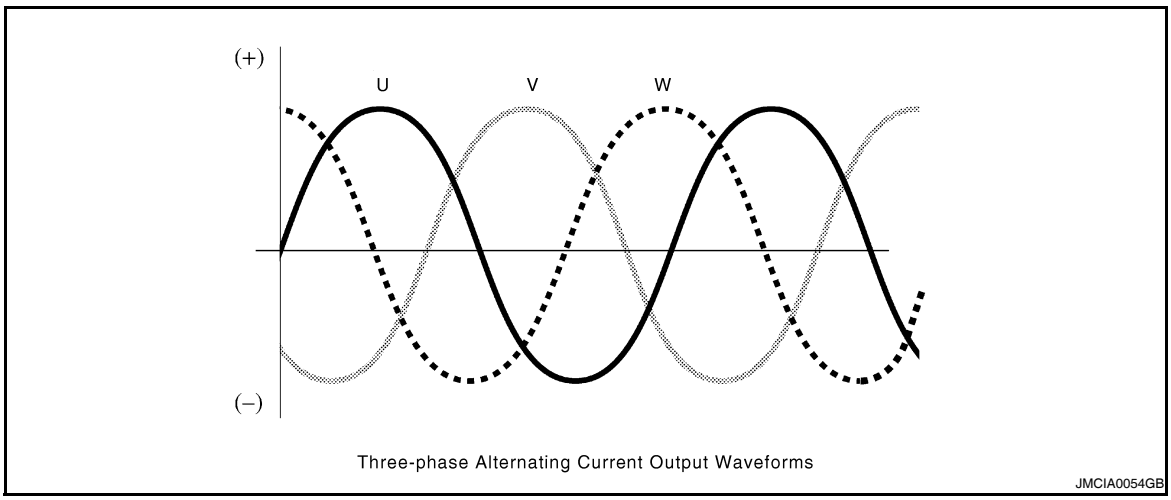
*: These voltage are converted into an alternating current and then supplied to MG1and MG2.

PERMANENT MAGNET MOTOR (FOR MG1 AND MG2)

- When a three-phase alternating current is passed through the three-phase windings of the stator coil, a rotational magnetic field is created in the electric motor. By controlling this rotating magnetic field according to the rotor's rotational position and speed, the permanent magnets that are provided in the rotor become attracted by the rotating magnetic field, thus generating torque.
  The generated torque is for all practical purposes proportionate to the amount of current, and the rotational speed is controlled by the frequency of the alternating current.
  Furthermore, a high level of torque, all the way to high speeds, can be generated efficiently by properly controlling the rotating magnetic field and the angles of the rotor magnets.

- When the motor generates electricity, the rotor rotates to create a magnetic field, which creates a current in the stator coil.

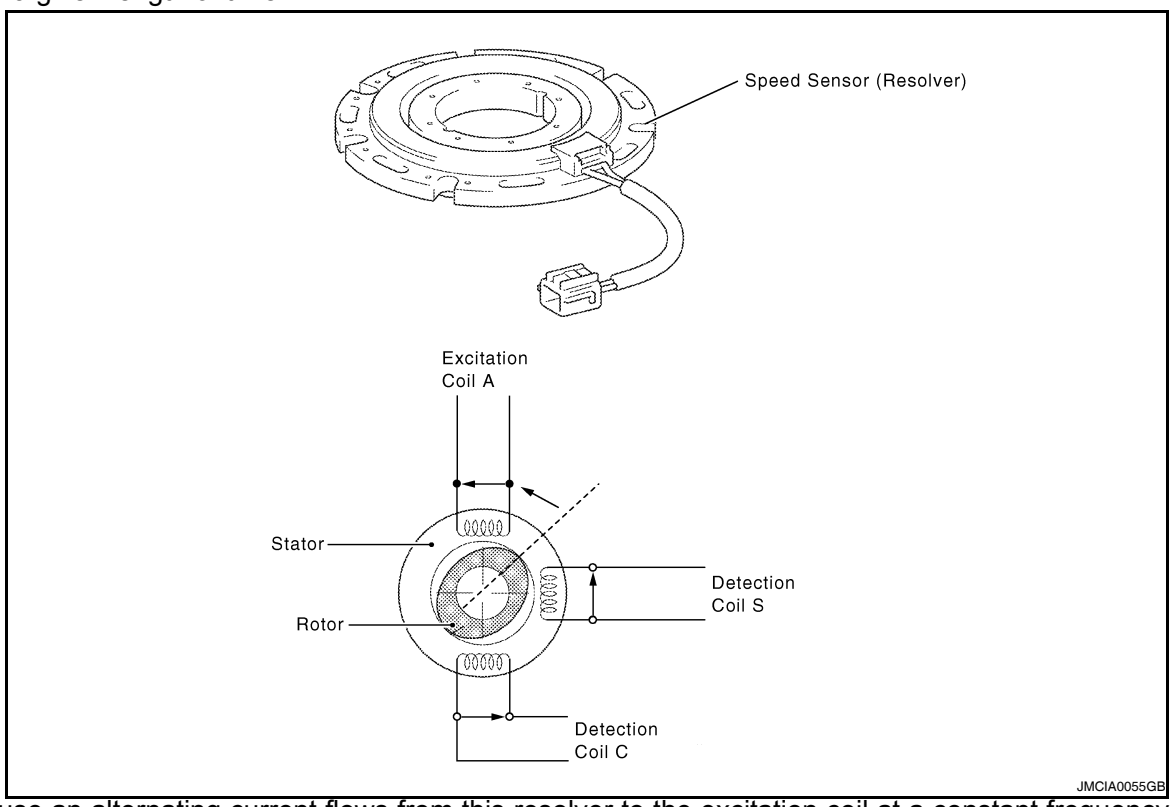




SPEED SENSOR/RESOLVER (FOR MG1 AND MG2)

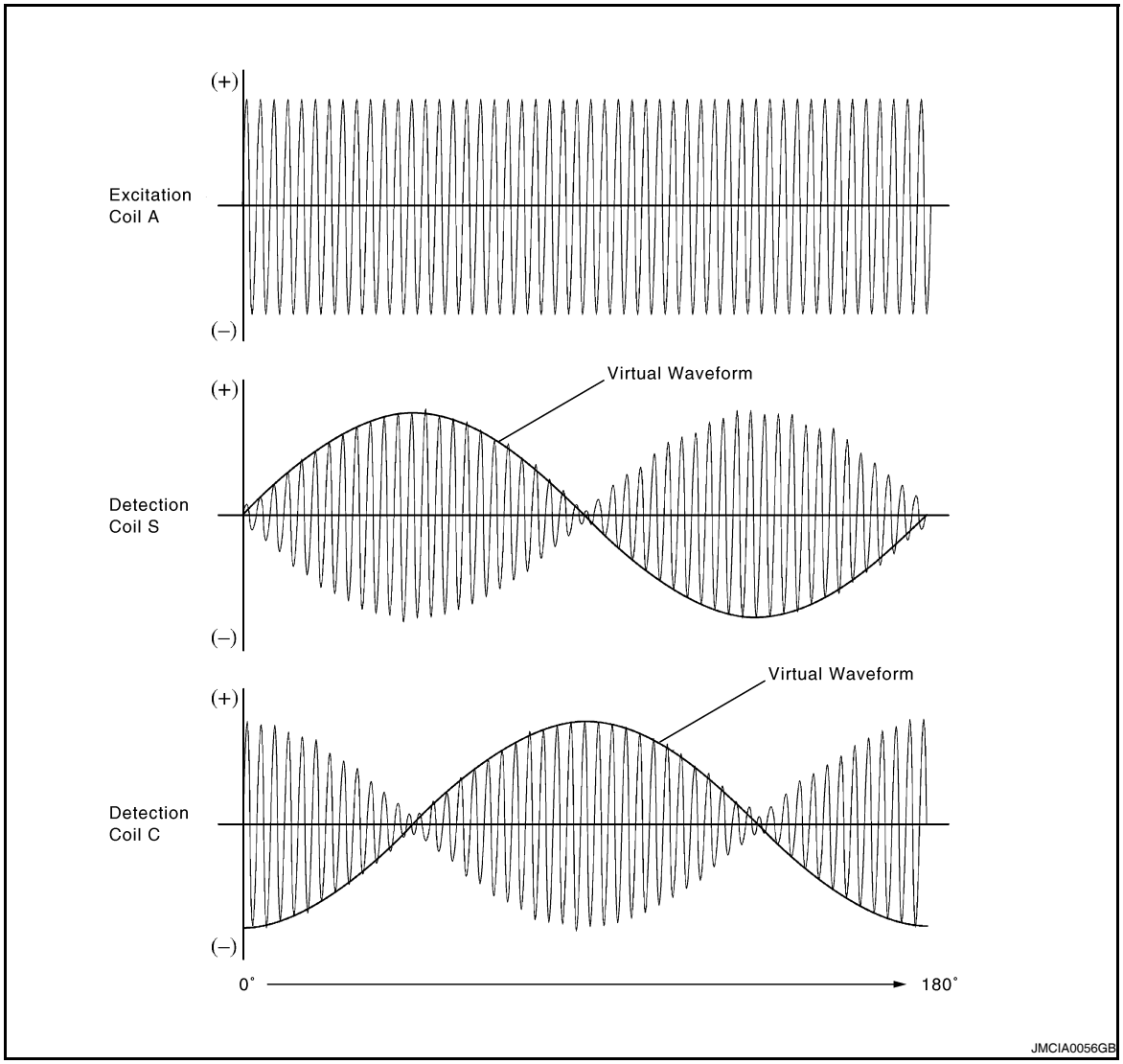
- This is an extremely reliable and compact sensor that precisely detects the magnetic pole position, which is indispensable for ensuring the efficient control of MG1 and MG2.
- The stator of the sensor contains three types of coils: excitation coil A, detection coil S, and detection coil C. The detection coils S and C are electrically staggered 90 degrees.
  The rotor is oval, the distance of the gap between the stator and the rotor varies with the rotation of the rotor.
- The flow of an alternating current into an excitation coil A results in the output of signals of a constant frequency. Coil S and coil C output values that correspond to the position of the rotor. Therefore, the MG ECU detects the absolute position based on the difference between the coil S and coil C output values.

Furthermore, the MG ECU calculates the rotational speed based on the amount of change in the position within a given length of time.



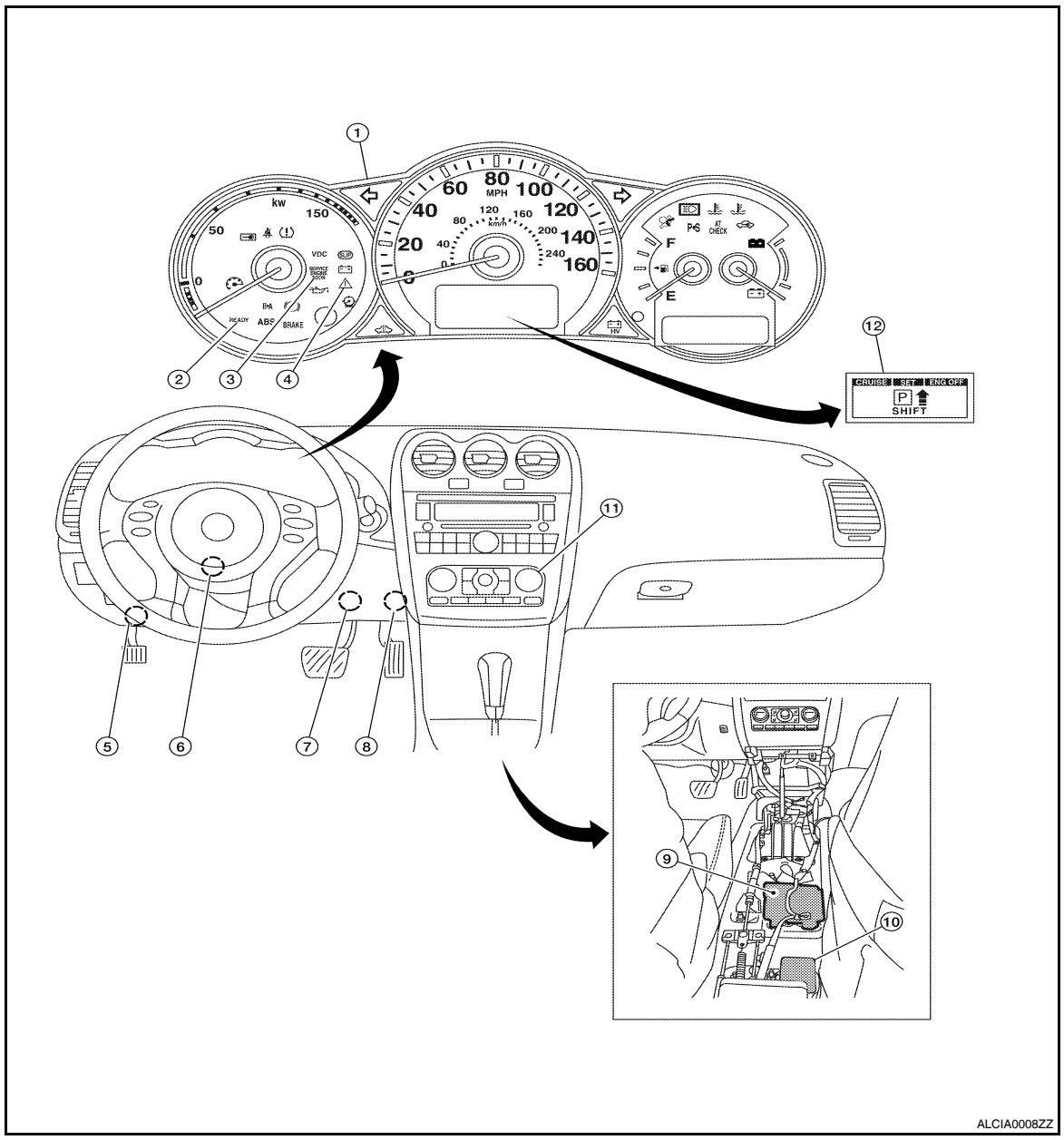
- Because an alternating current flows from this resolver to the excitation coil at a constant frequency, a constant frequency is output to the coils S and C, regardless of the rotor speed. The rotor is oval, and the distance of the gap between the stator and the rotor varies with the rotation of the rotor. Consequently, the peak values of the waveforms output by the coils S and C vary in accordance with the position of the rotor.
- The MG ECU constantly monitors these peak values, and connects them to form a virtual waveform. The MG ECU calculates the absolute position of the rotor from the difference between the values of the coils S and C. It determines the rotor direction based on the difference between the phases of the virtual waveform of the coil S and the virtual waveform of the coil C. Furthermore, the MG ECU calculates the rotational speed based on the amount of change in the rotor position within a given length of time.

- The diagrams below illustrate the waveforms that are output at coils A, S, and C when the rotor makes a positive rotation of 180° from a certain position.

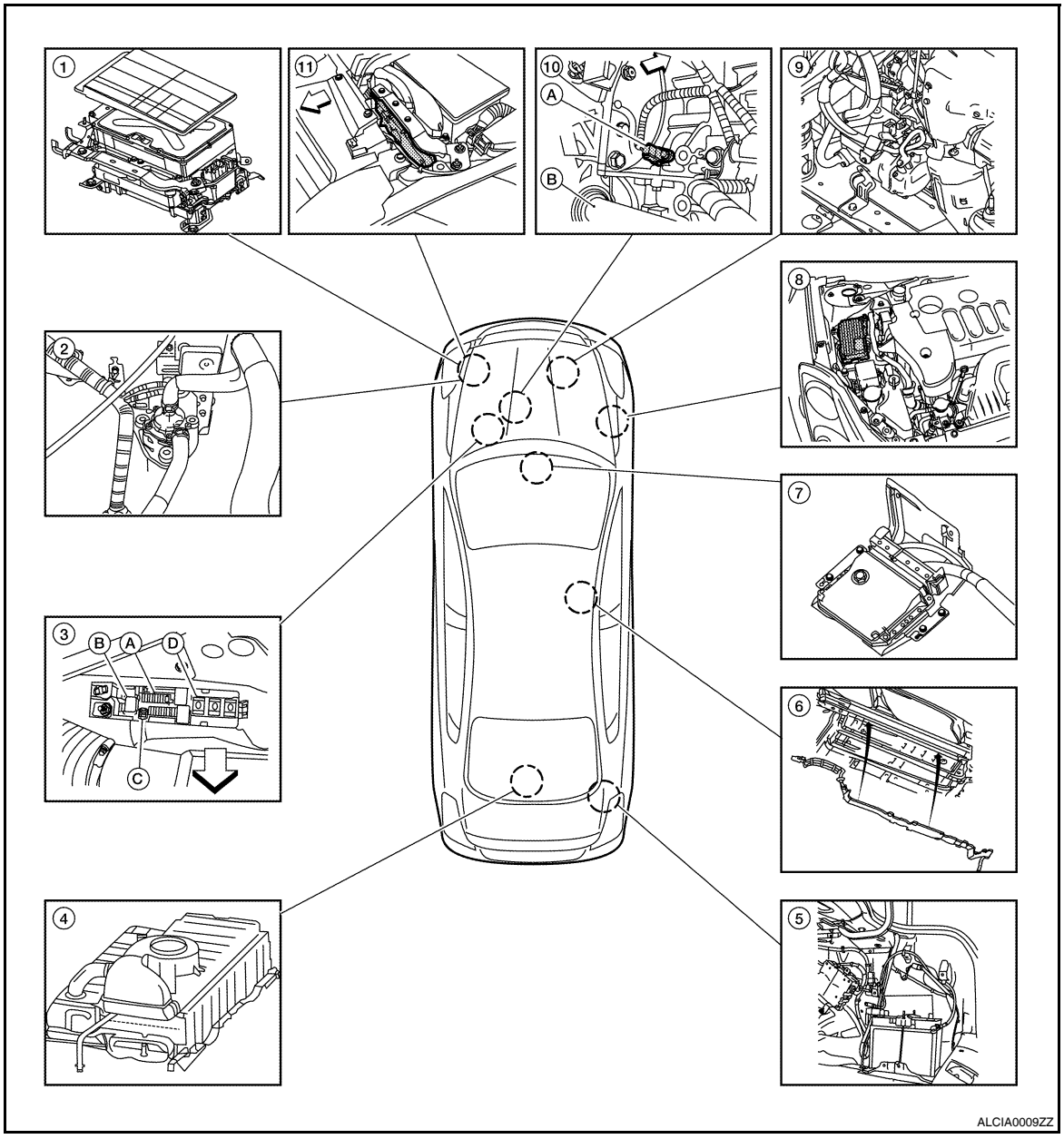


MOTOR AND GENERATOR : Component Parts Location

INFOID:0000000004211734

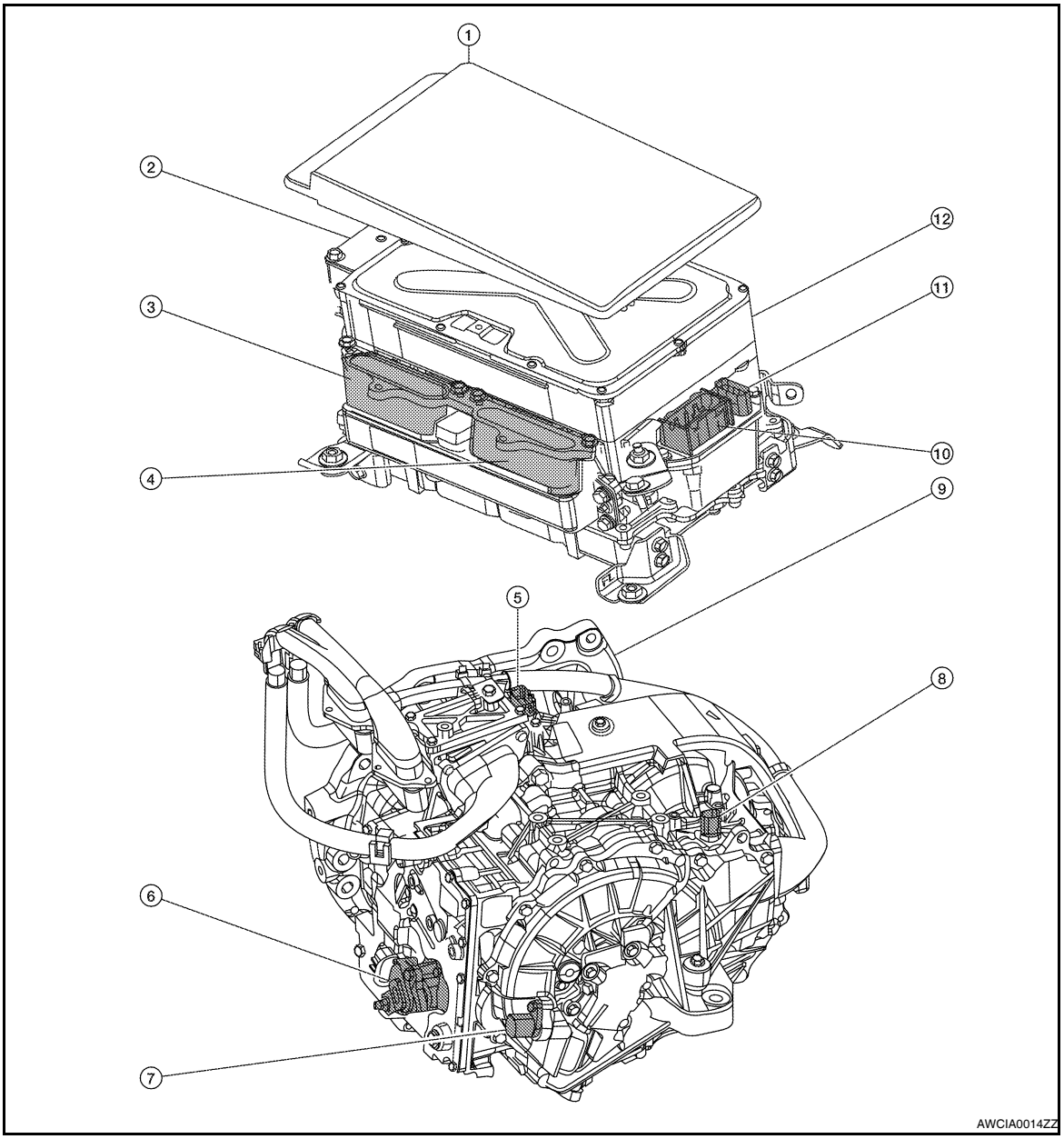


1. Combination meter
2. READY operation indicator light
3. Malfunction indicator light
4. Master warning light
5. Data link connector
6. Steering angle sensor
7. Stop lamp switch
8. Accelerator pedal position sensor
9. ACU (Air bag diagnosis sensor unit)
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator

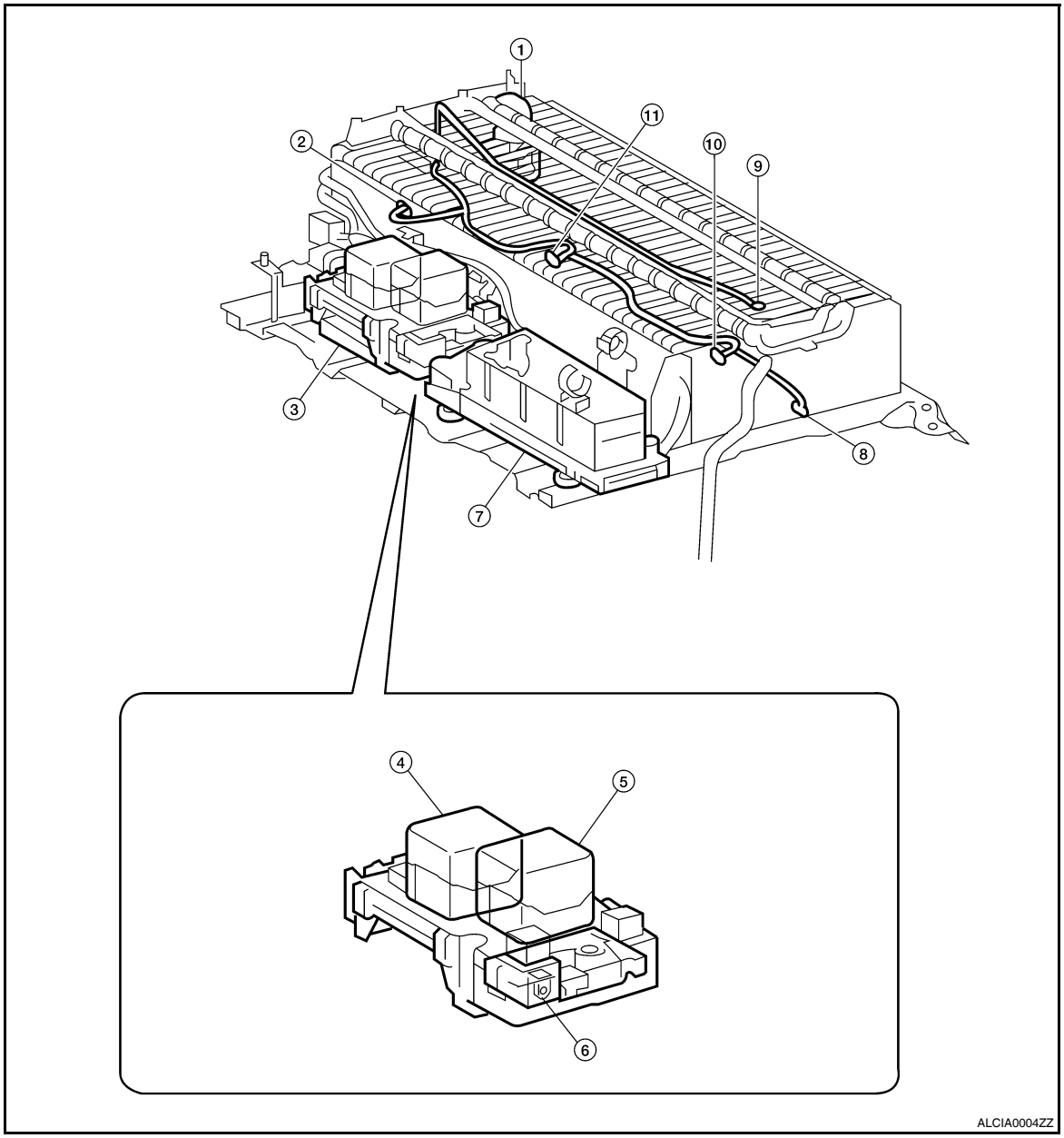


1. Inverter with converter assembly
2. Water pump with motor & bracket assembly
3. High voltage fuse and fusible link box
   A: HV CONT MAIN fuse 10A
   B: IGCT relay
   C: IGCT fusible link 50A
   D: DC/DC fusible link 120A
4. HV battery
5. Auxiliary battery
6. Frame wire
7. Hybrid vehicle control ECU (located under heater box assembly)
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

⇦ Vehicle front



1. Cover	2. Compressor fuse cover	3. MG1 connector
4. MG2 connector	5. Generator resolver and generator temperature sensor	6. Park/Neutral position (PNP) switch
7. Motor resolver	8. Motor temperature sensor	9. Hybrid transaxle (MG1, MG2, motor speed reduction planetary gear unit, power split planetary gear unit)
10. Inverter with converter assembly connector (MG ECU)	11. Inverter with converter assembly connector (Resolver)	12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

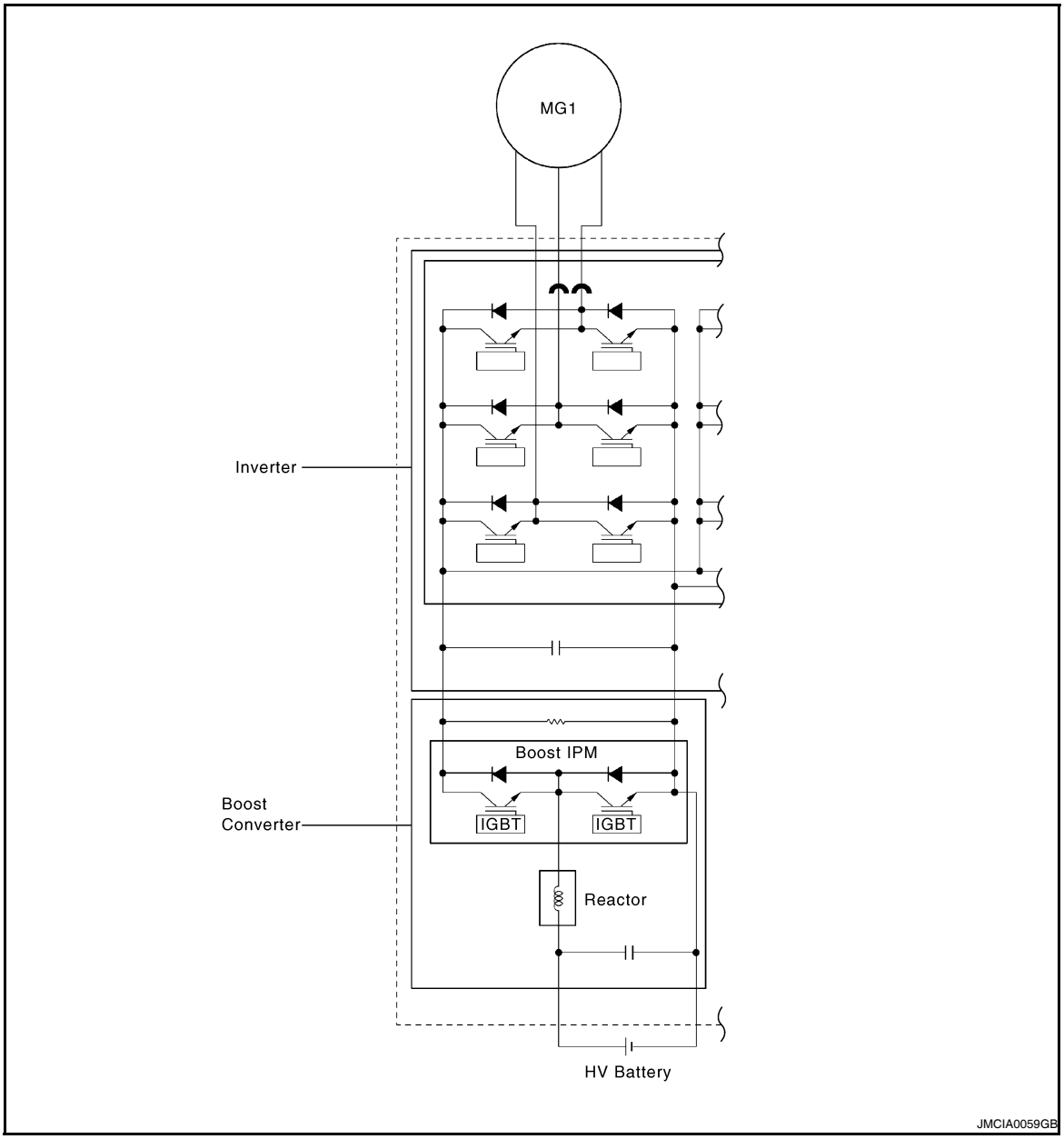


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

MG1 AND MG2 MAIN CONTROL

MG1 AND MG2 MAIN CONTROL : System Diagram

INFOID:0000000004211735



MG1 AND MG2 MAIN CONTROL : System Description

INFOID:0000000004211736

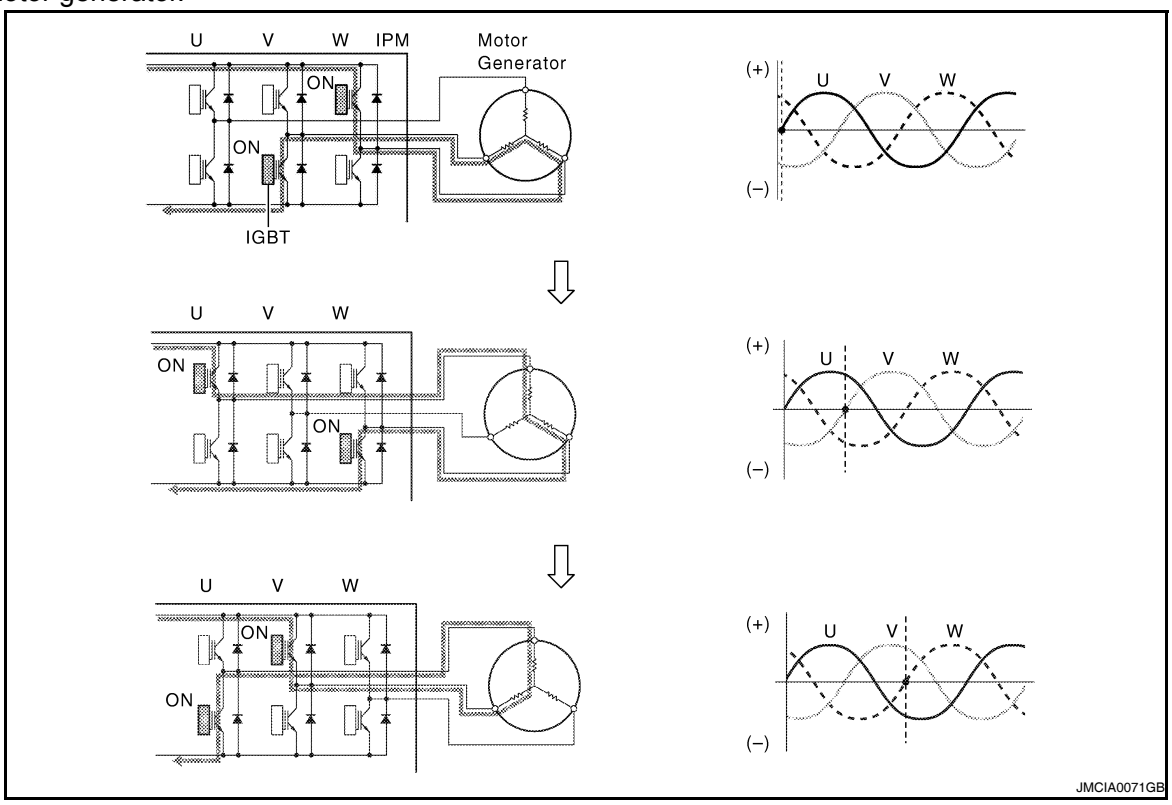
GENERAL

- MG1, which is rotated by the engine, generates high voltage (alternating current) in order to operate MG2 and charge the HV battery. Also, it functions as a starter to start the engine.
- MG2 is driven by electrical power from MG1 or HV battery, and generates motive force for the front wheels.
- MG2 generate electricity to charge the HV battery (regenerative brake control) during braking, or when the accelerator pedal is not being depressed.
- The MG ECU, which follows the commands of the hybrid vehicle control ECU, controls MG1 and MG2 via the IPM (Intelligent Power Module), for driving the vehicle. Six IGBTs (Insulated Gate Bipolar Transistors) switch ON and OFF to control the individual motors in accordance with the driving or generation operation.

MOTOR DRIVE OPERATION

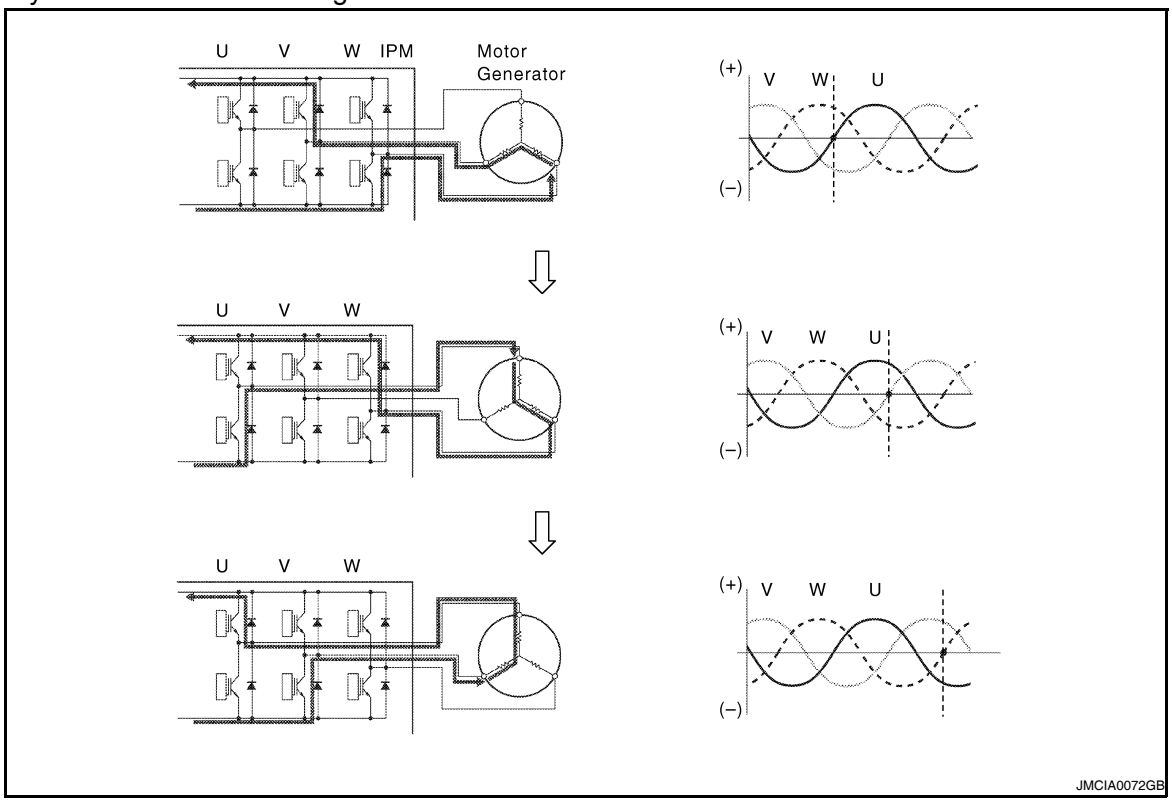
- The illustration below describes the basic control for driving a motor. The IGBTs (Insulated Gate Bipolar Transistors) in the IPM switch ON and OFF to supply a three-phase alternating current to the motor.

- In order to create the motive force required of the motor generator as calculated by the hybrid vehicle control ECU, the MG ECU switches the IGBTs ON and OFF and controls the speed, in order to control the speed of the motor generator.



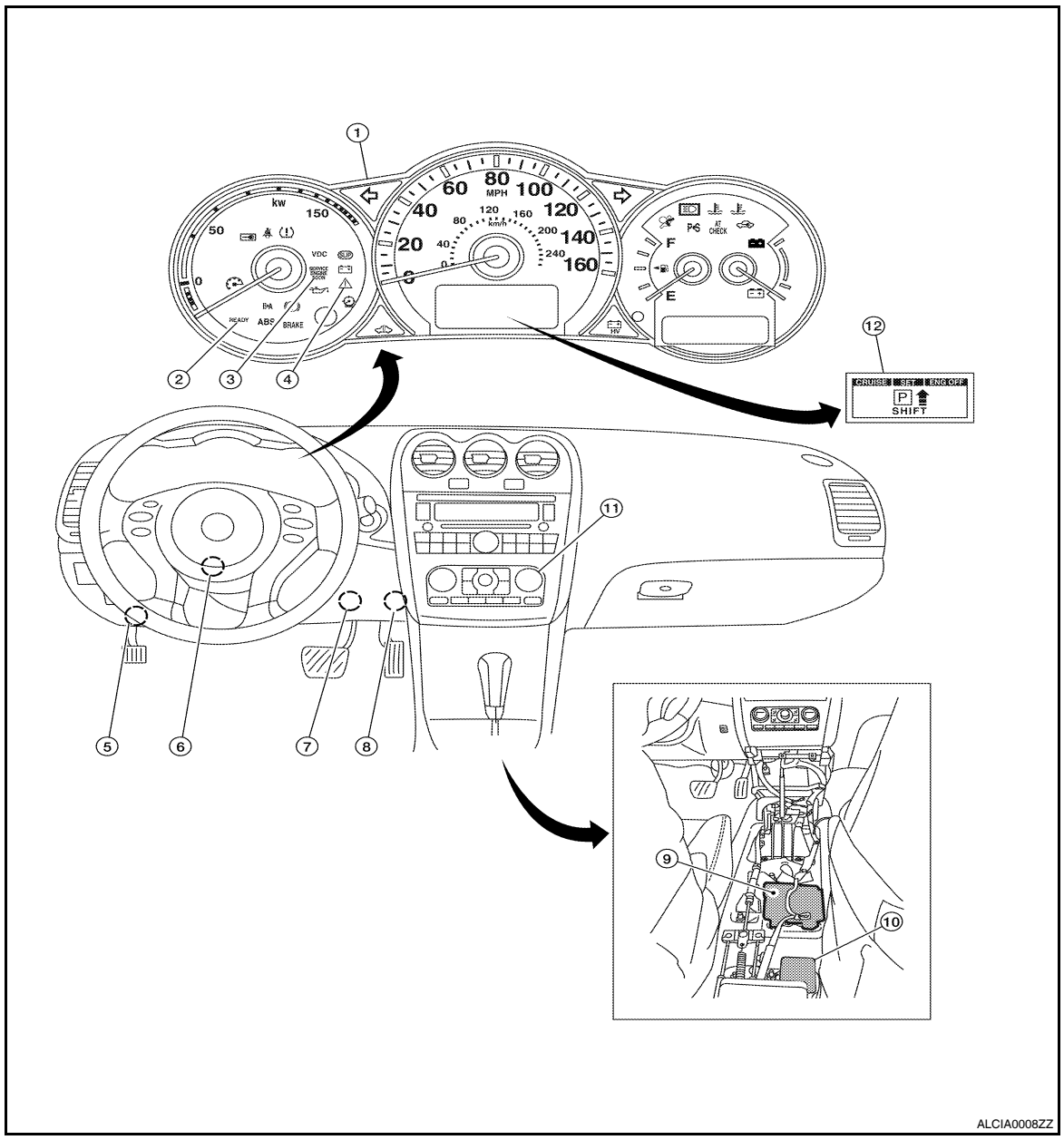
MOTOR GENERATION OPERATION

The illustration below describes the basic control for the motor to generate electricity. The current that is generated sequentially by the three phases of the motor, which is driven by the wheels, is utilized to charge the HV battery or drive another motor generator.

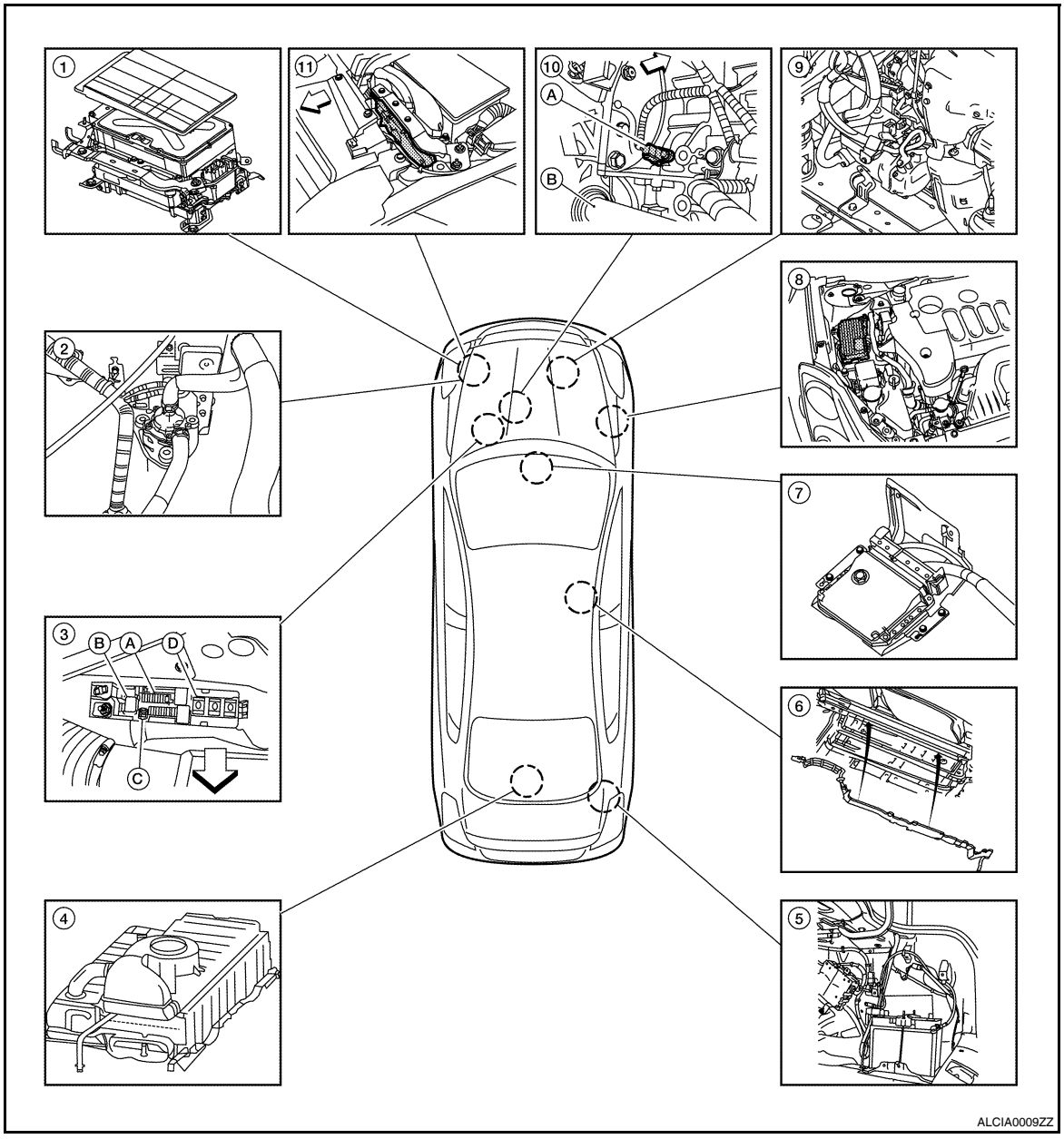


MG1 AND MG2 MAIN CONTROL : Component Parts Location

INFOID:0000000004211737



1. Combination meter
2. READY operation indicator light
3. Malfunction indicator light
4. Master warning light
5. Data link connector
6. Steering angle sensor
7. Stop lamp switch
8. Accelerator pedal position sensor
9. ACU (Air bag diagnosis sensor unit)
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator



1. Inverter with converter assembly
2. Water pump with motor & bracket assembly
3. High voltage fuse and fusible link box
   A: HV CONT MAIN fuse 10A
   B: IGCT relay
   C: IGCT fusible link 50A
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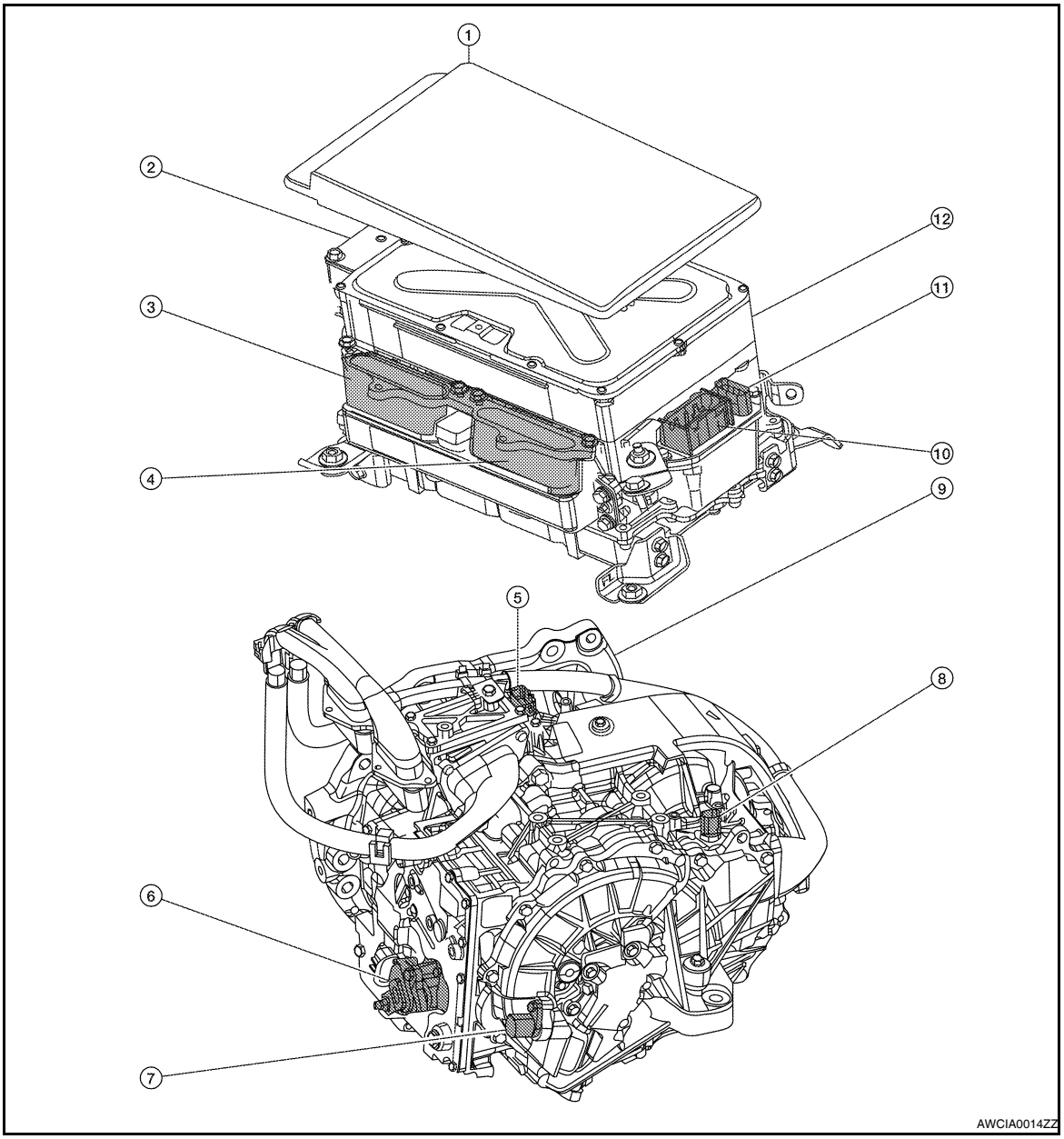
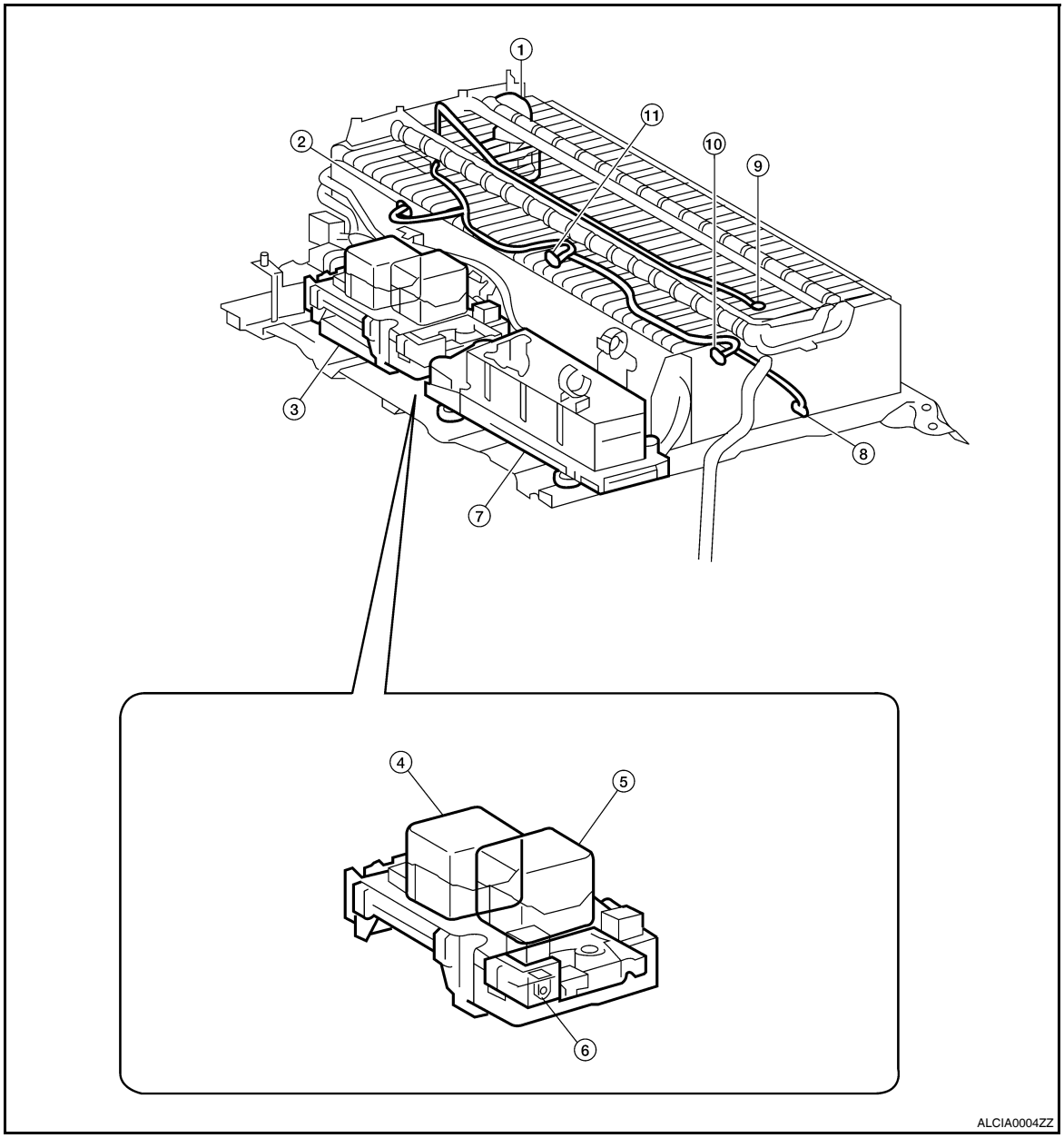
5. Auxiliary battery
6. Frame wire
7. Hybrid vehicle control ECU (located under heater box assembly)
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

⇦ Vehicle front



1. Cover	2. Compressor fuse cover	3. MG1 connector
4. MG2 connector	5. Generator resolver and generator temperature sensor	6. Park/Neutral position (PNP) switch
7. Motor resolver	8. Motor temperature sensor	9. Hybrid transaxle (MG1, MG2, motor speed reduction planetary gear unit, power split planetary gear unit)
10. Inverter with converter assembly connector (MG ECU)	11. Inverter with converter assembly connector (Resolver)	12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

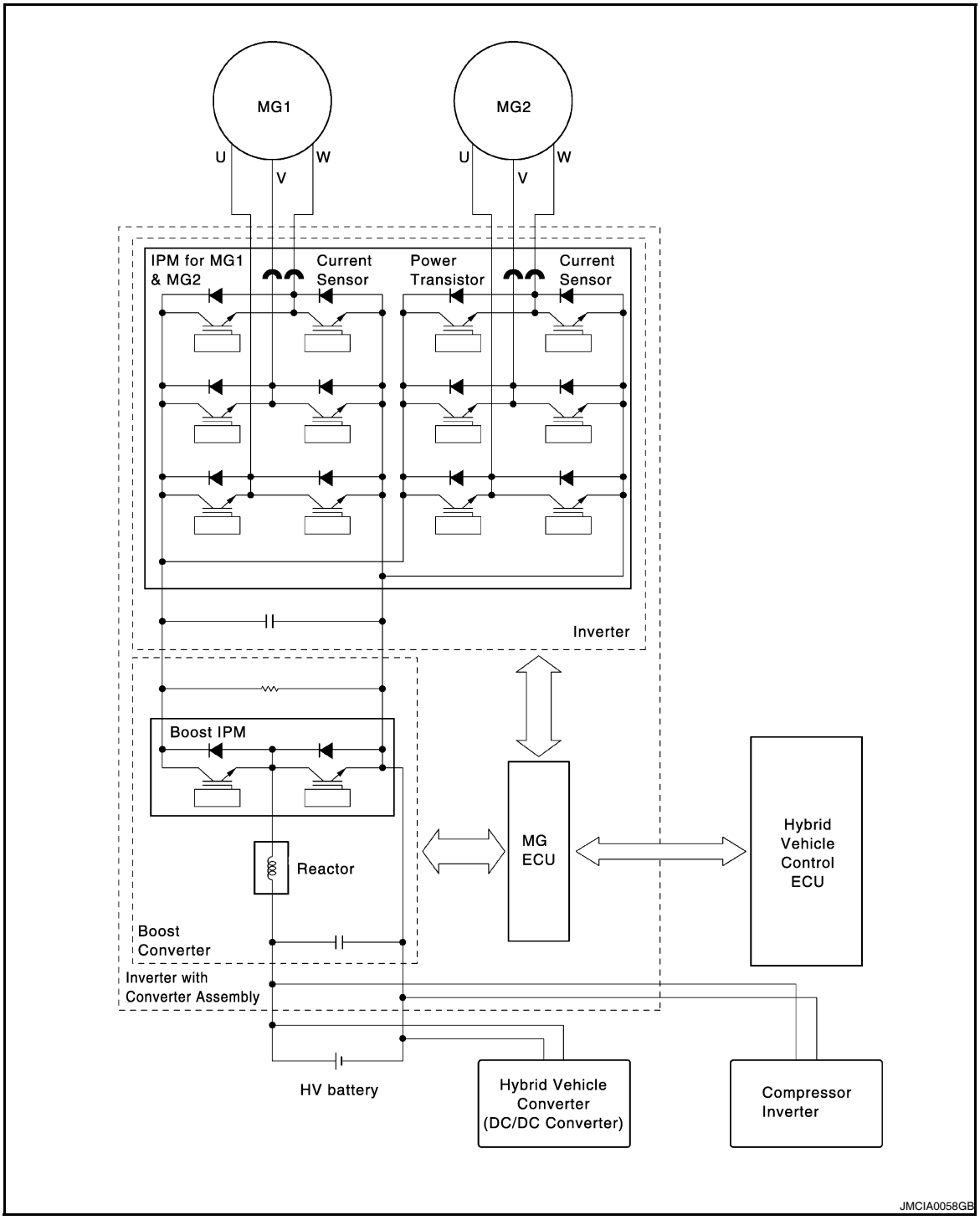


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

INVERTER ASSEMBLY

INVERTER ASSEMBLY : System Diagram

INFOID:0000000004211738



INVERTER ASSEMBLY : System Description

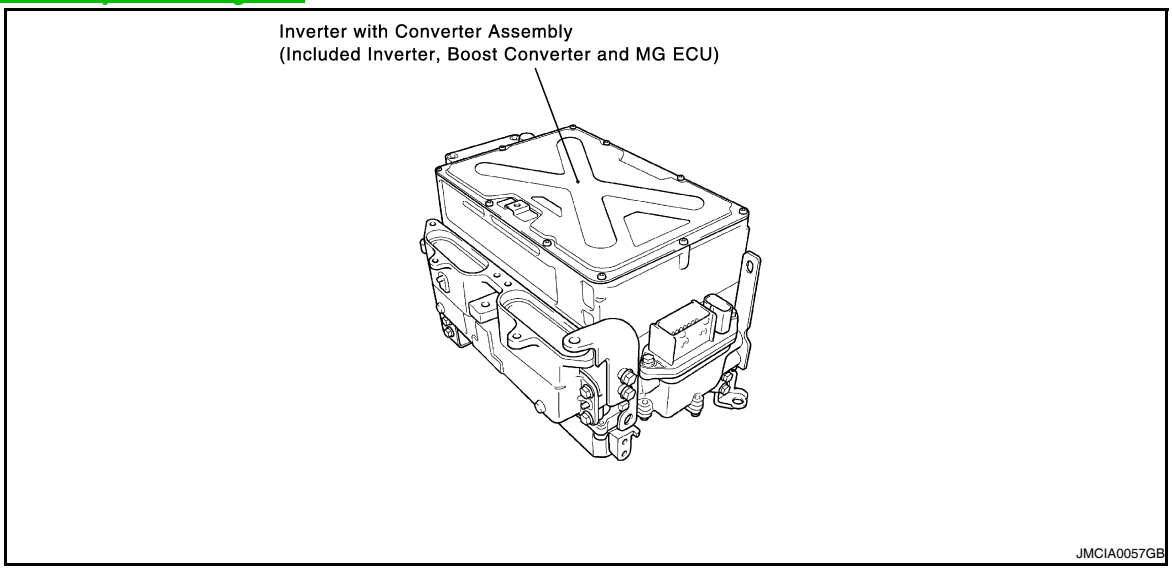
INFOID:0000000004211739

GENERAL

- The inverter converts the high-voltage direct current of the HV battery into three-phase alternating current for driving MG1 and MG2.
- The activation of the power transistors is controlled by the hybrid vehicle control ECU, via the MG ECU. In addition, the inverter transmits information that is needed for current control, such as the output amperage or voltage, to the hybrid vehicle control ECU via the MG ECU.
- Together with MG1 and MG2, the inverter is cooled by the dedicated sub radiator of the coolant system that is separate from that of the engine.

- In the event of a collision involving the vehicle, the sensor detects a collision signal in order to stop the system. For details, refer to During Collision Control on HBC-61, "System Diagram".
- A boost converter is used in the inverter assembly, in order to boost the nominal voltage output by the HV battery from DC 244.8 V to maximum voltage of DC 650 V. After the voltage is boosted, the inverter converts the direct current into an alternating current.
- Each of the bridge circuits for MG1 and MG2 contains 6 power transistors. In addition, a signal processor/ protective function processor has been integrated into a compact IPM (Intelligent Power Module) for driving the vehicle.

For details on the multiple functions of the inverter, refer to Inverter Assembly Control on HBC-45, "INVERTER ASSEMBLY : System Diagram".



BOOST CONVERTER

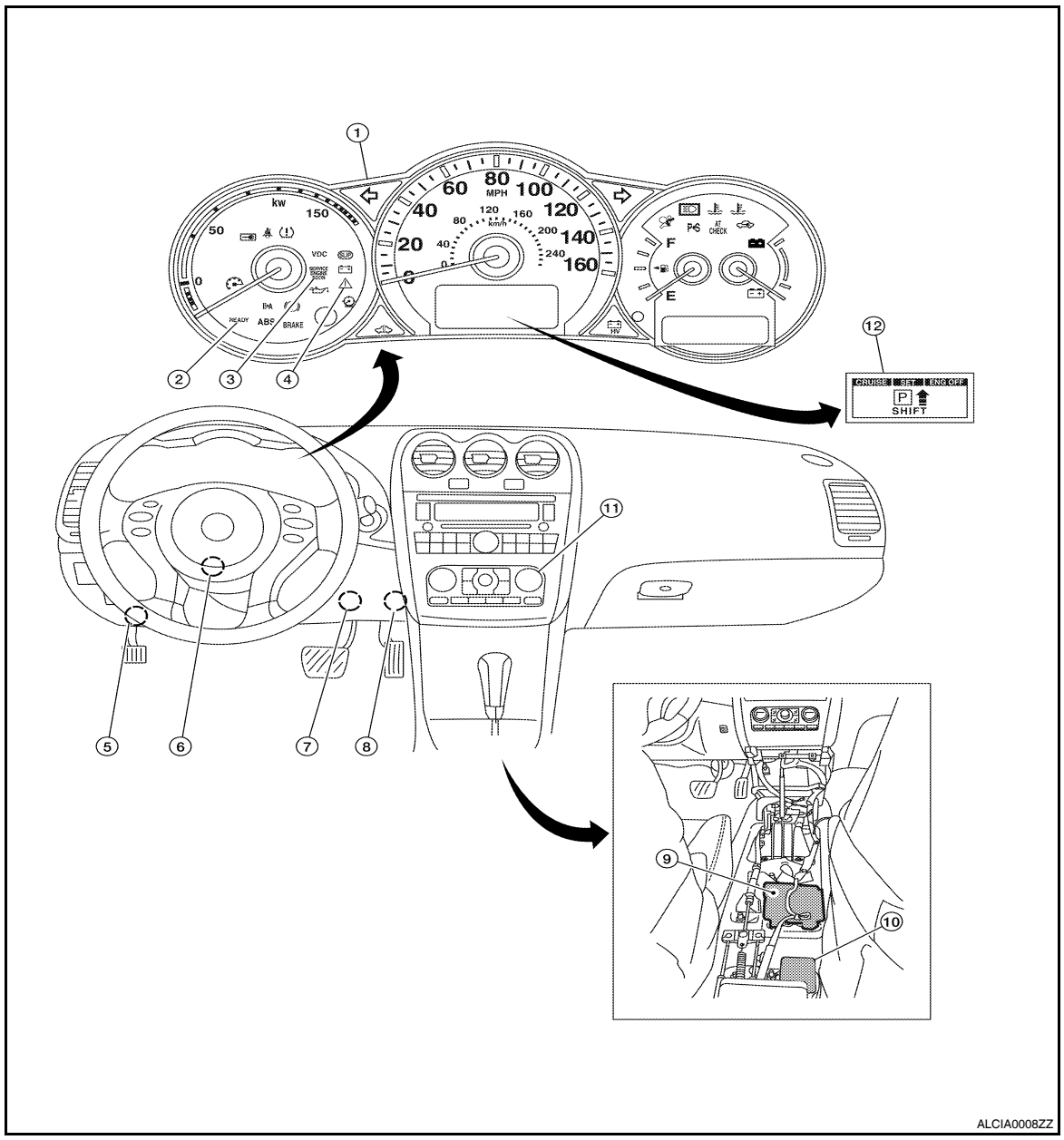
- This boost converter boosts the nominal voltage of DC 244.8 V that is output by the HV battery to the maximum voltage of DC 650 V. The converter consists of the boost IPM (Intelligent Power Module) with a built-in IGBT (Insulated Gate Bipolar Transistor) which performs the switching control, and the reactor which stores energy. By using these components, the converter boosts the voltage. For details, refer to Inverter Assembly Control on HBC-45, "INVERTER ASSEMBLY : System Diagram".
- When MG1 and MG2 acts as the generator, the inverter converts the alternating current into the maximum voltage of DC 650 V, and then the boost converter reduces the voltage to the nominal voltage of DC 244.8 V, thus the HV battery is charged.

MG (MOTOR GENERATOR) ECU

- The MG ECU is provided in the inverter assembly. In accordance with the signals received from the hybrid vehicle control ECU, the MG ECU controls the inverter and boost converter in order to drive MG1 or MG2 or cause them to generate electricity.
- The MG ECU transmits information that is required for vehicle control, such as the inverter output amperage, inverter temperature, and any failure information, to the THS ECU. It receives information that is required for controlling the motor generator, such as the required motive force and the motor temperature, from the hybrid vehicle control ECU.

INVERTER ASSEMBLY : Component Parts Location

INFOID:0000000004211740



1. Combination meter
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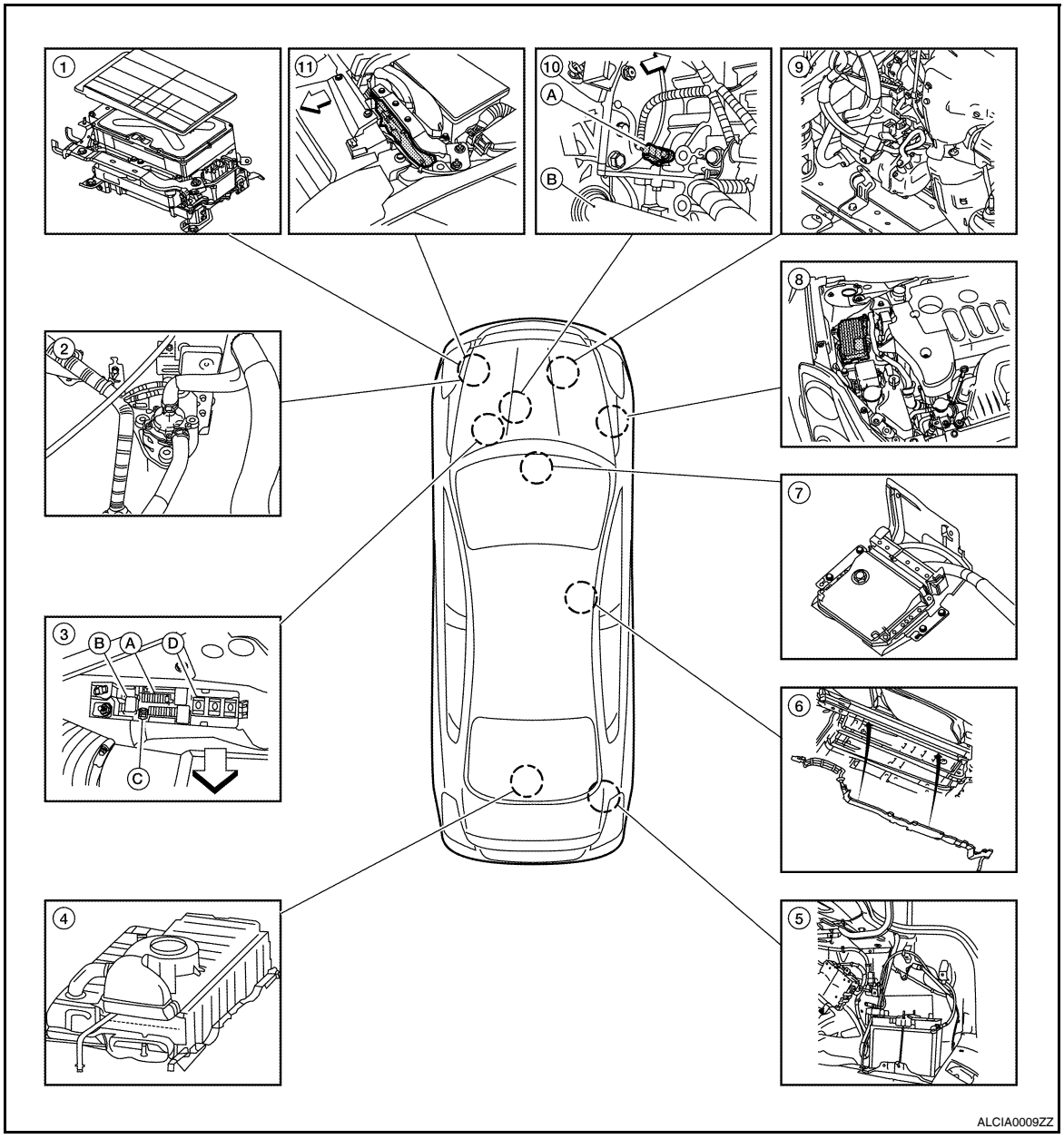
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator



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   B: IGCT relay
   C: IGCT fusible link 50A
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5. Auxiliary battery
6. Frame wire
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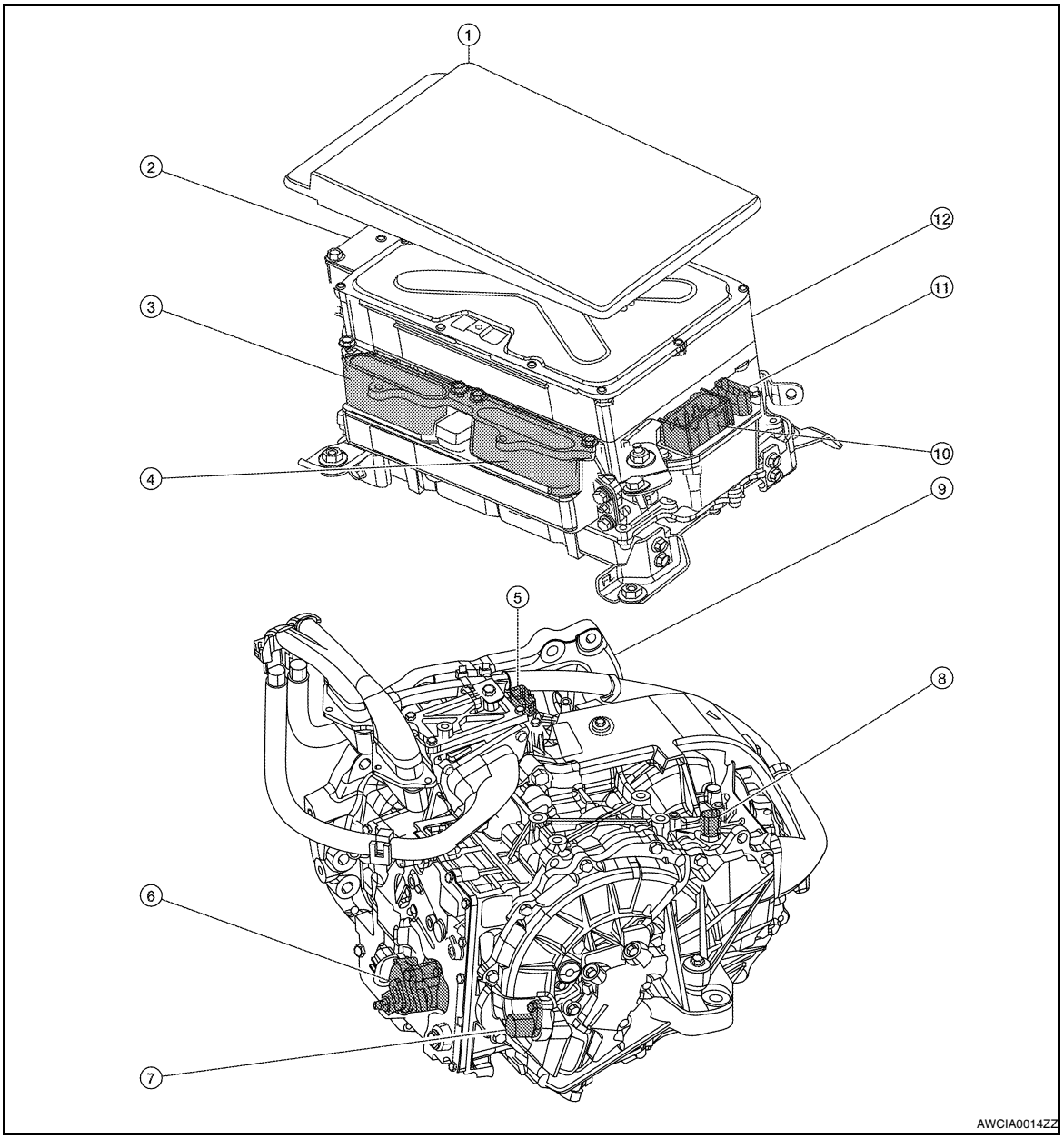
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

⇦ Vehicle front



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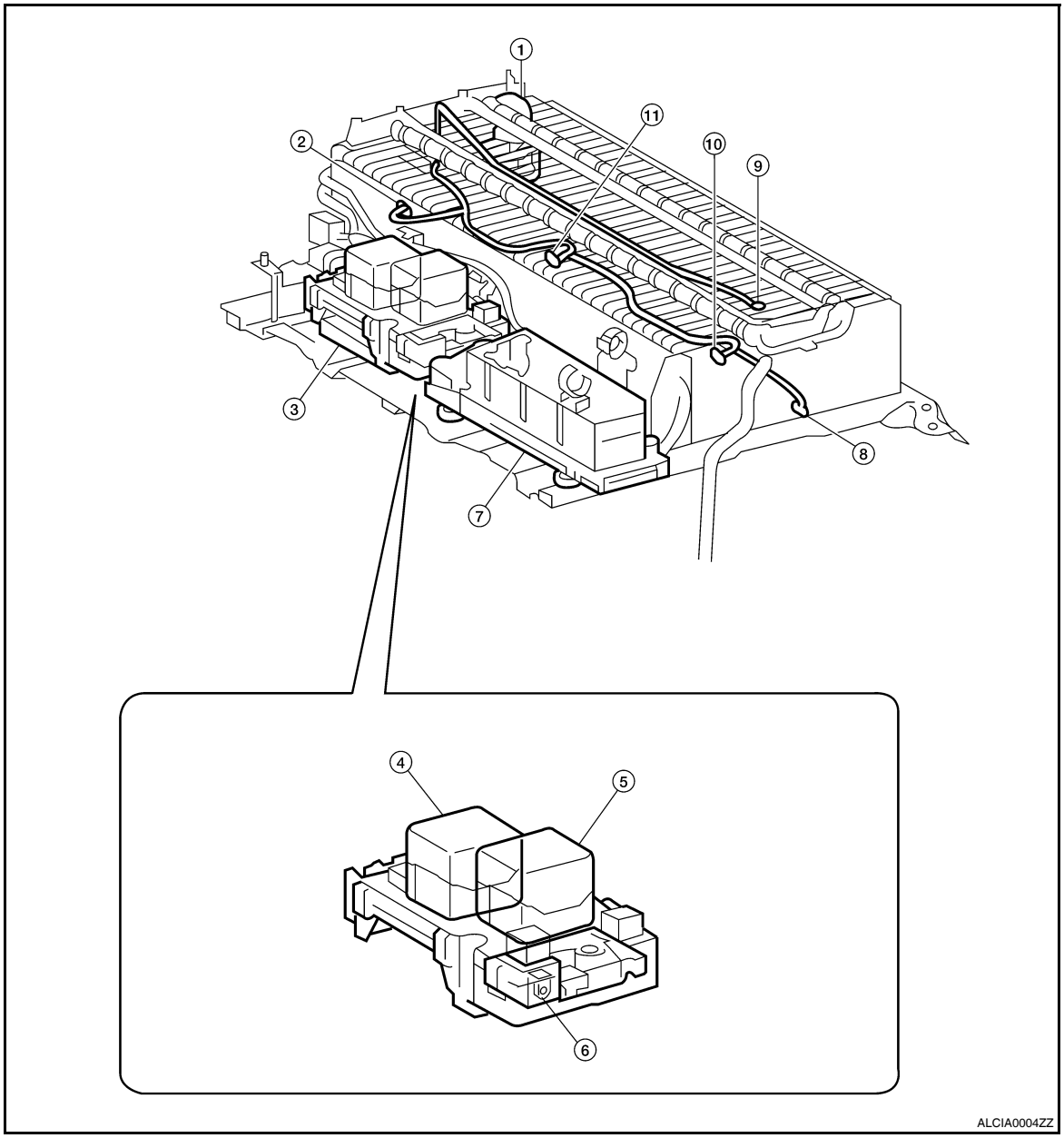

1. Service plug grip
2. Battery temperature sensor 0
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4. SMRG
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6. Battery current sensor
7. Hybrid vehicle converter
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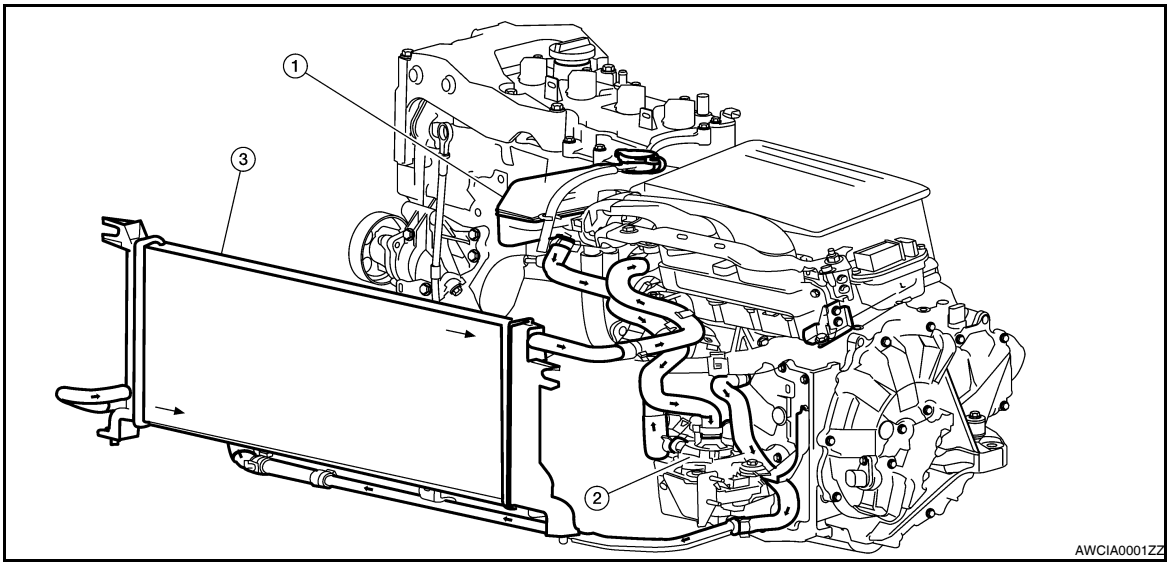
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

COOLING SYSTEM FOR INVERTER, MG1 AND MG2

System Diagram

INFOID:0000000004211741



1. Coolant reservoir
2. Water pump with motor and bracket assembly
3. Sub radiator

System Description

INFOID:0000000004211742

- An inverter cooling system that is independent from the engine cooling system has been provided to cool the inverter, MG1 and MG2.
- This inverter cooling system activates when the power supply status is switched to the READY ON state.
- A sub radiator, which is exclusively used for the inverter, MG1 and MG2, has been provided in front of the radiator and condenser assembly (for the engine cooling and A/C).

Specifications

Water Pump	Discharge Volume	liter/min.	10 or above [65°C (149°F)]
Coolant	Capacity	US measure (Imp. measure/Liters)	7/8 gal (3/4 gal, 3.2)
	Type		NISSAN Genuine Long Life Coolant (LLC) or the equivalent
	Maintenance Intervals	First Time	60,000 miles (96,000 km) or 48 months
		Subsequent	Every 30,000 miles (48,000 km) or 24 months

- The inverter cooling system is filled at the factory with a high-quality, year-round, anti-freeze coolant solution. The anti-freeze solution contains rust and corrosion inhibitors. Therefore, additional inverter cooling system additives are not necessary.

CAUTION:

When adding or replacing coolant, always use only Genuine NISSAN Long Life Antifreeze/ Coolant or equivalent with the proper mixture ratio of 50% anti-freeze and 50% demineralized water/distilled water.

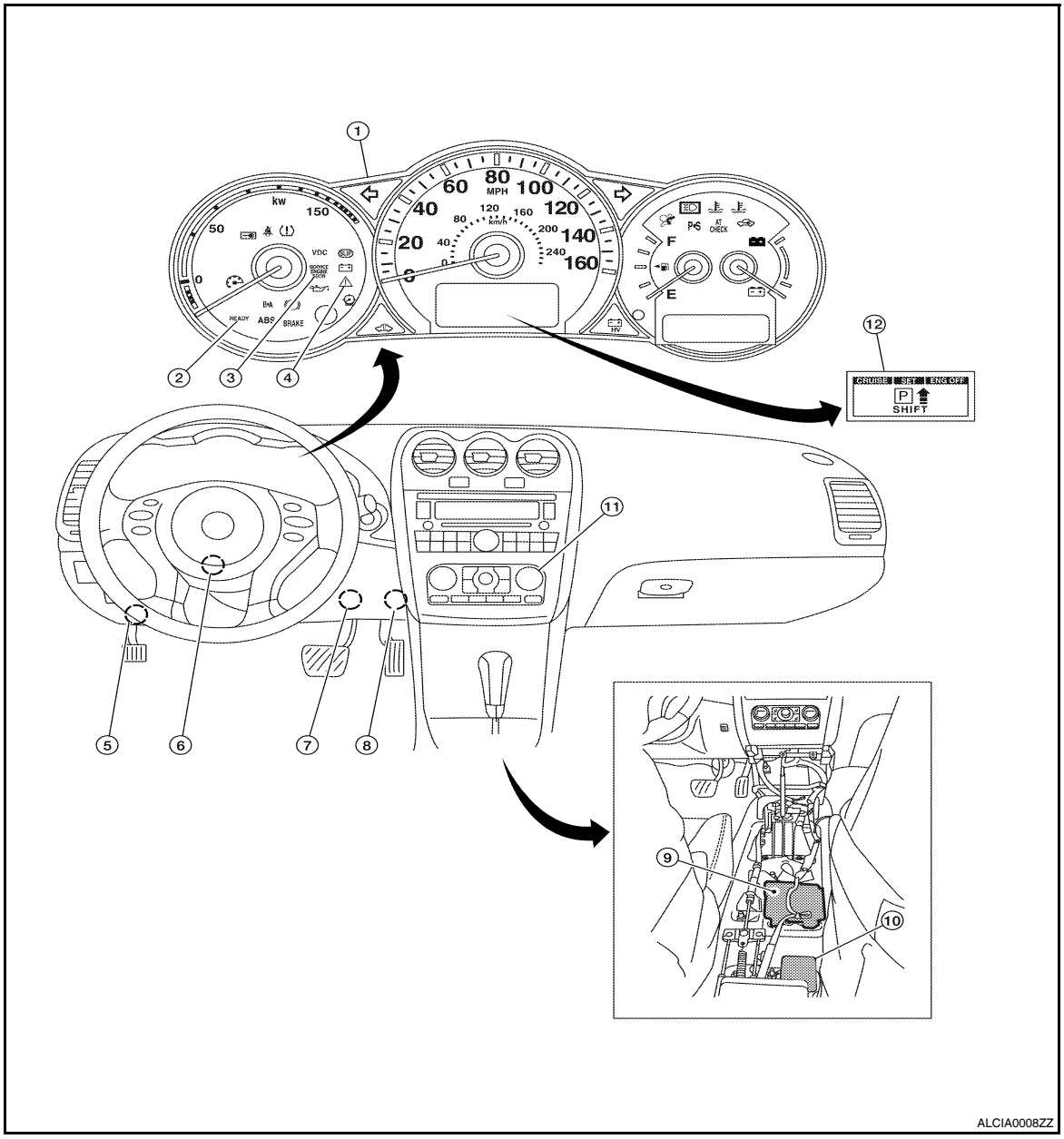
Other types of coolant solutions may damage your inverter cooling system.

Outside temperature down to		Anti-freeze	Demineralized water or distilled water
°C	°F		
–35	–30	50%	50%

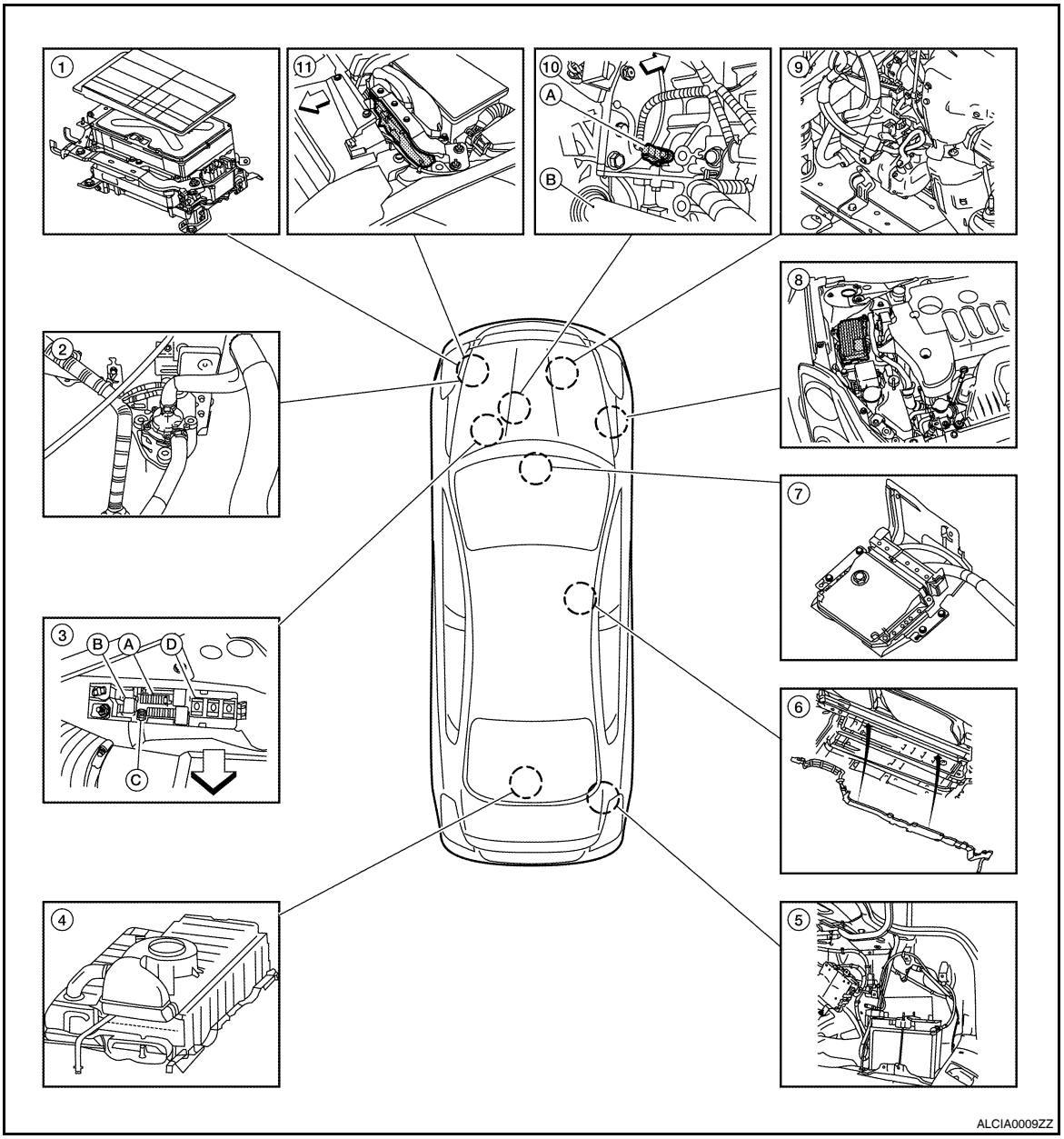
SMA947CA

Component Parts Location

INFOID:0000000004211743

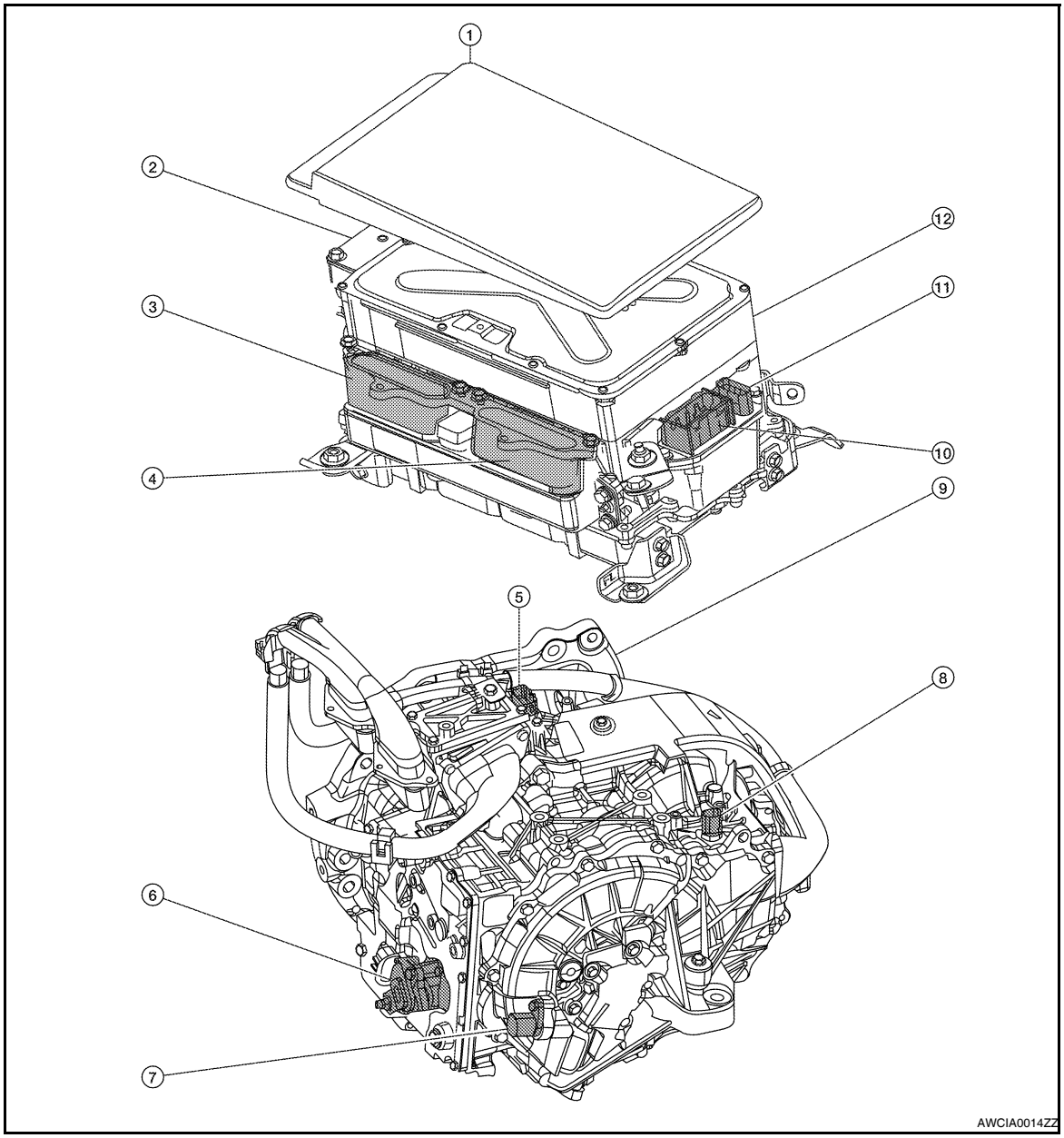


1. Combination meter
2. READY operation indicator light
3. Malfunction indicator light
4. Master warning light
5. Data link connector
6. Steering angle sensor
7. Stop lamp switch
8. Accelerator pedal position sensor
9. ACU (Air bag diagnosis sensor unit)
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator

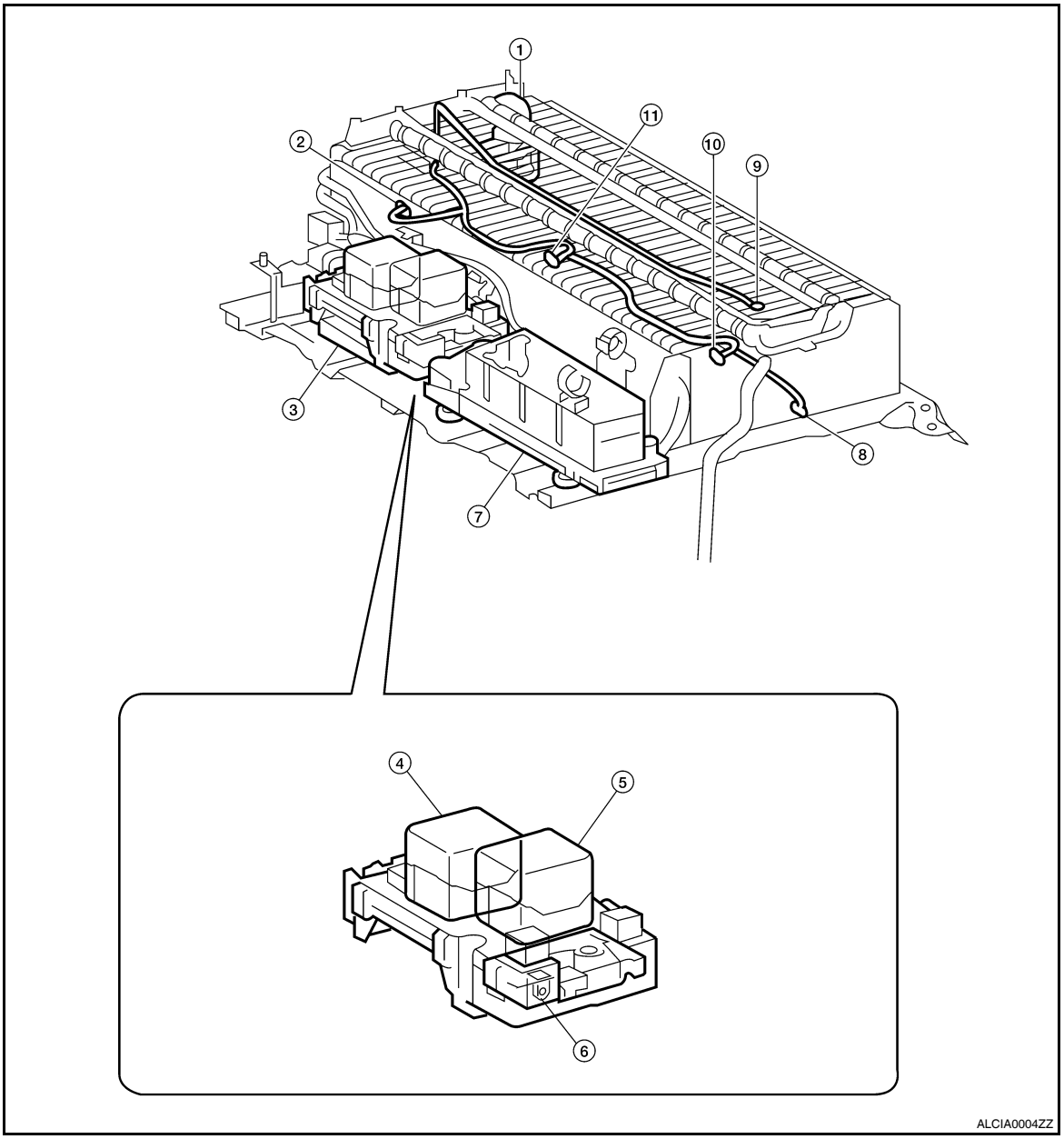


1. Inverter with converter assembly
2. Water pump with motor & bracket assembly
3. High voltage fuse and fusible link box
   A: HV CONT MAIN fuse 10A
   B: IGCT relay
   C: IGCT fusible link 50A
   D: DC/DC fusible link 120A
4. HV battery
5. Auxiliary battery
6. Frame wire
7. Hybrid vehicle control ECU (located under heater box assembly)
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

⇦ Vehicle front



1. Cover	2. Compressor fuse cover	3. MG1 connector
4. MG2 connector	5. Generator resolver and generator temperature sensor	6. Park/Neutral position (PNP) switch
7. Motor resolver	8. Motor temperature sensor	9. Hybrid transaxle (MG1, MG2, motor speed reduction planetary gear unit, power split planetary gear unit)
10. Inverter with converter assembly connector (MG ECU)	11. Inverter with converter assembly connector (Resolver)	12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

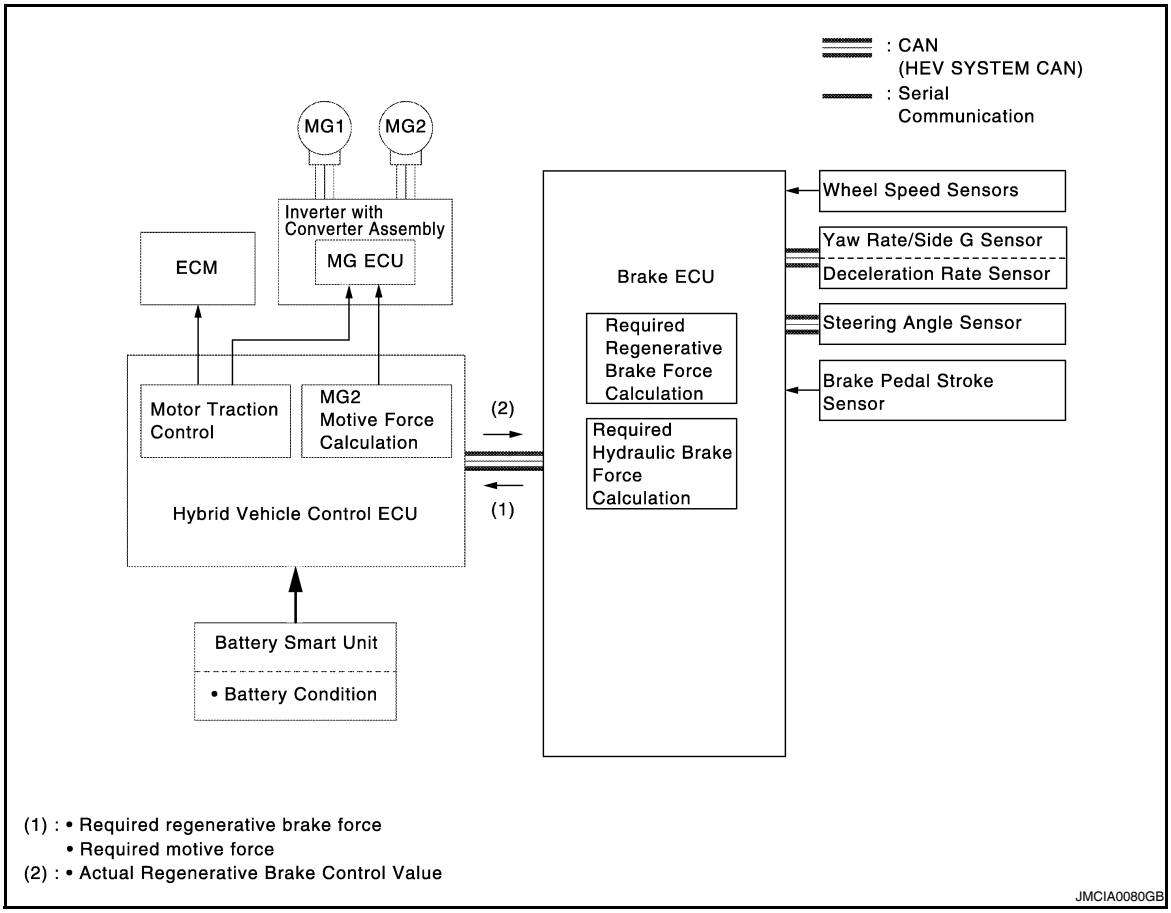


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

BRAKE CONTROL

System Diagram

INFOID:0000000004211744



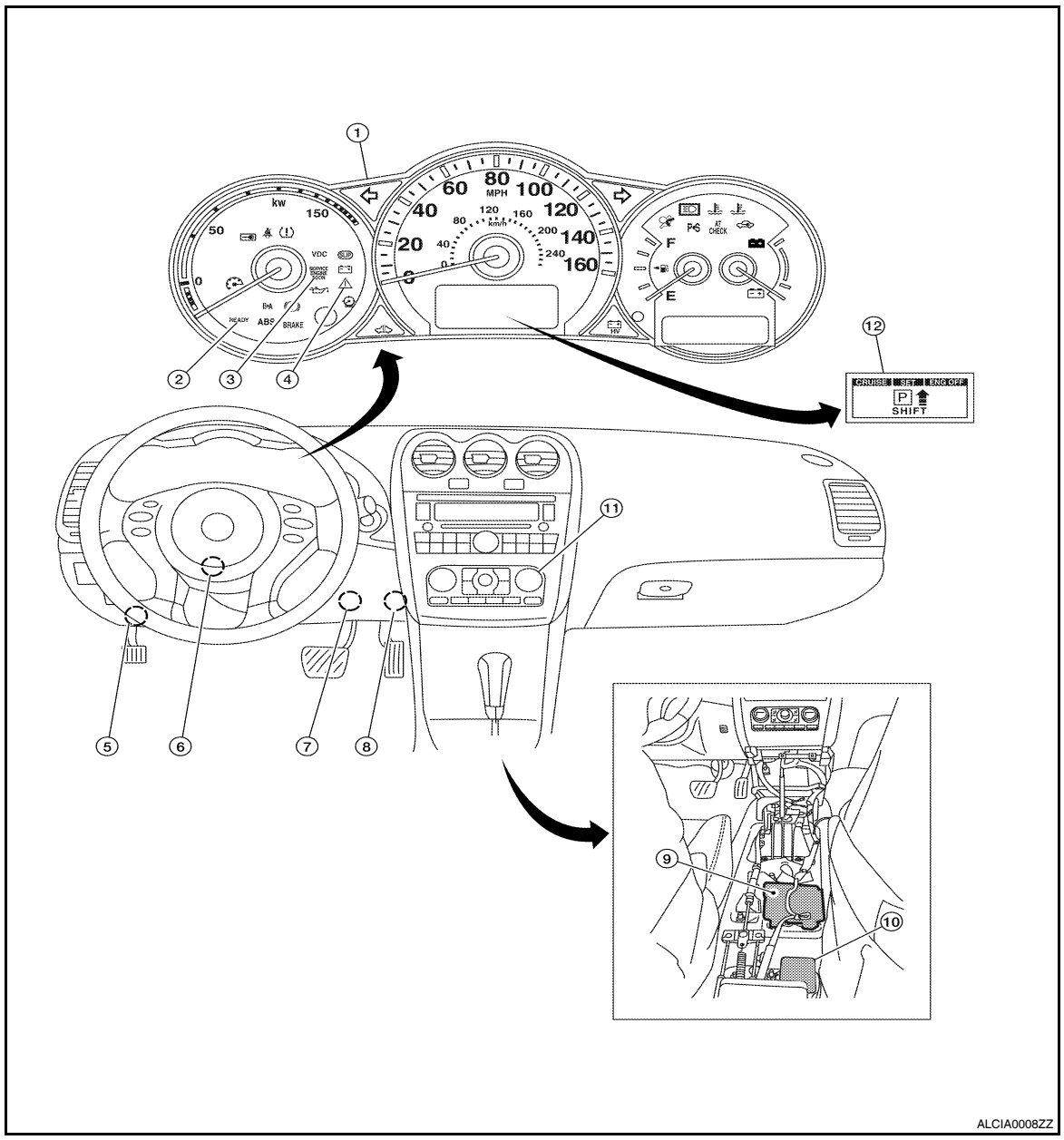
System Description

INFOID:0000000004211745

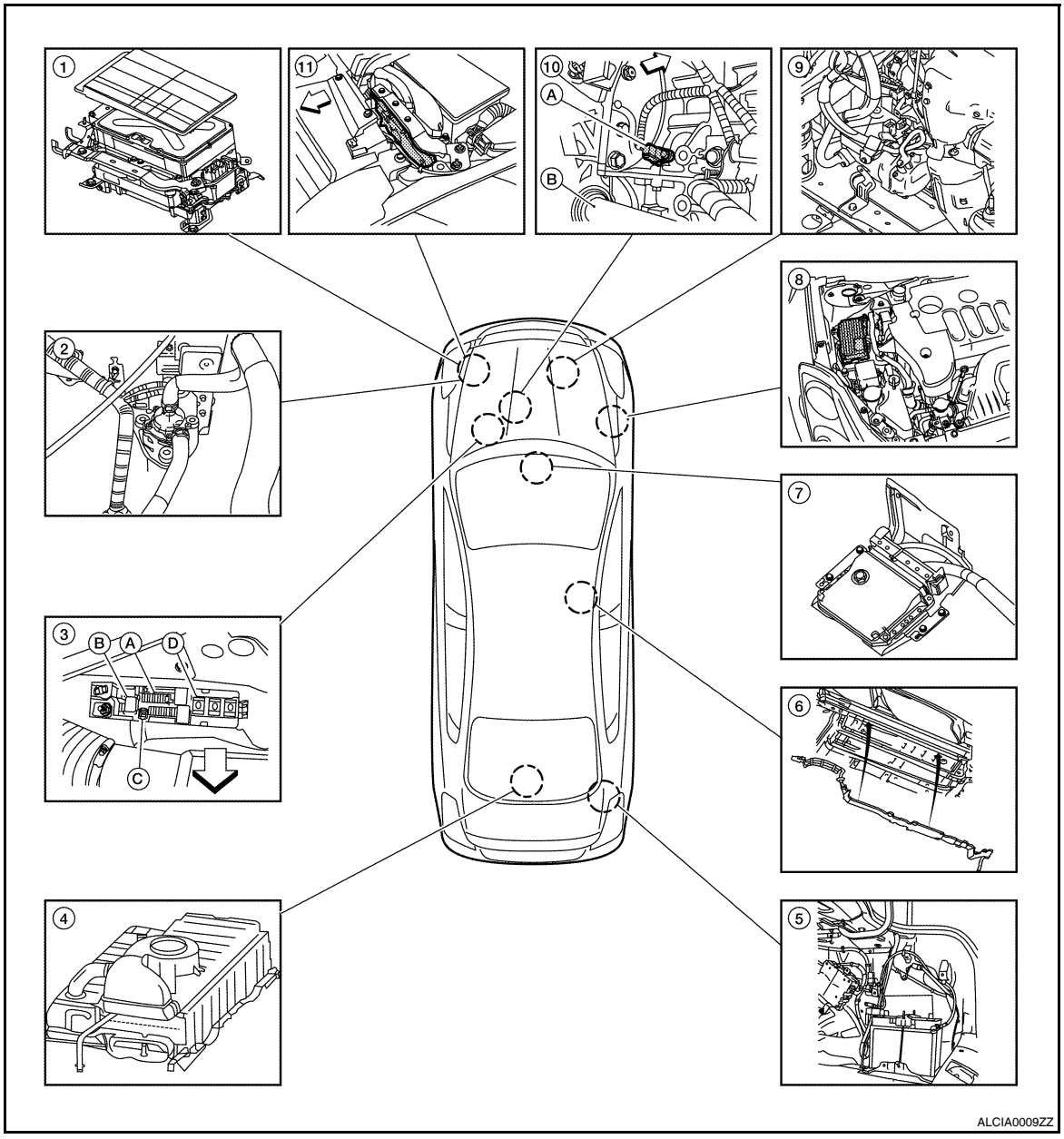
- The brake ECU calculates the total braking force needed, based on the master cylinder pressure in the brake actuator and brake pedal stroke sensor generated when the driver depresses the brake pedal.
- The brake ECU computes a part for the required regeneration brake force from the total braking force, and sends the result to the hybrid vehicle control ECU.
- The hybrid vehicle control ECU executes to the minus torque to MG2, and carries out the regenerative brake functions.
  The brake ECU controls the brake actuator solenoid valves and generates the wheel cylinder pressure, which is the actual regenerative brake control value subtracted from the total braking force.
- The brake ECU outputs a request to the hybrid vehicle control ECU to effect motor traction control while the vehicle is operating under TCS function control. The hybrid vehicle control ECU controls the engine, MG1, and MG2 in accordance with the present driving conditions in order to suppress the motive force.

Component Parts Location

INFOID:0000000004211746

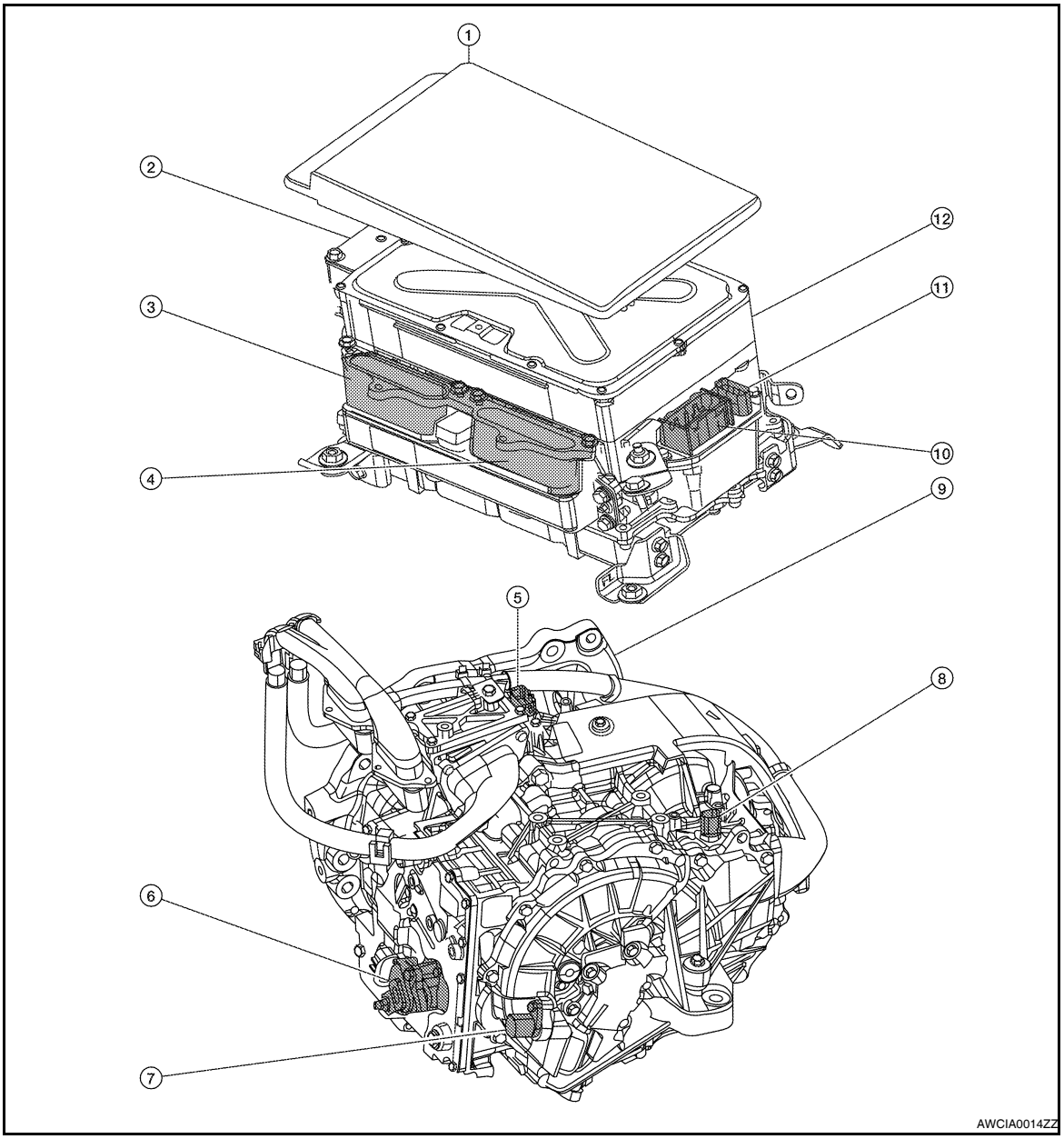


1. Combination meter
2. READY operation indicator light
3. Malfunction indicator light
4. Master warning light
5. Data link connector
6. Steering angle sensor
7. Stop lamp switch
8. Accelerator pedal position sensor
9. ACU (Air bag diagnosis sensor unit)
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator

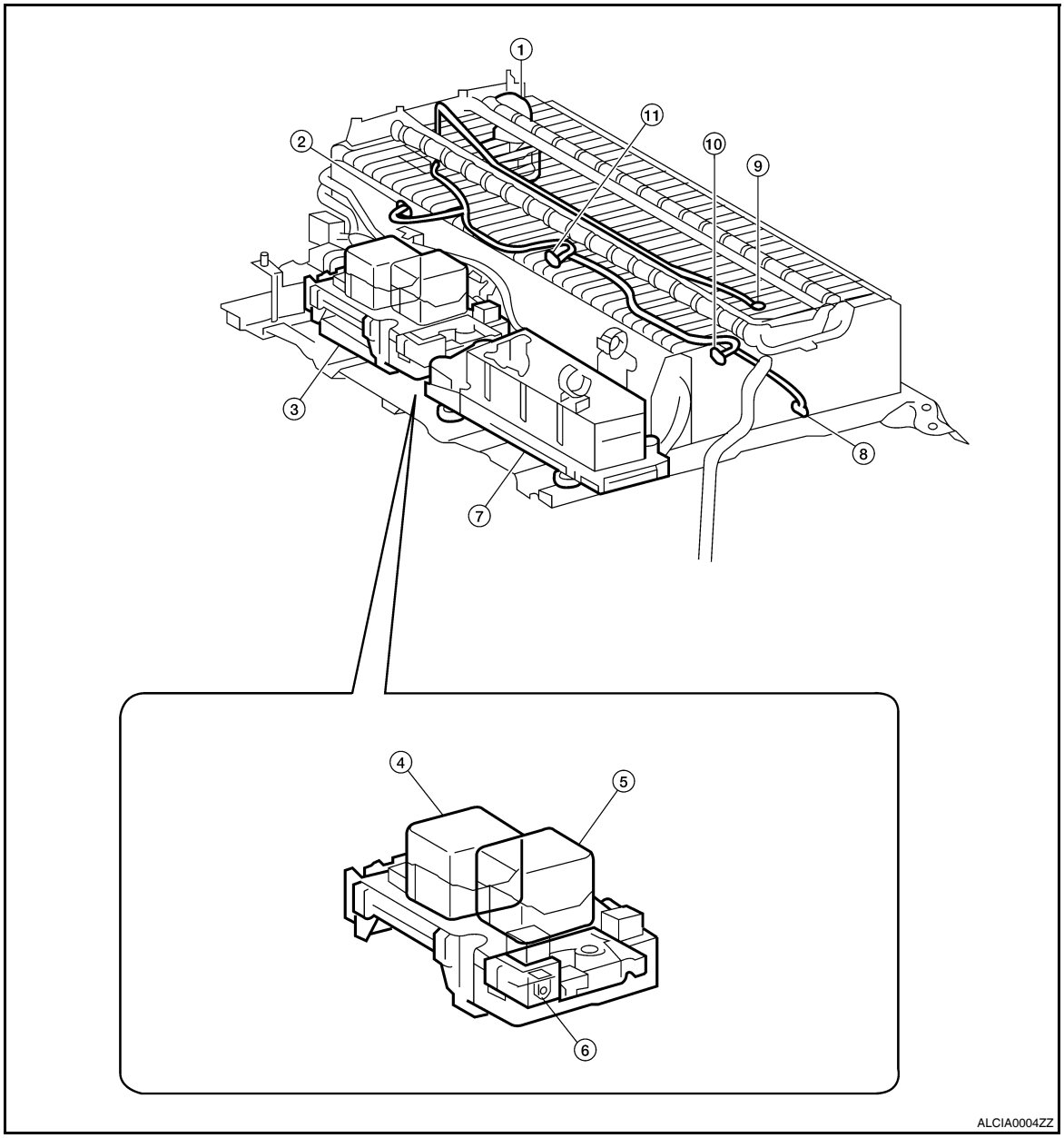


1. Inverter with converter assembly
2. Water pump with motor & bracket assembly
3. High voltage fuse and fusible link box
   A: HV CONT MAIN fuse 10A
   B: IGCT relay
   C: IGCT fusible link 50A
   D: DC/DC fusible link 120A
4. HV battery
5. Auxiliary battery
6. Frame wire
7. Hybrid vehicle control ECU (located under heater box assembly)
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

⇦ Vehicle front



1. Cover
2. Compressor fuse cover
3. MG1 connector
4. MG2 connector
5. Generator resolver and generator temperature sensor
6. Park/Neutral position (PNP) switch
7. Motor resolver
8. Motor temperature sensor
9. Hybrid transaxle (MG1, MG2, motor speed reduction planetary gear unit, power split planetary gear unit)
10. Inverter with converter assembly connector (MG ECU)
11. Inverter with converter assembly connector (Resolver)
12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

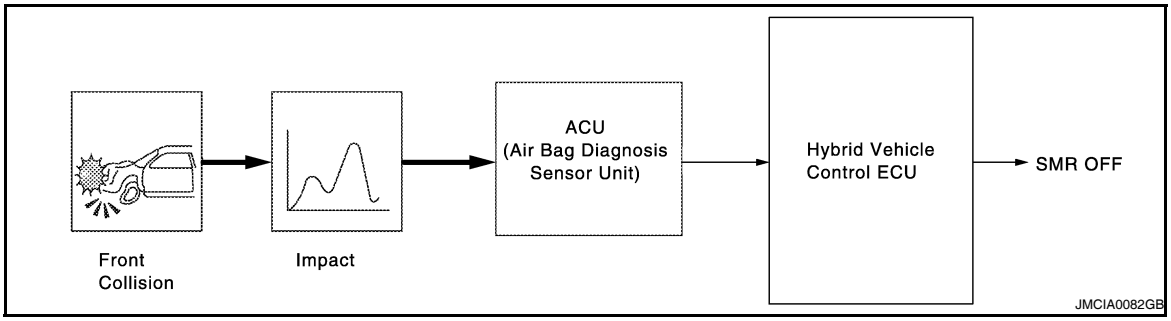


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

DURING COLLISION CONTROL

System Diagram

INFOID:0000000004211747



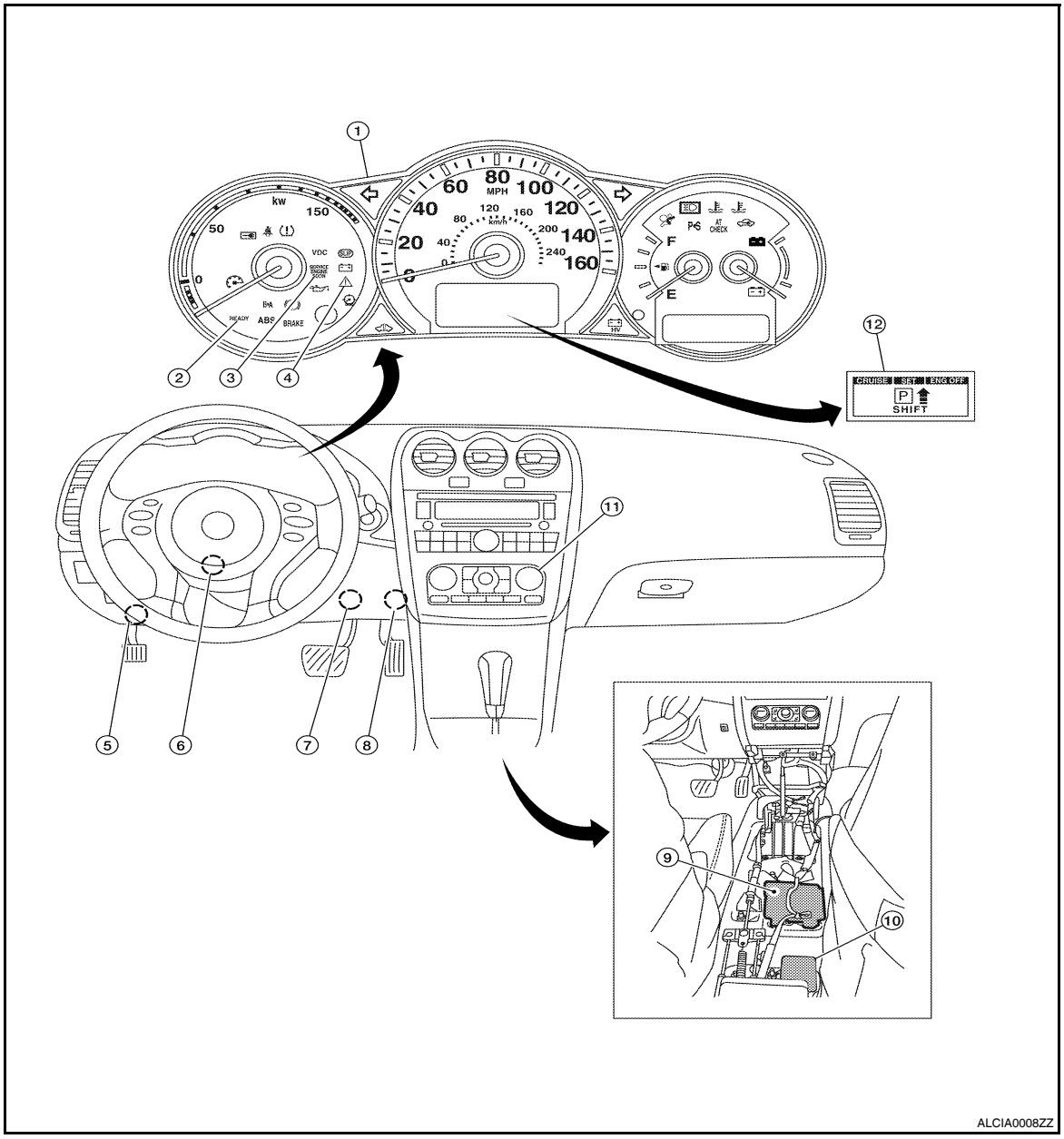
System Description

INFOID:0000000004211748

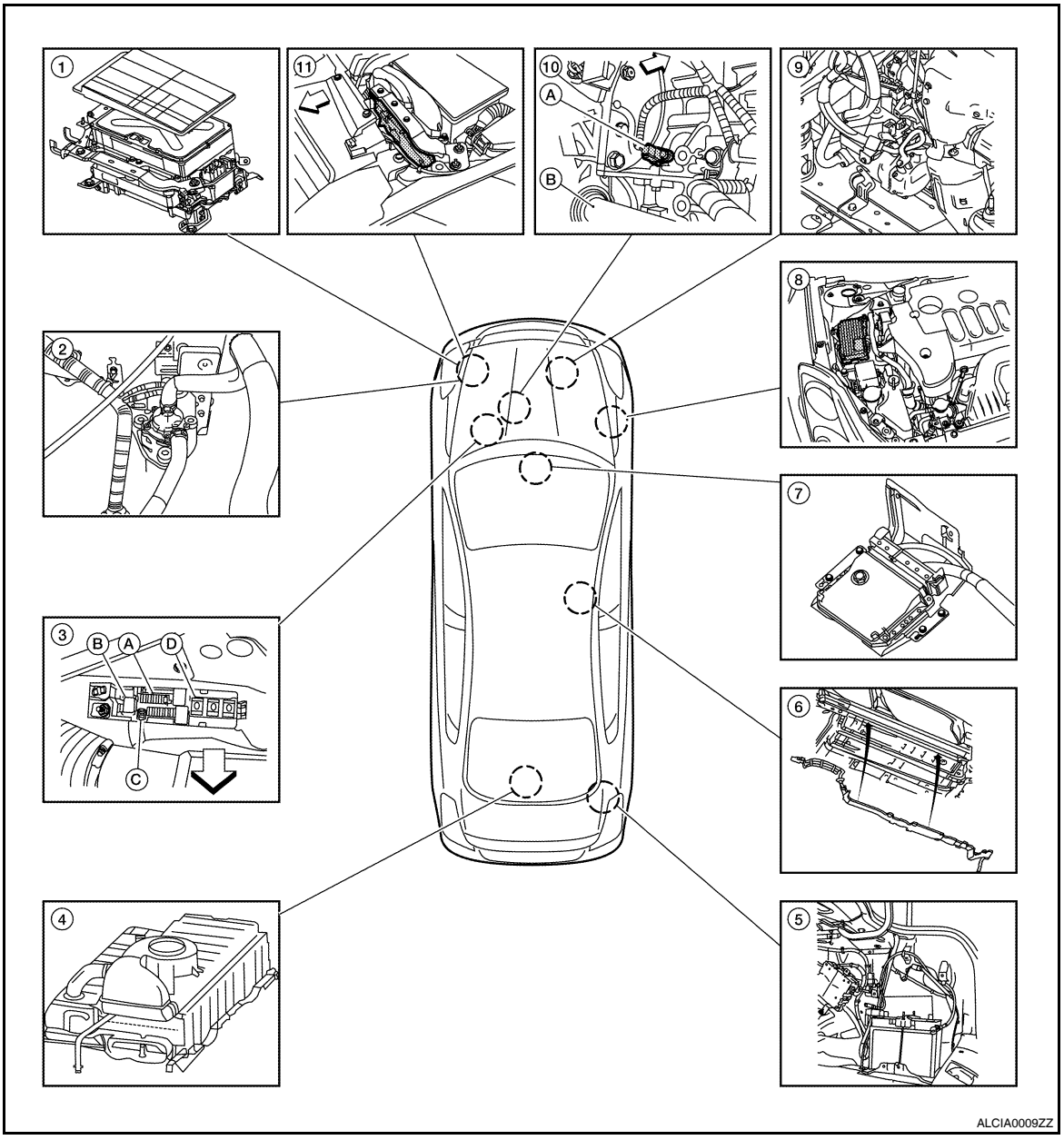
If the vehicle encounters one of the situations described below, the hybrid vehicle control ECU will shut down the entire power supply by turning the SMR (System Main Relay) OFF, in order to ensure safety.
The hybrid vehicle control ECU receives an air bag deployment signal from the air bag diagnosis sensor unit during a frontal collision.

Component Parts Location

INFOID:0000000004211749

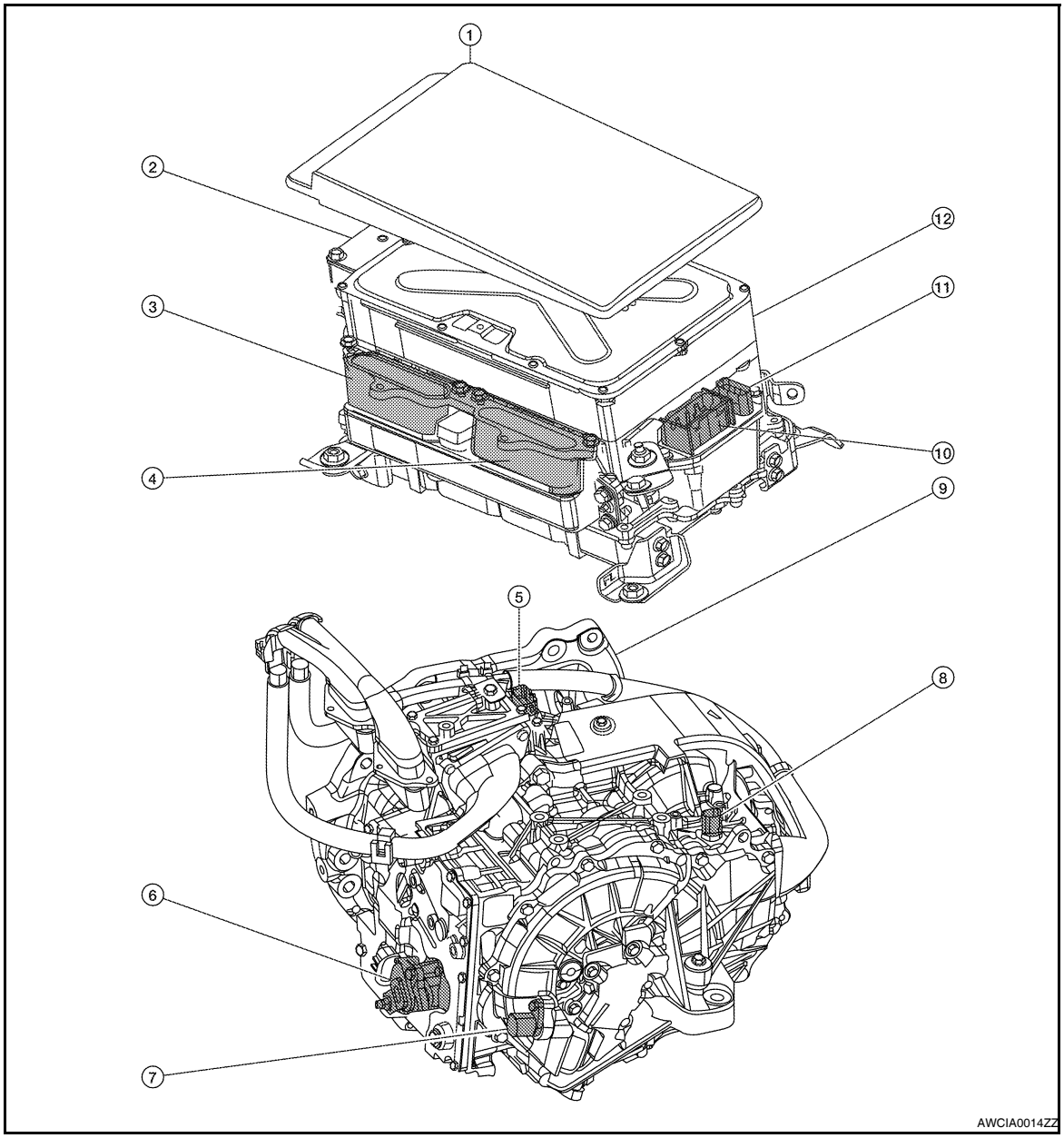


1. Combination meter
2. READY operation indicator light
3. Malfunction indicator light
4. Master warning light
5. Data link connector
6. Steering angle sensor
7. Stop lamp switch
8. Accelerator pedal position sensor
9. ACU (Air bag diagnosis sensor unit)
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator

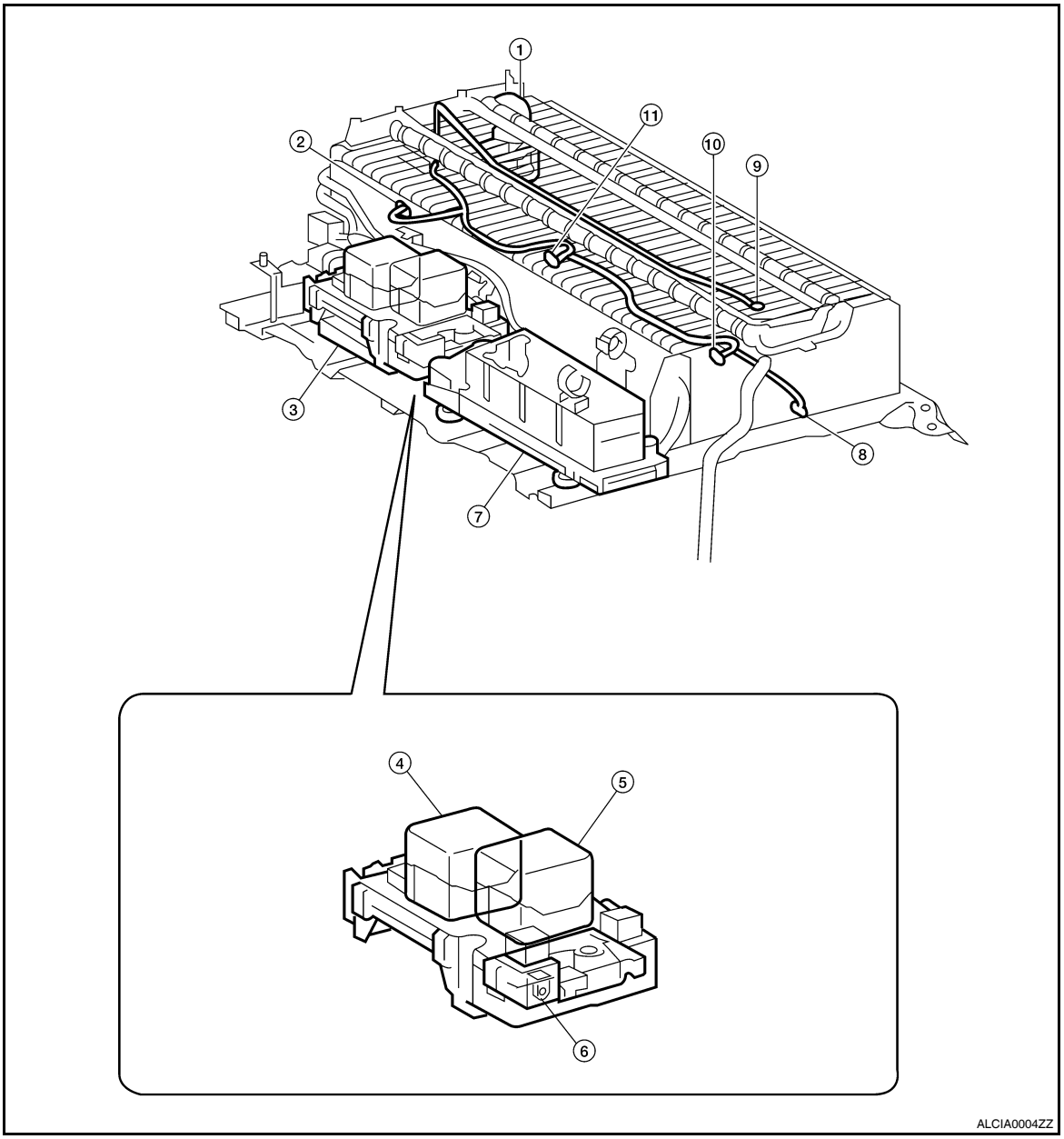


1. Inverter with converter assembly
2. Water pump with motor & bracket assembly
3. High voltage fuse and fusible link box
   A: HV CONT MAIN fuse 10A
   B: IGCT relay
   C: IGCT fusible link 50A
   D: DC/DC fusible link 120A
4. HV battery
5. Auxiliary battery
6. Frame wire
7. Hybrid vehicle control ECU (located under heater box assembly)
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

⇦ Vehicle front



1. Cover	2. Compressor fuse cover	3. MG1 connector
4. MG2 connector	5. Generator resolver and generator temperature sensor	6. Park/Neutral position (PNP) switch
7. Motor resolver	8. Motor temperature sensor	9. Hybrid transaxle (MG1, MG2, motor speed reduction planetary gear unit, power split planetary gear unit)
10. Inverter with converter assembly connector (MG ECU)	11. Inverter with converter assembly connector (Resolver)	12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

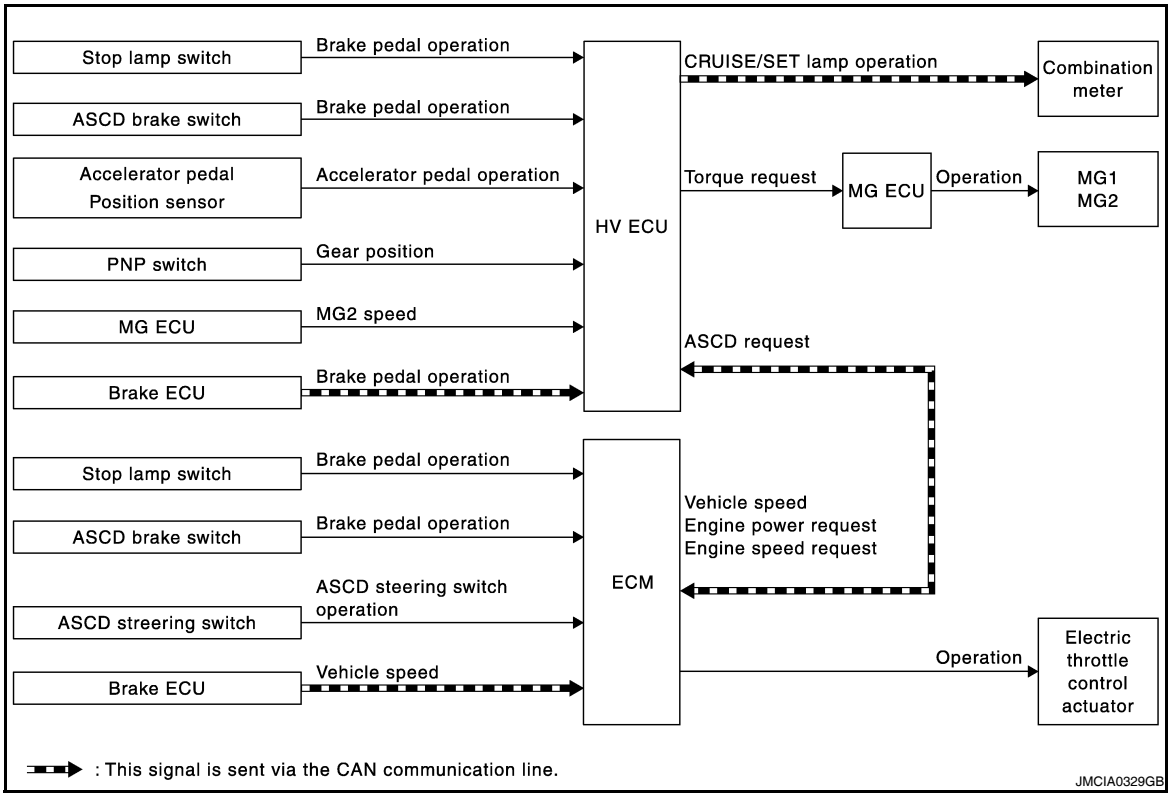


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1

AUTOMATIC SPEED CONTROL DEVICE (ASCD)

System Diagram

INFOID:0000000004211750



System Description

INFOID:0000000004211751

INPUT/OUTPUT SIGNAL CHART

Input				ECU	Output			
Sensor	Signal				Signal			Actuator
Stop lamp switch	Brake pedal operation			Hybrid vehicle control ECU	CRUISE lamp operation*			Combination meter
ASCD brake switch	Brake pedal operation				SET lamp operation*			
Accelerator pedal position sensor	Accelerator pedal operation				Torque request	MG ECU	Operation	MG1 MG2
PNP switch	Gear position							
MG ECU	MG2 speed							
Brake ECU	Brake pedal operation*							
Stop lamp switch	Brake pedal operation	ECM	ASCD request*		Vehicle speed* Engine power request* Engine speed request*	ECM	Operation	Electric throttle control actuator
ASCD brake switch	Brake pedal operation							
ASCD steering switch	ASCD steering switch operation							
Brake ECU	Vehicle speed*							

*: This signal is sent via the CAN communication line.

BASIC ASCD SYSTEM

Refer to Owner's Manual for ASCD operating instructions.

Automatic Speed Control Device (ASCD) allows a driver to keep vehicle at predetermined constant speed without depressing accelerator pedal. Driver can set vehicle speed in advance between approximately 40 km/h (25 MPH) and 144 km/h (89 MPH).

The hybrid vehicle control ECU receives signals from each switch, sensor, control unit, and maintains constant vehicle speed by optimizing the use of the engine and motor driving force.
Operation status of ASCD is indicated by CRUISE lamp and SET lamp in combination meter. If any malfunction occurs in ASCD system, it automatically deactivates control.

NOTE:
Always drive vehicle in safe manner according to traffic conditions and obey all traffic laws.

SET OPERATION

Press MAIN switch. (The CRUISE lamp in combination meter illuminates.)
When vehicle speed reaches a desired speed between approximately 40 km/h (25 MPH) and 144 km/h (89 MPH), press SET/COAST switch. (Then SET lamp in combination meter illuminates.)

ACCELERATE OPERATION

If the RESUME/ACCELERATE switch is pressed during cruise control driving, increase the vehicle speed until the switch is released or vehicle speed reaches maximum speed controlled by the system.
And then ASCD will keep the new set speed.

CANCEL OPERATION

When any of following conditions exist, cruise operation will be canceled.
- CANCEL switch is pressed
- More than 2 switches at ASCD steering switch are pressed at the same time (Set speed will be cleared)
- Brake pedal is depressed
- Selector lever is changed to N, P, R position
- Vehicle speed decreased to 13 km/h (8 MPH) lower than the set speed
- TCS system is operated

When any of the following conditions is detected, the hybrid vehicle control ECU will cancel the cruise operation and inform the driver by blinking indicator lamp.
- Malfunction for some self-diagnoses regarding ASCD control: SET lamp will blink quickly.

If MAIN switch is turned to OFF during ASCD is activated, all of ASCD operations will be canceled and vehicle speed memory will be erased.

COAST OPERATION

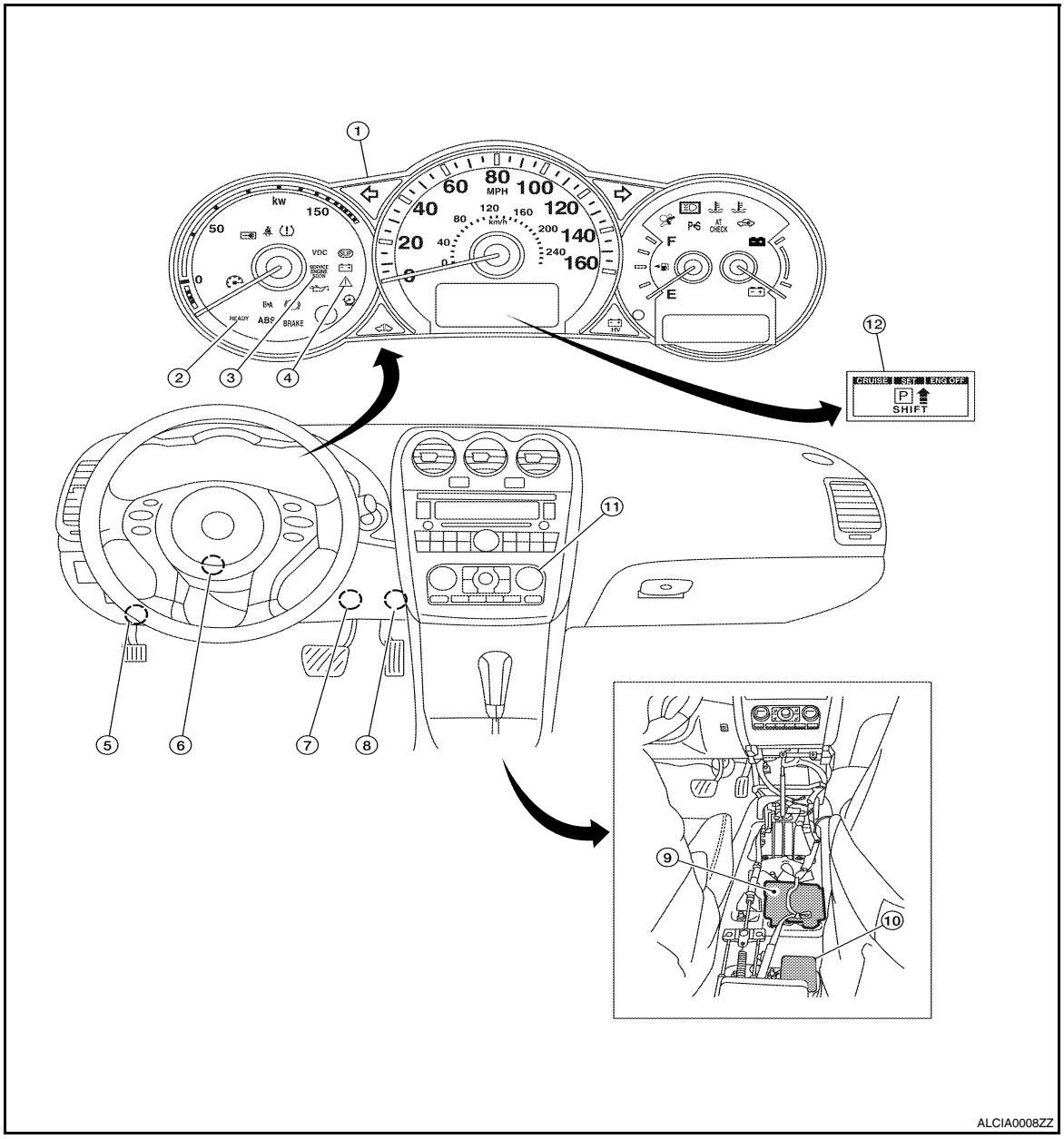
When the SET/COAST switch is pressed during cruise control driving, decrease vehicle set speed until the switch is released. And then ASCD will keep the new set speed.

RESUME OPERATION

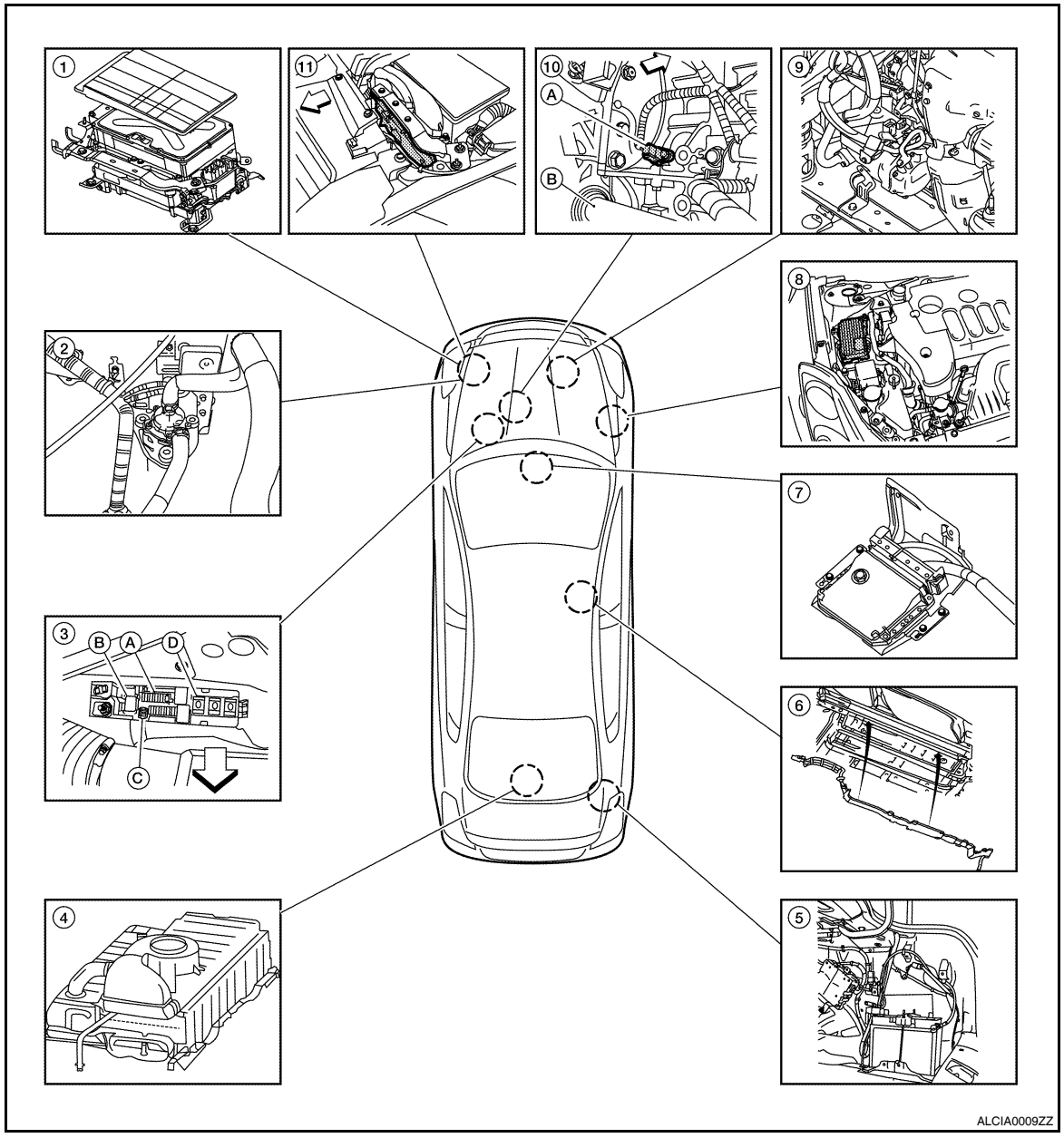
When the RESUME/ACCELERATE switch is pressed after cancel operation other than pressing MAIN switch is performed, vehicle speed will return to last set speed. To resume vehicle set speed, vehicle condition must meet following conditions.
- Brake pedal is released
- Selector lever is in other than P and N positions
- Vehicle speed is greater than 40 km/h (25 MPH) and less than 144 km/h (89 MPH)

Component Parts Location

INFOID:0000000004211752

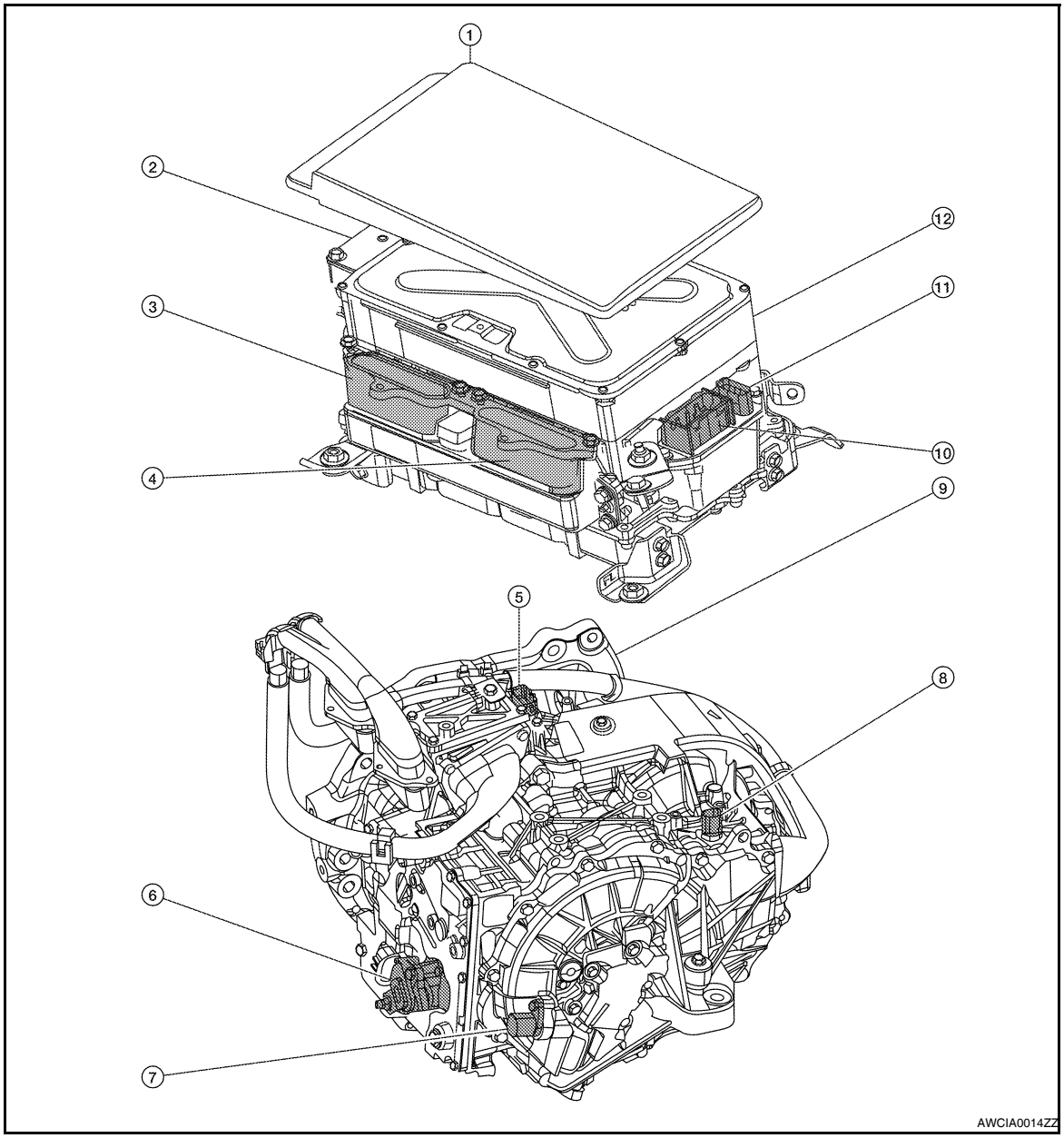


1. Combination meter
2. READY operation indicator light
3. Malfunction indicator light
4. Master warning light
5. Data link connector
6. Steering angle sensor
7. Stop lamp switch
8. Accelerator pedal position sensor
9. ACU (Air bag diagnosis sensor unit)
10. Yaw rate/side G sensor
11. Controller (A/C auto AMP.)
12. Vehicle information display indicator

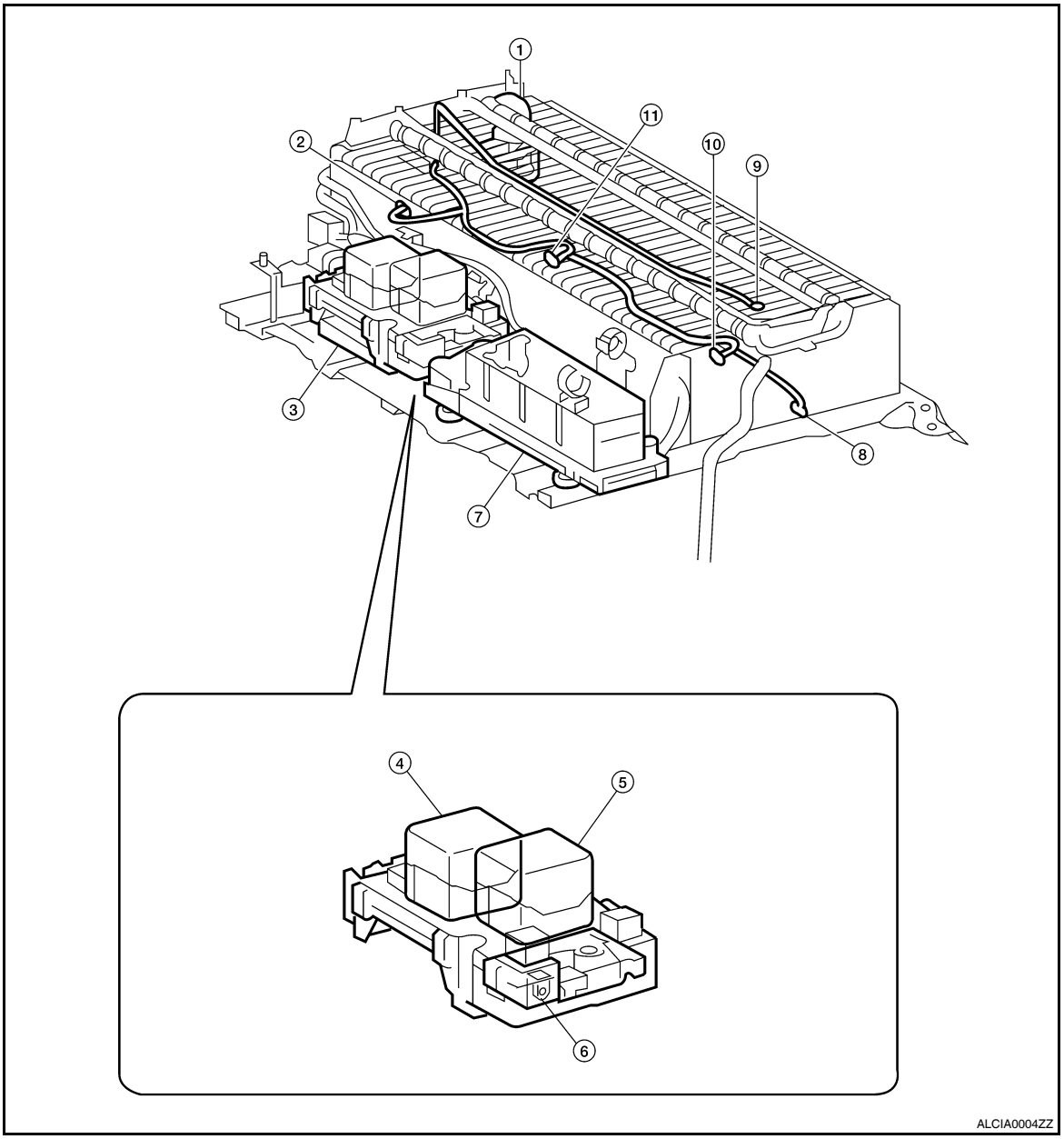


1. Inverter with converter assembly
2. Water pump with motor & bracket assembly
3. High voltage fuse and fusible link box
   A: HV CONT MAIN fuse 10A
   B: IGCT relay
   C: IGCT fusible link 50A
   D: DC/DC fusible link 120A
4. HV battery
5. Auxiliary battery
6. Frame wire
7. Hybrid vehicle control ECU (located under heater box assembly)
8. Brake ECU
9. Electric compressor (For A/C)
10. A: Crankshaft position sensor
    B: Axle
11. ECM

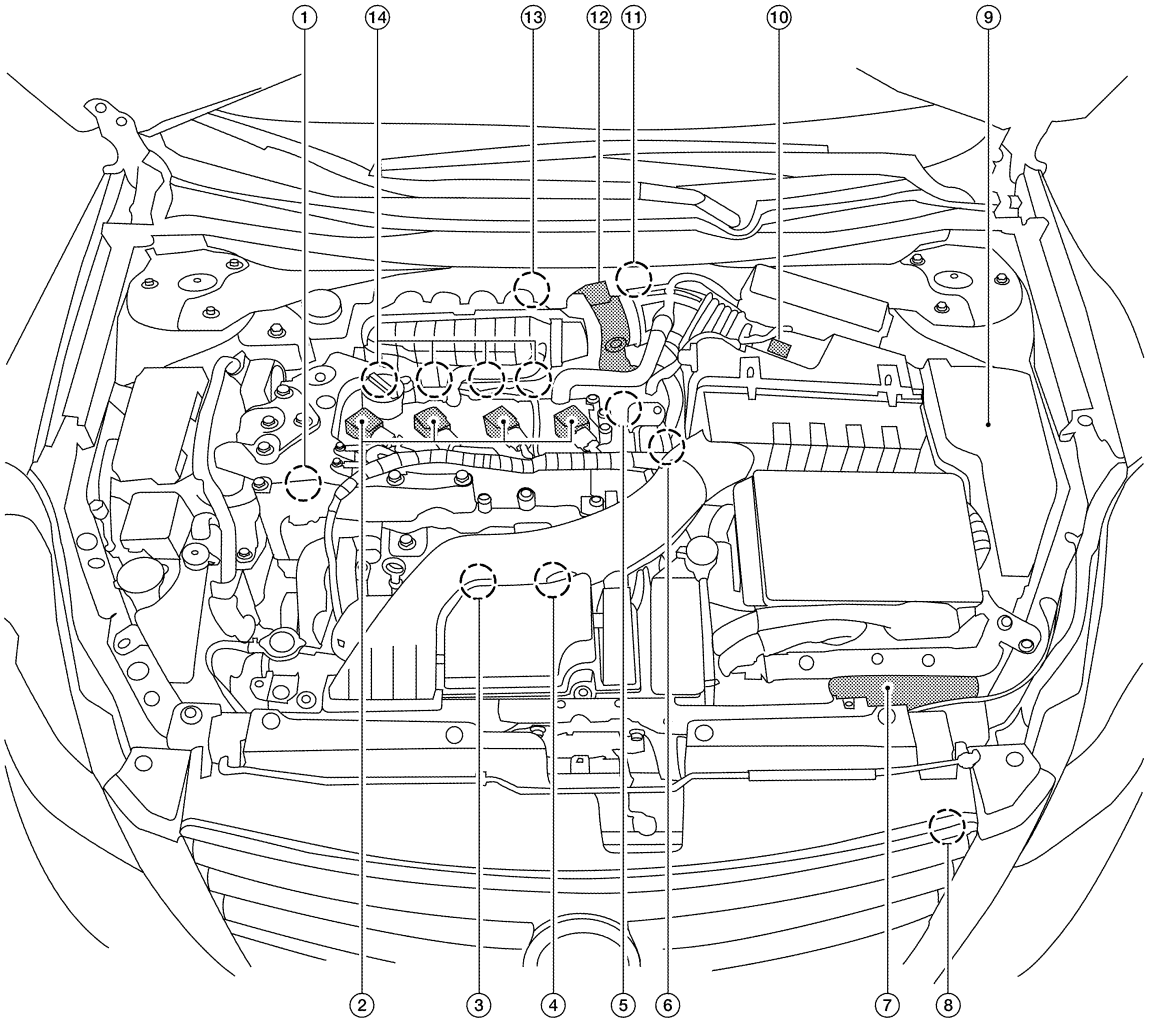
⇦ Vehicle front



1. Cover
2. Compressor fuse cover
3. MG1 connector
4. MG2 connector
5. Generator resolver and generator temperature sensor
6. Park/Neutral position (PNP) switch
7. Motor resolver
8. Motor temperature sensor
9. Hybrid transaxle (MG1, MG2, motor speed reduction planetary gear unit, power split planetary gear unit)
10. Inverter with converter assembly connector (MG ECU)
11. Inverter with converter assembly connector (Resolver)
12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

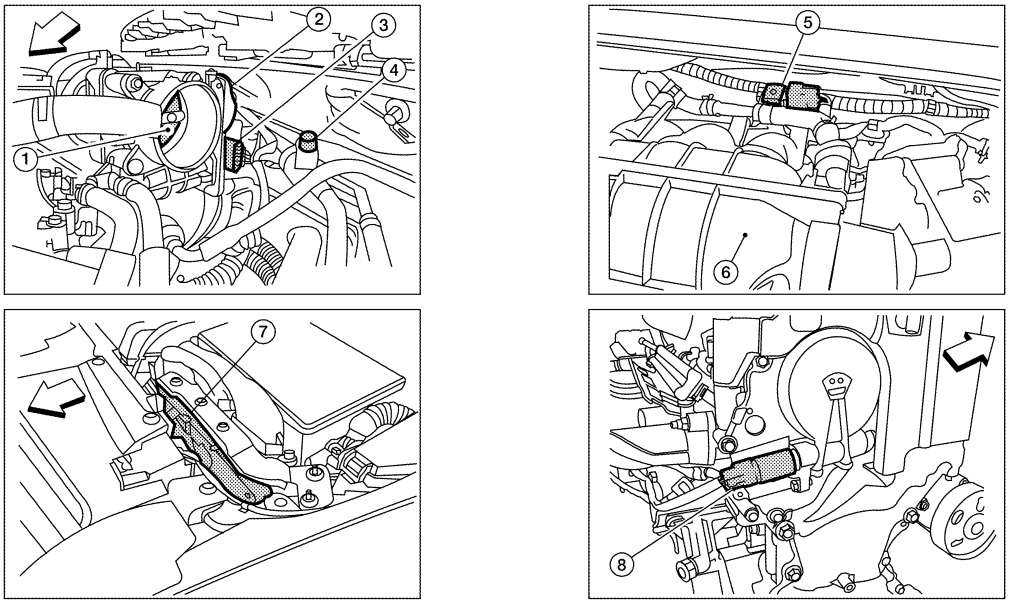


1. Service plug grip
2. Battery temperature sensor 0
3. Battery smart unit
4. SMRG
5. SMRB
6. Battery current sensor
7. Hybrid vehicle converter
8. Battery temperature sensor 3
9. Intake air temperature sensor
10. Battery temperature sensor 2
11. Battery temperature sensor 1



ALBIA0138ZZ

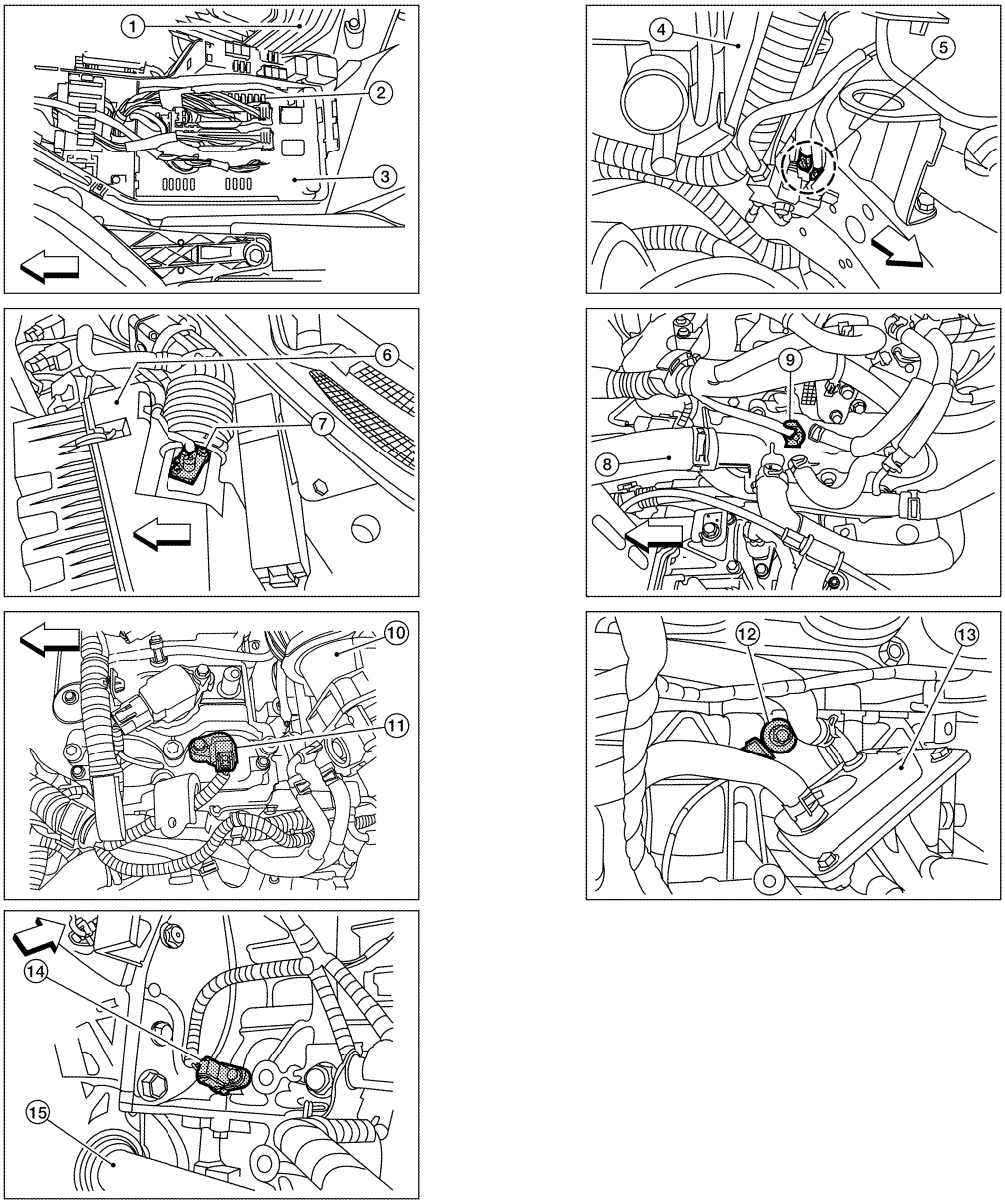
1. Intake valve timing control solenoid valve
2. Ignition coil (with power transistor) and spark plug
3. Knock sensor, Crankshaft position sensor (POS)
4. Air fuel ratio (A/F) sensor 1
5. Camshaft position sensor (PHASE)
6. Engine coolant temperature sensor
7. ECM
8. Refrigerant pressure sensor
9. IPDM E/R
10. Mass air flow sensor (with intake temperature sensor)
11. EVAP service port
12. Electric throttle control actuator (with built in throttle position sensor and throttle control motor)
13. EVAP canister purge volume control solenoid valve
14. Fuel injector



ALBIA0160ZZ

1. Throttle valve
2. Electric throttle control actuator
3. Electric throttle control actuator harness connector
4. EVAP service port
5. EVAP canister purge volume control solenoid valve
6. Intake manifold collector
7. ECM
8. Intake valve timing control solenoid valve

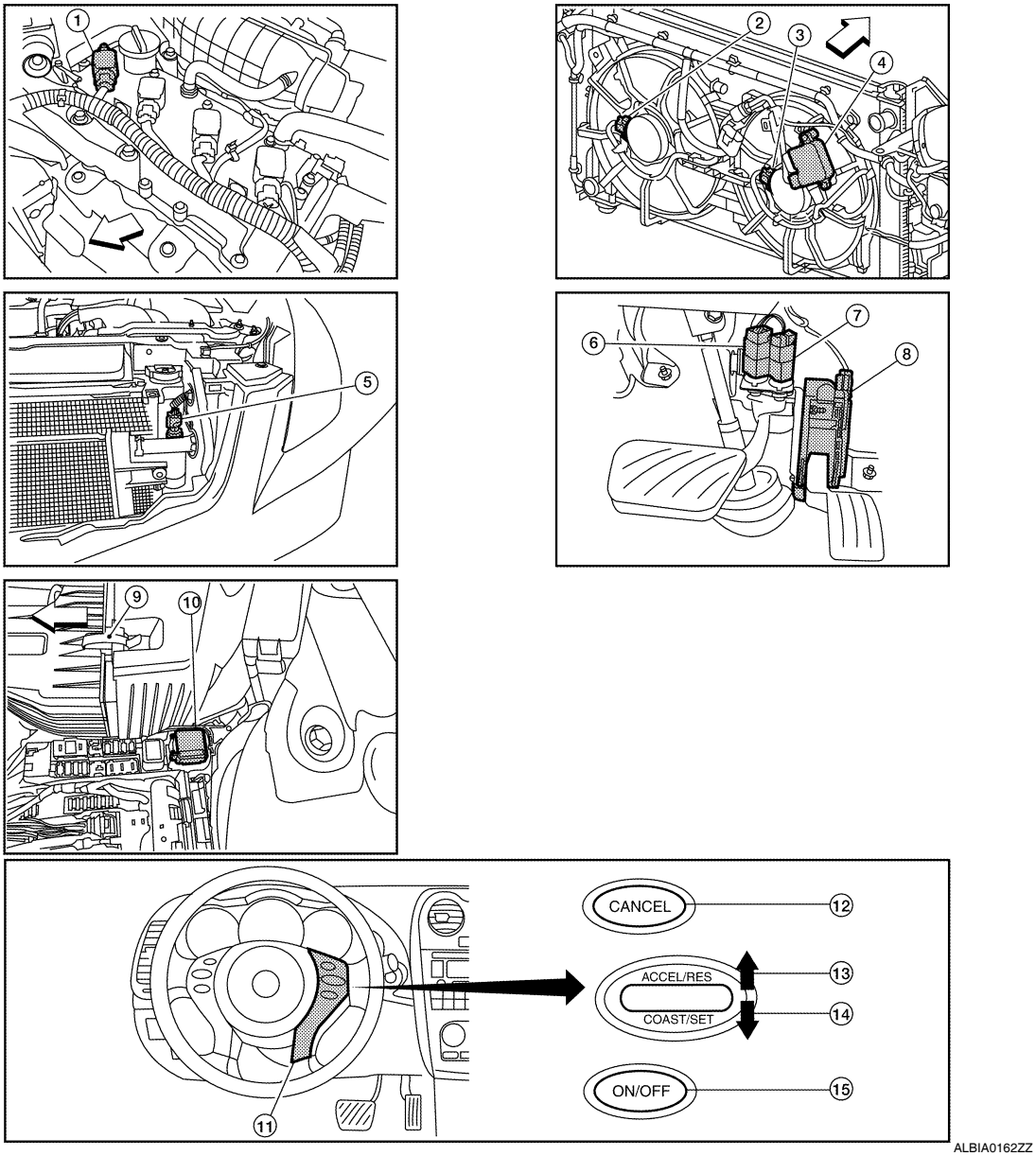
⇦: Vehicle front



ALBIA0161ZZ

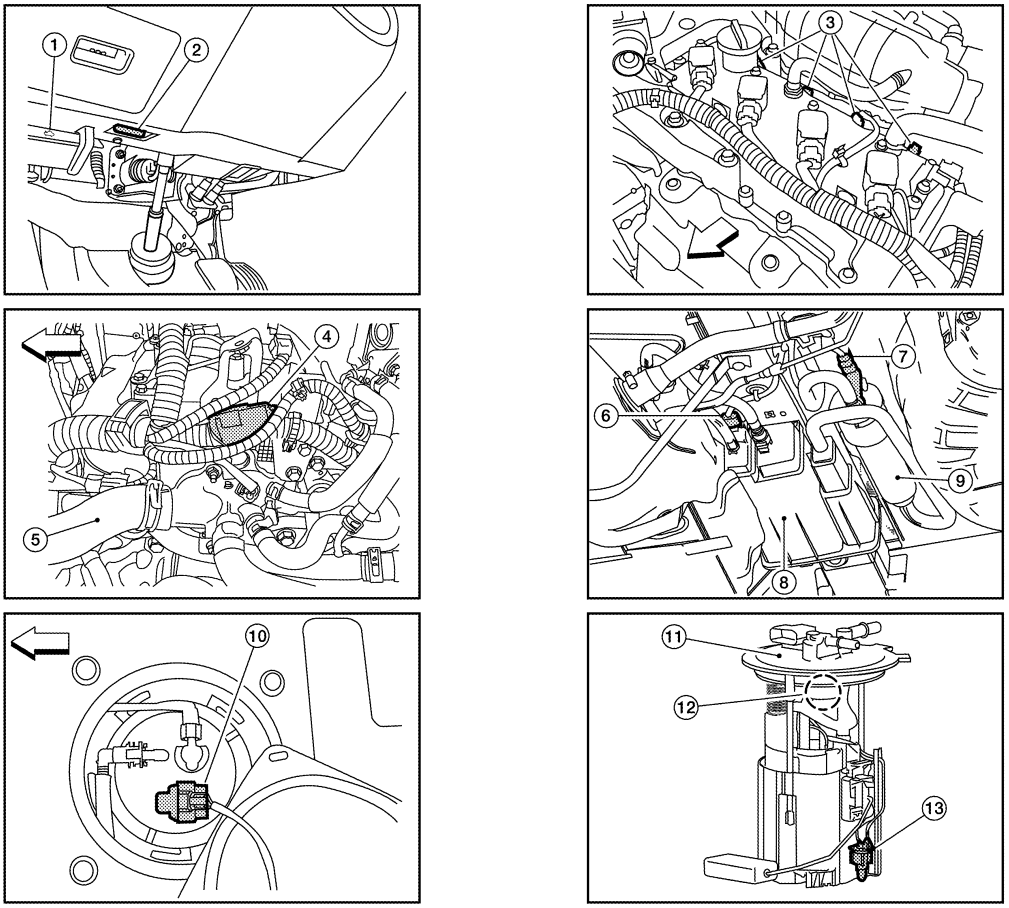
1. Air cleaner assembly
2. Fuel pump fuse
3. IPDM E/R
4. EPS control unit (view with air cleaner assembly removed)
5. Engine grounds
6. Air cleaner assembly
7. Mass air flow sensor (with intake temperature sensor)
8. Upper radiator hose
9. Engine coolant temperature sensor
10. Intake manifold collector
11. Camshaft position sensor (PHASE)
12. Knock sensor
13. Engine oil cooler
14. Crankshaft position sensor (POS)
15. Drive shaft RH

⇦: Vehicle front



1. No.1 ignition coil
2. Cooling fan motor-1
3. Cooling fan motor-2
4. Cooling fan control module
5. Refrigerant pressure sensor
6. Stop lamp switch
7. ASCD brake switch
8. Accelerator pedal position sensor
9. Air cleaner assembly
10. Cooling fan relay-1
11. ASCD steering switch
12. CANSEC switch
13. RESUME/ACCELERATE switch
14. SET/COAST switch
15. MAIN switch

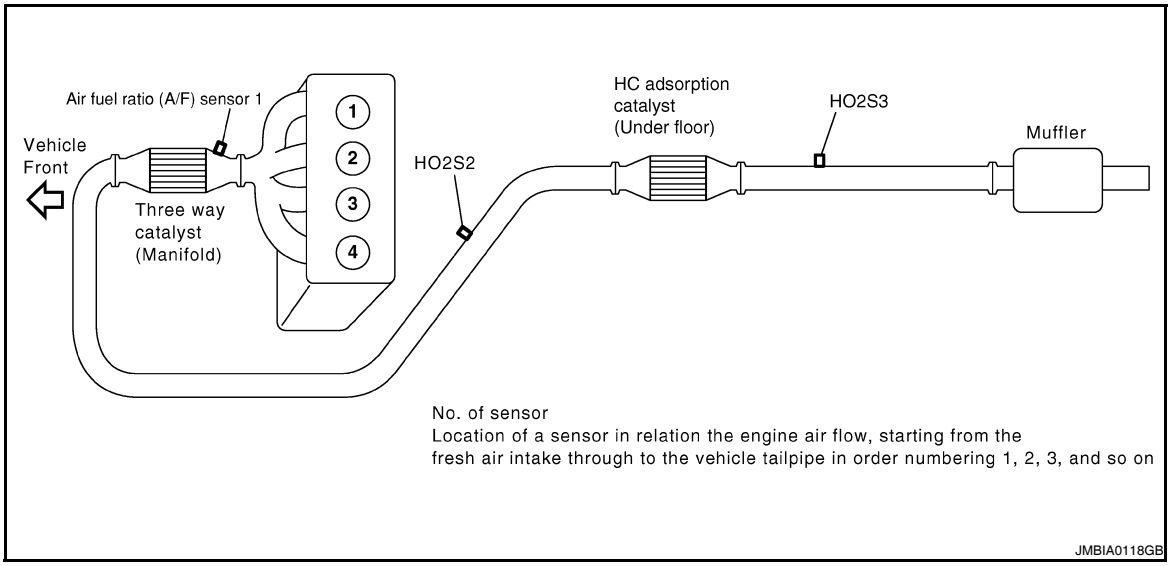
⇦: Vehicle front

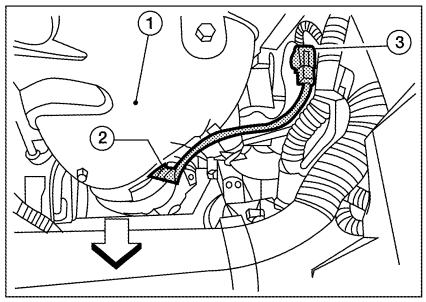


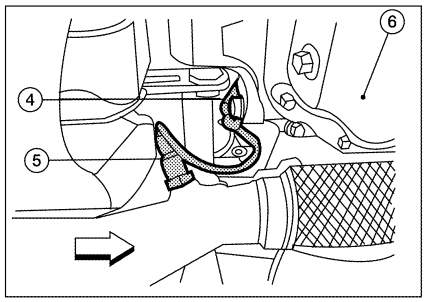
ALBIA0173ZZ

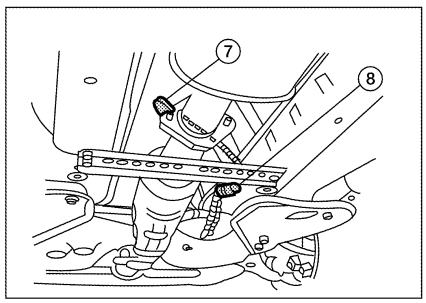
1. Hood opener handle
2. Data link connector
3. Fuel injector harness connector
4. Condenser-2
5. Upper radiator hose
6. EVAP control system pressure sensor
7. EVAP canister vent control valve
8. EVAP canister (MAIN)
9. EVAP canister (SUB)
10. Fuel level sensor unit and fuel pump harness connector (This illustration is view with rear seat cushion and inspection hole cover removed.)
11. Fuel pump assembly
12. Fuel pressure regulator
13. Fuel tank temperature sensor

⇦ : Vehicle front









ALBIA0272ZZ

1. Exhaust manifold cover
2. Air fuel ratio (A/F) sensor 1
3. Air fuel ratio (A/F) sensor 1 harness connector
4. Heated oxygen sensor 2 harness connector
5. Heated oxygen sensor 2
6. Oil pan
7. Heated oxygen sensor 3
8. Heated oxygen sensor 3 harness connector

⇦: Vehicle front

Component Description

INFOID:0000000004211753

Component	Reference
ASCD steering switch	EC-342, "Description"
ASCD brake switch	HBC-483, "Description", EC-345, "Description"

Component	Reference
Stop lamp switch	HBC-488, "Description", EC-353, "Description"
Electric throttle control actuator	EC-365, "Description"
MG1, MG2	HBC-13, "System Description"
ASCD indicator	HBC-589, "Description"

CAN COMMUNICATION

System Description

INFOID:0000000004211754

CAN (Controller Area Network) is a serial communication line for real time application. It is an on-vehicle multiplex communication line with high data communication speed and excellent error detection ability. Many electronic control units are equipped onto a vehicle, and each control unit shares information and links with other control units during operation (not independent). In CAN communication, control units are connected with 2 communication lines (CAN H line, CAN L line) allowing a high rate of information transmission with less wiring. Each control unit transmits/receives data but selectively reads required data only.
This vehicle has two types of CAN communication systems; CAN and HEV SYSTEM CAN. The hybrid vehicle control ECU functions as the network gateway ECU for signal transmitting/receiving between CAN and HEV SYSTEM CAN.
Refer to LAN-27, "CAN Communication Signal Chart", about CAN communication for detail.

ON BOARD DIAGNOSTIC (OBD) SYSTEM

Diagnosis Description

INFOID:0000000004211755

INTRODUCTION

The hybrid vehicle control ECU has an on board diagnostic system, which detects malfunctions related to hybrid vehicle control system, sensors, actuators or HV battery systems, and records various diagnostic information relating to the malfunction. The hybrid vehicle control ECU also illuminates the MIL and/or 3 warning lights (Hybrid system warning light, High voltage battery warning light, Charge warning light) in the combination meter. For which light illuminates, refer to HBC-619, "DTC Index".
Three-digit information code (INF code) has been provided in the conventional DTC as subset of a primary five-digit code. This enable the troubleshooting procedure to further narrow down a malfunctioning area to identify a problem.

Diagnostic information	Diagnostic service
Diagnostic Trouble Code (DTC)	Service $03 of SAE J1979
Information code (INF code)	
Freeze Frame data	Service $02 of SAE J1979
Information data	
Operation history data	
Calibration ID	Service $09 of SAE J1979

The above information can be checked using procedures listed in the table below.

×: Applicable —:Not applicable

	DTC	INF code	Freeze Frame data	Information data	Operation history data
CONSULT-III	×	×	×	×	×
GST	×	—	×	—	—

ONE TRIP DETECTION LOGIC

When a malfunction is detected, DTC and freeze frame data are stored in the hybrid vehicle control ECU memory and illuminates the MIL and/or warning lights on the combination meter. Refer to HBC-619, "DTC Index".

TWO TRIP DETECTION LOGIC

Specific on board diagnostic items have the two trip detection logic. When a malfunction is detected for the first time, DTC is not stored in the hybrid vehicle control ECU memory. <1st trip>
If the same malfunction is detected again during the next drive, the DTC and Freeze Frame data are stored in the hybrid vehicle control ECU memory, and the MIL and/or warning lights in the combination meter illuminates. <2nd trip>
The “trip” in the “Two trip detection logic” means a driving mode in which self-diagnosis is performed during vehicle operation. For the items which have the two trip detection logic, refer to HBC-619, "DTC Index".

HOW TO READ DTC

With CONSULT-III

With GST

CONSULT-III or GST (Generic Scan Tool) Examples: P0560, P0A1A, etc.
These DTCs are prescribed by SAE J2012.
(CONSULT-III also displays the malfunctioning component or system.)
DTC of a malfunction is displayed in SELF-DIAGNOSTIC RESULTS mode of CONSULT-III.

HOW TO ERASE DTC

With CONSULT-III

The diagnostic information in the hybrid vehicle control ECU can be erased by selecting “Erase” in the” “SELF-DIAG RESULTS” mode with CONSULT-III.

With GST

The diagnostic information in the hybrid vehicle control ECU can be erased by selecting Service $04 with GST.

OBD System Operation Chart

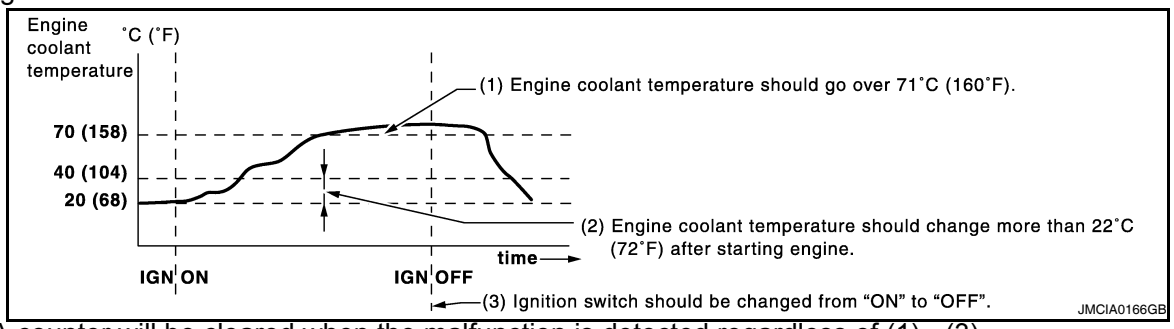
Relationship Between MIL and Detectable Items

- When a malfunction is detected for the first time, DTC is stored in the hybrid vehicle control ECU memory.
- When the same malfunction is detected in two consecutive trips, the DTC and the freeze frame data are stored in the hybrid vehicle control ECU memory for some DTCs.
- The MIL will turn off after the vehicle is driven 3 times (driving pattern B) with no malfunction. The drive is counted only when the recorded driving pattern is met (as stored in the hybrid vehicle control ECU). If another malfunction occurs while counting, the counter will reset.
- The DTC and the freeze frame data will be stored until the vehicle is driven 40 times (driving pattern A) without the same malfunction recurring.

Summary Chart

Items	Operation	Condition
MIL	Turns off	3 (pattern B)
DTC, Freeze Frame Data	No display	40 (pattern A)

<Driving Pattern A>



- The A counter will be cleared when the malfunction is detected regardless of (1) - (3).
- The A counter will be counted up when (1) - (3) are satisfied without the same malfunction.
- The DTC will not be displayed after the A counter reaches 40.

<Driving Pattern B>

Driving pattern B means the vehicle operation as per the following:

All components and systems should be monitored at least once by the OBD system.

- The B counter will be cleared when the malfunction is detected once regardless of the driving pattern.
- The B counter will be counted up when driving pattern B is satisfied without any malfunctions.
- The MIL will turn off when the B counter reaches 3.

CONSULT-III Function

INFOID:0000000004211756

FUNCTION

Diagnostic test mode	Function
ECU Identification	The hybrid vehicle control ECU part number can be read.
Self Diagnostic result	Self-diagnostic results such as DTC data can be read and erased quickly.*
Data Monitor	Input/Output data, freeze frame data and operation history data in the hybrid vehicle control ECU can be read.
Active Test	Diagnostic Test Mode in which CONSULT-III drives some actuators apart from the hybrid vehicle control ECU and also shifts some parameters in a specified range.

*: The following emission-related diagnostic information is cleared when the hybrid vehicle control ECU memory is erased.

- Diagnostic trouble codes
- Freeze frame data

SELF-DIAG RESULTS MODE

Self Diagnostic Item

Regarding items of DTC, refer to HBC-619, "DTC Index".)

DATA MONITOR MODE

Data Monitor

NOTE:

- Some monitor item values may vary significantly if there are slight differences in the environment in which the vehicle is operating when measurements are obtained. Variations may also occur due to aging of the vehicle. Due to these considerations, it is not always possible to provide definite values to be used for judgment of malfunctions. It is possible that a malfunction may be present even if measured values are within the reference range.
- In the event of a problem with intricate symptoms, collect sample data from another vehicle of the same model operating under identical conditions in order to reach an overall judgment by comparing all the items in the data monitor.
- Using the CONSULT-III to read the data monitor allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the data monitor information early in troubleshooting is one way to save diagnostic time.

×: Applicable

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
MIL STATUS						MIL status/ ON or OFF	MIL ON: OFF	Constant ON: Repair in accordance with detected DTCs
CCM MONITOR						Comprehensive component monitor/ ON or OFF	—	—
INT/A TEMP SEN (Intake Air Temperature Sensor)	X	X	X	X		Intake air temperature/ Min.: -40°C, Max.: 140°C	Constant: Same as ambient air temperature	—
ENG RUN TIME						Elapsed time after starting engine/ Min.: 0 s, Max.: 65,535 s	—	—
DTC ON RUN DIST (MIL ON Run Distance)						Travel distance after a malfunction occurs/ Min.: 0 km, Max.: 65,535 km	—	—
DTC CLEAR WARM (DTC Clear Warm Up Times)						The number of times engine is warmed up after clearing DTCs/ Min.: 0, Max.: 255	MIL OFF, engine coolant temperature increases from below 22°C (71.6°F) before starting the engine to above 70°C (158°F) after starting the engine: Increases once	—
DTC CLEAR RUN (DTC Clear Run Distance)						Drive distance after clearing DTCs/ Min.: 0 km, Max.: 65,535 km	—	—
ACCEL SENSOR 1 (Accelerator Pedal Position #1)	X	X	X	X		Accelerator pedal position sensor 1/ Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	—
ACCEL SENSOR 2 (Accelerator Pedal Position #2)	X	X	X	X		Accelerator pedal position sensor 2/ Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
MIL ON RUN TIME (MIL ON Engine Run Time)						Engine running time after a malfunction occurs/ Min.: 0 min, Max.: 65,535 min	—	—
DTC CLEAR MIN (DTC Clear Min)						Elapsed time after clearing DTCs/ Min.: 0 min, Max.: 65,535 min	—	—
CCM SRT STATUS (Comprehensive Component Monitoring SRT Status)						Comprehensive component monitoring SRT status/ ON or OFF	—	—
CCM DIAG STATUS (Comprehensive Component Monitoring Diagnosis Status)						Comprehensive component monitoring diagnosis status/ ON or OFF	—	—
MG2 REVOLUTION [Motor (MG2) Revolution]	X	X	X	X		Motor (MG2) revolution/ Min.: -16,383 rpm, Max.: 16,256 rpm	—	—
MG2 TORQUE [Motor (MG2) Torque]	X	X	X	X		Motor (MG2) torque/ Min.: -512 N·m, Max.: 508 N·m	—	—
MG1 REVOLUTION [Generator (MG1) Revolution]	X	X	X	X		Generator (MG1) revolution/ Min.: -16,383 rpm, Max.: 16,256 rpm	—	—
MG1 TORQUE [Generator (MG1) Torque]	X	X	X	X		Generator (MG1) torque/ Min.: -512 N·m, Max.: 508 N·m	—	—
POWER REQUEST (Request Power)	X	X	X	X		Request engine power/ Min.: 0 W, Max.: 320,000 W	—	—
TARGET ENG SPEED (Target Engine Revolution)	X	X	X	X		Target engine speed/ Min.: 0 rpm, Max.: 8,000 rpm	—	—
ENGINE SPEED (Engine Speed)	X	X	X	X		Engine speed/ Min.: 0 rpm, Max.: 8,000 rpm	Idling: 950 to 1,050 rpm	—
SOC (State of Charge)	X	X	X	X		Battery state of charge/ Min.: 0%, Max.: 100%	Constant: 0 to 100%	—
WOUT (Wout Control Power)	X	X	X	X		Discharge (Wout) control power value/ Min.: 0 W, Max.: 81,600 W	26,000 W or less	—
WIN (Win Control Power)	X	X	X	X		Charge (Win) control power value/ Min.: -40,800 W, Max.: 0 W	-25,000 W or more	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
DRIVE COND ID (Drive Condition ID)	X	X	X	X		Drive condition ID/ Min.: 0, Max.: 6	• Engine stopped: 0 • Engine about to be stopped: 1 • Engine about to be started: 2 • Engine operated or operating: 3 • Generating or loading movement: 4 • Revving in P position: 6	—
MG1 INV TEMP [Inverter Temperature (MG1)]	X	X	X	X		Generator (MG1) inverter temperature/ Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MG2 INV TEMP [Inverter Temperature (MG2)]	X	X	X	X		Motor (MG2) inverter temperature/ Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MG1 MOTOR TEMP [Generator (MG1) Temperature)]	X	X	X	X		Generator (MG1) temperature/ Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 90°C (77 to 194°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MG2 MOTOR TEMP [Motor (MG2) Temperature]	X	X	X	X		Motor (MG2) temperature/ Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 100°C (77 to 212°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
PWR RESOURCE VB (Power Resource VB)	X	X	X	X		HV battery voltage/ Min.: 0 V, Max.: 510 V	READY light ON: 200 to 340 V	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
PWR RESOURCE IB (Power Resource IB)	X	X	X	X		HV battery current/ Min.: -256 A, Max.: 254 A	—	—
SHIFT POSITION (Shift Sensor Shift Position)	X	X	X	X		Shift lever position	P, R, N, D or B	—
VEHICLE SPEED [Vehicle Speed (Resolver)]	X	X	X	X		Vehicle speed (Resolver)/ Min.: -256 km/h, Max.: 254 km/h	Same as vehicle speed	—
SHIFT SW P		X				PNP switch (P position)/ ON or OFF	P position: ON Except P position: OFF	—
SHIFT SW R		X				PNP switch (R position)/ ON or OFF	R position: ON Except R position: OFF	—
SHIFT SW N		X				PNP switch (N position)/ ON or OFF	N position: ON Except N position: OFF	—
SHIFT SW D		X				PNP switch (D position)/ ON or OFF	D position: ON Except D position: OFF	—
SHIFT SW B		X				PNP switch (B position)/ ON or OFF	B position: ON Except B position: OFF	—
SHIFT SW FD		X				PNP switch (FD position)/ ON or OFF	D or B position: ON Except D or B position: OFF	—
SHIFT SW RV		X				PNP switch (RV position)/ ON or OFF	R position: ON Except R position: OFF	—
SHIFT SW MJ		X				PNP switch (MJ position)/ ON or OFF	P, R, N, D or B position: ON	—
REGEN EXEC TORQ (Regenerative Brake Execution Torque)		X				Regenerative brake execution torque/ Min.: 0 N·m, Max.: 186 N·m	—	—
REGEN RQST TORQ (Regenerative Brake Request Torque)	X	X	X	X		Regenerative brake request torque/ Min.: 0 N·m, Max.: 186 N·m	Vehicle speed 30 km/h (19 mph) and master cylinder hydraulic pressure -200 N·m: Changes with brake pedal pressure	—
MCYL CTRL TORQ (Master Cylinder Control Torque)	X	X	X	X		Braking torque that is equivalent to master cylinder hydraulic pressure/ Min.: -2,040 N·m, Max.: 0 N·m	Brake pedal depressed: Changes with brake pedal pressure	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
L-TEMP ST JUDGE (Low Temperature Start Judgement Number of Times)						Time of low temperature start judging/ Min.: 0, Max.: 65,535	—	—
L-TEMP ST TIME (Low Temperature Start Judgement Time)						Low temperature starting accumulation time/ Min.: 0, Max.: 67,107,840	—	—
DCDC CMD VOL (DC) (DC/DC Converter Command Voltage)					X	Target auxiliary battery voltage (DC/DC Converter)/ Min.: 0 V, Max.: 20 V	—	—
DCDC FAN MODE (DC/DC Converter Cooling Fan Mode)					X	Hybrid vehicle converter (DC/DC converter) cooling fan mode/ Min.: 0%, Max.: 255%	—	—
INV COOLANT TMP (Inverter Coolant Temperature)		X	X			Inverter coolant temperature/ Min.: -128°C, Max.: 127°C	Cold start → Fully warmed up: Gradually rises	—
DCDC VLO DUTY [DC/DC Converter Control Duty Ratio (VLO)]		X			X	DC/DC converter control duty ratio/ Min.: 0%, Max.: 99%	—	—
DCDC CTRL MODE (DC/DC Converter Control Mode)		X			X	DC/DC converter control mode/ Min.:0, Max.: 4	• 0: Initial • 1: Low temperature • 2: Normal temperature • 3: High temperature • 4: Fail safe	—
DCDC TAR VOLT (DC/DC Converter Target Voltage)					X	Target volume of DC/DC converter/ Min.:0V, Max.: 19.92V	—	—
AMBIENT TEMP (Ambient Air Temperature)	X	X	X	X		Ambient air temperature/ Min.: -40°C, Max.: 215°C	Ignition switch ON (IG): Same as ambient air temperature	—
AMB/S CIRC SHORT (Ambient Air Temperature Sensor Circuit Short					X	Ambient air temperature sensor circuit short/ ON or OFF	• OFF: Normal	—
AMB/S CIRC OPEN (Ambient Air Temperature Sensor Circuit Open)					X	Ambient air temperature sensor circuit open/ ON or OFF	• OFF: Normal	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
DCDC CONDITION (DC/DC Converter Feedback Condition)		X			X	DC/DC converter condition/ Min.:0, Max.: 30	• 0, 1: Normal • 2, 3: DC/DC Converter Cooling Request to Air Conditioner	—
LOAD CONDITION (Loading Condition)						Driving (Loading) condition	• 0: Generator load: MG1 • 1: Motor load: MG2	—
DRIVING PATTEN 3 (Driving Pattern 3)						Driving pattern 3/ Min.: 0, Max.: 3	• 0: Driving at a low speed • 1: Driving at a medium speed • 2: Driving at a medium-high speed • 3: Driving at a high speed	—
DRIVING PATTEN 2 (Driving Pattern 2)						Driving pattern 2/ Min.: 0, Max.: 3	• 0: Driving at a low speed • 1: Driving at a medium speed • 2: Driving at a medium-high speed • 3: Driving at a high speed	—
DRIVING PATTEN 1 (Driving Pattern 1)						Driving pattern 1/ Min.: 0, Max.: 3	• 0: Driving at a low speed • 1: Driving at a medium speed • 2: Driving at a medium-high speed • 3: Driving at a high speed	—
ENG STOP RQST (Engine Stop Request)	X	X	X	X		Engine stop request/ ON or OFF	Requesting engine stop: ON	—
ENG IDLING RQST (Engine Idling Request)	X	X	X	X		Engine idling request/ ON or OFF	Requesting idle: ON	—
HV BATT CHG RQST (HV Battery Charging Request)	X	X	X	X		HV battery charging request/ ON or OFF	Requesting HV battery charging: ON	—
AIRCON REQUEST (Air Conditioner Engine Starting Request)	X	X	X	X		Engine starting request from controller (auto amp.)/ ON or OFF	Requesting engine start from controller (auto amp.): ON	—
ENG WARM UP RQST (Engine Warming Up Request)	X	X	X	X		Engine warming up request/ ON or OFF	Requesting engine warm-up: ON	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
ACCEL DEG (The Difference Degree of an Accelerator)	X	X	X	X		Accelerator pedal depressed angle/ Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	—
VL (VL-Voltage Before Boosting)		X	X			High voltage before boosting/ Min.: 0 V, Max.: 510 V	READY ON: Practically the same as the HV battery voltage	• If the value is 0 V: Open or GND short in sensor circuit • If the value is 510 V: +B short in sensor circuit
VH (VH-Voltage After Boosting)		X	X			High voltage after boosting/ Min.: 0 V, Max.: 765 V	Engine revving up in P position: HV battery voltage to 650 V	• If the value is 0 V: Open or GND short in sensor circuit • If the value is 765 V: +B short in sensor circuit
CONVERTER TEMP (Converter Temperature)	X	X	X	X		Boost converter temperature/ Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 60°C (77 to 140°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
CRANK POSITION (Crank Position)		X				Crankshaft position/ Min.: -90 deg, Max.: 90 deg	—	—
SMRG (System Main Relay Status-SMRG)		X				Operating condition of system main relay SMRG/ ON or OFF	READY ON: ON	—
SMRB (System Main Relay Status-SMRB)		X				Operating condition of system main relay SMRB/ ON or OFF	READY ON: ON	—
SMRP (System Main Relay Status-SMRP)		X				Operating condition of system precharge relay SMRP/ ON or OFF	READY ON: OFF	—
MG2 TRQ EXC VAL [Motor (MG2) Torque Execute Value]			X			Motor (MG2) torque execution value/ Min.: -512 N·m, Max.: 508 N·m	After full-load acceleration with READY light ON and engine stopped: Within ± 20% of MG2 TORQ	—
MG1 TRQ EXC VAL [Generator (MG1) Torque Execute Value]			X			Generator (MG1) torque execution value/ Min.: -512 N·m, Max.: 508 N·m	After full-load acceleration with READY light ON and engine stopped: Within ± 20% of MG1 TORQ	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
SHORT WAVE HIGH (Short Circuit Wave Highest Value)		X				Short circuit wave highest value (Waveform voltage in leak detection circuit in battery smart unit)/ Min.: 0 V, Max.: 5 V	Left for 2 minutes in READY-on state, and boost converter and inverter voltages are equal: 4 V or more	—
MG1 CTRL MODE [Generator (MG1) Control Mode]			X			MG1 control mode	—	—
MG1 CARRIR FREQ [Generator (MG1) Carrier Frequency]			X			MG1 carrier frequency/ 10 kHz/ 5 kHz/ 2.5 kHz/ 1.25 kHz	—	—
MG2 CTRL MODE [Motor (MG2) Control Mode]			X			MG2 control mode	—	—
MG2 CARRIR FREQ [Motor (MG2) Carrier Frequency]			X			MG2 carrier frequency/ 10 kHz/ 5 kHz/ 2.5 kHz/ 1.25 kHz	—	—
BOOST RATIO (Converter Boosting Ratio)			X			Boosting ratio/ Min.: 0%, Max.: 100%	The boost converter and the inverter voltages are equal: 0 to 10%	—
A/C CONSMPT PWR (A/C Consumption Power)	X	X	X	X		A/C consumption power/ Min.: 0 kW, Max.: 5 kW	—	—
MG1 GATE STATUS [Generator (MG1) Gate Status]		X	X			MG1 gate status/ ON or OFF	Shutting down generator inverter: ON	—
MG2 GATE STATUS [Motor (MG2) Gate Status]		X	X			MG2 gate status/ ON or OFF	Shutting down motor inverter: ON	—
CNV GATE STATUS (Boost Converter Gate Status)		X	X			Boost converter gate status/ ON or OFF	Shutting down boost converter: ON	—
A/C GATE STATUS (Air Conditioner Gate Status)		X	X			A/C gate status/ ON or OFF	While compressor inverter is being shutoff: ON	—
CNV CARRIER FREQ (Converter Carrier Frequency)			X			Converter signal carrier frequency/ 5kHz/ 10kHz	5kHz/ 10kHz	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
SUB BATTERY VOLT [Sub Battery Voltage (Batt)]		X			X	Auxiliary battery voltage (Batt)/ Min.: 0 V, Max.: 19.92 V	Equivalent to battery voltage	—
BATTERY VOLT [Battery voltage (VB)]	X	X	X	X		Auxiliary battery voltage (VB)/ Min.: 0 V, Max.: 19.92 V	Equivalent to sub battery voltage	—
ACCEL SENSOR M (Accelerator Pedal Position Sensor Main)		X				Accelerator pedal position sensor main/ Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	—
ACCEL SENSOR S (Accelerator Pedal Position Sensor Sub)		X				Accelerator pedal position sensor sub/ Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	—
ENG SPEED (NEI) [Engine Speed (NEI)]		X				Engine speed based on NEI signal/ Min.: 0 rpm, Max.: 16,383.75 rpm	Idling: 950 to 1,050 rpm	—
ENG TDC SIG (GI) [Engine Speed (GI)]		X				Engine speed based on GI signal/ Min.: 0 rpm, Max.: 16,383.75 rpm	Idling: 950 to 1,050 rpm	—
DCDC MNT/STP REQ (DC/DC Converter Monitor/Stop Request Signal)					X	DC/DC converter monitor/ stop request signal/ Min.: 0V, Max.: 4.98V	READY ON: 2.788V - 4.6V	If the value is over 4.6V: +B short in circuit If the value is under 0.5V: GND short in circuit If the value is between 1.0V to 2.788V: DC/DC converter malfunction
DCDC OUTPUT VOLT (DC/DC Converter Output Voltage)					X	DC/DC converter output voltage change signal/ Min.: 0V, Max.: 4.98V	IGN ON: Under 1V and over 1V repeatedly	If the value is always under 1V: GND short in circuit If the value is always over 1V: +B short in circuit
A/B CRASH SIGNAL (Air Bag Communication Signal)		X				A/bag communication signal/ Min.: 0, Max.: 32	IGN ON: After 7 second: 1	0: Circuit abnormality (+B short or GND short or abnormal pulse)
NDB WARN LAMP (NDB Warning Lamp Signal)						NDB warning lamp signal/ ON or OFF	IGN ON or READY ON: OFF	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
ENG OIL/P WARN/L (Engine Oil Pressure Warning Light Signal)						Engine oil pressure warning light signal ON or OFF	ENG RUN: OFF	If the signal is ON during engine running, check engine oil level and pressure.
READY LMP SIGNAL (Ready Lamp Signal)						Ready signal/ ON or OFF	READY ON: ON	—
START SW SIGNAL (Start Switch Signal)						Start switch signal/ ON or OFF	Start switch ON: ON	—
IGN SW SIGNAL (Ignition Switch Signal)						Ignition switch signal/ ON or OFF	Ignition switch ON: ON	—
IGCTRLY OPRT SIG (IGCT Relay Operation Signal)						IGCT relay port monitor/ ON or OFF	While ignition switch is ON: ON	—
BATT FAN RELAY (HV Battery Cooling Fan Relay Operation Signal)				X		Battery cooling fan relay drive signal port/ ON or OFF	IGN ON: ON	—
SMRP MNTR (System Main Relay-SMRP Operation Signal Monitor)		X				Precharge relay monitor/ ON or OFF	READY ON: OFF	—
SMRB MNTR (System Main Relay-SMRB Operation Signal Monitor)		X				High voltage power on relay signal monitor(+)/ ON or OFF	READY ON: ON	—
SMRG MNTR (System Main Relay-SMRG Operation Signal Monitor)		X				High voltage power on relay signal monitor(–)/ ON or OFF	READY ON: ON	—
CHARGE WARN/L (Charge Warning Light Signal)						Charge warning signal/ ON or OFF	READY ON: OFF	—
HV BATT WARN/L (High-Voltage Battery Warning Light Signal)						Main battery low voltage warning signal/ ON or OFF	READY ON: OFF	—
HV SYSTEM WARN/L (Hybrid System Warning Light Signal)						Caution lamp signal/ ON or OFF	READY ON: OFF	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
ENG OFF LAMP SIG (EV Mode Indicator Signal)						Engine off lamp signal/ ON or OFF	Engine OFF: ON	—
SET LAMP SIGNAL (Cruise Set Switch Indicator Signal)						ASCD execute flag/ ON or OFF	When the cruise control main switch is pushed: ON	—
ASCD LAMP SIGNAL (Cruise Main Switch Indicator Signal)						Cruise lamp request signal/ ON or oFF	While the vehicle speed is controlled by the cruise control system: ON	—
PNP SW SIGNAL (Shift PNP Signal)		X				Shift P or N signal output/ ON or OFF	While the shift is P or N: ON	—
DOOR SW (DR) SIG (Driver's Side Door Switch Signal)						Drivers side door switch signal/ ON or OFF	While the door is opened: ON	—
BRAKE SIGNAL (Brake Operation Signal)		X				Brake operation signal/ ON or OFF	Brake pedal depressed: ON	—
ASCD CANSEL SW (ASCD Cancel Switch Signal)		X				ASCD brake switch signal/ ON or OFF	Brake pedal depressed: ON	—
BRAKE SWITCH (Brake Switch Signal)		X				Stop lamp switch signal/ ON or OFF	Brake pedal depressed: ON	—
INTERLOCK SW (Interlock Switch Signal)		X				Interlock switch signal/ ON or OFF	IGN ON: OFF	—
BATTERY SOC (Battery State of Charge)				X		Battery state of charge/ Min.: 0%, Max.: 127.5%	—	—
IB BATTERY (Current Value of Battery Pack)				X		Current value of battery pack/ Min.: -327.68 A, Max.: 327.67 A	—	—
V1 to V17 BATT BLOCK (Battery Block Voltage V01 to V17)				X		Battery block voltage V01 to V17/ Min.: -327.68 V, Max.: 327.67 V	SOC 60%: 12 to 20 V	—
BATT INSIDE AIR (Inhalation of Air Temperature Into a Battery Pack)				X		Battery cooling fan intake air temperature/ Min.: -327.68°C, Max.: 327.67°C	—	—
VMF FAN VOLT 1 (VMF Fan Motor voltage 1)				X		Battery blower motor monitoring voltage/ Min.: -25.6 V, Max.: 25.4 V	Fan mode 1 with READY light ON and P position: 0.8 to 1.2 V	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
AUX BATT VOLT (Auxiliary Battery Voltage)				X		Auxiliary battery voltage/ Min.: -25.6 V, Max.: 25.4 V	Equivalent to auxiliary battery voltage.	—
WIN (Charge Control Value)				X		Charge control wattage/ Min.: -64 kW, Max.: 63.5 kW	-25 kW or more	—
WOUT (Discharge Control Value)				X		Discharge control wattage/ Min.: 0 kW, Max.: 63.5 kW	26 kW or less	—
DELTA SOC (Delta SOC)				X		Difference between maximum and minimum values of SOC/ Min.: 0%, Max.: 100%	READY light ON, engine stopped and no electrical load: 0 to 60%	—
SBLW RQST [Cooling Fan Stop Control Request (Stand by Blower)]				X		Battery blower motor stop control request (standby blower)/ ON or OFF	While blower motor stop control is requested: ON	—
COOLING FAN 1 (Cooling Fan Mode 1)				X		Battery blower motor actuation mode/ Min.: 0, Max.: 40	Stopped: 0 Low to high speed actuation: 1 to 40	—
ECU CTRL MODE (ECU Control Mode)				X		ECU control mode/ Min.: 0, Max.: 4	—	—
BATT TEMP 1 to 4 (Temperature of Battery TB 1 to 4)				X		Temperature of HV battery 1 to 4/ Min.: -327.68°C, Max.: 327.67°C	Undisturbed for 1 day: Same as ambient air temperature	—
NUM OF BATT (The Number of Battery Block)				X		The number of battery blocks/ Min.: 0, Max.: 255	Always: 17	—
BLOW TIME (Accumulated Time of Battery LOW)				X		Accumulated time of battery low/Battery low time Min.: 0, Max.: 65,535	—	—
DCIH TIME (Accumulated Time of DC Inhibit)				X		Accumulated time of DC inhibit/DC inhibit time Min.: 0, Max.: 65,535	—	—
BHI TIME (Accumulated Time of Battery too High)				X		Accumulated time of battery too high/Battery too high time Min.: 0, Max.: 65,535	—	—
HTMP TIME (Accumulated Time of Hot Temperature)				X		Accumulated time of hot temperature/Hot temperature time Min.: 0, Max.: 65,535	—	—
BAT BLOCK MIN V (Battery Block Minimum Voltage)				X		Battery block minimum voltage/ Min.: -327.68 V, Max.: 327.67 V	SOC 50 to 60%: 12 V or more	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
MIN BAT BLOCK (Minimum Battery Block No)				X		Battery block number with minimum voltage/ Min.: 1, Max.: 255	One of numbers 1 to 17	—
BAT BLOCK MAX V (Battery Block Minimum Voltage)				X		Battery block maximum voltage/ Min.: -327.68 V, Max.: 327.67 V	SOC 55 to 60%: 18 V or less	—
MAX BAT BLOCK (Maximum Battery Block No.)				X		Battery block number with maximum voltage/ Min.: 1, Max.: 255	One of numbers 1 to 17	—
R1 to R17 INTNL RESIST (Internal Resistance R01 to R17)				X		Internal resistance of each battery block R01 to R17/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1	—
SOC GAUGE SIGNAL						SOC gauge signal/ Min.: 0%, Max.: 99%	Same as state of charge	—
WHEEL RND DIRCT (Wheel Round Direction Signal)						Wheel round direction signal/ Min.: 0, Max.: 2	• 0: Step • 1: Backward • 2: Forward	—
EGY FLW [E TO W]						Energy flow signal [Engine to wheel]/ Min.: 0, Max.: 4	• 2: No flow • 3: Engine to wheel Low • 4: Engine to wheel High	—
EGY FLW [E TO M]						Energy flow signal [Engine to motor]/ Min.: 0, Max.: 4	• 2: No flow • 3: Engine to motor Low	—
EGY FLW [M TO B]						Energy flow signal [Motor to battery]/ Min.: 0, Max.: 4	• 0: Motor to battery High • 1: Motor to Battery Low • 2: No flow • 3: Battery to motor Low • 4: Battery to motor High	—
EGY FLW [M TO W]						Energy flow signal [Motor to wheel]/ Min.: 0, Max.: 4	• 0: Wheel to motor High • 1: Wheel to motor Low • 2: No flow • 3: Motor to wheel Low • 4: Motor to wheel High	—
ANALYSIS DATA1		×				Analysis Data 1/ Min.: 0, Max.: 65535	0 or More	—
ANALYSIS DATA2		X				Analysis Data 2/ Min.: 0, Max.: 65535	0 or More	—
ANALYSIS DATA3		X				Analysis Data 3/ Min.: 0, Max.: 65535	0 or More	—
ANALYSIS DATA4		X				Analysis Data 4/ Min.: 0, Max.: 65535	0 or More	—

Monitored item	VEHICLE	HYBRID CONT	MOTOR GENERATOR	HV BATTERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
CAL/LD VALUE	X	X				Calculated Load Value Min.:0%, Max.:100%	• Idling: 10 - 35% • 2,500 rpm: 10 - 35%	—
COOLANT TEMP	X	X	X		X	Engine coolant temperature Min: –40°C, Max.: 215°C	• Engine is warmed up: More than 70°C (158°F)	—
ABSOL TH·P/S	X	X				Throttle valve opening angle Min.: 0%, Max.: 100%		—
THROTTLE POS	X	X				Throttle position sensor Min.: 0%, Max.: 100%		—
ENG TRQ CRCT VAL (Engine Torque Correction Value)		X				Engine torque correction value/ Min.: 0, Max.: 1.992	Always: 1.0 to 1.5	—
HISTORY DTC (The Number of History DTC)						Number of DTCs which 40 trips (warm-up cycles) have not completed for.	—	—
ALL DTC (The Number of Current DTC)						Number of all DTCs/ Min.: 0, Max.: 127	—	—
ENG COOLANT TMP (Engine coolant temperature)	X	X	X	X	X	Engine coolant temperature/ Min.: -40°C, Max.: 215°C	—	—

Freeze Frame Data

NOTE:

- The hybrid vehicle control ECU records vehicle and driving condition information as freeze frame data the moment a DTC is stored. It can be used for estimating or duplicating the vehicle conditions that were present when the malfunction occurred.
- To confirm the details of the hybrid control system, check the INF code which is a detailed information for the displayed DTC. INF code is displayed in freeze frame Data screen.
- 5 sets of the freeze frame data are can be recorded in the hybrid vehicle control ECU memory.
- The freeze frame data is displayed in Data Monitor mode.

CONSULT-III Display	Measurement Item/ Range (Display)	Suspected Vehicle Status When Malfunction Occurs
ECM ENG SPEED (Engine speed)	Engine speed/ Min.: 0 rpm, max.: 16,320 rpm	Engine speed
VEHICLE SPEED (Vehicle speed)	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	
INT/A TEMP SEN (Intake air temperature)	Intake air temperature/ Min.: -40°C, Max.: 140°C	Hot or cold weather
ENG RUN TIME (Engine run time)	Elapsed time after engine start/ Min.: 0 sec., Max.: 65,535 sec.	Elapsed time after engine start
DTC CLEAR WARM (DTC Clear Warm Up Times)	The number of times engine is warmed up after clearing DTCs/ Min.: 0, Max.: 255	Frequency of malfunction recurrence after clearing DTCs
DTC CLEAR RUN (DTC Clear Run Distance)	Drive distance after clearing DTCs/ Min.: 0 km, Max.: 65,535 km	Frequency of malfunction recurrence after clearing DTCs
SYSTEM VOL +B (Battery voltage)	Auxiliary battery voltage/ Min.: 0 V, Max.: 66.535 V	Auxiliary battery voltage

CONSULT-III Display	Measurement Item/ Range (Display)	Suspected Vehicle Status When Malfunction Occurs
AMBIENT TEMP (Ambient temperature)	Ambient air temperature/ Min.: –40°C, Max.: 215°C	Ambient air temperature
ACCEL SENSOR 1 (Accelerator pedal position 1)	Accelerator pedal position sensor No. 1/ Min.: 0%, Max.: 100%	Idling, accelerating, or decelerating
ACCEL SENSOR 2 (Accelerator pedal position 2)	Accelerator pedal position sensor No. 2/ Min.: 0%, Max.: 100%	Idling, accelerating, or decelerating
DTC CLEAR MIN (DTC Clear Min)	Elapsed time after clearing DTCs/ Min.: 0 min, Max.: 65,535 min	Elapsed time after clearing DTCs
INFO 1 to 5 DETAIL (Detail information 1 to 5)	Information code	—
MG1 REVOLUTION [Generator (MG1) Revolution]	Generator revolution/ Min.: -16,384 rpm, Max.: 16,256 rpm	Generator speed • Forward rotation appears as “+” • Backward rotation appears as “–”
MG2 REVOLUTION [Motor (MG2) Revolution]	Motor revolution/ Min.: -16,384 rpm, Max.: 16,256 rpm	Motor speed (proportionate to vehicle speed) • Forward rotation appears as “+” • Backward rotation appears as “–” Moving direction of vehicle • Forward rotation appears as “+” • Backward rotation appears as “–”
MG1 TORQUE [Generator (MG1) Torque]	Generator torque/ Min.: -512 N·m, Max.: 508 N·m	When generator rotation in “+” direction: • Torque appears as “+” while generator discharges • Torque appears as “–” while generator charges When generator rotation in “–” direction: • Torque appears as “–” while generator discharges • Torque appears as “+” while generator charges
MG2 TORQUE [Motor (MG2) Torque]	Motor torque/ Min.: -512 N·m, Max.: 508 N·m	When motor rotation in “+” direction: • Torque appears as “+” while motor discharges • Torque appears as “–” while motor charges When motor rotation in “–” direction: • Torque appears as “–” while motor discharges • Torque appears as “+” while motor charges
POWER REQUEST (Request Power)	Request engine power/ Min.: 0 W, Max.: 255 W	Engine power output requested to ECM
ENGINE SPEED (Engine Speed)	Engine speed/ Min.: 0 rpm, Max.: 16,320 rpm	Engine speed
MCYL CTRL TORQ (Master Cylinder Control Torque)	Master cylinder control torque/ Min.: -512 N·m, Max.: 508 N·m	Brake force requested by driver
SOC (SOC)	Battery state of charge/ Min.: 0%, Max.: 100%	State of charge of HV battery
WOUT (Wout Control Power)	Power value discharge control/ Min.: 0 W, Max.: 81,600 W	Discharge amount of HV battery
WIN (Win Control Power)	Power value charge control/ Min.: -40,800 W, Max.: 0 W	Charge amount of HV battery
DRIVE COND ID (Drive Condition ID)	Drive condition ID • Engine stopped: 0 • Engine about to be stopped: 1 • Engine about to be started: 2 • Engine operated or operating: 3	Engine operating condition

CONSULT-III Display	Measurement Item/ Range (Display)	Suspected Vehicle Status When Malfunction Occurs
MG1 INV TEMP [Inverter Temperature (MG1)]	Generator inverter temperature/ Min.: -50°C, Max.: 205°C	Generator inverter temperature
MG2 INV TEMP [Inverter Temperature (MG2)]	Generator inverter temperature/ Min.: -50°C, Max.: 205°C	Motor inverter temperature
MG1 MOTOR TEMP [Generator (MG1) Temperature]	Generator inverter temperature/ Min.: -50°C, Max.: 205°C	Generator temperature
MG2 MOTOR TEMP [Motor (MG2) Temperature]	Generator inverter temperature/ Min.: -50°C, Max.: 205°C	Motor temperature
PWR RESOURCE VB (Power Resource VB)	HV battery voltage/ Min.: 0 V, Max.: 510 V	HV battery voltage
PWR RESOURCE IB (Power Resource IB)	HV battery charge/discharge status/ Min.: -256 A, Max.: 254 A	HV battery charge and discharge current • Amount of current during discharge is indicated with positive values • Amount of current during charge is indicated with negative values
ACCEL SENSOR M (Accelerator Pedal Position Sensor Main)	Accelerator pedal position sensor main/ Min.: 0%, Max.: 100%	Idling, accelerating, or decelerating
BATTERY VOLT [Battery Voltage (VB)]	Auxiliary battery voltage/ Min.: 0 V, Max.: 19.92 V	Auxiliary battery voltage
EXCLUSIVE INFO 1 to 7 (Exclusive Information 1 to 7)	Exclusive information (in numerical data)	Exclusive information linked to Information
OCCURRENCE ORDER (Occurrence Order)	Occurrence sequence of information	Occurrence sequence of information
DISPLAY INFO (Display Information)	Display information	Display information
WIN CTRL POWER (Win Control Power)	Power value charge control/ Min.: -40.96 kW, Max.: 40.64 kW	Charge amount of HV battery
WOUT CTRL POWER (Wout Control Power)	Power value discharge control/ Min.: -40.96 kW, Max.: 40.64 kW	Discharge amount of HV battery
SUB BATTERY VOLT [Sub Battery Voltage (Batt)]	Auxiliary battery voltage/ Min.: 0 V, Max.: 19.92 V	Auxiliary battery voltage
ENG TRQ CRCT VAL (Engine Torque Correction Value)	Engine torque correction value/ Min.: 0, Max.: 19.92	Engine torque correction value
CONVERTER TEMP (Converter Temperature)	Boost converter temperature/ Min.: -50°C, Max.: 205°C	Boost converter temperature
VL (VL-Voltage Before Boosting)	High voltage before it is boosted/ Min.: 0 V, Max.: 510 V	High voltage level before it is boosted
VH (VH-Voltage After Boosting)	High voltage after it is boosted/ Min.: 0 V, Max.: 765 V	High voltage level after it is boosted
IGN ON TIME (The Time of Ignition ON)	The time after ignition switch on (IG)/ Min.: 0 min, Max.: 255 min	Time elapsed with ignition switch on (IG)
MG1 INV TEMP [Inverter Temperature (MG1) After IGN ON]	Generator inverter temperature/ Min.: -50°C, Max.: 205°C	Generator inverter temperature
MG2 INV TEMP [Inverter Temperature (MG2) After IGN ON]	Motor inverter temperature/ Min.: -50°C, Max.: 205°C	Motor inverter temperature
MG2 MOTOR TEMP [Motor (MG2) Temperature After IGN ON]	Motor temperature/ Min.: -50°C, Max.: 205°C	Motor temperature
TAR BAT VOL (DC) (DC/DC converter Target Voltage)	Target battery voltage/ Min.: 0V, Max.: 19.92V	DC/DC converter target voltage

CONSULT-III Display	Measurement Item/ Range (Display)	Suspected Vehicle Status When Malfunction Occurs
CONVRTR TEMP IG (Boost Converter Temperature After IGN-ON)	Boost converter temperature after ignition switch on (IG)/ Min.: -50°C, Max.: 205°C	Boost converter temperature soon after ignition switch on (IG)
SOC IG (Status of Charge After IGN-ON)	Battery state of charge after ignition switch on (IG)/ Min.: 0%, Max.: 100%	Battery state of charge soon after ignition switch on (IG)
MG1 INV TEMP MAX [Inverter Temperature (MG1) MAX]	Generator inverter maximum temperature/ Min.: -50°C, Max.: 205°C	Overheating state of Generator inverter
MG2 INV TEMP MAX [Inverter Temperature (MG2) MAX]	Motor inverter maximum temperature/ Min.: -50°C, Max.: 205°C	Overheating state of Motor inverter
MG2 MTR TEMP MAX [Motor (MG2) Temperature MAX]	Motor maximum temperature/ Min.: -50°C, Max.: 205°C	Overheating state of Motor
DCDC CONVERTER (DC/DC Converter Feedback Condition)	DC/DC converter Feedback Condition/ Min.: 0, Max.: 3	DC/DC converter feedback condition
ENG COOLANT TEMP (Engine Coolant Temperature)	Engine coolant temperature/ Min.: -50°C, Max.: 205°C	Engine coolant temperature
CONVRTR TEMP MAX (Boost Converter Temperature MAX)	Boost converter maximum temperature/ Min.: -50°C, Max.: 205°C	Overheating state of boost converter
SOC MAX (Status of Charge MAX)	Maximum status of charge/ Min.: 0%, Max.: 100%	Over-charging of HV battery
SOC MIN (Status of Charge MIN)	Minimum status of charge/ Min.: 0%, Max.: 100%	Over-charging of HV battery
MG2 SPEED MAX [Motor (MG2) Speed (Max)]	Maximum vehicle speed/ Min.: -256 km/h, Max.: 254 km/h	Over-discharging of HV battery
A/C COSMPT PWR (Air Con Consumption Power)	A/C consumption power/ Min.: 0 kW, Max.: 5 kW	A/C load
HV COOLANT TEMP (Inverter Coolant Temperature)	Inverter coolant temperature/ Min.: -40°C, Max.: 140°C	Inverter coolant temperature
BATTERY SOC (Battery State of Charge)	Battery state of charge/ Min.: 0%, Max.: 100%	State of charge of HV battery
IB BATTERY (Current value of Battery Pack)	Current value of battery pack/ Min.: -327.68 A, Max.: 327.67 A	HV battery charge/discharge status • Amount of current during discharge is displayed with positive values • Amount of current during charge is displayed with negative values
V1 to V17 BATT BLOCK (Battery Block Voltage V01 to V17)	Battery block voltage/ Min.: -327.68 V, Max.: 327.67 V	Each HV battery block voltage variance
BATT INSIDE AIR (Inhalation-of-air temperature into a battery pack)	Battery cooling fan intake air temperature/ Min.: -327.68°C, Max.: 327.67°C	—
VMF FAN VOLT1 (VMF fan motor voltage1)	VMF fan voltage/ Min.: -25.6 V, Max.: 25.4 V	Cooling fan operation condition
AUX BATT VOLT (Auxiliary battery voltage)	Auxiliary battery voltage/ Min.: -25.6 V, Max.: 25.4 V	Auxiliary battery voltage
WIN (Charge control value)	Charge control power value/ Min.: -64 kW, Max.: 63.5 kW	Charge amount of HV battery
WOUT (Discharge control value)	Discharge control power value/ Min.: -64 kW, Max.: 63.5 kW	Discharge amount of HV battery
DELTA SOC (Delta SOC)	Difference between maximum and minimum value of SOC/ Min.: 0%, Max.: 100%	SOC variance

CONSULT-III Display	Measurement Item/ Range (Display)	Suspected Vehicle Status When Malfunction Occurs
COOLING FAN 1 (COOLING FAN MODE1)	Cooling fan mode/ Min.: 0, Max.: 40	HV battery cooling fan activation condition • Stopped: 0 • Low speed drive - high speed drive: 1 - 40
ECU CTRL MODE (ECU control mode)	ECU control mode/ Min.: 1, Max.: 5	HV battery control status
BATT TEMP 1 to 4 (Temperature of battery TB 1 to 4)	Battery temperature/ Min.: -327.68°C, Max.: 327.67°C	HV battery temperature
INFORMATION 1 to 5 (INFORMATION 1 to 5)	Information data application/ NONE or AVAILABLE	—
SHIFT POSITION (Shift Sensor Shift Position)	Shift position (P, R, N, D or B position)/ P: 0, R: 1, N: 2, D: 3, B: 4	Shift position
ENG STOP RQST (Engine Stop Request)	Engine stop request/ ON or OFF	Engine stop request
ENG IDLING RQST (Engine Idling Request)	Engine idling request/ ON or OFF	Idle stop request
ENG FUEL CUT (Engine Fuel Cut)	Engine fuel cut request/ ON or OFF	Fuel cut request
HV BATT CHG RQST (Main Battery Charging Request)	HV battery charging request/ ON or OFF	HV battery charging request
ENG WARM UP RQST (Engine Warming up Request)	Engine warming up request/ ON or OFF	Engine warm-up request
BRAKE SWITCH (Brake switch)	Stop lamp switch/ ON or OFF	Brake pedal depressed or released
ASCD CONTROL (Cruise Control)	Cruise control active condition/ ON or OFF	Operation under cruise control ON or OFF
VEC RESON JDGE1	Vehicle vibration by running in rough road/ ON or OFF	Vehicle vibration by running in rough road
VEC RESON JDGE2	Vehicle vibration by running in rough road/ ON or OFF	Vehicle vibration by running in rough road
DCDC CONVRT STOP (DC/DC Converter Stop Condition)	DC/DC converter stop condition/ ON or OFF	DC/DC converter stop condition
AMB/S CIRC OPEN (Ambient Temperature Sensor Circuit Open)	Ambient temperature sensor circuit open/ ON or OFF	Ambient temperature condition
AMB/S CIRC SHORT (Ambient Temperature Sensor Circuit Open)	Ambient temperature sensor circuit short/ ON or OFF	Ambient temperature condition
SBLW RQST [Cooling fan stop control request (Stand by Blower)]	Standby blower request	—
DCDC CONVRT MODE (DC/DC Converter Control Mode)	DC/DC converter control mode/ Min.: 0, Max.: 7	DC/DC converter control mode
CAL/LD VALUE (Calculated Load Value)	Calculated Load Value/ Min.: 0%, Max.: 100%	—
COOLANT TEMP (Engine Coolant Temperature)	Engine coolant temperature/ Min.: –40°C, Max.: 215°C	Cold or warmed-up engine
ABSOL TH·P/S (Throttle Valve Opening Angle)	Throttle valve opening angle/ Min.: 0%, Max.: 100%	Idling, accelerating or decelerating
THROTTLE POS (Throttle Position Sensor)	Throttle position sensor/ Min.: 0%, Max.: 100%	Idling, accelerating or decelerating

Operation History Data

NOTE:

- The hybrid vehicle control ECU records inappropriate operations performed by the driver and the number of abnormal conditions that have been input to the ECU as operation history data.
- The operation history data is displayed in Data Monitor mode.

- LATEST OPERATION [L/O]: Among the past occurrences, the number of special operations or controls that have been effected during the most recent 1 trip detection.
- LATEST TRIP [L/T]: The number of trips after the occurrence of LATEST OPERATION.
- BEFORE LATEST OPERATION [B/O]: The number of occurrences during the trip previous to the LATEST OPERATION.
- BEFORE LATEST TRIP [B/T]: The number of trips after the occurrence of BEFORE LATEST OPERATION.

CONSULT-III Display	Operation	Count Condition
SFT BEF RDY[L/O]	Shift gear before READY	Shift lever moved with READY light blinking
SFT BEF RDY[L/T]		
SFT BEF RDY[B/O]		
SFT BEF RDY[B/T]		
N RNG CTRL1[L/O]	N range control in half shift	Shift position cannot be determined
N RNG CTRL1[L/T]		
N RNG CTRL1[B/O]		
N RNG CTRL1[B/T]		
N RNG CTRL2[L/O]	N range control by busy shift	N position control effected due to frequent shifting operation
N RNG CTRL2[L/T]		
N RNG CTRL2[B/O]		
N RNG CTRL2[B/T]		
S/ACC IN N[L/O]	Step accelerator in N range	Accelerator pedal depressed in N position
S/ACC IN N[L/T]		
S/ACC IN N[B/O]		
S/ACC IN N[B/T]		
AUX BATT LO[L/O]	Auxiliary Battery Low	Auxiliary battery voltage below 9.5 V
AUX BATT LO[L/T]		
AUX BATT LO[B/O]		
AUX BATT LO[B/T]		
HV INTERMIT[L/O]	Hybrid vehicle control ECU Intermittent incident	Instantaneous open circuit at IGN SW terminal of the hybrid vehicle control ECU
HV INTERMIT[L/T]		
HV INTERMIT[B/O]		
HV INTERMIT[B/T]		
MG2 TEMP HI[L/O]	Motor (MG2) temperature high	Motor (MG2) temperature rose above 162°C (334°F)
MG2 TEMP HI[L/T]		
MG2 TEMP HI[B/O]		
MG2 TEMP HI[B/T]		
MG1 TEMP HI[L/O]	Generator (MG1) temperature high	Generator (MG1) temperature rose above 162°C (334°F)
MG1 TEMP HI[L/T]		
MG1 TEMP HI[B/O]		
MG1 TEMP HI[B/T]		
MG2 INV HI[L/O]	Inverter temperature (MG2) high	Motor inverter temperature rose above 127°C (248°F)
MG2 INV HI[L/T]		
MG2 INV HI[B/O]		
MG2 INV HI[B/T]		

CONSULT-III Display	Operation	Count Condition
MG1 INV HI[L/O]	Inverter temperature (MG1) high	Generator inverter temperature rose above 127°C (248°F)
MG1 INV HI[L/T]		
MG1 INV HI[B/O]		
MG1 INV HI[B/T]		
HV BATT LOW[L/O]	Main Battery low voltage	Battery state of charge dropped below 30%
HV BATT LOW[L/T]		
HV BATT LOW[B/O]		
HV BATT LOW[B/T]		
RESIST O/H[L/O]	Resister over heat	System main resistor overheated
RESIST O/H[L/T]		
RESIST O/H[B/O]		
RESIST O/H[B/T]		
COOLANT HT[L/O]	Coolant heating	Inverter coolant forecast temperature rose above 65°C (149°F)
COOLANT HT[L/T]		
COOLANT HT[B/O]		
COOLANT HT[B/T]		
CONVERTER H[L/O]	Converter heating	Boost converter temperature rose above 120°C (248°F)
CONVERTER H[L/T]		
CONVERTER H[B/O]		
CONVERTER H[B/T]		
BKWRD SHIFT[L/O]	Shift backward direction	Shifted to R while moving forward or shifted to D or B while moving in reverse
BKWRD SHIFT[L/T]		
BKWRD SHIFT[B/O]		
BKWRD SHIFT[B/T]		
PREVENT STY[L/O]	Prevention control of staying	Engine speed stays in resonance frequency band
PREVENT STY[L/T]		
PREVENT STY[B/O]		
PREVENT STY[B/T]		
ACCEL & BRK[L/O]	Accelerator and brake depressing	Both accelerator and brake pedals depressed
ACCEL & BRK[L/T]		
ACCEL & BRK[B/O]		
ACCEL & BRK[B/T]		

ACTIVE TEST MODE

Test Item

NOTE:

- Using the CONSULT-III to perform active tests allows relays, actuators and other items to be operated without removing any parts. This non intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing active tests early in troubleshooting is one way to save diagnostic time. Data monitor information can be displayed while performing active tests.

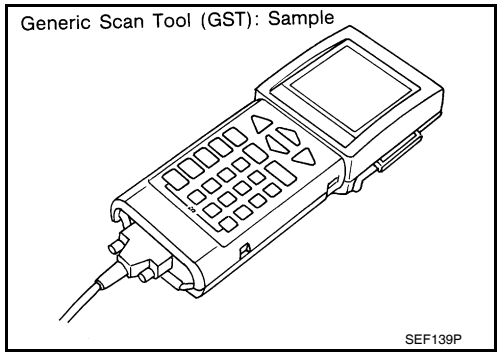
TEST ITEM	TEST PART	CONTROL RANGE	TEST DETAILS	TEST CONDITION
INSPECTION MODE 1 (Inspection mode-2WD inspection)	• To check engine running operation • To release traction control while using a speedometer tester	ON or OFF	• Runs the engine continuously with the shift lever in the P position • Releases traction control that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P	Ignition switch ON, HV system normal, not in maintenance mode, and other active tests not being done
INSPECTION MODE 2 (Inspection mode-2WD chassis-dynamo)	To release traction control while using a speedometer tester	ON or OFF	Releases traction control that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P	Ignition switch ON, HV system normal, not in maintenance mode, and other active tests not being done
COMPRESSION TEST (Compression Test)	To crank the engine continuously in order to measure the compression	ON or OFF	Allows the engine to continue cranking by activating the MG1 continuously	• Ignition switch ON, HV system normal, not in maintenance mode, and other active tests not being done • This test is available when keeping to push ignition switch with brake pedal depressed.
INV WATER PUMP (Activate the Water Pump)	To activate the inverter water pump continuously	ON or OFF	Activates the inverter water pump continuously	Ignition switch ON, inverter system normal, not in maintenance mode, and other active tests not being done
COOLING FAN SPD (Driving the battery cooling fan)	To check operation of the cooling fan and if there is sufficient air flow	0 to 6	Stops the cooling fan or changes air volume mode (1 to 6)	—
DC/DC CONVERTER	To check operation of the DC/DC converter	ON or OFF	Change the voltage that is supplied to auxiliary battery	• Ignition switch ON, not in maintenance mode • Turn ignition switch to READY position • Keep the shift lever “P” position

Diagnosis Tool Function

INFOID:0000000004211757

DESCRIPTION

Generic Scan Tool (OBDII scan tool) complying with SAE J1978 has 6 different functions explained below.
ISO9141 is used as the protocol.
The name GST or Generic Scan Tool is used in this service manual.

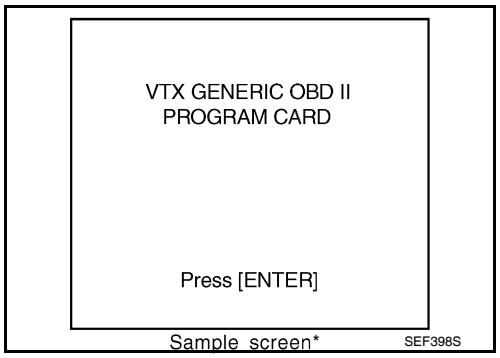


FUNCTION

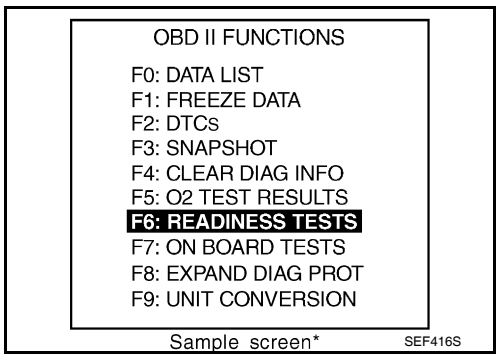
Diagnostic Service		Function
Service $01	READINESS TESTS	This diagnostic service gains access to current emission-related data values, including analog inputs and outputs, digital inputs and outputs, and system status information.
Service $02	(FREEZE DATA)	This diagnostic service gains access to emission-related data value which were stored by ECM during the freeze frame. For details, refer to HBC-619, "DTC Index".
Service $03	DTCs	This diagnostic service gains access to emission-related power train trouble codes which were stored by the hybrid vehicle control ECU.
Service $04	CLEAR DIAG INFO	This diagnostic service can clear all emission-related diagnostic information. This includes: • Clear number of diagnostic trouble codes (Service $01) • Clear diagnostic trouble codes (Service $03) • Clear trouble code for freeze frame data (Service $01) • Clear freeze frame data (Service $02) • Reset status of system monitoring test (Service $01) • Clear on board monitoring test results (Service $07)
Service $07	(ON BOARD TESTS)	This diagnostic service enables the off board test drive to obtain test results for emission-related powertrain components/systems that are continuously monitored during normal driving conditions.
Service $09	(CALIBRATION ID)	This diagnostic service enables the off-board test device to request specific vehicle information such as Calibration Verification Number (CNV) and Calibration IDs.

INSPECTION PROCEDURE

1. Turn ignition switch OFF.
2. Connect “GST” to data link connector, which is located under LH dash panel near the hood opener handle.
3. Turn ignition switch ON.
4. Enter the program according to instruction on the screen or in the operation manual.
   (*: Regarding GST screens in this section, sample screens are shown.)



5. Perform each diagnostic mode according to each service procedure.
   For further information, see the GST Operation Manual of the tool maker.



INSPECTION MODE

MODE 1

MODE 1 : Diagnosis Description

INFOID:0000000004211758

DESCRIPTION

This vehicle will perform the engine idling stop when the engine is warmed up and SOC is in good condition. If engine running with vehicle stopped is necessary for service, the vehicle should be set in the inspection mode. And if the vehicle is necessary to be set on a chassis-dynamometer, also the vehicle should be set in the inspection mode.
2 types of inspection mode are available.

Type	Condition
Mode 1 (Inspection mode - 2WD inspection)	• Engine runs continuously with the shift lever in P range. • The traction control, that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P, is released.
Mode 2 (Inspection mode - 2WD chassis-dynamo)	• The traction control, that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P, is released.

ACTIVATING PROCEDURE

CAUTION:
Driving the vehicle without deactivating the inspection mode may damage the hybrid transaxle.
NOTE:
- **The idling speed in inspection mode is approximately 1,000 rpm. The engine speed increases to 1,500 rpm if the accelerator pedal is depressed by less than 60% with P range. If the accelerator pedal is depressed by more than 60%, the engine speed increases to 2,500 rpm.**
- **If a DTC is set during the inspection mode, the hybrid system warning light will stop blinking and illuminate continuously.**
- **When the hybrid system warning light illuminates during the inspection mode, deactivate the inspection mode and check DTC.**

With CONSULT-III
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Shift the selector lever to P position.
3. Turn ignition switch ON.
4. Select “INSPECTION MODE 1” in “ACTIVE TEST” mode with CONSULT-III.
5. Check that hybrid system warning light is blinking in the combination meter.
6. Turn ignition switch ON (READY), then the engine will start.

Without CONSULT-III
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Shift the selector lever to P position.
3. Turn ignition switch ON and perform the following steps 5 to 9 within 60 seconds.
4. Repeat the following procedure 2 times.
- Fully depress the accelerator pedal.
- Fully release the accelerator pedal.
5. Shift the selector lever to N position.
6. Repeat the following procedure 2 times.
- Fully depress the accelerator pedal.
- Fully release the accelerator pedal.
7. Shift the selector lever to P position.
8. Repeat the following procedure 2 times.
- Fully depress the accelerator pedal.
- Fully release the accelerator pedal.
9. Check that hybrid system warning light is blinking in the combination meter.
   If not blinking, perform steps 1 to 9 again.
10. Turn ignition switch ON (READY), then the engine will start.

DEACTIVATING PROCEDURE

CAUTION:

Driving the vehicle without deactivating the inspection mode may damage the hybrid transaxle.

With CONSULT-III
1. Touch “BACK” on the “CONSULT-III” screen to cancel the “ACTIVE TEST”.
2. Turn ignition switch OFF. The HV main system turns off simultaneously.

Without CONSULT-III
1. Turn ignition switch OFF. The HV main system turns off simultaneously.

MODE 2

MODE 2 : Diagnosis Description

INFOID:0000000004211759

DESCRIPTION

This vehicle will perform the engine idling stop when the engine is warmed up and SOC is in good condition. If engine running with vehicle stopped is necessary for service, the vehicle should be set in the inspection mode. And if the vehicle is necessary to be set on a chassis-dynamometer, also the vehicle should be set in the inspection mode.
2 types of inspection mode are available.

Type	Condition
Mode 1 (Inspection mode - 2WD inspection)	• Engine runs continuously with the shift lever in P range. • The traction control, that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P, is released.
Mode 2 (Inspection mode - 2WD chassis-dynamo)	• The traction control, that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P, is released.

ACTIVATING PROCEDURE

CAUTION:
Driving the vehicle without deactivating the inspection mode may damage the hybrid transaxle.
NOTE:
- **The idling speed in inspection mode is approximately 1,000 rpm. The engine speed increases to 1,500 rpm if the accelerator pedal is depressed by less than 60% with P range. If the accelerator pedal is depressed by more than 60%, the engine speed increases to 2,500 rpm with P range.**
- **If a DTC is set during the inspection mode, the high voltage battery warning light will stop blinking and illuminate continuously.**
- **When the high voltage battery warning light illuminates during the inspection mode, deactivate the inspection mode and check DTC.**

With CONSULT-III
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Shift the selector lever to P position.
3. Turn ignition switch ON.
4. Select “INSPECTION MODE 2” in “ACTIVE TEST” mode with CONSULT-III.
5. Check that high voltage battery warning light is blinking in the combination meter.
6. Turn ignition switch ON (READY).

Without CONSULT-III
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Shift the selector lever to P position.
3. Turn ignition switch ON and perform the following steps 5 to 9 within 60 seconds.
4. Repeat the following procedure 3 times.
- Fully depress the accelerator pedal.
- Fully release the accelerator pedal.
5. Shift the selector lever to N position.
6. Repeat the following procedure 3 times.
- Fully depress the accelerator pedal.
- Fully release the accelerator pedal.
7. Shift the selector lever to P position.
8. Repeat the following procedure 3 times.
- Fully depress the accelerator pedal.
- Fully release the accelerator pedal.

9. Check that high voltage battery warning light is blinking in the combination meter.
   If not blinking, perform steps 1 to 9 again.
10. Turn ignition switch ON (READY).

DEACTIVATING PROCEDURE

CAUTION:

Driving the vehicle without deactivating the inspection mode may damage the hybrid transaxle.

With CONSULT-III

1. Touch “BACK” on the “CONSULT-III” screen to cancel the “ACTIVE TEST”.
2. Turn ignition switch OFF. The HV main system turns off simultaneously.

Without CONSULT-III

1. Turn ignition switch OFF. The HV main system turns off simultaneously.

COMPONENT DIAGNOSIS

P0338-885

Description

INFOID:0000000004211760

The hybrid vehicle control ECU receives three engine speed signals such as NEI signal, GI signal and ENE signal from the ECM. ENE signal is computed from crankshaft position sensor (POS) signal, GI signal and NEI signal are from both sensor signals. ENE signal is sent via the CAN communication line.
The hybrid vehicle control ECU compares NEI signal and GI signal with ENE signal. If NEI signal or GI signal is extremely low, the hybrid vehicle control ECU detects a malfunction.

DTC Logic

INFOID:0000000004211761

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0338	885	Crankshaft position sensor “A” Circuit high	NEI signal is not sent to the hybrid vehicle control ECU while the engine is running.	• Harness or connector • Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1. PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.
TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 10.5V with ignition switch ON.

>> GO TO 2.

2. PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON (READY).
2. Shift the selector lever to P position.
3. Depress the accelerator pedal to start engine and keep the engine running for at least 5 seconds.
4. Check DTC.

Is DTC detected?

YES >> Go to HBC-107, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004211762

1. PRECONDITIONING

- 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. 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 BETWEEN HYBRID VEHICLE CONTROL ECU AND ECM

1. Turn ignition switch OFF.
2. Disconnect hybrid vehicle control ECU harness connector E66.
3. Disconnect ECM harness connector E10.
4. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		ECM		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	101 (NEI)	E10	99 (NEO)	Below 1Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	101 (NEI)	Ground	10kΩ or higher

ECM		Ground	Resistance
Harness connector	Terminal		
E10	99 (NEO)	Ground	10kΩ or higher

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3. DETECT MALFUNCTIONING PART

Check the following.
- Joint connector-E01
- Harness continuity between hybrid vehicle control ECU and ECM

>> Repair open circuit or short to ground or short to power in harness or connectors.

4. CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NO >> Repair or replace harness or connectors.

P0343-747

Description

INFOID:0000000004211763

The crankshaft position sensor sends the engine speed signal (NE) to the engine CPU of the ECM. The hybrid vehicle control ECU compares the input engine speed signals (NE) in the engine CPU and HV CPU. If DTC P0335 or P0340 is detected by ECM, this DTC will be output.

DTC Logic

INFOID:0000000004211764

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0343	747	Camshaft position sensor “A” Circuit High Input	GI pulse signal is not input for 2 sec. or more while the engine is running.	• Wire harness or connector • Hybrid vehicle control ECU • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211765

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (ENGINE)

1. Turn ignition switch ON.
2. Check DTC for “ENGINE”.

Is DTC P0335 or P0340 detected?

YES (P0335 is detected.)>>Go to diagnosis procedure for DTC P0335. (See EC-252, "Diagnosis Procedure").

YES (P0340 is detected.)>>Go to diagnosis procedure for DTC P0340. (See EC-256, "Diagnosis Procedure").

NO >> GO TO 3.

3.CHECK ENGINE START

1. Check if the engine can start.
2. Check DTC for “ENGINE”.

Result	Proceed to
The engine cannot start.	B
The engine can start and DTC P0335 or P0340 is output within 10 seconds.	B
The engine can start and DTC P0335 and P0340 are not output after 10 seconds.	A

A or B

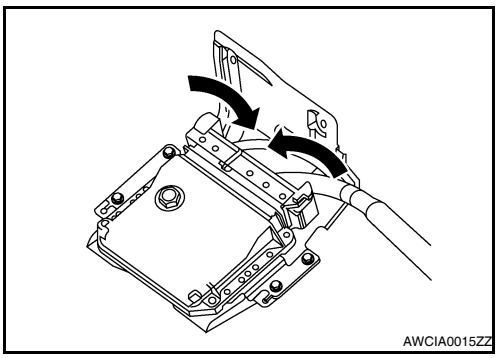
A >> GO TO 4.

B >> Go to diagnosis procedure for DTC P0335 EC-252, "Diagnosis Procedure" or P0340 (See EC-256, "Diagnosis Procedure").

4.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

1. Check the connections of the hybrid vehicle control ECU connectors.

- Confirm that the lever is securely engaged.
- Confirm that the connector does not come out when its body is pulled.



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

OK or NG

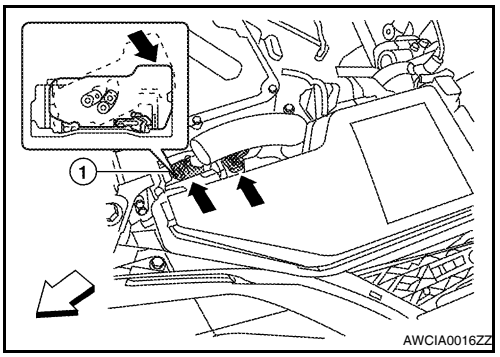
OK >> GO TO 5.
NG >> Connect securely.

5. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   Do not turn ignition switch ON (READY) with the service plug grip removed as this may cause a malfunction.
2. Check the connections of the inverter with converter assembly connectors (1).

- Confirm that the lever is securely engaged.
- Confirm that the connector does not come out when its body is pulled.



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

OK or NG

OK >> GO TO 6.
NG >> Connect securely.

6. CHECK HARNESS AND CONNECTOR (ECM - INVERTER WITH CONVERTER ASSEMBLY)

1. Disconnect ECM harness connector E10.
2. Disconnect inverter with converter assembly connector E69.
3. Measure the resistance according to the value(s) in the table below.

Check for open

ECM		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E10	103 (GO)	E69	30 (GI)	Below 1Ω

Check for short

ECM		Ground	Resistance
Harness connector	Terminal		
E10	103 (GO)	Ground	10kΩ or higher

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
E69	30 (GI)	Ground	10kΩ or higher

OK or NG

OK >> GO TO 8.

NG >> GO TO 7.

7. DETECT MALFUNCTIONING PART

Check the following.
- Joint connector E-01
- Harness continuity between ECM and inverter with converter assembly

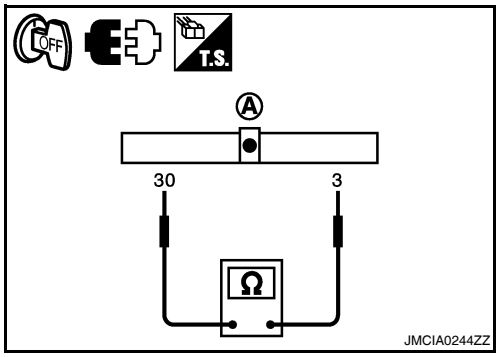
>> Repair open circuit or short to ground or short to power in harness or connectors.

8. CHECK INVERTER WITH CONVERTER ASSEMBLY

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

Check for open

Inverter with converter assembly (A)		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E69	30 (GI)	E69	3 (GND1)	10 kΩ or higher



NOTE:
After the inspection, check DTC. If DTC P0343-747 is output again, replace the inverter with converter assembly.

OK or NG

OK >> GO TO 9.
NG >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

9. CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".

>> INSPECTION END

P0343-886

Description

INFOID:0000000004211766

The hybrid vehicle control ECU receives three engine speed signals such as NEI signal, GI signal and ENE signal from the ECM. ENE signal is computed from crankshaft position sensor (POS) signal, GI signal and NEI signal are from both sensor signals. ENE signal is sent via the CAN communication line.
The hybrid vehicle control ECU compares NEI signal and GI signal with ENE signal. If NEI signal or GI signal is extremely low, the hybrid vehicle control ECU detects a malfunction.

DTC Logic

INFOID:0000000004211767

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0343	886	Camshaft position sensor “A” Circuit High Input	GI signal is not sent to the hybrid vehicle control ECU while the engine is running.	• Harness or connector • Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.
TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 10.5V with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON (READY).
2. Shift the selector lever to P position.
3. Depress the accelerator pedal to start engine and keep the engine running for at least 5 seconds.
4. Check DTC.

Is DTC detected?

YES >> Go to HBC-112, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004211768

1.PRECONDITIONING

- 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. 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 BETWEEN HYBRID VEHICLE CONTROL ECU AND ECM

1. Turn ignition switch OFF.
2. Disconnect hybrid vehicle control ECU harness connector E66.
3. Disconnect ECM harness connector E10.
4. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		ECM		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	100 (GI)	E10	103 (GO)	Below 1Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	100 (GI)	Ground	10kΩ or higher

ECM		Ground	Resistance
Harness connector	Terminal		
E10	103 (GO)	Ground	10kΩ or higher

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3. DETECT MALFUNCTIONING PART

Check the following.
- Joint connector-E01
- Harness continuity between hybrid vehicle control ECU and ECM

>> Repair open circuit or short to ground or short to power in harness or connectors.

4. CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NO >> Repair or replace harness or connectors.

P0560-117

Description

INFOID:0000000004211769

Battery power is constantly supplied to the BATT terminal of the hybrid vehicle control ECU to allow DTCs and freeze frame data to be retained in memory even though the ignition switch is turned OFF. The back-up power is supplied even when the ignition switch is OFF.

DTC Logic

INFOID:0000000004211770

DTC DETECTION LOGIC

If a period of time has elapsed with a low voltage at the BATT terminal of the hybrid vehicle control ECU, the hybrid vehicle control ECU will determine that a malfunction has occurred in the back-up power supply system, and set a DTC. The MIL will illuminate the next time the engine is started.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0560	117	System Voltage	Malfunction in the hybrid vehicle control ECU back-up power source circuit	• Wire harness or connector • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211771

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

Refer to HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> Connect securely.

3.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - FUSE)

1. Turn ignition switch OFF.
2. Remove the 10A fuse (No. 70) from the high voltage fuse and fusible link box.
3. Disconnect the hybrid vehicle control ECU harness connector E65.
4. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		High voltage fuse and fusible link box		Resistance
Harness connector	Terminal	Component connector	Terminal	
E65	165 (BATT)	-	10A fuse (No. 70) downstream side	Below 1Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E65	165 (BATT)	Ground	10kΩ or higher

High voltage fuse and fusible link box		Ground	Resistance
Component connector	Terminal		
-	10A fuse (N0. 70) downstream side	Ground	10kΩ or higher

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

OK or NG

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

4. CHECK HARNESS AND CONNECTOR (FUSE - BATTERY POSITIVE TERMINAL)

1. Disconnect the positive and negative terminals from the auxiliary battery.
2. Measure the resistance according to the value(s) in the table below.

Check for open

High voltage fuse and fusible link box		Battery	Resistance
Component connector	Terminal		
-	10A fuse (No. 70) upstream side	Positive (+) battery terminal	Below 1Ω

Check for short

High voltage fuse and fusible link box		Ground	Resistance
Component connector	Terminal		
-	10A fuse (No. 70) upstream side	Ground	10kΩ or higher

OK or NG

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

5. RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

NOTE:
If DTC P0560-117 is output after this inspection, replace the hybrid vehicle control ECU. If the DTC is not output, check for intermittent incident because there may be a malfunction in the wire harness or connector.

- Connect the CONSULT-III to the data link connector.
- Turn ignition switch ON.
- Select “DELF-DIAG RESULTS” mode.
- Recheck for DTCs.

DTC P0560-117 is output again.

YES >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NO >> Check for intermittent incident (See GI-42, "Intermittent Incident").

P0616-142

DTC Logic

INFOID:0000000004211772

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0616	142	Starter relay circuit	An ST signal from the hybrid vehicle control ECU is present when the ignition switch OFF.	• Wire harness or connector • Hybrid vehicle control ECU • BCM

Diagnosis Procedure

INFOID:0000000004211773

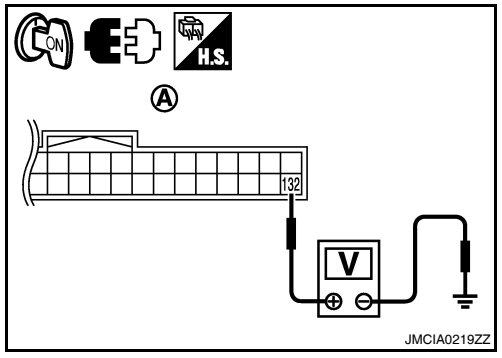
1.PRECONDITIONING

- 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. 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 (ST-CONT TERMINAL VOLTAGE) AND BCM

1. Turn ignition switch OFF.
2. Disconnect the BCM harness connector M21.
3. Measure the voltage according to the value(s) in the table below when the ignition switch is ON.



BCM (A)		Ground	Voltage
Harness connector	Terminal		
M21	132 (ST−CONT)	Ground	10 - 14 V

OK or NG

OK >> Replace BCM.
NG >> GO TO 3.

3.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BCM)

1. Disconnect the hybrid vehicle control ECU harness connector E66.
2. Measure the resistance according to the value(s) in the table below when the ignition switch is OFF.

Check for open

Hybrid vehicle control ECU		BCM		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	167 (ST2)	M21	132 (ST−CONT)	Below 1 Ω

OK or NG

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

4.CLEAR DTC

1. Connect the CONSULT-III to the data link connector.
2. Turn ignition switch ON.
3. Read and record the DTCs and freeze frame data.

4. Clear the DTCs.

>> GO TO 5.

5. RECONFIRM DTC OUTPUT

1. Turn ignition switch OFF and leave the vehicle as it is for approximately 5 seconds.
2. Turn ignition switch ON again.
3. Recheck for DTCs.

DTC P0616-142 is output again.

YES >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NO >> Check for intermittent incident (See GI-42, "Intermittent Incident").

P062F-143

Description

INFOID:0000000004211774

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211775

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P062F	143	EEPROM Malfunction	ECU internal error is detected.	Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is more than 10.5V with ignition switch ON.

>> GO TO 2.

2.PERFOM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-118, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004211776

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> INSPECTION END

P0705-757, P0705-758, P0851-775

Description

INFOID:0000000004211777

The park / neutral position switch can send 8 different switch signals to the hybrid vehicle control ECU. The hybrid vehicle control ECU uses the signals to detect the shift lever position (P, R, N, D or B). The hybrid vehicle control ECU also uses this information to determine intended direction of travel (forward or reverse).

DTC Logic

INFOID:0000000004211778

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0705	757	Transmission Range Sensor Circuit	Park/neutral position switch pattern problem	• Wire harness or connector • Park / neutral position switch • Hybrid vehicle control ECU
	758		Shifting malfunction (open circuit in MJ)	
P0851	775	Park / Neutral Switch Input Circuit Low	N signal line malfunction	

Diagnosis Procedure

INFOID:0000000004211779

1.PRECONDITIONING

- 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. 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.CLEAR DTC

1. Turn ignition switch OFF.
2. Connect the CONSULT-III to the data link connector.
3. Turn ignition switch ON.
4. Read and record the DTCs and freeze frame data.
5. Clear the DTCs.

>> GO TO 3.

3.READ VALUE OF DATA MONITOR (SHIFT POSITION)

1. While slowly moving the shift lever from P to B, and then back to the P position, read the DATA MONITOR (SHIFT POSITION) displayed on the CONSULT-III.
   NOTE:
   Make sure to move the shift lever slowly.

	Shift Position				
Data Monitor	P	R	N	D	B
SHIFT SW P	ON	OFF	OFF	OFF	OFF
SHIFT SW R	OFF	ON	OFF	OFF	OFF
SHIFT SW N	OFF	OFF	ON	OFF	OFF
SHIFT SW D	OFF	OFF	OFF	ON	OFF
SHIFT SW B	OFF	OFF	OFF	OFF	ON
SHIFT SW RV	OFF	ON	OFF	OFF	OFF

	Shift Position				
Data Monitor	P	R	N	D	B
SHIFT SW FD	OFF	OFF	OFF	ON	ON
SHIFT SW MJ	ON	ON	ON	ON	ON

2. Check if DTCs are output.

DTCs P0705-757, P0705-758, and P0851-775 are not output.

OK >> GO TO 9.
NG >> GO TO 4.

4. CHECK CONNECTOR CONNECTION CONDITION (PARK/NEUTRAL POSITION SWITCH)

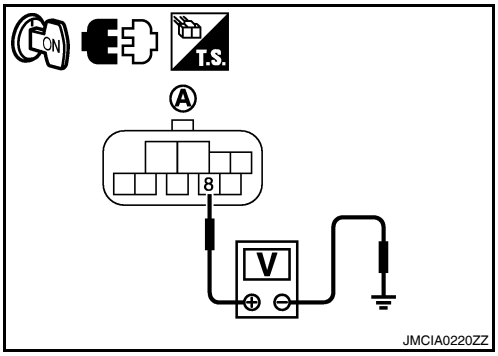
1. Check the connections of the park/neutral position switch connectors.

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HARNESS AND CONNECTOR (POWER SOURCE CIRCUIT)

1. Disconnect the park / neutral position switch harness connector F81.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.



Park/neutral position switch (A)		Ground	Voltage
Harness connector	Terminal		
F81	8 (+B)	Ground	10 to 14 V

NOTE:
Turn ignition switch ON with the park/neutral position switch harness connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

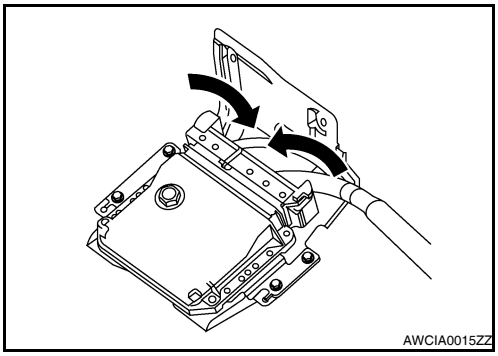
OK or NG

OK >> GO TO 6.
NG >> Repair or replace harness or connector.

6. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

1. Check the connections of the hybrid vehicle control ECU connectors.

- Confirm that the lever is securely engaged.
- Confirm that the connector does not come out when its body is pulled.



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

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - PARK/NEUTRAL POSITION SWITCH)

1. Turn ignition switch ON.
2. Disconnect the hybrid vehicle control ECU harness connector E65.
3. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E65	60 (+BS)	Ground	Below 1 V
	45 (P)		
	46 (R)		
	47 (N)		
	48 (D)		
	49 (B)		
	50 (RV)		
	51 (FD)		
	52 (MJ)		

NOTE:
Turning ignition switch ON with the park/neutral position switch harness connector and hybrid vehicle control ECU harness connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

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

Check for open

Hybrid vehicle control ECU		Park/neutral position switch		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E65	60 (+BS)	F81	8 (+B)	Below 1Ω
	45 (P)		3 (P)	
	46 (R)		4 (R)	
	47 (N)		2 (N)	
	48 (D)		1 (D)	
	49 (B)		7 (B)	
	50 (RV)		9 (RV)	
	51 (FD)		6 (FD)	
	52 (MJ)		5 (MJ)	

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E65	60 (+BS)	Ground	10kΩ or higher
	45 (P)		
	46 (R)		
	47 (N)		
	48 (D)		
	49 (B)		
	50 (RV)		
	51 (FD)		
	52 (MJ)		

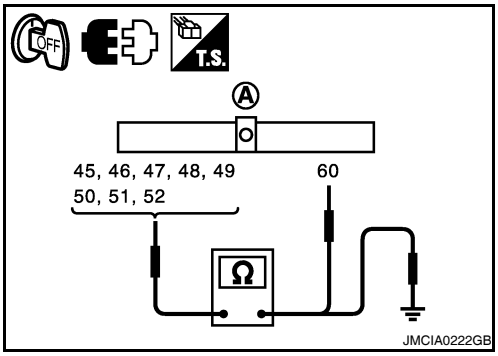
Park/neutral position switch		Ground	Resistance
Harness connector	Terminal		
F81	8 (+B)	Ground	10kΩ or higher
	3 (P)		
	4 (R)		
	2 (N)		
	1 (D)		
	7 (B)		
	9 (RV)		
	6 (FD)		
	5 (MJ)		

OK or NG

OK >> GO TO 8.
NG >> Repair or replace harness or connector.

8.CHECK PARK / NEUTRAL POSITION SWITCH

1. Connect the park / neutral position switch connector.
2. Measure the resistance according to the value(s) in the table below.



Check for open

Shift lever position	Hybrid vehicle control ECU (A)		Hybrid vehicle control ECU (A)		Resistance
	Harness connector	Terminal	Harness connector	Terminal	
P	E65	60 (+BS)	E65	45 (P)	Below 1Ω
				52 (MJ)	

Shift lever position	Hybrid vehicle control ECU (A)		Hybrid vehicle control ECU (A)		Resistance
	Harness connector	Terminal	Harness connector	Terminal	
R	E65	60 (+BS)	E65	46 (R)	Below 1Ω
				50 (RV)	
				52 (MJ)	

Shift lever position	Hybrid vehicle control ECU (A)		Hybrid vehicle control ECU (A)		Resistance
	Harness connector	Terminal	Harness connector	Terminal	
N	E65	60 (+BS)	E65	47 (N)	Below 1Ω
				52 (MJ)	

Shift lever position	Hybrid vehicle control ECU (A)		Hybrid vehicle control ECU (A)		Resistance
	Harness connector	Terminal	Harness connector	Terminal	
D	E65	60 (+BS)	E65	48 (D)	Below 1Ω
				52 (MJ)	
				51 (FD)	

Shift lever position	Hybrid vehicle control ECU (A)		Hybrid vehicle control ECU (A)		Resistance
	Harness connector	Terminal	Harness connector	Terminal	
B	E65	60 (+BS)	E65	49 (B)	Below 1Ω
				51 (FD)	
				52 (MJ)	

Check for short

Shift lever position	Hybrid vehicle control ECU (A)		Ground	Resistance
	Harness connector	Terminal		
P	E65	60 (+BS)	Ground and other terminal	10 kΩ or higher*
		45 (P)		
		52 (MJ)		
R		60 (+BS)		
		46 (R)		
		52 (MJ)		
		50 (RV)		
N		60 (+BS)		
		47 (N)		
		52 (MJ)		
D		60 (+BS)		
		48 (D)		
		52 (MJ)		
		51 (FD)		
B		60 (+BS)		
		49 (B)		
		52 (MJ)		
		51 (FD)		

NOTE:
*: The resistance between terminals 60 and 47 should be 4.2 to 5.2 kΩ.

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Replace park / neutral position switch (See TM-32, "Removal and Installation").

9. CHECK FOR INTERMITTENT INCIDENT

1. Check for intermittent incident (See GI-42, "Intermittent Incident").

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace malfunctioning parts, component and area.

P0A01-725, P0A01-726

Description

INFOID:0000000004211780

Refer to the description for DTC P0A02-719 (See HBC-128, "Description").

DTC Logic

INFOID:0000000004211781

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A01	725	Motor electronics coolant temperature sensor circuit range/performance	Sudden change in inverter coolant temperature sensor output	• Wire harness or connector • Inverter cooling system • Cooling fan system • Water pump with motor & bracket assembly • Inverter with converter assembly • Hybrid vehicle control ECU
P0A01	726	Motor electronics coolant temperature sensor circuit range/performance	Inverter coolant temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Cooling fan system • Water pump with motor & bracket assembly • Inverter with converter assembly • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211782

1.PRECONDITIONING

- 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. 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 DTC (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A93-346	Inverter cooling system malfunction

Is DTC P0A93-346 detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK QUANTITY OF INVERTER COOLANT

1. Check for coolant leaks.
2. check the coolant in the sub reserve tank assembly is above the low level.

Result	Proceed to
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is above the low level.	A
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is below the low level.	B
Coolant leaks are evident.	C

NOTE:
After repairing the coolant leaks and adding coolant, perform the “INV WATER PUMP” and “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III and make sure that the there are no malfunctions.

A or B or C

A >> GO TO 5.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

5.CHECK FUSE (NO. 68)

1. Remove the 10A fuse (No. 68) from the high voltage fuse and fusible link box.
2. Measure the resistance of the fuse.

Resistance : Below 1Ω

OK or NG

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

6.CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Correct the problem.

7.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8.CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9.PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 12.

10.CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11.PERFORM ACTIVE TEST WITH CONSULT-III (COOLING FAN SPD)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Check cooling fan system (See EC-382, "Component Function Check").

12. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 13.

13. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> GO TO 15.

14. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

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

15. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

Refer to PG-65, "Terminal Arrangement".

OK or NG

OK >> GO TO 16.
NG >> Replace high voltage fuse and fusible link box.

16. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

P0A02-719, P0A03-720

Description

INFOID:0000000004211783

The hybrid vehicle control ECU detects the inverter coolant temperature through the coolant temperature sensor built into the inverter with converter assembly. The inverter cooling system is the same as that for MG2 or MG1, and operates independently of the engine cooling system. The hybrid vehicle control ECU controls the inverter cooling system to prevent overheating based on signals from the inverter coolant temperature sensor. The hybrid vehicle control ECU also monitors inverter cooling system operation and detects malfunctions in the inverter coolant temperature sensor and the circuit.

DTC Logic

INFOID:0000000004211784

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A02	719	Motor electronics coolant temperature sensor circuit low	Short to GND in the inverter coolant temperature sensor circuit	Inverter with converter assembly
P0A03	720	Motor electronics coolant temperature sensor circuit high	Open or short to +B in the inverter coolant temperature sensor circuit	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211785

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

Refer to HBC-638, "Removal and Installation".

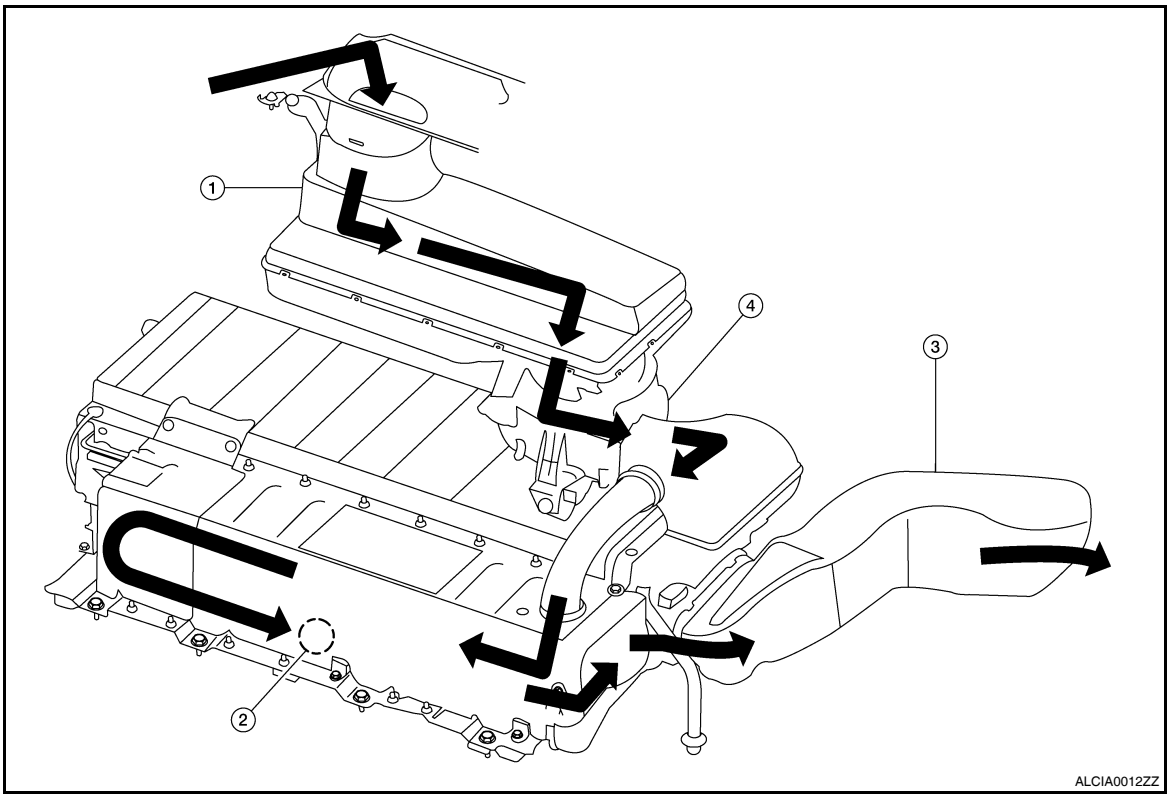
>> COMPLETED

P0A08-101

Description

INFOID:0000000004211786

The cooling fan of the HV battery and cooling fan in the hybrid vehicle converter are used to cool the hybrid vehicle converter (DC/DC converter).



1. HV battery air intake duct
2. Converter cooling fan
3. HV battery air exhaust duct
4. Battery cooling blower assembly

DTC Logic

INFOID:0000000004211787

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A08	101	DC/DC Converter Status Circuit	Overheating of the hybrid vehicle converter (DC/DC converter)	• Duct • Hybrid vehicle converter (DC/DC converter) • Auxiliary battery

Diagnosis Procedure

INFOID:0000000004211788

1.PRECONDITIONING

- 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. 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.
  Placing an object on the package tray trim panel assembly, which is the inlet of the duct, may cause the duct to be unable to take in air. In this case, DTCs may be set.

>> GO TO 2.

2.CHECK PACKAGE TRAY TRIM PANEL ASSEMBLY

1. Check that the air intake grill of the package tray trim panel assembly is not clogged.

The air intake grill is not clogged.

OK or NG

OK >> GO TO 3.
NG >> Remove foreign object.

3.CHECK AIR DUCT (ALL)

1. Check if the duct is installed correctly.

The duct is installed correctly.

2. Check the duct for clogging.

The duct is not clogged.

OK or NG

OK >> GO TO 4.
NG >> Repair or replace air duct (all).

4.REPLACE HYBRID VEHICLE CONVERTER

1. Replace the hybrid vehicle converter (DC/DC converter) (See HBB-103, "Removal and Installation").

>> GO TO 5.

5.CHECK AUXILIARY BATTERY

1. Turn ignition switch to READY position.
2. Leave the vehicle for 5 minutes.
3. Measure the voltage of the auxiliary battery.

More than 10.5 V

OK or NG

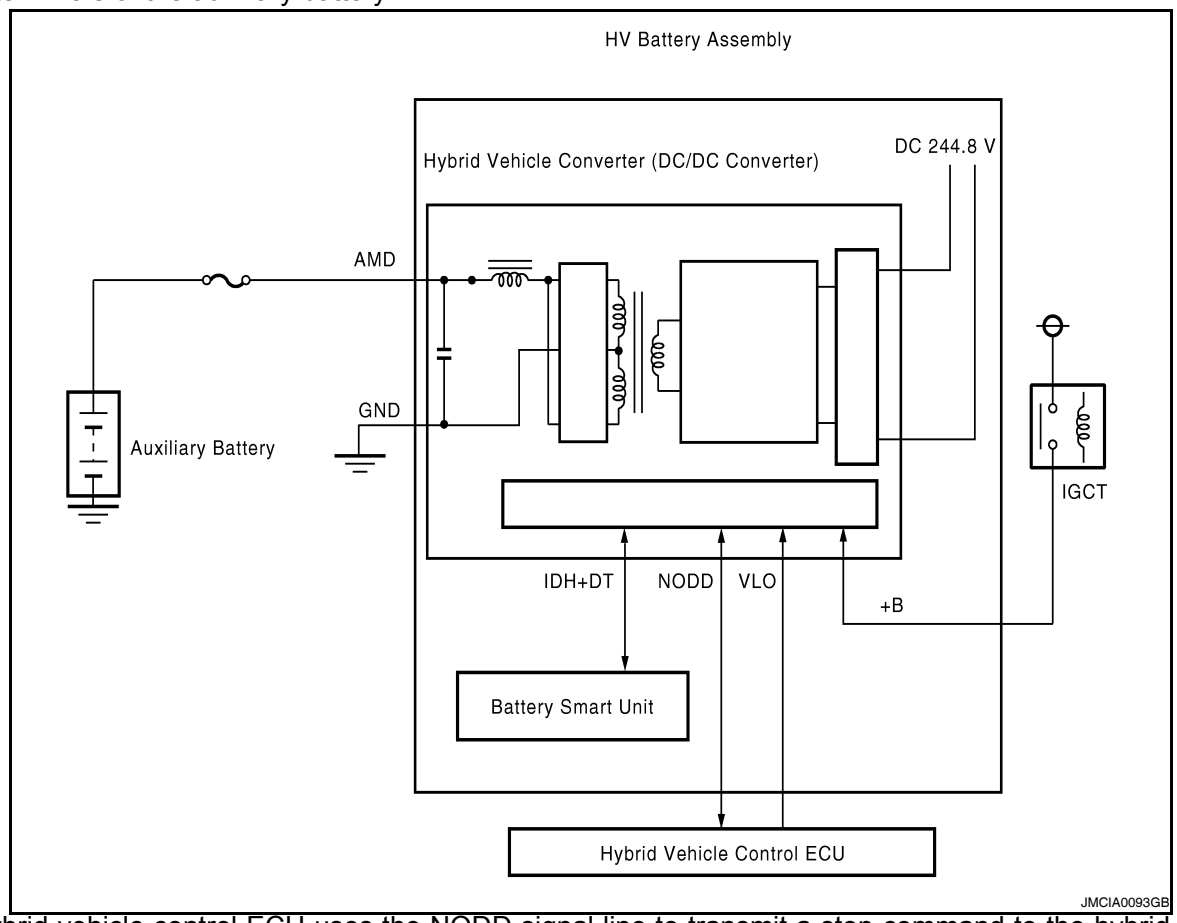
OK >> COMPLETED
NG >> Check and replace auxiliary battery.

P0A08-264

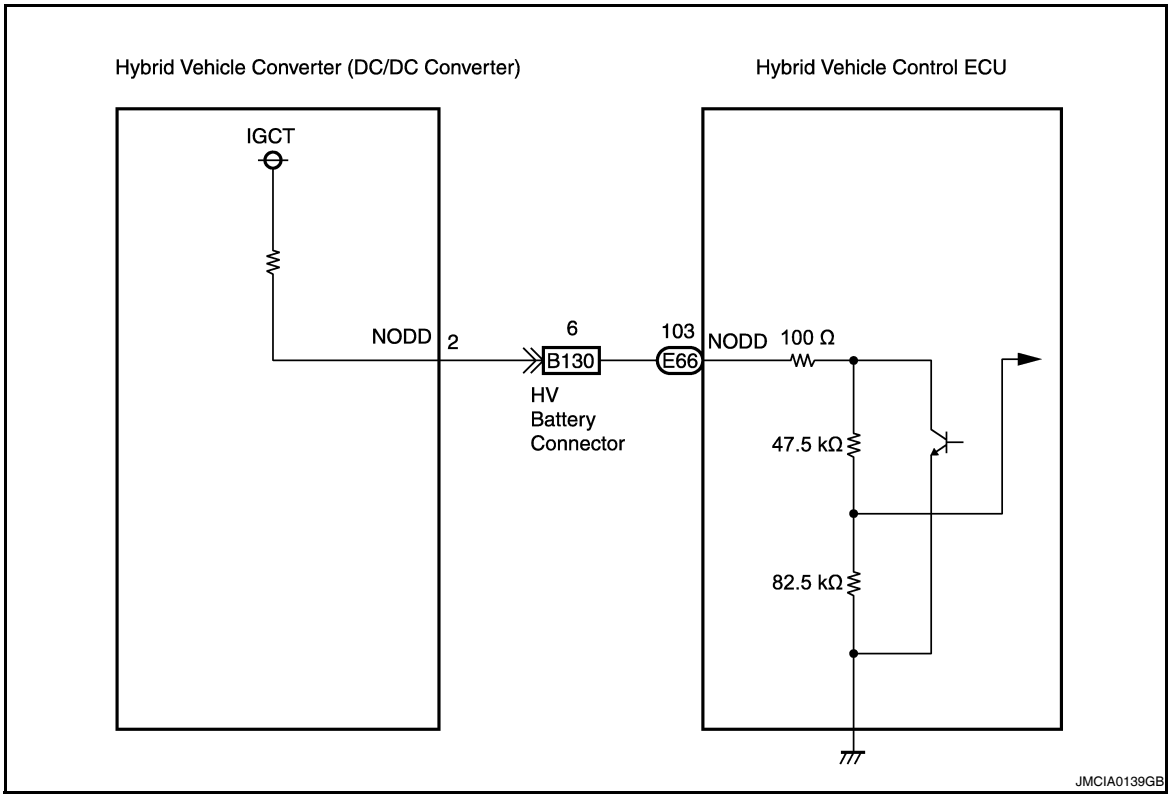
Description

INFOID:0000000004211789

The hybrid vehicle converter (DC/DC converter) converts the DC 244.8 V of the HV battery into DC 12 V in order to supply power to areas such as the vehicle's lighting, audio, and ECU systems. In addition, it charges the auxiliary battery.
A transistor bridge circuit initially converts DC 244.8 V into alternating current, and a transformer lowers its voltage. Then, it is rectified and smoothed (into DC) and converted into DC 12 V.
The hybrid vehicle converter (DC/DC converter) controls the output voltage in order to keep a constant voltage at the terminals of the auxiliary battery.



The hybrid vehicle control ECU uses the NODD signal line to transmit a stop command to the hybrid vehicle converter (DC/DC converter) and receive signals indicating the normal or abnormal condition of the 12 V charging system.
If the vehicle is being driven with an inoperative hybrid vehicle converter (DC/DC converter), the voltage of the auxiliary battery will drop, which will prevent the continued operation of the vehicle. Therefore, the hybrid vehicle control ECU monitors the operation of the hybrid vehicle converter (DC/DC converter) and alerts the driver if it detects a malfunction.



DTC Logic

INFOID:0000000004211790

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A08	264	DC/DC converter status circuit	Malfunction in the hybrid vehicle converter (DC/DC converter)	• Wire harness or connector • Fusible link or fuse • Frame wire • Hybrid vehicle converter (DC/DC connector) • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211791

1.PRECONDITIONING

- 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. 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 DTC OUTPUT

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

DTC No.	Relevant Diagnosis
P0A94-547, 548, 549, 550, 124, 125, 126, 127	Boost converter circuit
P0ABC-226, P0ADB-227, P0ADB-229, P0AF0-228	SMR circuit
P3004-131, 803	High-voltage system
P0AE6-225	SMRP circuit

Is DTC detected?

YES >> Go to the inspection procedure relevant to the output DTC.
NO >> GO TO 3.

3. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (HV BATTERY CONNECTOR)

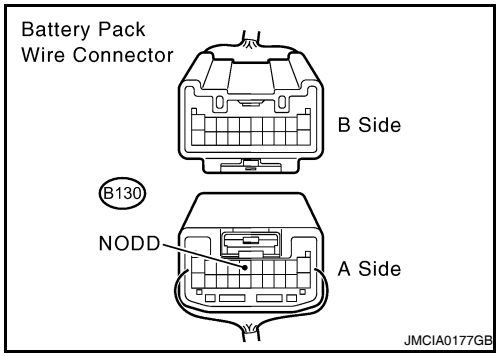
See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HARNESS AND CONNECTOR (RESISTANCE VALUE OF NODD INSIDE HYBRID VEHICLE CONTROL ECU)

1. Disconnect the HV battery harness connector B130 (See HBB-97, "Removal and Installation").
2. Measure the resistance according to the value(s) in the table below.



Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	6 (NODD)	Ground	120 to 140 kΩ

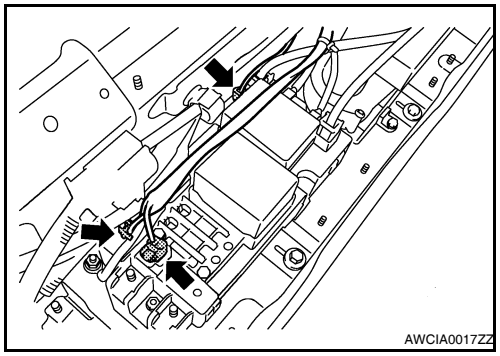
OK or NG

OK >> GO TO 6.
NG >> GO TO 12.

6. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not Turn ignition switch to READY position, unless instructed by the repair manual because this may cause a malfunction.
2. Check the connections of the HV relay assembly connectors.
   NOTE:
   For the removal procedure of the HV relay assembly connector, (See HBB-105, "Removal and Installation").



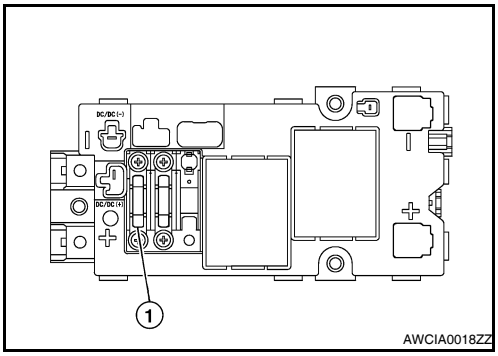
The connectors are connected securely and there are no contact problems.

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK HV RELAY ASSEMBLY (HIGH VOLTAGE FUSE)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Remove the HV relay assembly (See HBB-105, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



HV relay assembly		Resistance
Component connector	Terminal	
High voltage fuse (DC/DC) (1)	Both ends of fuse	Below 1Ω

OK or NG

OK >> GO TO 8.
NG >> Replace high voltage fuse.

8. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

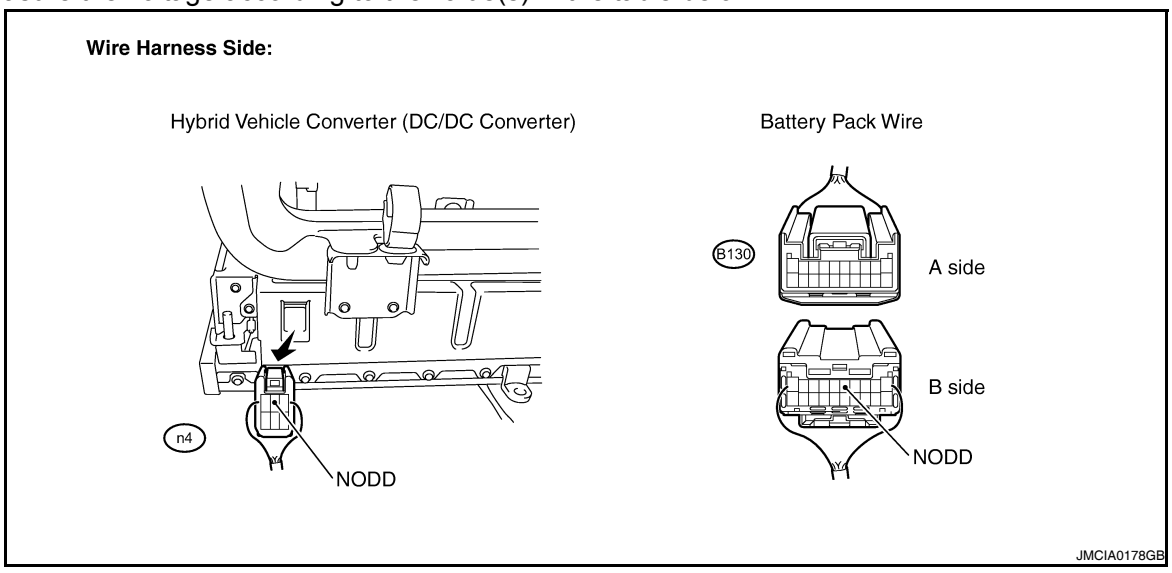
OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. CHECK HARNESS AND CONNECTOR (HV BATTERY CONNECTOR - HYBRID VEHICLE CONVERTER)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the hybrid vehicle converter connector (DC/DC converter) (See HBB-103, "Removal and Installation").
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.



Battery pack wire		Ground	Voltage
Harness connector	Terminal		
B130	6 (NODD)	Ground	Below 1 V

NOTE:
Turning ignition switch ON with the hybrid vehicle control ECU harness connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Check for open

Battery pack wire		Hybrid vehicle converter (DC/DC converter)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
B130	6 (NODD)	n4	2 (NODD)	Below 1Ω

Check for short

Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	6 (NODD)	Ground	10kΩ or higher

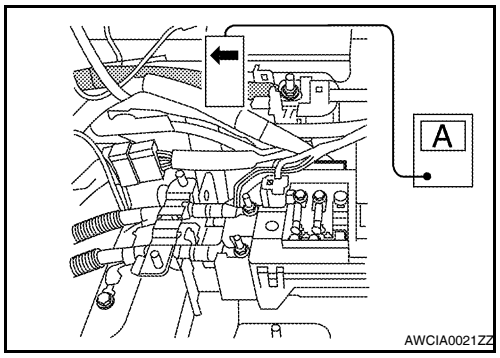
Hybrid vehicle converter (DC/DC converter)		Ground	Resistance
Harness connector	Terminal		
n4	2 (NODD)	Ground	10kΩ or higher

OK or NG

OK >> GO TO 10.
NG >> Repair or replace harness or connector.

10.CHECK HYBRID VEHICLE CONVERTER

1. Connect all the disconnected connectors.
2. Install the service plug grip.
3. Measure the current output from the hybrid vehicle converter (DC/DC converter) with the headlight position switch and blower motor switch in the HI position, and the rear window defogger turned on (*1).
4. Measure the auxiliary battery voltage according to the previous conditions (*1).



Item	Specified condition
Current flowing from the hybrid vehicle converter (DC/DC converter)	60 to 140 A
Auxiliary battery voltage	13 to 15 V

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid vehicle converter (See HBC-644, "Removal and Installation").

11.CHECK FOR INTERMITTENT INCIDENT

1. Check for intermittent incident (See GI-42, "Intermittent Incident").

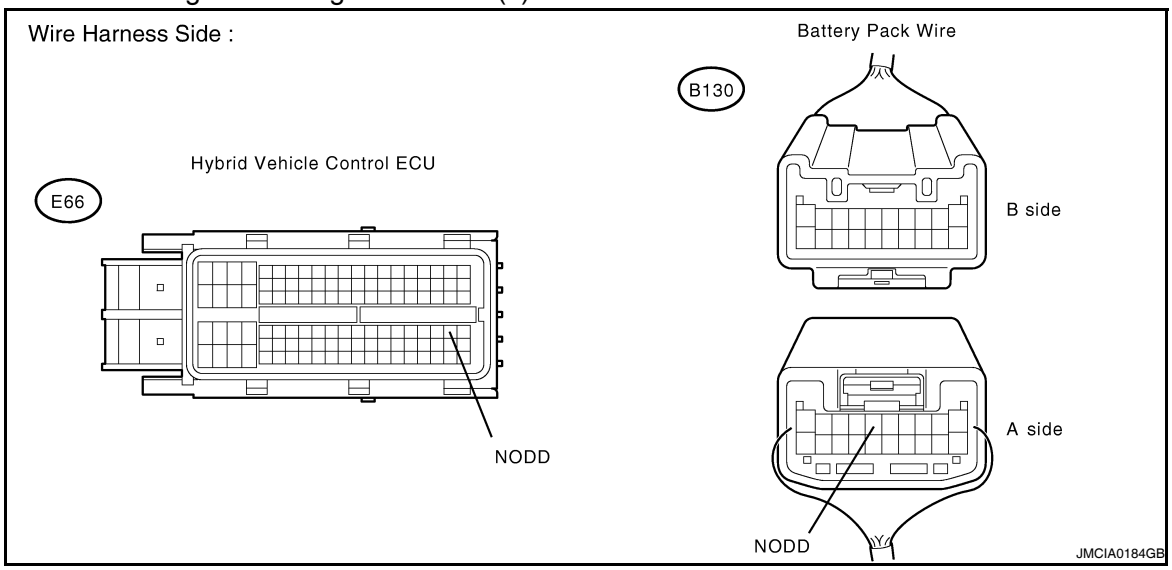
YES or NO

YES >> Repair or replace malfunctioning parts, component and area.
NO >> Replace hybrid vehicle converter (See HBC-644, "Removal and Installation").

12.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - HV BATTERY)

1. Disconnect the hybrid vehicle control ECU harness connector E66.
2. Turn ignition switch ON.

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



Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E66	103 (NODD)	Ground	Below 1 V

NOTE:
Turning ignition switch ON with the hybrid vehicle control ECU harness connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

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

Check for open

Hybrid vehicle control ECU		Battery pack wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	103 (NODD)	B130	6 (NODD)	Below 1Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	103 (NODD)	Ground	10kΩ or higher

Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	6 (NODD)	Ground	10kΩ or higher

OK or NG

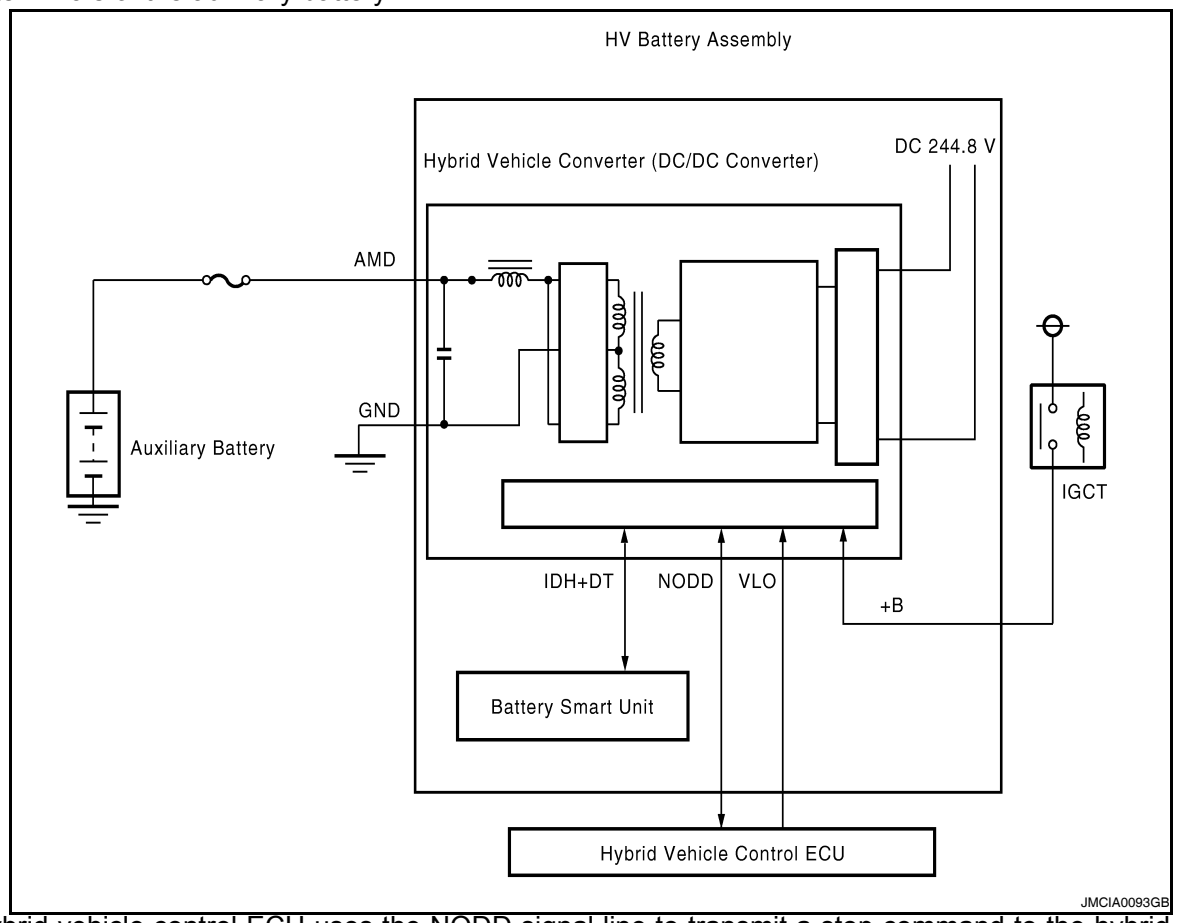
OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A09-265

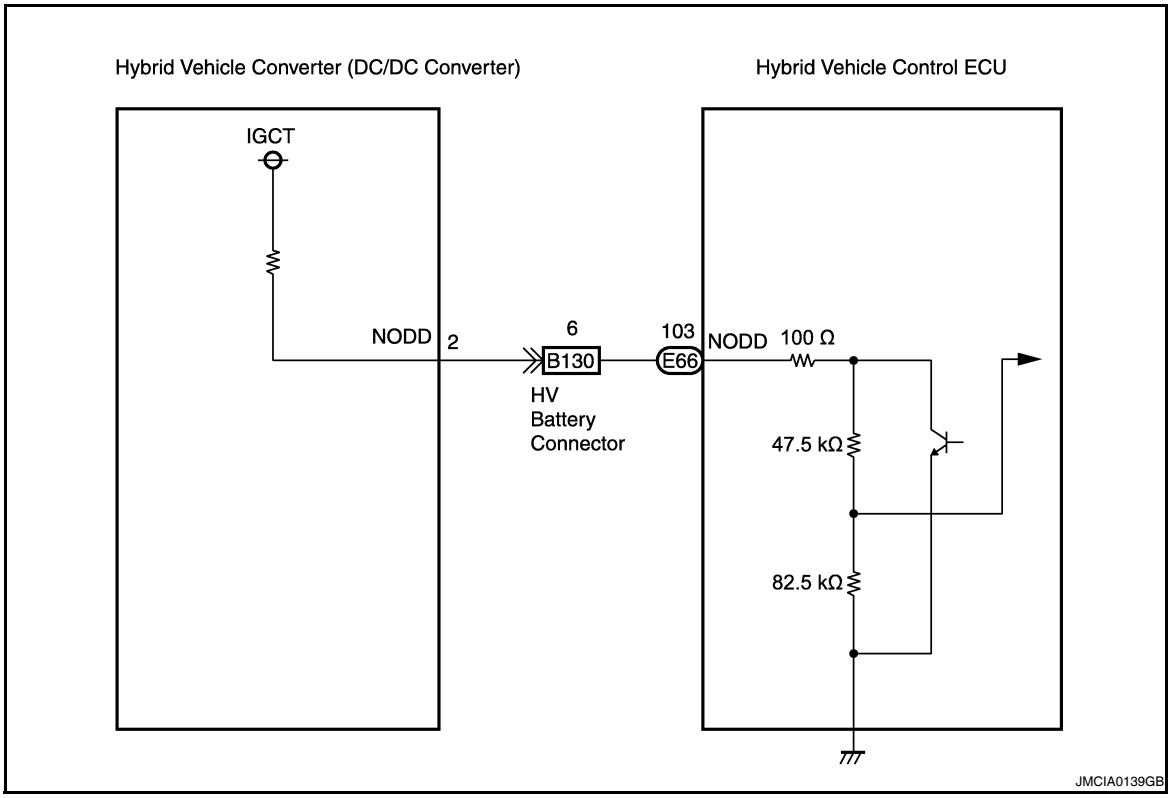
Description

INFOID:0000000004211792

The hybrid vehicle converter (DC/DC converter) converts the DC 244.8 V of the HV battery into DC 12 V in order to supply power to areas such as the vehicle's lighting, audio, and ECU systems. In addition, it charges the auxiliary battery.
A transistor bridge circuit initially converts DC 244.8 V into alternating current, and a transformer lowers its voltage. Then, it is rectified and smoothed (into DC) and converted into DC 12 V.
The hybrid vehicle converter (DC/DC converter) controls the output voltage in order to keep a constant voltage at the terminals of the auxiliary battery.



The hybrid vehicle control ECU uses the NODD signal line to transmit a stop command to the hybrid vehicle converter (DC/DC converter) and receive signals indicating the normal or abnormal condition of the 12 V charging system.
If the vehicle is being driven with an inoperative hybrid vehicle converter (DC/DC converter), the voltage of the auxiliary battery will drop, which will prevent the continued operation of the vehicle. Therefore, the hybrid vehicle control ECU monitors the operation of the hybrid vehicle converter (DC/DC converter) and alerts the driver if it detects a malfunction.



DTC Logic

INFOID:0000000004211793

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A09	265	DC/DC Converter Status Circuit Low Input	Open or short to GND in the hybrid vehicle converter (DC/DC converter) (NODD) signal line	• Wire harness or connector • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211794

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC P0AE6-225 detected?

YES >> Go to inspection procedure relevant to output DTC (P0AE6-225).
NO >> GO TO 3.

3.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> COnnect securely.

5. CHECK HARNESS AND CONNECTOR (RESISTANCE VALUE OF NODD INSIDE HYBRID VEHICLE CONTROL ECU)

See HBC-132, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> GO TO 8.

6. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HYBRID VEHICLE CONVERTER)

See HBC-132, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle converter (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

8. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

See HBC-132, "Diagnosis Procedure".

OK or NG

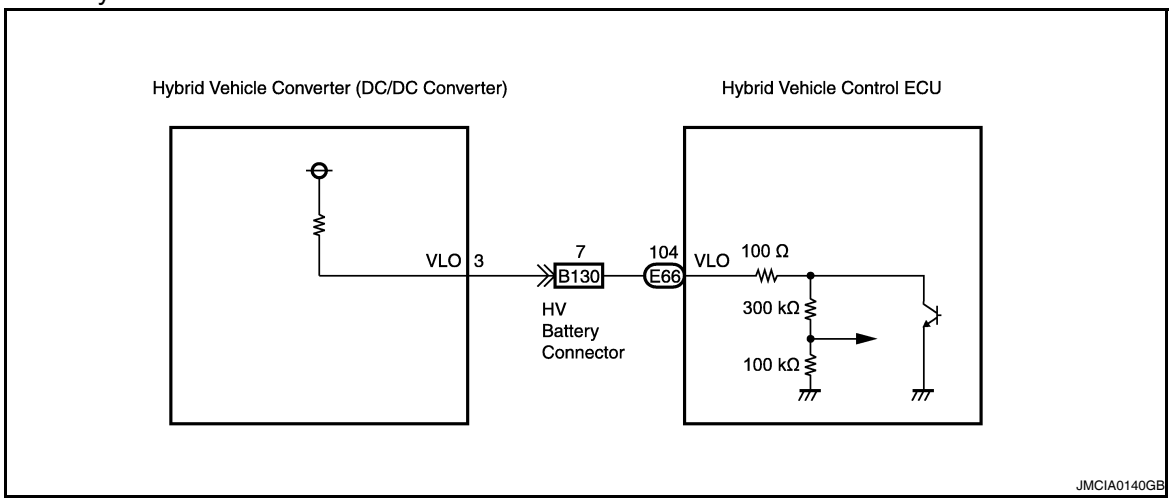
OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A09-591

Description

INFOID:0000000004211795

The hybrid vehicle converter (DC/DC converter) controls output voltage based on voltage switching signals sent from the hybrid vehicle control ECU.



DTC Logic

INFOID:0000000004211796

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A09	591	DC/DC Converter Status Circuit Low Input	Hybrid vehicle converter (DC/DC converter) voltage switching (VLO) signal circuit malfunction (Open or short to GND)	• Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004211797

1.PRECONDITIONING

- 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.
  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 DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC P0AE6-225 detected?

YES >> Go to inspection procedure relevant to output DTC (P0AE6-225).
NO >> GO TO 3.

3.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

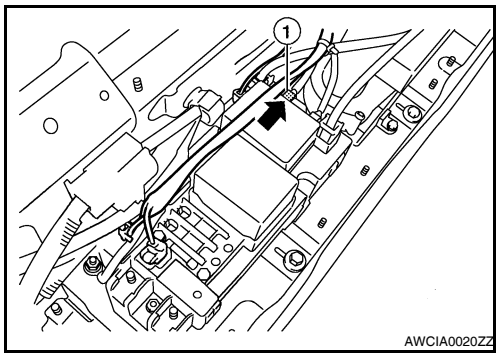
See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

1. Check the connection of the battery pack wire connector (1).



The connector is connected securely and there are no contact problems.

NOTE:
For the removal and installation procedures related to inspection of the connection of the battery pack wire connector, (See HBB-97, "Removal and Installation").

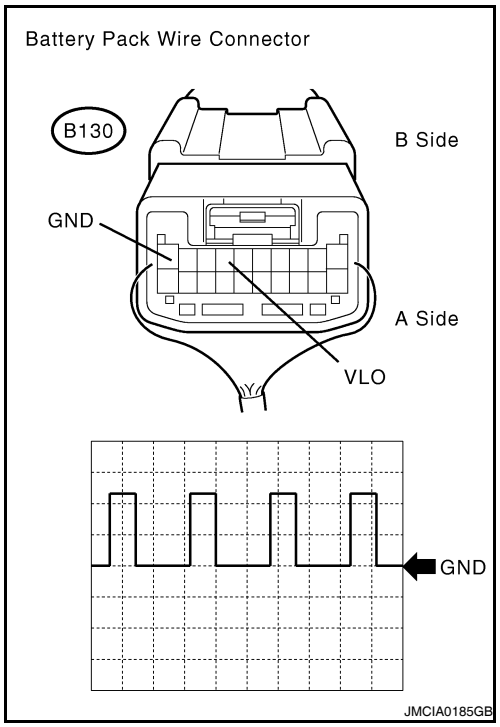
OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HYBRID VEHICLE CONTROL ECU

1. Connect an oscilloscope between the battery pack wire terminals specified in the table below, and measure the waveform.

Item	Contents
Terminal (A side)	7 (VLO) - 10 (GND)
Equipment Setting	5 V/DIV, 50 ms./DIV
Condition	Ignition switch ON



NOTE:
Perform this inspection with the battery pack wire connected.

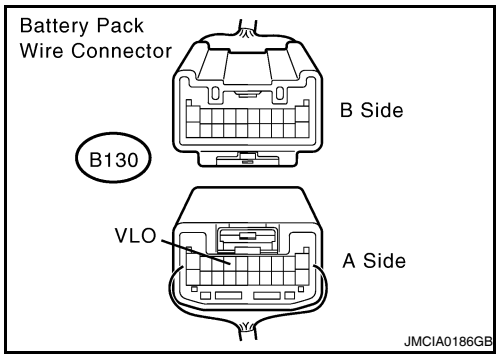
OK or NG

OK >> GO TO 10.
NG >> GO TO 6.

6. CHECK HARNESS AND CONNECTOR (RESISTANCE VALUE INSIDE HYBRID VEHICLE CONTROL ECU)

1. Disconnect the battery pack wire connector B130.
2. Check that auxiliary battery terminal is disconnected.
3. Measure the resistance according to the value(s) in the table below.

Battery pack wire connector		Ground	Resistance
Component connector	Terminal		
B130	7 (VLO)	Ground	370 to 430 kΩ



OK or NG

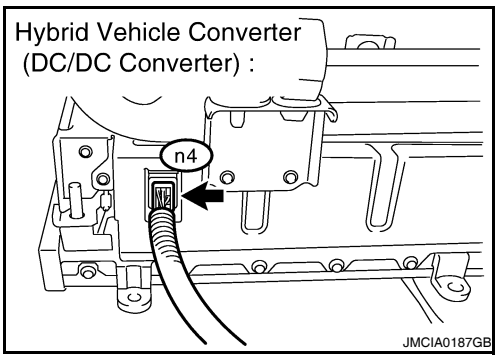
OK >> GO TO 7.
NG >> GO TO 9.

7. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

CAUTION:

Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check the connection of the hybrid vehicle converter (DC/DC converter) connector.



- **The connector is connected securely and there are no contact problems.**
- **Dirt or foreign objects have not entered the connector or there is no evidence of contamination.**

OK or NG

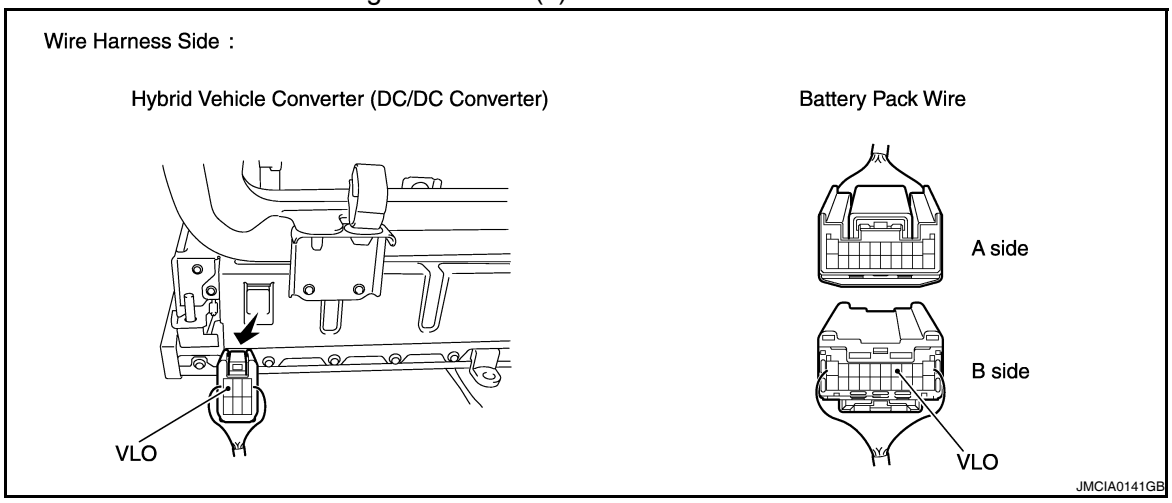
OK >> GO TO 8.
NG >> Connect securely.

8. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HYBRID VEHICLE CONVERTER)

CAUTION:

Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



Check for open

Battery pack wire		Hybrid vehicle converter (DC/DC converter)		Resistance
Component connector	Terminal	Harness connector	Terminal	
B130	7 (VLO)	n4	3 (VLO)	Below 1Ω

Check for short

Battery pack wire		Ground	Resistance
Component connector	Terminal		
B130	7 (VLO)	Ground	10 kΩ or higher

Hybrid vehicle converter (DC/DC converter)		Ground	Resistance
Harness connector	Terminal		
n4	3 (VLO)	Ground	10 kΩ or higher

OK or NG

OK >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").
NG >> Repair or replace harness or connector.

9. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

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

Check for open

Hybrid vehicle control ECU		Battery pack wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	104 (VLO)	B130	7 (VLO)	Below 1Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	104 (VLO)	Ground	10 kΩ or higher

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
B130	7 (VLO)	Ground	10 kΩ or higher

OK or NG

OK >> GO TO 10
NG >> Repair or replace harness or connector.

10. CLEAR DTC

1. Reconnect all harness connectors disconnected.
2. Turn ignition switch ON.
3. Read and record the DTCs and freeze frame data.
4. Clear the DTCs.

>> GO TO 11.

11. RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC P0A09-591 detected?

YES >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NO >> GO TO 12.

12. CHECK FOR INTERMITTENT INCIDENT

1. Check for intermittent incident (See GI-42, "Intermittent Incident").

OK or NG

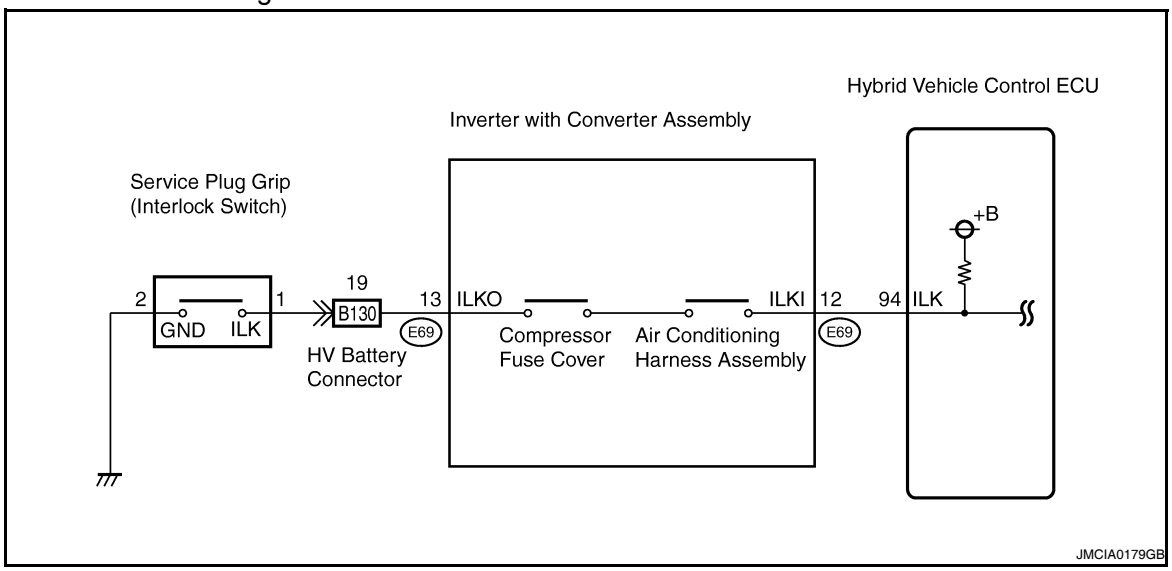
OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace malfunctioning parts, component and area.

P0A0D-350, P0A0D-351

Description

INFOID:0000000004211798

When the hybrid vehicle control ECU detects that a safety device is operated, it will prohibit the hybrid system operation or shut off the system main relay. There are three safety devices in three different locations. The first safety device is located at the service plug grip. The second one is located at the air conditioner fuse maintenance compressor fuse cover of the inverter with converter assembly. The third one is located at the air conditioning harness assembly that is connected to the inverter with converter assembly.
If the service plug grip, compressor fuse cover, or air conditioning harness assembly is removed, the interlock signal line will be open. If the vehicle is being driven, this condition will be determined to be an open malfunction and the system main relay will not be shut off. If the safety devices are installed correctly, the system returns to normal when the ignition switch is turned ON.



DTC Logic

INFOID:0000000004211799

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A0D	350	High Voltage System Inter-Lock Circuit High	Operating any of the safety devices with the vehicle stopped (ILK signal is ON)	• Wire harness or connector • Hybrid vehicle control ECU • Service plug grip • Inverter with converter assembly • Air conditioning harness assembly
P0A0D	351	High Voltage System Inter-Lock Circuit High	Interlock signal line opens while the vehicle is being driven	• Wire harness or connector • Hybrid vehicle control ECU • Service plug grip • Inverter with converter assembly • Air conditioning harness assembly

Diagnosis Procedure

INFOID:0000000004211800

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC P0A1D detected?

YES >> Go to inspection procedure relevant to output DTC.
NO >> GO TO 3.

3. CLEAR DTC (HYBRID SYSTEM)

1. Turn ignition switch ON.
2. Read and record the DTC and freeze frame data.
3. Clear the DTC.

>> GO TO 4.

4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
2. Check if the inverter with converter assembly is installed correctly.

The inverter with converter assembly is installed correctly.

YES >> GO TO 5.
NO >> Connect securely.

5. RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC P0A0D-350 or P0A0D-351 detected again?

YES >> GO TO 6.
NO >> GO TO 15.

6. CHECK SERVICE PLUG GRIP

CAUTION:
Be sure to wear insulated gloves.

1. Check if the service plug grip is installed correctly.
   NOTE:
   For the removal and installation procedures, (See HBC-632, "Precautions for Inspecting the Hybrid Control System").

The service plug grip is installed correctly.

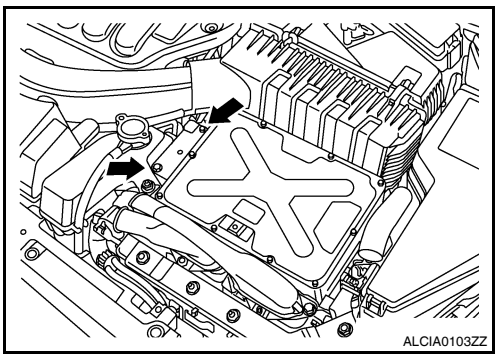
YES >> GO TO 7.
NO >> Connect securely.

7. CHECK INVERTER WITH CONVERTER ASSEMBLY (COMPRESSOR FUSE COVER INSTALLATION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").

2. Check if the compressor fuse cover of the inverter with converter assembly is installed correctly.


ALCIA0103ZZ

Tightening torque: 5.0 N·m (0.51 kg-m, 44 in-lb)

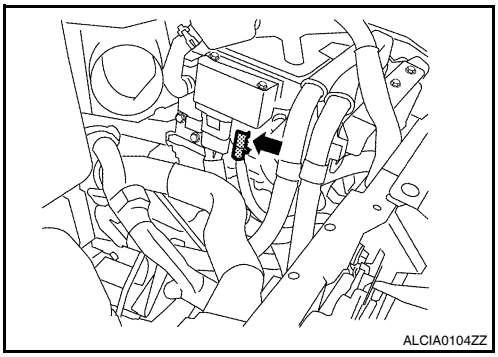
The compressor fuse cover of the inverter with converter assembly is installed correctly.

YES >> GO TO 8.
NO >> Connect securely.

8. CHECK AIR CONDITIONING HARNESS ASSEMBLY (AIR CONDITIONING HARNESS ASSEMBLY CONNECTION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check if the air conditioning harness assembly connector is connected correctly.


ALCIA0104ZZ

Tightening torque: 5.0 N·m (0.51 kg-m, 44 in-lb)

The air conditioning harness assembly connector is connected correctly.

YES >> GO TO 9.
NO >> Connect securely.

9. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

Refer to HBC-109, "Diagnosis Procedure".

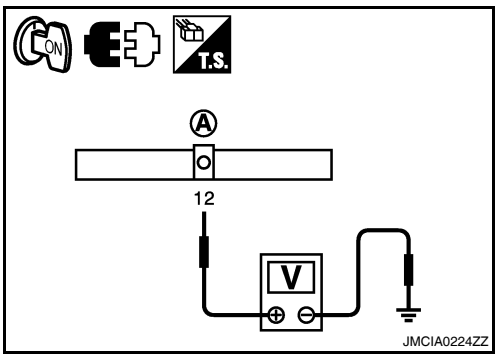
OK or NG

OK >> GO TO 10.
NG >> Connect securely.

10. CHECK HYBRID VEHICLE CONTROL ECU

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
   NOTE:
   After removing the service plug grip, do not turn ignition switch to READY position, unless instructed by the repair manual because this may cause a malfunction.
2. Disconnect the inverter with converter assembly harness connector E69.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.



JMCIA0224ZZ

Inverter with converter assembly (A)		Ground	Voltage
Harness connector	Terminal		
E69	12 (ILKI)	Ground	9 to 14 V

NOTE:
Turning ignition switch ON with the inverter with converter assembly harness connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

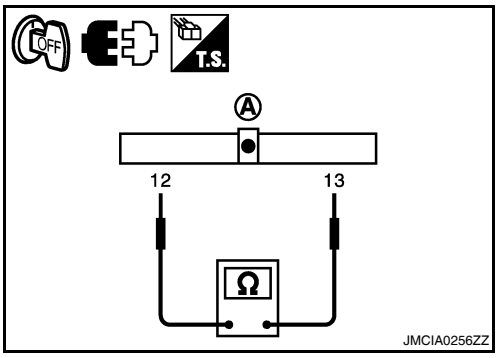
OK or NG

OK >> GO TO 11.
NG >> GO TO 21.

11. CHECK INVERTER WITH CONVERTER ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Measure the resistance according to the value(s) in the table below.



Inverter with converter assembly		Inverter with converter assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E69	12 (ILKI)	E69	13 (ILKO)	1Ω or less

OK or NG

OK >> GO TO 12.
NG >> GO TO 19.

12. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

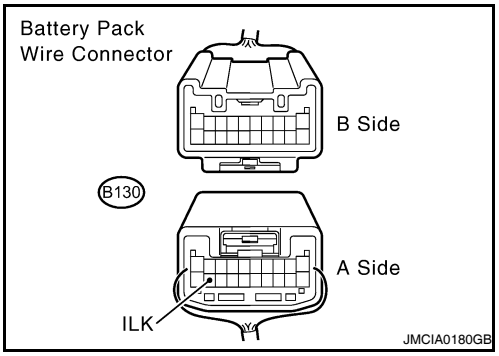
Refer to HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Connect securely.

13. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - BATTERY PACK WIRE)

1. Connect the inverter with converter assembly harness connector.
2. Disconnect the battery pack wire harness connector B130. (See HBB-97, "Removal and Installation").
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.



Battery pack wire connector		Ground	Voltage
Harness connector	Terminal		
B130	19 (ILK)	Ground	9 to 14 V

NOTE:
Turning ignition switch ON with the battery pack wire harness connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

OK >> GO TO 14.
NG >> Repair or replace harness or connector.

14. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE - BODY GROUND)

1. Connect service plug grip. Refer to HBC-632, "Precautions for Inspecting the Hybrid Control System".
2. Measure the resistance according to the value(s) in the table below.

Battery pack wire connector		Ground	Resistance
Harness connector	Terminal		
B130	19 (ILK)	Ground	Below 1Ω

OK or NG

OK >> GO TO 15.
NG >> GO TO 16.

15. CHECK CONNECTOR CONNECTION CONDITION (INTERLOCK CIRCUIT)

1. Check the connections of each connector.

- **Dirt or foreign objects have not entered the connection**
- **There is no evidence of contamination.**

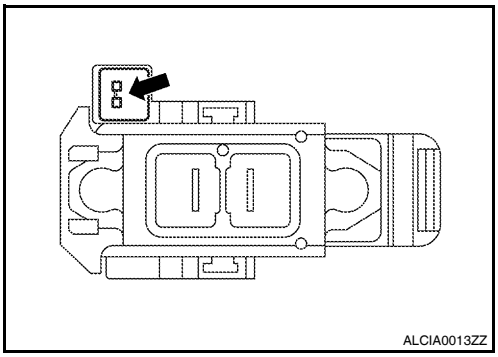
OK or NG

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

16. CHECK SERVICE PLUG GRIP

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch to READY position, unless instructed by the repair manual because this may cause a malfunction.
2. Check the condition of the service plug grip interlock.



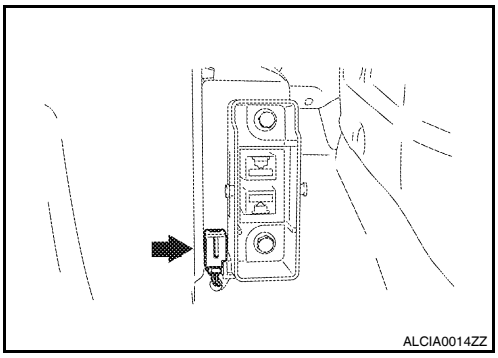
- **Dirt or foreign objects have not entered the connection**
- **There is no evidence of contamination.**

OK or NG

OK >> GO TO 17.
NG >> Replace service plug grip.

17. CHECK HARNESS AND CONNECTOR (INTERLOCK CONNECTOR CONNECTION CONDITION)

1. Check that the interlock connector at the service plug grip installation socket is connected correctly.



The connector is connected correctly.

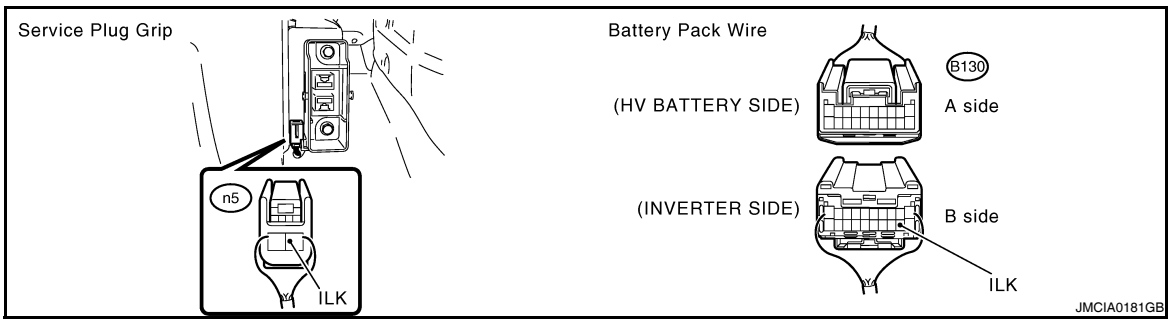
OK >> GO TO 18.
NG >> Connect securely.

18. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - SERVICE PLUG GRIP)

CAUTION:
Be sure to wear insulated gloves.

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

Battery pack wire		Service plug grip		Resistance
Component connector	Terminal	Harness connector	Terminal	
B130	19 (ILK)	n5	1 (ILK)	Below 1Ω



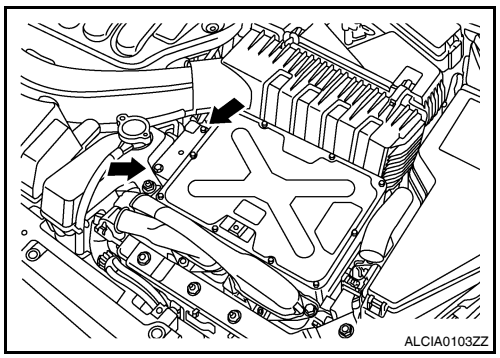
OK or NG

OK >> Repair or replace harness or connector (service plug grip - body ground).
NG >> Repair or replace harness or connector (battery pack wire connector - service plug grip).

19. CHECK INVERTER WITH CONVERTER ASSEMBLY (COMPRESSOR FUSE COVER OF INVERTER WITH CONVERTER ASSEMBLY)

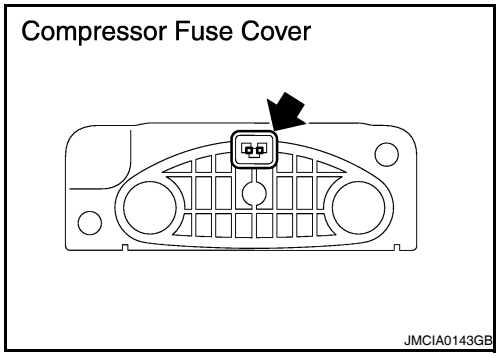
CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch to READY position, unless instructed by the repair manual because this may cause a malfunction.
2. Remove the compressor fuse cover from the inverter with converter assembly.



3. Check the condition of the compressor fuse cover interlock.

   - **Dirt or foreign objects have not entered the connection**
   - **There is no evidence of contamination.**



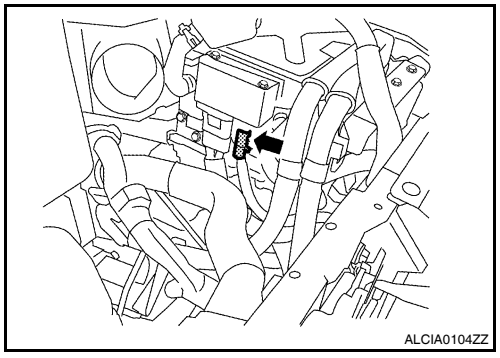
OK or NG

OK >> GO TO 20.
NG >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

20. CHECK AIR CONDITIONING HARNESS ASSEMBLY (INTERLOCK)

CAUTION:
Be sure to wear insulated gloves.

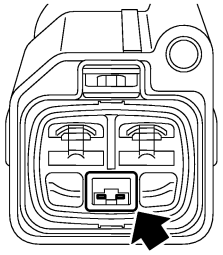
1. Check that the service plug grip is not installed.
2. Remove the air conditioning harness assembly from the inverter with converter assembly.



3. Check the condition of the air conditioning harness assembly interlock.

- **Dirt or foreign objects have not entered the connection**
- **There is no evidence of contamination.**

Air Conditioning Harness Assembly



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OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace air conditioning harness assembly.

21. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

Refer to HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 22.
NG >> Connect securely.

22. CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - INVERTER WITH CONVERTER ASSEMBLY)

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

Hybrid vehicle control ECU		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	94 (ILK)	E69	12 (ILKI)	Below 1Ω

OK or NG

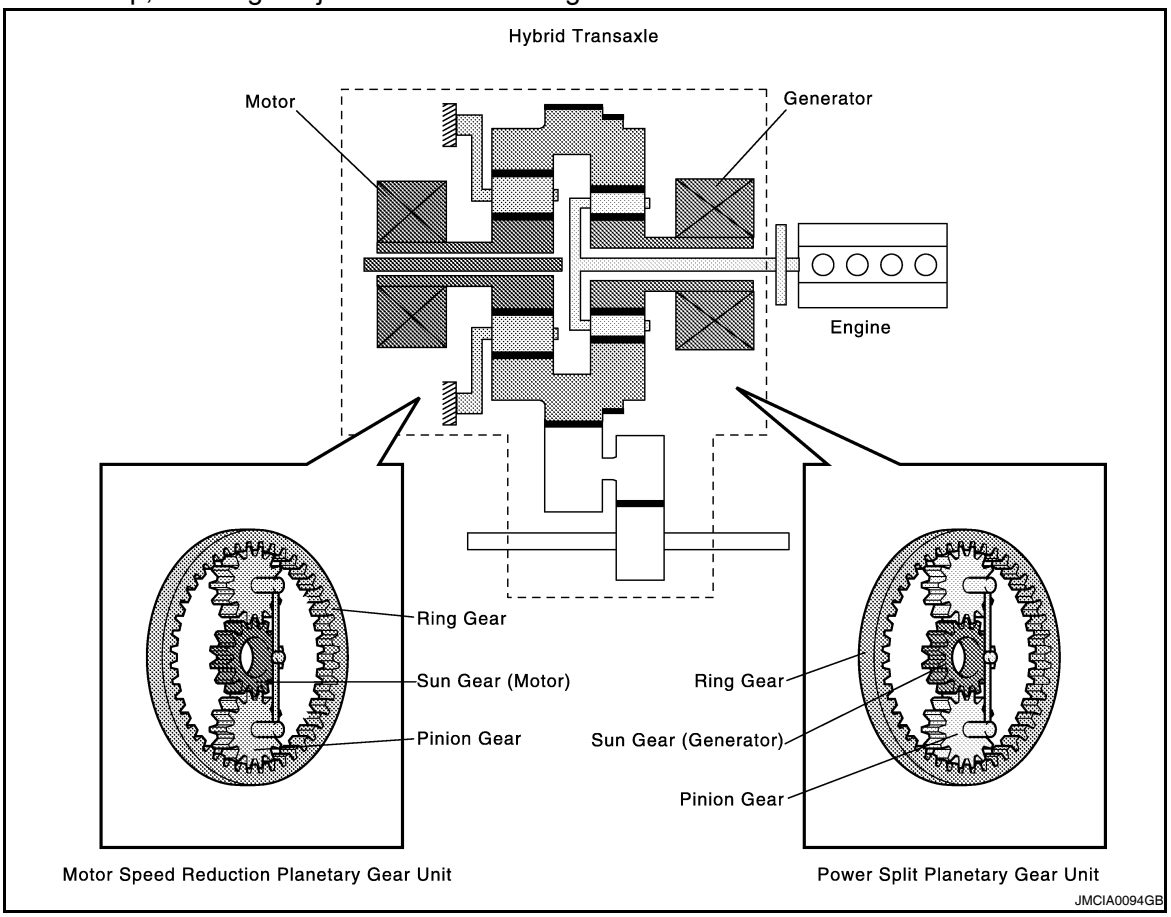
OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A0F-238

Description

INFOID:0000000004211801

The hybrid vehicle control ECU detects this DTC and effects fail-safe control if the engine or hybrid transaxle gear has seized up, or foreign objects have been caught in either of them.



NOTE:
If this DTC is output, the engine or hybrid transaxle gear may be seized up. Be sure to check the level of the engine oil, hybrid transaxle oil (ATF), and coolant before inspection.

DTC Logic

INFOID:0000000004211802

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A0F	238	Engine failed to start	Engine does not start even though cranking it [hybrid transaxle input malfunction (engine system)]	• Engine • Hybrid transaxle (shaft, gear) • Transmission input damper • Wire harness or connector • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211803

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (ENGINE)

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

Is DTC detected?

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

3.CHECK CRANKSHAFT PULLEY REVOLUTION (P POSITION)

1. Turn ignition switch OFF, move the shift lever to the P position, and lift up the vehicle.
2. Turn the crankshaft pulley by hand to check if the crankshaft rotates.

CAUTION:
Do not turn ignition switch to READY position while performing this inspection. Be sure to turn ignition switch OFF before performing this inspection, to prevent the engine from starting.

The crankshaft rotates.

OK or NG

OK >> GO TO 4.
NG >> GO TO 12.

4.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - CRANKSHAFT POSITION SENSOR)

See EC-252, "Diagnosis Procedure".

OK or NG

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

5.INSPECT CRANKSHAFT POSITION SENSOR

See EC-253, "Component Inspection".

OK or NG

OK >> GO TO 6.
NG >> Replace crankshaft position sensor.

6.CHECK DTC OUTPUT (HYBRID SYSTEM)

1. Check DTC.
2. Confirm and record the DTCs, freeze frame data, and information for the HV system.

>> GO TO 7.

7.CLEAR DTC

1. Clear DTC.

>> GO TO 8.

8.CHECK READY LIGHT ON

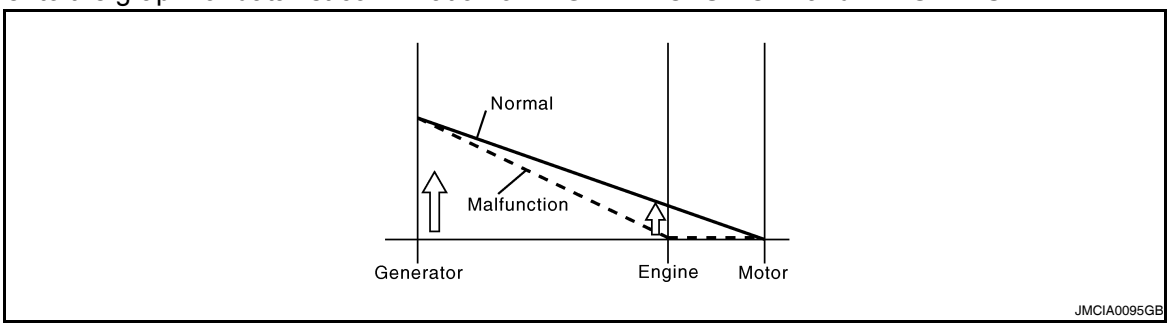
1. Turn ignition switch ON.
2. Select “MG1 REVOLUTION” and “ENGINE SPEED” in “” mode with CONSULT-III.
3. Depress the brake pedal and turn ignition switch to READY position.

The READY light comes on.

NOTE:

- If the READY light does not come on and the reading on the CONSULT-III shows DTC P0A90-239 (hybrid transaxle input malfunction [shaft damaged]), or the READY light comes on and MG1 turns but the engine does not crank, replace the hybrid transaxle.
- If this DTC (P0A0F-238) is output, the HV battery may be dead and DTC P3000-388 or P3000-389 may be output.

4. Refer to the graph for data list confirmation of “MG1 REVOLUTION” and “ENGINE SPEED”.



Engine speed	Generator speed
Approx. 900 rpm	Approx. 3,200 rpm
Approx. 1,500 rpm	Approx. 5,400 rpm

OK or NG

OK >> GO TO 9.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

9. CHECK ENGINE RACING

1. Turn ignition switch to READY position.
2. While the READY light is on, depress the accelerator pedal for 10 seconds with the shift lever in the P position.

The engine revs up.

NOTE:
If the engine does not rev up and the reading on the CONSULT-III shows DTC P3147-239 (hybrid transaxle input malfunction [shaft damaged]), or the Generator turns but the engine does not crank, replace the hybrid transaxle.

OK or NG

OK >> GO TO 10.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

10. CHECK CREEP MOVEMENT

1. Depress the brake pedal, move the shift lever to the D position, and release the brake pedal.

The wheels turn (creeping along).

NOTE:
If the wheels do not turn and the reading on the CONSULT-III shows DTC P3147 (hybrid transaxle malfunction), replace the hybrid transaxle.

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

11. CHECK ENGINE SPEED

1. While driving at the vehicle speed of more than 6 mph (10 km/h), fully depress the accelerator pedal to raise the engine speed.

Engine speed increases smoothly.

NOTE:

If the engine over-revs or the reading on the CONSULT-III shows DTC P3147-241 (hybrid transaxle input malfunction [torque limiter slipping]), replace the transmission input damper.

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Replace transmission input damper assembly.

12. CHECK FRONT TIRE REVOLUTION

1. Stop vehicle and turn ignition switch OFF.
2. Lift up the vehicle.
3. Move the shift lever to the N position.
   CAUTION:
   Do not turn ignition switch to READY position while performing this inspection. Be sure to turn ignition switch OFF before performing this inspection, to prevent the engine from starting.
4. Turn the crank pulley by hand to check if the front tires rotate.

The front tires do not rotate.

OK or NG

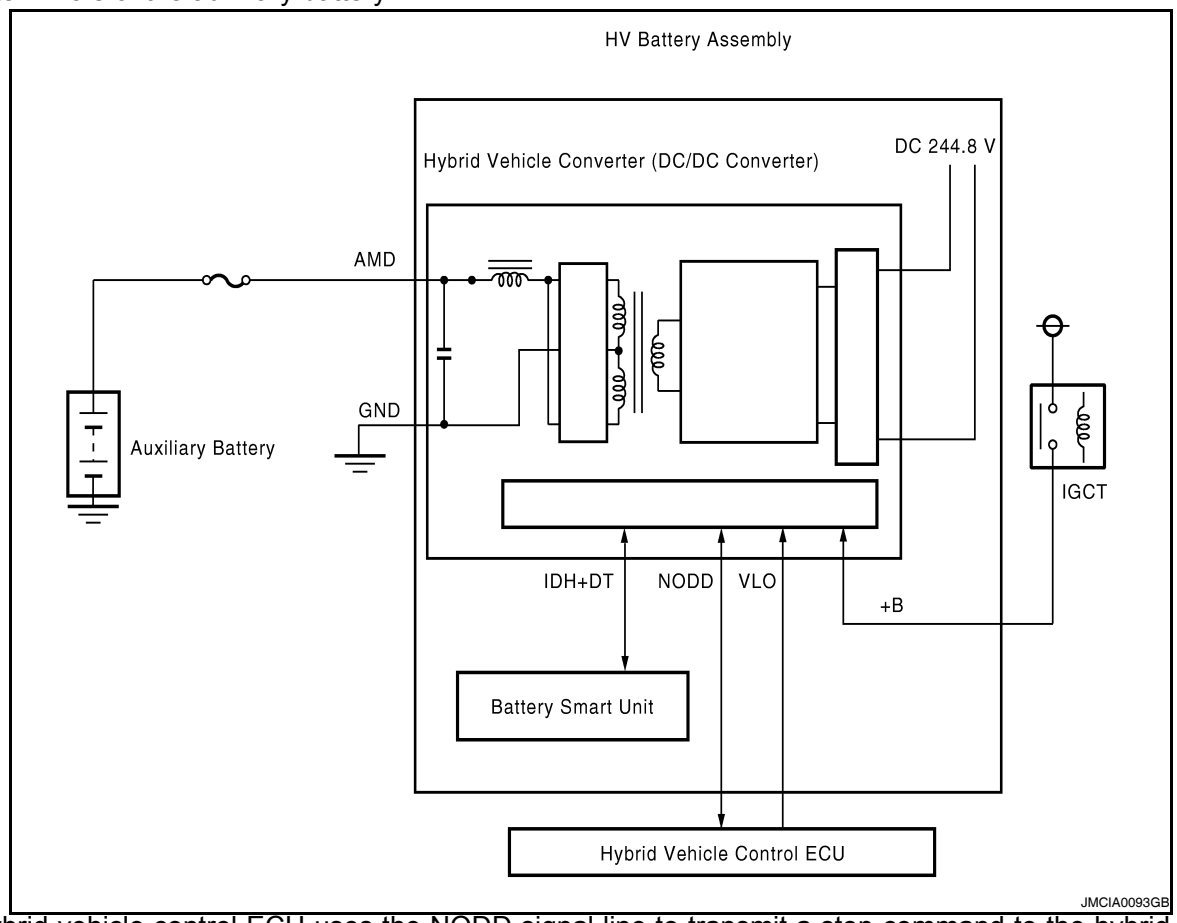
OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Check and repair engine.

P0A10-263

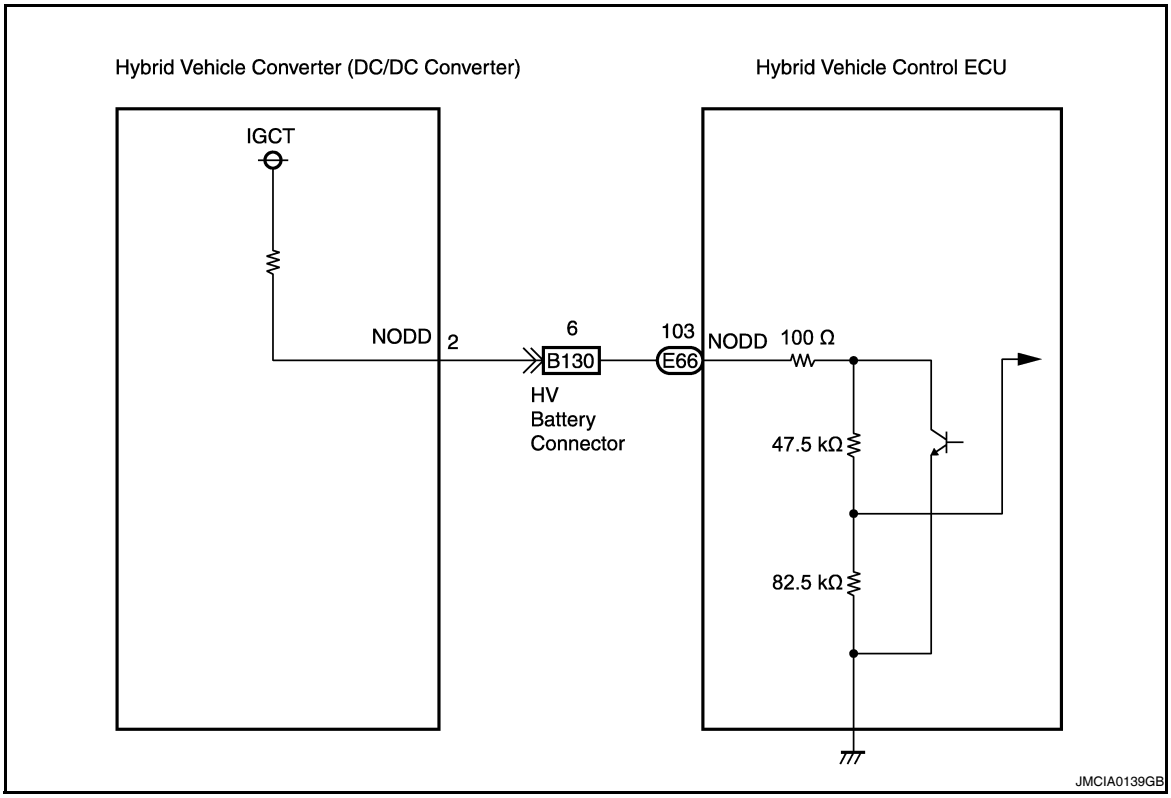
Description

INFOID:0000000004211804

The hybrid vehicle converter (DC/DC converter) converts the DC 244.8 V of the HV battery into DC 12 V in order to supply power to areas such as the vehicle's lighting, audio, and ECU systems. In addition, it charges the auxiliary battery.
A transistor bridge circuit initially converts DC 244.8 V into alternating current, and a transformer lowers its voltage. Then, it is rectified and smoothed (into DC) and converted into DC 12 V.
The hybrid vehicle converter (DC/DC converter) controls the output voltage in order to keep a constant voltage at the terminals of the auxiliary battery.



The hybrid vehicle control ECU uses the NODD signal line to transmit a stop command to the hybrid vehicle converter (DC/DC converter) and receive signals indicating the normal or abnormal condition of the 12 V charging system.
If the vehicle is being driven with an inoperative hybrid vehicle converter (DC/DC converter), the voltage of the auxiliary battery will drop, which will prevent the continued operation of the vehicle. Therefore, the hybrid vehicle control ECU monitors the operation of the hybrid vehicle converter (DC/DC converter) and alerts the driver if it detects a malfunction.



DTC Logic

INFOID:0000000004211805

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A10	263	DC/DC Converter Status Circuit High Input	+B short in hybrid vehicle converter (DC/DC converter) NODD signal line	• Wire harness or connector • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211806

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

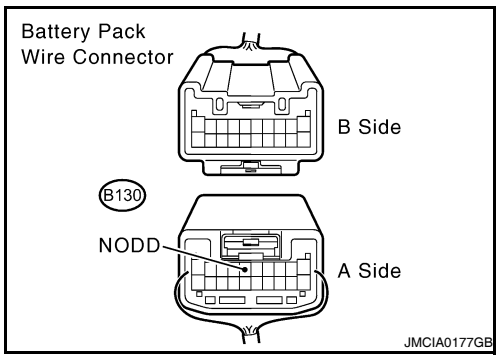
Are DTC P0A10-263 and other DTCs detected?

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

3.CHECK HARNESS AND CONNECTOR

1. Turn ignition switch OFF.

2. Disconnect the battery pack wire connector B130 (See HBB-97, "Removal and Installation").
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.



Battery pack wire		Ground	Voltage
Harness connector	Terminal		
B130	6 (NODD)	Ground	Below 1 V

NOTE:
Turning ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

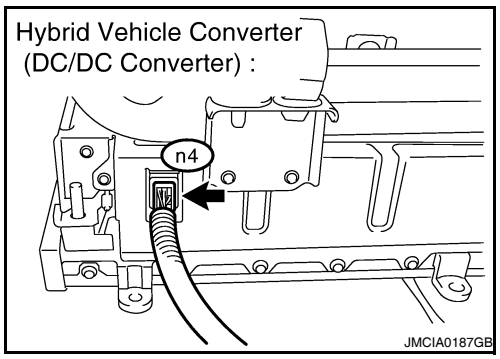
OK or NG

OK >> GO TO 4.
NG >> GO TO 5.

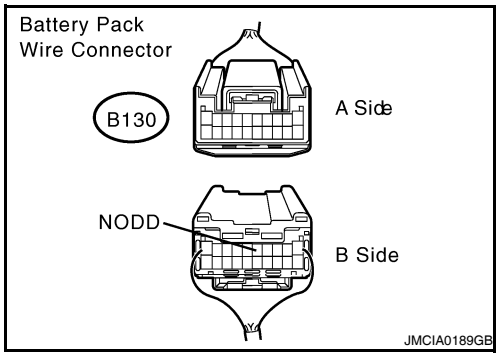
4. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HYBRID VEHICLE CONVERTER)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Check that the service plug grip is not installed.
3. Disconnect the hybrid vehicle converter (DC/DC converter) connector n4 (See HBB-103, "Removal and Installation").
4. Turn ignition switch ON.



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



Battery pack wire		Ground	Voltage
Component connector	Terminal		
B130	6 (NODD)	Ground	Below 1 V

NOTE:
Turning ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

6. Turn ignition switch OFF.
7. Measure the resistance according to the value(s) in the table below.

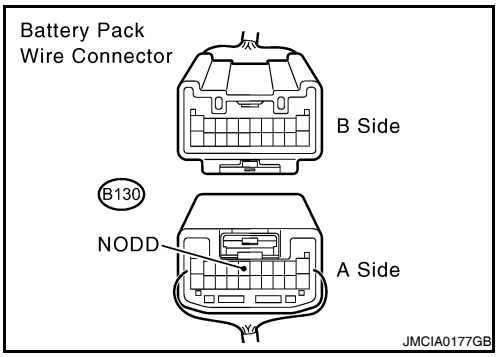
Battery pack wire connector		Ground	Resistance
Component connector	Terminal		
B130	6 (NODD)	Each of the other terminals	10 kΩ or higher

OK or NG

OK >> Replace hybrid vehicle converter (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

5. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE)

1. Disconnect the hybrid vehicle control ECU harness connector E66.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.



Battery pack wire		Ground	Voltage
Harness connector	Terminal		
B130	6 (NODD)	Ground	Below 1 V

NOTE:
Turning ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

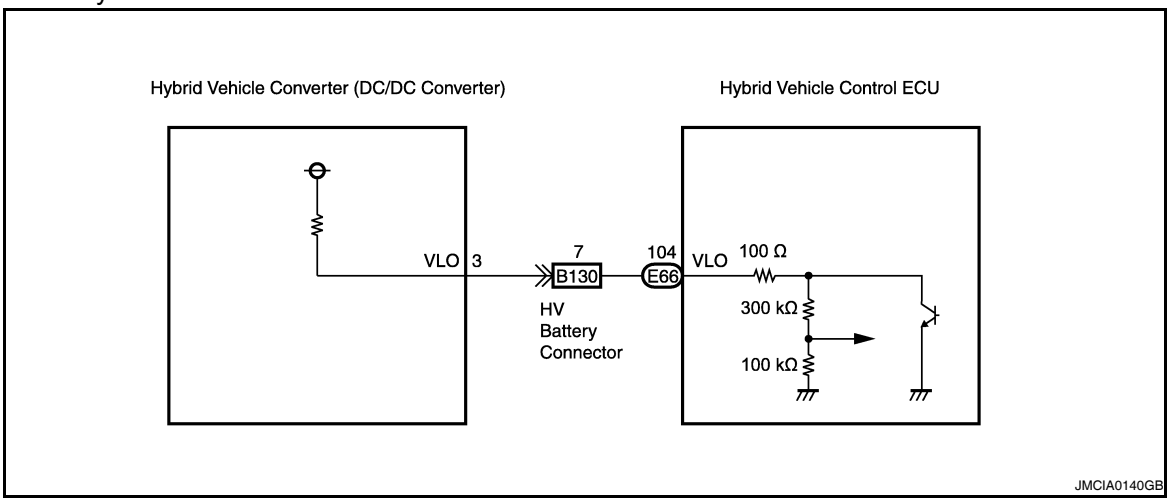
OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A10-592

Description

INFOID:0000000004211807

The hybrid vehicle converter (DC/DC converter) controls output voltage based on voltage switching signals sent from the hybrid vehicle control ECU.



DTC Logic

INFOID:0000000004211808

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A10	592	DC/DC Converter Status Circuit High Input	Hybrid vehicle converter (DC/DC converter) voltage switching (VLO) signal circuit malfunction (+B short)	• Wire harness or connector • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211809

1.PRECONDITIONING

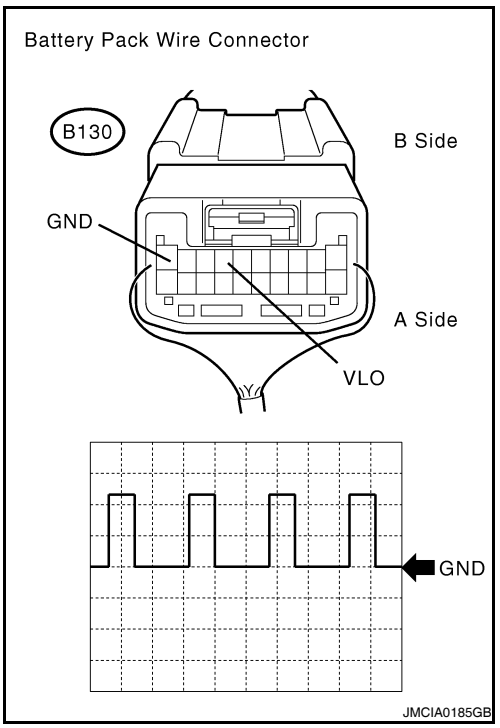
- Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your 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 HYBRID VEHICLE CONTROL ECU

1. Connect an oscilloscope between the battery pack wire terminals specified in the table below, and measure the waveform.

Item	Contents
Terminal (A side)	7 (VLO) - 10 (GND)
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Ignition switch ON



NOTE:
Perform this inspection with the battery pack wire connected.

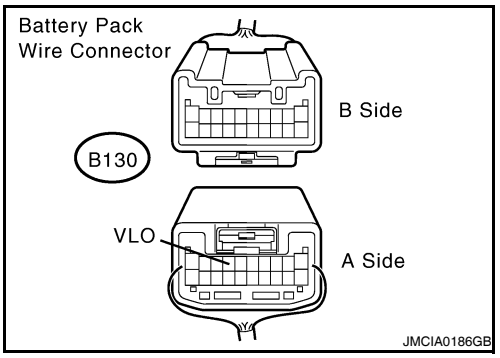
OK or NG

OK >> GO TO 6.
NG >> GO TO 3.

3. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

1. Disconnect the battery pack wire connector B130.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.

Battery pack wire		Ground	Voltage
Harness connector	Terminal		
B130	7 (VLO)	Ground	Below 1V



NOTE:
Turning ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

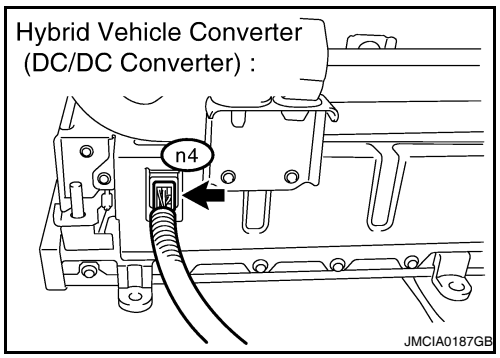
OK or NG

OK >> GO TO 4.
NG >> GO TO 5.

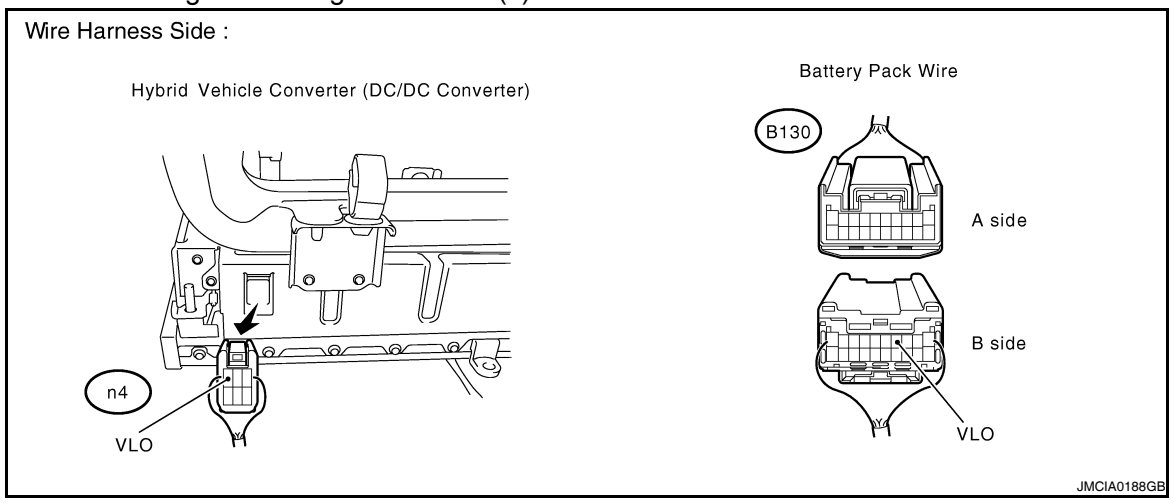
4. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

1. Turn ignition switch OFF.
   CAUTION:
   Be sure to wear insulated gloves.
2. Remove the service plug grip.
   NOTE:
   After removing the service plug grip, do not turn ignition switch to READY position, unless instructed by the repair manual because this may cause a malfunction.

3. Disconnect the hybrid vehicle converter (DC/DC converter) connector n4.
4. Turn ignition switch ON.



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



Battery pack wire		Ground	Voltage
Component connector	Terminal		
B130	7 (VLO)	Ground	Below 1V

Hybrid vehicle converter (DC/DC converter)		Ground	Voltage
Harness connector	Terminal		
n4	3 (VLO)	Ground	Below 1V

NOTE:
Turning ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

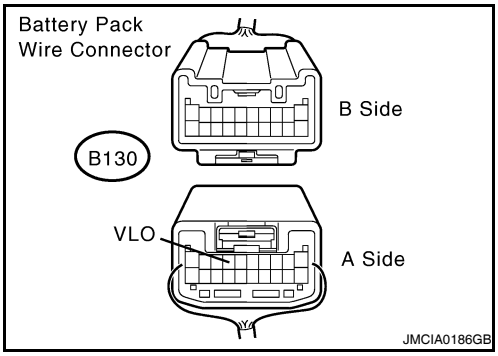
OK or NG

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

5. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

1. Turn ignition switch OFF.
2. Disconnect E66 hybrid vehicle control ECU harness connector.
3. Turn ignition switch ON.

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



Battery pack wire		Ground	Voltage
Component connector	Terminal		
B130	7 (VLO)	Ground	Below 1V

NOTE:
Turning ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

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

6. CLEAR DTC

1. Turn ignition switch ON.
2. Read and record the DTCs and freeze frame data.
3. Clear the DTCs.

>> GO TO 7.

7. RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC P0A10-592 detected?

YES >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NO >> GO TO 8.

8. CHECK FOR INTERMITTENT INCIDENT

1. Check for intermittent incident (See GI-42, "Intermittent Incident").

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace malfunctioning parts, component and area.

P0A1A-151, P0A1A-155, P0A1A-156, P0A1A-158, P0A1A-166

Description

INFOID:0000000004211810

The inverter with converter assembly (MG ECU) monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211811

DTC DETECTION LOGIC

The MG ECU performs many diagnostic tests to verify proper operation of internal ECU systems. For one of these diagnostics, the MG ECU checks the result of the generator CPU self-test. If the MG ECU detects a “Fail” from the generator CPU self-test, it will conclude that there is an internal malfunction in the generator CPU. 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
P0A1A	151	Generator Control Module	Run pulse error	Inverter with converter assembly (MG ECU)
	155		A/D error	
	156		ROM-RAM error	
	158		CPU recognition error	
	166		R/D converter NM stop error	
	658		ALU error	
	659		Communication error (from MG1 to MG2)	
	791		R/D converter communication error	

Diagnosis Procedure

INFOID:0000000004211812

1.PRECONDITIONING

- 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. 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.ol Module

>> GO TO 2.

2.REPLACE INVERTER WITH CONVERTER ASSEMBLY

Refer to HBC-638, "Removal and Installation".

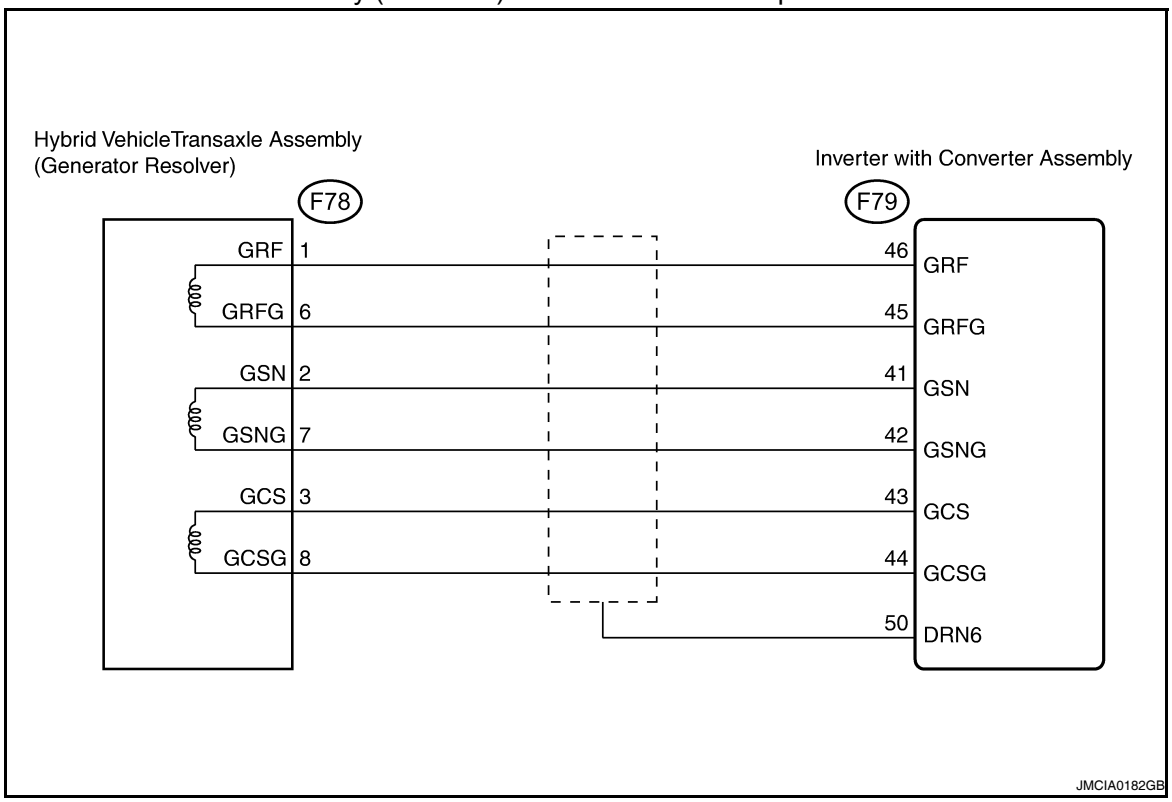
>> COMPLETED

P0A1A-200, P0A1A-792, P0A1A-793

Description

INFOID:0000000004211813

The inverter with converter assembly (MG ECU) monitors its internal operation and detects malfunctions.



DTC Logic

INFOID:0000000004211814

DTC DETECTION LOGIC

The MG ECU (in the inverter with converter assembly) performs many diagnostic tests to verify proper operation of internal ECU systems. For this diagnostic monitor, the MG ECU checks for an R/D (Resolver/Digital converter) malfunction involving the generator resolver. If MG ECU detects an R/D error, it will conclude that there is an internal malfunction involving the generator resolver. 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
P0A1A	200	Generator Control Module	Generator R/D resolver angle error	• Inverter with converter assembly (MG ECU) • Hybrid transaxle (Generator resolver) • Wire harness or connector
	792		REF frequency error	• Inverter with converter assembly (MG ECU) • Hybrid transaxle (Generator resolver) • Wire harness or connector
	793		REF signal open error	• Inverter with converter assembly (MG ECU) • Hybrid transaxle (Generator resolver) • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004211815

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A4B-253, P0A4C-513, P0A4D-255	Generator resolver circuit

Is any DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

1. Check the connection of the generator resolver connector.

The connector is connected securely and there are no contact problems.

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip.
   NOTE:
   After removing the service plug grip, do not turn ignition switch to READY position, unless instructed by the repair manual because this may cause a malfunction.
2. Disconnect the inverter with converter assembly harness connector F79.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Inverter with converter assembly		Ground	Voltage
Harness connector	Terminal		
F79	46 (GRF)	Ground	Below 1 V
	45 (GRFG)		
	41 (GSN)		
	42 (GSNG)		
	43 (GCS)		
	44 (GCSG)		

NOTE:

Turning ignition switch ON with the inverter with converter assembly connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

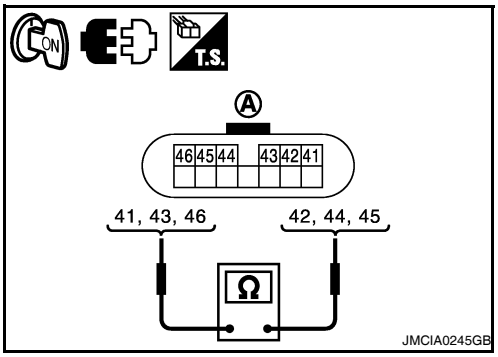
OK >> GO TO 6.
NG >> Repair or replace harness or connector.

6. CHECK GENERATOR RESOLVER

1. Turn ignition switch OFF.
2. Measure the resistance according to the value(s) in the table below.

Check for open

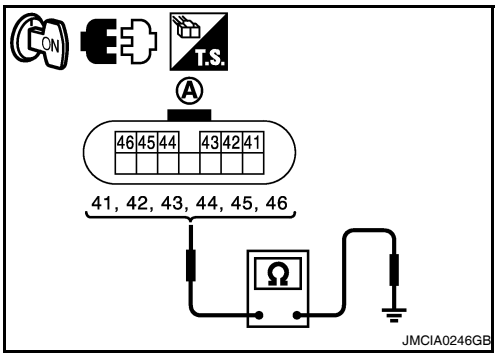
Inverter with converter assembly (A)		Inverter with converter assembly (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	46 (GRF)	F79	45 (GRFG)	5.8 to 11.8 Ω
	41 (GSN)		42 (GSNG)	11.7 to 17.7 Ω
	43 (GCS)		44 (GCSG)	11.7 to 17.7 Ω



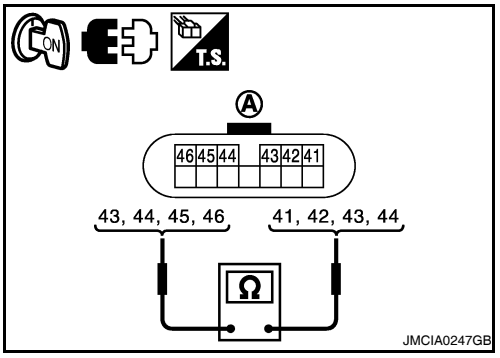
3. Measure the resistance according to the value(s) in the table below.

Check for short

Inverter with converter assembly (A)		Ground	Resistance
Harness connector	Terminal		
F79	46 (GRF)	Ground	10 kΩ or higher
	45 (GRFG)		
	41 (GSN)		
	42 (GSNG)		
	43 (GCS)		
	44 (GCSG)		



Inverter with converter assembly (A)		Inverter with converter assembly (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	46 (GRF)	F79	44 (GCSG)	10 kΩ or higher
			43 (GCS)	
			41 (GSN)	
			42 (GSNG)	
	45 (GRFG)		44 (GCSG)	
			43 (GCS)	
			41 (GSN)	
			42 (GSNG)	
	44 (GCSG)		41 (GSN)	
			42 (GSNG)	
	43 (GCS)		41 (GSN)	
			42 (GSNG)	



OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> GO TO 7.

7. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

1. Disconnect the motor generator No.1 harness connector F78.
2. Measure the resistance according to the value(s) in the table below.

Check for open

Inverter with converter assembly		Motor generator No.1		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	46 (GRF)	F78	1 (GRF)	Below 1 Ω
	45 (GRFG)		6 (GRFG)	
	41 (GSN)		2 (GSN)	
	42 (GSNG)		7 (GSNG)	
	43 (GCS)		3 (GCS)	
	44 (GCSG)		8 (GCSG)	

Check for short

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
F79	46 (GRF)	Ground	10 kΩ or higher
	45 (GRFG)		
	41 (GSN)		
	42 (GSNG)		
	43 (GCS)		
	44 (GCSG)		

Check for short

Motor generator N0.1		Ground	Resistance
Harness connector	Terminal		
F78	1 (GRF)	Ground	10 kΩ or higher
	6 (GRFG)		
	2 (GSN)		
	7 (GSNG)		
	3 (GCS)		
	8 (GCSG)		

Inverter with converter assembly		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	46 (GRF)	F79	45 (GRFG)	10 kΩ or higher
	43 (GCS)		44 (GCSG)	
	41 (GSN)		42 (GSNG)	
	46 (GRF)		44 (GCSG)	
	46 (GRF)		43 (GCS)	
	46 (GRF)		41 (GSN)	
	46 (GRF)		42 (GSNG)	
	45 (GRFG)		44 (GCSG)	
	45 (GRFG)		43 (GCS)	
	45 (GRFG)		41 (GSN)	
	45 (GRFG)		42 (GSNG)	
	44 (GCSG)		41 (GSN)	
	44 (GCSG)		42 (GSNG)	
	43 (GCS)		41 (GSN)	
	43 (GCS)		42 (GSNG)	

NOTE:
The generator resolver is not available separately. If it requires replacement, replace the hybrid transaxle.

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A1A-658, P0A1A-659, P0A1A-791

Description

INFOID:0000000004211816

The inverter with converter assembly (MG ECU) monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211817

DTC DETECTION LOGIC

The MG ECU performs many diagnostic tests to verify proper operation of internal ECU systems. For one of these diagnostics, the MG ECU checks the result of the generator CPU self-test. If the MG ECU detects a “Fail” from the generator CPU self-test, it will conclude that there is an internal malfunction in the generator CPU. 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
P0A1A	151	Generator Control Module	Run pulse error	Inverter with converter assembly (MG ECU)
	155		A/D error	
	156		ROM-RAM error	
	158		CPU recognition error	
	166		R/D converter NM stop error	
	658		ALU error	
	659		Communication error (from MG1 to MG2)	
	791		R/D converter communication error	

Diagnosis Procedure

INFOID:0000000004211818

1.PRECONDITIONING

- 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. 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.ol Module

>> GO TO 2.

2.REPLACE INVERTER WITH CONVERTER ASSEMBLY

Refer to HBC-638, "Removal and Installation".

>> COMPLETED

P0A1B-163, P0A1B-164, P0A1B-192, P0A1B-193, P0A1B-195, P0A1B-198

Description

INFOID:0000000004211819

The inverter with converter assembly (MG ECU) monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211820

DTC DETECTION LOGIC

The MG ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of those diagnostics, the MG ECU checks the result of the motor CPU self-test. If the MG ECU detects a “Fail” from the motor CPU self-test, it will conclude that there is an internal malfunction in the motor CPU.
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
P0A1B	163	Drive Motor “A” Control Module	IPM positive power source error	Inverter with converter assembly (MG ECU)
P0A1B	164		IPM negative power source error	
P0A1B	192		A/D error	
P0A1B	193		ROM-RAM error	
P0A1B	195		CPU recognition error	
P0A1B	198		R/D converter NM stop error	
P0A1B	511		Standard voltage for analog signal offset	
P0A1B	512		Standard voltage for analog signal	
P0A1B	661		Communication error (from MG2 to MG1)	
P0A1B	786		ALU error	
P0A1B	794		R/D converter communication error	

Diagnosis Procedure

INFOID:0000000004211821

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

Refer to HBC-638, "Removal and Installation".

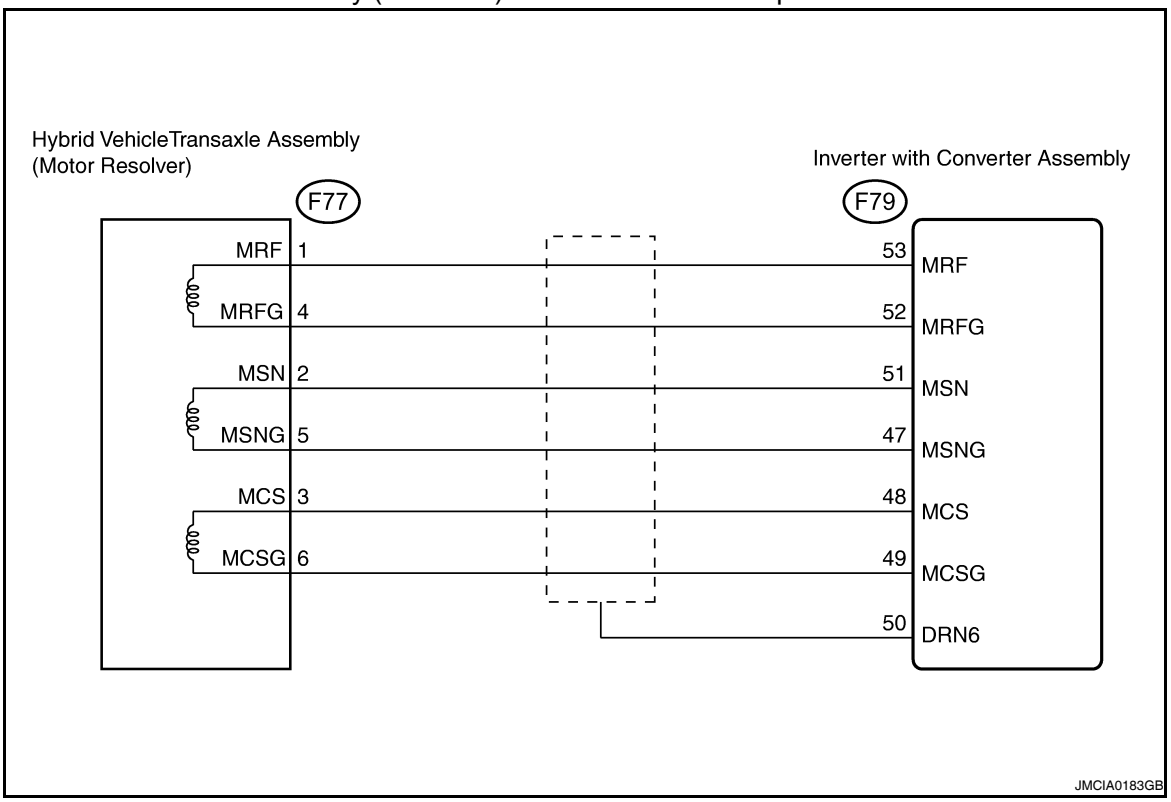
>> COMPLETED

P0A1B-168, P0A1B-795, P0A1B-796

Description

INFOID:0000000004211822

The inverter with converter assembly (MG ECU) monitors its internal operation and detects malfunctions.



DTC Logic

INFOID:0000000004211823

DTC DETECTION LOGIC

The MG ECU (in the inverter with converter assembly) performs many diagnostic tests to verify proper operation of internal ECU systems. For this diagnostic monitor, the MG ECU checks for an R/D (Resolver/ Digital converter) malfunction involving the motor resolver. If the MG ECU detects an R/D converter error, it will conclude that there is an internal malfunction involving the motor resolver. 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
P0A1B	168	Drive Motor “A” Control Module	Motor R/D resolver angle error	• Inverter with converter assembly (MG ECU) • Hybrid transaxle (Motor resolver) • Wire harness or connector
	795		REF frequency error	• Inverter with converter assembly (MG ECU) • Hybrid transaxle (Motor resolver) • Wire harness or connector
	796		REF signal open error	• Inverter with converter assembly (MG ECU) • Hybrid transaxle (Motor resolver) • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004211824

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A3F-243, P0A40-500, P0A41-245	Motor resolver circuit

Is any DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

1. Check the connection of the motor resolver connector.

The connector is connected securely and there are no contact problems.

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip.
   NOTE:
   After removing the service plug grip, do not turn ignition switch to READY position, unless instructed by the repair manual because this may cause a malfunction.
2. Disconnect the inverter with converter assembly harness connector F79.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Inverter with converter assembly		Ground	Voltage
Harness connector	Terminal		
F79	53 (MRF)	Ground	Below 1 V
	52 (MRFG)		
	51 (MSN)		
	47 (MSNG)		
	48 (MCS)		
	49 (MCSG)		

NOTE:
Turning ignition switch ON with the inverter with converter assembly connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

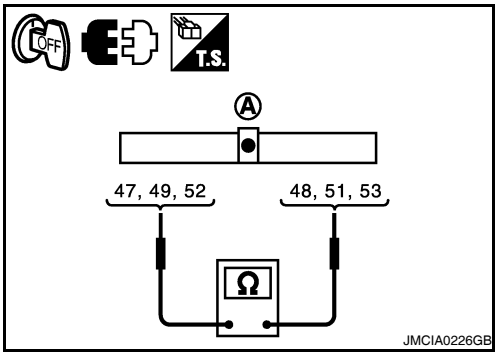
OK >> GO TO 6.
NG >> Repair or replace harness or connector.

6. CHECK MOTOR RESOLVER

1. Turn ignition switch OFF.
2. Measure the resistance according to the value(s) in the table below.

Check for open

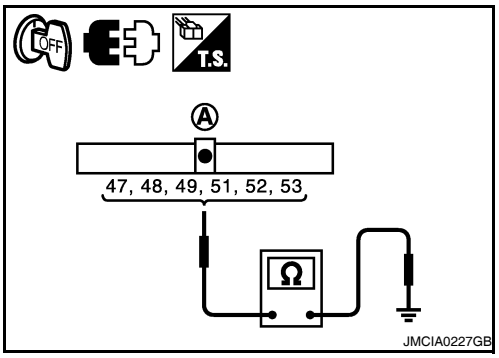
Inverter with converter assembly (A)		Inverter with converter assembly (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	53 (MRF)	F79	52 (MRFG)	5.8 to 11.8 Ω
	51 (MSN)		47 (MSNG)	11.7 to 17.7 Ω
	48 (MCS)		49 (MCSG)	11.7 to 17.7 Ω



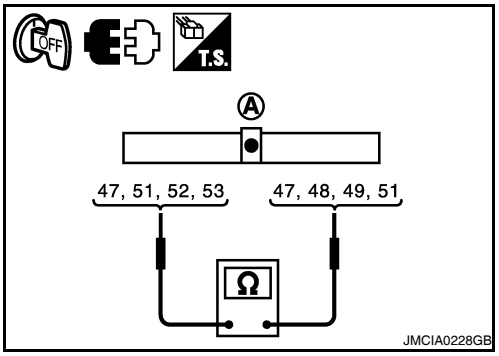
3. Measure the resistance according to the value(s) in the table below.

Check for short

Inverter with converter assembly (A)		Ground	Resistance
Harness connector	Terminal		
F79	53 (MRF)	Ground	10 kΩ or higher
	52 (MRFG)		
	51 (MSN)		
	47 (MSNG)		
	48 (MCS)		
	49 (MCSG)		



Inverter with converter assembly (A)		Inverter with converter assembly (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	53 (MRF)	F79	51 (MSN)	10 kΩ or higher
			49 (MCSG)	
			48 (MCS)	
			47 (MSNG)	
	52 (MRFG)		51 (MSN)	
			49 (MCSG)	
			48 (MCS)	
			47 (MSNG)	
	51 (MSN)		48 (MCS)	
			49 (MCSG)	
	47 (MSNG)		48 (MCS)	
			47 (MSNG)	



OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

NG >> GO TO 7.

7. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

1. Disconnect the motor generator No.2 harness connector F77.
2. Measure the resistance according to the value(s) in the table below.

Check for open

Inverter with converter assembly		Motor generator No.2		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	53 (MRF)	F77	1 (MRF)	Below 1 Ω
	52 (MRFG)		4 (MRFG)	
	51 (MSN)		2 (MSN)	
	47 (MSNG)		5 (MSNG)	
	48 (MCS)		3 (MCS)	
	49 (MCSG)		6 (MCSG)	

Check for short

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
F79	53 (MRF)	Ground	10 kΩ or higher
	52 (MRFG)		
	51 (MSN)		
	47 (MSNG)		
	48 (MCS)		
	49 (MCSG)		

Check for short

Motor generator N0.2		Ground	Resistance
Harness connector	Terminal		
F77	1 (MRF)	Ground	10 kΩ or higher
	4 (MRFG)		
	2 (MSN)		
	5 (MSNG)		
	3 (MCS)		
	6 (MCSG)		

Inverter with converter assembly		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F79	53 (MRF)	F79	52 (MRFG)	10 kΩ or higher
	51 (MSN)		47 (MSNG)	
	48 (MCS)		49 (MCSG)	
	53 (MRF)		51 (MSN)	
	53 (MRF)		49 (MCSG)	
	53 (MRF)		48 (MCS)	
	53 (MRF)		47 (MSNG)	
	52 (MRFG)		51 (MSN)	
	52 (MRFG)		49 (MCSG)	
	52 (MRFG)		48 (MCS)	
	52 (MRFG)		47 (MSNG)	
	51 (MSN)		48 (MCS)	
	51 (MSN)		49 (MCSG)	
	47 (MSNG)		48 (MCS)	
	47 (MSNG)		49 (MCSG)	

NOTE:
The generator resolver is not available separately. If it requires replacement, replace the hybrid transaxle.

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A1B-511, P0A1B-512, P0A1B-661, P0A1B-786, P0A1B-794

Description

INFOID:0000000004211825

The inverter with converter assembly (MG ECU) monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211826

DTC DETECTION LOGIC

The MG ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of those diagnostics, the MG ECU checks the result of the motor CPU self-test. If the MG ECU detects a “Fail” from the motor CPU self-test, it will conclude that there is an internal malfunction in the motor CPU.
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
P0A1B	163	Drive Motor “A” Control Module	IPM positive power source error	Inverter with converter assembly (MG ECU)
P0A1B	164		IPM negative power source error	
P0A1B	192		A/D error	
P0A1B	193		ROM-RAM error	
P0A1B	195		CPU recognition error	
P0A1B	198		R/D converter NM stop error	
P0A1B	511		Standard voltage for analog signal offset	
P0A1B	512		Standard voltage for analog signal	
P0A1B	661		Communication error (from MG2 to MG1)	
P0A1B	786		ALU error	
P0A1B	794		R/D converter communication error	

Diagnosis Procedure

INFOID:0000000004211827

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

Refer to HBC-638, "Removal and Installation".

>> COMPLETED

P0A1B-788

Description

INFOID:0000000004211828

If the inverter with converter assembly (MG ECU) is reset due to a problem with the power source in the inverter, the hybrid vehicle control ECU will set this DTC.

NOTE:

Clearing the DTCs using the CONSULT-III when DTC U0110-657 is detected and the problem is still occurring will cause DTC P0A1B-788 to be stored. However, it is not necessary to perform inspection for DTC P0A1B-788 because DTC P0A1B-788 indicates a communication system malfunction.

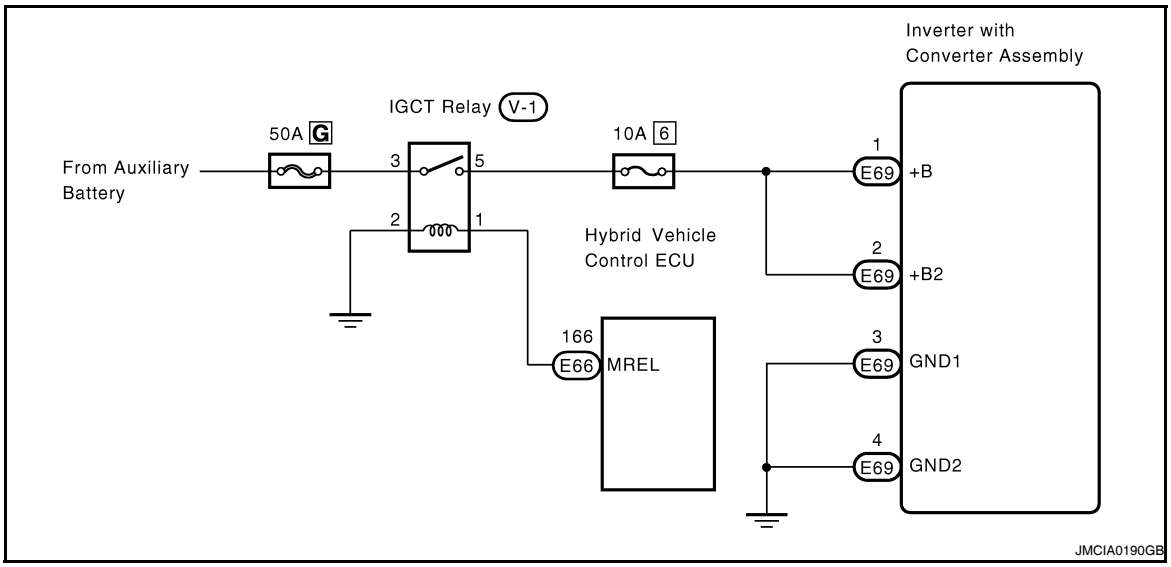
DTC Logic

INFOID:0000000004211829

DTC DETECTION LOGIC

If an abnormal power source IC CPU reset is detected in the MG ECU, 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
P0A1B	788	Drive Motor “A” Control Module	Error in reset signal from power source IC	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid transaxle



Diagnosis Procedure

INFOID:0000000004211830

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> Connect securely.

3. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch to READY position, unless instructed by the service manual because this may cause a malfunction.
2. Remove the IGCT relay from the high voltage fuse and fusible link box.
3. Disconnect the inverter with converter assembly harness connector E69.
4. Measure the resistance according to the value(s) in the table below.

Check for open

Inverter with converter assembly		High voltage fuse and fusible link box		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E69	1 (+B)	V-1	5 (IGCT relay)	Below 1 Ω
	2 (+B2)			

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
E69	3 (GND1)	Ground	Below 1 Ω
	4 (GND2)		

Check for short

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
E69	1 (+B)	Ground	150 Ω or higher
	2 (+B2)		

5. Remove 10A fuse (No. 67).
6. Measure the resistance according to the value(s) in the table below.

Check for short

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
E69	1 (+B)	Ground	10 kΩ or higher
	2 (+B2)		

OK or NG

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

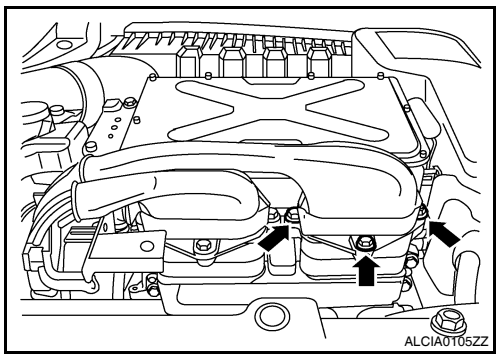
4. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.

2. Check that the bolts for the motor cable are tightened to the specified torque.
NOTE:
Make sure that the tightening torque of the bolts is between 3.0 and 5.0 N·m (0.3 and 0.5 kg-m, 27 and 44 in-lb).

Torque : 4.0 N·m (0.4 kg-m, 35 in-lb)



OK or NG

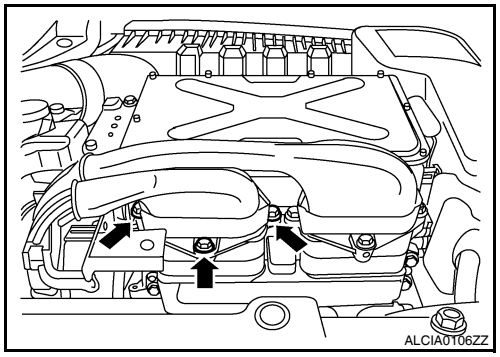
OK >> GO TO 5.
NG >> Tighten to specified torque.

5. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check that the bolts for the generator cable are tightened to the specified torque.
NOTE:
Make sure that the tightening torque of the bolts is between 3.0 and 50 N·m (0.3 and 0.5 kg-m, 27 and 44 in-lb).

Torque : 4.0 N·m (0.4 kg-m, 35 in-lb)



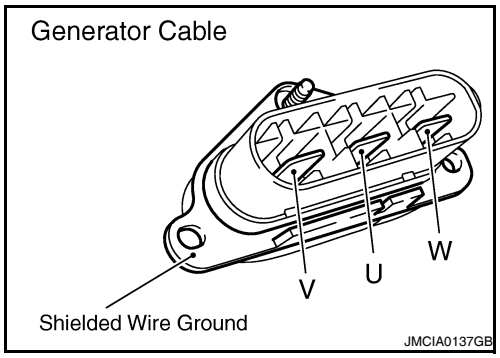
OK or NG

OK >> GO TO 6.
NG >> Tighten to specified torque.

6. INSPECT HYBRID TRANSAXLE (MG1)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the generator cable and motor cable from the inverter with converter assembly (See HBC-638, "Removal and Installation").
3. Check that dirt or foreign objects have not entered the connection, or there is no evidence of contaminations.
4. Using a milliohmmeter, measure the resistance according to the value(s) in the table below. (Check MG1 for an interphase short.)
NOTE:
If the MG1 temperature is high, the resistance varies greatly. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.



Terminal	Terminal	Resistance
U	V	59 to 65 mΩ
V	W	56 to 62 mΩ
W	U	56 to 62 mΩ

NOTE:
To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 20°C.

R20 = Rt / [1 + 0.00393 X (T - 20)]
The calculation is based on the following:
R20 : Resistance at 20°C (mΩ)
Rt : Measured resistance (mΩ)
T : Temperature when the resistance is measured (°C)

5. Using a megohmmeter (500 V range), measure the resistance according to the value(s) in the table below.
NOTE:
Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Terminal	Ground	Resistance
U	Body ground and shielded wire ground	20 MΩ or higher
V		
W		

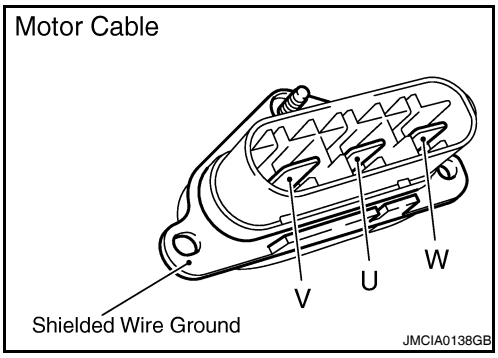
OK or NG

OK >> GO TO 7.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

7. INSPECT HYBRID TRANSAXLE (MG2)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the generator cable and motor cable from the inverter with converter assembly (See HBC-638, "Removal and Installation").
3. Using a milliohmmeter, measure the resistance according to the value(s) in the table below. (Check MG2 for an interphase short.)
NOTE:
If the MG2 temperature is high, the resistance varies greatly. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.



Terminal	Terminal	Resistance
U	V	69.5 to 76.5 mΩ
V	W	66.5 to 73.5 mΩ
W	U	66.5 to 73.5 mΩ

NOTE:
To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 20°C.

R20 = Rt / [1 + 0.00393 X (T - 20)]
The calculation is based on the following:
R20 : Resistance at 20°C (mΩ)
Rt : Measured resistance (mΩ)
T : Temperature when the resistance is measured (°C)

4. Using a megohmmeter (500 V range), measure the resistance according to the value(s) in the table below.
NOTE:
Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Terminal	Ground	Resistance
U	Body ground and shielded wire ground	20 MΩ or higher
V		
W		

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

P0A1D-134, P0A1D-135, P0A1D-570

Description

INFOID:0000000004211831

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211832

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs diagnostic monitoring to verify proper operation of vehicle systems. One of these monitors the rationality of internal analog (signal) to digital conversions. The hybrid vehicle control ECU monitors the internal A/D (Analog/Digital converter) value. If there is an A/D converter malfunction, 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
P0A1D	134	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU
	135			
	570			

Diagnosis Procedure

INFOID:0000000004211833

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-140

Description

INFOID:0000000004211834

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211835

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. One of these tests checks for errors after a memory read/write diagnostic test. If the hybrid vehicle control ECU detects this malfunction inside the ECU, it will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A1D	140	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211836

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-141

Description

INFOID:0000000004211837

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211838

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. One of these tests checks for errors in the ROM (Read Only Memory) circuits of the hybrid vehicle control ECU. If the hybrid vehicle control ECU detects this malfunction inside the ECU, it will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A1D	141	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211839

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-144, P0A1D-145

Description

INFOID:0000000004211840

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211841

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the hybrid vehicle control ECU performs a self-test. If the hybrid vehicle control ECU detects an internal problem during this self-test, it will conclude that there is an internal malfunction. 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
P0A1D	144	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU
	145			

Diagnosis Procedure

INFOID:0000000004211842

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-148

Description

INFOID:0000000004211843

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211844

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the hybrid vehicle control ECU performs a self-test. If the hybrid vehicle control ECU detects an internal problem during this self-test, it will conclude that there is an internal malfunction. 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
P0A1D	148	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211845

1.PRECONDITIONING

- 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. 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 withconverter assembly.

>> GO TO 2.

2.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-162, P0A1D-821, P0A1D-822, P0A1D-823

Description

INFOID:0000000004211846

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211847

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs diagnostic monitoring to verify proper operation of internal ECU systems. For this diagnostics monitor, the hybrid vehicle control ECU checks the communication bus off count and the message register of the CAN (Controller Area Network) controller. If the hybrid vehicle control ECU detects an error in the communication bus off count or message register, it will conclude that there is a malfunction in the hybrid vehicle control ECU. 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
P0A1D	162	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU
	821			
	822			
	823			

Diagnosis Procedure

INFOID:0000000004211848

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-179

Description

INFOID:0000000004211849

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211850

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the hybrid vehicle control ECU performs a self-test. If the hybrid vehicle control ECU detects an internal problem during this self-test, it will conclude that there is an internal malfunction. 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
P0A1D	179	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211851

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-187

Description

INFOID:0000000004211852

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211853

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs diagnostic monitoring to verify proper operation of internal and external ECU systems. In one of these diagnostics, the hybrid vehicle control ECU monitors the important RAM range of the hybrid vehicle control ECU. If the hybrid vehicle control ECU detects an error in the important RAM circuits, it will conclude that there is an internal malfunction in the hybrid vehicle control ECU. 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
P0A1D	187	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211854

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-390, P3004-133

Description

INFOID:0000000004211855

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211856

DTC DETECTION LOGIC

When the hybrid vehicle control ECU detects that the HV battery has received too much charge, 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
P0A1D	390	Hybrid Powertrain Control Module	Charge control error	Hybrid vehicle control ECU
P3004	133	Power Cable Malfunction	A high-voltage wiring system error signal is detected in the hybrid vehicle control ECU	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211857

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Are DTCs other than P0A1D-390 and P3004-133 detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").

P0A1D-393

Description

INFOID:0000000004211858

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211859

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the hybrid vehicle control ECU performs a self-test. If the hybrid vehicle control ECU detects an internal problem during this self-test, it will conclude that there is an internal malfunction. 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
P0A1D	393	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211860

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-721, P0A1D-722, P0A1D-723, P0A1D-765, P0A1D-787

Description

INFOID:0000000004211861

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211862

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these diagnostics, the hybrid vehicle control ECU performs a self-test. If the hybrid vehicle control ECU detects an internal problem during this self-test, it will conclude that there is an internal malfunction. 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
P0A1D	721	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU
P0A1D	722			
P0A1D	723			
P0A1D	765			
P0A1D	787			

Diagnosis Procedure

INFOID:0000000004211863

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> COMPLETED

P0A1D-924, P0A1D-925

Description

INFOID:0000000004211864

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211865

DTC DETECTION LOGIC

The hybrid vehicle control ECU performs diagnostic monitoring to verify proper operation of internal ECUsystems. In this diagnostic monitor, the hybrid vehicle control ECU checks the communication bus offcount and the message register of the CAN (Controller Area Network) controller. If the hybrid vehiclecontrol ECU detects an error in the communication bus off count or message register, it will conclude thatthere is a malfunction in the hybrid vehicle control ECU. 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
P0A1D	924	Hybrid Powertrain Control Module	ECU internal error is detected. (Resister value stuck-CAN BUS 1)	Hybrid vehicle control ECU
P0A1D	925	Hybrid Powertrain Control Module	ECU internal error is detected. (Resister value stuck-CAN BUS 2)	Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-193, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004211866

1.PRECONDITIONING

- 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. 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.REPLACE HYBRID VEHICLE CONTROL ECU

Refer to HBC-644, "Removal and Installation".

>> INSPECTION END

P0A1F-129

Description

INFOID:0000000004211867

The battery smart unit (battery energy control module) sends HV battery voltage information to the hybrid vehicle control ECU via serial communication.

DTC Logic

INFOID:0000000004211868

DTC DETECTION LOGIC

The hybrid vehicle control ECU calculates the differences among the received HV battery voltage, boost converter voltage, and inverter voltage. If any of the differences exceed prescribed values, the hybrid vehicle control ECU determines that there is a malfunction in a battery smart unit circuit. When the hybrid vehicle control ECU detects a malfunction, it will illuminate the MIL and set a DTC.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A1F	129	Battery Energy Control Module	HV battery voltage circuit malfunction	Battery smart unit

Diagnosis Procedure

INFOID:0000000004211869

1.PERFORM COMPONENT FUNCTION CHECK

1. Turn ignition switch ON (READY).
2. Shift the selector lever to N position.
3. Select “PWR RESOURCE” “VB” (HV battery voltage), “VL” (Boost converter voltage), “VH” (Inverter voltage) in “” mode with CONSULT-III.
4. Check their indication and calculate the difference and confirm they are within the specified range.
   NOTE:
   - When the system is normal, the PWR RESOURCE VB, VL and VH values should be almost equal because voltage boosting will not occur when the shift lever is in N position.
   - If the difference between voltage exceeds the specified below, there is a malfunction in the battery smart unit.
   - This check should also be performed after the battery smart unit is replaced.

Inspection voltage	Maximum voltage difference
Difference between PWR RESOURCE VB and VL	50 V
Difference between PWR RESOURCE VB and VH	70 V
Difference between VL and VH	90 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.PRECONDITIONING

- 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. 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 3.

3.CHECK DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A60 (all INF codes)	Drive motor “A” Phase V current
P0A63 (all INF codes)	Drive motor “A” Phase W current
P0A72 (all INF codes)	Generator Phase V current
P0A75 (all INF codes)	Generator Phase W current

Is DTC detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> Replace battery smart unit (See HBB-101, "Removal and Installation").

P0A1F-150, P0A1F-157

Description

INFOID:0000000004211870

The battery smart unit (battery energy control module) sends HV battery voltage information to the hybrid vehicle control ECU via serial communication.

DTC Logic

INFOID:0000000004211871

DTC DETECTION LOGIC

The hybrid vehicle control ECU calculates the differences among the received HV battery voltage, boost converter voltage, and inverter voltage. If any of the differences exceed prescribed values, the hybrid vehicle control ECU determines that there is a malfunction in a battery smart unit circuit. When the hybrid vehicle control ECU detects a malfunction, it will illuminate the MIL and set a DTC.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A1F	150	Battery Energy Control Module	Power source voltage of the battery smart unit is insufficient during pre-charge.	• Battery smart unit • Wire harness or connector • Auxiliary battery • Fuse (N0. 68) • IGCT relay
	157		Power source voltage of the battery smart unit is insufficient during discharge.	• Battery smart unit • Wire harness or connector • Auxiliary battery • Fuse (No. 68) • IGCT relay

Diagnosis Procedure

INFOID:0000000004211872

1.PRECONDITIONING

- 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. 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 DTCs (See HBC-80, "Diagnosis Description").

>> GO TO 2.

2.CHECK AUXILIARY BATTERY

1. Measure the voltage between the terminals of the auxiliary battery.

11 to 14 V [Battery electrolyte temperature: 20°C (68°F)]

OK or NG

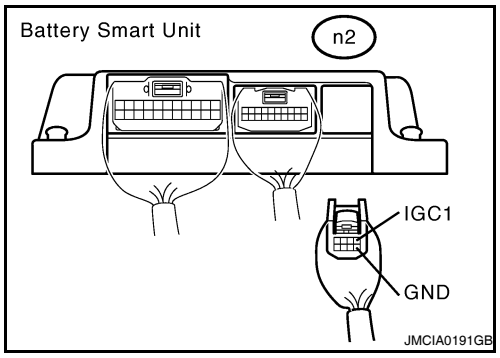
OK >> GO TO 3.
NG >> Charge or replace auxiliary battery.

3.CHECK HARNESS AND CONNECTOR (IGCT VOLTAGE)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
2. Remove the luggage compartment trim cover front (See INT-27, "Removal and Installation").
3. Disconnect the frame wire (See HBC-648, "Removal and Installation").
4. Remove the battery bracket sub-assembly (See HBB-97, "Removal and Installation").

5. Connect the auxiliary battery positive terminal cable of the frame wire.
6. Disconnect the n2 battery smart unit connector.
7. Turn ignition switch ON.
8. Measure the voltage according to the value(s) in the table below.



Battery smart unit		Battery smart unit		Voltage
Harness connector	Terminal	Harness connector	Terminal	
n2	1 (IGC1)	n2	5 (GND)	8.6 V or more

OK or NG

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

4. CHECK FUSE (NO. 68)

1. Remove the 10A fuse (No. 68) from the high voltage fuse and fusible link box.
2. Measure the resistance of the fuse.

Resistance : Below 1Ω

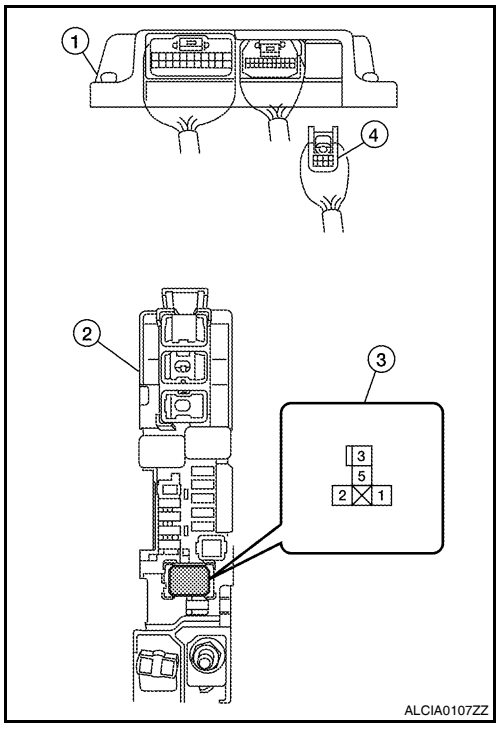
OK or NG

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

5. 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 (3) from the high voltage fuse and fusible link box (2).
3. Disconnect connector n2 (4) from the battery smart unit (1).
4. Measure the resistance according to the value(s) in the table below.



Battery smart unit		high voltage fuse and fusible link box		Resistance
Harness connector	Terminal	Harness connector	Terminal	
n2	1 (IGC1)	V-1	5 (IGCT relay)	Below 1 Ω

OK or NG

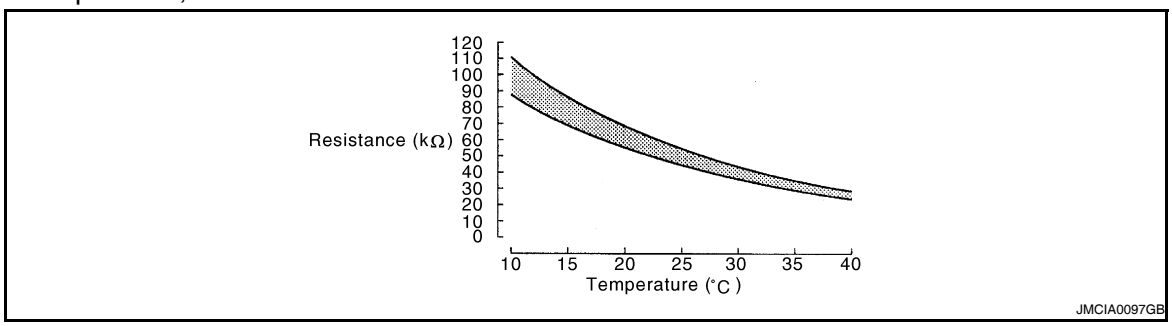
OK >> Check and repair power source circuit.
NG >> Repair or replace harness or connector.

P0A2B-248, P0A2B-250

Description

INFOID:0000000004211873

The resistance of the thermistor built into the motor temperature sensor changes in accordance with changes in MG2 temperature. The lower the MG2 temperature, the more the thermistor resistance. Conversely, the more the temperature, the lower the resistance.



DTC Logic

INFOID:0000000004211874

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A2B	248	Drive Motor "A" Temperature Sensor Circuit Range / Performance	Motor temperature sensor malfunction	Hybrid transaxle (Motor temperature sensor)
	250		Motor temperature sensor performance problem	

Diagnosis Procedure

INFOID:0000000004211875

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (MOTOR TEMPERATURE SENSOR CONNECTOR)

Check the connection of the motor temperature sensor connector.

- **The connectors are connected securely and there are no contact problems.**
- **Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.**

OK or NG

OK >> GO TO 3.
>> Connect securely.

3.REPLACE HYBRID TRANSAXLE

Refer to TM-36, "Removal and Installation".

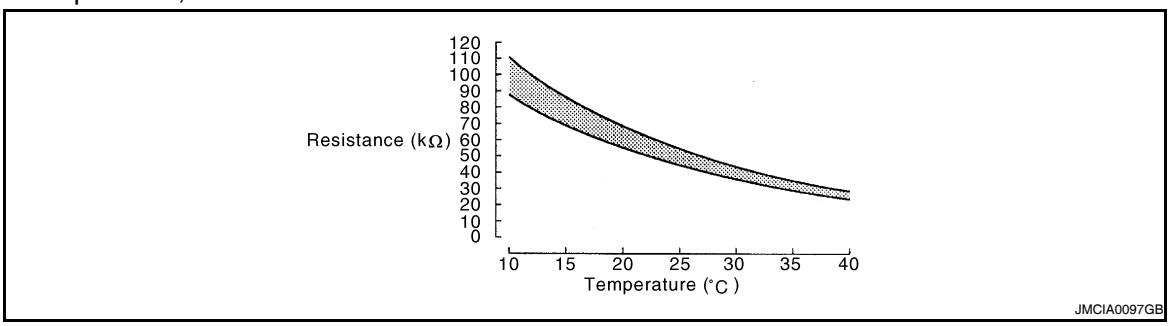
>> COMPLETED

P0A2C-247, P0A2D-249

Description

INFOID:0000000004211876

The resistance of the thermistor built into the motor temperature sensor changes in accordance with changes in MG2 temperature. The lower the MG2 temperature, the more the thermistor resistance. Conversely, the more the temperature, the lower the resistance.



DTC Logic

INFOID:0000000004211877

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A2C	247	Drive Motor “A” Temperature Sensor Circuit Low	GND short in motor temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid transaxle (Motor temperature sensor)
P0A2D	249	Drive Motor “A” Temperature Sensor Circuit High	Open or +B short in motor temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid transaxle (Motor temperature sensor)

Diagnosis Procedure

INFOID:0000000004211878

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> Connect securely.

3.CHECK CONNECTOR CONNECTION CONDITION (MOTOR TEMPERATURE SENSOR CONNECTOR)

Check the connections of the motor temperature sensor connectors.

- **The connectors are connected securely and there are no contact problems.**
- **Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.**

OK or NG

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

4. READ VALUE OF DATA MONITOR (MOTOR1 TEMP)

1. Turn ignition switch ON.
2. Select “MG1 MOTOR TEMP” in DATA MONITOR mode with CONSULT-III.
3. Read the indication.

A	B	C
-50°C (-58°F)	205°C (401°F) or more	Same as actual temperature

A or B or C

A >> GO TO 5.
B >> GO TO 7.
C >> Check for intermittent incident (See GI-42, "Intermittent Incident").

5. READ VALUE OF DATA MONITOR (MG1 MOTOR TEMP)

1. Disconnect the motor temperature sensor harness connector F60.
2. Connect terminals 7 and 9 of the motor temperature sensor vehicle side connector.
3. Turn ignition switch ON.
4. Select “MG1 MOTOR TEMP” in DATA MONITOR mode with CONSULT-III.
5. Read the indication.

Displayed temperature : 205°C (401°F) or more

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> GO TO 6.

6. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - MOTOR TEMPERATURE SENSOR)

1. Disconnect the hybrid vehicle control ECU harness connector E65.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E65	16 (MMT)	Ground	Below 1 V
	15 (MMTG)		

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

4. Turn ignition switch OFF.
5. Disconnect the motor temperature sensor harness connector F69.
6. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		Motor temperature sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E65	16 (MMT)	F69	7 (MMT)	Below 1 Ω
	15 (MMTG)		9 (MMTG)	

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E65	16 (MMT)	Ground	10 kΩ or higher
	15 (MMTG)		

Motor temperature sensor		Ground	Resistance
Harness connector	Terminal		
F69	7 (MMT)	Ground	10 kΩ or higher
	9 (MMTG)		

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connectors.

7. READ VALUE OF DATA MONITOR (MG1 MOTOR TEMP)

1. Disconnect the motor temperature sensor harness connector F69.
2. Turn ignition switch ON.
3. Select “MG1 MOTOR TEMP” in DATA MONITOR mode with CONSULT-III.
4. Read the indication.

Displayed temperature : -50°C (-58°F)

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> GO TO 8.

8. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - MOTOR TEMPERATURE SENSOR)

1. Disconnect the hybrid vehicle control ECU harness connector E65.
2. Disconnect the motor temperature sensor connector F69.
3. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		Motor temperature sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E65	16 (MMT)	F69	7 (MMT)	Below 1Ω
	15 (MMTG)		9 (MMTG)	

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E65	16 (MMT)	Ground	10 kΩ or higher
	15 (MMTG)		

Motor temperature sensor		Ground	Resistance
Harness connector	Terminal		
F69	7 (MMT)	Ground	10 kΩ or higher
	9 (MMTG)		

OK or NG

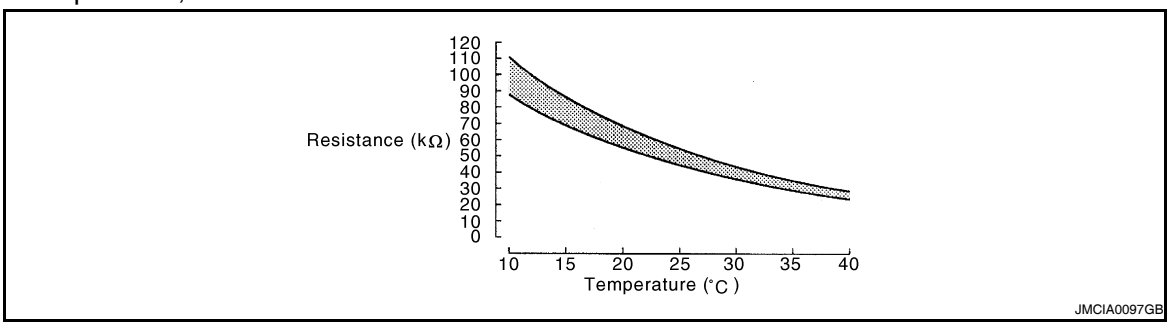
OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A37-258, P0A37-260

Description

INFOID:0000000004211879

The resistance of the thermistor built into the motor temperature sensor changes in accordance with changes in MG2 temperature. The lower the MG2 temperature, the more the thermistor resistance. Conversely, the more the temperature, the lower the resistance.



DTC Logic

INFOID:0000000004211880

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A37	258	Generator Temperature Sensor Circuit Range/Performance	Generator temperature sensor malfunction	Hybrid transaxle (Generator temperature sensor)
	260		Generator temperature sensor performance problem	

Diagnosis Procedure

INFOID:0000000004211881

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (GENERATOR TEMPERATURE SENSOR CONNECTOR)

Check the connection of the generator temperature sensor connector.

- **The connectors are connected securely and there are no contact problems.**
- **Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.**

OK or NG

OK >> GO TO 3.
>> Connect securely.

3.REPLACE HYBRID TRANSAXLE

Refer to TM-36, "Removal and Installation".

< COMPONENT DIAGNOSIS >

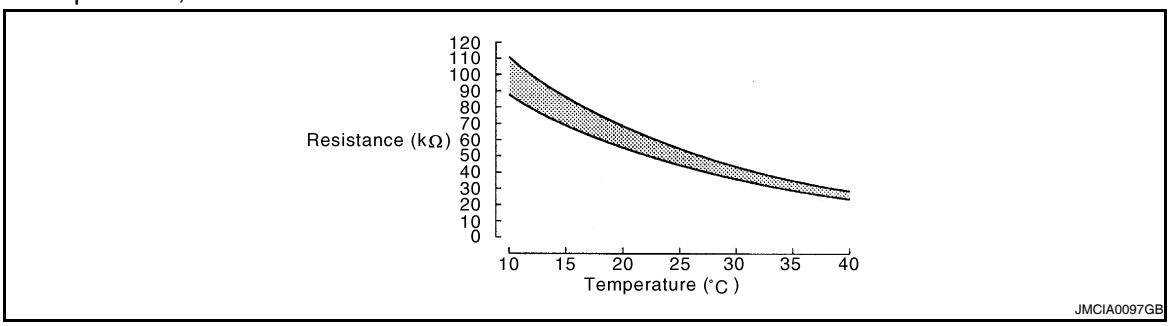
>> COMPLETED

P0A38-257, P0A39-259

Description

INFOID:0000000004211882

The resistance of the thermistor built into the motor temperature sensor changes in accordance with changes in MG2 temperature. The lower the MG2 temperature, the more the thermistor resistance. Conversely, the more the temperature, the lower the resistance.



DTC Logic

INFOID:0000000004211883

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A38	257	Generator Temperature Sensor Circuit Low	GND short in generator temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid transaxle (Generator temperature sensor)
P0A39	259	Generator Temperature Sensor Circuit High	Open or +B short in generator temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid transaxle (Generator temperature sensor)

Diagnosis Procedure

INFOID:0000000004211884

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> Connect securely.

3.CHECK CONNECTOR CONNECTION CONDITION (GENERATOR TEMPERATURE SENSOR CONNECTOR)

Check the connections of the generator temperature sensor connector.

- **The connectors are connected securely and there are no contact problems.**
- **Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.**

OK or NG

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

4. READ VALUE OF DATA MONITOR (MG2 MOTOR TEMP)

1. Turn ignition switch ON.
2. Select “MG2 MOTOR TEMP” in DATA MONITOR mode with CONSULT-III.
3. Read the indication.

A	B	C
50°C (-58°F)	205°C (401°F) or more	Same as actual temperature

A or B or C

A >> GO TO 5.
B >> GO TO 7.
C >> Check for intermittent incident (See GI-42, "Intermittent Incident").

5. READ VALUE OF DATA MONITOR (MG2 MOTOR TEMP)

1. Disconnect the generator temperature sensor harness connector F78.
2. Connect terminals 4 and 9 of the generator temperature sensor vehicle side connector.
3. Turn ignition switch ON.
4. Select “MG2 MOTOR TEMP” in DATA MONITOR mode with CONSULT-III.
5. Read the indication.

Displayed temperature : 205°C (401°F) or more

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> GO TO 6.

6. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - GENERATOR TEMPERATURE SENSOR)

1. Disconnect the hybrid vehicle control ECU harness connector E65.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E65	14 (GMT)	Ground	Below 1 V
	13 (GMTG)		

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

4. Turn ignition switch OFF.
5. Disconnect the generator temperature sensor harness connector F78.
6. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		Generator temperature sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E65	14 (GMT)	F78	4 (GMT)	Below 1 Ω
	13 (GMTG)		9 (GMTG)	

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E65	14 (GMT)	Ground	10 kΩ or higher
	13 (GMTG)		

Generator temperature sensor		Ground	Resistance
Harness connector	Terminal		
F78	4 (GMT)	Ground	10 kΩ or higher
	9 (GMTG)		

OK or NG

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

7. READ VALUE OF DATA MONITOR (MG2 MOTOR TEMP)

1. Disconnect the generator temperature sensor harness connector F78.
2. Turn ignition switch ON.
3. Select “MG2 MOTOR TEMP” in DATA MONITOR mode with CONSULT-III.
4. Read the indication.

Displayed temperature : -50°C (-58°F)

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> GO TO 8.

8. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - GENERATOR TEMPERATURE SENSOR)

1. Disconnect the hybrid vehicle control ECU harness connector E65.
2. Disconnect the generator temperature sensor harness connector F78.
3. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		Generator temperature sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E65	14 (GMT)	F78	4 (GMT)	Below 1 Ω
	13 (GMTG)		9 (GMTG)	

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E65	14 (GMT)	Ground	10 kΩ or higher
	13 (GMTG)		

Generator temperature sensor		Ground	Resistance
Harness connector	Terminal		
F78	4 (GMT)	Ground	10 kΩ or higher
	9 (GMTG)		

OK or NG

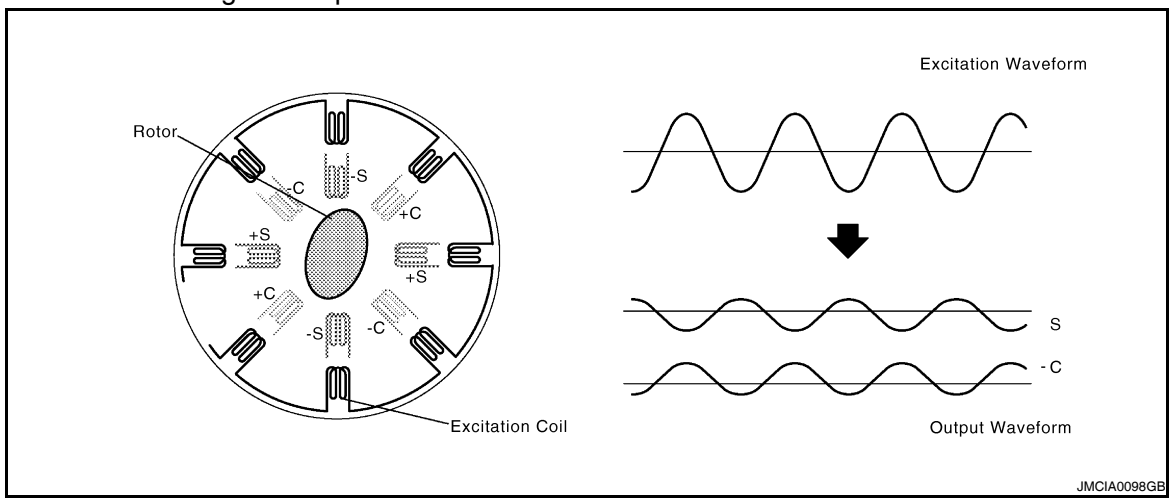
OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A3F-243, P0A40-500, P0A41-245

Description

INFOID:0000000004211885

A resolver is a sensor that detects the position of the magnetic poles, which are indispensable for ensuring highly efficient control of MG2 and MG1.
The resolver stator contains an excitation coil and 2 detection coils. The gap between the stator and rotor changes as the rotor turns because the rotor is oval shaped. An alternating current with a predetermined frequency flows through the excitation coil, and detection coils S and C output alternating currents in accordance with the sensor rotor position.
The MG ECU detects the absolute position of the rotor according to the phases of detection coils S and C and the height of their waveforms. Furthermore, the CPU calculates the amount of change in the position within a predetermined length of time, in order to use the resolver as a speed sensor.
The MG ECU monitors signals output from the motor resolver and detects malfunctions.



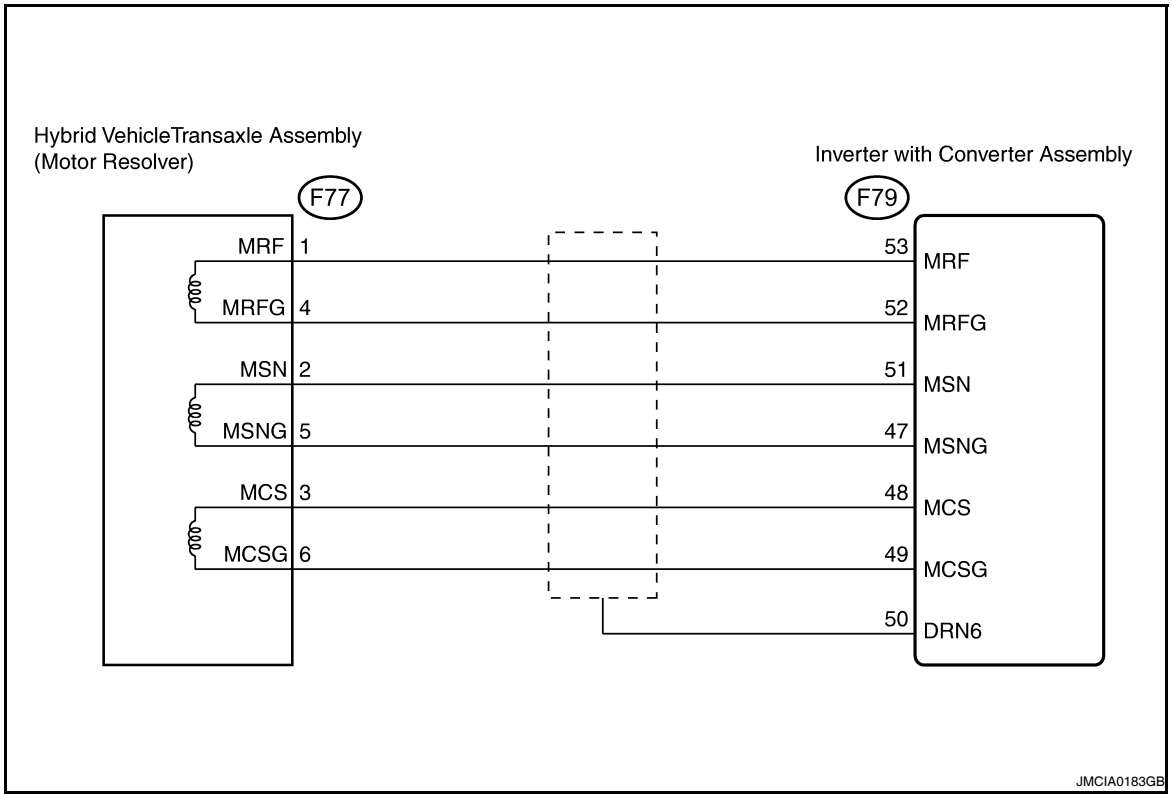
DTC Logic

INFOID:0000000004211886

DTC DETECTION LOGIC

The MG ECU monitors the motor resolver output signal. If the MG ECU detects output signals that are out of the normal range or specification, it will conclude that there is a malfunction in the motor resolver. 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
P0A3F	243	Drive Motor “A” Position Sensor Circuit	Interphase short in motor resolver circuit	• Wire harness or connector • Hybrid transaxle (Motor resolver) • Inverter with converter assembly
P0A40	500	Drive Motor “A” Position Sensor Circuit Range/Performance	Motor resolver output is out of normal range	• Wire harness or connector • Hybrid transaxle (Motor resolver) • Inverter with converter assembly
P0A41	245	Drive Motor “A” Position Sensor Circuit Low	Open or short in motor resolver circuit	• Wire harness or connector • Hybrid transaxle (Motor resolver) • Inverter with converter assembly



Diagnosis Procedure

INFOID:0000000004211887

1.PRECONDITIONING

- 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. 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.)
- Check for output DTCs again after the repair has been completed. If P0A78-286 or P0A7A-324 is output, replace the inverter with converter assembly.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.
- If the problem symptom cannot be reproduced, performing a road test on a road on which the vehicle tends to vibrate will make it easier to reproduce the symptom.
- If INF code 243 is output, there may be an interphase short in the motor resolver circuit due to an intrusion of water into the resolver. Therefore, if the problem symptom cannot be reproduced, replace the hybrid transaxle last.

>> GO TO 2.

2.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> Connect securely.

3.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

4. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation")

5. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Connect securely.

6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A4B-253, P0A4C-513, P0A4D-255

Description

INFOID:0000000004211888

A resolver is a sensor that detects the position of the magnetic poles, which are indispensable for ensuring highly efficient control of MG2 and MG1.
The generator resolver structure and method of connection with the inverter with converter assembly are the same as those of the motor resolver.
The inverter with converter assembly monitors output signals from the generator resolver and detects malfunctions.

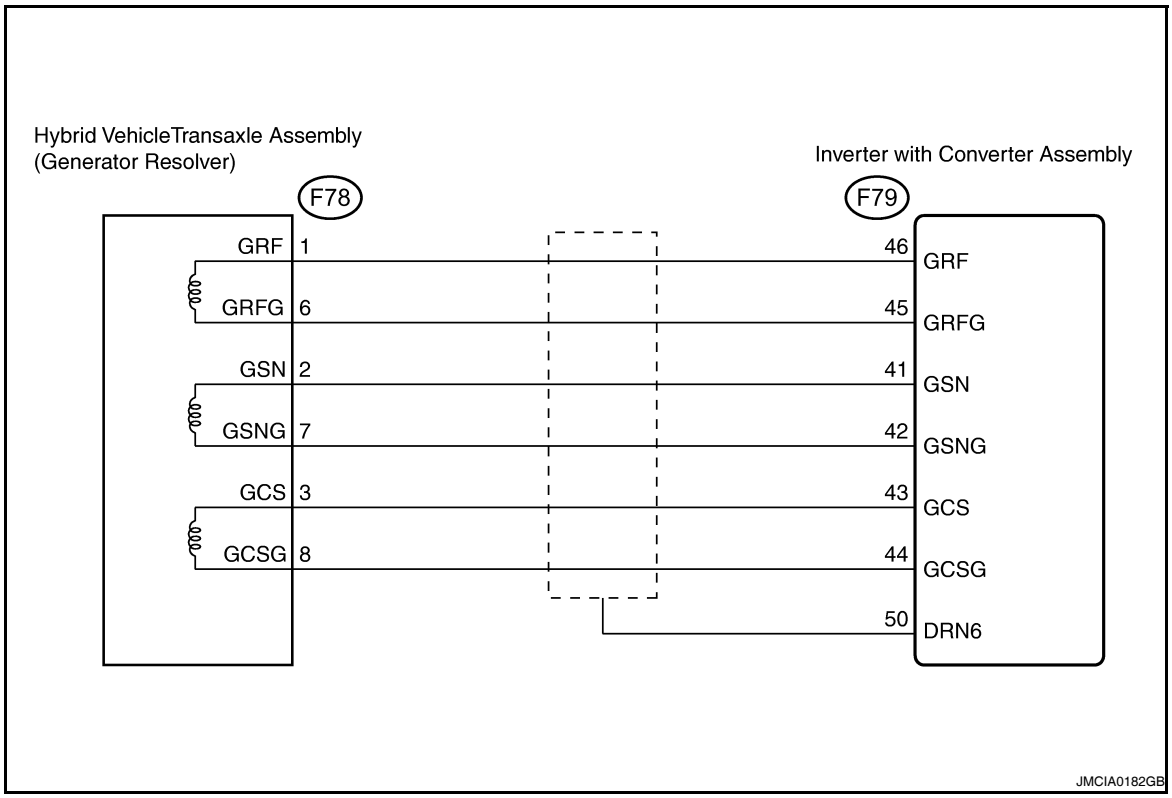
DTC Logic

INFOID:0000000004211889

DTC DETECTION LOGIC

The MG ECU monitors the generator resolver output signal. If the MG ECU detects output signals that are out of the normal range or specification, it will conclude that there is a malfunction of the generator resolver. 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
P0A4B	253	Generator Position Sensor Circuit	Interphase short in the generator resolver circuit	• Wire harness or connector • Hybrid transaxle (Generator resolver) • Inverter with converter assembly
P0A4C	513	Generator Position Sensor Circuit Range / Performance	Generator resolver output is out of the normal range	• Wire harness or connector • Hybrid transaxle (Generator resolver) • Inverter with converter assembly
P0A4D	255	Generator Position Sensor Circuit Low	Open or short in the generator resolver circuit	• Wire harness or connector • Hybrid transaxle (Generator resolver) • Inverter with converter assembly



Diagnosis Procedure

INFOID:0000000004211890

1.PRECONDITIONING

- 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. 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).
- Check for output DTCs again after the repair has been completed. If P0A78-286 or P0A7A-324 is output, replace the inverter with converter assembly.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.
- If the problem symptom cannot be reproduced, performing a road test on a road on which the vehicle tends to vibrate will make it easier to reproduce the symptom.
- If INF code 253 is output, there may be an interphase short in the generator resolver circuit due to an intrusion of water into the resolver. Therefore, if the problem symptom cannot be reproduced, replace the hybrid transaxle last.

>> GO TO 2.

2.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> Connect securely.

3.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

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

4.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> GO TO 5.

5.CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Connect securely.

6.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A51-174

Description

INFOID:0000000004211891

The inverter with converter assembly (MG ECU) monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004211892

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A51	174	Drive Motor “A” Current Sensor Circuit	Inverter with converter assembly (MG ECU) internal error	• Wire harness or connector • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211893

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A”” Phase W Current
P0A78-113, 287, 505, 506	Drive Motor “A” Inverter Performance

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - BODY GROUND)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this many cause a malfunction.
2. Disconnect the inverter with converter assembly harness connector E69.
3. Measure the resistance according to the value(s) in the table below.

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
E69	3 (GND1)	Ground	Below 1Ω
	4 (GND2)		

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A60-288, P0A60-290, P0A60-294, P0A60-501

Description

INFOID:0000000004211894

The inverter with converter assembly (MG ECU) monitors the inverter current sensor. The MG ECU detects malfunctions in the sensor system and does not detect malfunctions in the high-voltage system.

DTC Logic

INFOID:0000000004211895

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the motor inverter current sensor. If the hybrid vehicle control ECU detects a fault, it will illuminate the MIL and set a DTC.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A60	288	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (phase V sub sensor)	• Inverter with converter assembly • Service plug grip
P0A60	290	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (phase V main sensor)	• Inverter with converter assembly • Service plug grip
P0A60	294	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (Performance problem or open phase V)	• Inverter with converter assembly • Service plug grip
P0A60	501	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (phase V main and sub sensors offset)	• Inverter with converter assembly • Service plug grip
P0A63	296	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (phase W sub sensor)	• Inverter with converter assembly • Service plug grip
P0A63	298	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (phase W main sensor)	• Inverter with converter assembly • Service plug grip
P0A63	302	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (Performance problem or open phase W)	• Inverter with converter assembly • Service plug grip
P0A63	502	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (phase W main and sub sensors offset)	• Inverter with converter assembly • Service plug grip

Diagnosis Procedure

INFOID:0000000004211896

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> GO TO 4.

3.REPLACE INVERTER WITH CONVERTER ASSEMBLY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

4. CONNECT SECURELY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

P0A63-296, P0A63-298, P0A63-302, P0A63-502

Description

INFOID:0000000004211897

The inverter with converter assembly (MG ECU) monitors the inverter current sensor. The MG ECU detects malfunctions in the sensor system and does not detect malfunctions in the high-voltage system.

DTC Logic

INFOID:0000000004211898

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the motor inverter current sensor. If the hybrid vehicle control ECU detects a fault, it will illuminate the MIL and set a DTC.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A60	288	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (phase V sub sensor)	• Inverter with converter assembly • Service plug grip
P0A60	290	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (phase V main sensor)	• Inverter with converter assembly • Service plug grip
P0A60	294	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (Performance problem or open phase V)	• Inverter with converter assembly • Service plug grip
P0A60	501	Drive Motor “A” Phase V Current	Malfunction in motor inverter current sensor (phase V main and sub sensors offset)	• Inverter with converter assembly • Service plug grip
P0A63	296	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (phase W sub sensor)	• Inverter with converter assembly • Service plug grip
P0A63	298	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (phase W main sensor)	• Inverter with converter assembly • Service plug grip
P0A63	302	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (Performance problem or open phase W)	• Inverter with converter assembly • Service plug grip
P0A63	502	Drive Motor “A” Phase W Current	Malfunction in motor inverter current sensor (phase W main and sub sensors offset)	• Inverter with converter assembly • Service plug grip

Diagnosis Procedure

INFOID:0000000004211899

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> GO TO 4.

3.REPLACE INVERTER WITH CONVERTER ASSEMBLY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

4. CONNECT SECURELY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

P0A72-326, P0A72-328, P0A72-333, P0A72-515

Description

INFOID:0000000004211900

The inverter with converter assembly (MG ECU) monitors the inverter current sensor. The MG ECU detects malfunctions in the sensor system and does not detect malfunctions in the high-voltage system.

DTC Logic

INFOID:0000000004211901

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the generator inverter current sensor. If the hybrid vehicle control ECU detects a fault, it will illuminate the MIL and set a DTC.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A72	326	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V sub sensor)	• Inverter with converter assembly • Service plug grip
P0A72	328	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main sensor)	• Inverter with converter assembly • Service plug grip
P0A72	333	Generator Phase V Current	Malfunction in generator inverter current sensor (Performance problem or open phase V)	• Inverter with converter assembly • Service plug grip
P0A72	515	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main and sub sensors offset)	• Inverter with converter assembly • Service plug grip
P0A75	334	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W sub sensor)	• Inverter with converter assembly • Service plug grip
P0A75	336	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main sensor)	• Inverter with converter assembly • Service plug grip
P0A75	341	Generator Phase W Current	Malfunction in generator inverter current sensor (Performance problem or open phase W)	• Inverter with converter assembly • Service plug grip
P0A75	516	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main and sub sensors offset)	• Inverter with converter assembly • Service plug grip

Diagnosis Procedure

INFOID:0000000004211902

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> GO TO 4.

3.REPLACE INVERTER WITH CONVERTER ASSEMBLY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

4. CONNECT SECURELY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

P0A75-334, P0A75-336, P0A75-341, P0A75-516

Description

INFOID:0000000004211903

The inverter with converter assembly (MG ECU) monitors the inverter current sensor. The MG ECU detects malfunctions in the sensor system and does not detect malfunctions in the high-voltage system.

DTC Logic

INFOID:0000000004211904

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the generator inverter current sensor. If the hybrid vehicle control ECU detects a fault, it will illuminate the MIL and set a DTC.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A72	326	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V sub sensor)	• Inverter with converter assembly • Service plug grip
P0A72	328	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main sensor)	• Inverter with converter assembly • Service plug grip
P0A72	333	Generator Phase V Current	Malfunction in generator inverter current sensor (Performance problem or open phase V)	• Inverter with converter assembly • Service plug grip
P0A72	515	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main and sub sensors offset)	• Inverter with converter assembly • Service plug grip
P0A75	334	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W sub sensor)	• Inverter with converter assembly • Service plug grip
P0A75	336	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main sensor)	• Inverter with converter assembly • Service plug grip
P0A75	341	Generator Phase W Current	Malfunction in generator inverter current sensor (Performance problem or open phase W)	• Inverter with converter assembly • Service plug grip
P0A75	516	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main and sub sensors offset)	• Inverter with converter assembly • Service plug grip

Diagnosis Procedure

INFOID:0000000004211905

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.
NG >> GO TO 4.

3.REPLACE INVERTER WITH CONVERTER ASSEMBLY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

4. CONNECT SECURELY

If any DTCs indicating malfunctions in the current sensor circuit are output, overcurrent to the electric vehicle fuse is suspected. In this case, replace the electric vehicle fuse installed on the service plug grip.

>> Replace service plug grip.

P0A78-113

Description

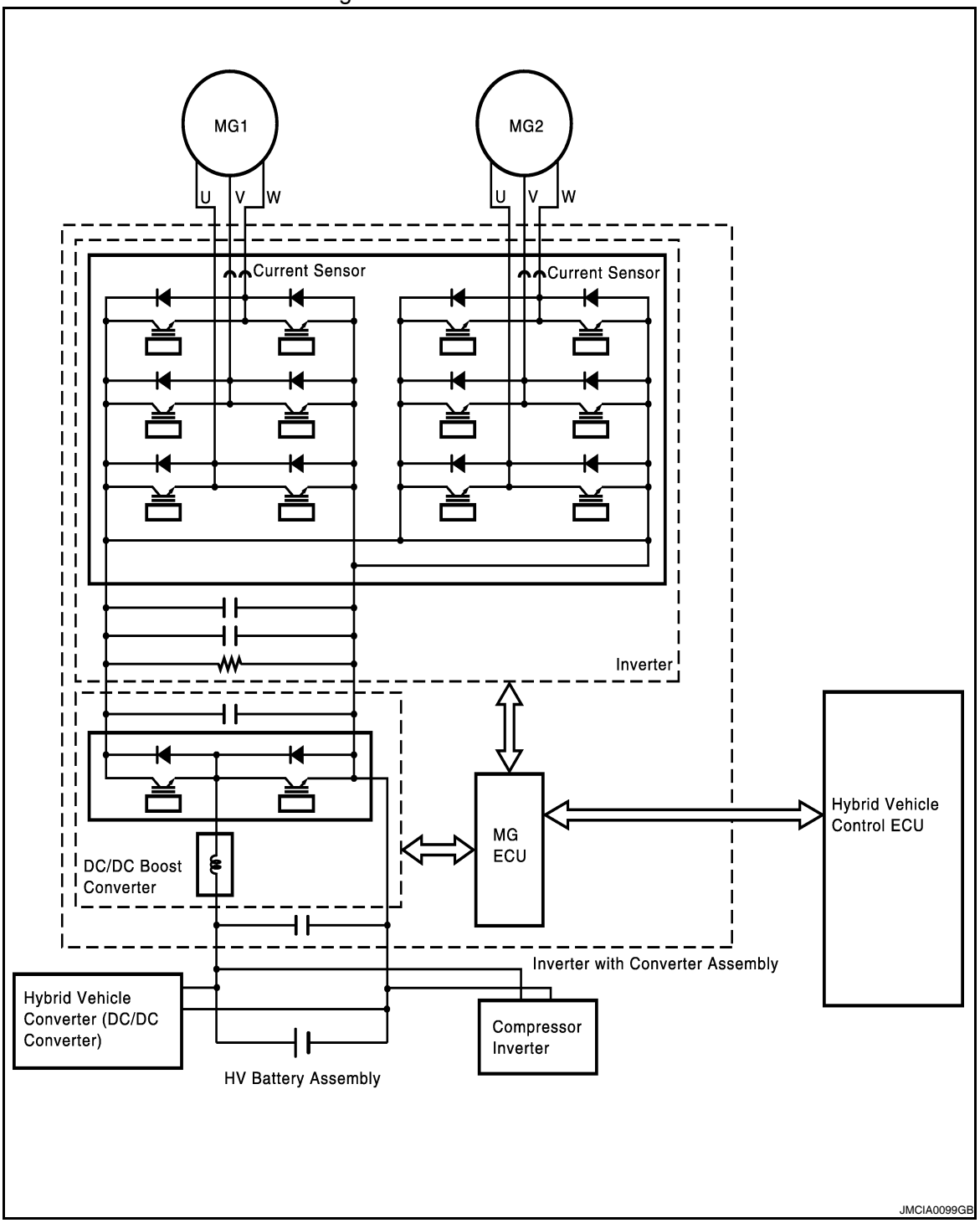
INFOID:0000000004211906

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.

The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211907

DTC DETECTION LOGIC

If MG ECU detects overheat or circuit malfunction of the traction motor inverter, the inverter assembly transmits this information via the traction motor inverter fail signal line.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A78	113	Drive Motor “A” Inverter Performance	Motor inverter fail signal detection (overcurrent due to system malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211908

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 503, 279, 504, 306, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-517, 325, 518, 344, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:
P0A78-113 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.

NG >> CONNECT SECURELY

4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

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

5. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> GO TO 12.

6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

7. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 14.

8. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Tighten to specified torque.

9. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Tighten to specified torque.

10. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation".)

11. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation".)
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation".)

12. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.

NG >> Connect securely.

13.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation".)
NG >> Repair or replace harness or connector.

14.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

15.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation".)
NG >> Repair or replace harness or connector.

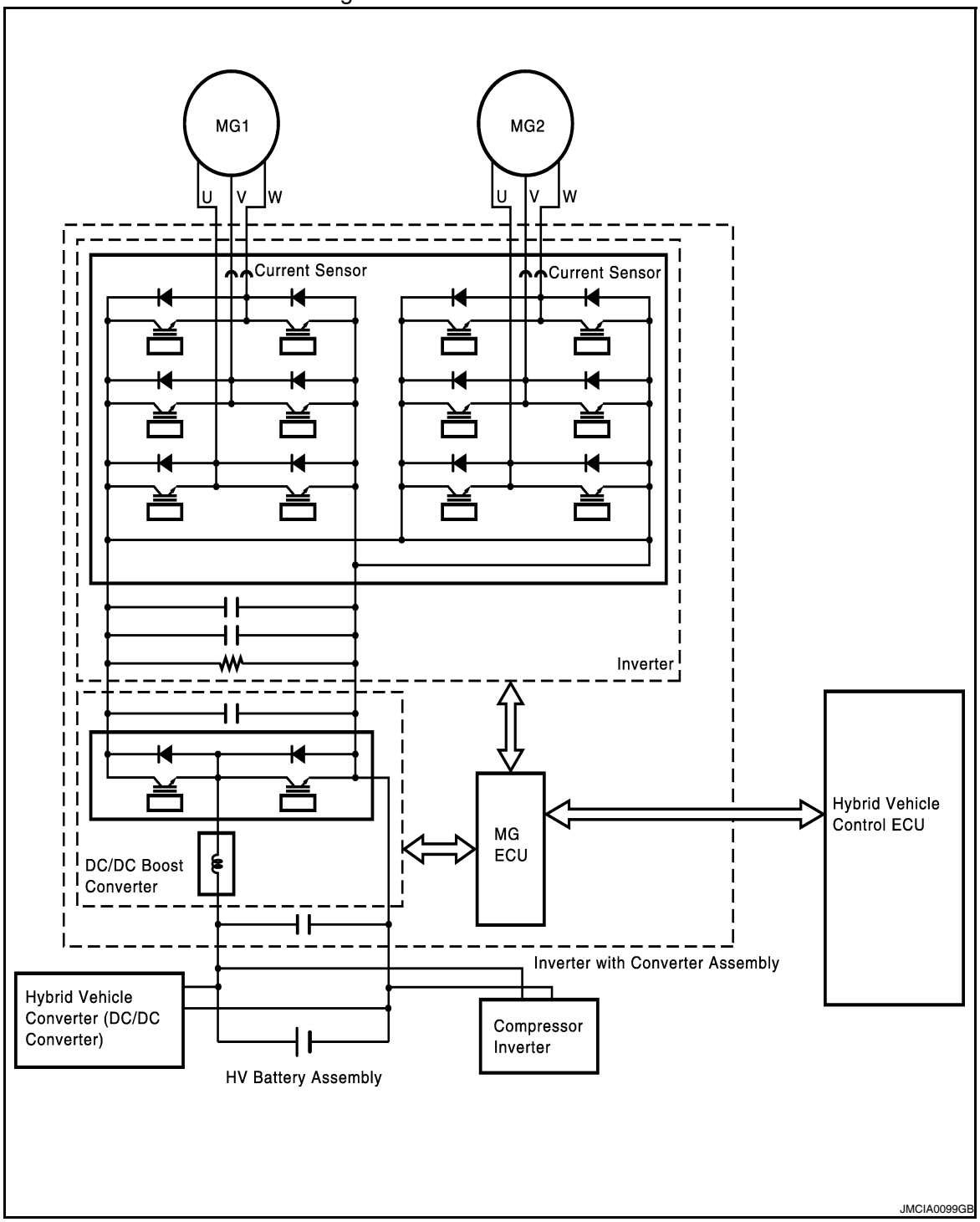
P0A78-121

Description

INFOID:0000000004211909

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211910

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A78	121	Drive Motor “A” Inverter Performance	Motor inverter overvoltage signal detection (overvoltage due to system malfunction)	• HV relay assembly • Inverter with converter assembly • Service plug grip • Frame wire • Hybrid transaxle

Diagnosis Procedure

INFOID:0000000004211911

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A51-174	Drive Motor “A” Current Sensor Circuit
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A78-266, 267, 523, 586, 284, 505, 287, 506, 113, 286, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 553, 554, 555, 556, 172, 557, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 324, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance
P3004-803	High Voltage Power Resource
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low

NOTE:
P0A78-121 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

OK >> Go to Diagnosis Procedure relevant to output DTC.

NG >> GO TO 3.

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

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

5.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> GO TO 21.

6.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

7.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 19.

8.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Tighten to specified torque.

9.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Tighten to specified torque.

10.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle (See page HX-10)

11.INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

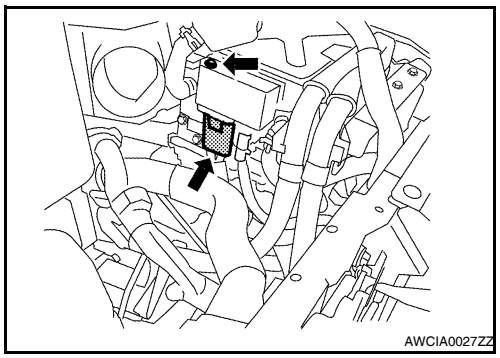
OK or NG

OK >> GO TO 12.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation".)

12. CHECK INVERTER WITH CONVERTER ASSEMBLY (HIGH VOLTAGE CONNECTOR CONNECTION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
   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.
2. Check the connection of the high voltage connector of the inverter with converter assembly.



The connector is connected securely and there are no contact problems.

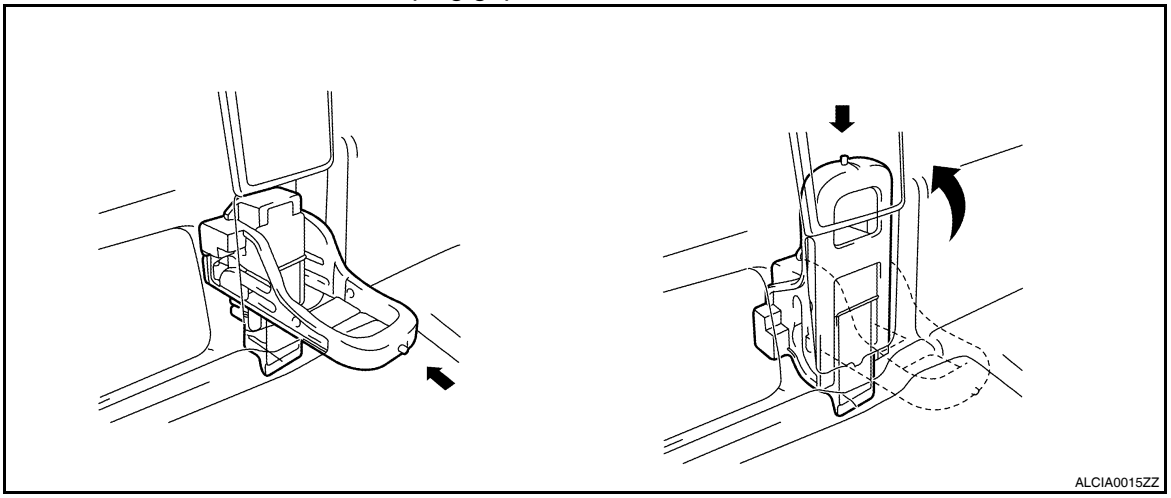
OK or NG

OK >> GO TO 13.
NG >> Connect securely.

13. CHECK SERVICE PLUG GRIP

CAUTION:
Be sure to wear insulated gloves.

1. Check the connection of the service plug grip.



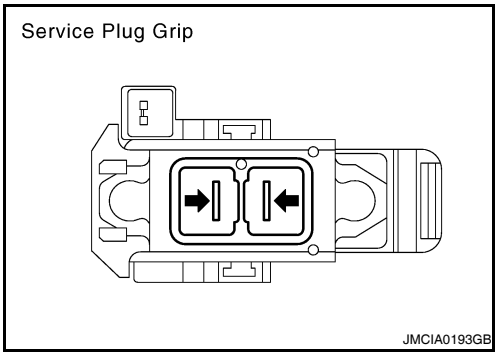
Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

OK or NG

OK >> GO TO 14.
NG >> Replace service plug grip.

14. CHECK SERVICE PLUG GRIP

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



Service plug grip		Resistance
Component connector	Terminal	
—	See figure	Below 1 Ω

OK or NG

OK >> GO TO 15.
NG >> Replace service plug grip.

15. CHECK CONDITION OF FRAME WIRE CONNECTIONS (HV RELAY ASSEMBLY SIDE)

See HBC-527, "Diagnosis Procedure".

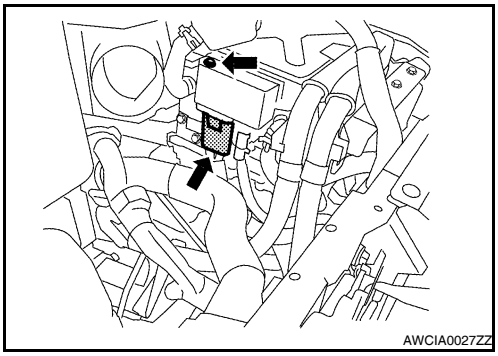
OK or NG

OK >> GO TO 16.
NG >> Tighten to specified torque.

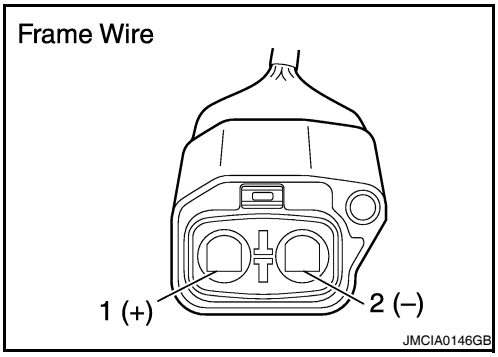
16. CHECK FRAME WIRE

CAUTION:
Be sure to wear insulated gloves and protective goggles.

1. Check that the service plug grip is not installed.
2. Disconnect the frame wire from the HV relay.
3. Disconnect the frame wire from the high voltage connector of the inverter with converter assembly.

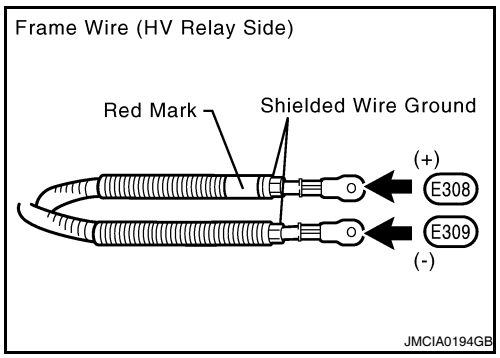


4. Measure the resistance according to the value(s) in the table below.



Frame wire (HV relay side)		Frame wire (Inverter with converter assembly side)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E308	1 (high voltage+)	E313	1 (high voltage+)	Below 1 Ω
E309	1 (high voltage-)		2 (high voltage-)	Below 1 Ω

5. Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
NOTE:
Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.



Frame wire (HV relay side)		Ground	Resistance
Harness connector	Terminal		
E308	1 (high voltage+)	Body ground and shielded wire ground	10 MΩ or higher
E309	1 (high voltage-)	Body ground and shielded wire ground	10 MΩ or higher

Frame wire (HV relay side)		Frame wire (HV relay side)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E308	1 (high voltage+)	E309	1 (high voltage-)	10 MΩ or higher

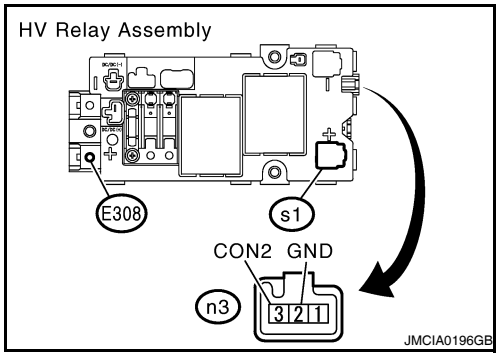
OK or NG

OK >> GO TO 17.
NG >> Replace frame wire.

17. INSPECT HV RELAY ASSEMBLY (SMRB)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Remove the HV relay assembly from the vehicle (See HBB-105, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



HV relay assembly		HV relay assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E308	1 (high voltage+)	s1	1	Below 1 Ω [When battery voltage (12 V) is applied to n3 terminals 2 (GND) and 3 (CON2)]

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

Frame wire (HV relay side)		Frame wire (HV relay side)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
n3	3 (CON2)	n3	2 (GND)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

OK or NG

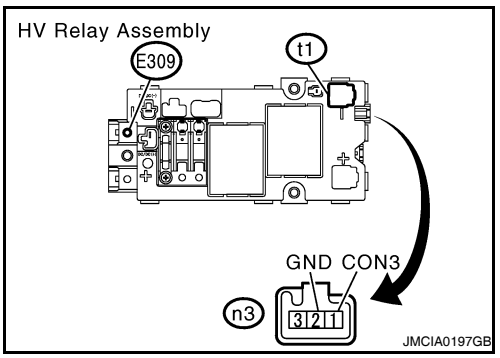
OK >> GO TO 18.
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

18. INSPECT HV RELAY ASSEMBLY (SMRG)

CAUTION:
Be sure to wear insulated gloves and protective goggles.

1. Check that the service plug grip is not installed.

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



HV relay assembly		HV relay assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E309	1 (high voltage-)	t1	1	Below 1 Ω [When battery voltage (12 V) is applied to n3 terminals 1 (CON3) and 2 (GND)]

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

HV relay assembly		HV relay assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
n3	1 (CON3)	n3	2 (GND)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

19. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 20.
NG >> Connect securely.

20. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

21. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 22.
NG >> Connect securely.

22. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

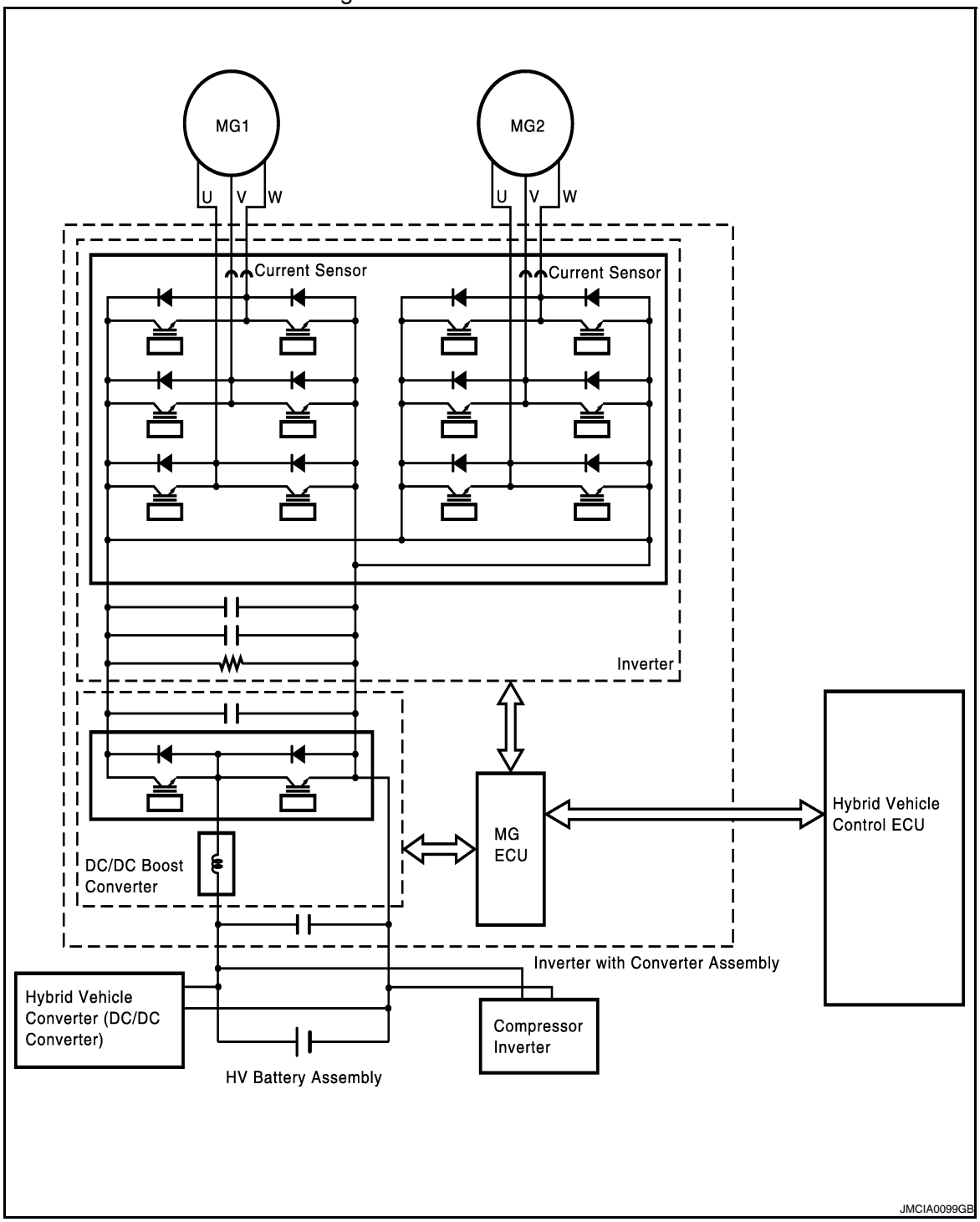
P0A78-128

Description

INFOID:0000000004211912

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211913

DTC DETECTION LOGIC

If an abnormal amount of current flows through the motor inverter, the MG ECU detects it and sends a signal to inform the hybrid vehicle control ECU of the malfunction.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A78	128	Drive Motor “A” Inverter Performance	Abnormal motor current value detection (System malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211914

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 503, 279, 504, 306, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-517, 325, 518, 344, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:
P0A78-128 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.

NG >> Connect securely.

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

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

5.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> GO TO 12.

6.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

7.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 14.

8.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTOR CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Tighten to specified torque.

9.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Tighten to specified torque.

10.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

11.INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

12.CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.

NG >> Connect securely.

13.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

14.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

15.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

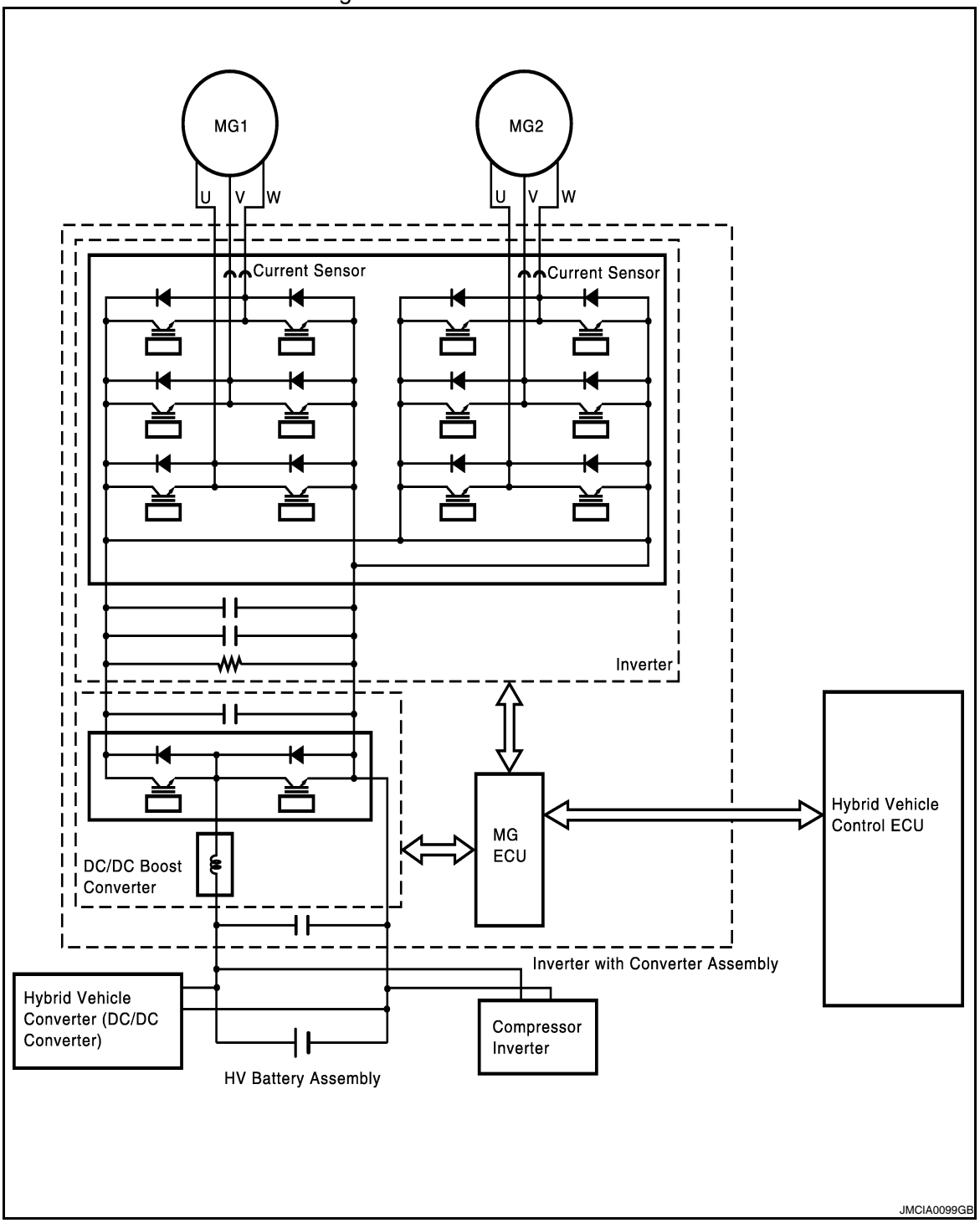
P0A78-266, P0A78-267

Description

INFOID:0000000004211915

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211916

DTC DETECTION LOGIC

The MG ECU monitors the inverter voltage (VH) sensor circuit. If the MG ECU detects an open or short in the VH sensor circuit, 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
P0A78	266	Drive Motor “A” Inverter Performance	Open or short to GND in the inverter voltage (VH) signal line	Inverter with converter assembly
	267		Short to +B in the inverter voltage (VH) signal line	

Diagnosis Procedure

INFOID:0000000004211917

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

Refer to HBC-638, "Removal and Installation".

>> COMPLETED

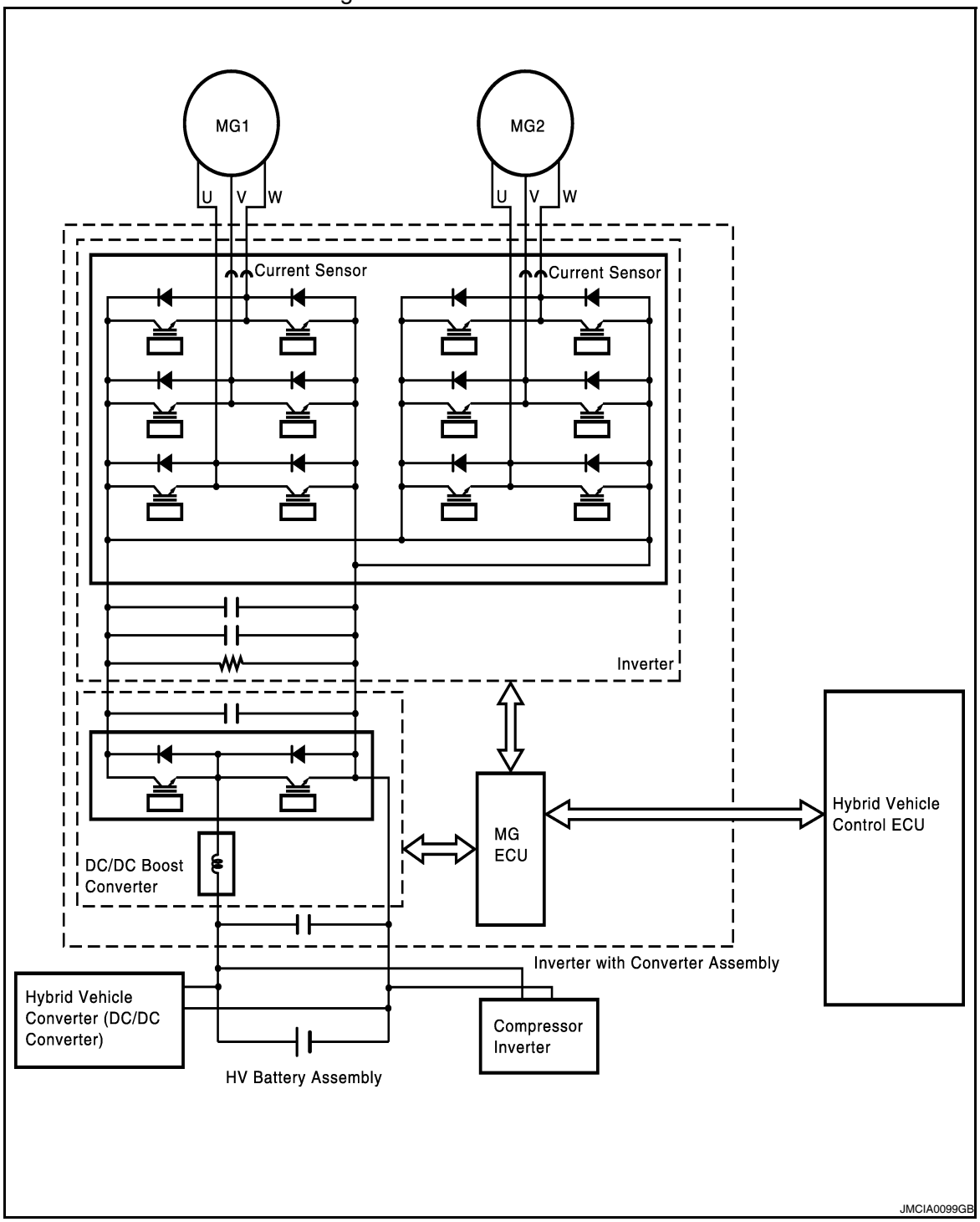
P0A78-279

Description

INFOID:0000000004211918

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211919

DTC DETECTION LOGIC

If the motor inverter detects overvoltage, it transmits an overvoltage signal to the MG ECU. Upon receiving this signal, 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
P0A78	279	Drive Motor “A” Inverter Performance	Motor inverter overvoltage signal detection (overvoltage due to inverter with converter assembly malfunction)	P0A78 279 Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211920

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556	DC/DC Converter Performance
P0A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance
P3004-803	High Voltage Power Resource
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low

NOTE:
P0A78-279 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

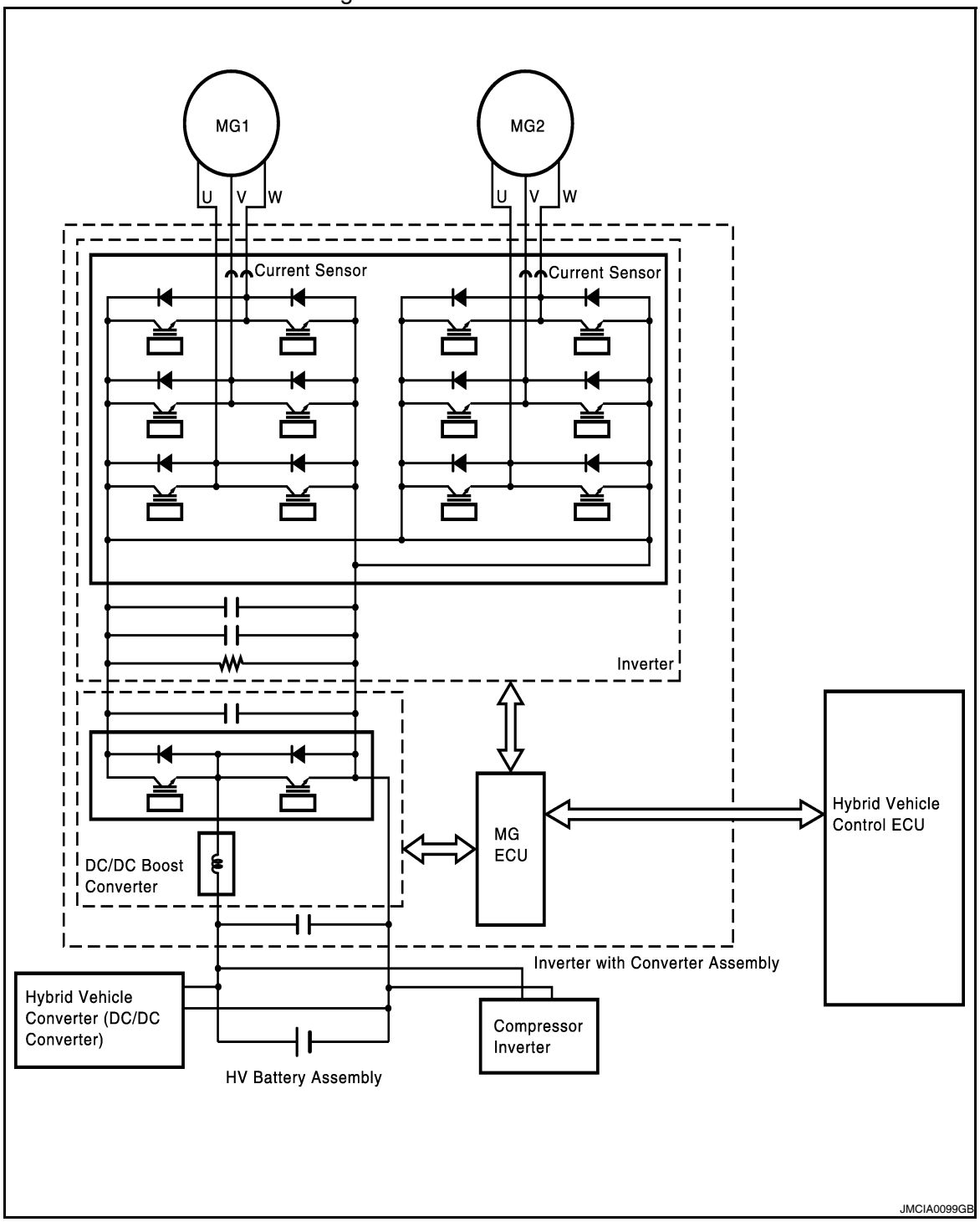
P0A78-282

Description

INFOID:0000000004211921

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211922

DTC DETECTION LOGIC

If the motor inverter detects a circuit malfunction, it transmits a motor inverter overvoltage signal to the MG ECU. Upon receiving this signal, 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
P0A78	282	Drive Motor “A” Inverter Performance	Motor inverter overvoltage signal detection (circuit malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211923

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

P0A78-284

Description

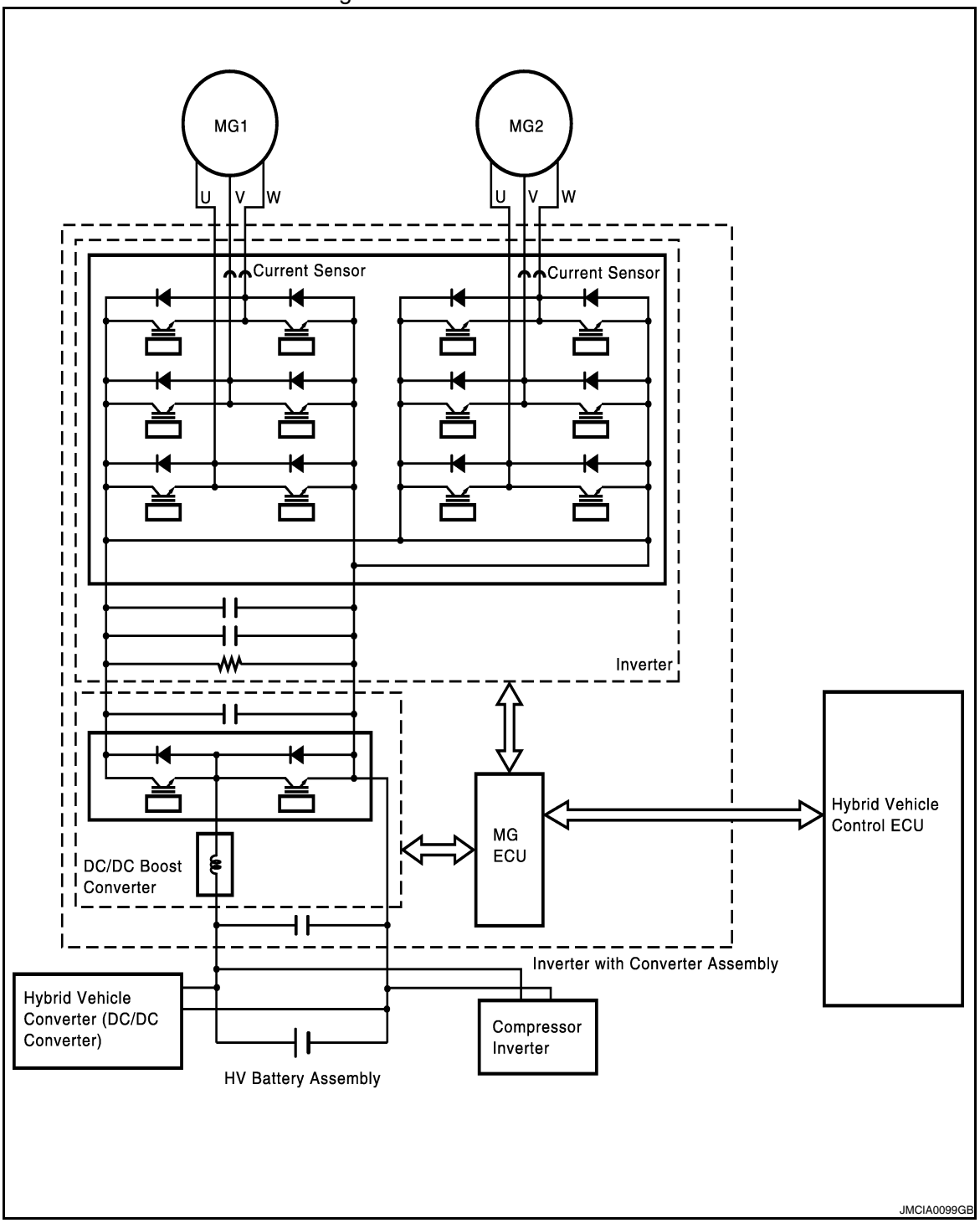
INFOID:0000000004211924

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.

The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211925

DTC DETECTION LOGIC

If the motor inverter overheats, or has a circuit malfunction or internal short, the inverter transmits this information to the MFIV terminal of the MG ECU via the motor inverter fail signal line.
If the motor inverter overheats, it transmits an inverter fail signal to the MG ECU. Upon receiving this signal, 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
P0A78	284	Drive Motor “A” Inverter Performance	Motor inverter fail signal detection (overheat)	• Wire harness or connector • Inverter cooling system • Cooling fan system • Water pump with motor & bracket assembly • Hybrid transaxle • Inverter with converter assembly • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211926

1.PRECONDITIONING

- 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. 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.
- After inspection, be sure to replace the inverter with converter assembly.
- 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 503, 279, 504, 306, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-517, 325, 518, 344, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:
DTC P0A78-284 may be set due to a malfunction which also causes DTCs in the table above to be set.

First troubleshoot the output DTCs in the table above. After troubleshooting all output DTCs, be sure to replace the inverter with converter assembly.

Is DTC detected?

OK >> Go to Diagnosis Procedure relevant to output DTC.
NG >> GO TO 3.

3. CHECK QUANTITY OF INVERTER COOLANT

1. Check for coolant leaks.
2. Check the coolant in the sub reserve tank assembly is above the low level.

Result	Proceed to
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is above the low level.	A
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is below the low level.	B
Coolant leaks are evident.	C

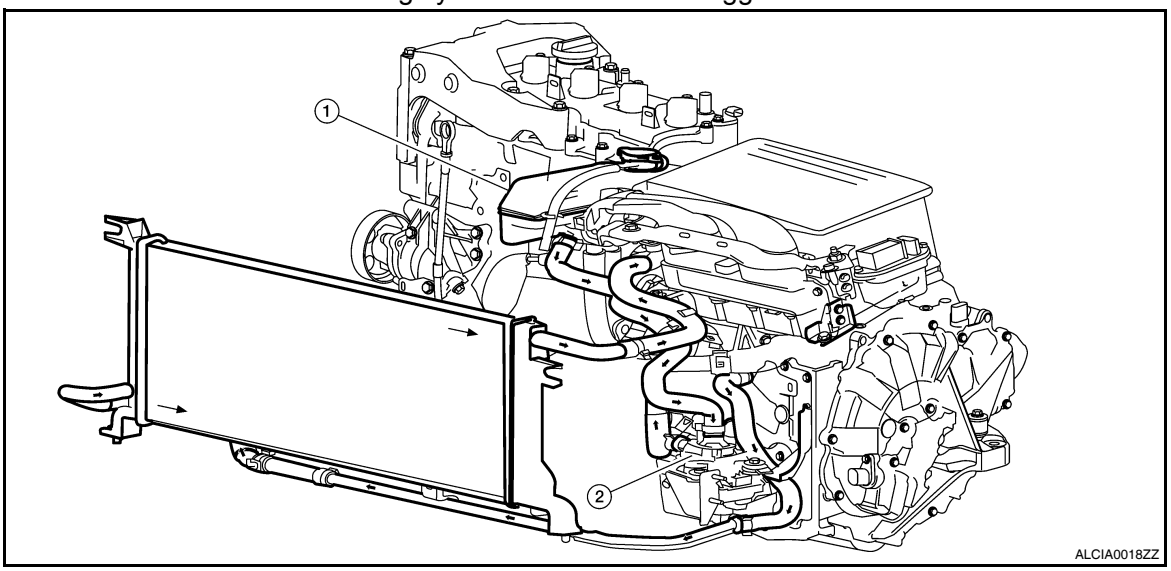
NOTE:
After repairing the coolant leaks and adding coolant, perform the “INV WATER PUMP” and “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III and make sure that there are no malfunctions.

A or B or C

A >> GO TO 4.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

4. CHECK COOLANT HOSE

Check if the hoses of the inverter cooling system are kinked or clogged.



1 Coolant reservoir
2. Water pump with motor and bracket assembly

OK or NG

OK >> GO TO 5.
NG >> Correct the problem.

5. CHECK FUSE

1. Turn ignition switch OFF.
2. Remove the 10A fuse (No. 67).
3. Check the resistance of the fuse.

Resistance: Below 1 Ω

Is the inspection result normal?

YES >> Install the 10A fuse (No. 67). GO TO 6.

NO >> Replace fuse.

6.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
>> Connect securely.

7.CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

Check the connection of the water pump with motor & bracket assembly connector.

The connector is connected securely and there are no contact problems.

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8.PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

1. Reconnect all harness connectors removed.
2. Turn ignition switch ON.
3. Perform “INV WATER PUMP” in “ACTIVE TEST” mode with CONSULT-III.
4. During this test, open the sub reserve tank cap and check that there are ripples in the coolant. Continue the active test for at least 1 minute.
   NOTE:
   The water pump motor operates even in inspection mode.

There are ripples in the coolant in the sub reserve tank assembly for 1 minute.

OK >> GO TO 9.
NG >> GO TO 24.

9.CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

Check the connections of the cooling fan motor connectors.

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

OK or NG

OK >> GO TO 10.
NG >> Connect securely.

10.PERFORM ACTIVE TEST WITH CONSULT-III (COOLING FAN SPD)

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

The cooling fan rotates.

OK or NG

OK >> GO TO 11.
NG >> Check cooling fan system (See EC-382, "Component Function Check").

11.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Connect securely.

12.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Repair or replace harness or connector.

13. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> GO TO 20.

14. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Repair or replace harness or connector.

15. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> GO TO 22.

16. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Tighten to specified torque.

17. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 18.
NG >> Tighten to specified torque.

18. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

19. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

20. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 21.
NG >> Connect securely.

21. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

22. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 23.
NG >> CONNECT SECURELY

23. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

24. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 25.

25. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 26.
NG >> GO TO 27.

26. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

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

27. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

Refer to PG-65, "Terminal Arrangement".

OK or NG

OK >> GO TO 28.
NG >> Replace high voltage fuse and fusible link box.

28. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

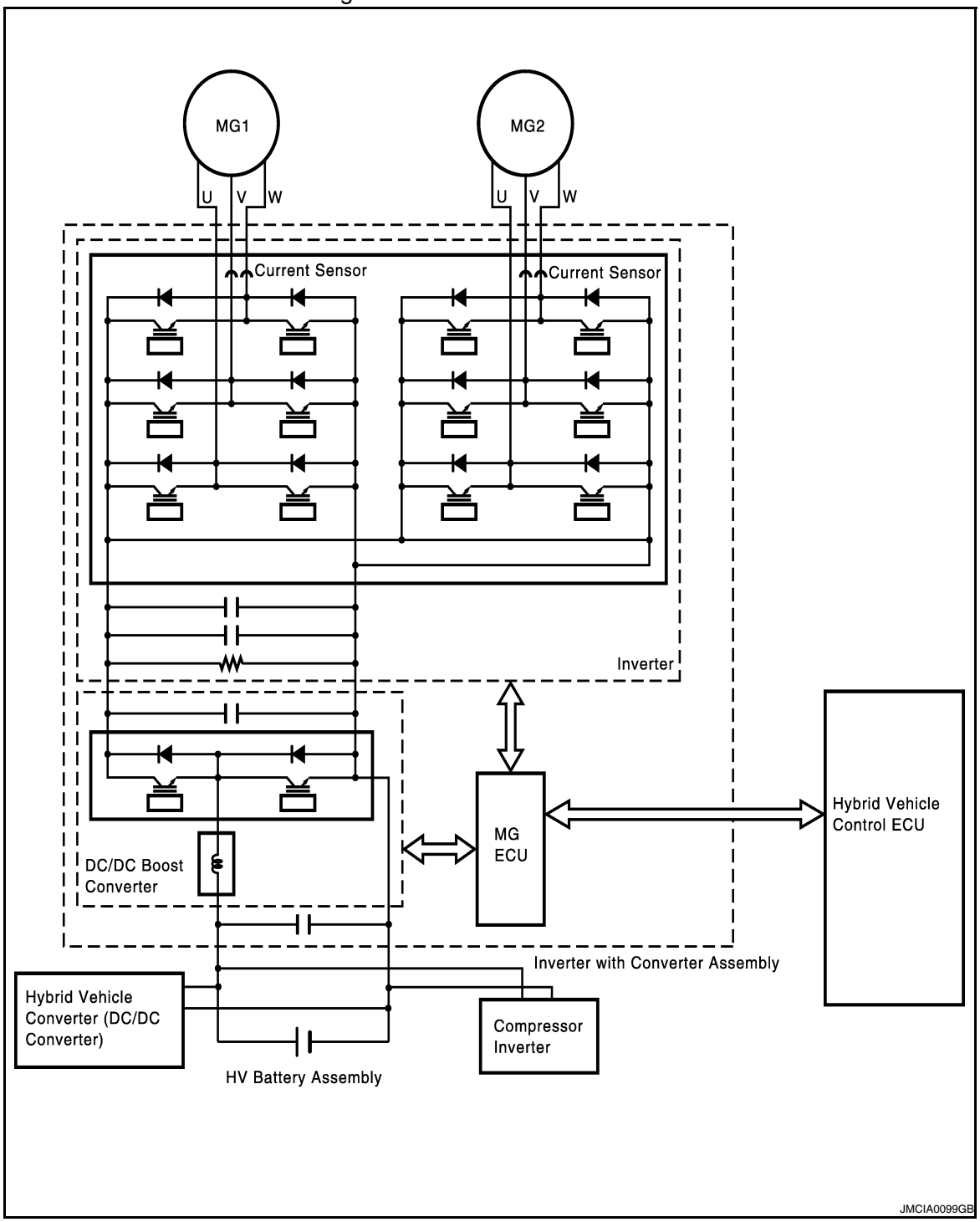
P0A78-286

Description

INFOID:0000000004211927

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211928

DTC DETECTION LOGIC

If the motor inverter overheats, or has a circuit malfunction or internal short, the inverter transmits this information to the MFIV terminal of the MG ECU via the motor inverter fail signal line.
If the motor inverter detects a circuit malfunction, it transmits a motor inverter fail signal to the MG ECU.
Upon receiving this signal, 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
P0A78	286	Drive Motor “A” Inverter Performance	Motor inverter fail signal detection (circuit malfunction)	• Wire harness or connector • Inverter cooling system • Cooling fan system • Water pump with motor & bracket assembly • Hybrid transaxle • Inverter with converter assembly • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211929

1.PRECONDITIONING

- 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. 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.
- After inspection, be sure to replace the inverter with converter assembly.
- 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 113, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:
DTC P0A78-286 may be set due to a malfunction which also causes DTCs in the table above to be set.

First troubleshoot the output DTCs in the table above. After troubleshooting all output DTCs, be sure to replace the inverter with converter assembly.

Is DTC detected?

OK >> Go to Diagnosis Procedure relevant to output DTC.
NG >> GO TO 3.

3. CHECK QUANTITY OF INVERTER COOLANT

1. Check for coolant leaks.
2. Check the coolant in the sub reserve tank assembly is above the low level.

Result	Proceed to
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is above the low level.	A
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is below the low level.	B
Coolant leaks are evident.	C

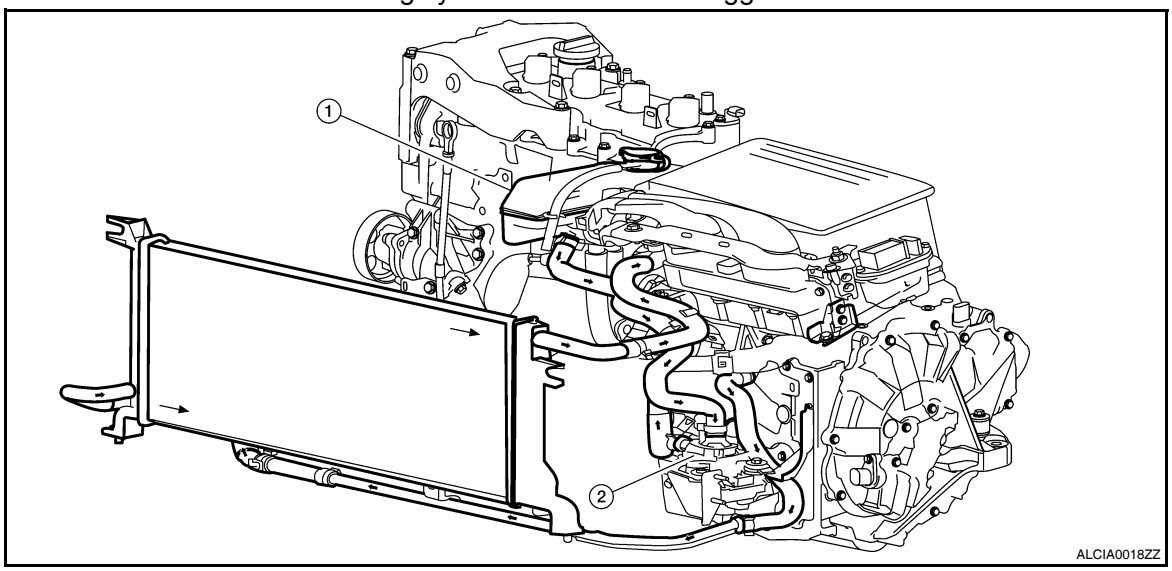
NOTE:
After repairing the coolant leaks and adding coolant, perform the “INV WATER PUMP” and “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III and make sure that there are no malfunctions.

A or B or C

A >> GO TO 4.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

4. CHECK COOLANT HOSE

Check if the hoses of the inverter cooling system are kinked or clogged.



1 Coolant reservoir
2. Water pump with motor and bracket assembly

OK or NG

OK >> GO TO 5.
NG >> Correct the problem.

5. CHECK FUSE

1. Turn ignition switch OFF.
2. Remove the 10A fuse (No. 67).
3. Check the resistance of the fuse.

Resistance: Below 1 Ω

Is the inspection result normal?

YES >> Install the 10A fuse (No. 67). GO TO 6.

NO >> Replace fuse.

6. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
>> Connect securely.

7. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

Check the connection of the water pump with motor & bracket assembly connector.

The connector is connected securely and there are no contact problems.

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

1. Reconnect all harness connectors removed.
2. Turn ignition switch ON.
3. Perform “INV WATER PUMP” in “ACTIVE TEST” mode with CONSULT-III.
4. During this test, open the sub reserve tank cap and check that there are ripples in the coolant. Continue the active test for at least 1 minute.
   NOTE:
   The water pump motor operates even in inspection mode.

There are ripples in the coolant in the sub reserve tank assembly for 1 minute.

OK >> GO TO 9.
NG >> GO TO 24.

9. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

Check the connections of the cooling fan motor connectors.

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

OK or NG

OK >> GO TO 10.
NG >> Connect securely.

10. PERFORM ACTIVE TEST WITH CONSULT-III (COOLING FAN SPD)

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

The cooling fan rotates.

OK or NG

OK >> GO TO 11.
NG >> Check cooling fan system (See EC-382, "Component Function Check").

11. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Connect securely.

12. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Repair or replace harness or connector.

13. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> GO TO 20.

14. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Repair or replace harness or connector.

15. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> GO TO 22.

16. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Tighten to specified torque.

17. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 18.
NG >> Tighten to specified torque.

18. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

19. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

20. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 21.
NG >> Connect securely.

21. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

22. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 23.
NG >> CONNECT SECURELY

23. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

24. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 25.

25. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 26.
NG >> GO TO 27.

26. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

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

27. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

Refer to PG-65, "Terminal Arrangement".

OK or NG

OK >> GO TO 28.
NG >> Replace high voltage fuse and fusible link box.

28. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

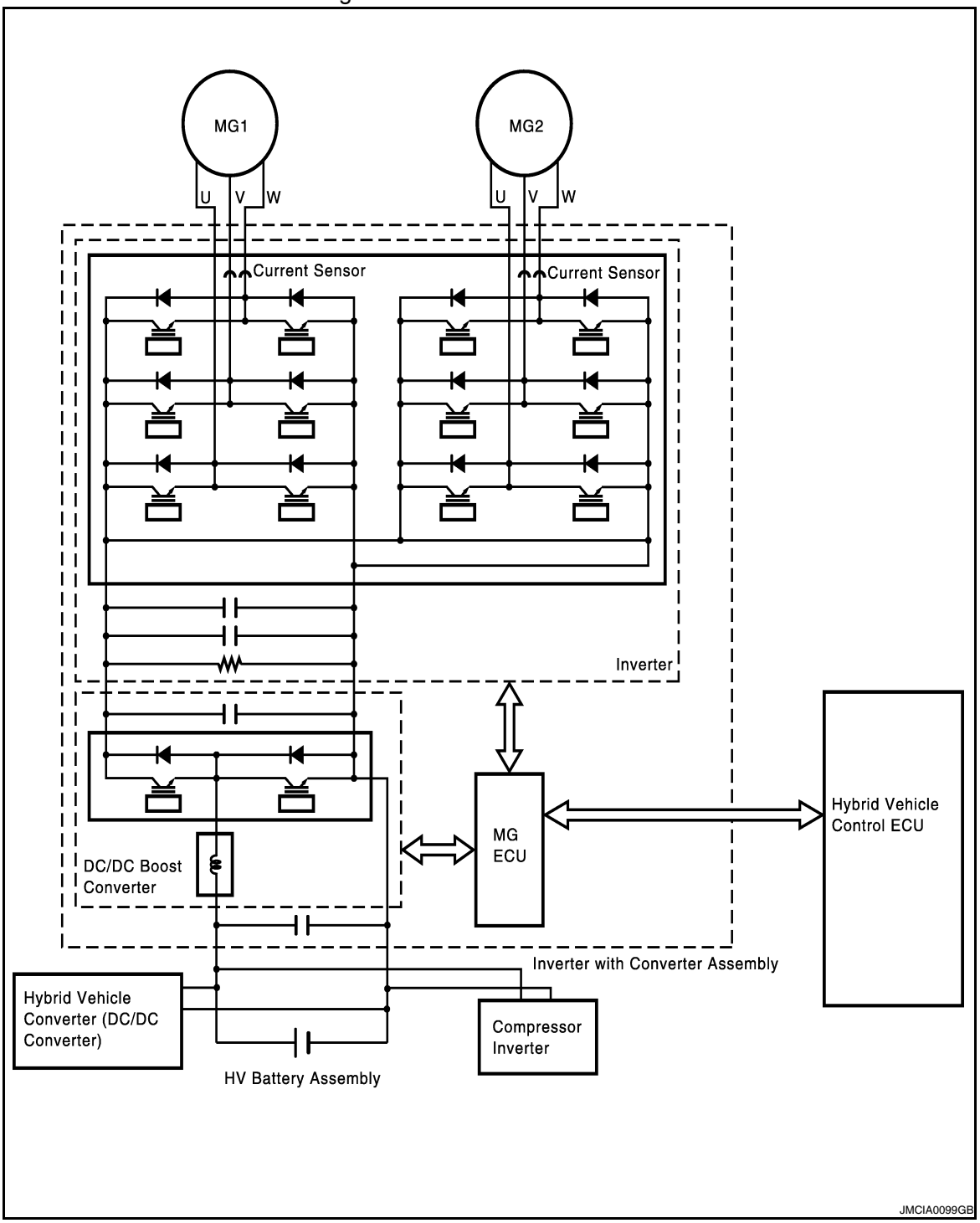
P0A78-287

Description

INFOID:0000000004211930

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211931

DTC DETECTION LOGIC

If MG ECU detects overheat or circuit malfunction of the traction motor inverter, the inverter assembly transmits this information via the traction motor inverter fail signal line.

If excessive amperage flows through the motor inverter due to an internal short, the motor inverter will transmit an inverter fail signal to the MG ECU. Upon receiving this signal, 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
P0A78	287	Drive Motor “A” Inverter Performance	Motor inverter fail signal detection (overcurrent due to inverter assembly malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211932

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance

NOTE:
P0A78-287 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

NG >> Connect securely.

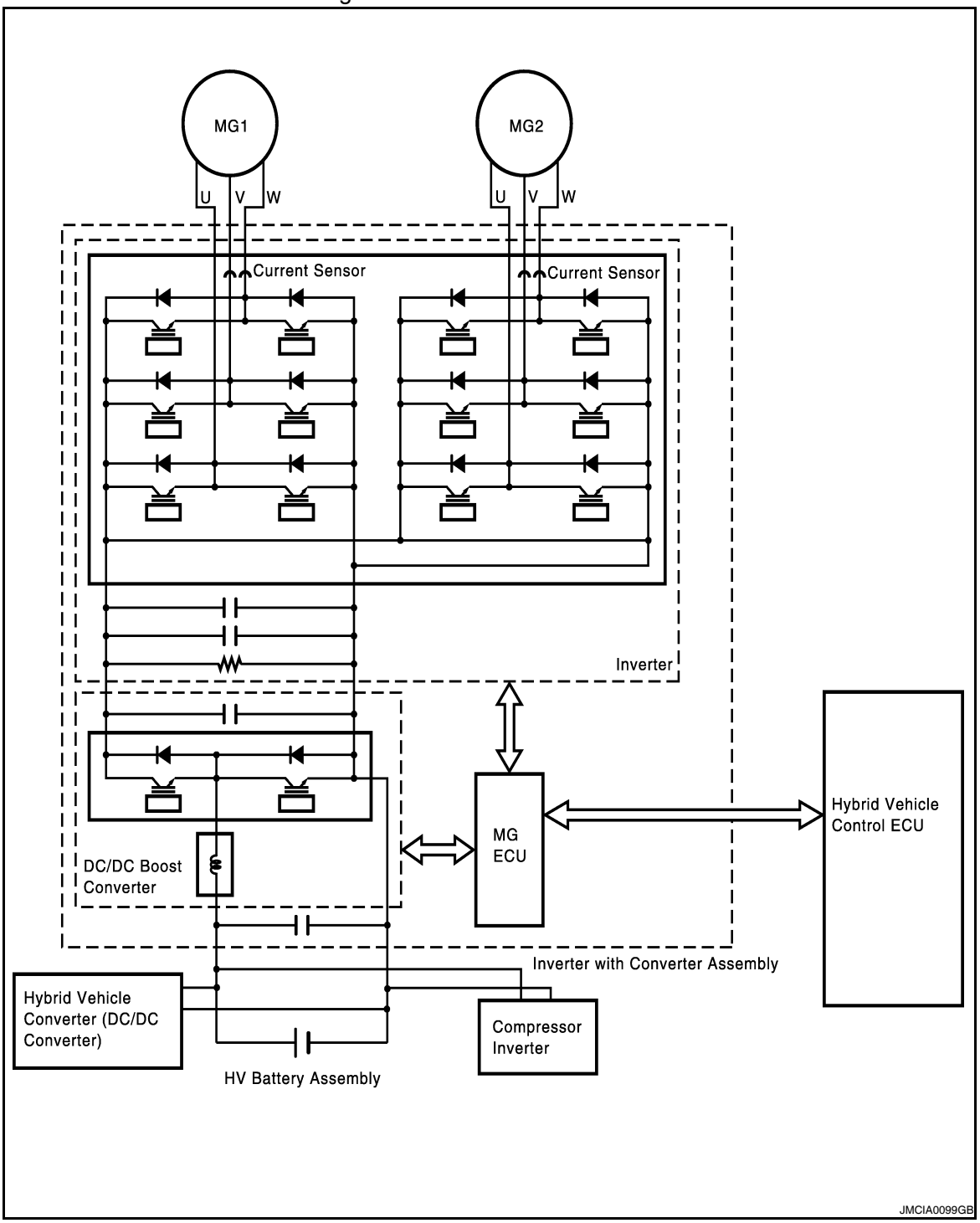
P0A78-306

Description

INFOID:0000000004211933

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211934

DTC DETECTION LOGIC

The MG ECU controls motor torque according to driving conditions.
If the difference between the requested MG2 torque and the actual MG2 torque exceeds a predetermined value, the MG ECU determines that there is a malfunction in the execution or monitoring of the MG2 torque. Then, 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
P0A78	306	Drive Motor “A” Inverter Performance	Motor torque execution monitoring malfunction	• Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211935

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor ““A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 510, 523, 586, 505, 287, 506, 503, 279, 504, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549	DC/DC Converter Performance
P0A7A-517, 522, 325, 518, 809, 810, 811	Generator Inverter Performance
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3004-132	Power Cable Malfunction
P3233-750	Short to B+ in Blocking of HV Gate Connection

NOTE:
P0A78-306 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Tighten to specified torque.

5. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

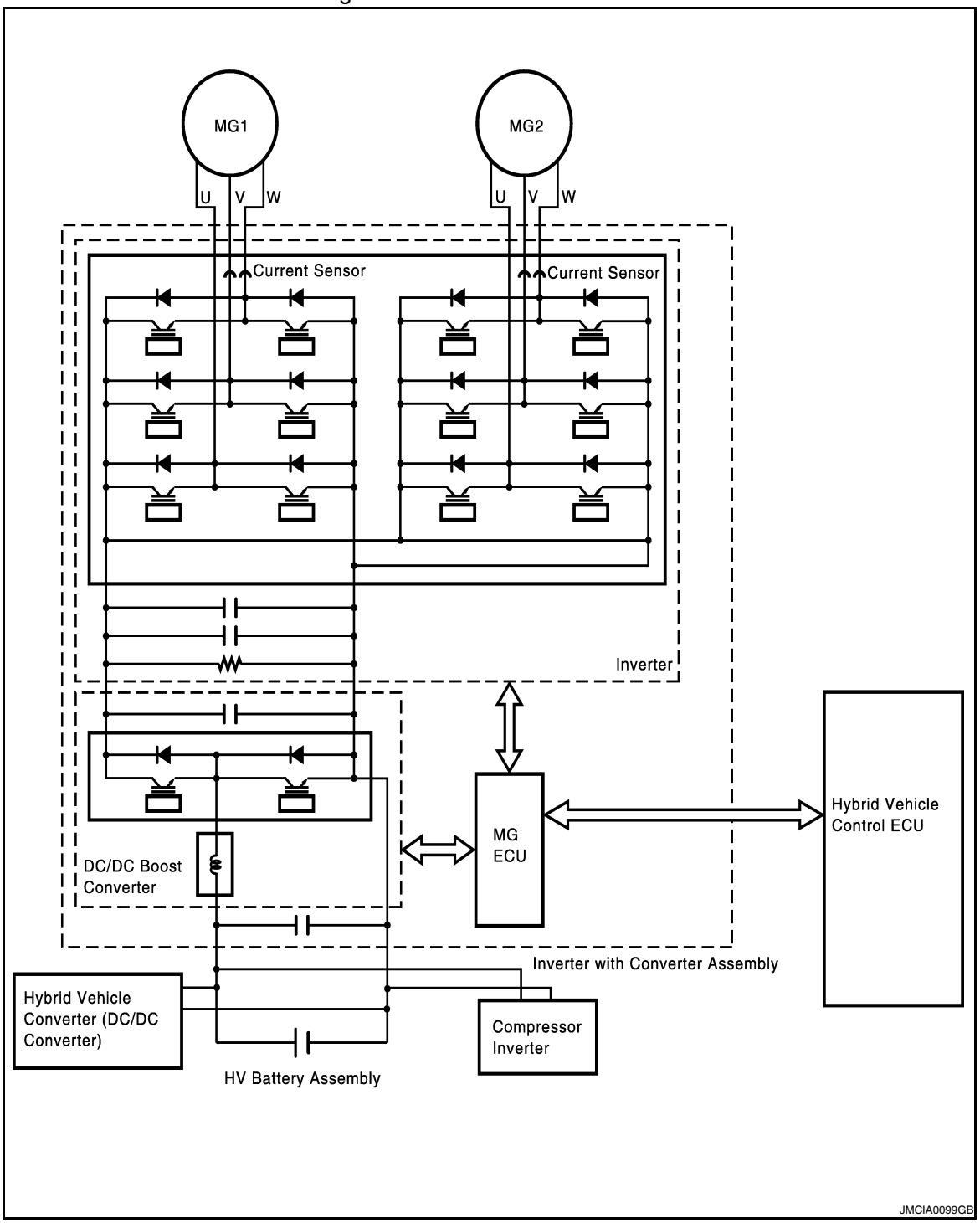
P0A78-503, P0A78-504

Description

INFOID:0000000004211936

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211937

DTC DETECTION LOGIC

If the motor inverter detects overvoltage, it transmits an overvoltage signal to the MG ECU. Upon receiving this signal, 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
P0A78	503	Drive Motor “A” Inverter Performance	Motor inverter overvoltage signal detection (overvoltage due to MG ECU malfunction)	• Wire harness or connector • Inverter with converter assembly • Hybrid transaxle
	504		Motor inverter overvoltage signal detection (overvoltage due to hybrid transaxle malfunction)	

Diagnosis Procedure

INFOID:0000000004211938

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556	DC/DC Converter Performance
P0A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance
P3004-803	High Voltage Power Resource
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low

NOTE:
P0A78-503 or 504 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

5.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 6.

6.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVRTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

8.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 14.

10.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Tighten to specified torque.

11.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-

TION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Tighten to specified torque.

12. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation".)

13. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation".)
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation".)

14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

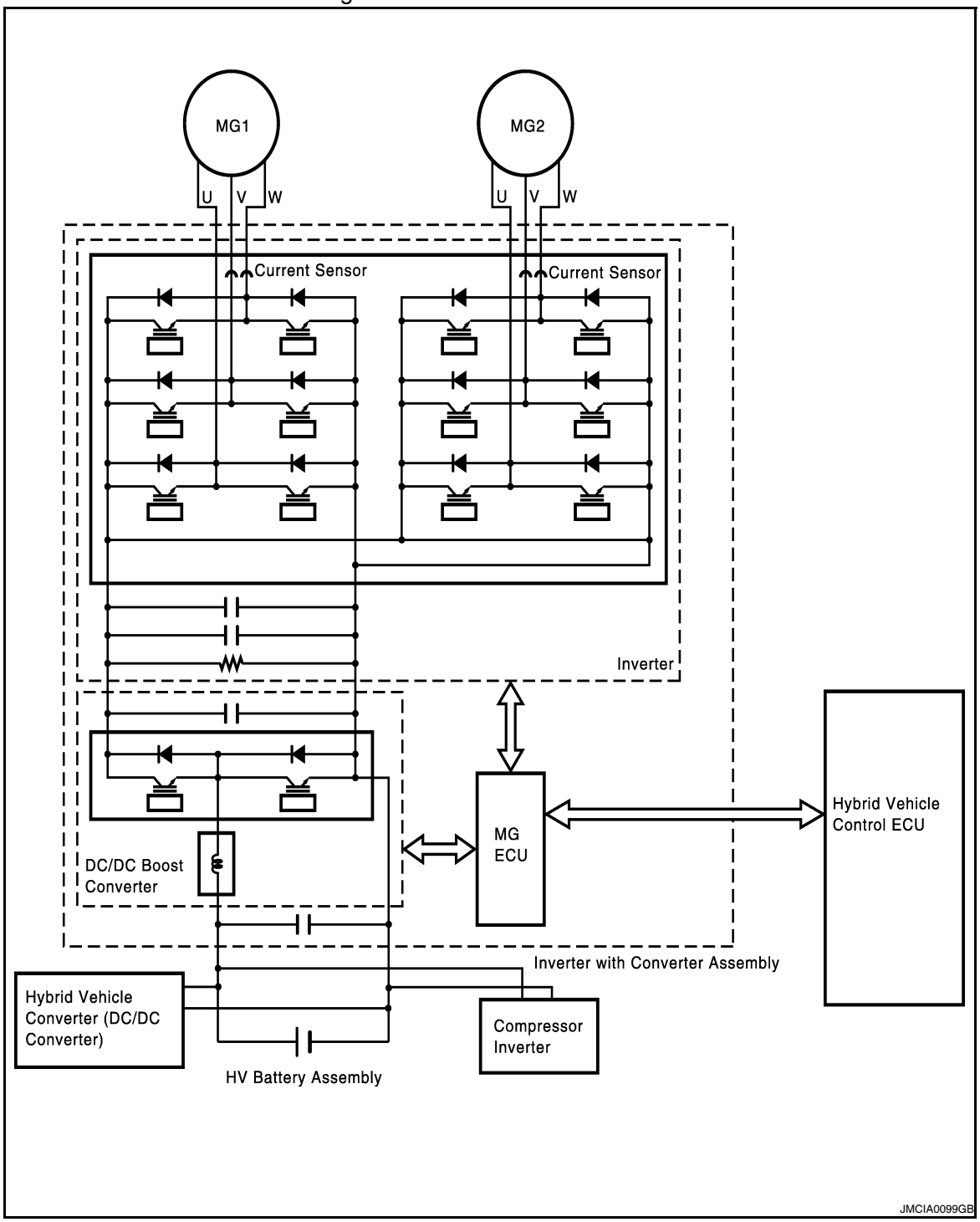
P0A78-505, P0A78-506

Description

INFOID:0000000004211939

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211940

DTC DETECTION LOGIC

If an abnormal amount of current flows through the motor inverter, the MG ECU detects it and sends a signal to inform the hybrid vehicle control ECU of the malfunction.
The MG ECU monitors the motor inverter electric current. If the current exceeds the threshold for a specified period of time, 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
P0A78	505	Drive Motor “A” Inverter Performance	Motor inverter fail signal detection (overcurrent due to MG ECU malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly
	506		Motor inverter fail signal detection (overcurrent due to hybrid transaxle malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211941

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance

NOTE:
P0A78-505 or 506 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

5. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 6.

6. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle assembly. (See TM-36, "Removal and Installation".)
NG >> Repair or replace harness or connector.

8. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 14.

10. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Tighten to specified torque.

11. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Tighten to specified torque.

12. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation".)

13. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation".)
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation".)

14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

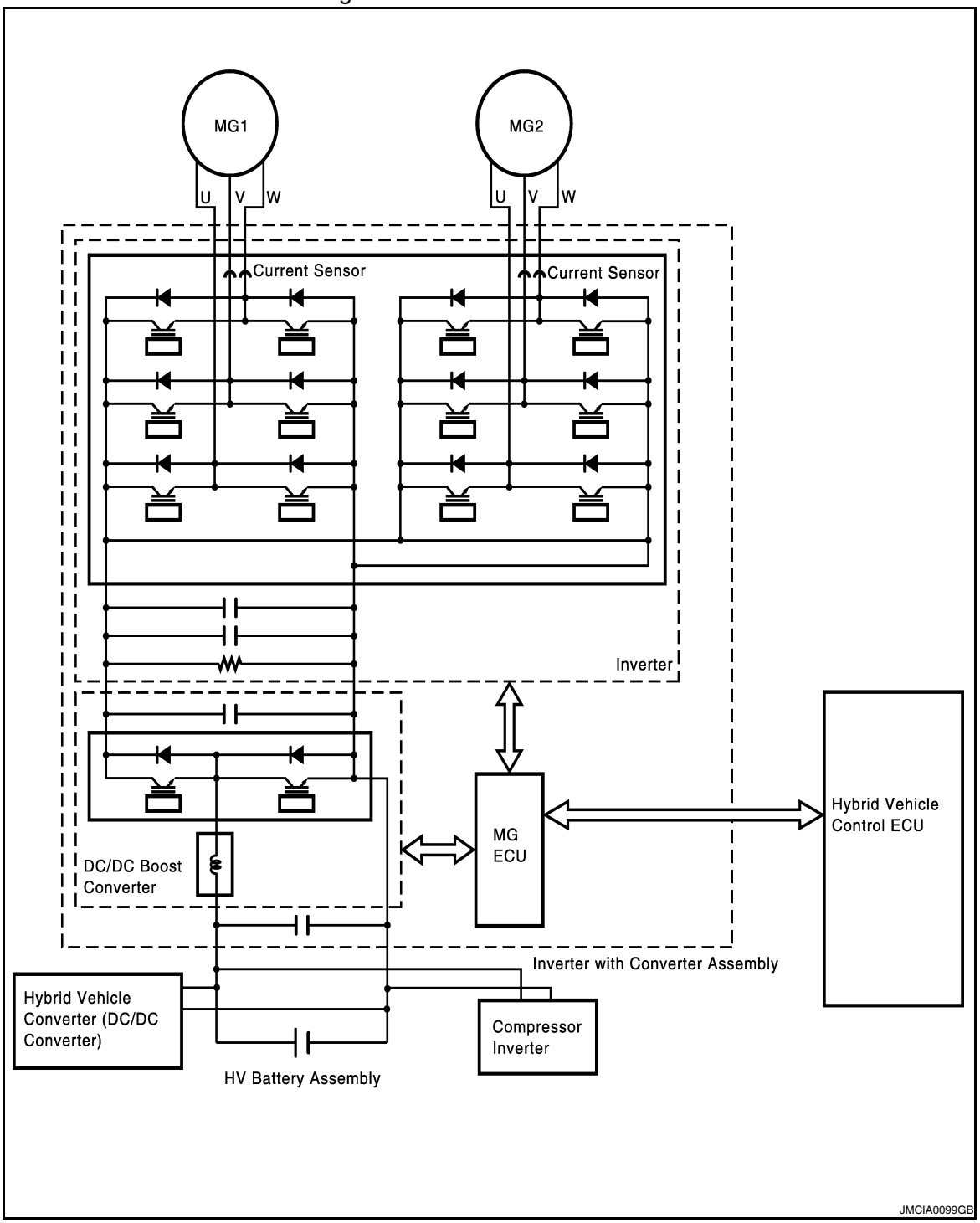
P0A78-510

Description

INFOID:0000000004211942

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211943

DTC DETECTION LOGIC

Upon receiving a motor gate shutdown signal from the MG ECU, the inverter forcibly stops MG2 by turning off all power transistors that are actuating MG2.
The MG ECU monitors the motor gate shutdown signal line and detects malfunctions.
The MG ECU monitors the current that flows in MG2. If the current flows in MG2 while the vehicle is stationary with the ignition switch ON or the shift lever in the N position, the MG ECU will detect a malfunction. 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
P0A78	510	Drive Motor “A” Inverter Performance	Motor inverter gate malfunction	Inverter with converter assembly

NOTE:
- If DTC P0A78-510 is output, the hybrid system cannot be restarted until the DTC is cleared.
- If the malfunction is not reproduced, leave the vehicle for 1 minute with the shift lever in the N position in order to easily reproduce the malfunction.

Diagnosis Procedure

INFOID:0000000004211944

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

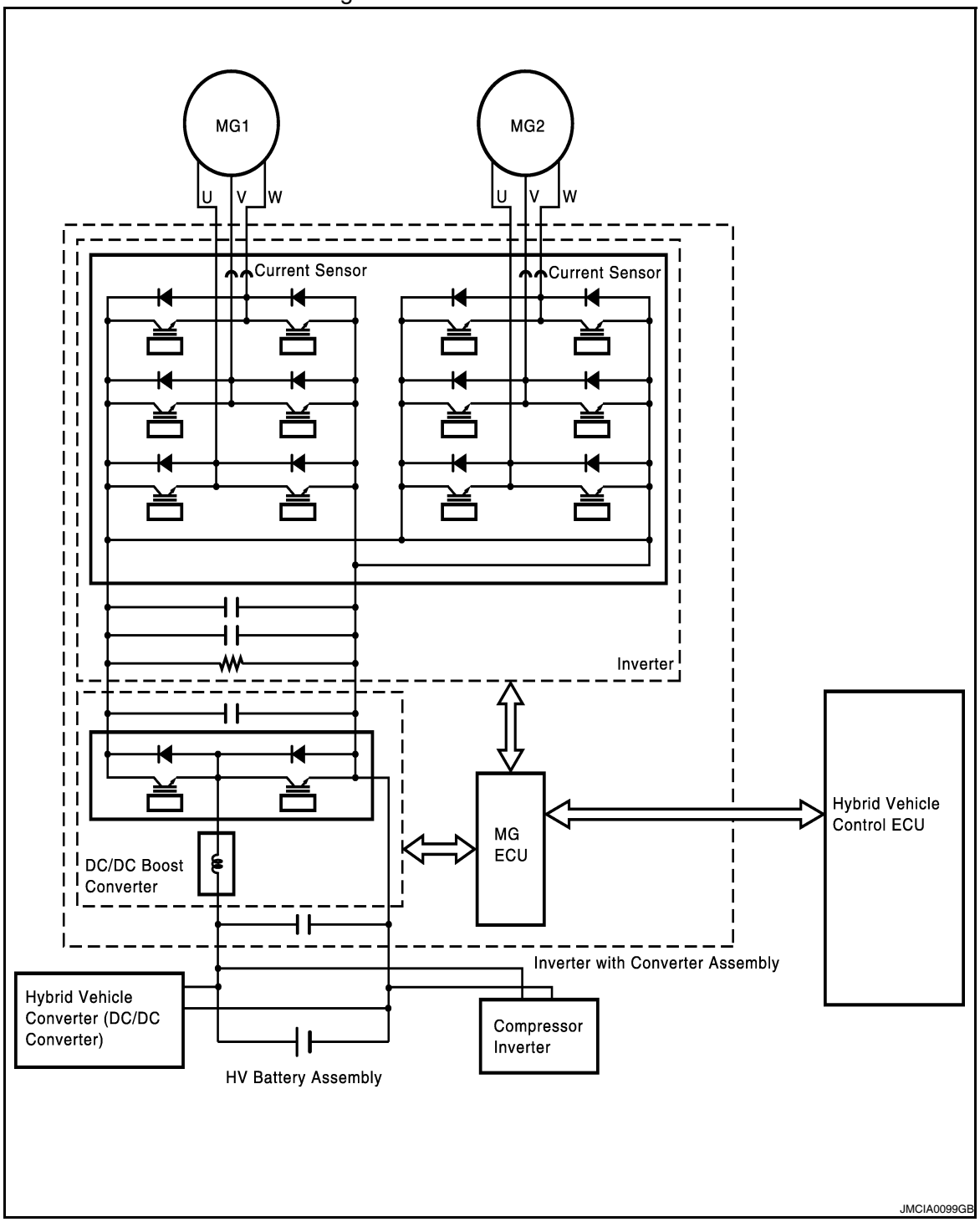
P0A78-523

Description

INFOID:0000000004211945

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211946

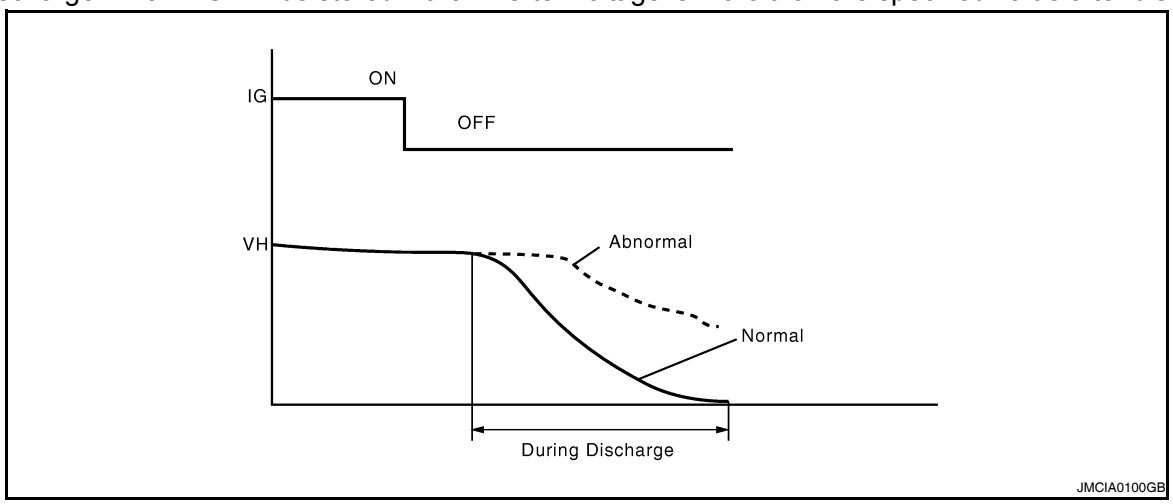
DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the inverter voltage (VH) sensor signal. If the hybrid vehicle control ECU detects a fault in the sensor signal, the hybrid vehicle control ECU interprets this as a VH sensor malfunction. 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
P0A78	523	Drive Motor “A” Inverter Performance	Inverter voltage (VH) sensor offset malfunction	Inverter with converter assembly

NOTE:

Turning ignition switch off causes the voltage in the inverter to discharge. The inverter voltage is almost 0 V after discharge. The DTC will be stored if the inverter voltage is more than the specified value after discharge.



Diagnosis Procedure

INFOID:0000000004211947

1.PRECONDITIONING

- 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. 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 DTC OUTPUT

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

DTC No.	Relevant Diagnosis
P0AE2-773, 161	SMRP
P0AE0-228	SMRG
P0ADC-226	SMRB
P0A1A-156, 658, 659, 151, 155, P0A1B-511, 164, 163, 512, 193, 786, 788, 661, P0A78-266, 267, P0A94-442	VH sensor circuit
P0A1A-200, 791, 792, 793, P0A1B-192, 168, 794, 795, 796, P0A3F-243, P0A41-245, P0A40-500, P0A4B-253, P0A4C-513, P0A4D-255	MG resolver circuit

Is DTC detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

P0A78-586

Description

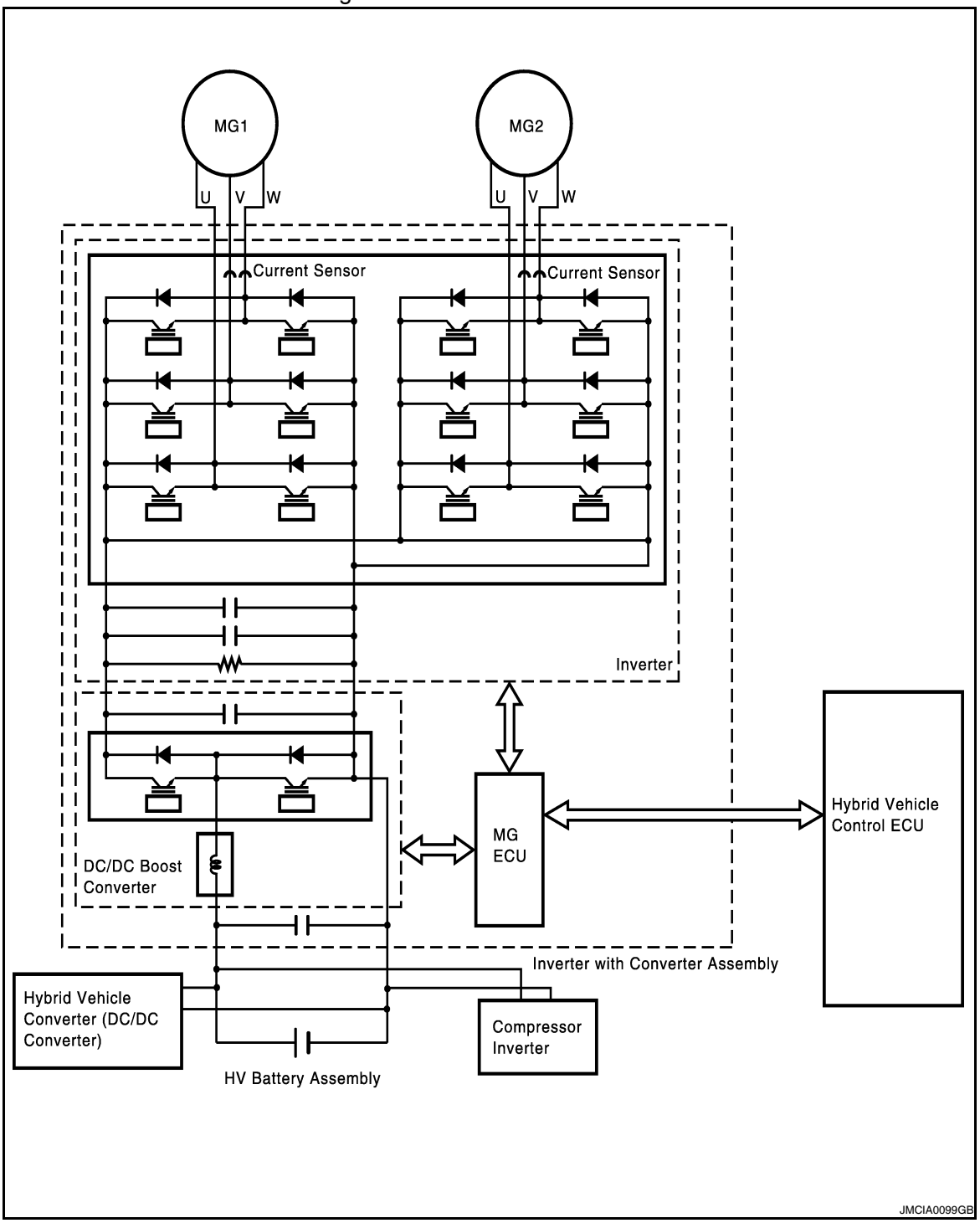
INFOID:0000000004211948

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.

The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211949

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the inverter voltage (VH) sensor signal. If the hybrid vehicle control ECU detects a fault in the sensor signal, the hybrid vehicle control ECU interprets this as a VH sensor failure. 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
P0A78	586	Drive Motor “A” Inverter Performance	Inverter voltage (VH) sensor performance problem	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211950

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

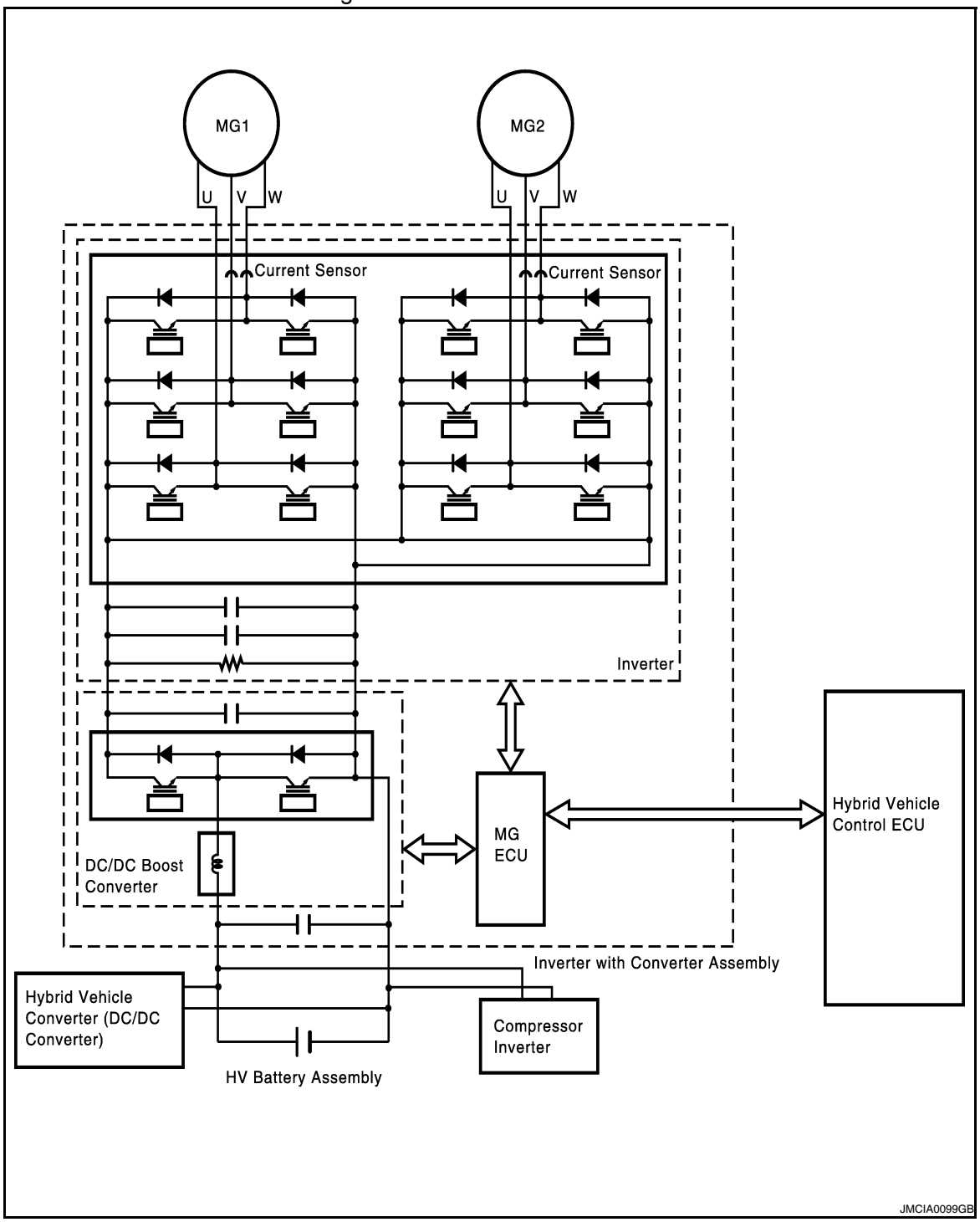
P0A78-806, P0A78-808

Description

INFOID:0000000004211951

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211952

DTC DETECTION LOGIC

If an abnormal amount of current flows through the motor inverter, the MG ECU detects it and sends a signal to inform the hybrid vehicle control ECU of the malfunction.
The MG ECU monitors the motor inverter electric current. If the current exceeds the threshold for a specified period of time, 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
P0A78	806	Drive Motor “A” Inverter Performance	Abnormal motor current value detection (MG ECU malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly
	808		Abnormal motor current value detection (Hybrid transaxle malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211953

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance DC Converter Performance

NOTE:
P0A78-806 or 808 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

5. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> GO TO 12.

6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

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

7. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 13.

8. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Tighten to specified torque.

9. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Tighten to specified torque.

10. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

11. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

12. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Connect securely.

13. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

14. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A78-807

Description

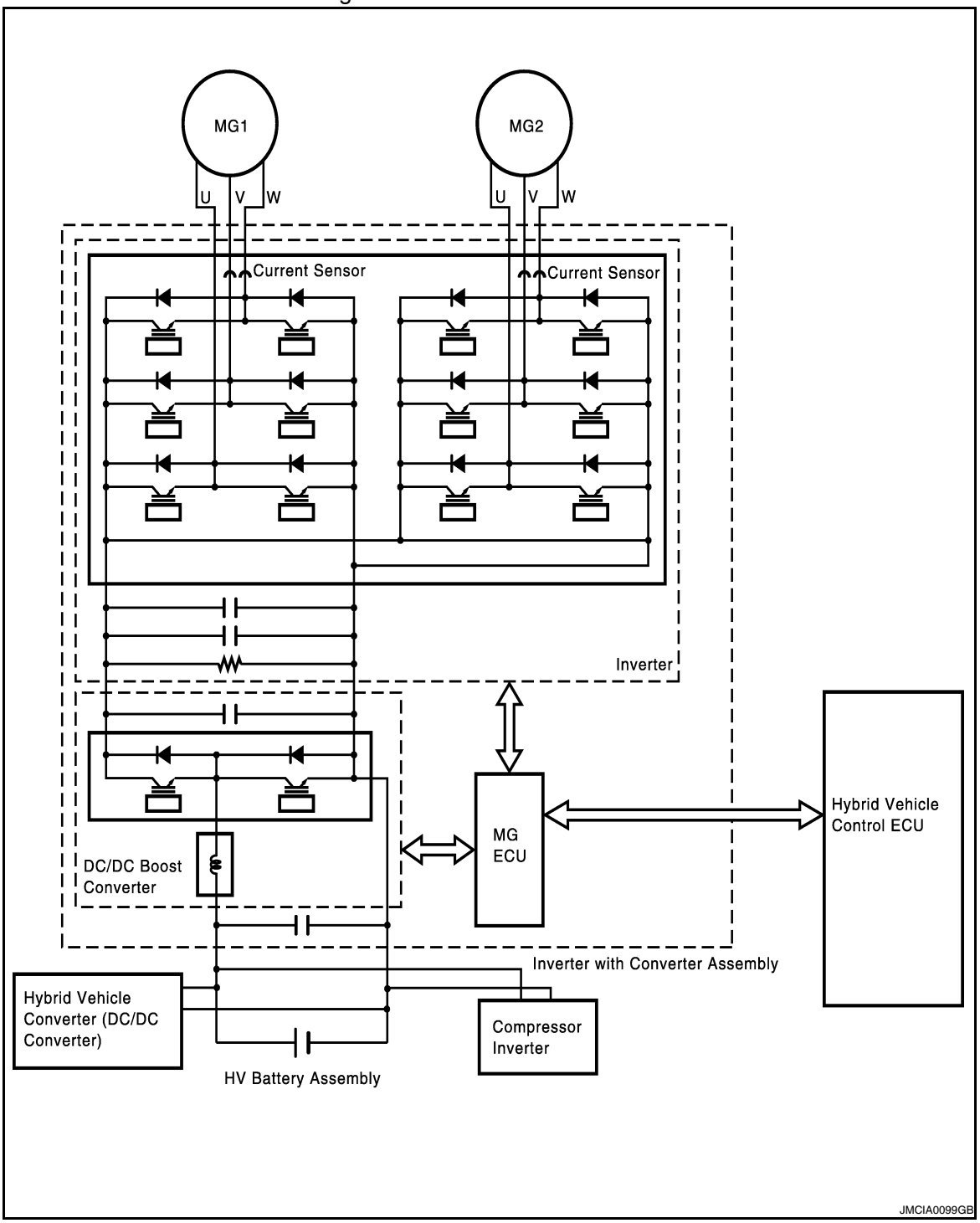
INFOID:0000000004211954

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.

The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211955

DTC DETECTION LOGIC

If an abnormal amount of current flows through the motor inverter, the MG ECU detects it and sends a signal to inform the hybrid vehicle control ECU of the malfunction.
The MG ECU monitors the motor inverter electric current. If the current exceeds the threshold for a specified period of time, 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
P0A78	807	Drive Motor “A” Inverter Performance	Abnormal motor current value detection (Inverter malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211956

1.PRECONDITIONING

- Before inspecting the high-voltage system or disconnecting the low voltage connector of inverter with converter assembly, 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance DC Converter Performance

NOTE:
P0A78-807 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation")
NG >> Connect securely.

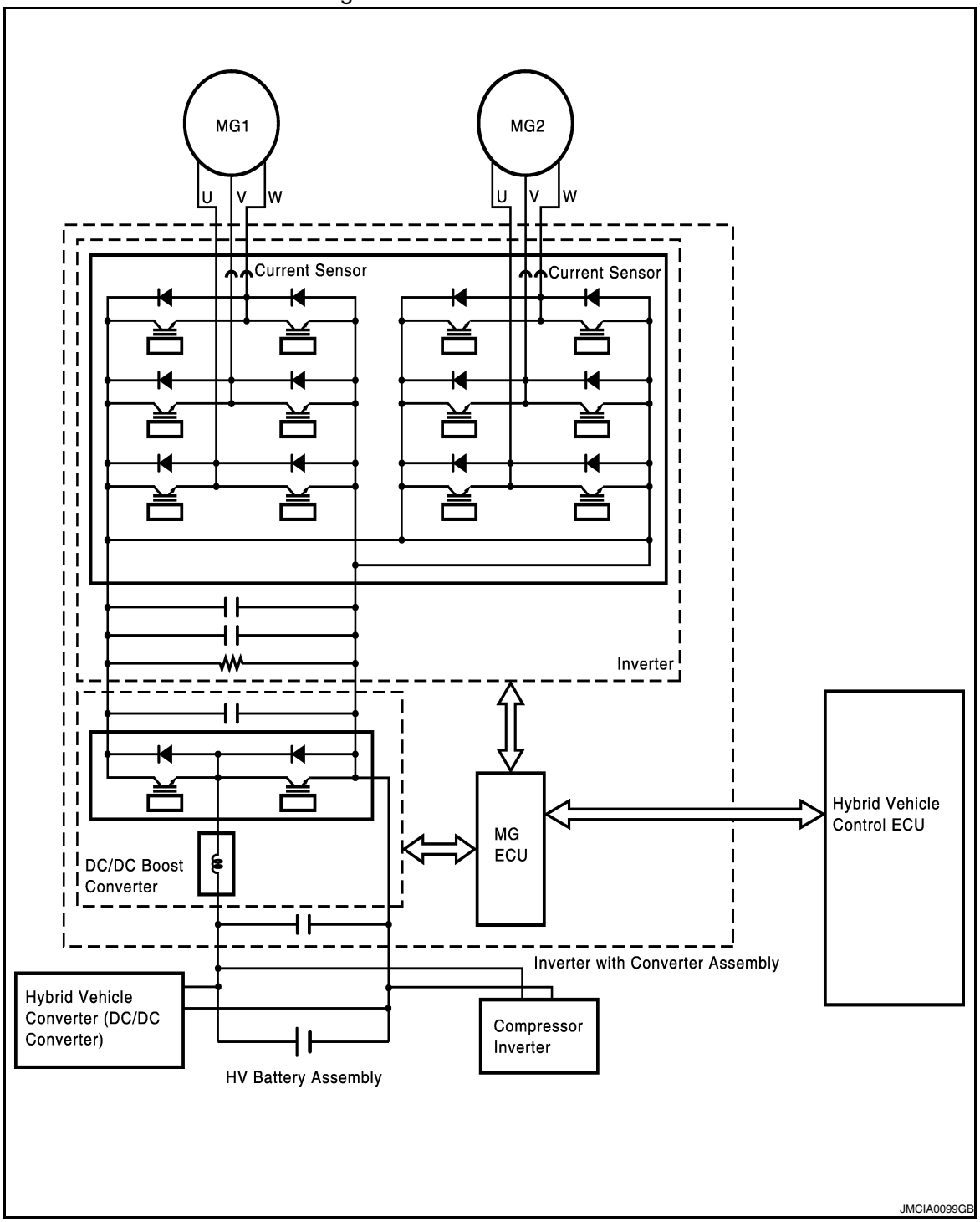
P0A7A-122

Description

INFOID:0000000004211957

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211958

DTC DETECTION LOGIC

If the generator inverter circuit is open or shorted, or if the circuit overheats, the malfunction is transmitted from the inverter to the GFIV terminal of the MG ECU via the generator inverter fail signal line.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A7A	122	Generator Inverter Performance	Generator inverter fail signal detection (overcurrent due to system malfunction)	• Fuel level • Hybrid transaxle • Engine assembly • Inverter with converter assembly • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004211959

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 503, 279, 504, 306, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-517, 325, 518, 344, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:
P0A7A-122 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3. CHECK AMOUNT OF GASOLINE

1. Turn ignition switch ON.
2. Check the amount of fuel by referring to the fuel gauge in the meter.

Proper amount of fuel is in the tank.

OK or NG

OK >> GO TO 4.
NG >> Refuel vehicle.

4. CHECK ENGINE START

1. Turn ignition switch ON (READY).
2. Check if the engine starts.

NOTE:
Depressing the accelerator pedal with the shift lever in the P position will cause the engine to start.

The engine starts.

OK or NG

OK >> GO TO 7.
NG >> GO TO 5.

5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

1. Turn ignition switch OFF, move the shift lever to the P position, and lift up the vehicle.
2. Turn the crankshaft pulley using hand tools to check if the crankshaft pulley can rotate.

CAUTION:
Do not turn ignition switch ON (READY) while performing this inspection. Be sure to turn ignition switch OFF before performing this inspection, to prevent the engine from starting.

The crankshaft pulley rotates.

OK or NG

OK >> GO TO 7.
NG >> GO TO 6.

6. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

1. Lower the vehicle.
2. Turn ignition switch OFF, move the shift lever to the N position, and lift up the vehicle.
3. Turn the crankshaft pulley using hand tools to check if the crankshaft pulley can rotate.

CAUTION:
Do not turn ignition switch ON (READY) while performing this inspection. Be sure to turn ignition switch OFF before performing this inspection, to prevent the engine from starting.

The crankshaft pulley rotates.

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace engine assembly.

7. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 16.

10.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

11.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> GO TO 18.

12.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Tighten to specified torque.

13.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Tighten to specified torque.

14.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

15.INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

16.CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Connect securely.

17.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR

RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

18. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Repair or replace harness or connector.

19. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

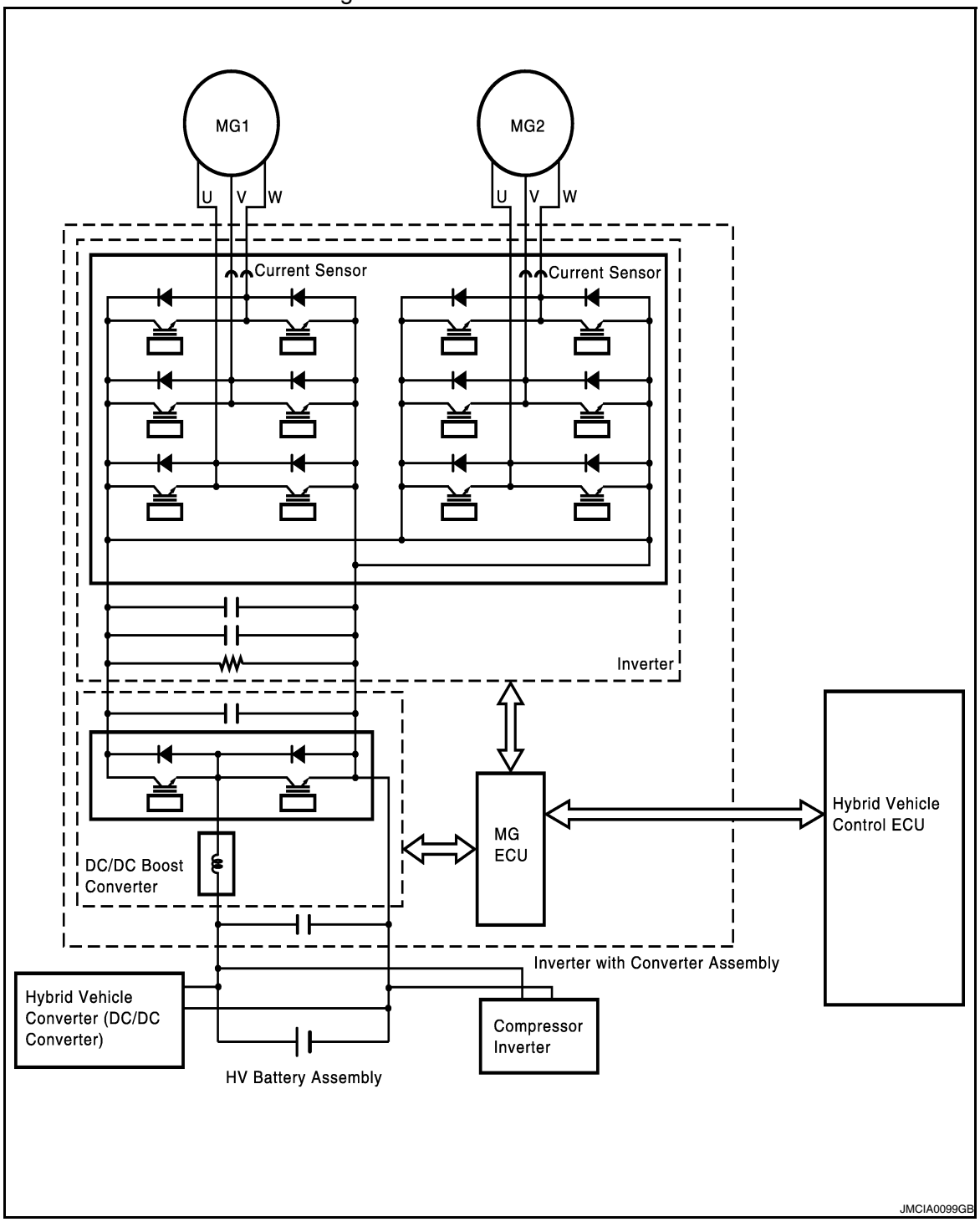
P0A7A-130

Description

INFOID:0000000004211960

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211961

DTC DETECTION LOGIC

If an abnormal amount of current flows through the generator inverter, the MG ECU detects it and sends a signal to inform the hybrid vehicle control ECU of the malfunction.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A7A	130	Generator Inverter Performance	Abnormal generator current value detection (System)	• Fuel level • Hybrid transaxle • Engine assembly • Inverter with converter assembly • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004211962

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 503, 279, 504, 306, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-517, 325, 518, 344, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:
P0A7A-130 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

OK >> Go to Diagnosis Procedure relevant to output DTC.

NG >> GO TO 3.

3.CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.
NG >> Refuel vehicle.

4.CHECK ENGINE START

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 5.

5.INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 6.

6.INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace engine assembly.

7.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 16.

10.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

11.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> GO TO 18.

12. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Tighten to specified torque.

13. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Tighten to specified torque.

14. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

15. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

16. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Connect securely.

17. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

18. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Repair or replace harness or connector.

19. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

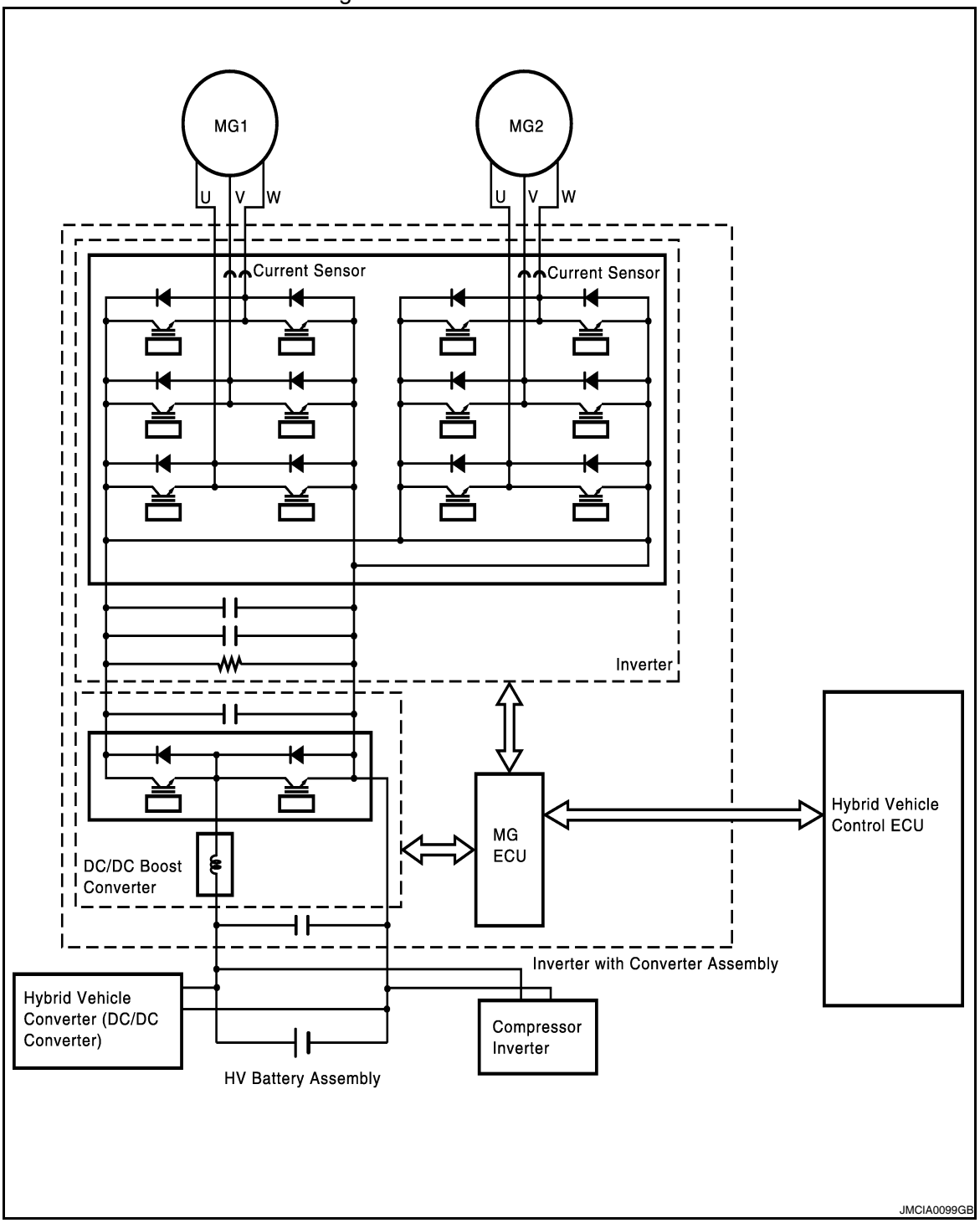
P0A7A-322

Description

INFOID:0000000004211963

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211964

DTC DETECTION LOGIC

If MG ECU detects overheat or circuit malfunction of the generator inverter, the inverter assembly transmits this information via the generator inverter fail signal line.
If the generator inverter overheats, it transmits an inverter fail signal to the MG ECU. Upon receiving this signal, 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
P0A7A	322	Generator Inverter Performance	Generator inverter fail signal detection (overheating)	• Inverter cooling system • Water pump with motor & bracket assembly • Hybrid transaxle • Inverter with converter assembly • Engine assembly • Fuel level • Cooling fan system • Wire harness or connector • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211965

1.PRECONDITIONING

- 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. 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.
- After inspection, be sure to replace the inverter with converter assembly.
- 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 503, 279, 504, 306, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-517, 325, 518, 344, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:

DTC P0A7A-322 may be set due to a malfunction which also causes DTCs in the table above to be set. First troubleshoot the output DTCs in the table above. After troubleshooting all output DTCs, be sure to replace the inverter with converter assembly.

Is DTC detected?

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

3. CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.
NG >> Refuel vehicle.

4. CHECK ENGINE START

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 5.

5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 6.

6. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace engine assembly.

7. CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

A or B or C

A >> GO TO 8.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

8. CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Correct the problem.

9. CHECK FUSE

1. Remove the 10A fuse (No. 68).
2. Check the resistance of the fuse.

Resistance: Below 1 Ω

Is the inspection result normal?

YES >> Install the 10A fuse (No. 68). GO TO 10.
NO >> Replace fuse.

10. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Connect securely.

12. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> GO TO 28.

13. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Connect securely.

14. PERFORM ACTIVE TEST WITH CONSULT-III (COOLING FAN SPD)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Check cooling fan system (See EC-382, "Component Function Check").

15. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> Connect securely.

16. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Repair or replace harness or connector.

17. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 18.
NG >> GO TO 24.

18. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Repair or replace harness or connector.

19. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 20.
NG >> GO TO 26.

20. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 21.
NG >> Tighten to specified torque.

21. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 22.
NG >> Tighten to specified torque.

22. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 23.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

23. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 25.
NG >> Connect securely.

25. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 27.
NG >> Repair or replace harness or connector.

27. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

28. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 29.

29. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 30.
NG >> GO TO 31.

30. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

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

31. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

Refer to PG-65, "Terminal Arrangement".

OK or NG

OK >> GO TO 32.
NG >> Replace high voltage fuse and fusible link box.

32. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

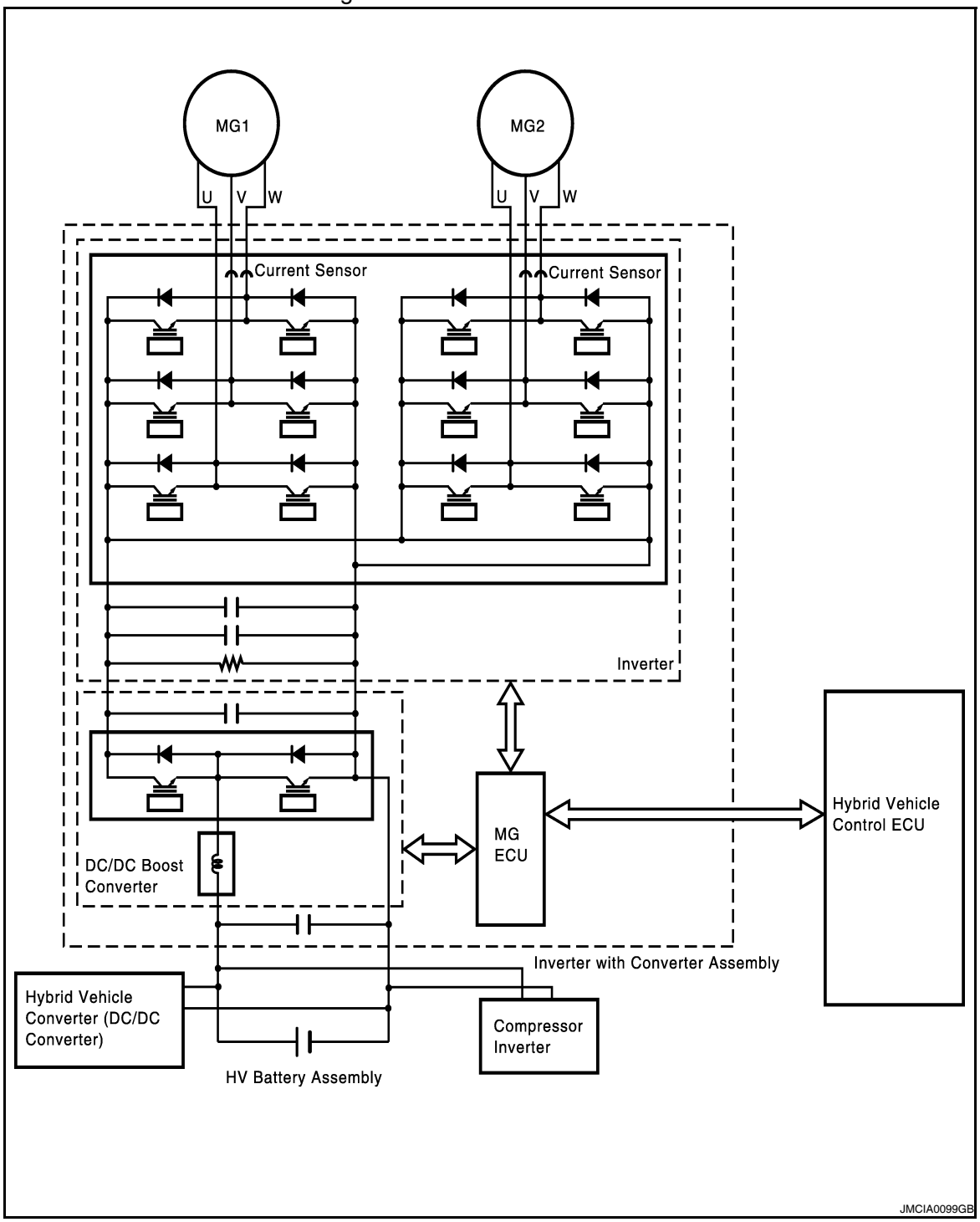
P0A7A-324

Description

INFOID:0000000004211966

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211967

DTC DETECTION LOGIC

If MG ECU detects overheat or circuit malfunction of the generator inverter, the inverter assembly transmits this information via the generator inverter fail signal line.

If the generator inverter detects a circuit malfunction, it will transmit a generator inverter fail signal to the MG ECU. Upon receiving this signal, 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
P0A7A	324	Generator Inverter Performance	Generator inverter fail signal detection (circuit malfunction)	• Inverter cooling system • Water pump with motor & bracket assembly • Hybrid transaxle • Inverter with converter assembly • Engine assembly • Fuel level • Cooling fan system • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004211968

1.PRECONDITIONING

- 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. 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.
- After inspection, be sure to replace the inverter with converter assembly.
- 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 284, 505, 287, 506, 113, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:

DTC P0A7A-324 may be set due to a malfunction which also causes DTCs in the table above to be set. First troubleshoot the output DTCs in the table above. After troubleshooting all output DTCs, be sure to replace the inverter with converter assembly.

Is DTC detected?

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

3. CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.
NG >> Refuel vehicle.

4. CHECK ENGINE START

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 5.

5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 6.

6. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace engine assembly.

7. CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

A or B or C

A >> GO TO 8.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

8. CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Correct the problem.

9. CHECK FUSE

1. Turn ignition switch OFF.
2. Remove the 10A fuse (No. 67).
3. Check the resistance of the fuse.

Resistance: Below 1 Ω

Is the inspection result normal?

YES >> Install the 10A fuse (No. 67). GO TO 10.
NO >> Replace fuse.

10. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Connect securely.

12. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> GO TO 28.

13. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Connect securely.

14. PERFORM ACTIVE TEST WITH CONSULT-III (COOLING FAN SPD)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Check cooling fan system (See EC-382, "Component Function Check").

15. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> Connect securely.

16. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Repair or replace harness or connector.

17. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 18.
NG >> GO TO 24.

18. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Repair or replace harness or connector.

19. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 20.
NG >> GO TO 26.

20. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 21.
NG >> Tighten to specified torque.

21. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 22.
NG >> Tighten to specified torque.

22. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 23.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

23. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 25.
NG >> Connect securely.

25. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 27.
NG >> Repair or replace harness or connector.

27. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

28. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 29

29. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 30.
NG >> GO TO 31.

30. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

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

31. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

Refer to PG-65, "Terminal Arrangement".

OK or NG

OK >> GO TO 32.
NG >> Replace high voltage fuse and fusible link box.

32. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

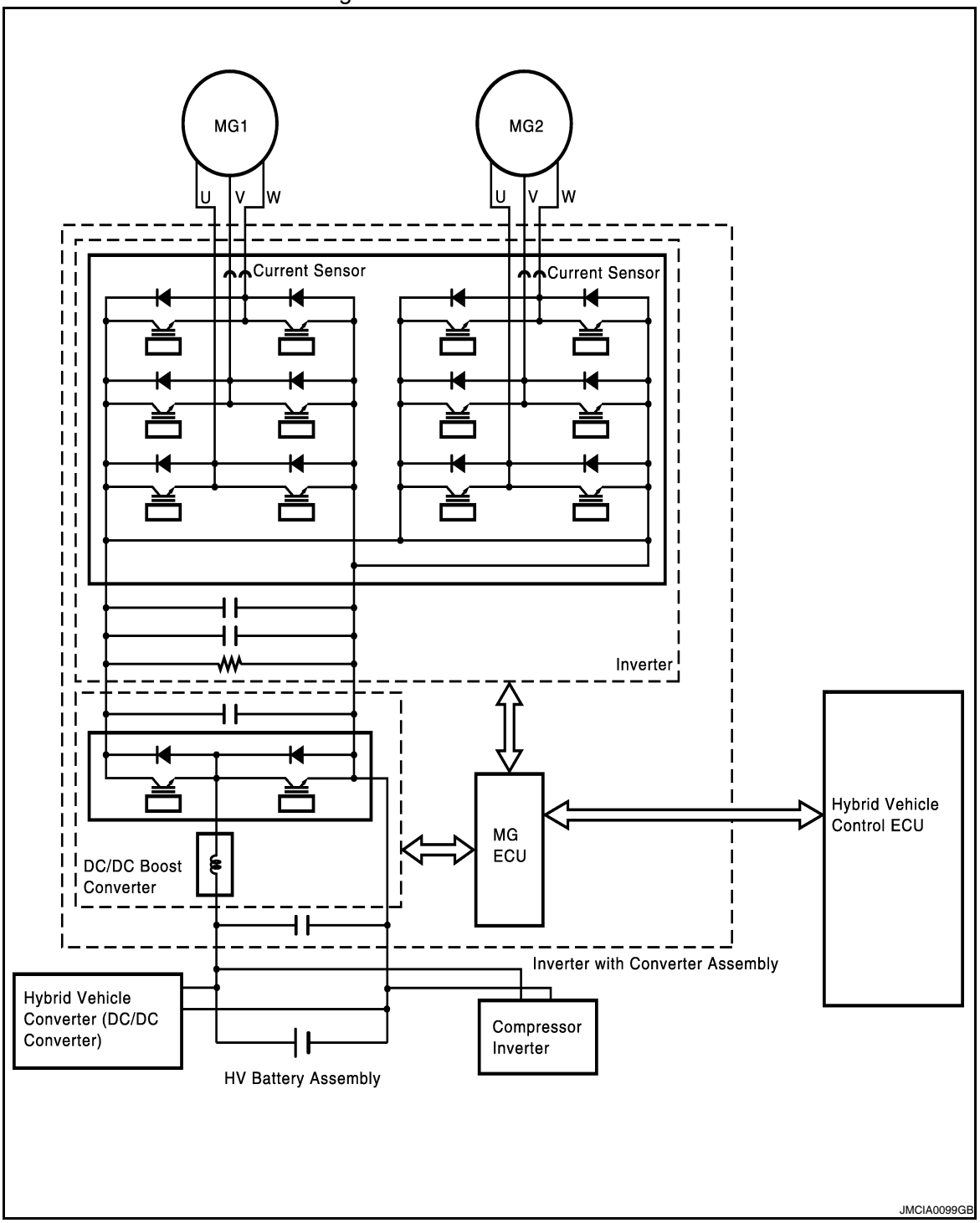
P0A7A-325

Description

INFOID:0000000004211969

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211970

DTC DETECTION LOGIC

If MG ECU detects overheat or circuit malfunction of the generator inverter, the inverter assembly transmits this information via the generator inverter fail signal line.

If excessive amperage flows through the generator inverter due to an internal short, the generator inverter will transmit an inverter fail signal to the MG ECU. Upon receiving this signal, 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
P0A7A	325	Generator Inverter Performance	Generator inverter fail signal detection (overcurrent due to inverter assembly malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211971

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance

NOTE:
P0A7A-325 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

OK >> Go to Diagnosis Procedure relevant to output DTC.
NG >> GO TO 3.

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

NG >> Connect securely.

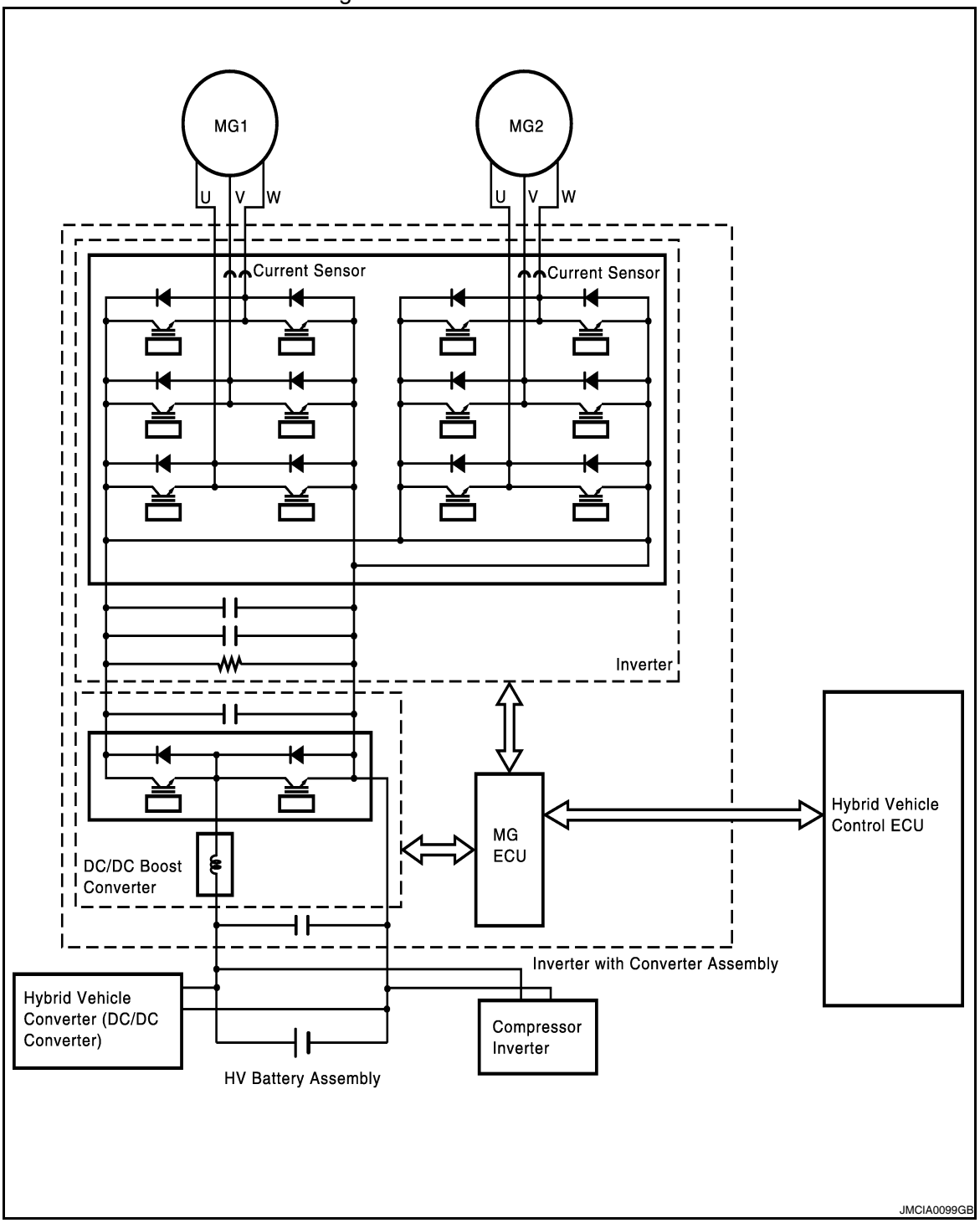
P0A7A-344

Description

INFOID:0000000004211972

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211973

DTC DETECTION LOGIC

The MG ECU controls generator torque according to driving conditions.
If the difference between the requested MG1 torque and the actual MG1 torque exceeds a predetermined value, the MG ECU determines that there is a malfunction in the execution or monitoring of the MG1 torque. Then, 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
P0A7A	344	Generator Inverter Performance	Generator torque execution monitoring malfunction	• Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211974

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 510, 523, 586, 505, 287, 506, 503, 279, 504, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549	DC/DC Converter Performance
P0A7A-517, 522, 325, 518, 809, 810, 811	Generator Inverter Performance
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3004-132	Power Cable Malfunction
P3233-750	Short to B+ in Blocking of HV Gate Connection

NOTE:
P0A7A-344 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Tighten to specified torque.

5. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

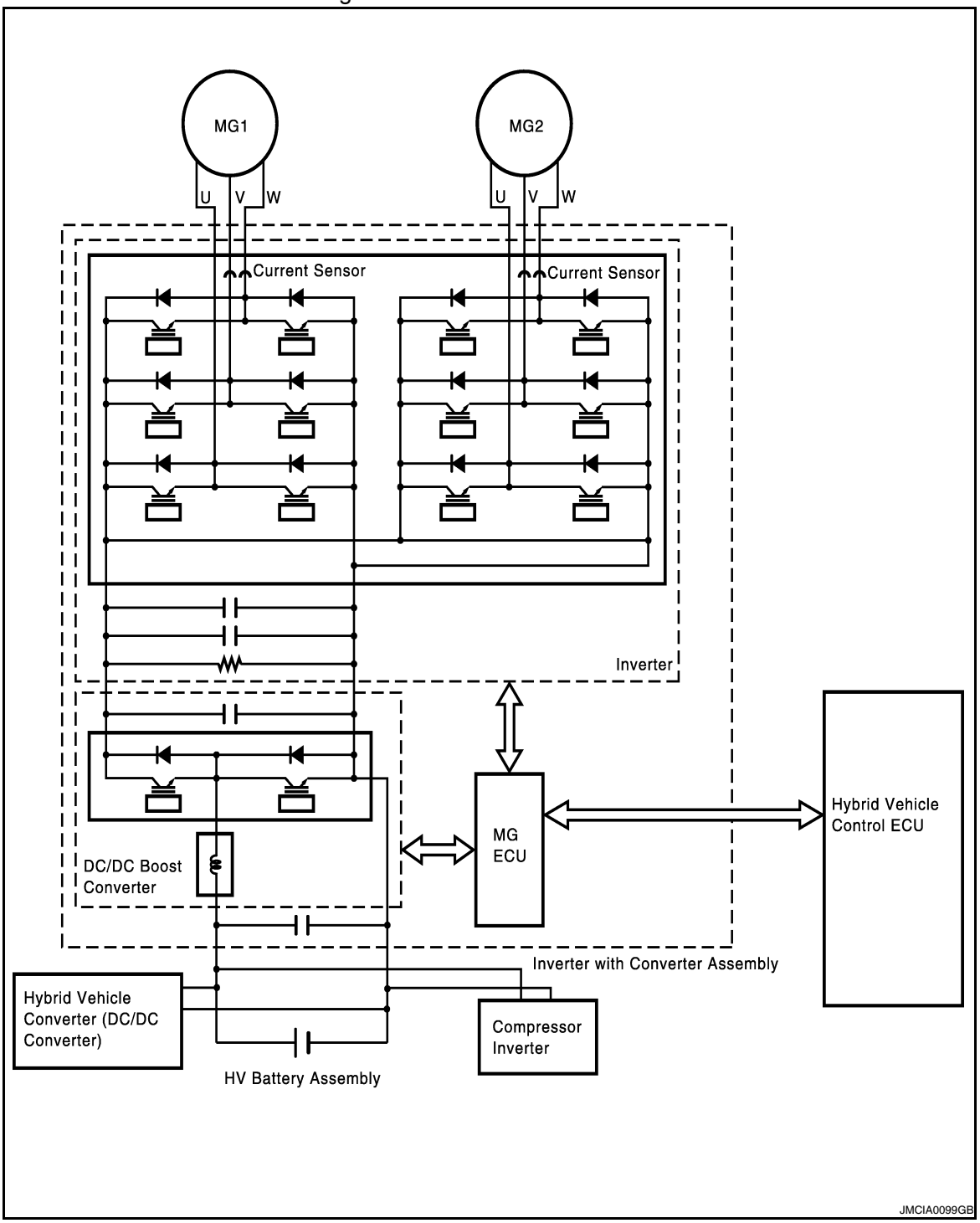
P0A7A-517, P0A7A-518

Description

INFOID:0000000004211975

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211976

DTC DETECTION LOGIC

If MG ECU detects overheat or circuit malfunction of the generator inverter, the inverter assembly transmits this information via the generator inverter fail signal line.

If excessive amperage flows through the generator inverter due to an internal short, the generator inverter will transmit an inverter fail signal to the MG ECU. Upon receiving this signal, 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
P0A7A	517	Generator Inverter Performance	Generator inverter fail signal detection (overcurrent due to MG ECU malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly
	518		Generator inverter fail signal detection (overcurrent due to hybrid transaxle malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211977

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance

NOTE:
P0A7A-517 or 518 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-

NECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

5. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 6.

6. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

8. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9. CHECK GENERATOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 14.

10. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Tighten to specified torque.

11. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.

NG >> Tighten to specified torque.

12. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

13. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Connect securely.
NG >> GO TO 15.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

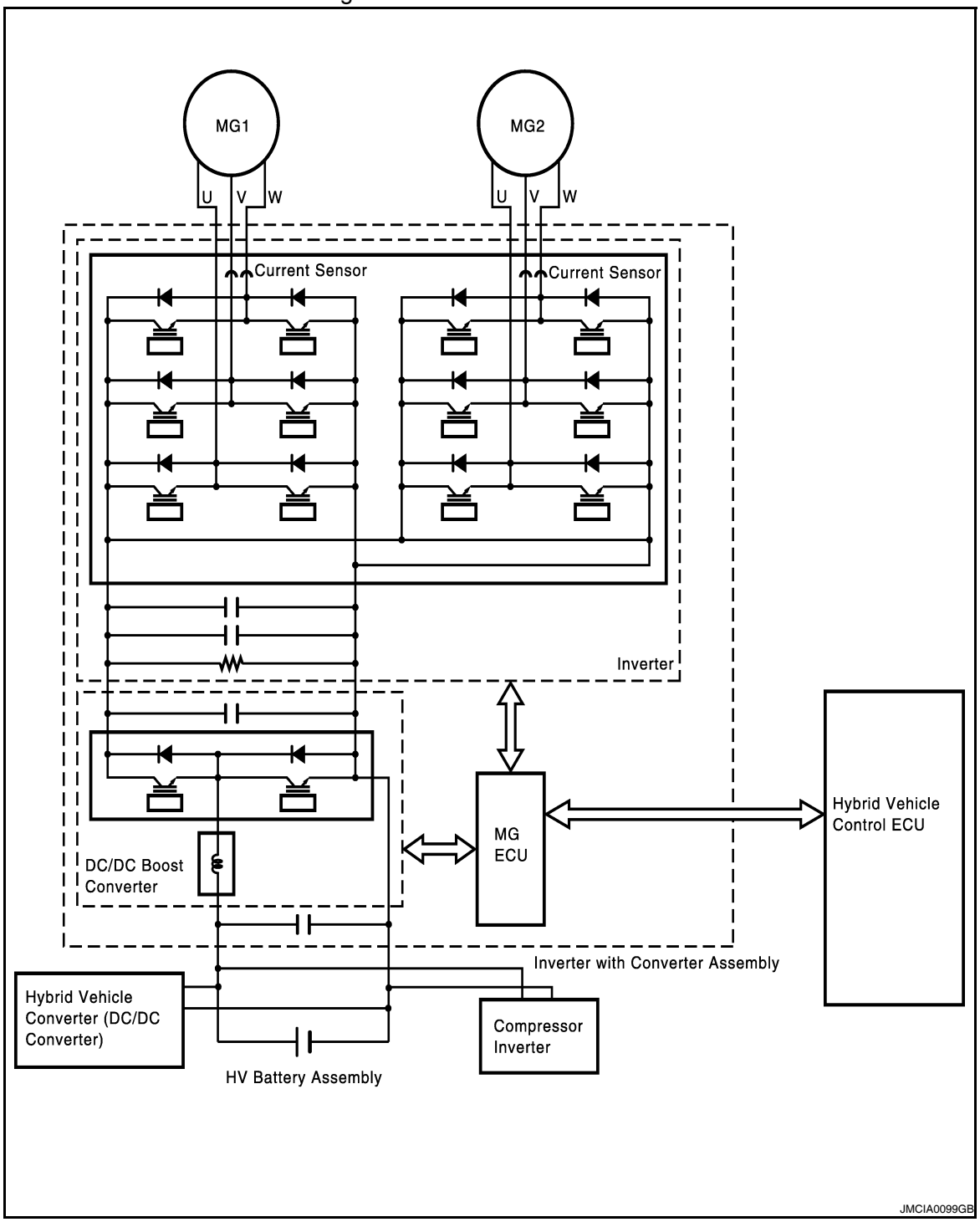
P0A7A-522

Description

INFOID:0000000004211978

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211979

DTC DETECTION LOGIC

If the inverter receives a generator gate shutdown signal from the MG ECU, it will turn all power transistors off which are activating the generator to forcibly stop generator operation. The MG ECU monitors the generator gate shutdown signal line and detects malfunctions.

The MG ECU monitors the current that flows in MG1. If current flows in MG1 while the vehicle is stationary with the ignition switch ON or the shift lever in the N position, the MG ECU will detect a malfunction.

The hybrid vehicle control ECU will illuminate the MIL and set a DTC.nate the MIL and set a DTC.

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A7A	522	Generator Inverter Performance	Generator inverter gate malfunction	Inverter with converter assembly

NOTE:
- If DTC P0A7A-522 is output, the hybrid system cannot be restarted until the DTC is cleared.
- If the malfunction is not reproduced, leave the vehicle for 1 minute with the shift lever in the N position in order to easily reproduce the malfunction.

Diagnosis Procedure

INFOID:0000000004211980

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

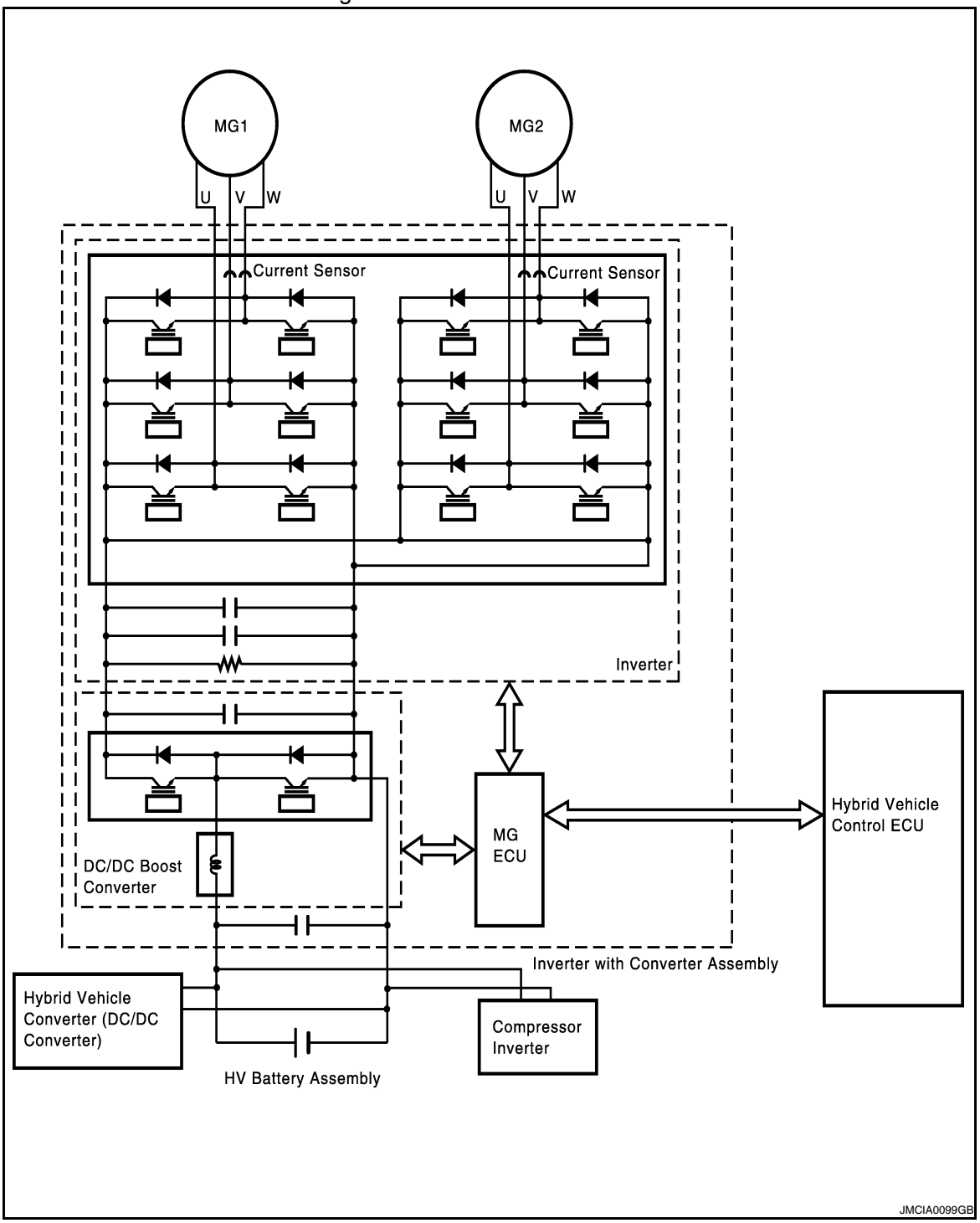
P0A7A-809, P0A7A-811

Description

INFOID:0000000004211981

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211982

DTC DETECTION LOGIC

If an abnormal amount of current flows through the generator inverter, the MG ECU detects it and sends a signal to inform the hybrid vehicle control ECU of the malfunction.
If the MG ECU detects that the generator inverter current exceeds the threshold level for a period of time, 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
P0A7A	809	Generator Inverter Performance	Abnormal generator current value detection (MG ECU malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly
	811		Abnormal generator current value detection (hybrid transaxle malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211983

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance

NOTE:
P0A7A-809 or 811 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

5. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> GO TO 12.

6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

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

7. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 13.

8. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Tighten to specified torque.

9. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Tighten to specified torque.

10. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

11. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

12. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Connect securely.

13. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

14. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

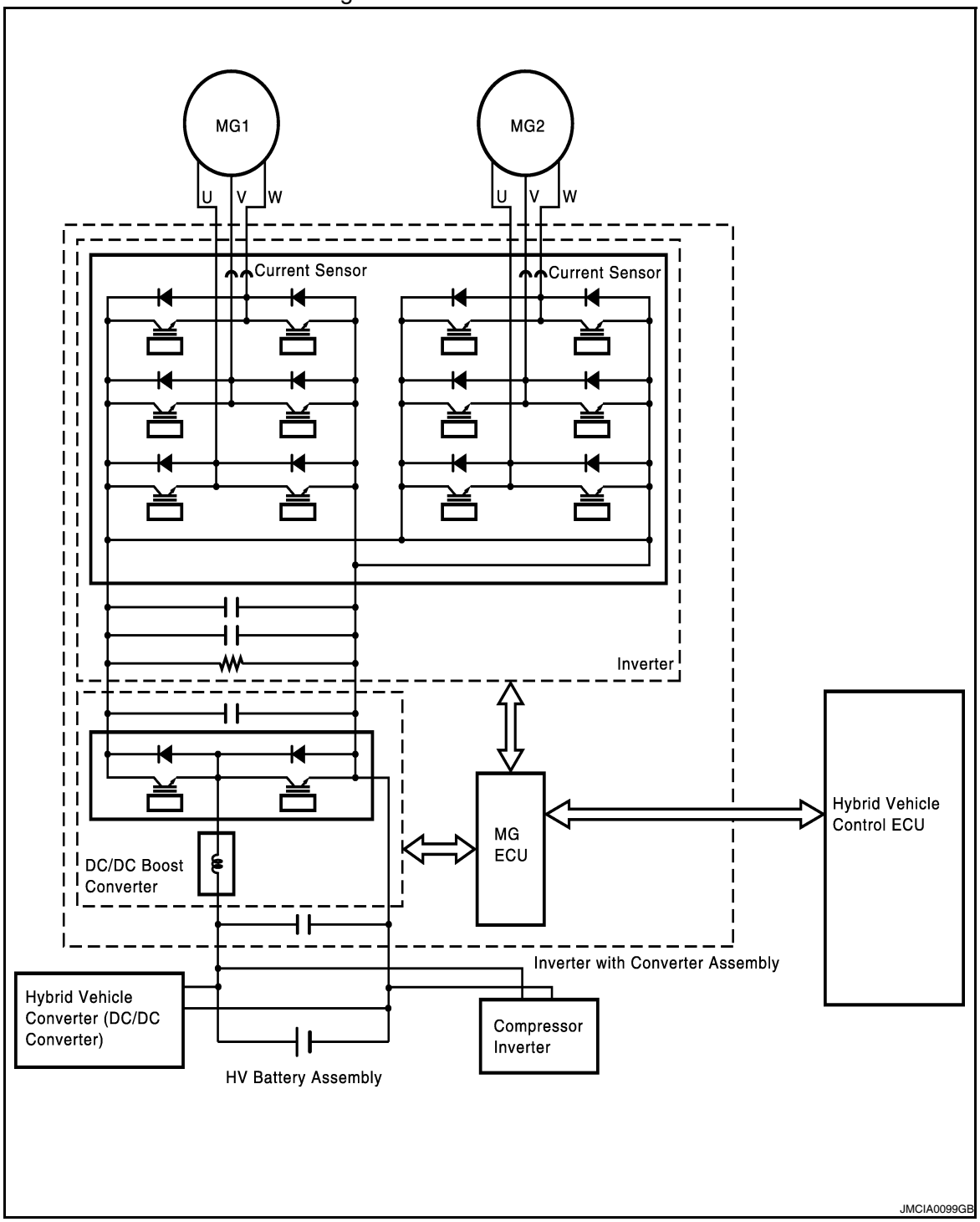
P0A7A-810

Description

INFOID:0000000004211984

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004211985

DTC DETECTION LOGIC

If an abnormal amount of current flows through the generator inverter, the MG ECU detects it and sends a signal to inform the hybrid vehicle control ECU of the malfunction.
If the MG ECU detects that the generator inverter current exceeds the threshold level for a period of time, 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
P0A7A	810	Generator Inverter Performance	Abnormal generator current value detection (inverter malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211986

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance

NOTE:
P0A7A-810 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

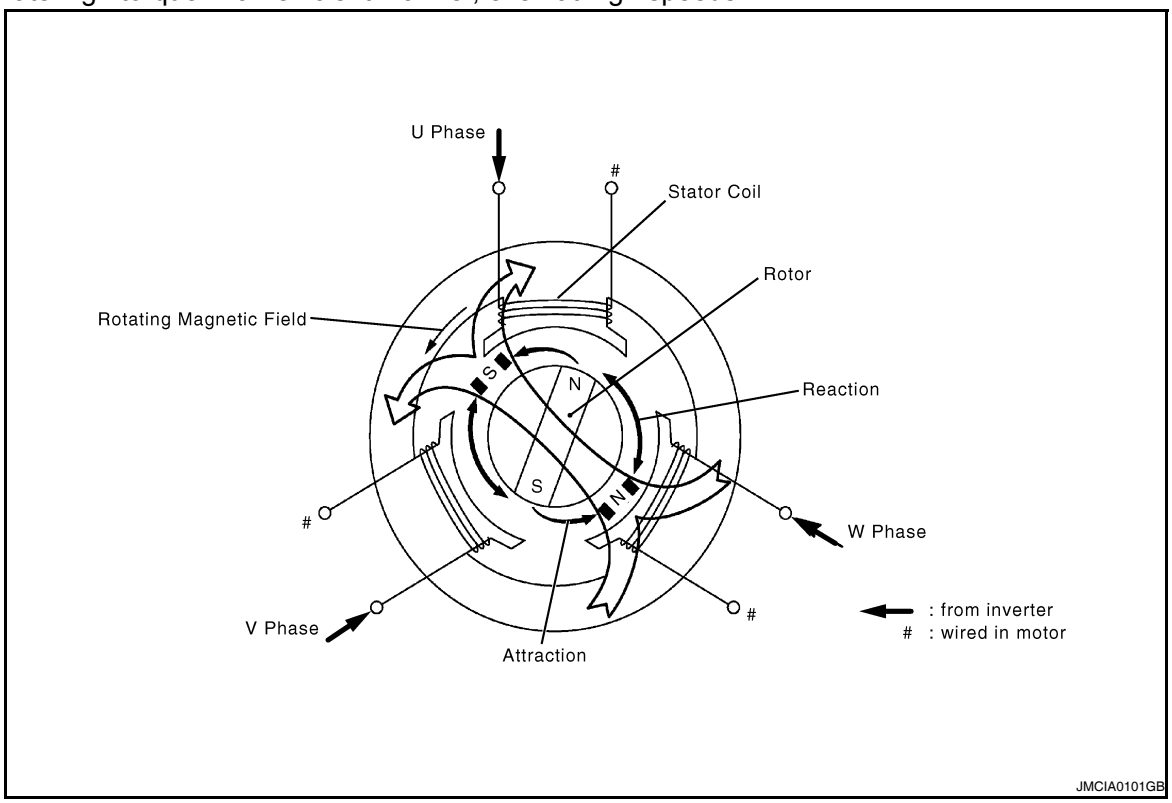
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

P0A90-251

Description

INFOID:0000000004211987

When three-phase alternating current flows through the three-phase windings of the stator coil, a rotating magnetic field is generated in MG2. The system controls the rotation of the magnetic field in accordance with the rotating position and speed of the rotor. As a result, the permanent magnets provided in the rotor are pulled in the direction of rotation, generating torque. The generated torque is almost proportional to the amount of current. The system controls MG2 speed by regulating the frequency of the alternating current. Furthermore, the system properly controls the rotating magnetic field and the angle of the rotor magnets in order to generate high torque in an efficient manner, even at high speeds.



DTC Logic

INFOID:0000000004211988

DTC DETECTION LOGIC

The MG ECU monitors MG2. If the MG ECU detects a reduction in the magnetic force of MG2 or an inphase short, it interprets this as an MG2 failure. 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
P0A90	251	Drive Motor “A” Performance	Motor magnetic force deterioration or same phase short circuit	Hybrid transaxle

Diagnosis Procedure

INFOID:0000000004211989

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1A (all INF codes), P0A1B (all INF codes)	MG ECU circuit malfunction
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A3F-243, P0A40-500, P0A41-245	Motor resolver circuit malfunction
P0A4B-253, P0A4C-513, P0A4D-255	Generator resolver circuit malfunction
P0A51-174	MG ECU circuit malfunction
P0A60 (all INF codes), P0A63 (all INF codes)	Motor current sensor circuit
P0A72 (all INF codes), P0A75 (all INF codes)	Generator current sensor circuit
P0A78-306, 510, 586, 266, 267, 523	Motor inverter malfunction
P0A7A-344, 522	Generator inverter malfunction
P0A90-509	MG2 malfunction
P0A92-521	MG1 malfunction
P0A94-585, 587, 589, 590	Boost converter circuit
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3004-132	Power Cable Malfunction
P3233-750	HV gate shutdown wiring malfunction

NOTE:
P0A90-251 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3. SIMULATION TEST

1. Test-drive the vehicle at a speed of 40 km/h for approximately 1 minute.
2. Check DTC.

DTC output	Proceed to
P0A78-306 or P0A90-509 is output	A
P0A90-251 is output or no DTC is output	B

A or B

A >> Go to Diagnosis Procedure relevant to output DTC.
B >> GO TO 4.

4. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

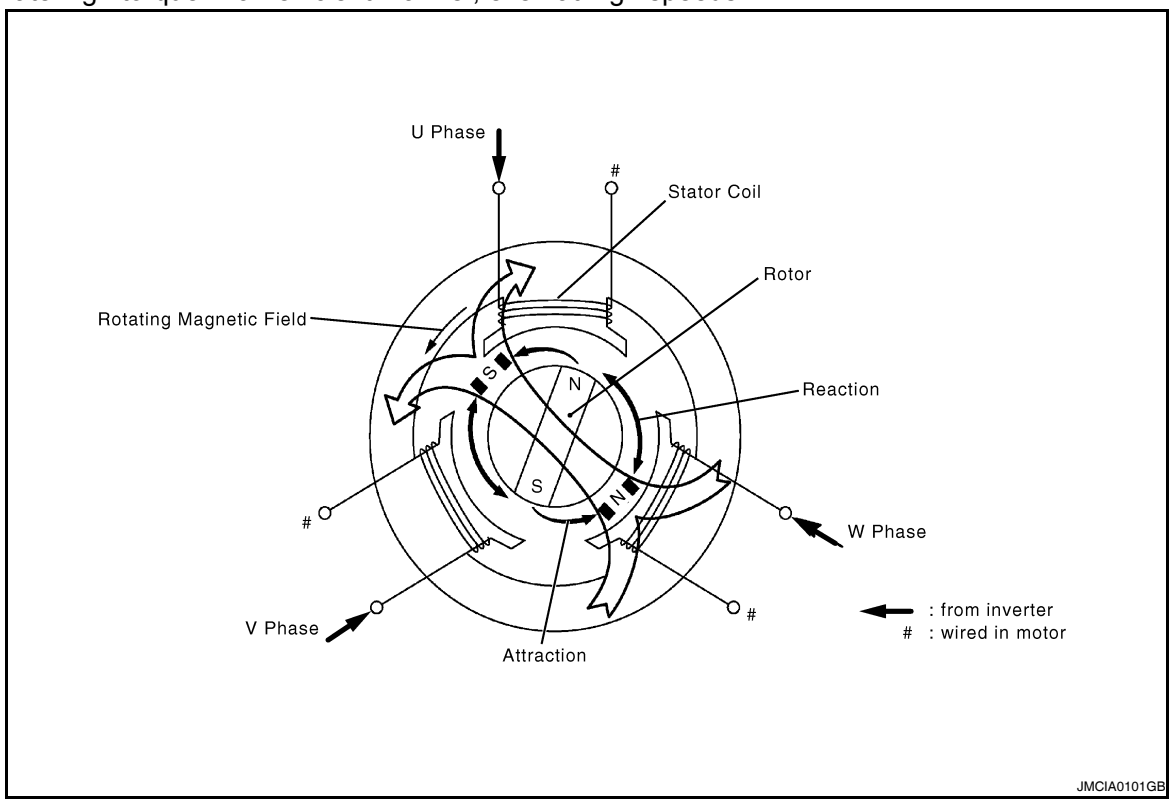
NG >> Tighten to specified torque.

P0A90-509

Description

INFOID:0000000004211990

When three-phase alternating current flows through the three-phase windings of the stator coil, a rotating magnetic field is generated in MG2. The system controls the rotation of the magnetic field in accordance with the rotating position and speed of the rotor. As a result, the permanent magnets provided in the rotor are pulled in the direction of rotation, generating torque. The generated torque is almost proportional to the amount of current. The system controls MG2 speed by regulating the frequency of the alternating current. Furthermore, the system properly controls the rotating magnetic field and the angle of the rotor magnets in order to generate high torque in an efficient manner, even at high speeds.



DTC Logic

INFOID:0000000004211991

DTC DETECTION LOGIC

The MG ECU monitors the MG2 system. If the MG ECU detects a malfunction of the MG2 system, 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
P0A90	509	Drive Motor “A” Performance	Motor system malfunction	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211992

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 510, 523, 586, 505, 287, 506, 503, 279, 504, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549	DC/DC Converter Performance
P0A7A-517, 522, 325, 518, 809, 810, 811	Generator Inverter Performance
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3004-132	Power Cable Malfunction
P3233-750	Short to B+ in Blocking of HV Gate Connection

NOTE:
P0A90-509 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Tighten to specified torque.

5.INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

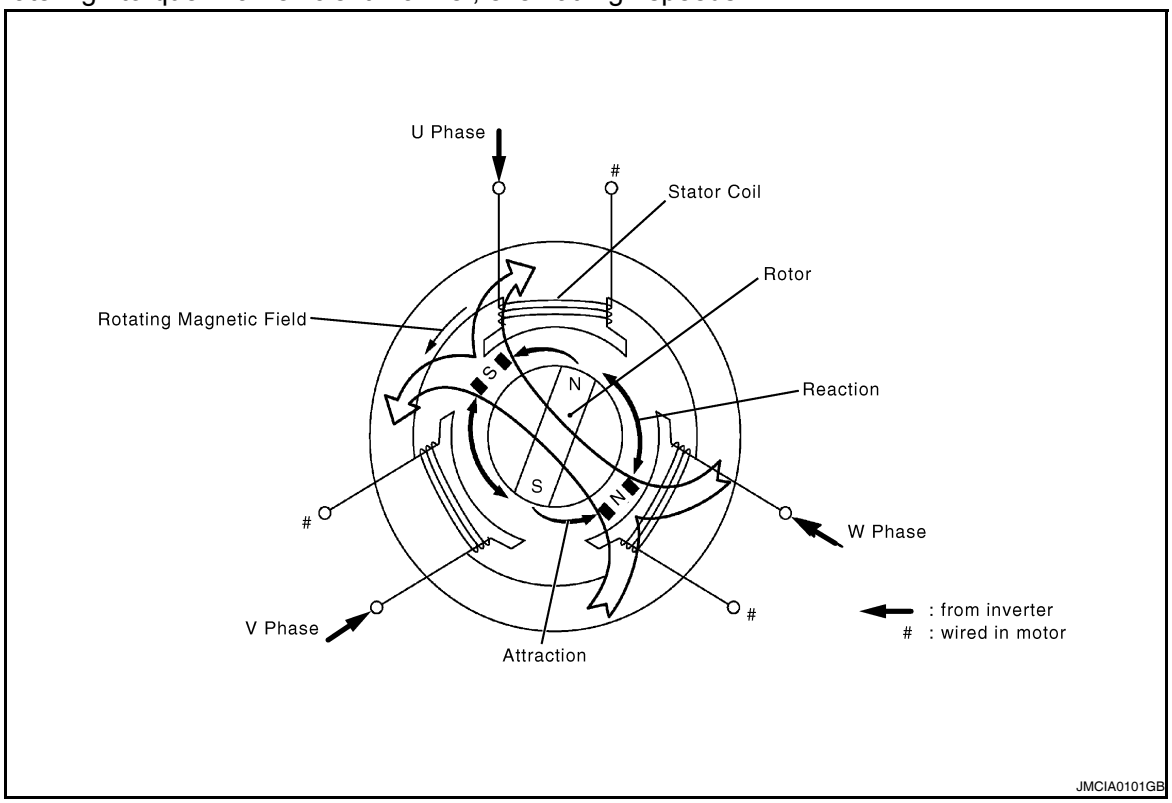
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

P0A92-261

Description

INFOID:0000000004211993

When three-phase alternating current flows through the three-phase windings of the stator coil, a rotating magnetic field is generated in MG2. The system controls the rotation of the magnetic field in accordance with the rotating position and speed of the rotor. As a result, the permanent magnets provided in the rotor are pulled in the direction of rotation, generating torque. The generated torque is almost proportional to the amount of current. The system controls MG2 speed by regulating the frequency of the alternating current. Furthermore, the system properly controls the rotating magnetic field and the angle of the rotor magnets in order to generate high torque in an efficient manner, even at high speeds.



DTC Logic

INFOID:0000000004211994

DTC DETECTION LOGIC

The MG ECU monitors MG1. If the MG ECU detects a reduction in the magnetic force of MG1 or an inphase short, it interprets this as an MG1 failure. 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
P0A92	261	Hybrid Generator Performance	Generator magnetic force deterioration or same phase short circuit	Hybrid transaxle

Diagnosis Procedure

INFOID:0000000004211995

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1A (all INF codes), P0A1B (all INF codes)	MG ECU circuit malfunction
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A3F-243, P0A40-500, P0A41-245	Motor resolver circuit malfunction
P0A4B-253, P0A4C-513, P0A4D-255	Generator resolver circuit malfunction
P0A51-174	MG ECU circuit malfunction
P0A60 (all INF codes), P0A63 (all INF codes)	Motor current sensor circuit
P0A72 (all INF codes), P0A75 (all INF codes)	Generator current sensor circuit
P0A78-306, 510, 586, 266, 267, 523	Motor inverter malfunction
P0A7A-344, 522	Generator inverter malfunction
P0A90-509	MG2 malfunction
P0A92-521	MG1 malfunction
P0A94-585, 587, 589, 590	Boost converter circuit
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3004-132	Power Cable Malfunction
P3233-750	HV gate shutdown wiring malfunction

NOTE:
P0A92-261 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.SIMULATION TEST

1. Leave the vehicle for 1 minute with the engine running (with MG1 rotating)
   NOTE:
   If the accelerator pedal is depressed with the shift lever in the P position, the engine will start.
2. Check DTC.

DTC output	Proceed to
P0A7A-344 or P0A92-521 is output	A
P0A92-261 is output or no DTC is output	B

A or B

A >> Go to Diagnosis Procedure relevant to output DTC.
B >> GO TO 4.

4.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

< COMPONENT DIAGNOSIS >

See HBC-177, "Diagnosis Procedure".

OK or NG

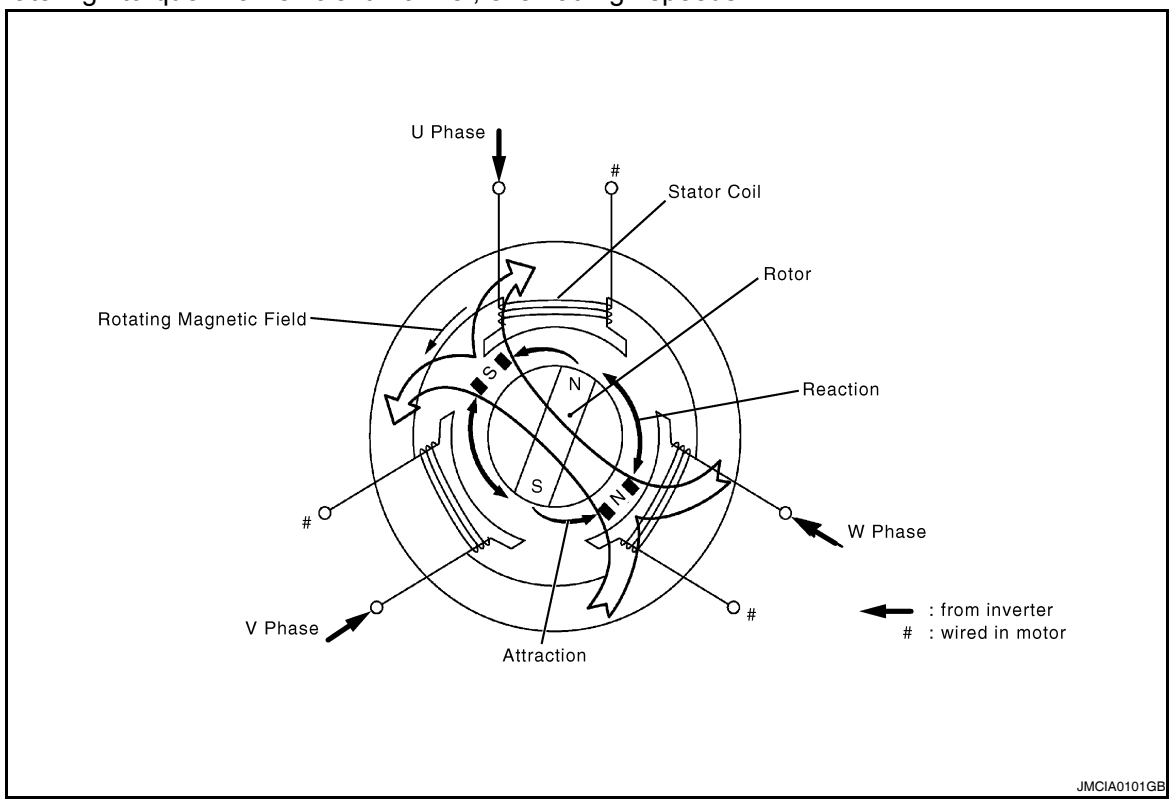
OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Tighten to specified torque.

P0A92-521

Description

INFOID:0000000004211996

When three-phase alternating current flows through the three-phase windings of the stator coil, a rotating magnetic field is generated in MG2. The system controls the rotation of the magnetic field in accordance with the rotating position and speed of the rotor. As a result, the permanent magnets provided in the rotor are pulled in the direction of rotation, generating torque. The generated torque is almost proportional to the amount of current. The system controls MG2 speed by regulating the frequency of the alternating current. Furthermore, the system properly controls the rotating magnetic field and the angle of the rotor magnets in order to generate high torque in an efficient manner, even at high speeds.



DTC Logic

INFOID:0000000004211997

DTC DETECTION LOGIC

The MG ECU monitors the MG1 system. If the MG ECU detects a malfunction of the MG1 system, 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
P0A92	521	Hybrid Generator Performance	Generator system malfunction	• Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004211998

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 510, 523, 586, 505, 287, 506, 503, 279, 504, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549	DC/DC Converter Performance
P0A7A-517, 522, 325, 518, 809, 810, 811	Generator Inverter Performance
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3004-132	Power Cable Malfunction
P3233-750	Short to B+ in Blocking of HV Gate Connection

NOTE:
P0A92-521 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Tighten to specified torque.

5.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

P0A93-346

Description

INFOID:0000000004211999

The inverter converts the boosted high-voltage direct-current from the HV battery into alternating current for MG2 and MG1. The inverter generates heat during the conversion process, and this heat could damage the inverter if a inverter cooling system is unavailable. Therefore, similar to MG2 and MG1, the inverter is cooled by a special inverter cooling system consisting of an electric water pump, cooling fan, and sub radiator. This inverter cooling system is independent of the engine cooling system. The hybrid vehicle control ECU monitors the electric water pump, cooling fan, and inverter cooling system, and detects malfunctions.

DTC Logic

INFOID:0000000004212000

DTC DETECTION LOGIC

If the hybrid vehicle control ECU detects a malfunction of the electric water pump, fan or sub radiator, the ECU will illuminate the MIL and set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A93	346	Inverter Cooling System Performance	Inverter cooling system malfunction (Inverter coolant malfunction)	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Hybrid vehicle control ECU • Inverter with converter assembly • Cooling fan system

Diagnosis Procedure

INFOID:0000000004212001

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A02-719, P0A03-720	Inverter coolant temperature circuit
P0A1D (all INF code)	Hybrid Powertrain Control Module
P0A1B (all INF code)	Drive Motor “A” Control Module

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.

NG >> Connect securely.

4. CHECK QUANTITY OF INVERTER COOLANT

1. Check for coolant leaks.
2. Check the coolant in the sub reserve tank assembly is above the low level.

Result	Proceed to
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is above the low level.	A
Coolant leaks are not evident. The coolant level in the sub reserve tank assembly is below the low level.	B
Coolant leaks are evident.	C

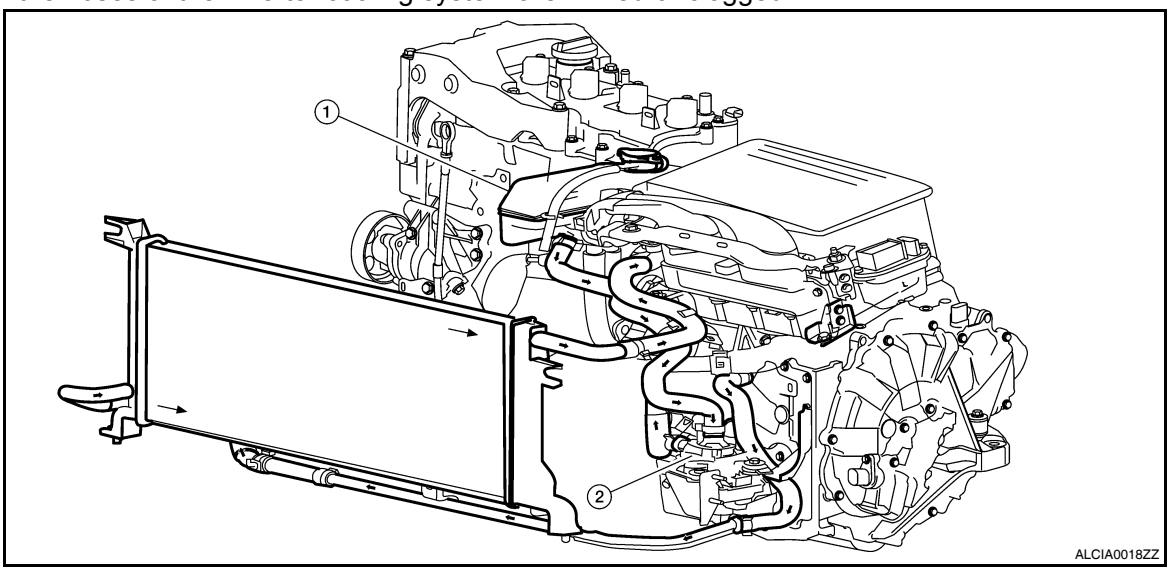
NOTE:
After repairing the coolant leaks and adding coolant, perform the “INV WATER PUMP” and “COOLING FAN SPD” in “ACTIVE TEST” mode with CONSULT-III and make sure that there are no malfunctions.

A or B or C

A >> GO TO 5.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

5. CHECK COOLANT HOSE

Check if the hoses of the inverter cooling system are kinked or clogged.



1 Coolant reservoir
2. Water pump with motor and bracket assembly

OK or NG

OK >> GO TO 6.
NG >> Correct the problem.

6. CHECK FUSE

1. Turn ignition switch OFF.
2. Remove the 10A fuse (No. 67).
3. Check the resistance of the fuse.

Resistance: Below 1 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace fuse.

7. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

Check the connection of the water pump with motor & bracket assembly connector.

The connector is connected securely and there are no contact problems.

OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

1. Reconnect all harness connectors removed.
2. Turn ignition switch ON.
3. Perform “INV WATER PUMP” in “ACTIVE TEST” mode with CONSULT-III.
4. During this test, open the sub reserve tank cap and check that there are ripples in the coolant. Continue the active test for at least 1 minute.

NOTE:
The water pump motor operates even in inspection mode.

There are ripples in the coolant in the sub reserve tank assembly for 1 minute.

OK >> GO TO 10.
NG >> GO TO 13.

10. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

Check the connections of the cooling fan motor connectors.

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

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11. PERFORM ACTIVE TEST WITH CONSULT-III (COOLING FAN SPD)

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

The cooling fan rotates.

OK or NG

OK >> GO TO 12.
NG >> Check cooling fan system (See EC-382, "Component Function Check").

12. READ VALUE OF DATA MONITOR

1. Stop the engine and leave the vehicle for at least 1 hour.
2. Turn ignition switch ON.
3. Select “INV COOLANT TMP”, “CONVERTER TEMP”, “MG1 INV TEMP”, “MG2 INV TEMP” in “DATA MONITOR” mode with CONSULT-III.
4. Read their indications.

The displayed INV COOLANT TMP value is at least 20°C (68°F) higher than MG2 INV TEMP, CONVERTER TEMP, and MG 1 INV TEMP.

NOTE:
The lower limit temperature that can be displayed for “MG2 INV TEMP”, “CONVERTER TEMP”, and “MG1 INV TEMP” is 15°C (59°F). The lower limit temperature for “INV COOLANT TMP” is -40°C (-40°F). The “INV COOLANT TMP” value displayed on CONSULT-III may be lower than the others, but this is not a malfunction.

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace water pump with motor & bracket assembly.

13. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)

1. Compress the inlet hose for the water pump with motor & bracket assembly several times.
2. Turn ignition switch ON.
3. Perform “INV WATER PUMP” in “ACTIVE TEST” with CONSULT-III.
4. During the test, open the sub reserve tank cap and check that there are ripples in the coolant. Continue the active test for at least 1 minute.
   NOTE:
   - Keep compressing the water pump inlet hose until the coolant level in the sub reserve tank assembly stops dropping.
   - The water pump motor operates even in maintenance mode.
   - After repairing the coolant leaks and adding coolant, perform the “INV WATER PUMP” and “COOLING FAN SPD” active tests and make sure that there are no malfunctions.

There are ripples in the coolant in the sub reserve tank assembly for 1 minute.

OK >> Add coolant.
NG >> GO TO 14.

14. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

1. Disconnect the hybrid vehicle control ECU harness connector E66.
2. Remove the 10A fuse (No. 67).
3. Apply 12 V to downstream terminal of the socket for the fuse in the high voltage fuse and fusible link box and check that the water pump operates.

The water pump operates.

4. Install the 10A fuse to the high voltage fuse and fusible link box.

OK or NG

OK >> GO TO 15.
NG >> GO TO 17.

15. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

1. Disconnect the water pump with motor & bracket assembly connector E72.
2. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		Water pump with motor & bracket assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	109 (IWP)	E72	3 (SWP)	Below 1 Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	109 (IWP)	Ground	10 kΩ

Water pump with motor & bracket assembly		Ground	Resistance
Harness connector	Terminal		
E72	3 (SWP)	Ground	10 kΩ

OK or NG

OK >> GO TO 16.
NG >> Repair or replace harness or connector.

16. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

1. Remove 10A fuse (No. 67) from the high voltage fuse and fusible link box.
2. Remove IGCT relay from the high voltage fuse and fusible link box.
3. Measure the resistance according to the values in the table below.

Check for open

High voltage fuse and fusible link box				Resistance
Component connector	Terminal	Component connector	Terminal	
—	Fuse (No. 67) upstream side	—	IGCT relay terminal 5	Below 1 Ω

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace high voltage fuse and fusible link box.

17. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

1. Remove the 10A fuse (No. 67) from the high voltage fuse and fusible link box.
2. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		Water pump with motor & bracket assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	109 (IWP)	E72	3 (SWP)	Below 1 Ω

Water pump with motor & bracket assembly		Ground	Resistance
Harness connector	Terminal		
E72	1 (GND)	Ground	Below 1 Ω

High voltage fuse and fusible link box		Water pump with motor & bracket assembly		Resistance
Component connector	Terminal	Harness connector	Terminal	
—	Fuse (No. 68) downstream side	E72	4 (+B)	Below 1 Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	109 (IWP)	Ground	10kΩ or higher

Water pump with motor & bracket assembly		Ground	Resistance
Harness connector	Terminal		
E72	3 (SWP)	Ground	10kΩ or higher

OK or NG

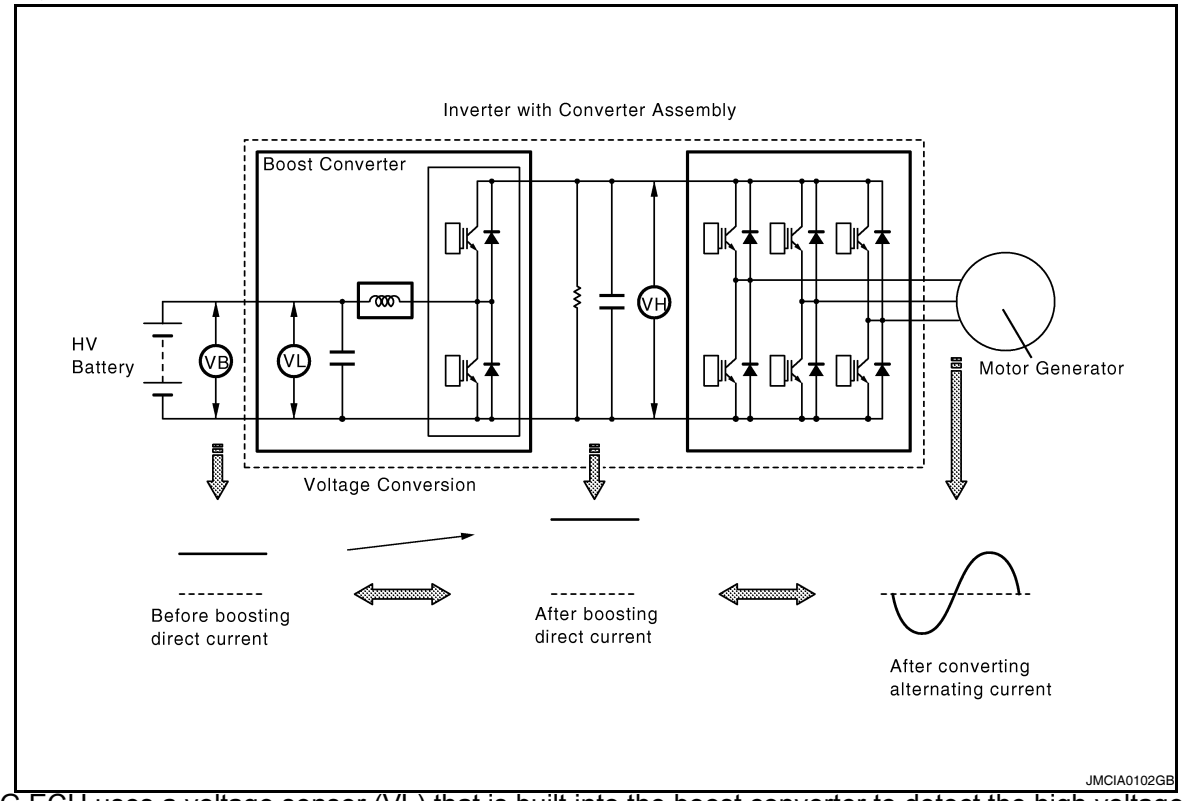
OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

P0A94-127

Description

INFOID:0000000004212002

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212003

DTC DETECTION LOGIC

If the boost converter detects a circuit malfunction or overvoltage, it transmits this information to the OVL terminal of the MG ECU via the boost converter overvoltage signal line.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A94	127	DC/DC Converter Performance	Boost converter overvoltage signal detection (overvoltage due to system malfunction)	• HV relay assembly • Inverter with converter assembly • Service plug grip • Frame wire • Hybrid transaxle

Diagnosis Procedure

INFOID:0000000004212004

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 284, 505, 287, 506, 113, 286, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 553, 554, 555, 556, 172, 557, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 324, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance
P3004-803	high Voltage Power Resource
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low

NOTE:
P0A94-127 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

OK >> Go to Diagnosis Procedure relevant to output DTC.
NG >> GO TO 3.

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

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

5. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> GO TO 20.

6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

7. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 18.

8. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Tighten to specified torque.

9. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Tighten to specified torque.

10. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

11. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

12. CHECK INVERTER WITH CONVERTER ASSEMBLY (HIGH VOLTAGE CONNECTOR CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Connect securely.

13.CHECK SERVICE PLUG GRIP

See HBC-231, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Replace service plug grip.

14.CHECK CONDITION OF FRAME WIRE CONNECTIONS (HV RELAY ASSEMBLY SIDE)

See HBC-543, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Tighten to specified torque.

15.CHECK FRAME WIRE

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> Replace frame wire (See HBC-648, "Removal and Installation").

16.INSPECT HV RELAY ASSEMBLY (SMRB)

See HBC-231, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

17.INSPECT HV RELAY ASSEMBLY (SMRG)

See HBC-231, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

18.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Connect securely.

19.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY-MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

20.CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 21.
NG >> Connect securely.

21.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

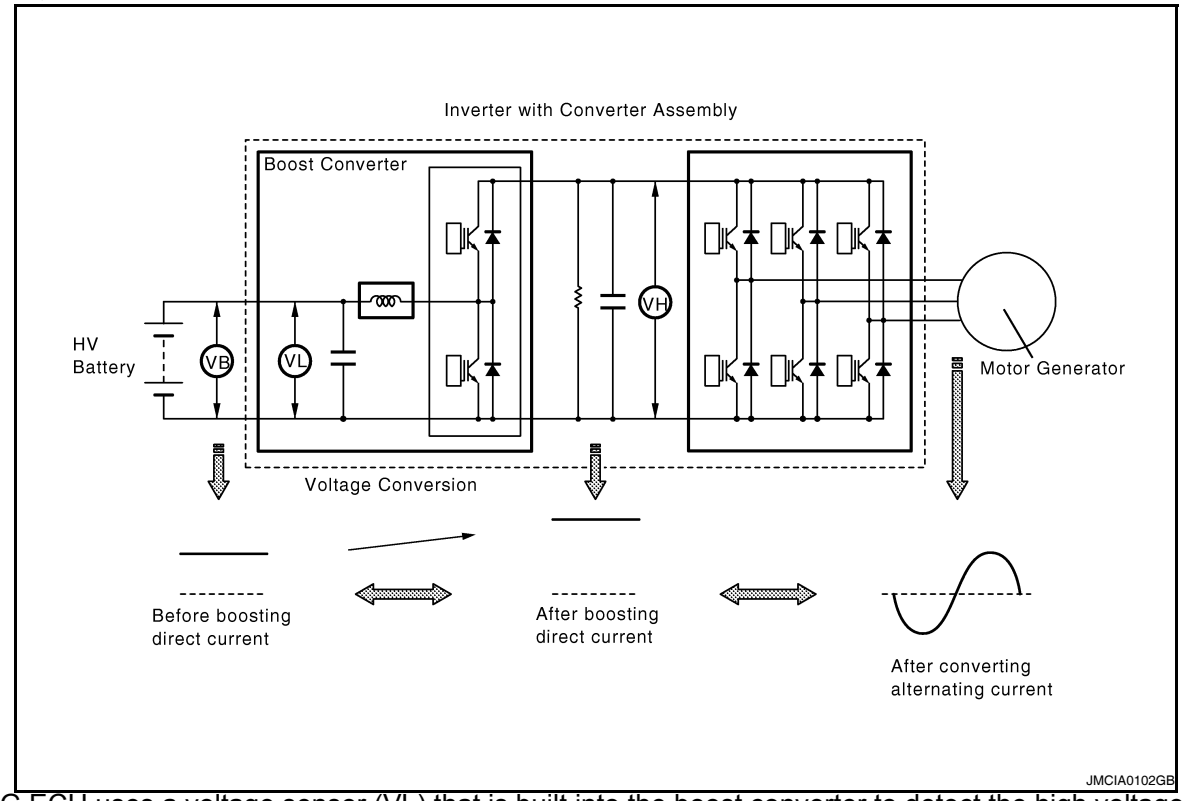
OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A94-172

Description

INFOID:0000000004212005

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212006

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A94	172	DC/DC Converter Performance	Boost converter fail signal detection (overcurrent due tosystem malfunction)	• Fuel level • Wire harness or connector • Hybrid transaxle • Inverter with converter assembly • Engine assembly

Diagnosis Procedure

INFOID:0000000004212007

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 284, 505, 287, 506, 113, 286, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 324, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance
P0AA6-526	Hybrid Battery Voltage System Isolation Fault
P0AA6-613	Hybrid Battery Voltage Isolation Sensor Circuit

NOTE:
P0A94-172 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.
NG >> Refuel vehicle.

4.CHECK ENGINE START

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 5.

5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 6.

6. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace engine assembly.

7. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 16.

10. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

11. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> GO TO 18.

12. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Tighten to specified torque.

13. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Tighten to specified torque.

14. INSPECTION HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

15. INSPECTION HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

16. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Connect securely.

17. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

18. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Connect securely.

19. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

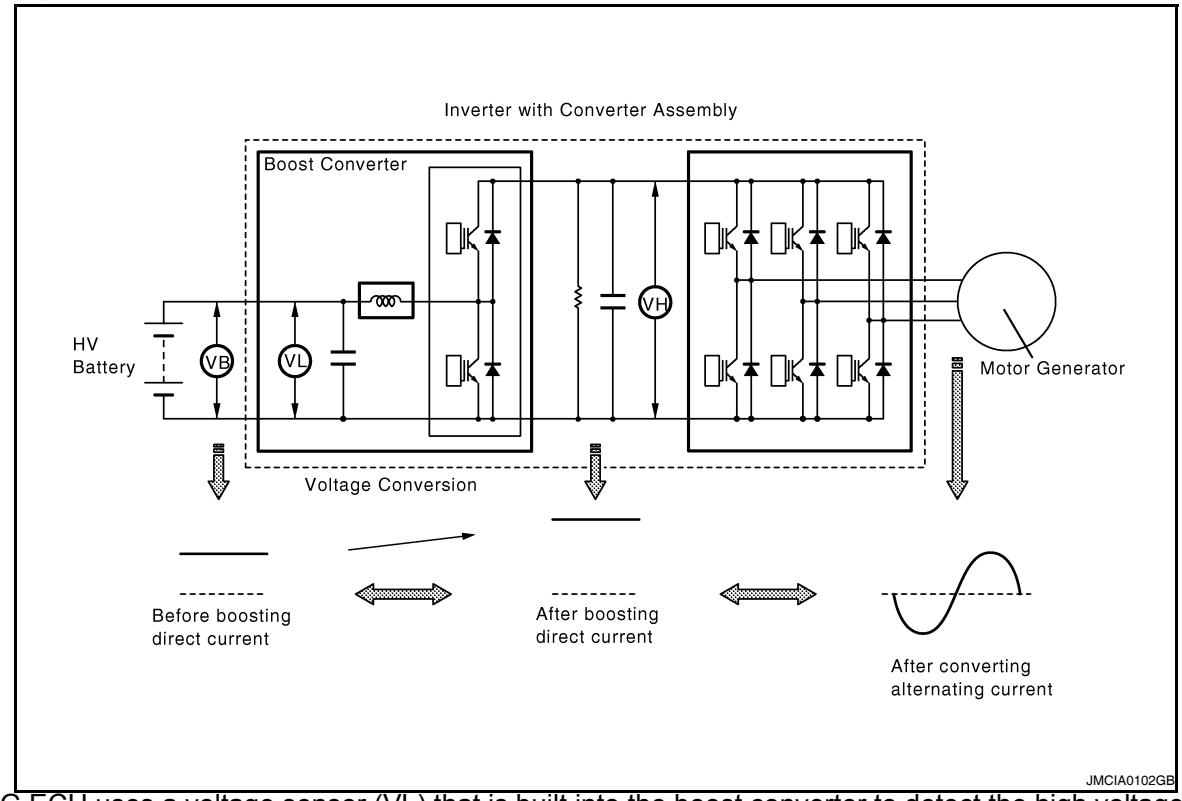
OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A94-442

Description

INFOID:0000000004212008

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212009

DTC DETECTION LOGIC

If the difference between the requested boost converter (inverter with converter assembly) voltage and the actual boost converter voltage exceeds a predetermined value, the hybrid vehicle control ECU determines that there is a malfunction of the execution or monitoring in the boost converter voltage. 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
P0A94	442	DC/DC Converter Performance	Abnormal voltage execution value	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212010

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 306, 510, 523, 586, 505, 287, 506, 503, 279, 504, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549	DC/DC Converter Performance
P0A7A-517, 325, 344, 518, 522, 809, 810, 811	Generator Inverter Performance
P0A92 (all INF codes)	Hybrid Generator Performance
P0A90 (all INF codes)	Hybrid Generator Performance
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3000 (all INF codes)	HV Battery Malfunction

NOTE:
P0A94-442 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

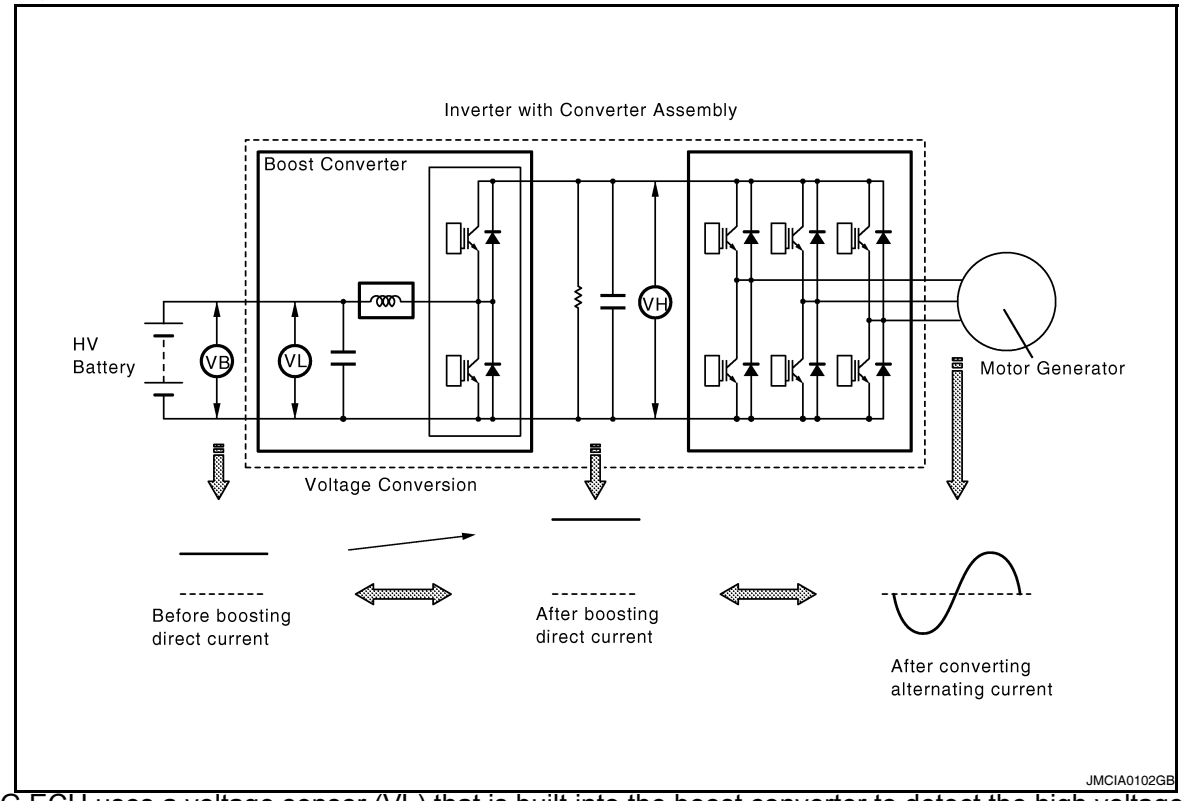
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

P0A94-547, P0A94-549

Description

INFOID:0000000004212011

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212012

DTC DETECTION LOGIC

If the boost converter detects a circuit malfunction or overvoltage, it transmits this information to the OVL terminal of the MG ECU via the boost converter overvoltage signal line.
If the boost converter (inverter with converter assembly) detects an overvoltage, it transmits a boost converter overvoltage signal to the MG ECU. Upon receiving this signal, 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
P0A94	547	DC/DC Converter Performance	Boost converter overvoltage signal detection (overvoltage due to MG ECU malfunction)	• Wire harness or connector • Inverter with converter assembly • Hybrid transaxle
	549		Boost converter overvoltage signal detection (overvoltage due to hybrid transaxle malfunction)	• Wire harness or connector • Inverter with converter assembly • Hybrid transaxle

Diagnosis Procedure

INFOID:0000000004212013

1.PRECONDITIONING

- 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. 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.

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556	DC/DC Converter Performance
P0A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance
P3004-803	High Voltage Power Resource
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low

NOTE:
P0A94-547 or 549 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

5.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 6.

6.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

8.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 14.

10.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Tighten to specified torque.

11.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Tighten to specified torque.

12.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

13. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

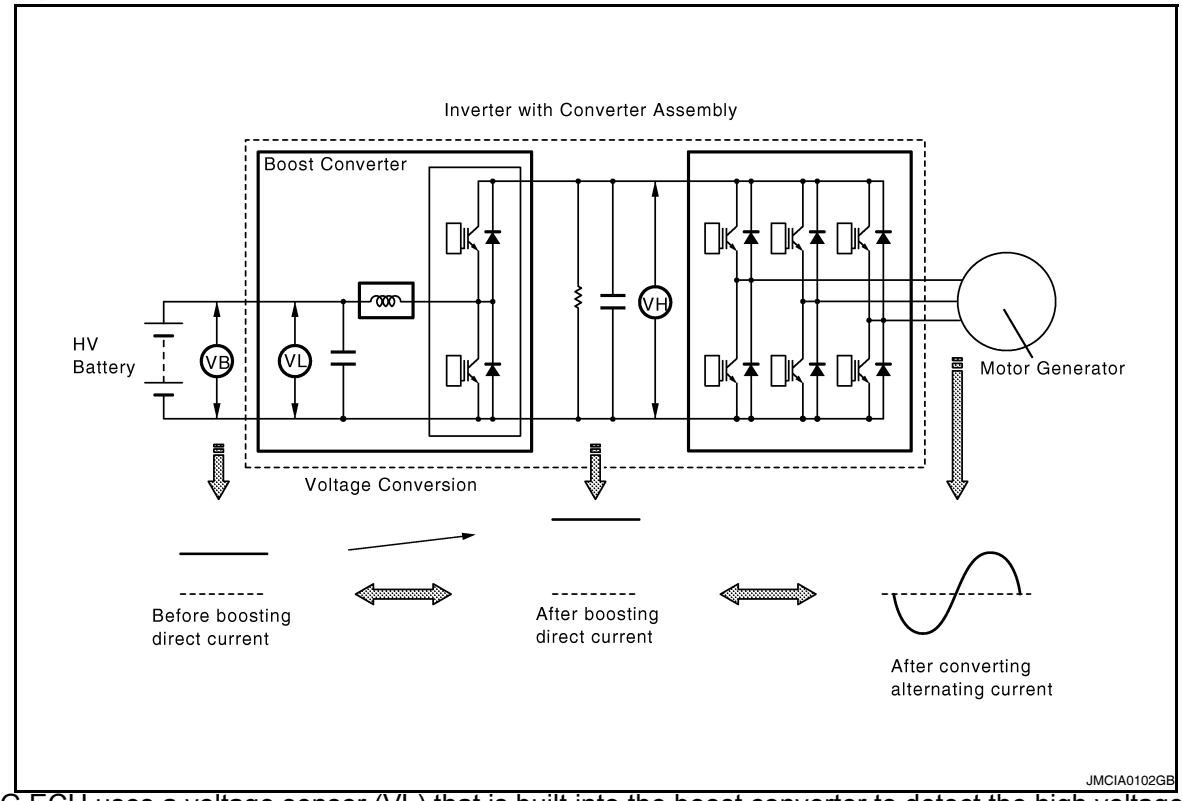
OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A94-548

Description

INFOID:0000000004212014

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212015

DTC DETECTION LOGIC

If the boost converter detects a circuit malfunction or overvoltage, it transmits this information to the OVL terminal of the MG ECU via the boost converter overvoltage signal line.
If the boost converter (inverter with converter assembly) detects an overvoltage, it transmits a boost converter overvoltage signal to the MG ECU. Upon receiving this signal, 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
P0A94	548	DC/DC Converter Performance	Boost converter overvoltage signal detection (overvoltage due to inverter malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212016

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556	DC/DC Converter Performance
P0A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance
P3004-803	High Voltage Power Resource
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low

NOTE:
P0A94-548 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above.
Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

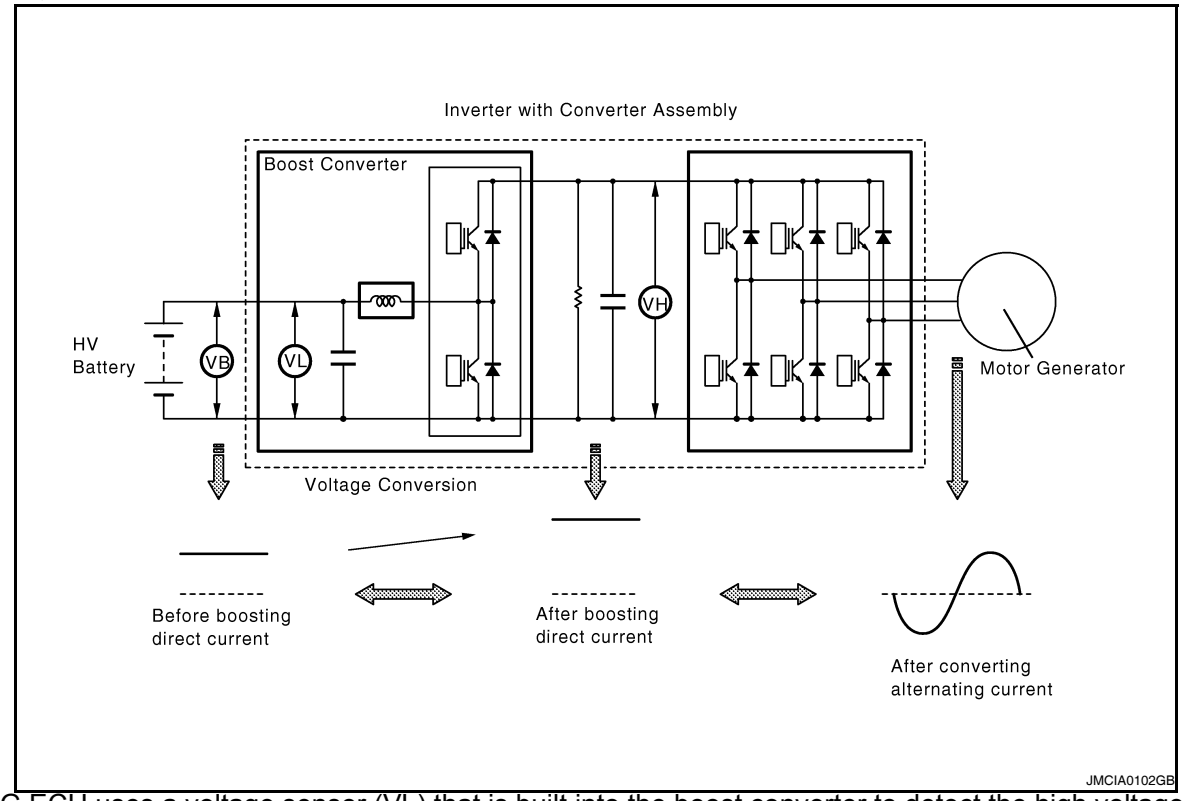
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

P0A94-550

Description

INFOID:0000000004212017

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212018

DTC DETECTION LOGIC

If the boost converter (inverter with converter assembly) detects a circuit malfunction, it transmits a boost converter overvoltage signal to the MG ECU. Upon receiving this signal, 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
P0A94	550	DC/DC Converter Performance	Boost converter overvoltage (OVL) signal detection (circuit malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212019

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

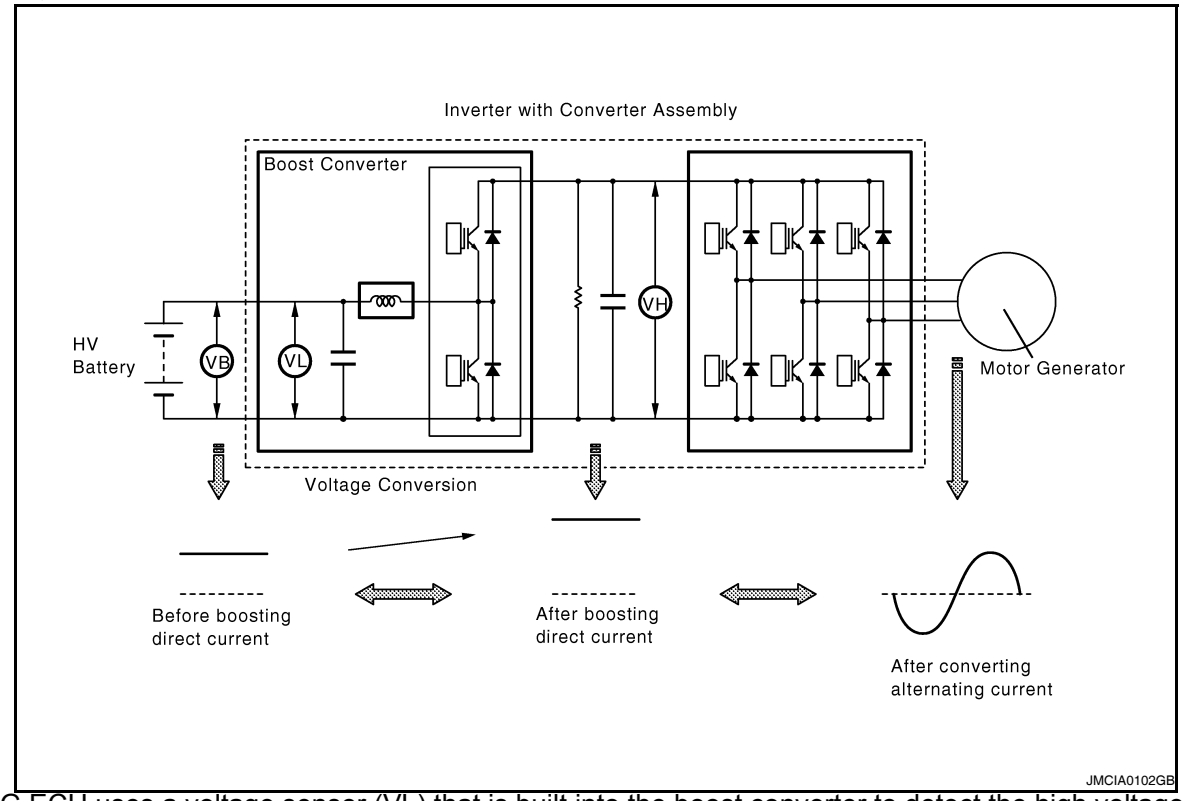
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

P0A94-553

Description

INFOID:0000000004212020

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212021

DTC DETECTION LOGIC

If the boost converter (inverter with converter assembly) overheats, it will transmit a boost converter fail signal to the MG ECU. Upon receiving this signal, 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
P0A94	553	DC/DC Converter Performance	Boost converter fail signal detection (boost converter overheating)	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Hybrid transaxle • Inverter with converter assembly • Fuel level • Engine assembly • Cooling fan system

Diagnosis Procedure

INFOID:0000000004212022

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 284, 505, 287, 506, 113, 286, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 324, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance
P0AA6-526	Hybrid Battery Voltage System Isolation Fault
P0AA6-613	Hybrid Battery Voltage Isolation Sensor Circuit

NOTE:
P0A94-553 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.
NG >> Refuel vehicle.

4. CHECK ENGINE START

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 5.

5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 6.

6. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace engine assembly.

7. CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

A or B or C

A >> GO TO 8.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

8. CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Correct the problem.

9. CHECK FUSE (NO. 67)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Replace fuse.

10. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Connect securely.

12. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> GO TO 28.

13. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Connect securely.

14. PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Check cooling fan system (See EC-382, "Component Function Check").

15. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> Connect securely.

16. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Repair or replace harness or connector.

17. CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 18.
NG >> GO TO 24.

18. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Repair or replace harness or connector.

19. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 20.
NG >> GO TO 26.

20. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 21.
NG >> Tighten to specified torque.

21. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 22.
NG >> Tighten to specified torque.

22. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 23.
NG >> Replace hybrid transaxle.

23. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 25.
NG >> Connect securely.

25. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 27.
NG >> Connect securely.

27. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

28. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 29.

29. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 30.
NG >> GO TO 32.

30. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 31.
NG >> Repair or replace harness or connector.

31. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle control ECU. Refer to HBC-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".
NG >> Repair or replace high voltage fuse and fusible link box.

32. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

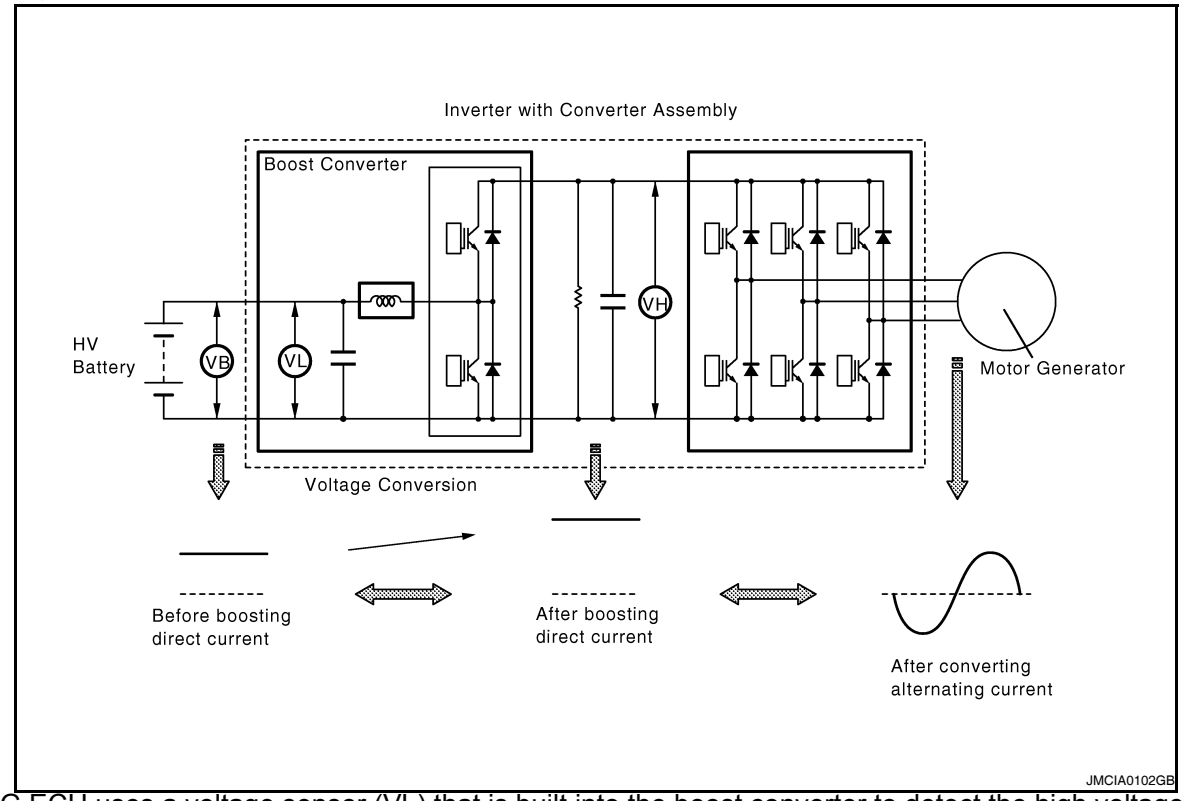
OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

P0A94-554, P0A94-556

Description

INFOID:0000000004212023

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212024

DTC DETECTION LOGIC

If excessive amperage flows through the boost converter (inverter with converter assembly) due to an internal short, the boost converter will transmit a boost converter fail signal to the MG ECU. Upon receiving this signal, 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
P0A94	554	DC/DC Converter Performance	Boost converter inverter fail signal detection (overcurrent due to MG ECU malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly
	556		Boost converter inverter fail signal detection (overcurrent due to hybrid transaxle malfunction)	• Wire harness or connector • Hybrid transaxle • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212025

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance
P0A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance

NOTE:
P0A94-554 and 556 may be output due to a malfunction which causes the DTCs in the table above to be output. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

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

5.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 6.

6.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

8.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 14.

10.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Tighten to specified torque.

11.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Tighten to specified torque.

12.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

13.INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

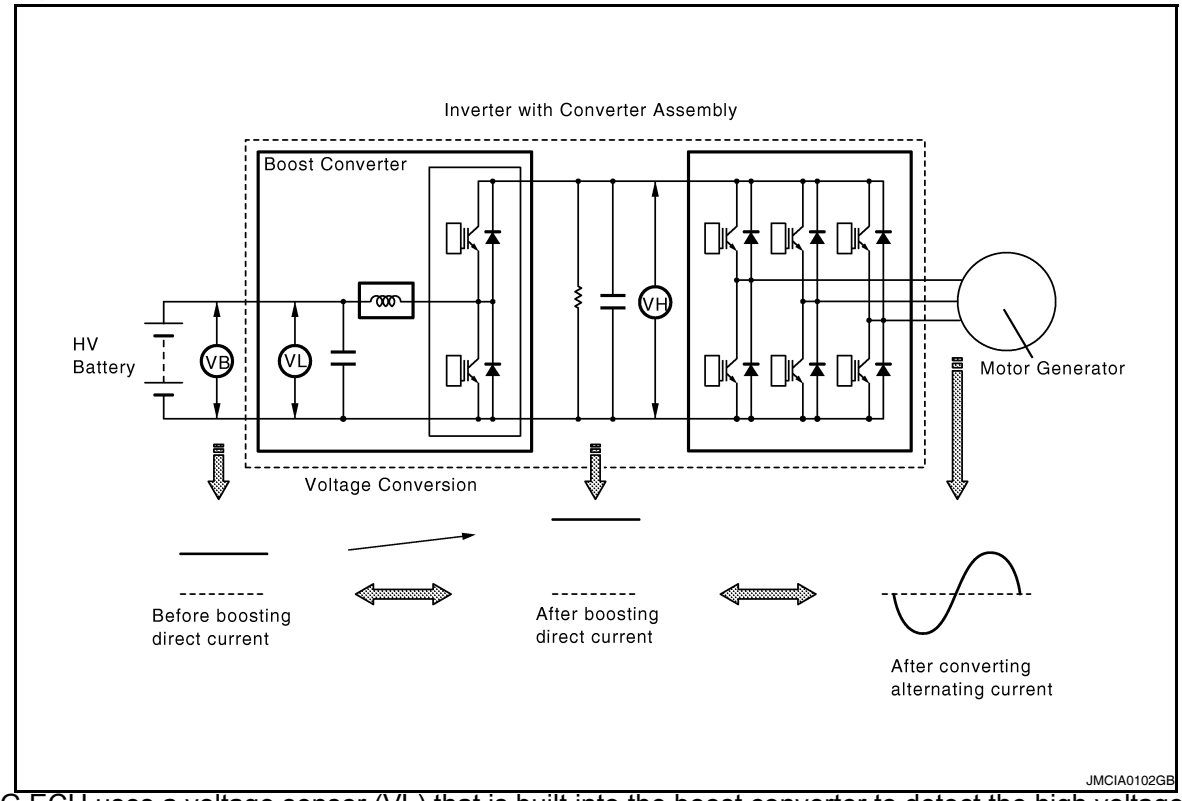
OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

P0A94-555

Description

INFOID:0000000004212026

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212027

DTC DETECTION LOGIC

If excessive amperage flows through the boost converter (inverter with converter assembly) due to an internal short, the boost converter will transmit a boost converter fail signal to the MG ECU. Upon receiving this signal, 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
P0A94	555	DC/DC Converter Performance	Boost converter inverter fail signal detection (overcurrent due to inverter assembly malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212028

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590	DC/DC Converter Performance
P0A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance

NOTE:
P0A94-555 may be output due to a malfunction which causes the DTCs in the table above to be output. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Connect securely.

P0A94-557

Description

INFOID:0000000004212029

For a description of the boost converter, (See HBC-376, "Description").
If MG ECU detects overheat or circuit malfunction of the boost converter, the inverter assembly transmits this information via the boost converter fail signal line.

DTC Logic

INFOID:0000000004212030

DTC DETECTION LOGIC

If MG ECU detects overheat or circuit malfunction of the boost converter, the inverter assembly transmits this information via the boost converter fail signal line.
If the boost converter detects a circuit malfunction, it transmits a boost converter fail signal to the MG ECU. Upon receiving this signal, 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
P0A94	557	DC/DC Converter Performance	Boost converter fail signal detection (circuit malfunction)	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Hybrid transaxle • Inverter with converter assembly • Fuel level • Engine assembly • Cooling fan system

Diagnosis Procedure

INFOID:0000000004212031

1.PRECONDITIONING

- 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. 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.
- After inspection, be sure to replace the inverter with converter assembly.
- 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
P0A1A (all INF codes)	Generator Control Module
P0A1B (all INF codes)	Drive Motor “A” Control Module
P0A72 (all INF codes)	Generator Phase V Current
P0A75 (all INF codes)	Generator Phase W Current
P0A60 (all INF codes)	Drive Motor “A” Phase V Current
P0A63 (all INF codes)	Drive Motor “A” Phase W Current
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low

DTC No.	Relevant Diagnosis
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A3F-243	Drive Motor “A” Position Sensor Circuit
P0A41-245	Drive Motor “A” Position Sensor Circuit Low
P0A40-500	Drive Motor “A” Position Sensor Circuit Range/Performance
P0A78-266, 267, 523, 586, 284, 505, 287, 506, 113, 286, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor “A” Inverter Performance
P0A94-585, 587, 589, 590, 553, 554, 555, 556, 172, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 324, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor “A” Performance

NOTE:
DTC P0A94-557 may be set due to a malfunction which also causes DTCs in the table above to be set. First troubleshoot the output DTCs in the table above. After troubleshooting all output DTCs, be sure to replace the inverter with converter assembly.

Is DTC detected?

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

3.CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.
NG >> Refuel vehicle.

4.CHECK ENGINE START

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 5.

5.INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> GO TO 6.

6.INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace engine assembly.

7.CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

A,B or C

A >> GO TO 8.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

8.CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Correct the problem.

9.CHECK FUSE (NO. 67)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Replace fuse.

10.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11.CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Connect securely.

12.PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> GO TO 28.

13.CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Connect securely.

14.PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Check cooling fan system (See EC-382, "Component Function Check").

15.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> Connect securely.

16.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Repair or replace harness or connector

17.CHECK GENERATOR RESOLVER

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 18.
NG >> GO TO 24.

18. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 19.
NG >> Repair or replace harness or connector.

19. CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 20.
NG >> GO TO 26.

20. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 21.
NG >> Tighten to specified torque.

21. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 22.
NG >> Tighten to specified torque.

22. INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> GO TO 23.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

23. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> GO TO 25.
NG >> Connect securely.

25. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 27.
NG >> Connect securely.

27. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").
NG >> Repair or replace harness or connector.

28. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 29.

29. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 30.
NG >> GO TO 32.

30. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 31.
NG >> Repair or replace harness or connector.

31. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Repair or replace high voltage fuse and fusible link box.

32. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

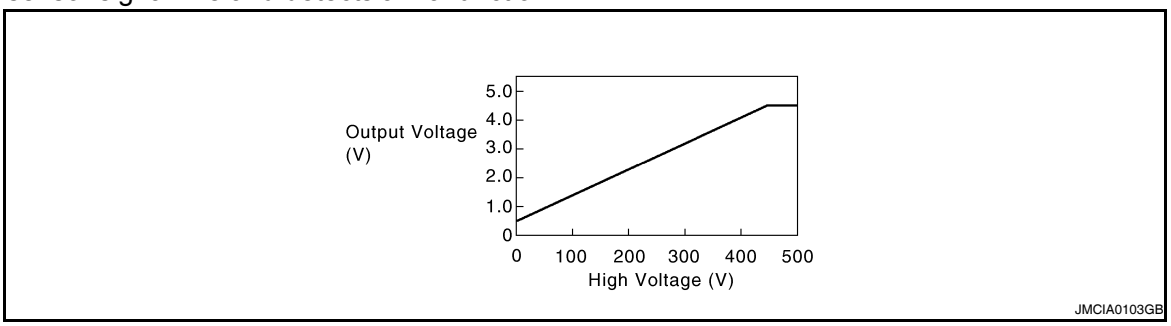
OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

P0A94-585

Description

INFOID:0000000004212032

The MG ECU uses a voltage sensor that is built into the boost converter to detect pre-boost high voltage (VL) to allow boost control. The boost converter voltage sensor outputs a voltage that varies between 0 and 5 V in accordance with changes in the high voltage. The higher the high voltage, the higher the output voltage. Conversely, the lower the high voltage, the lower the output voltage. The MG ECU monitors the boost converter voltage sensor signal line and detects a malfunction.



DTC Logic

INFOID:0000000004212033

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the boost converter voltage sensor signal. If the hybrid vehicle control ECU detects an abnormality in the sensor signal, 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
P0A94	585	DC/DC Converter Performance	Boost converter voltage (VL) sensor performance problem	Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212034

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Is DTC detected?

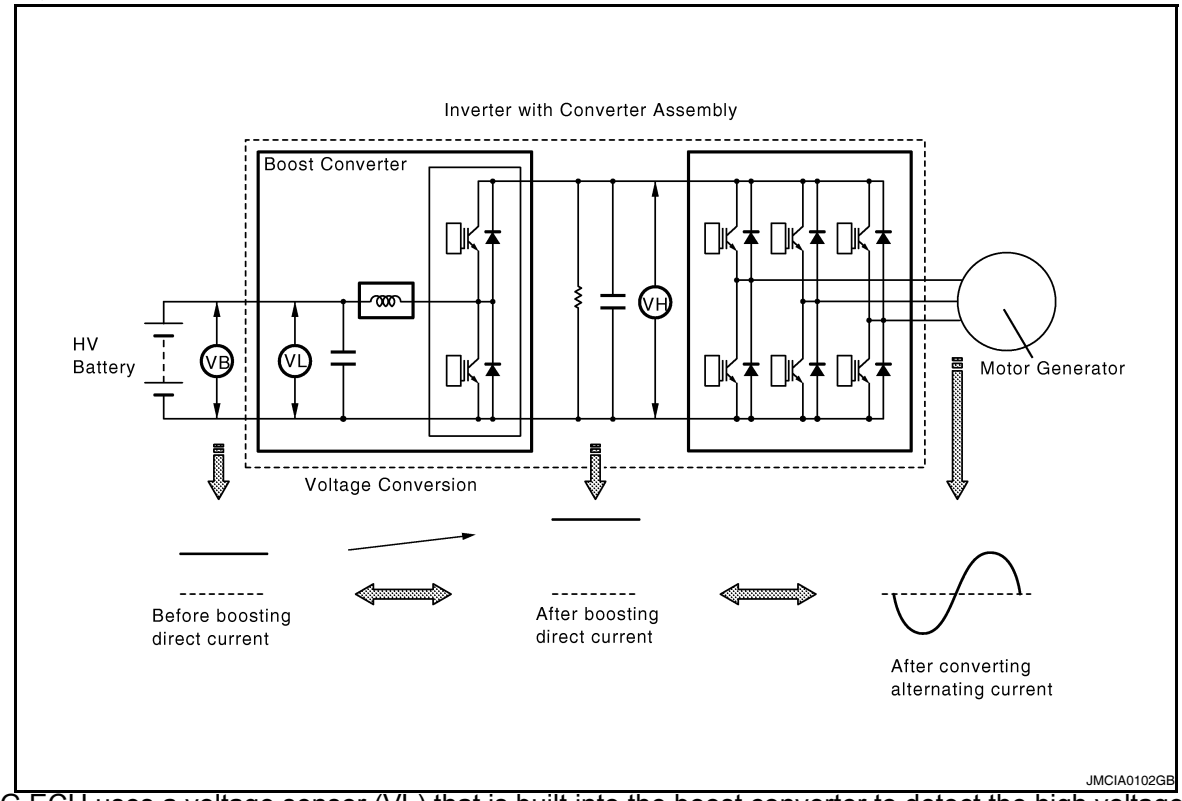
YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

P0A94-587

Description

INFOID:0000000004212035

The boost converter boosts the 244.8 V DC from the HV battery to a maximum of approximately 650 V DC. The inverter converts the voltage that has been boosted by the boost converter into alternating current, which is used for driving MG2 and MG1. When MG1 and MG2 operate as a generator, the alternating-current voltage from MG1 and MG2 is converted into direct-current voltage by the inverter.
Then the boost converter drops this voltage to a direct-current voltage rating of 244.8 V in order to charge the HV battery.



The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. It also uses a voltage sensor (VH) that is built into the inverter to detect the high voltage after it is boosted. Based on the voltage before and after it is boosted, the hybrid vehicle control ECU controls the operation of the boost converter to boost the voltage to the target voltage.

DTC Logic

INFOID:0000000004212036

DTC DETECTION LOGIC

The MG ECU uses a voltage sensor that is built into the boost converter to detect the high voltage (VL) before it is boosted. The hybrid vehicle control ECU also uses a battery smart unit to detect HV battery voltage (VB). The hybrid vehicle control ECU monitors the HV battery voltage (VB) and boost converter voltage (VL) sensors. When a large difference occurs between the voltages from the VB and VL sensors, the hybrid vehicle control ECU interprets this as a failure of either of the sensors. 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
P0A94	587	DC/DC Converter Performance	Voltages from HV battery voltage (VB) sensor and boost converter voltage (VL) sensor deviate	• Inverter with converter assembly • Battery smart unit

Diagnosis Procedure

INFOID:0000000004212037

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Output DTC	Proceed to
DTCs P0A94-587 and P0A1F-129 (HV battery voltage circuit malfunction)	A
DTCs P0A94-587 and P0A94-442 (Abnormal voltage execution value)	B
DTCs P0A94-587 and P0A94-585 (Boost converter voltage (VL) sensor performance problem)	C
DTC P0A94-587 only, or DTC P0A94-587 and DTCs other than above	D

A, B, C or D

A >> Go to inspection procedure relevant to output DTC (P0A1F-129).
B >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
C >> Go to inspection procedure relevant to output DTC (P0A94-585).
D >> GO TO 3.

3.CLEAR DTC

1. Turn ignition switch ON.
2. Read and record the DTCs and freeze frame data.
3. Clear the DTCs.

>> GO TO 4.

4.CHECK DTC OUTPUT (HYBRID SYSTEM)

1. Turn ignition switch ON (READY) and move the shift lever to the N position. (*1)
2. Turn the A/C switch to the MAX COOL position. (*2)
3. Confirm that “PWR RESOURCE IB” is more than 3A in “DATA MONITOR” mode with CONSULT-III. (*3)
4. Leave the vehicle in the condition specified in steps (*2) and (*3) above for 15 seconds. (*4)
   NOTE:
   If the low battery charge warning light comes on, move the shift lever to the P position and start the engine to charge the HV battery. After the engine stops, perform steps (*1) through (*5) again.
5. Check DTC. (*5)

DTC No.	Relevant Diagnosis	Proceed to
P0A1F-129	HV battery voltage circuit malfunction	A
P0A94-585	Boost converter voltage (VL) sensor performance problem	B
P3000-388	Discharge inhibition	C
P3004-132	Power Cable Malfunction	D
No DTC is output.	—	E

A,B,C,D or E

A >> Replace battery smart unit (See HBB-101, "Removal and Installation").
B >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
C >> Leave vehicle in P position, and charge HV battery in idle status until idling stops (perform steps (*1) through (*5).
D >> Replace battery smart unit (See HBB-101, "Removal and Installation").

E >> GO TO 5.

5. CHECK DTC OUTPUT (HYBRID SYSTEM)

1. Perform a road test that repeats full acceleration to 60 km/h and then full braking to a complete stop several times. (*6)
2. Check DTC. (*7)

DTC No.	Relevant Diagnosis	Proceed to
P0A1F-129	HV battery voltage circuit malfunction	A
P0A94-585	Boost converter voltage (VL) sensor performance problem	B
P3000-388	Discharge inhibition	C
P3004-132	Power Cable Malfunciton	D
No DTC is output.	—	E

A,B,C,D or E

A >> Replace battery smart unit (See HBB-101, "Removal and Installation").
B >> Replace inverter with converter assembly (See page HBC-638, "Removal and Installation").
C >> Leave vehicle in P position, and charge HV battery in idle status until idling stops (perform steps (*6) through (*7).
D >> Replace battery smart unit (See HBB-101, "Removal and Installation").
E >> GO TO 6.

6. READ VALUE OF DATA MONITOR

1. Turn ignition switch ON (READY).
2. Select “PWR RESOURCE VB”, “VL” and “VH”.
3. Read the data list when the shift lever is in the N position (the engine is off) and the vehicle is stationary.

Voltage	Voltage Difference	Result
Difference between HV battery voltage (PWR RESOURCE VB) and boost converter voltage (VL)	50 V or less	1
Difference between HV battery voltage (PWR RESOURCE VB) and inverter voltage (VH)	70 V or less	2
Difference between boost converter voltage (VL) and inverter voltage (VH)	90 V or less	3

Results	Proceed to
Only 2 is satisfied.	A
Only 3 is satisfied.	B
1, 2 and 3 are satisfied (normal condition).	C

A, B or C

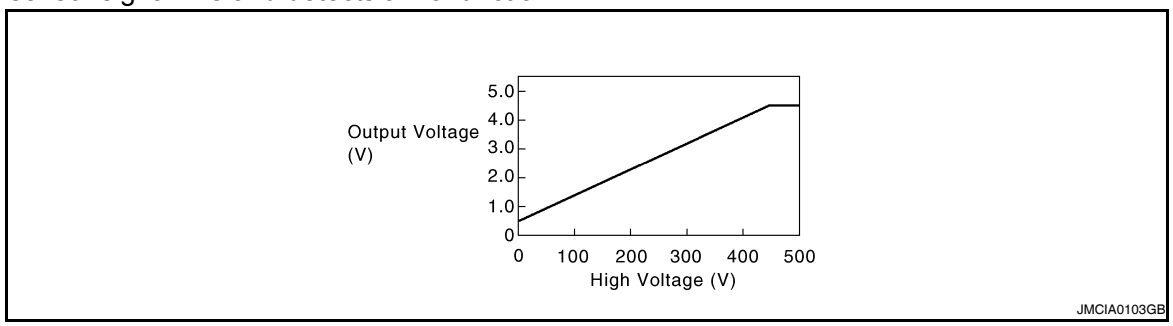
A >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
B >> Replace battery smart unit (See HBB-101, "Removal and Installation").
C >> Replace battery smart unit (See HBB-101, "Removal and Installation").

P0A94-589, P0A94-590

Description

INFOID:0000000004212038

The MG ECU uses a voltage sensor that is built into the boost converter to detect pre-boost high voltage (VL) to allow boost control. The boost converter voltage sensor outputs a voltage that varies between 0 and 5 V in accordance with changes in the high voltage. The higher the high voltage, the higher the output voltage. Conversely, the lower the high voltage, the lower the output voltage. The MG ECU monitors the boost converter voltage sensor signal line and detects a malfunction.



DTC Logic

INFOID:0000000004212039

DTC DETECTION LOGIC

The MG ECU monitors the boost converter voltage (VL) sensor circuit. If the MG ECU detects an open or short in the VL sensor circuit, the hybrid vehicle control ECU will illuminates the MIL and sets a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A94	589	DC/DC Converter Performance	Open or short to GND in the boost converter voltage (VL) sensor circuit	Inverter with converter assembly
P0A94	590		Short to +B in the boost converter voltage (VL) sensor circuit	

Diagnosis Procedure

INFOID:0000000004212040

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

>> COMPLETED

P0AA1-231

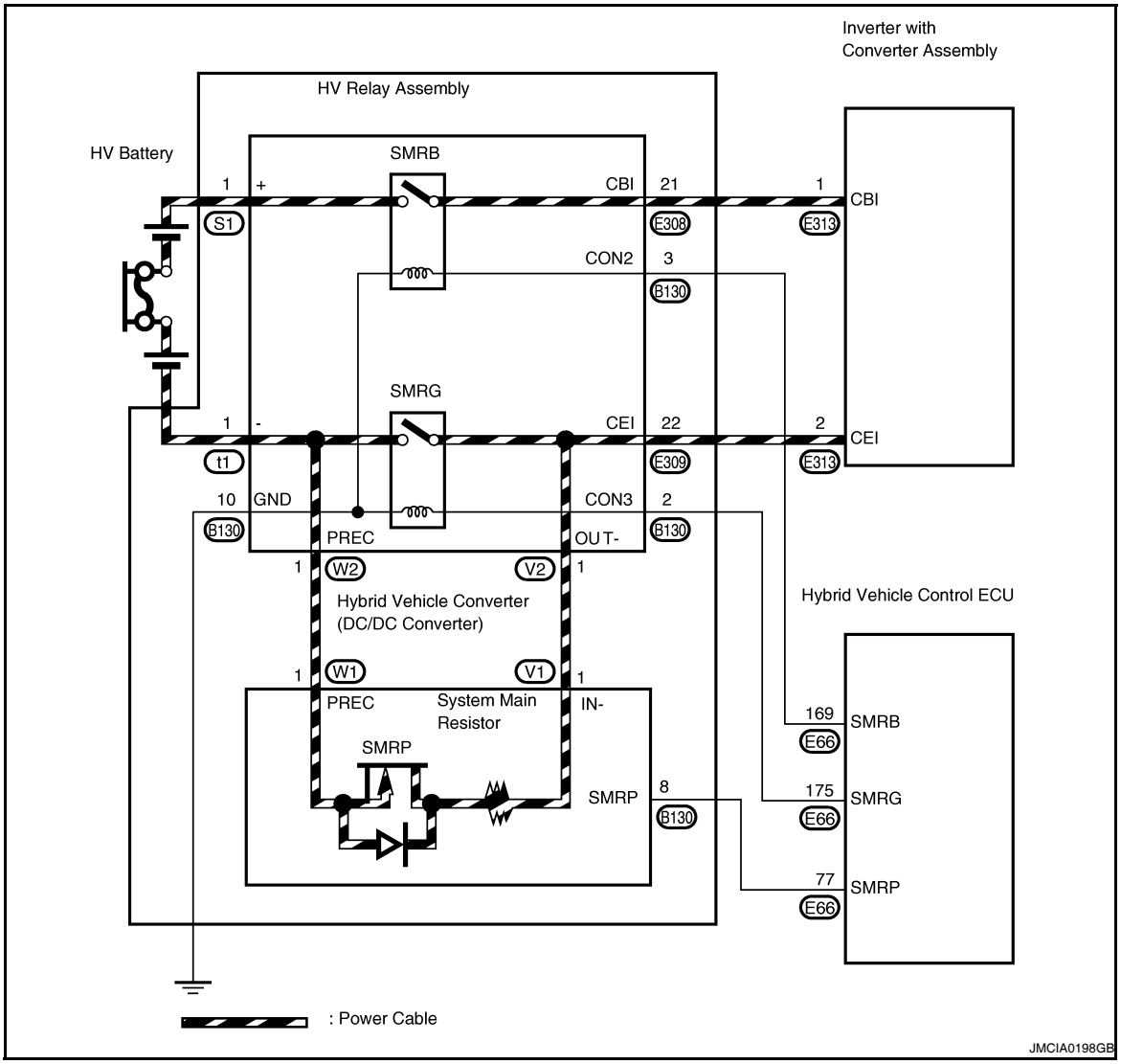
Description

INFOID:0000000004212041

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
21
22
E308
E309
1
2
E313
CBI
CEI
CON2
3
B130
CON3
2
10
GND
PREC
OUT-
W2
V2
W1
V1
Hybrid Vehicle Converter
(DC/DC Converter)
PREC
System Main
Resistor
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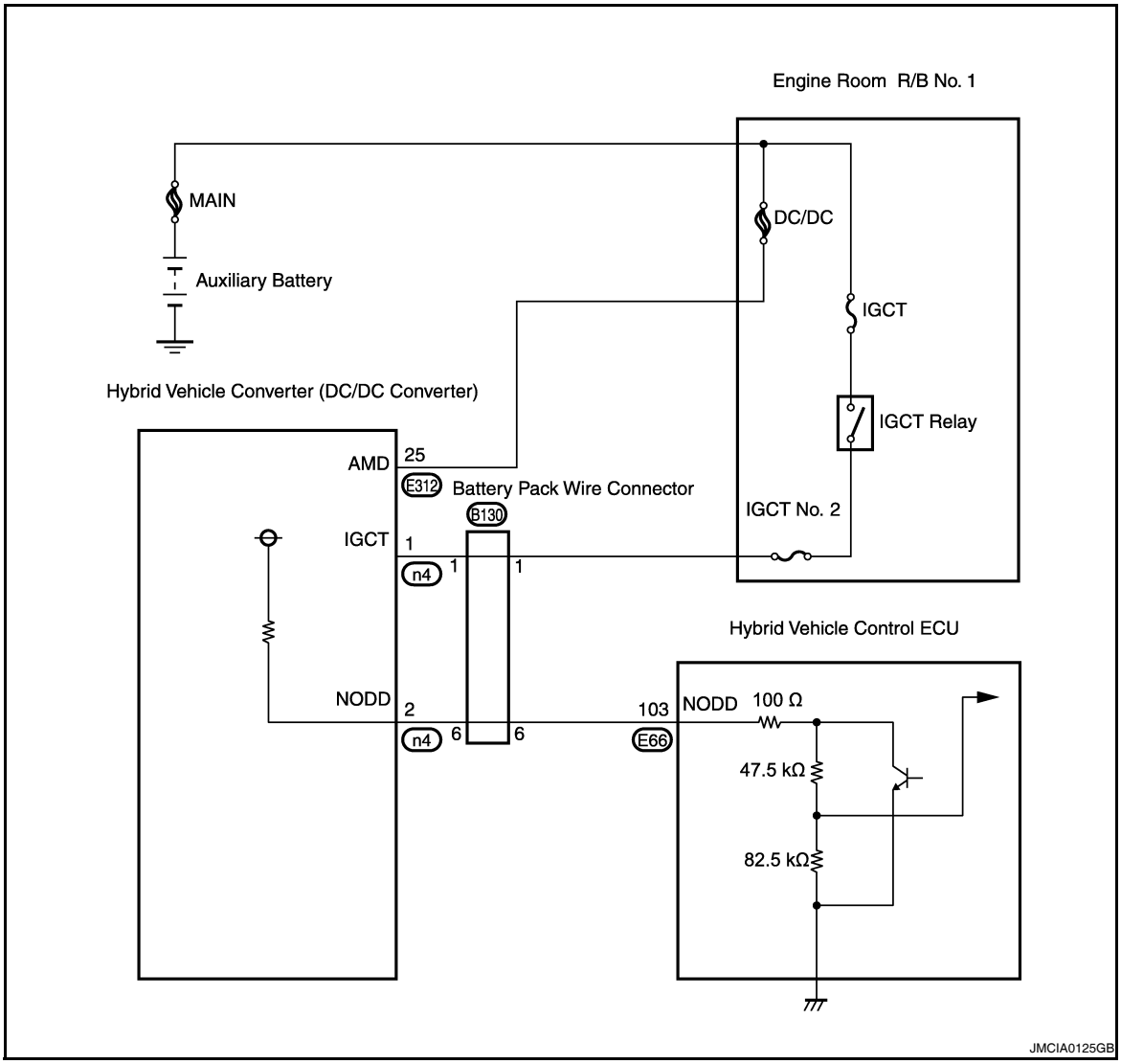


DTC Logic

INFOID:0000000004212042

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AA1	231	Hybrid Battery Positive Contactor Circuit Stuck Closed	System main relay B on the HV battery positive side is stuck closed.	• HV relay assembly • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212043

1.PRECONDITIONING

- 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. 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.
- If P0AA1-231 is output, the vehicle is prevented from starting.

>> GO TO 2.

2. CHECK DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Part
P0AE2-773, 161	SMRP short
P0ADC-226	SMRB control line
P0A1A-156, 658, 659, 151, 155, P0A1B-511, 164, 163, 512, 193, 786, 788, 661,P0A78-266, 267, 523, 586, P0A94-442, P3004-132	VH sensor circuit
P0A1A-200, 791, 792, 793, P0A1B-192, 168, 794, 795, 796, P0A3F-243,P0A41-245, P0A40-500, P0A4B-253, P0A4C-513, P0A4D-255	MG1 and MG2 rotation speed circuit

Is DTC detected?

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

3. CHECK FREEZE FRAME DATA

1. Turn ignition switch ON.
2. Read output DTCs.
3. Read the freeze frame data of P0AA1-231.

Result	Proceed to
Boost converter voltage (VL) is less than 60 V.	A
Boost converter voltage (VL) is 60 V or more.	B

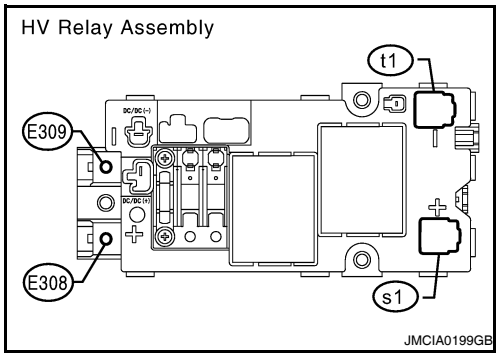
A or B

A >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
B >> GO TO 4.

4. CHECK HV RELAY ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.
   - For the removal and installation procedures related to inspection of the HV relay assembly, (See HBB-105, "Removal and Installation").
2. Measure the resistance according to the value(s) in the table below.



HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E308	21	s1	1	10 kΩ or higher

NOTE:
- Leave the HV relay in the vehicle while testing to prevent the movement that occurs during removal from causing a stuck relay to return to normal.
- If the result of reading the freeze frame data is B, the HV relay assembly must be replaced. Measuring resistance can determine that this is either a present or past malfunction.

OK or NG

OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

P0AA1-233

Description

INFOID:0000000004212044

Refer to the description for DTC P0AE6-225 (See HBC-460, "Description"). This circuit uses the hybrid vehicle control ECU to monitor the system main relays and stops the system if a malfunction is detected in the relays, because it may be impossible to shut off the high-voltage system if any of the relays becomes stuck.

DTC Logic

INFOID:0000000004212045

DTC DETECTION LOGIC

This circuit uses the hybrid vehicle control ECU to monitor the system main relays and stops the system if a malfunction is detected in the relays, because it may be impossible to shut off the high-voltage system if any of the relays becomes stuck.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AA1	233	Hybrid Battery Positive Contactor Circuit Stuck Closed	System main relays B, and G on the HV battery positive and negative sides are stuck closed.	HV relay assembly

Diagnosis Procedure

INFOID:0000000004212046

1.PRECONDITIONING

- 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. 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.
- If P0AA1-233 is output, the vehicle is prevented from starting.

>> GO TO 2.

2.CHECK DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Part
P0A1A-156, 658, 659, 151, 155, 200, 791, 792, 793	Generator Control Module
P0A1B-511, 164, 163, 512, 193, 786, 788, 661, 192, 168, 794, 795,796	Drive Motor "A" Control Module
P0A1F	Battery Energy Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A78-266, 267, 523, 586, 503, 504, 279, 282, 284, 505, 287, 506,286, 113, 306	Drive Motor "A" Inverter Performance
P0A7A-322, 517, 325, 518, 324, 122, 344	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance

DTC No.	Relevant Part
P0A94-442	DC/DC Converter Performance
P0AE0-228	Hybrid battery Negative Contactor Control Circuit High
P0AE2-161, 773	Hybrid Battery Precharge Contactor Circuit Stuck Closed
P3004-132	HV Battery Malfunction
P3105	Battery Observation Communication Circuit Malfunction

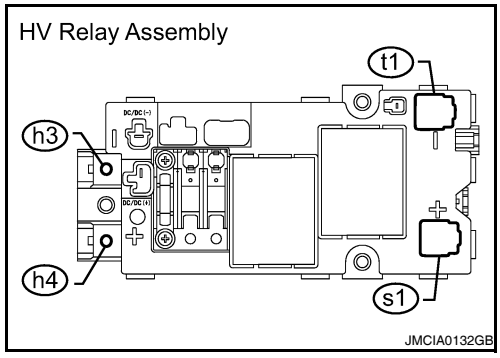
Is DTC detected?

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

3. CHECK HV RELAY ASSEMBLY (SMRB, SMRG)

CAUTION:
Be sure to wear insulated gloves.

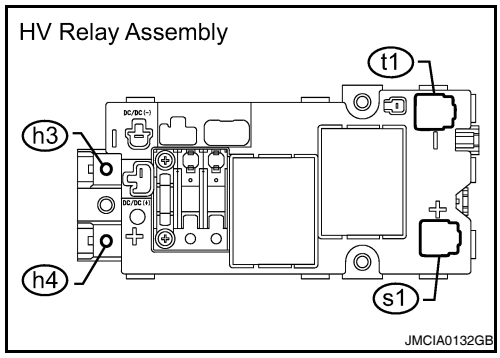
1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.
2. Disconnect the high voltage connector of the HV relay assembly (See HBB-105, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below. (SMRB inspection) (*1)



HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
h4	1	s1	1	10 kΩ or higher

NOTE:
- **Leave the HV relay in the vehicle while testing to prevent the movement that occurs during removal from causing a stuck relay to return to normal.**
- **Measuring resistance can determine that this is either a present or past malfunction.**

4. Measure the resistance according to the value(s) in the table below. (SMRG inspection) (*2)



HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
h3	1	t1	1	10 kΩ or higher

NOTE:
- **Leave the HV relay in the vehicle while testing to prevent the movement that occurs during removal from causing a stuck relay to return to normal.**
- **Measuring resistance can determine that this is either a present or past malfunction**.

Result	Proceed to
There is conduction in either step (*1) or (*2).	A
There is conduction in both steps (*1) and (*2).	B

A or B

A >> Replace HV relay assembly (See HBB-105, "Removal and Installation").
B >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

P0AA4-232

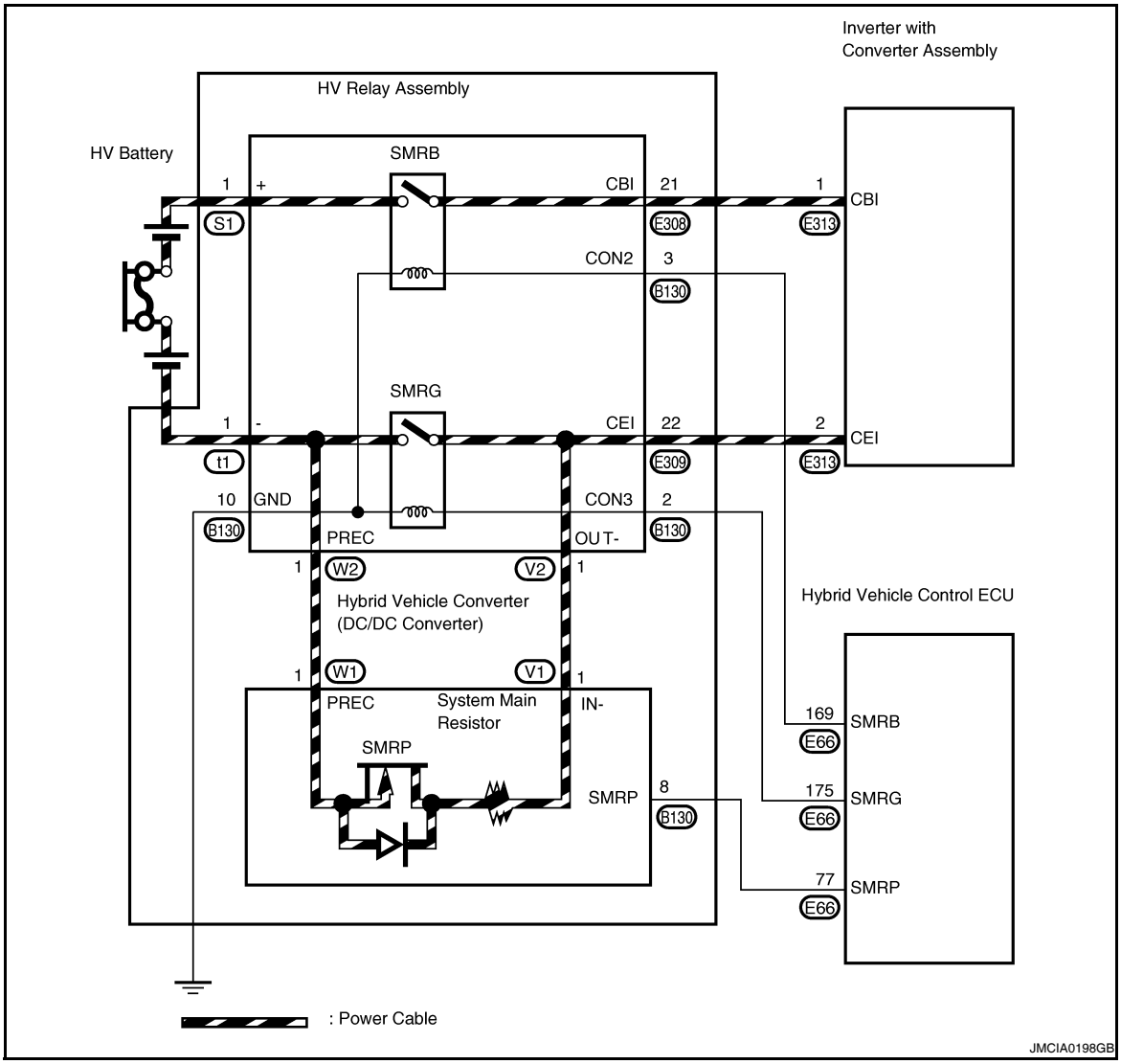
Description

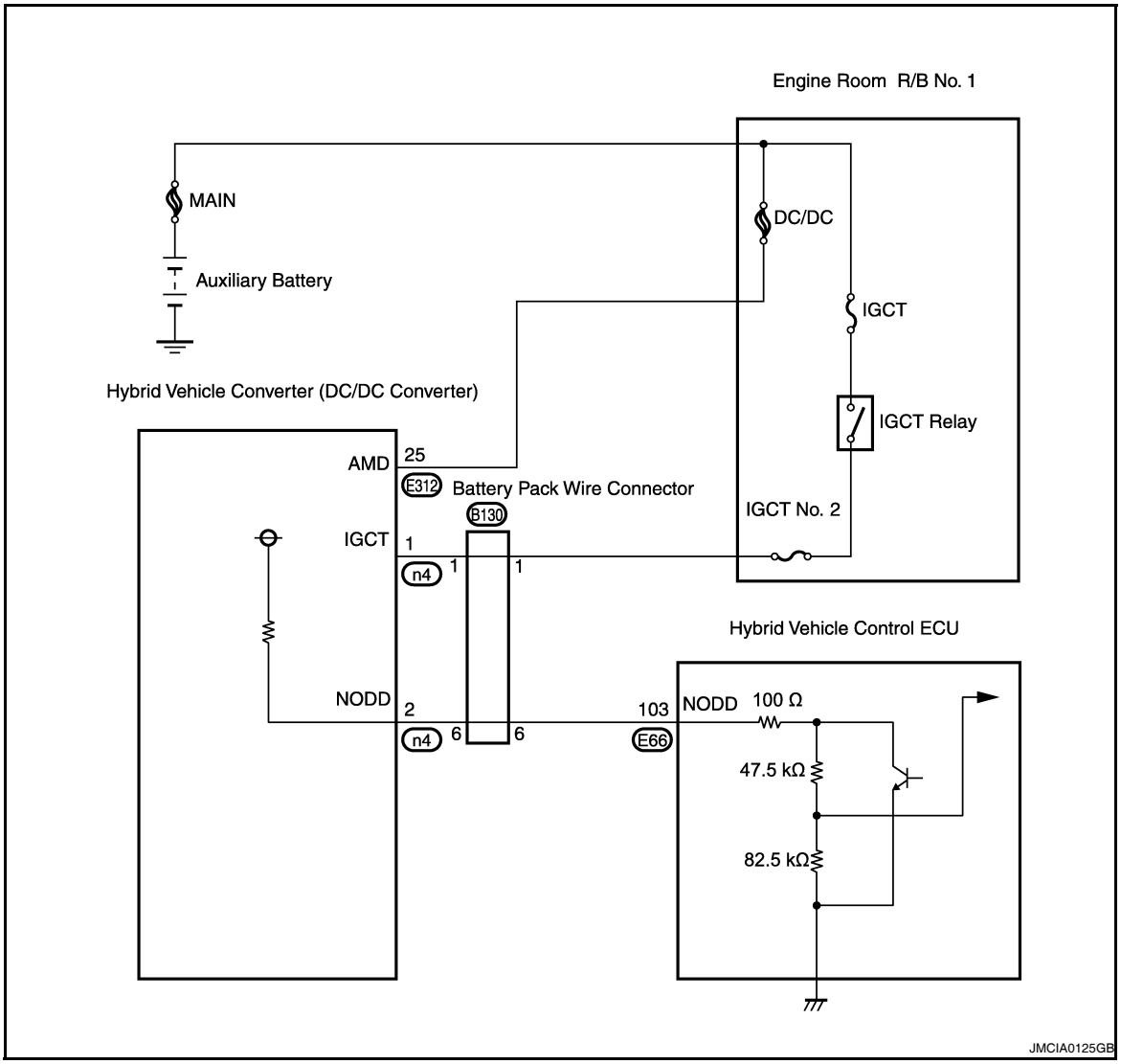
INFOID:0000000004212047

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
21
22
E308
E309
1
2
E313
CBI
CEI
CON2
3
B130
CON3
2
10
GND
PREC
OUT-
W2
V2
Hybrid Vehicle Converter
(DC/DC Converter)
W1
V1
PREC
System Main
Resistor
IN-
SMRP
8
Hybrid Vehicle Control ECU
169
SMRB
E66
175
SMRG
77
SMRP
: Power Cable
JMCIA0198GB



DTC Logic

INFOID:0000000004212048

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AA4	232	Hybrid Battery Negative Contactor Circuit Stuck Closed	System main relay G on the HV battery negative side is stuck closed.	• HV relay assembly • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212049

1.PRECONDITIONING

- 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. 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.
- If DTC P0AA4-232 is stored, the vehicle will not turn on.

>> GO TO 2.

2.CHECK DTC OUTPUT

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

DTC No.	Relevant Part
P0A1A-156, 658, 659, 151, 155, 200, 791, 792, 793	Generator Control Module
P0A1A-156, 658, 659, 151, P0A1B-511, 164, 163, 512, 193, 786, 788, 661, 192, 168, 794, 795, 796	Drive Motor "A" Control Module
P0A1F	Battery Energy Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A78-266, 267, 523, 586, 503, 504, 279, 282, 284, 505, 287, 506,286, 113, 306	Drive Motor "A" Inverter Performance
P0A7A-322, 517, 325, 518, 324, 122, 344	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-442	DC/DC Converter Performance
P0AE0-228	Hybrid Battery Negative Contactor Control Circuit High
P0AE2-161, 773	Hybrid Battery Precharge Contactor Circuit Stuck Closed
P3004-132	HV Battery Malfunction
P3105	Battery Observation Communication Circuit Malfunction

Is DTC detected?

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

3.CHECK FREEZE FRAME DATA

1. Turn ignition switch ON.
2. Read output DTCs.
3. Read the freeze frame data of P0AA4-232.

Result	Proceed to
IB BATTERY (Current value of HV battery) is less than 3 A.	A
IB BATTERY (Current value of HV battery) is 3 A or more.	B

A or B

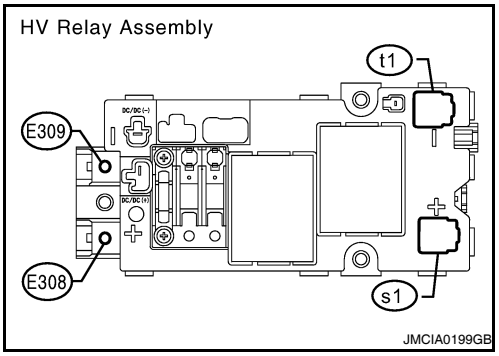
A >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
B >> GO TO 4.

4.CHECK HV RELAY ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.

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



HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E309	22	t1	1	10 kΩ or higher

NOTE:
- For the removal and installation procedures related to inspection of the HV relay assembly, (See HBB-105, "Removal and Installation").
- Leave the HV relay in the vehicle while testing to prevent the movement that occurs during removal from causing a stuck relay to return to normal.
- If the result of reading the freeze frame data is B, the HV relay assembly must be replaced. Measuring resistance can determine that this is either a present or past malfunction.

OK or NG

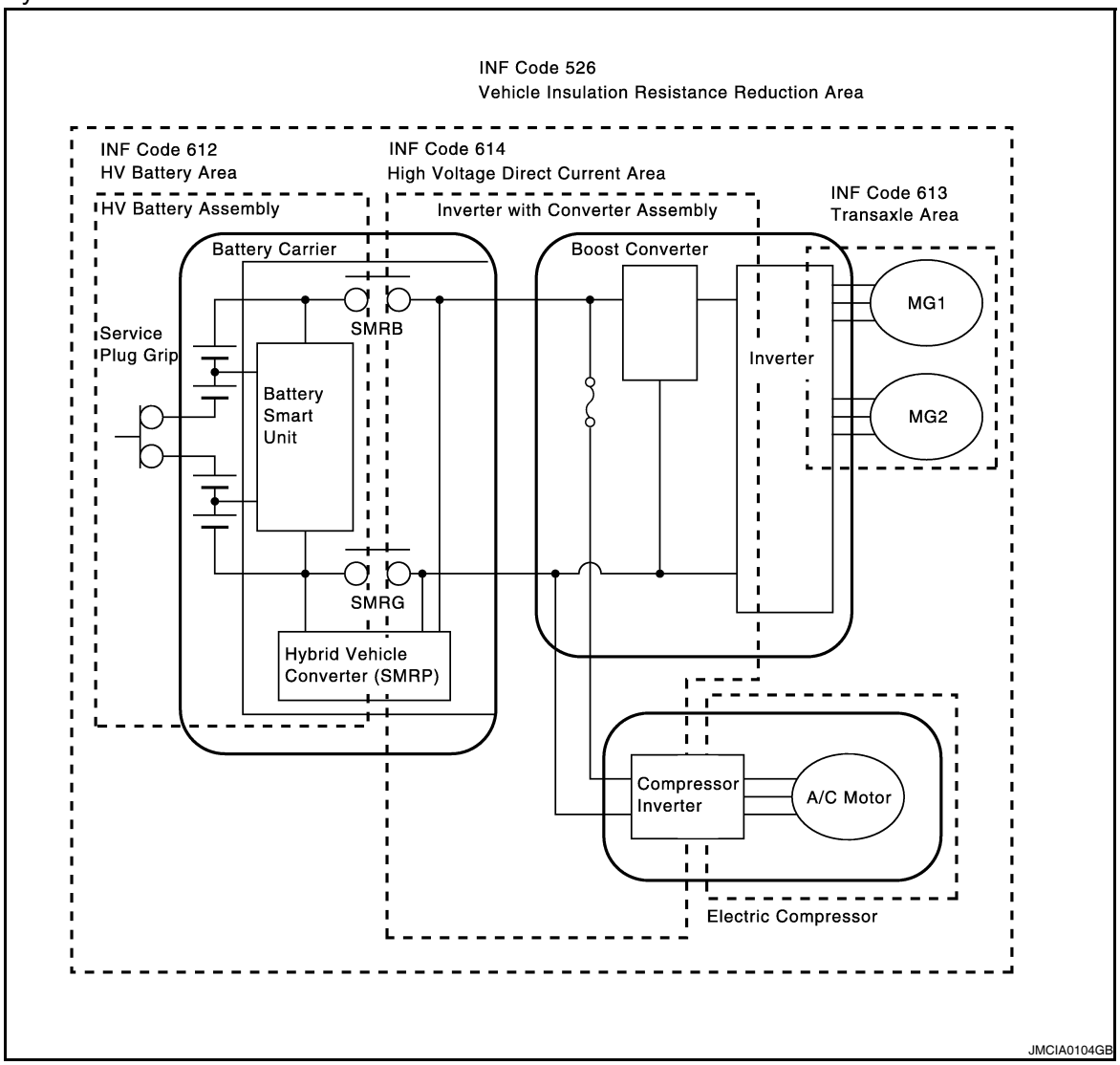
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

P0AA6-526, P0AA6-611, P0AA6-612, P0AA6-613, P0AA6-614

Description

INFOID:0000000004212050

The hybrid vehicle control ECU monitors the battery smart unit and detects insulation malfunctions in the high-voltage system.



DTC Logic

INFOID:0000000004212051

DTC DETECTION LOGIC

DTC No.	INF ode	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AA6	526 (*1)	Hybrid Battery Voltage System Isolation Fault	Insulation resistance between the high-voltage circuit and the body has decreased.	• Hybrid transaxle • Inverter with converter assembly • Frame wire • Air conditioning harness assembly • HV relay assembly • Compressor with motor assembly • HV battery • Battery smart unit • Hybrid vehicle converter (DC/DC converter)
P0AA6	611(*2)	Hybrid Battery Voltage System Isolation Fault	Insulation resistance of the compressor with motor assembly has decreased.	Compressor with motor assembly
P0AA6	612 (*2)	Hybrid Battery Voltage System Isolation Fault	Insulation resistance of the HV battery area is decreased.	• HV relay assembly • Battery smart unit • HV battery • Hybrid vehicle converter (DC/DC converter)
P0AA6	613 (*2)	Hybrid Battery Voltage System Isolation Fault	Insulation resistance of the hybrid transaxle area is decreased.	• Hybrid transaxle • Inverter with converter assembly
P0AA6	614(*2)	Hybrid Battery Voltage System Isolation Fault	Insulation resistance of the high-voltage DC area has decreased.	• Inverter with converter assembly • Floor wire • Compressor with motor assembly • Air conditioning harness assembly • HV relay assembly • Hybrid vehicle converter (DC/DC converter)

NOTE:
- *1: INF code 526 is stored together with P0AA6.
- *2: On a trip after INF code 526 is stored, these INF codes are stored if the malfunctioning area is determined.
- If P0AA6 is output, the vehicle cannot start until the DTC is cleared using CONSULT-III.
- If P0AA6 is output while driving, the vehicle can drive for the remainder of that trip.

Diagnosis Procedure

INFOID:0000000004212052

1.PRECONDITIONING

- When troubleshooting P0AA6, be sure to wrap the tools with insulating tape. (It will be very dangerous if high voltage is shorted to ground through the tools.)
- Turn ignition switch OFF 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 DTC OUTPUT (HYBRID SYSTEM)

1. Turn ignition switch ON.
2. Check DTC.
   NOTE:
   Do not remove the service plug grip.

Output DTC	Proceed to
Only P0AA6 is output.	A
P0AA6 and P0A1D (Hybrid vehicle control ECU malfunction) are output.	B
P0AA6 and P0AA7-727 (Malfunction in the battery smart unit) are output.	C
P0AA6 and P0A1F (Battery smart unit malfunction) are output.	D

A, B, C or D

A >> GO TO 3.
B >> Go to Diagnosis Procedure relevant to output DTC (P0A1D).
C >> Go to Diagnosis Procedure relevant to output DTC (P0AA7-727).
D >> Replace battery smart unit (See HBB-101, "Removal and Installation").

3.CHECK INFO CODE

1. Turn ignition switch ON.
2. Check DTC.
3. Access the freeze frame data of DTC P0AA6 and read the INF code.
   NOTE:
   INF codes 611, 612, 613, and 614 are not stored at the same time with 526. If INF code 526 only is output, turn ignition switch OFF and wait 30 seconds to determine the malfunctioning area. Then, read the INF code again.

Output INF	Proceed to
526 (decrease in the insulation resistance of the high-voltage circuit) only is output.	A
526 and 611 (decrease in the insulation resistance of the air conditioner area) are output.	B
526 and 612 (decrease in the insulation resistance of the HV battery area) are output.	C
526 and 613 (decrease in the insulation resistance of the hybrid transaxle area) are output.	D
526 and 614 (decrease in the insulation resistance of the high-voltage DC area) are output.	E

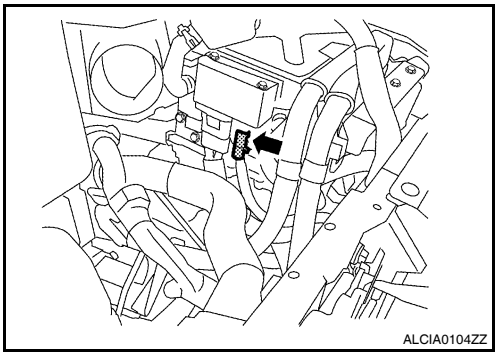
A, B, C or D

A >> GO TO 4.
B >> Go to air conditioning system.
C >> GO TO 10.
D >> GO TO 18.
E >> GO TO 13.

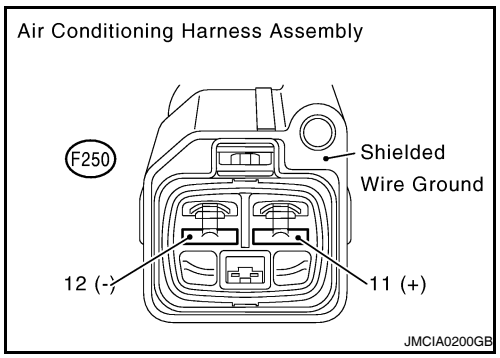
4.CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the repair manual because this may cause a malfunction.
2. Disconnect the air conditioning harness assembly from the inverter with converter assembly.



3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.



Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal		
F250	12 (–)	Ground	3 MΩ or higher
	11 (+)		

Air Conditioning Harness Assembly		shielded wire ground	Resistance
Harness connector	Terminal		
F250	12 (–)	shielded wire ground	3 MΩ or higher
	11 (+)		

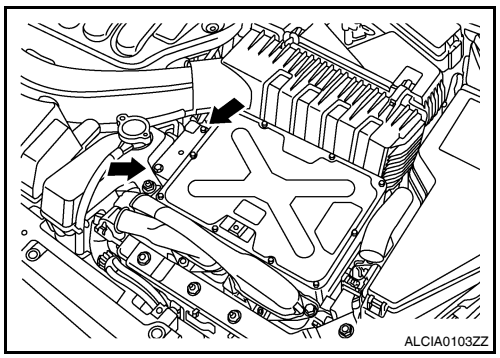
OK or NG

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

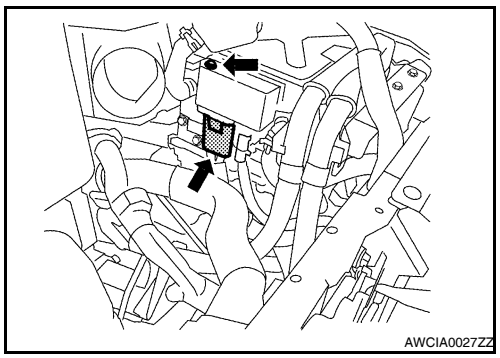
5. CHECK INVERTER WITH CONVERTER ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

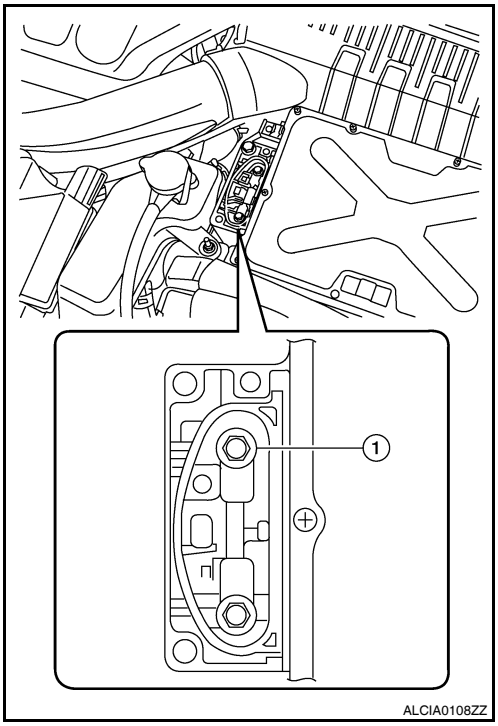
1. Check that the service plug grip is not installed.
2. Remove the compressor fuse cover from the inverter with converter assembly (See HBC-638, "Removal and Installation").



3. Disconnect the frame wire from the inverter with converter assembly (See HBC-648, "Removal and Installation").



4. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
NOTE:
- **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**
- Perform this inspection with the air conditioning harness assembly disconnected from the inverter with converter assembly.



Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
Compressor fuse	-	Ground	1.0 MΩ or higher

- A/C fuse (1)

OK or NG

OK >> GO TO 9.
NG >> GO TO 6.

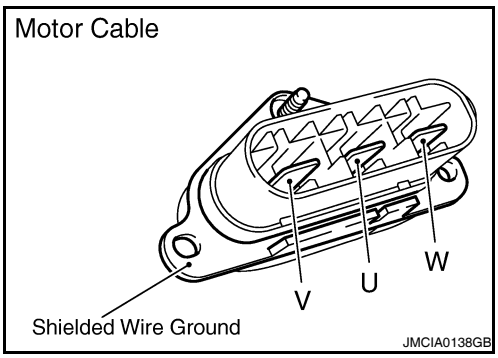
6. INSPECT HYBRID TRANSAXLE (MG2)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
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.
2. Disconnect the motor cable and generator cable from the inverter with converter assembly (See HBC-638, "Removal and Installation").
3. Check the connectors connection.

Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

4. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
NOTE:
- **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**



Motor Cable		Ground	Resistance
Harness connector	Terminal		
—	U	Ground	20 MΩ or higher
	V		
	W		

Motor Cable		Shielded wire ground	Resistance
Harness connector	Terminal		
—	U	Shielded wire ground	20 MΩ or higher
	V		
	W		

OK or NG

OK >> GO TO 7.
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

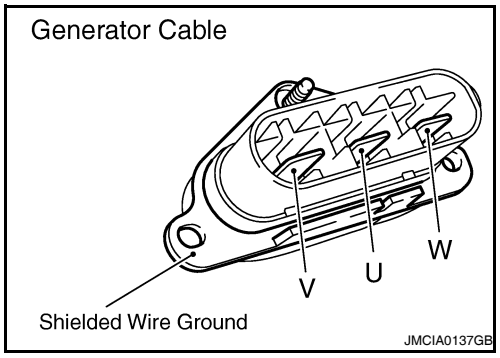
7. INSPECT HYBRID TRANSAXLE (MG1)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check the connectors connection.

Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
   NOTE:
   - **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**



Generator Cable		Ground	Resistance
Harness connector	Terminal		
—	U	Ground	20 MΩ or higher
	V		
	W		

Generator Cable		Shielded wire ground	Resistance
Harness connector	Terminal		
—	U	Shielded wire ground	20 MΩ or higher
	V		
	W		

OK or NG

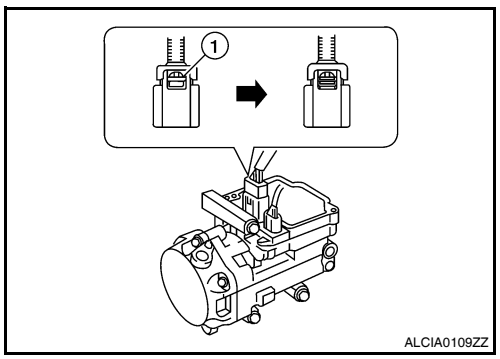
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

8. CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

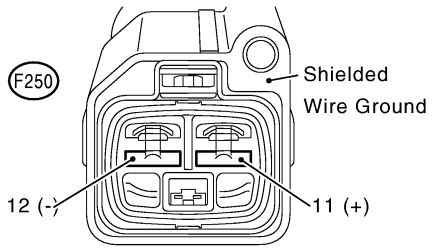
1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.
2. Disconnect the air conditioning harness assembly from the electric compressor.

- Green lock (1)



3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.

Air Conditioning Harness Assembly



JMCIA0200GB

Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal		
F250	12 (–)	Ground	3 MΩ or higher
	11 (+)		

Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal		
F250	12 (–)	Shielded wire ground	3 MΩ or higher
	11 (+)		

OK or NG

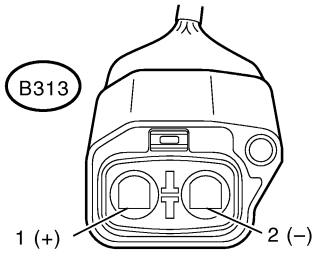
OK >> Go to air conditioning system.
NG >> Replace air conditioning harness assembly.

9. CHECK FRAME WIRE

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the frame wire from the HV relay assembly (See -HBB-105, "Removal and Installation").
3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.

Frame Wire (Inverter with converter assembly side)



JMCIA0195GB

Battery smart unit		Ground	Resistance
Harness connector	Terminal		
E308	21 (+)	Ground	10 MΩ or higher
E309	22 (–)		

Battery smart unit		Ground	Resistance
Harness connector	Terminal		
E308	21 (+)	Shielded wire ground	10 MΩ or higher
E309	22 (–)		

OK or NG

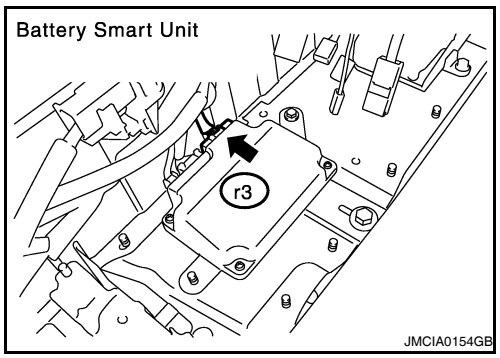
OK >> GO TO10.
NG >> Replace frame wire.

10. CHECK HV BATTERY AREA

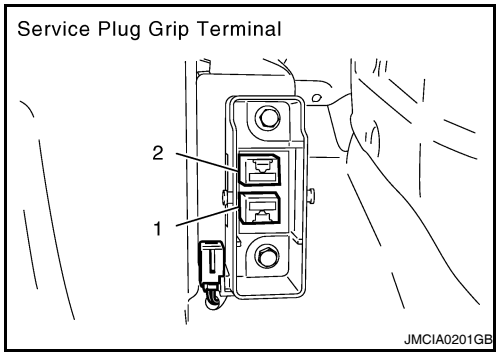
CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.

2. Disconnect the r3 battery smart unit connector.



3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
NOTE:
- **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**



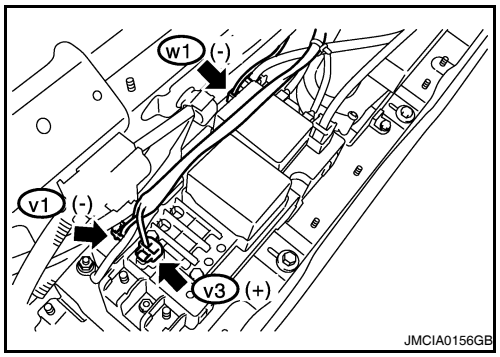
Service plug grip		Ground	Resistance
Component connector	Terminal		
–	1	Ground	10 MΩ or higher
	2		

OK or NG

OK >> Replace battery smart unit (See HBB-101, "Removal and Installation")
NG >> GO TO 11.

11. CHECK HYBRID VEHICLE CONVERTER

CAUTION:
Be sure to wear insulated gloves.
1. Check that the service plug grip is not installed.
2. Disconnect the w1, v1 and v3 hybrid vehicle converter (DC/DC converter) connectors from the HV relay assembly (See HBB-103, "Removal and Installation"). Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.



Component connector	Terminal	Ground	Resistance
w1	1 (High voltage precharge)	Ground	10 MΩ or higher
v3	1 (High voltage +)		
v1	1 (High voltage –)		

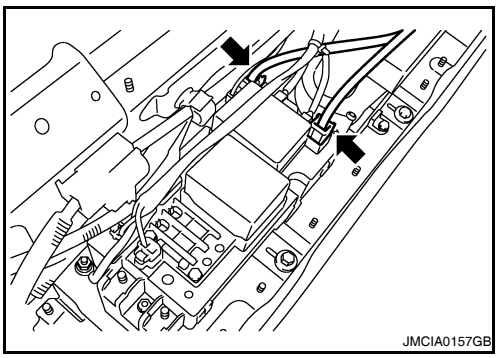
OK or NG

OK >> GO TO 12.
NG >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").

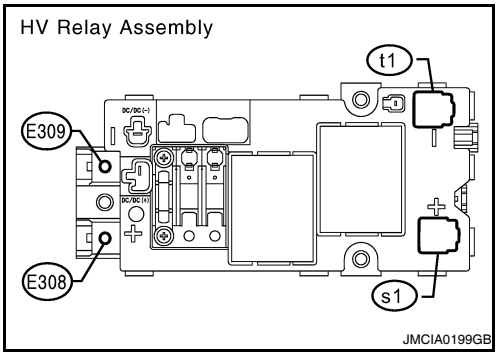
12. CHECK HV RELAY ASSEMBLY

CAUTION:
Be sure to wear insulated gloves and protective goggles.
1. Check that the service plug grip is not installed.
2. Check that the high-voltage connectors (v1, v3 and w1) of the hybrid vehicle converter (DC/DC converter) are connected securely.

3. Disconnect the high voltage connectors of the HV battery from the HV relay assembly (See HBB-105, "Removal and Installation").



4. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.



HV Relay Assembly		Ground	Resistance
Component connector	Terminal		
E308	1 (High voltage +)	Ground	10 MΩ or higher
E309	1 (High voltage –)		
t1	1 (High voltage –)		
s1	1 (High voltage +)		

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

HV Relay Assembly		Ground	Voltage
Component connector	Terminal		
E308	21 (High voltage +)	Ground	Below 1 V
E309	22 (High voltage –)		

NOTE:
The voltage decreases to below 1 V after 10 seconds. If the voltage is 1 V or higher, recheck the voltage after 10 seconds.

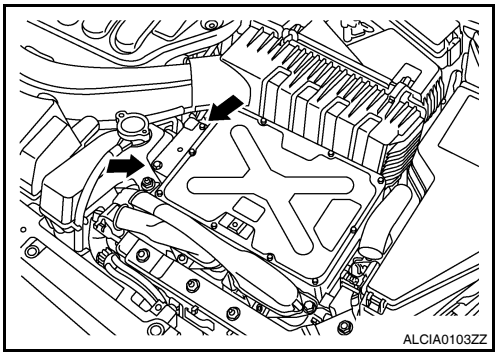
OK or NG

OK >> Replace HV battery (See HBB-97, "Removal and Installation").
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

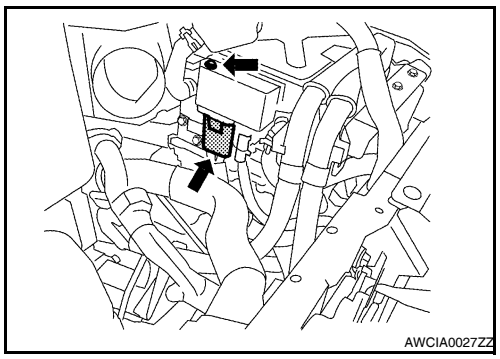
13. CHECK HIGH VOLTAGE DIRECT CURRENT AREA

CAUTION:
Be sure to wear insulated gloves.

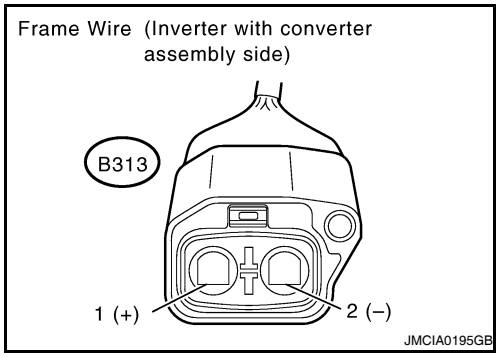
1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTE:
   After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.
2. Remove the compressor fuse cover from the inverter with converter assembly (See HBC-638, "Removal and Installation").



3. Disconnect the frame wire from the inverter with converter assembly.



4. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
NOTE:
- **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**



HV Relay Assembly		Ground	Resistance
Harness connector	Terminal		
E313	1 (High voltage +)	Ground	10 MΩ or higher
	2 (High voltage –)		

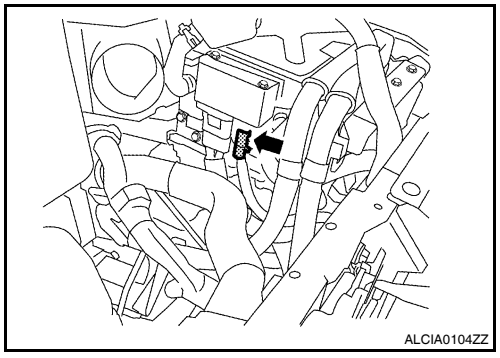
OK or NG

OK >> GO TO 14.
NG >> GO TO 16.

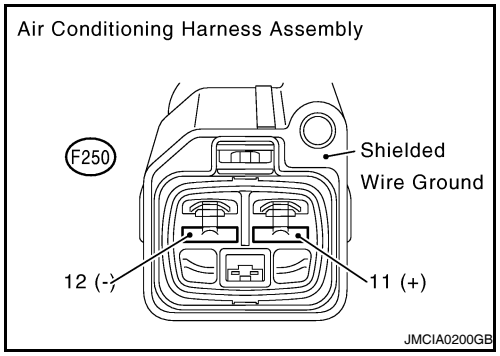
14. CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the air conditioning harness assembly from the inverter with converter assembly (See HBC-638, "Removal and Installation").



3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.



Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal		
F250	12 (–)	Ground	3 MΩ or higher
	11 (+)		

OK or NG

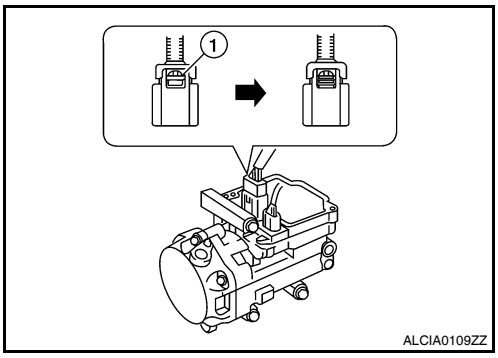
OK >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation")
NG >> GO TO 15.

15. CHECK AIR CONDITIONING HARNESS ASSEMBLY

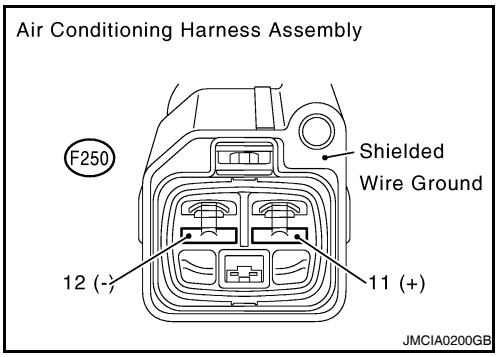
CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the air conditioning harness assembly from the electric compressor.

- Green lock (1)



3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
   NOTE:
   - **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**



Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal		
F250	12 (–)	Ground	10 MΩ or higher
	11 (+)		

Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal		
F250	12 (–)	Shielded wire ground	10MΩ or higher
	11 (+)		

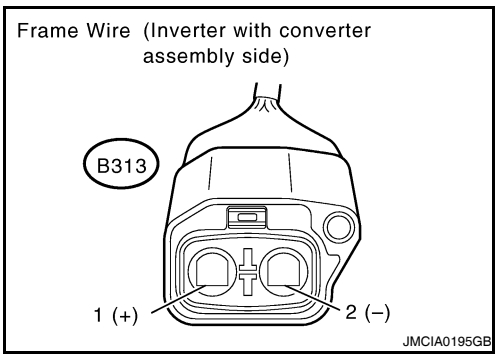
OK or NG

OK >> Go to air conditioning system.
NG >> Replace air conditioning harness assembly.

16. CHECK FRAME WIRE

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the frame wire from the HV relay assembly (See HBB-105, "Removal and Installation").
3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
   NOTE:
   - **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**



Frame Wire (HV Relay Side)		Ground	Resistance
Harness connector	Terminal		
E308	1 (+)	Ground	10 MΩ or higher
E309	1 (–)		

Frame Wire (HV Relay Side)		Ground	Resistance
Harness connector	Terminal		
E308	1 (+)	Shielded wire ground	10MΩ or higher
E309	1 (–)		

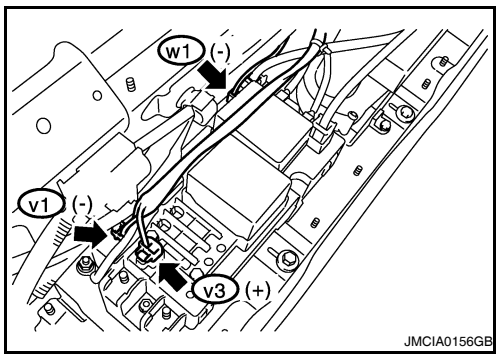
OK or NG

OK >> GO TO 17.
NG >> Replace frame wire.

17. CHECK HYBRID VEHICLE CONVERTER

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the w1, v1 and v3 hybrid vehicle converter (DC/DC converter) connectors from the HV relay assembly (See HBB-105, "Removal and Installation"). Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
   NOTE:
   - **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**



Frame Wire (HV Relay Side)		Ground	Resistance
Harness connector	Terminal		
w1	1 (High voltage precharge)	Ground	10 MΩ or higher
v3	1 (High voltage +)		
v1	1 (High voltage –)		

3. Connect the hybrid vehicle converter (DC/DC converter) connectors.

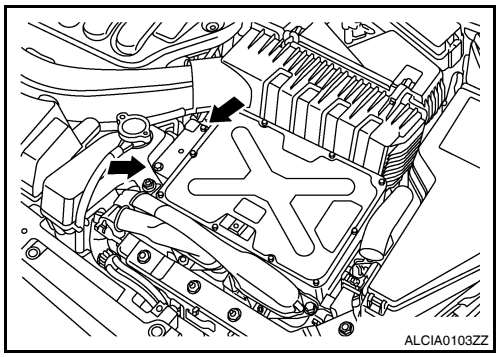
OK or NG

OK >> Replace HV relay assembly (See HBB-105, "Removal and Installation")
NG >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").

18. CHECK HYBRID TRANSAXLE AREA

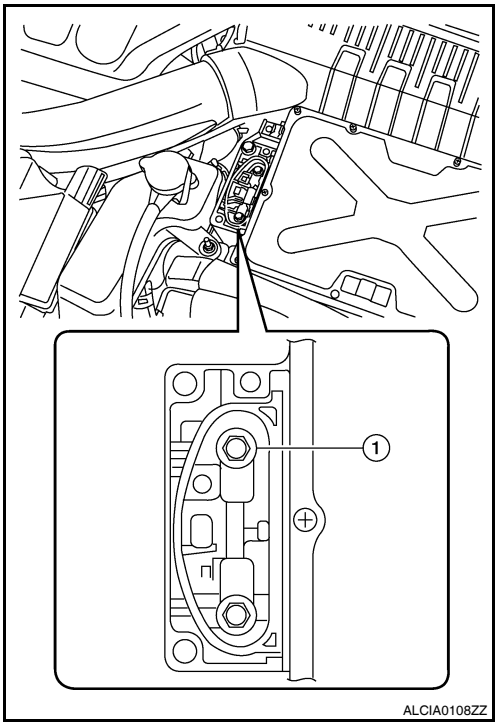
CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Remove the compressor fuse cover from the inverter with converter assembly (See HBC-638, "Removal and Installation").
3. Disconnect the generator cable and motor cable from the inverter with converter assembly.



4. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
   NOTE:
   - **Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.**

Inverter with converter assembly		Ground	Resistance
Component connector	Terminal		
Compressor fuse	–	Ground	1.0 MΩ or higher



- A/C fuse (1)

OK or NG

OK >> Replace hybrid transaxle (See TM-36, "Removal and Installation").

NG >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

P0AA7-727

Description

INFOID:0000000004212053

The hybrid vehicle control ECU monitors the insulation monitoring circuit located in the battery smart unit and detects a malfunction.

DTC Logic

INFOID:0000000004212054

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AA7	727	Hybrid Battery Voltage Isolation Sensor Circuit	Malfunction in the insulation monitoring circuit located in the battery smart unit	Battery smart unit

Diagnosis Procedure

INFOID:0000000004212055

1.PRECONDITIONING

- 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. 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.REPLACE BATTERY SMART UNIT

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

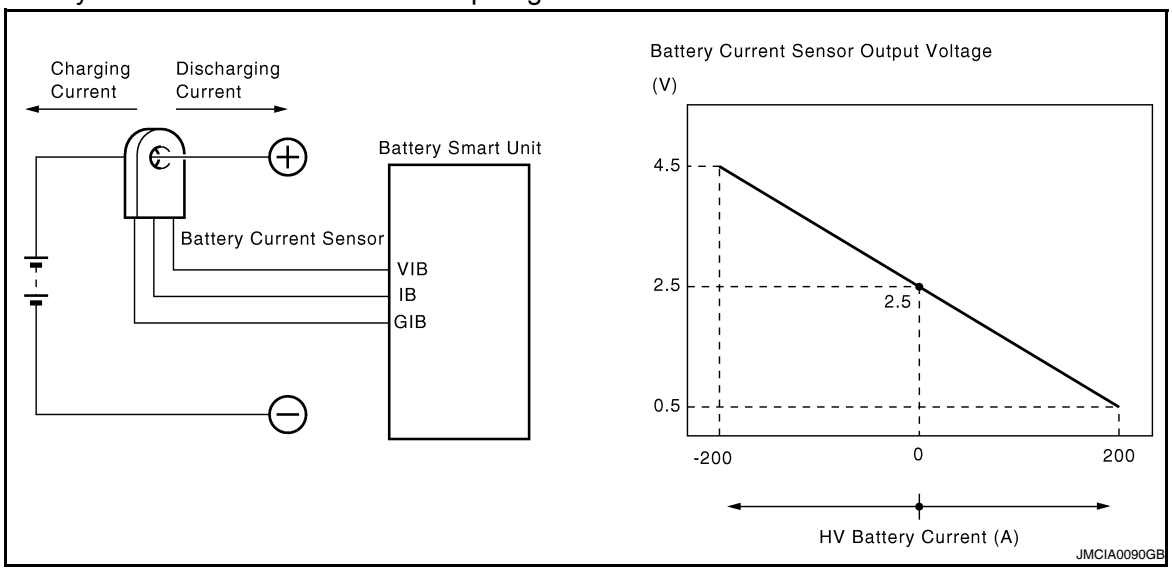
>> COMPLETED

P0AC0-817

Description

INFOID:0000000004212056

The battery current sensor, which is located in the HV battery junction block on the positive 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 assembly 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:0000000004212057

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AC0	817	Hybrid battery pack current sensor circuit range/performance	HV battery current sensor performance problem	• HV relay assembly • Battery smart unit

Diagnosis Procedure

INFOID:0000000004212058

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Result	Proceed to
P0AC0-817 only is output.	A
P0A1F-123 is also output.	B

A or B

A >> GO TO 3.
B >> Go to Diagnosis Procedure relevant to output DTC.

3.REPLACE HV RELAY ASSEMBLY

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

>> GO TO 4.

4.CLEAR DTC

1. Turn ignition switch ON.
2. Read and record the DTCs and freeze frame data.
3. Clear DTC.

>> GO TO 5.

5.SIMULATION TEST

1. Turn ignition switch ON (READY).
2. Drive the vehicle under the similar conditions to freeze frame data.

>> GO TO 6.

6.CHECK DTC OUTPUT (HYBRID SYSTEM)

1. Stop vehicle.
2. Check DTC again.

Result	Proceed to
P0AC0-817 is not output.	A
P0AC0-817 is output again.	B

A or B

A >> INSPECTION END
B >> Replace battery smart unit (See HBB-101, "Removal and Installation").

P0ADB-227, P0ADC-226

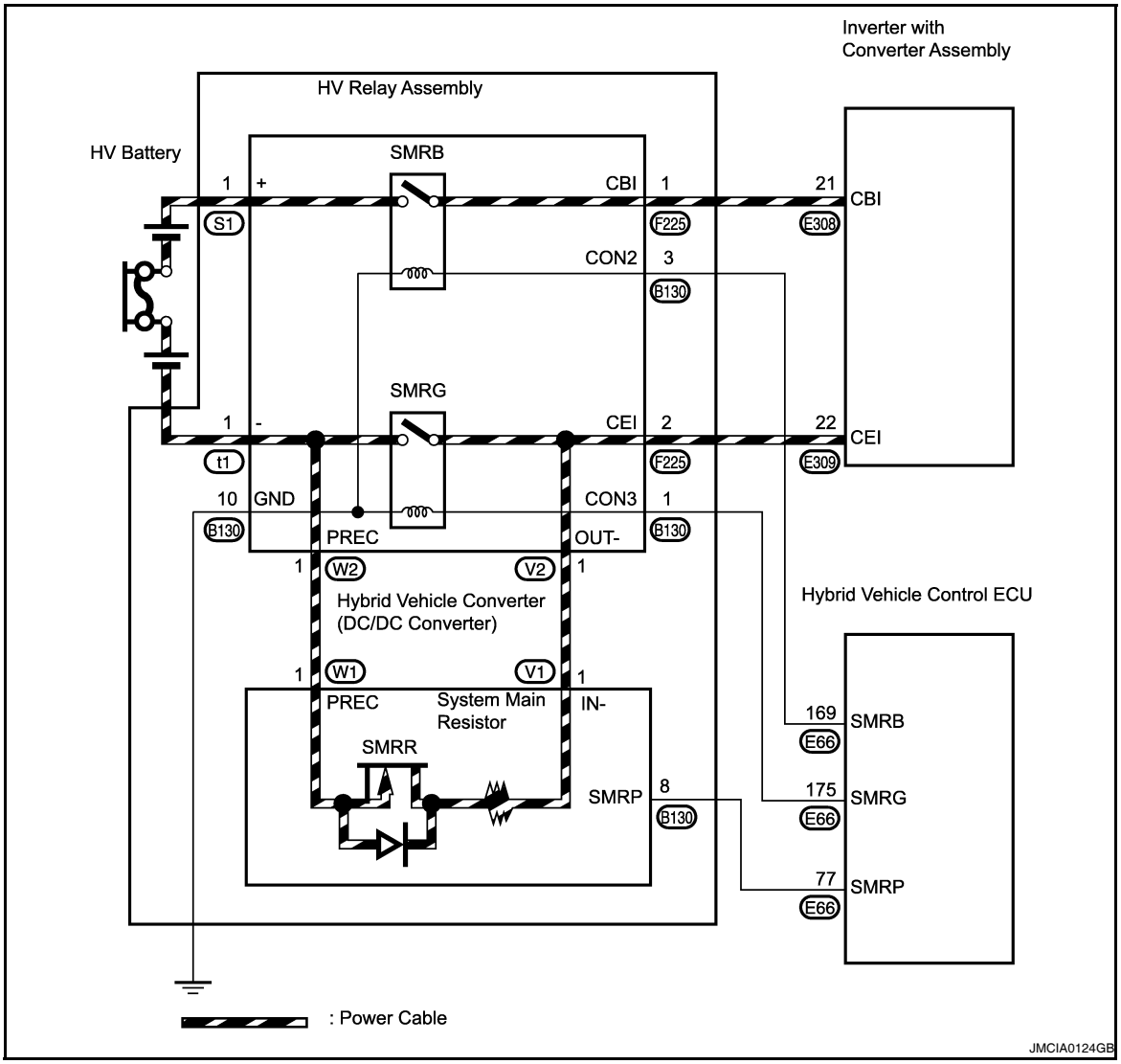
Description

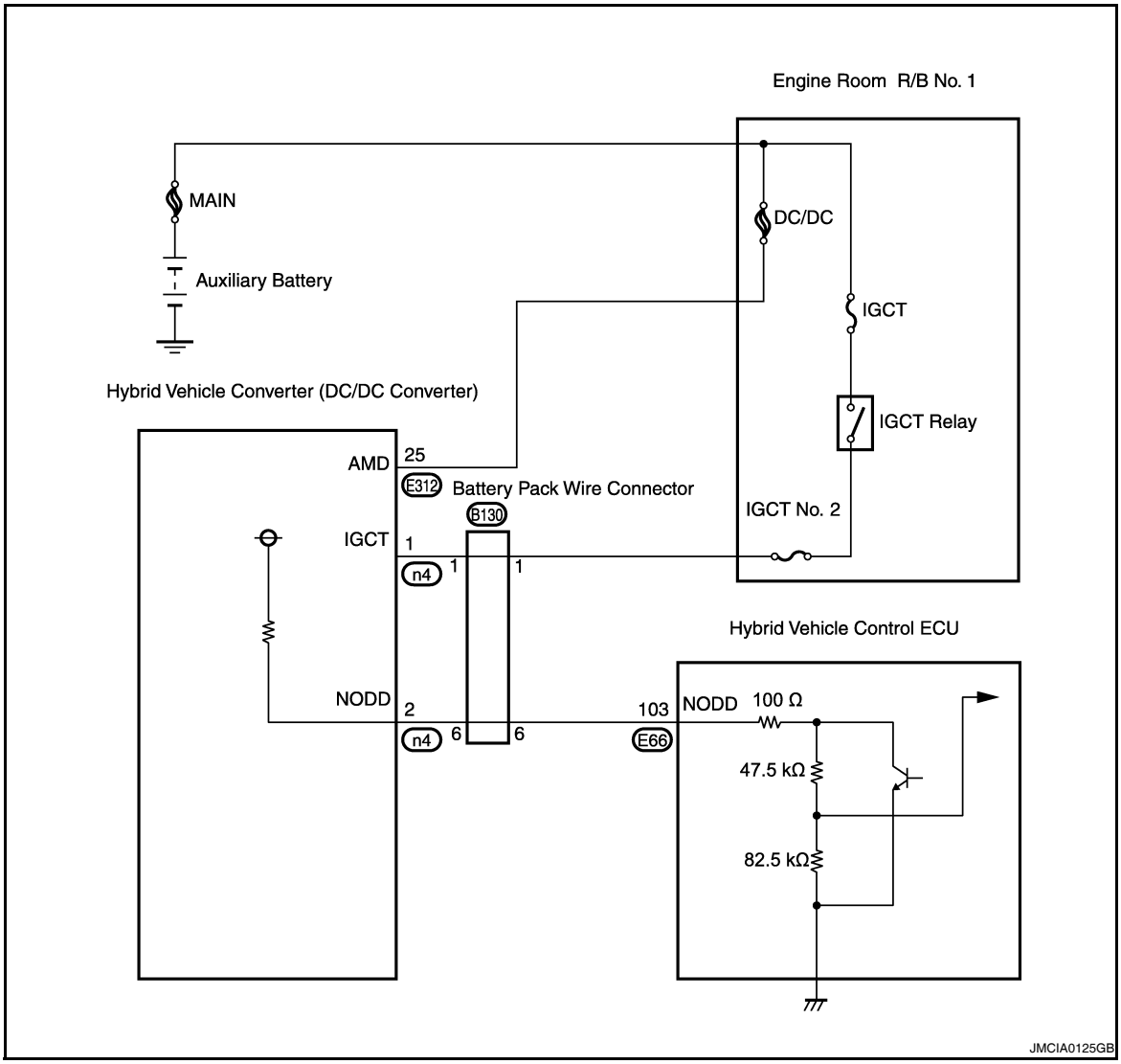
INFOID:0000000004212059

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
CON2
CON3
GND
PREC
OUT-
IN-
F225
B130
E308
E309
21
22
CBI
CEI
3
2
10
Hybrid Vehicle Converter
(DC/DC Converter)
W1
W2
V1
V2
System Main
Resistor
SMRR
SMRP
8
Hybrid Vehicle Control ECU
169
175
77
SMRB
SMRG
SMRP
E66
: Power Cable
JMCIA0124GB



DTC Logic

INFOID:0000000004212060

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0ADB	227	Hybrid Battery Positive Contactor Control Circuit Low	Short to GND in the SMRB circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU
P0ADC	226	Hybrid Battery Positive Contactor Control Circuit High	Open or short to +B in the SMRB circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004212061

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK >> GO TO 3.
NG >> Connect securely.

3. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

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

4. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

1. Turn ignition switch OFF.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Disconnect the B130 battery pack wire connector.
4. Turn ignition switch ON.
5. Measure the voltage according to the value(s) in the table below.

Hybrid Vehicle Control ECU		Ground	Voltage
Harness connector	Terminal		
E66	169 (SMRB)	Ground	Below 1 V

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

6. Turn ignition switch OFF.
7. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid Vehicle Control ECU		Battery Pack wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	169 (SMRB)	B130	3 (CON2)	Below 1 Ω

Check for short

Hybrid Vehicle Control ECU		Ground	Resistance
Harness connector	Terminal		
E66	169 (SMRB)	Ground	10 kΩ or higher

Battery Pack wire		Ground	Resistance
Harness connector	Terminal		
B130	3 (CON2)	Ground	10 kΩ or higher

OK or NG

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

5. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY CONNECTOR)

See HBC-450, "Diagnosis Procedure".

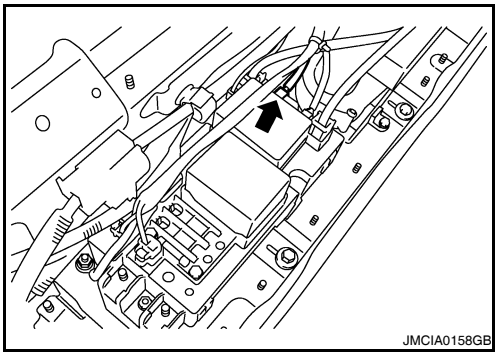
OK >> GO TO 6.

NG >> Connect securely.

6. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HV RELAY ASSEMBLY)

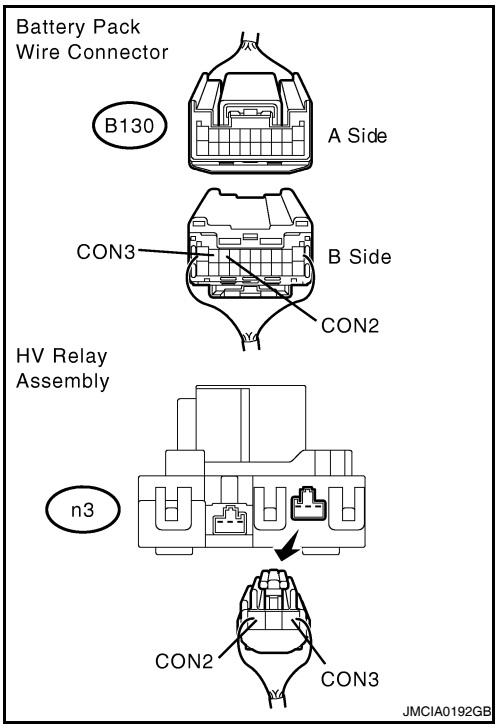
CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
2. Disconnect the n3 HV relay assembly connector (See HBB-105, "Removal and Installation").
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.
   NOTE:
   Turn ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.



Battery Pack Wire Connector		Ground	Voltage
Harness connector	Terminal		
B130	3 (CON2)	Ground	Below 1 V

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below



Check for open

Battery Pack Wire Connector		HV Relay Assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
B130	3 (CON2)	n3	3 (CON2)	Below 1 Ω

Check for short

Battery Pack Wire Connector		Ground	Resistance
Harness connector	Terminal		
B130	3 (CON2)	Ground	10 kΩ or higher

HV Relay Assembly		Ground	Resistance
Harness connector	Terminal		
n3	3 (CON2)	Ground	10 kΩ or higher

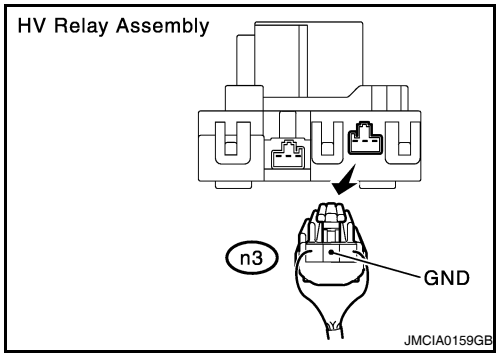
OK or NG

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

7. CHECK HARNESS AND CONNECTOR

CAUTION:
Be sure to wear insulated gloves.

1. Connect the battery pack wire connector.
2. Measure the resistance according to the value(s) in the table below.



HV Relay Assembly		Ground	Resistance
Harness connector	Terminal		
n3	2 (GND)	Ground	Below 1 Ω

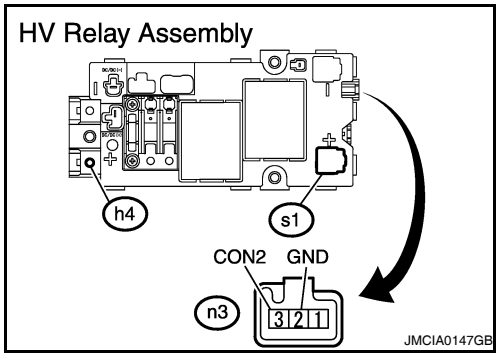
OK or NG

OK >> GO TO 8.
NG >> Repair or replace harness or connector.

8. INSPECT HV RELAY ASSEMBLY (SMRB)

CAUTION:
Be sure to wear insulated gloves and protective goggles.

1. Check that the service plug grip is not installed.
2. Remove the HV relay assembly from the vehicle (See HBB-105, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
h4	1	s1	1	Below 1 Ω [When battery voltage (12 V) applied to terminals n3-2 and n3-3]
				10 kΩ or higher

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

HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
n3	3 (CON2)	n3	2 (GND)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176° F)

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

P0ADF-229, P0AE0-228

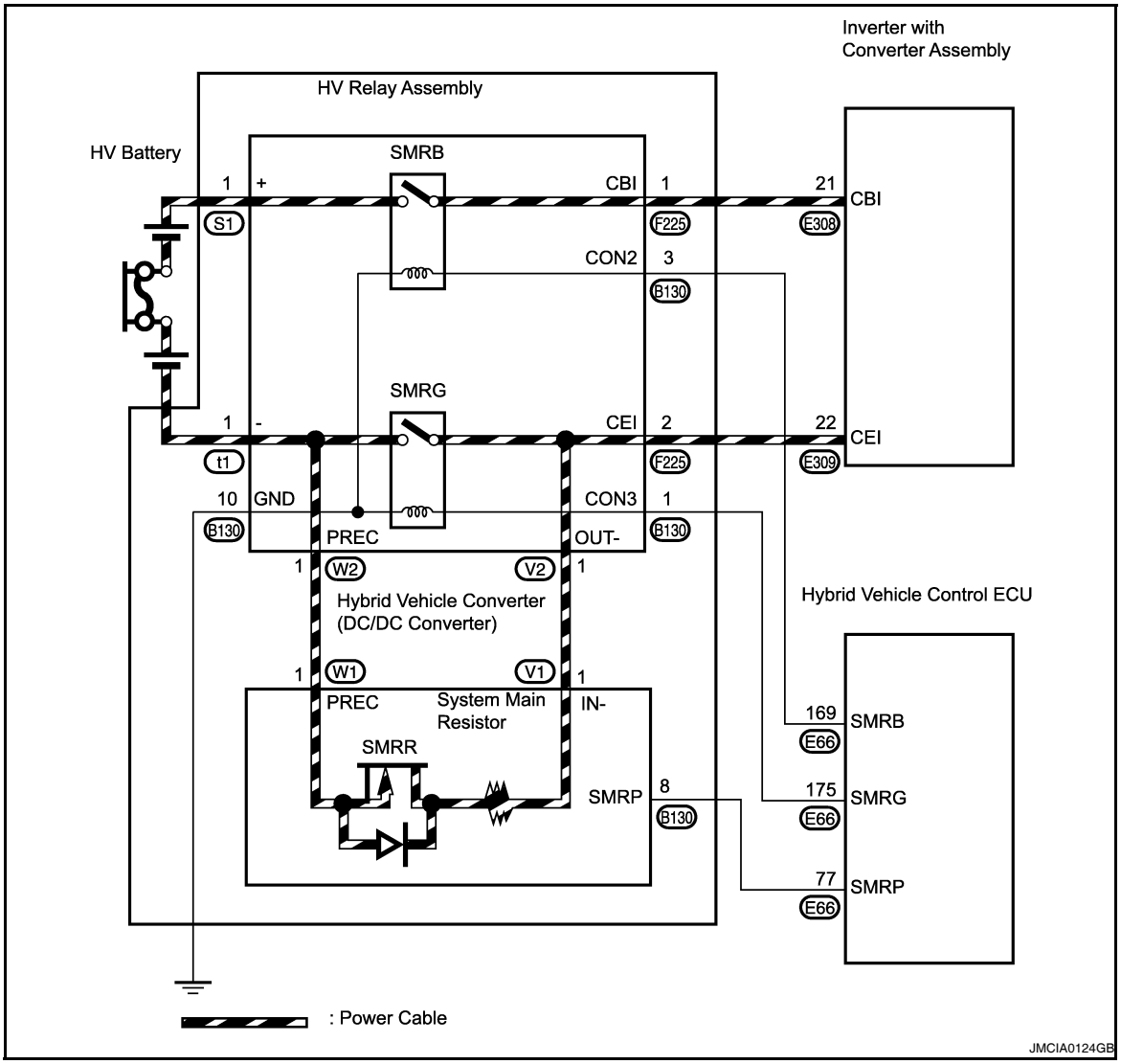
Description

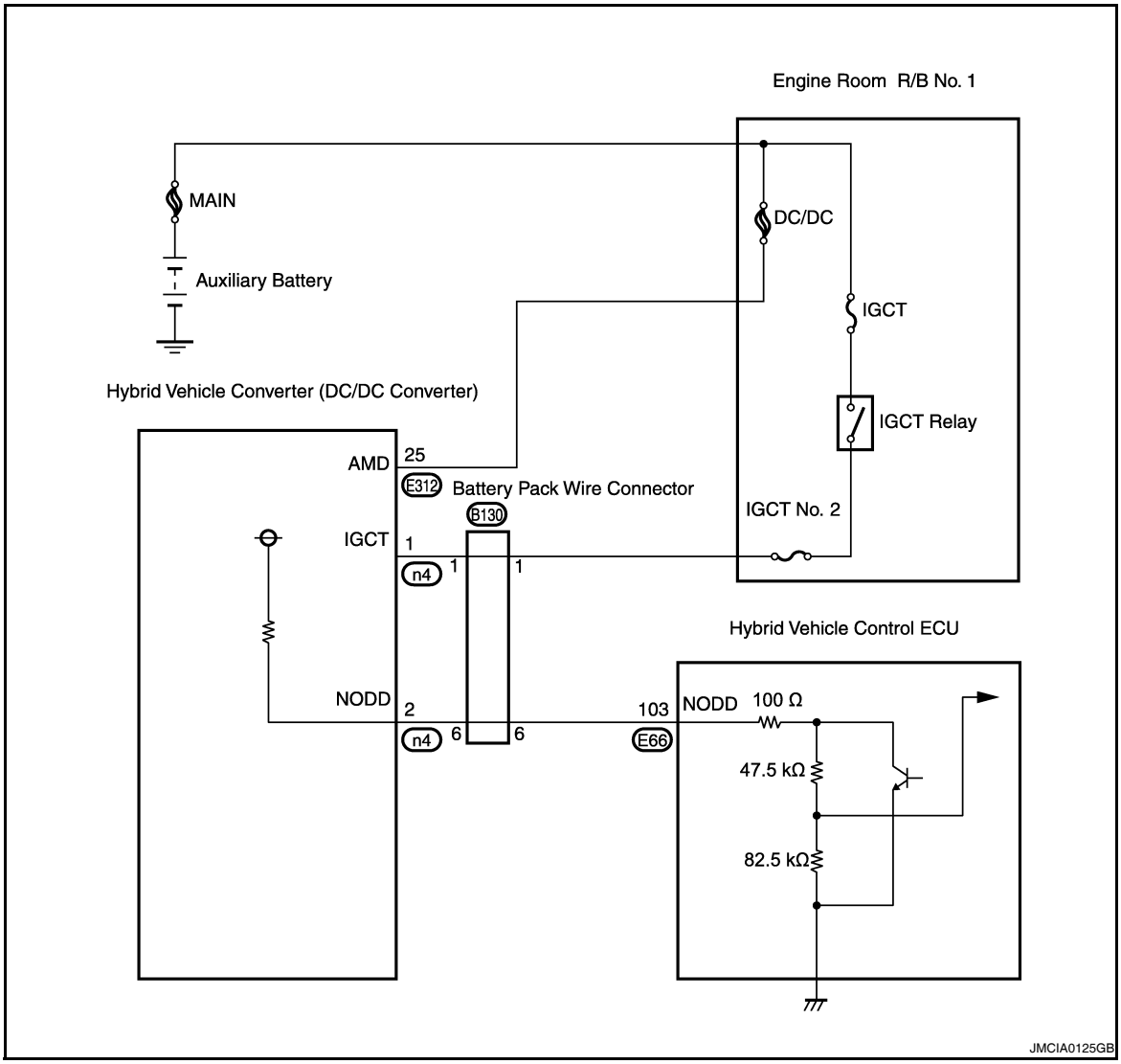
INFOID:0000000004212062

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
CON2
CON3
GND
PREC
OUT-
IN-
SMRR
SMRP
System Main
Resistor
F225
B130
E308
E309
21
22
10
2
3
W2
V2
W1
V1
Hybrid Vehicle Converter
(DC/DC Converter)
Hybrid Vehicle Control ECU
169
175
77
E66
8
: Power Cable
JMCIA0124GB



DTC Logic

INFOID:0000000004212063

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0ADF	229	Hybrid Battery Negative Contactor Control Circuit Low	Short to GND in the SMRG circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU
P0AE0	228	Hybrid Battery Negative Contactor Control Circuit High	Open or short to +B in the SMRG circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004212064

1.PRECONDITIONING

- 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. 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 CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK >> GO TO 3.
NG >> Connect securely.

3. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

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

4. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

1. Turn ignition switch OFF.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Disconnect the B130 battery pack wire connector.
4. Turn ignition switch ON.
5. Measure the voltage according to the value(s) in the table below.

Hybrid Vehicle Control ECU		Ground	Voltage
Harness connector	Terminal		
E66	175 (SMRG)	Ground	Below 1 V

NOTE:
Turning ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

6. Turn ignition switch OFF.
7. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid Vehicle Control ECU		Battery Pack wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	175 (SMRG)	B130	2 (CON3)	Below 1 Ω

Check for short

Hybrid Vehicle Control ECU		Ground	Resistance
Harness connector	Terminal		
E66	175 (SMRG)	Ground	10 kΩ or higher

Battery Pack wire		Ground	Resistance
Harness connector	Terminal		
B130	2 (CON3)	Ground	10 kΩ or higher

OK or NG

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

5. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY CONNECTOR)

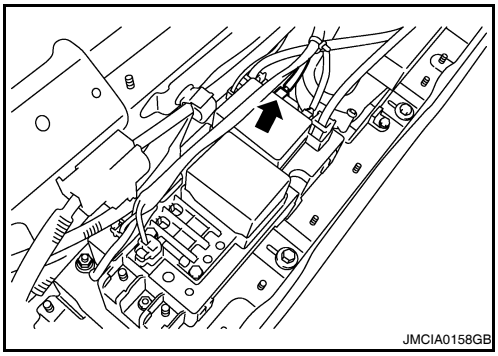
See HBC-450, "Diagnosis Procedure".

OK >> GO TO 6.
NG >> Connect securely.

6. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HV RELAY ASSEMBLY)

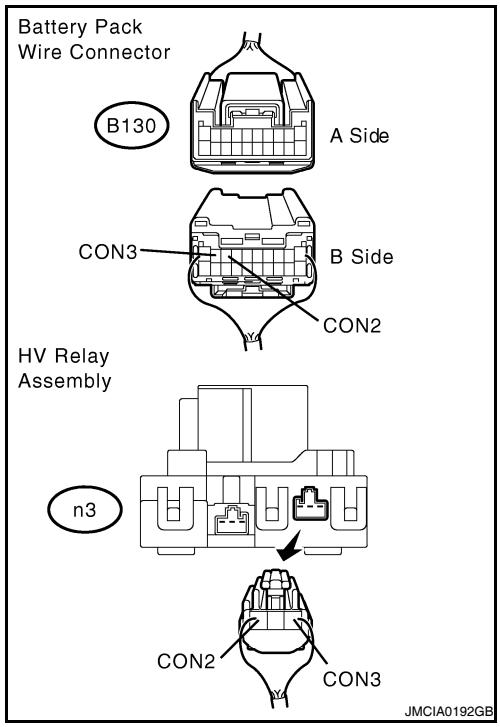
CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
2. Disconnect the n3 HV relay assembly connector (See HBB-105, "Removal and Installation").
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.
   NOTE:
   Turn ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.



Battery Pack Wire Connector		Ground	Voltage
Harness connector	Terminal		
B130	2 (CON3)	Ground	Below 1 V

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below



Check for open

Battery Pack Wire Connector		HV Relay Assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
B130	2 (CON3)	n3	1 (CON3)	Below 1 Ω

Check for short

Battery Pack Wire Connector		Ground	Resistance
Harness connector	Terminal		
B130	2 (CON3)	Ground	10 kΩ or higher

HV Relay Assembly		Ground	Resistance
Harness connector	Terminal		
n3	1 (CON3)	Ground	10 kΩ or higher

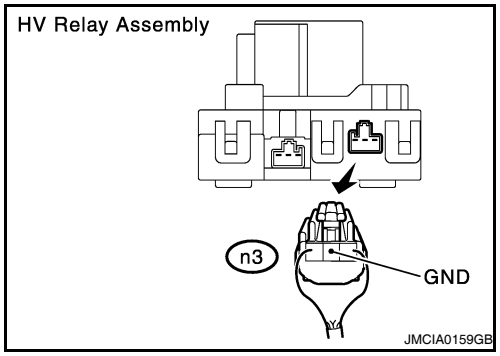
OK or NG

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

7. CHECK HARNESS AND CONNECTOR

CAUTION:
Be sure to wear insulated gloves.

1. Connect the battery pack wire connector.
2. Measure the resistance according to the value(s) in the table below.



HV Relay Assembly		Ground	Resistance
Harness connector	Terminal		
n3	2 (GND)	Ground	Below 1 Ω

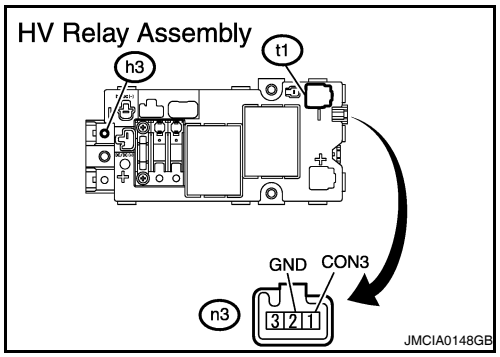
OK or NG

OK >> GO TO 8.
NG >> Repair or replace harness or connector.

8. INSPECT HV RELAY ASSEMBLY (SMRB)

CAUTION:
Be sure to wear insulated gloves and protective goggles.

1. Check that the service plug grip is not installed.
2. Remove the HV relay assembly from the vehicle (See HBB-105, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
h3	1	t1	1	Below 1 Ω [When battery voltage (12 V) applied to terminals n3-2 and n3-1]
				10 kΩ or higher

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

HV Relay Assembly		HV Relay Assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
n3	1 (CON3)	n3	2 (GND)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176° F)

OK or NG

OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NG >> Replace HV relay assembly (See HBB-105, "Removal and Installation").

P0AE2-161

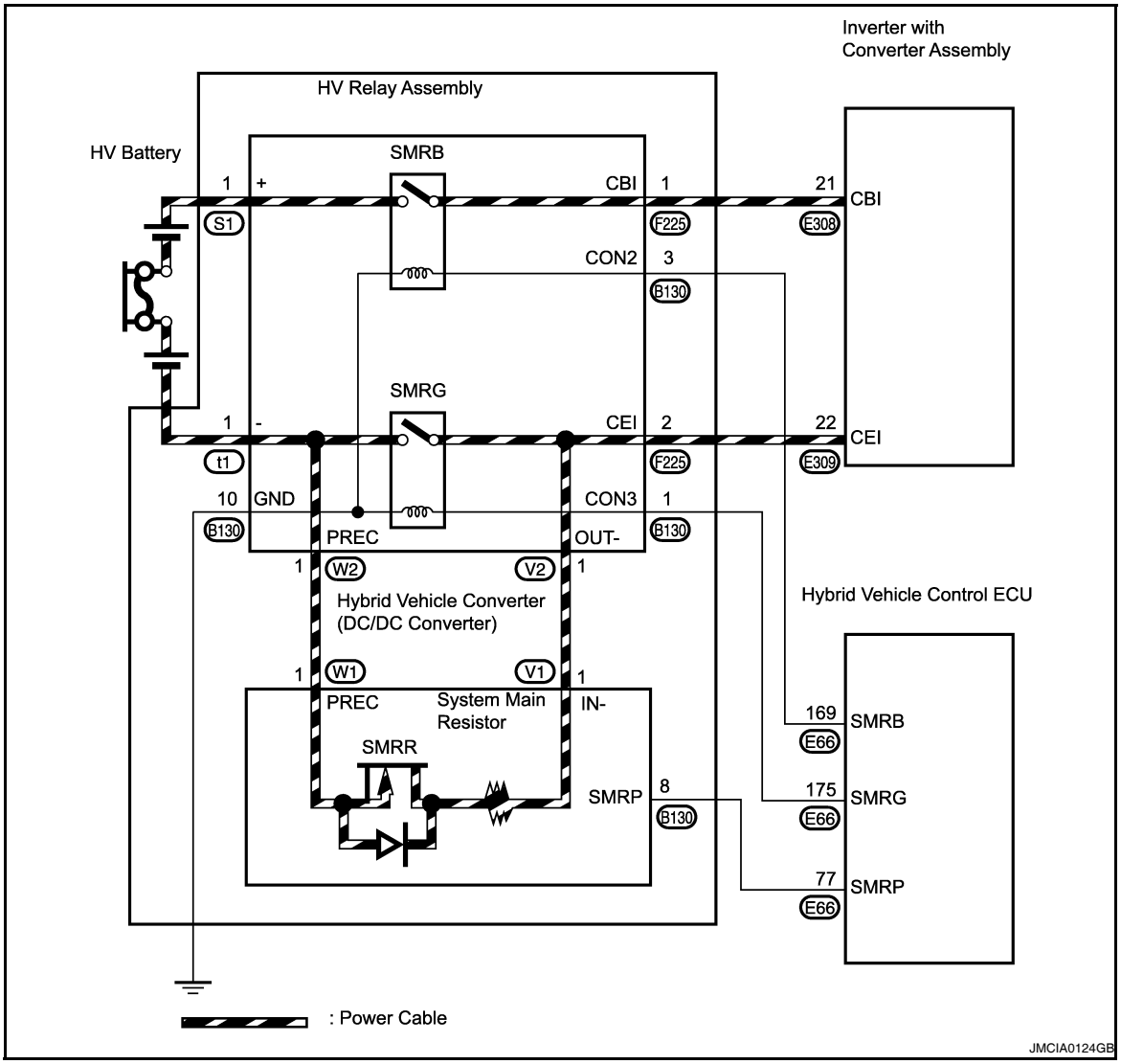
Description

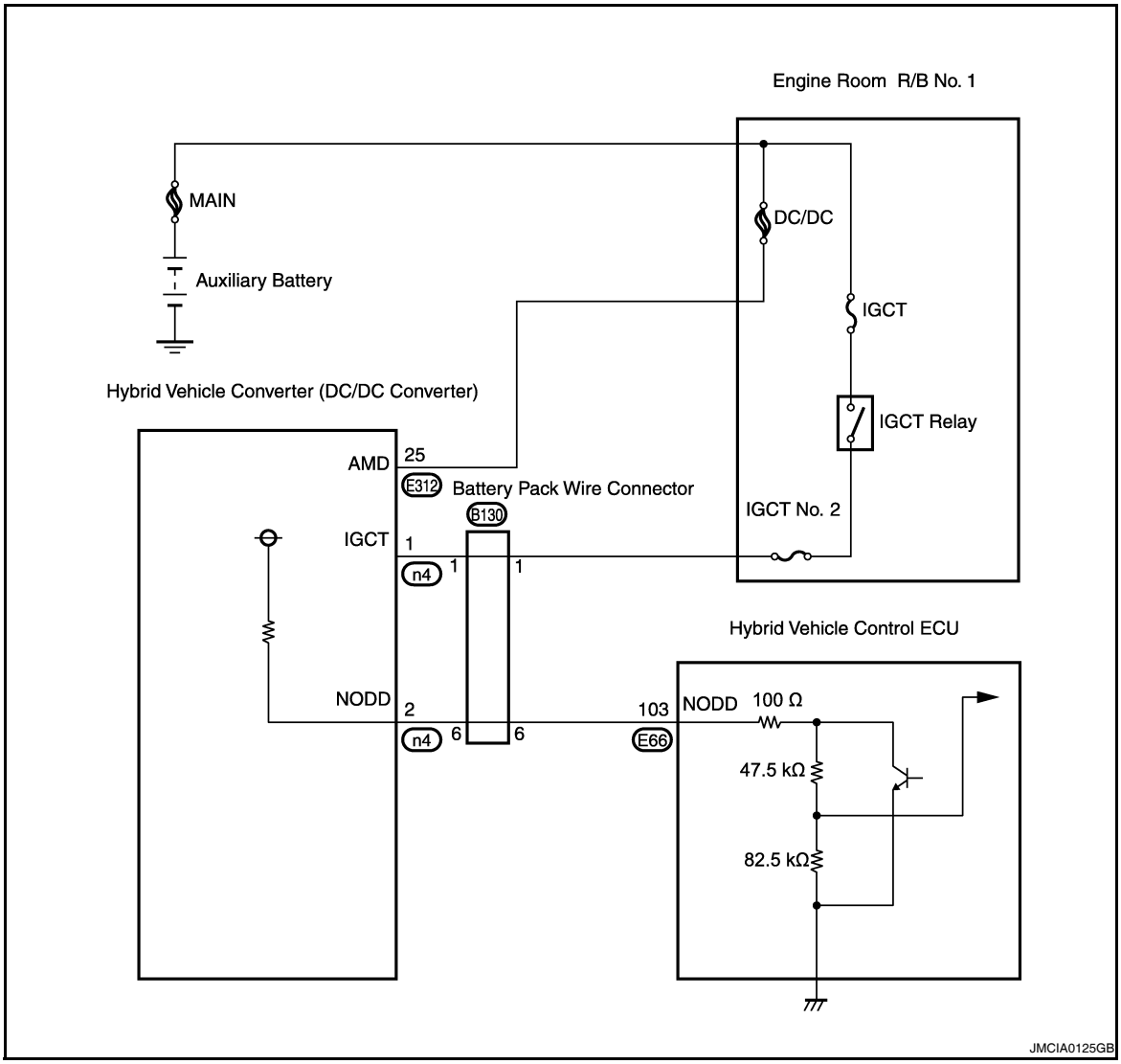
INFOID:0000000004212065

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
CON2
CON3
GND
PREC
OUT-
IN-
SMRR
SMRP
System Main
Resistor
Hybrid Vehicle Converter
(DC/DC Converter)
W1
W2
V1
V2
F225
B130
E308
E309
21
22
10
2
3
169
175
77
E66
8
Hybrid Vehicle Control ECU
: Power Cable
JMCIA0124GB



DTC Logic

INFOID:0000000004212066

DTC DETECTION LOGIC

If the SMRG is stuck open, P0AE0-228 will usually be set. P0AE2-161 is used to pinpoint the problem more quickly and accurately.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AE2	161	Hybrid Battery Precharge Contactor Circuit Stuck Closed	When the ignition switch ON (READY) and regenerative braking is occurring, current is applied to SMRP (SMRG is turned off).	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU • Hybrid vehicle converter (DC/DC converter)

Diagnosis Procedure

INFOID:0000000004212067

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HVHYBRID SYSTEM)

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

P0AE0-228 is output

Is DTC detected?

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

3. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

1. Check the connection of the battery pack wire connector.

The connector is connected securely and there are no contact problems.

NOTE:
For the removal and installation procedures related to inspection of the connection of the battery pack wire connector (See HBB-97, "Removal and Installation").

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HYBRID VEHICLE CONTROL ECU

1. Disconnect the battery pack wire connector (See HBB-97, "Removal and Installation").
2. Measure the resistance according to the value(s) in then table below.

Battery Pack Wire Connector		Ground	Resistance
Harness connector	Terminal		
B130	8 (SMRP)	Ground	370 to 430 kΩ

OK or NG

OK >> GO TO 6.
NG >> GO TO 13.

6. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

1. Disconnect the E66 hybrid vehicle control ECU.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.

Hybrid Vehicle Control ECU		Ground	Voltage
Harness connector	Terminal		
E66	175 (SMRG)	Ground	Below 1 V

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

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

Check for open

Hybrid Vehicle Control ECU		Battery Pack Wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	175 (SMRG)	B130	2 (CON3)	Below 1 Ω

Check for short

Hybrid Vehicle Control ECU		Ground	Resistance
Harness connector	Terminal		
E66	175 (SMRG)	Ground	10 kΩ or higher

Battery Pack Wire		Ground	Resistance
Harness connector	Terminal		
B130	2 (CON3)	Ground	10 kΩ or higher

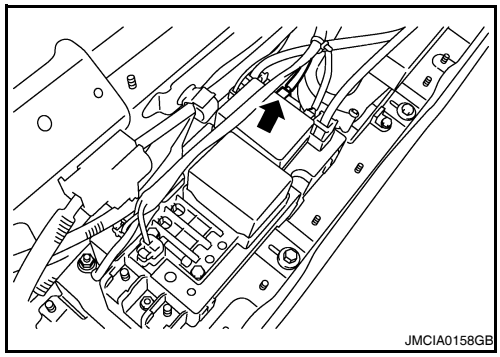
OK or NG

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

7. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control System").
2. Check the connection of the low voltage connector that drives the HV relay assembly.



The connector is connected securely and there are no contact problems.

NOTE:
For the removal and installation procedures related to inspection of the connection of the connector that drives the HV relay assembly, (See HBB-105, "Removal and Installation").

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

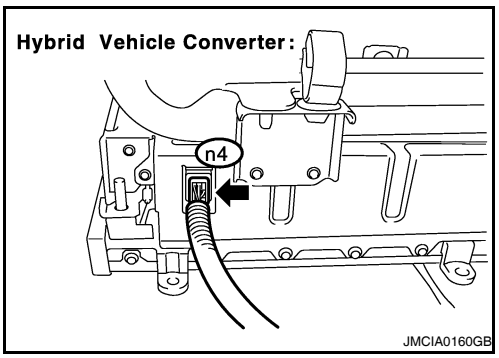
8. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER ASSEMBLY CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.

2. Check the connection of the low voltage connector of the hybrid vehicle converter (DC/DC converter).

The connector is connected securely and there are no contact problems.



OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

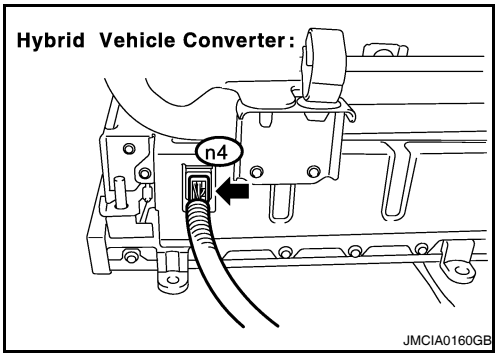
OK or NG

OK >> GO TO 10.
NG >> Repair or replace harness or connector.

10. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.



Battery Pack Wire		Ground	Voltage
Harness connector	Terminal		
B130	8 (SMRP)	Ground	Below 1 V

NOTE:
Turn ignition switch ON with the hybrid vehicle converter (DC/DC converter) connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Check for open

Battery Pack Wire		Hybrid Vehicle Converter (DC/DC Converter)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
B130	8 (SMRP)	n4	4 (SMRP)	Below 1 Ω

Check for short

Battery Pack Wire Connector		Ground	Resistance
Harness connector	Terminal		
B130	8 (SMRP)	Ground	10 kΩ or higher

Hybrid Vehicle Converter (DC/DC Converter)		Ground	Resistance
Harness connector	Terminal		
n4	4 (SMRP)	Ground	10 kΩ or higher

OK or NG

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

11. INSPECT HV RELAY ASSEMBLY (SMRG)

See HBC-444, "Diagnosis Procedure".

OK or NG

OK >> Repair or replace harness or connector.
NG >> Inspect HV relay assembly (SMRG) (See HBB-105, "Removal and Installation").

12. INSPECT HV RELAY ASSEMBLY (SMRG)

See HBC-444, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle converter.
NG >> Replace HV relay assembly.

13. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

NOTE:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Hybrid Vehicle Control ECU		Ground	Voltage
Harness connector	Terminal		
E66	77 (SMRP)	Ground	Below 1 V

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid Vehicle Control ECU		Battery Pack Wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	77 (SMRP)	B130	8 (SMRP)	Below 1 Ω

Check for short

Hybrid Vehicle Control ECU		Ground	Resistance
Harness connector	Terminal		
E66	77 (SMRP)	Ground	10 kΩ or higher

Battery Pack Wire		Ground	Resistance
Harness connector	Terminal		
B130	8 (SMRP)	Ground	10 kΩ or higher

OK or NG

OK >> Replace hybrid vehicle control ECU.
NG >> Repair or replace harness or connector.

P0AE2-773

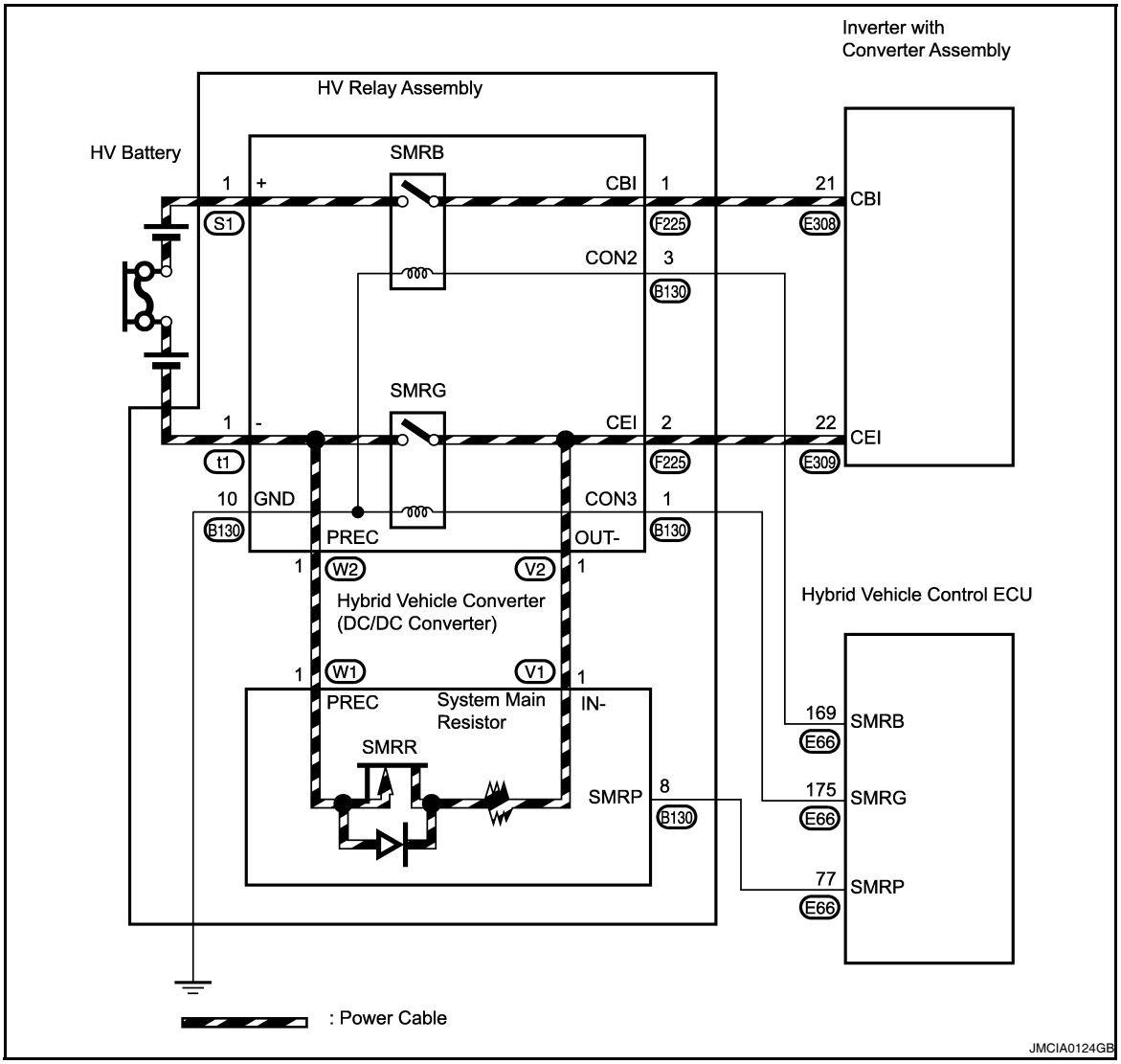
Description

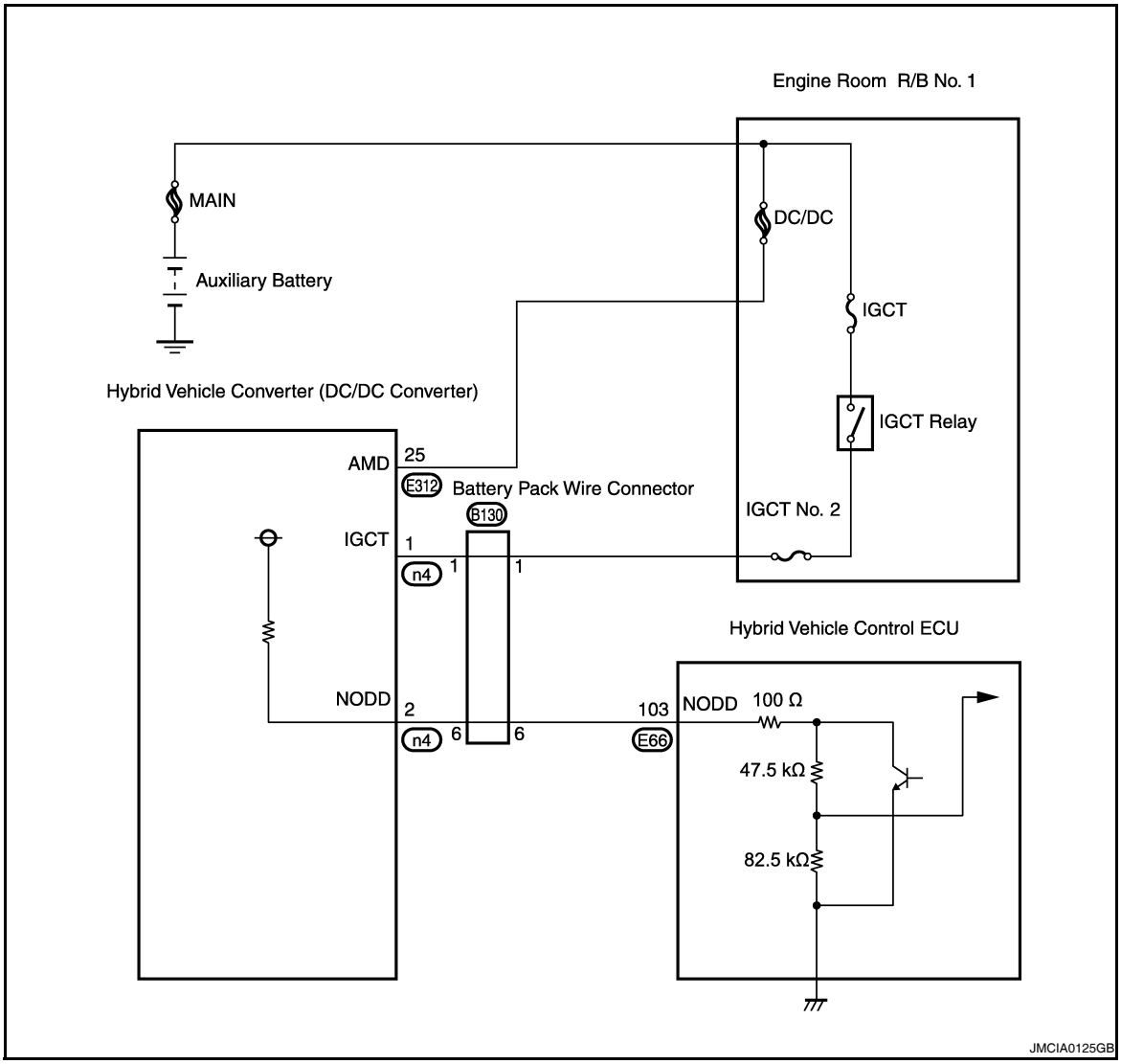
INFOID:0000000004212068

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
CON2
CON3
GND
PREC
OUT-
IN-
SMRR
SMRP
System Main
Resistor
Hybrid Vehicle Converter
(DC/DC Converter)
W1
W2
V1
V2
F225
B130
E308
E309
21
22
10
2
3
169
175
77
E66
8
Hybrid Vehicle Control ECU
: Power Cable
JMCIA0124GB



DTC Logic

INFOID:0000000004212069

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AE2	773	Hybrid Battery Precharge Contactor Circuit Stuck Closed	When only SMRB is ON, current is applied to SMRP (SMRP is stuck closed).	• Connector connection • Hybrid vehicle converter (DC/DC converter)

Diagnosis Procedure

INFOID:0000000004212070

1.PRECONDITIONING

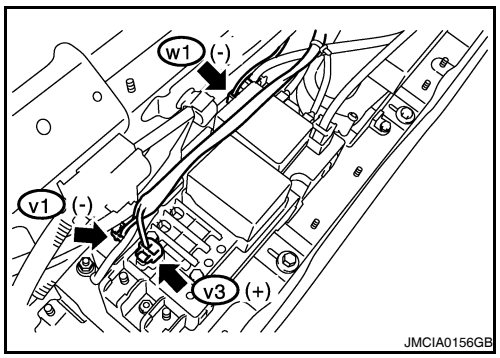
- Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your 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.
- If P0AE2-773 is output, the vehicle is prevented from starting.

>> GO TO 2.

2. CHECK HYBRID VEHICLE CONVERTER

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See page HBC-632, "Precautions for Inspecting the Hybrid Control System").
   NOTICE:
   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.
2. Disconnect the w1, v1 and v3 hybrid vehicle converter (DC/DC converter) connectors from the HV relay assembly.
3. Measure the resistance according to the value(s) in the table below.
   NOTE:
   If the resistance is between 28.5 and 31.5Ω, it can be determined that the SMRP is stuck closed.



Frame Wire		Frame Wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
w1	1 (Pre-charge+)	v1	1 (High voltage –)	10 kΩ or higher

OK or NG

OK >> GO TO 3.
NG >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").

3. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle converter (See page HBB-103, "Removal and Installation").
NG >> Connect securely.

P0AE6-225

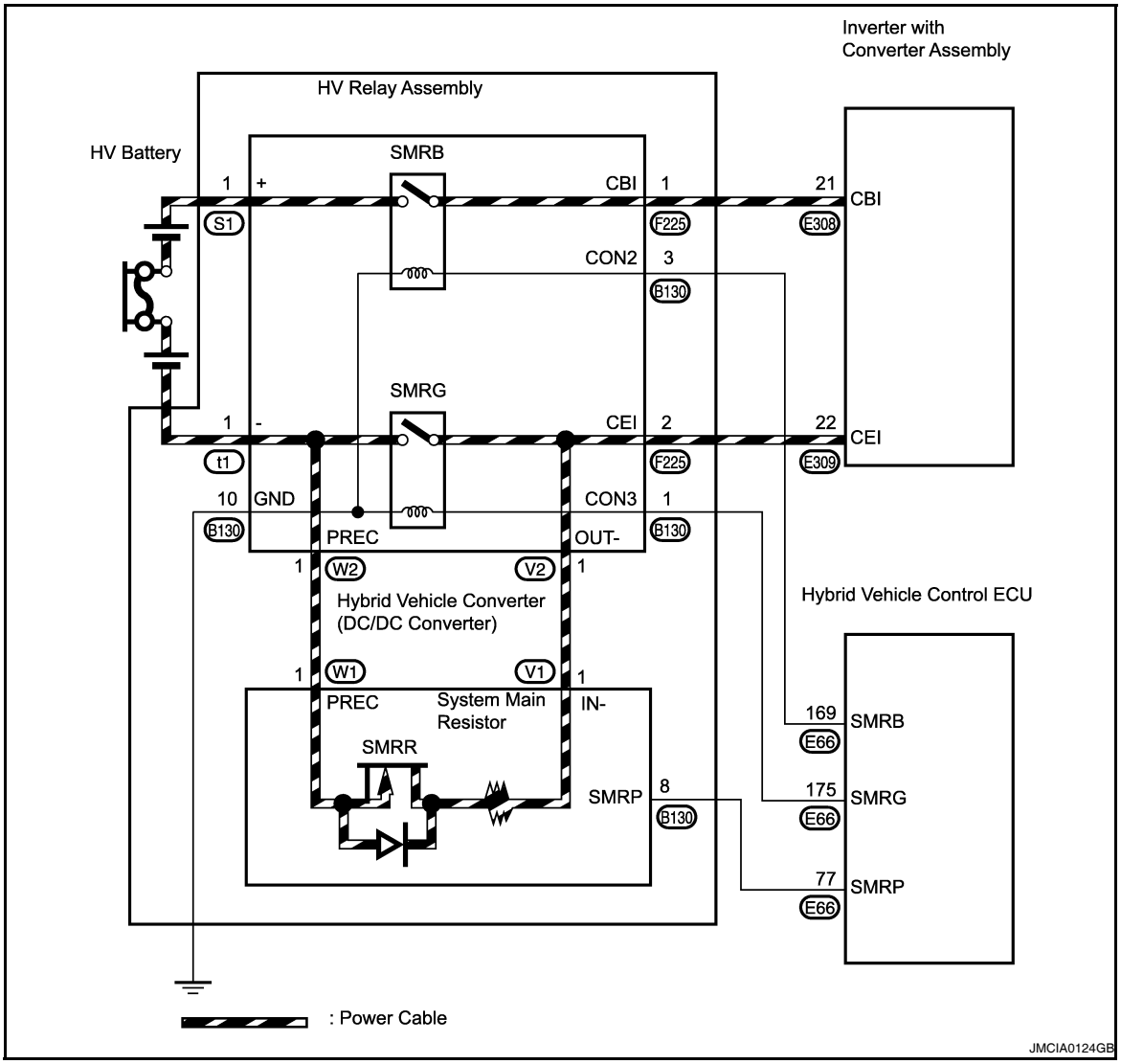
Description

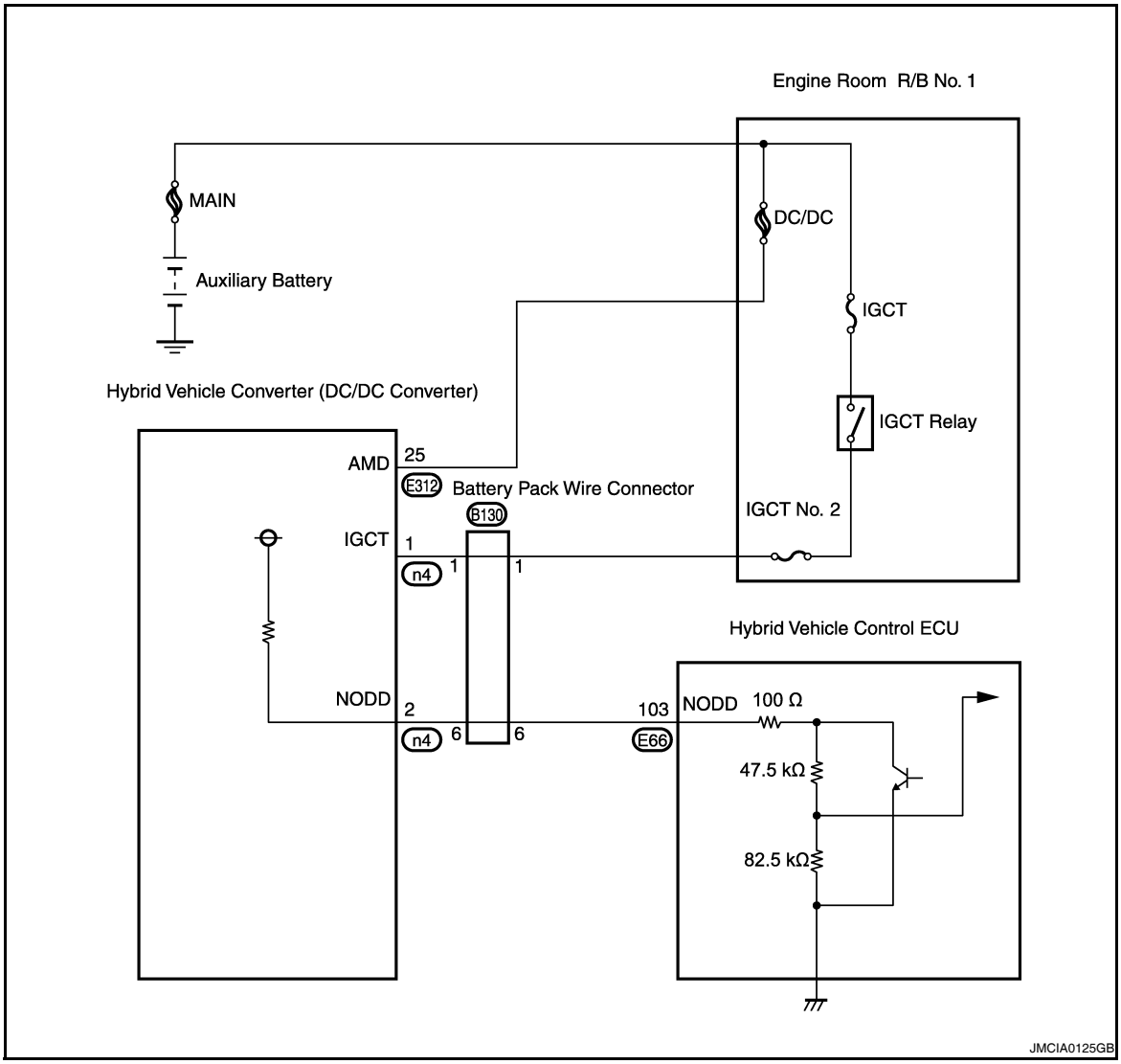
INFOID:0000000004212071

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
CON2
CON3
GND
PREC
OUT-
IN-
F225
B130
E308
E309
21
22
3
2
10
CBI
CEI
Hybrid Vehicle Converter
(DC/DC Converter)
W1
W2
V1
V2
System Main
Resistor
SMRR
SMRP
8
Hybrid Vehicle Control ECU
169
175
77
E66
SMRB
SMRG
SMRP
: Power Cable
JMCIA0124GB



DTC Logic

INFOID:0000000004212072

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the proper operation of the SMRP. If the hybrid vehicle control ECU detects an open or short in the SMRP circuit, 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
P0AE6	225	Hybrid battery precharge contactor control circuit low	Open or short to GND in the SMRP circuit	• Wire harness or connector • Frame wire • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU • Fuse • Fusible link

Diagnosis Procedure

INFOID:0000000004212073

1.PRECONDITIONING

- Turn ignition switch OFF 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 DTC OUTPUT (HYBRID SYSTEM)

1. Turn ignition switch ON.
2. Check DTC.
3. Refer to “Proceed to” in the table below to perform each inspection.

Item to inspect	P0A08-264	P0A09-265	P0A09-591	P2519-766	P0AE6-225	Proceed to
Only AMD open circuit inspection	○	—	○	○	○	A
	○	—	—	○	○	
	○	—	—	—	○	
Only IGCT open circuit inspection	—	○	○	○	○	B
	—	○	—	—	○	
	—	○	—	○	○	
AMD and IGCT open circuit inspections	—	—	○	○	○	C
	—	—	—	○	○	
AMD and IGCT open circuit and SMRP system inspections	—	—	—	—	○	D

NOTE:
- ○ : DTCs that are output
- — : DTCs that are not output

A,B,C or D

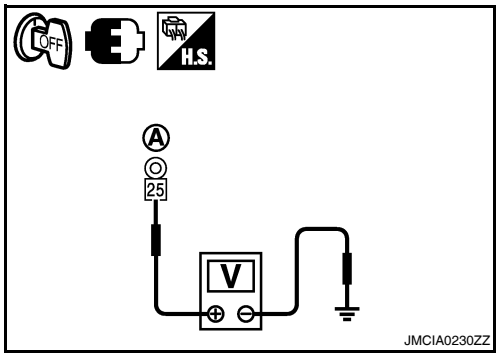
A >> GO TO 14.
B >> GO TO 18.
C >> GO TO 23.
D >> GO TO 3.

3.CHECK FRAME WIRE (AUXILIARY BATTERY POSITION TERMINAL AND AMD TERMINAL VOLTAGE)

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

Auxiliary battery		Ground	Voltage
Harness connector	Terminal		
—	Positive (+)	Ground	9 to 14V

Hybrid vehicle converter (DC/DC converter) (A)		Ground	Voltage
Harness connector	Terminal		
E312	25 (AMD)	Ground	9 to 14V



OK or NG

OK >> GO TO 4.
NG >> GO TO 31.

4.CHECK FUSIBLE LINK AND FUSE

1. Check the fusible link (letter D), the fuse (No. 68) and the fusible link (letter G) that are installed at the high voltage fuse and fusible link box, for improper installation and for open circuits.

They are connected securely. There are no open circuits in the fusible links or fuse.

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

5. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Connect securely.

6. CHECK HYBRID VEHICLE CONVERTER (AMD TERMINAL CONNECTION CONDITION)

1. Check for DTCs and save freeze frame data.
2. Disconnect the negative terminal from the auxiliary battery.
3. Check for looseness of AMD terminals 1 and 2.

Result 1:

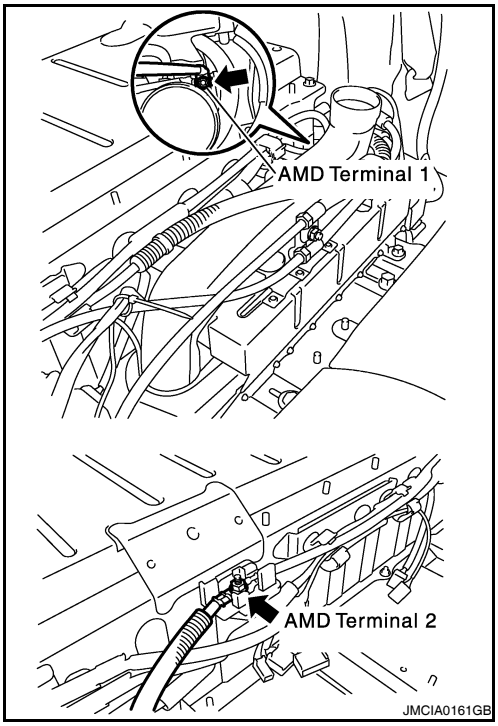
AMD terminal 1: 8.0 N·m (82 kgf-cm, 71 in-lbf)

AMD terminal 2: 9.0 N·m (92 kgf-cm, 80 in-lbf)

4. Make sure to disconnect the terminals 1 and 2 to check for arc marks.

Result 2:

There are no arc marks.



Result 1		Procedure	Procedure to
Result 1	Result 2		
No looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery, and go to step 7.	A
No looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter (DC/DC converter), terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	C
Looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter (DC/DC converter), terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B

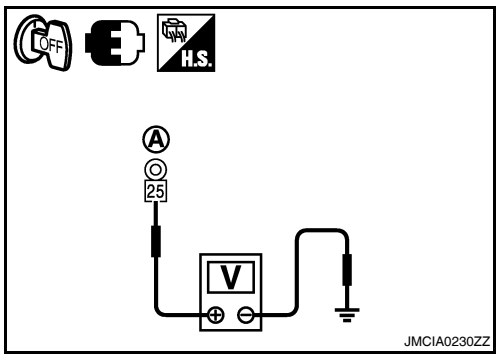
A, B or C

A >> GO TO 7.
B >> Repair or replace malfunctioning parts, component and area.
C >> Tighten to specified torque.

7. CHECK TERMINAL VOLTAGE (AMD TERMINAL)

1. Turn ignition switch OFF.

2. Measure the voltage according to the value(s) in the table below when the ignition switch OFF.



Frame Wire (A)		Ground	Voltage
Harness connector	Terminal		
E312	25	Ground	9 to 14V

OK or NG

OK >> GO TO 8.
NG >> Repair or replace frame wire.

8. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

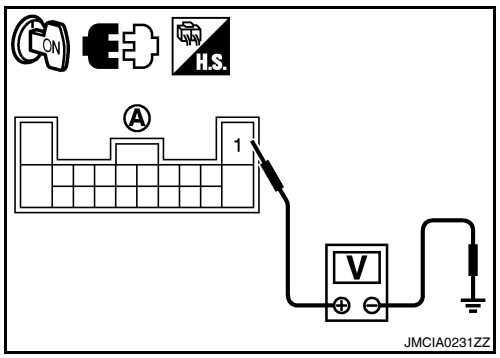
See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. CHECK HARNESS AND CONNECTOR

1. Disconnect the battery pack wire connector (See HBB-97, "Removal and Installation").
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.



Battery pack wire connector (A)		Ground	Voltage
Harness connector	Terminal		
B130	1 (IGCT)	Ground	9 to 14V

OK or NG

OK >> GO TO 10.
NG >> Repair or replace harness or connector.

10. CHECK HYBRID VEHICLE CONTROL ECU

1. Turn ignition switch OFF.
2. Measure the resistance according to the value(s) in the table below.

Battery pack wire connector		Ground	Resistance
Harness connector	Terminal		
B130	8 (SMRP)	Ground	370 to 430 kΩ

OK or NG

OK >> GO TO 11.
NG >> GO TO 13.

11. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Connect securely.

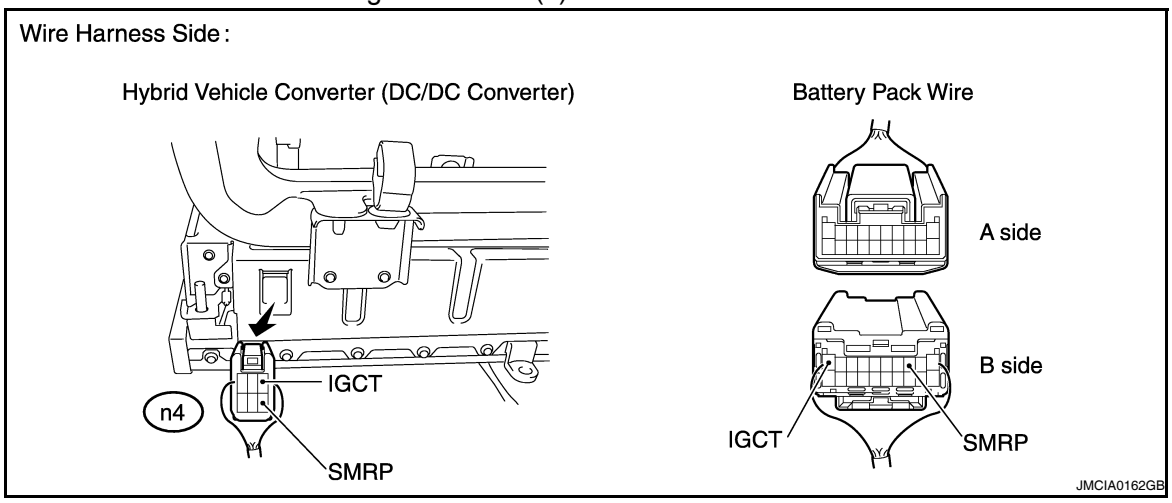
12. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and Installation").

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

Wire Harness Side :



Battery pack wire		Hybrid vehicle converter		Resistance
Harness connector	Terminal	Harness connector	Terminal	
B130	1 (IGCT)	n4	1 (IGCT)	Below 1Ω
	8 (SMRP)		4 (SMRP)	

Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	1 (IGCT)	Ground	10 kΩ or higher
	8 (SMRP)		

Hybrid vehicle converter		Ground	Resistance
Harness connector	Terminal		
n4	1 (IGCT)	Ground	10 kΩ or higher
	4 (SMRP)		

OK or NG

OK >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").
NG >> Repair or replace harness or connector.

13. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

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

Check for open

Hybrid vehicle control ECU		Battery pack wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	77 (SMRP)	B130	8 (SMRP)	Below 1Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	77 (SMRP)	Ground	10 kΩ or higher

Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	8 (SMRP)	Ground	10 kΩ or higher

OK or NG

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

14. CHECK FRAME WIRE (AUXILIARY BATTERY POSITIVE TERMINAL AND AMD TERMINAL)

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

Frame Wire		Ground	Voltage
Harness connector	Terminal		
—	AMD	Ground	9 to 14 V

OK or NG

OK >> GO TO 15.
NG >> GO TO 31.

15. CHECK FUSIBLE LINK

1. Check the fusible link (letter B) and the fusible link (letter G) for improper installation and for open circuits.

They are connected securely. There are no open circuits in the fusible links.

OK or NG

OK >> GO TO 16.
NG >> Replace fusible link.

16. CHECK HYBRID VEHICLE CONVERTER (AMD TERMINAL CONNECTION CONDITION)

1. Check for DTCs and save freeze frame data.
2. Disconnect the negative terminal from the auxiliary battery.
3. Check for looseness of AMD terminals 1 and 2.

Result 1:

AMD terminal 1 : 8.0 N·m (82 kg-f-cm, 71 in-lbf)

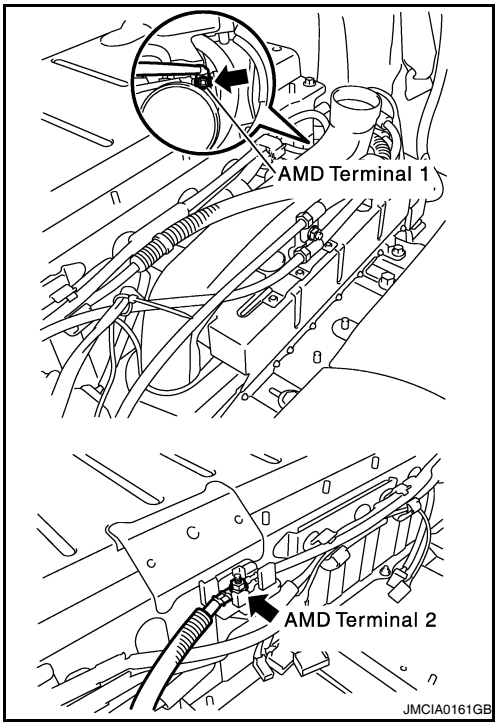
Result 2:

AMD terminal 2 : 9.0 N·m (92 kgf-cm, 80 in-lbf)

4. Make sure to disconnect the terminals 1 and 2 to check for arc marks.

Result 2:

There are no arc marks.



Result 1		Procedure	Procedure to
Result 1	Result 2		
No looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery, and go to step 17.	A
No looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter (DC/DC converter), terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	C
Looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter (DC/DC converter), terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B

A, B or C

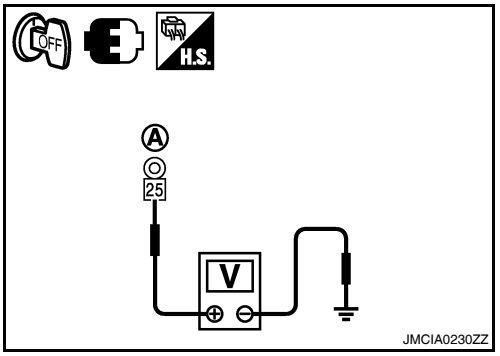
A >> GO TO 17.
B >> Repair or replace malfunctioning parts, component or area.
C >> Tighten to specified torque.

17. CHECK TERMINAL VOLTAGE (AMD TERMINAL)

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

Auxiliary battery		Ground	Voltage
Harness connector	Terminal		
–	positive (+)	Ground	9 to 14V

Hybrid vehicle converter (DC/DC converter) (A)		Ground	Voltage
Harness connector	Terminal		
E312	25 (AMD)	Ground	9 to 14V



OK or NG

OK >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").
NG >> Repair or replace frame wire.

18. CHECK FUSE

1. Check the fuse (No. 68) for improper installation and open circuit.

The fuse is installed securely. There is no open in the fuse.

OK or NG

OK >> GO TO 19.
NG >> Replace fuse.

19. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

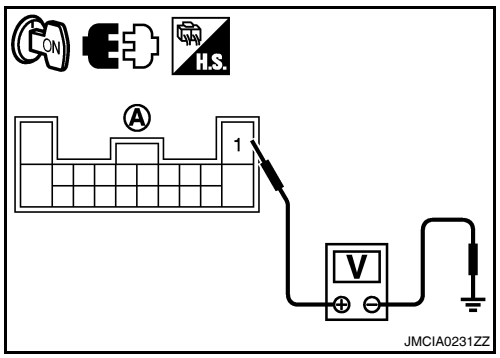
OK or NG

OK >> GO TO 20.
NG >> Connect securely.

20. CHECK HARNESS AND CONNECTOR

1. Disconnect the battery pack wire connector (See HBB-97, "Removal and Installation").
2. Turn ignition switch ON.

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



Battery pack wire connector (A)		Ground	Voltage
Harness connector	Terminal		
B130	1 (IGCT)	Ground	9 to 14V

OK or NG

OK >> GO TO 21.
NG >> Repair or replace harness or connector.

21. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

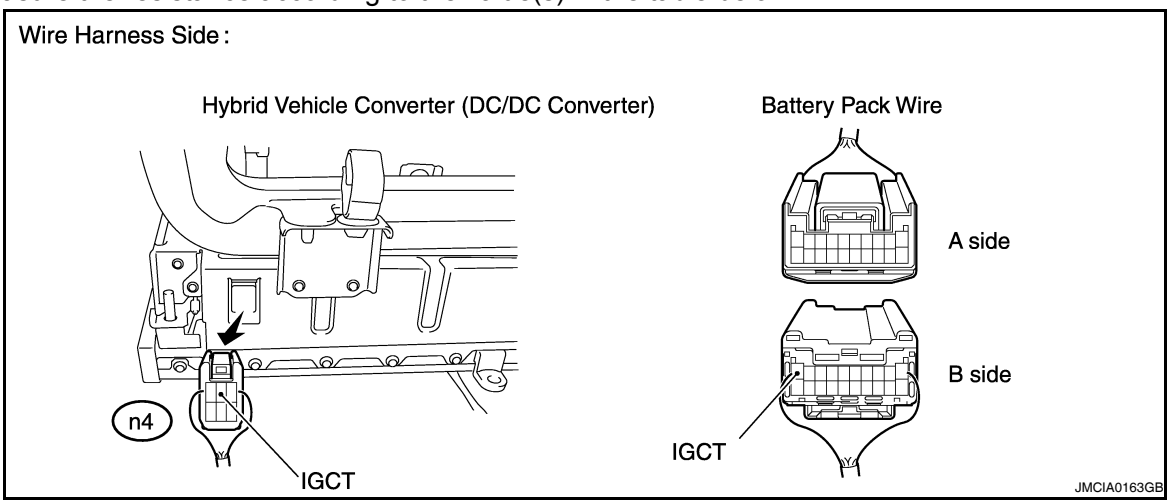
OK or NG

OK >> GO TO 22.
NG >> Connect securely.

22. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



Battery pack wire		Hybrid vehicle converter (DC/DC converter)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
B130	1 (IGCT)	n4	1 (IGCT)	Below 1Ω

Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	1 (IGCT)	Ground	10 kΩ or higher

Hybrid vehicle converter (DC/DC converter)		Ground	Resistance
Harness connector	Terminal		
n4	1 (IGCT)	Ground	10 kΩ or higher

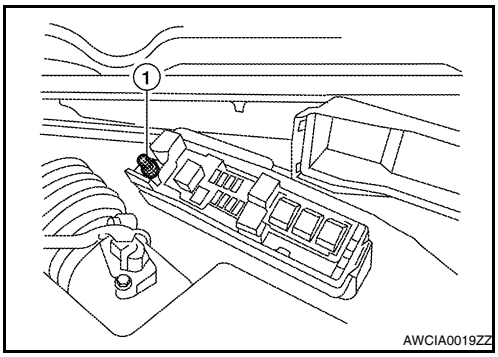
OK or NG

OK >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").
NG >> Repair or replace harness or connector.

23. CHECK FRAME WIRE (AUXILIARY BATTERY POSITIVE TERMINAL AND AMD TERMINAL)

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

- AMD terminal (1)



Hybrid vehicle converter (DC/DC converter)		Ground	Voltage
Harness connector	Terminal		
E312	25 (AMD)	Ground	9 to 14V

OK or NG

OK >> GO TO 24.
NG >> GO TO 31.

24. CHECK FUSIBLE LINK AND FUSE

1. Check the fusible link (letter D) and the fuse (No. 68) and the fusible link (letter G) for improper installation and for open circuits.

They are connected securely. There are no open circuits in the fusible links or fuse.

OK or NG

OK >> GO TO 25.
NG >> Replace fuse.

25. CHECK HYBRID VEHICLE CONVERTER (AMD TERMINAL CONNECTION CONDITION)

1. Check for DTCs and save freeze frame data.
2. Disconnect the negative terminal from the auxiliary battery.

3. Check for looseness of AMD terminals 1 and 2.

Result 1:

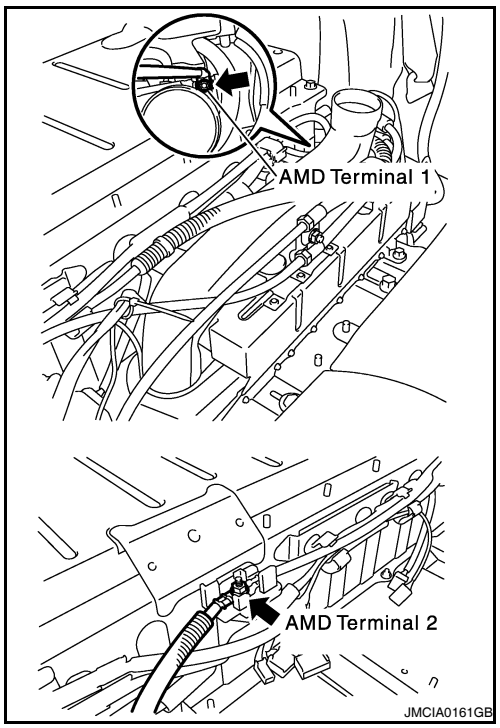
AMD terminal 1 : 8.0 N·m (82 kgf-cm, 71 in-lbf)

AMD terminal 2 : 9.0 N*m (92 kgf-cm, 80 in-lbf)

4. Make sure to disconnect the terminals 1 and 2 to check for arc marks.

Result 2:

There are no arc marks.



Result 1		Procedure	Procedure to
Result 1	Result 2		
No looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery, and go to step 26.	A
No looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter (DC/DC converter), terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	C
Looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter (DC/DC converter), terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B

A, B or C

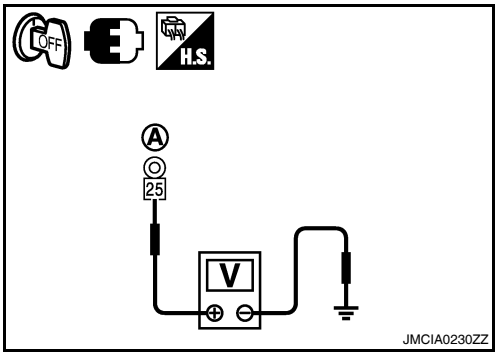
A >> GO TO 26.
B >> Repair or replace malfunctioning parts, component or area.
C >> Tighten to specified torque.

26. CHECK TERMINAL VOLTAGE (AMD TERMINAL)

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

AUxiliary battery (A)		Ground	Voltage
Harness connector	Terminal		
–	positive (+)	Ground	9 to 14V

Hybrid vehicle converter (DC/DC converter)		Ground	Voltage
Harness connector	Terminal		
E312	25 (AMD)	Ground	9 to 14V



OK or NG

OK >> GO TO 27.
NG >> Repair or replace frame wire.

27. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

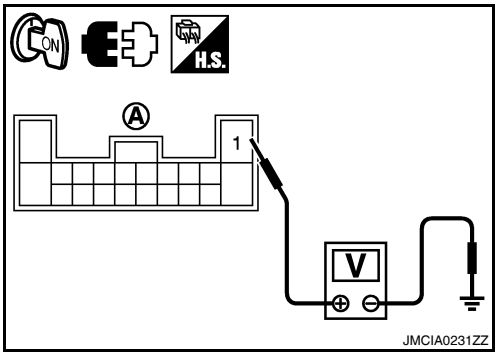
OK or NG

OK >> GO TO 28.
NG >> Connect securely.

28. CHECK HARNESS AND CONNECTOR

1. Disconnect the battery pack wire connector (See HBB-97, "Removal and Installation").
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.

Battery pack wire connector (A)		Ground	Voltage
Harness connector	Terminal		
B130	1 (IGCT)	Ground	9 to 14V



OK or NG

OK >> GO TO 29.
NG >> Repair or replace harness or connector.

29. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 30.
NG >> Connect securely.

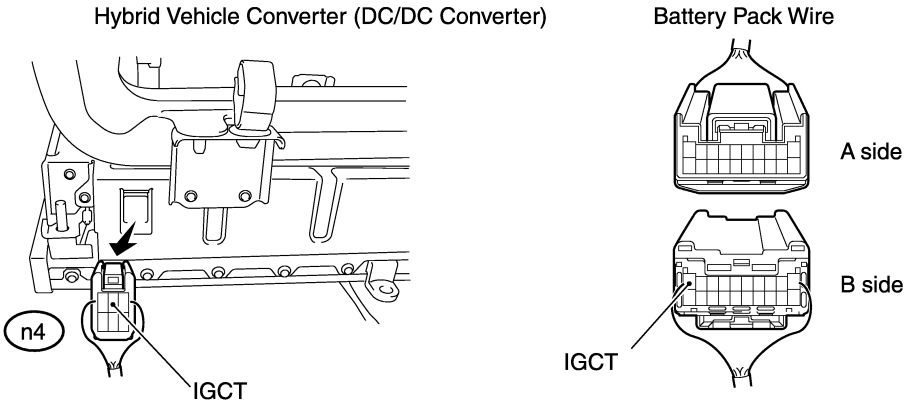
30. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and Installation").

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

Wire Harness Side :



Battery pack wire		Hybrid vehicle converter (DC/DC converter)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
B130	1 (IGCT)	n4	1 (IGCT)	Below 1Ω

Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	1 (IGCT)	Ground	10 kΩ or higher

Hybrid vehicle converter (DC/DC converter)		Ground	Resistance
Harness connector	Terminal		
n4	1 (IGCT)	Ground	10kΩ or higher

OK or NG

OK >> Replace hybrid vehicle converter (See HBB-103, "Removal and Installation").
NG >> Repair or replace harness or connector.

31.CHECK AUXILIARY BATTERY

1. Check the connection of the auxiliary battery negative terminal.

The terminal is connected securely and there is no contact problem.

2. Check for arc marks on the auxiliary battery negative terminal.

There are no arc marks.

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

Auxiliary battery		Ground	Resistance
Harness connector	Terminal		
–	negative	Ground	Below 1Ω

OK or NG

OK >> Repair or replace frame wire.
NG >> Repair or replace harness or connector.

P0AE7-224

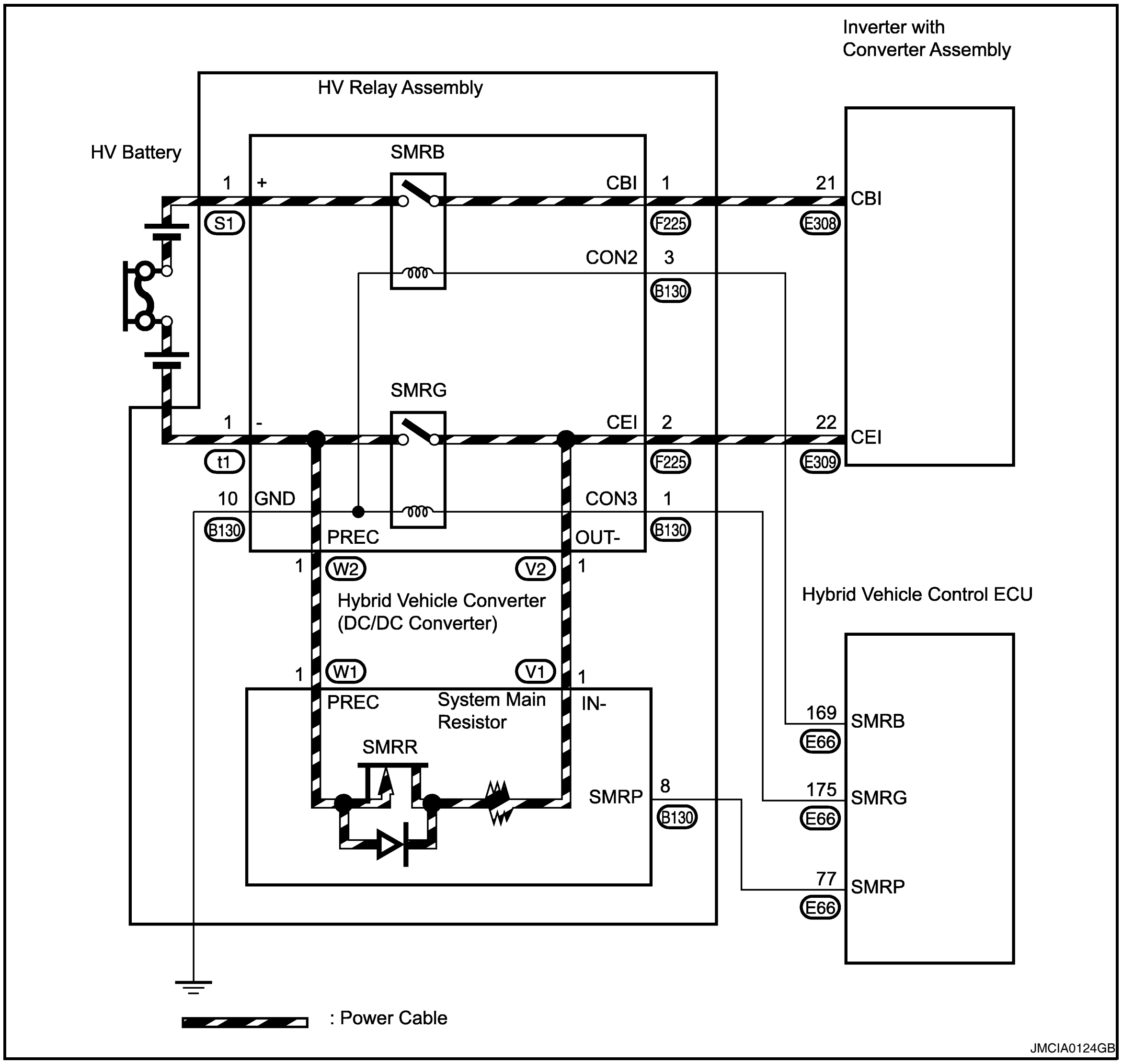
Description

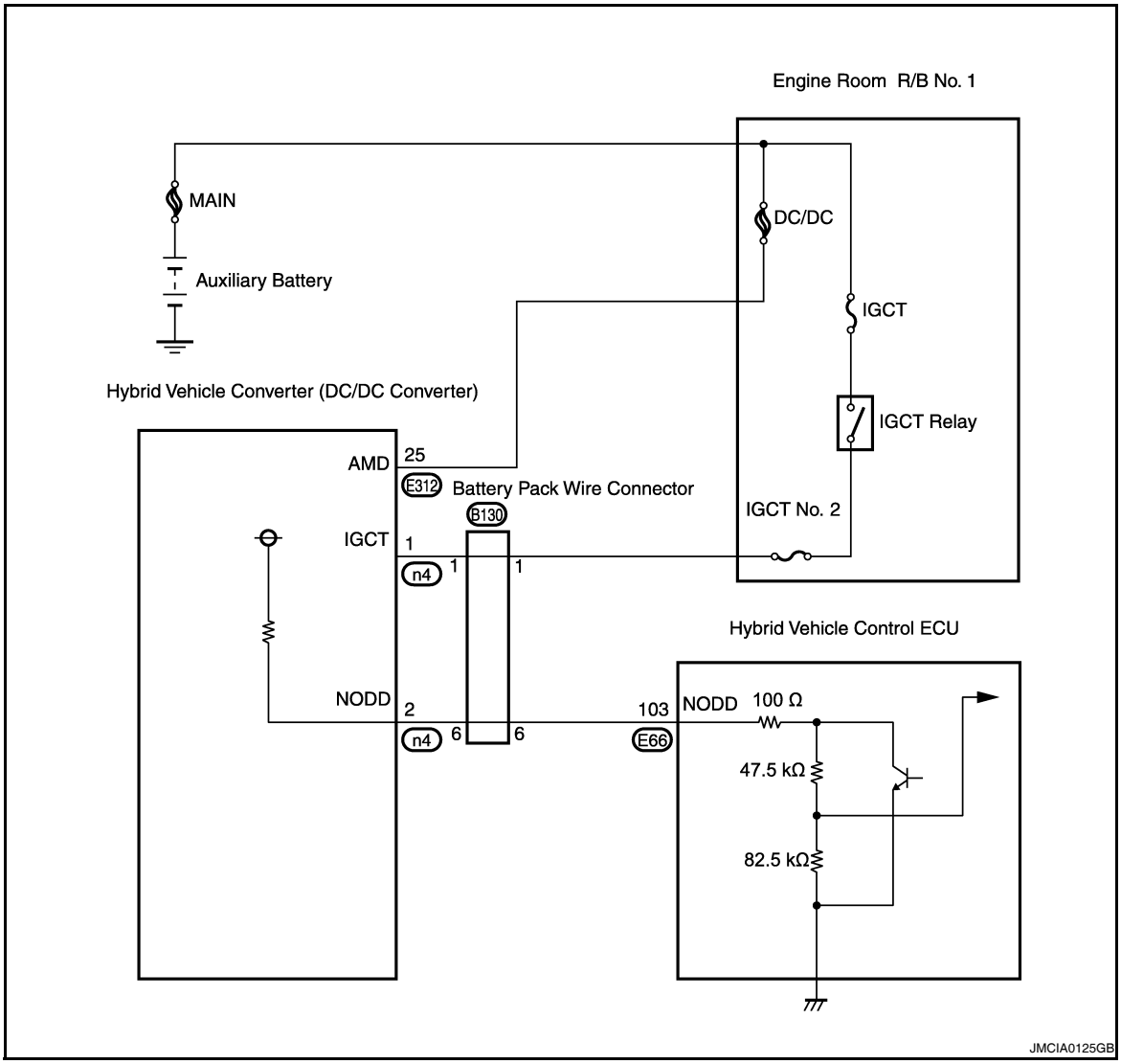
INFOID:0000000004212074

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
1 +
CBI 1
21 CBI
S1
F225
E308
CON2 3
B130
SMRG
1 -
CEI 2
22 CEI
t1
F225
E309
10 GND
CON3 1
B130
B130
PREC
OUT-
1 W2
V2 1
Hybrid Vehicle Converter
(DC/DC Converter)
Hybrid Vehicle Control ECU
1 W1
V1 1
PREC
System Main
Resistor
IN-
SMRR
169 SMRB
E66
SMRP 8
B130
175 SMRG
E66
77 SMRP
E66
: Power Cable
JMCIA0124GB



DTC Logic

INFOID:0000000004212075

DTC DETECTION LOGIC

The hybrid vehicle control ECU monitors the proper operation of the SMRP. If the hybrid vehicle control ECU detects an open or short in the SMRP circuit, 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
P0AE7	224	Hybrid battery precharge contactor control circuit high	Short to +B in the SMRP circuit	• Wire harness or connector • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004212076

1.PRECONDITIONING

- 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. 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.

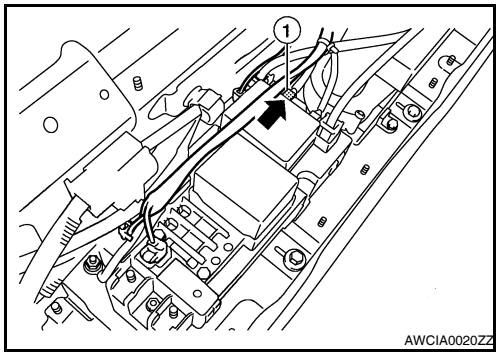
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

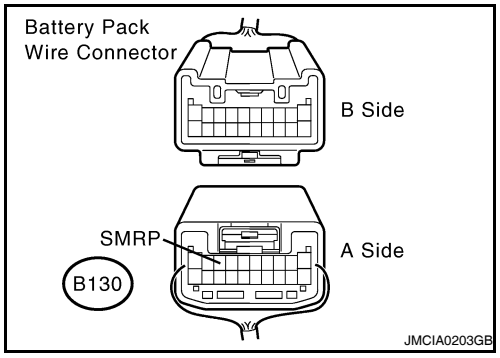
2. CHECK HARNESS AND CONNECTOR

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.
2. Disconnect the battery pack wire connector (See HBB-97, "Removal and Installation").
- Battery pack wire connector B130 (1)
3. Turn ignition switch ON.



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



Battery pack wire		Ground	Voltage
Harness connector	Terminal		
B130	8 (SMRP)	Ground	Below 1V

NOTE:
Turn ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

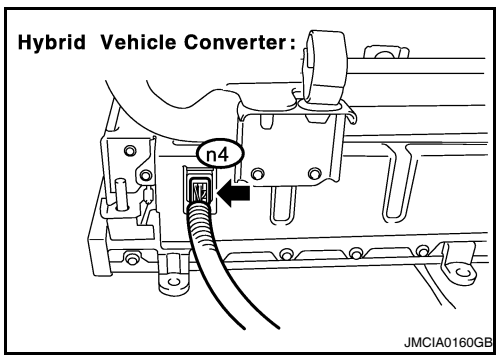
OK or NG

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

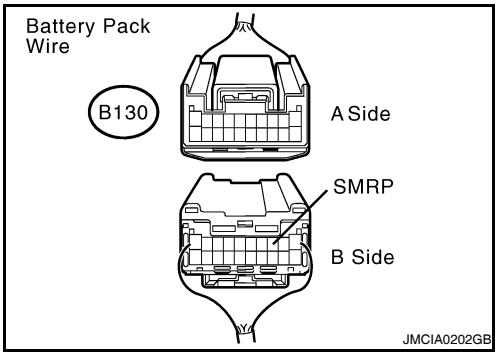
3. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector.
3. Turn ignition switch ON.



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



Battery pack wire		Ground	Voltage
Component connector	Terminal		
B130	8 (SMRP)	Ground	Below 1V

NOTE:
Turn ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

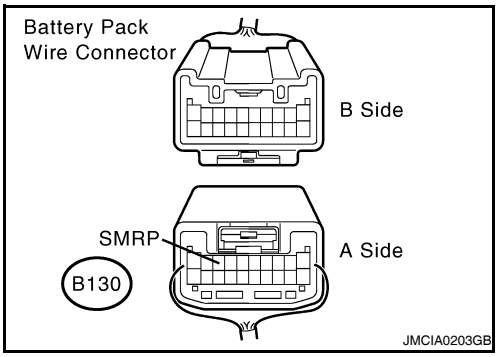
Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	8 (SMRP)	Ground	10 kΩ or higher

OK or NG

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

4. CHECK HYBRID VEHICLE CONTROL ECU

1. Turn ignition switch OFF.
2. Measure the resistance according to the value(s) in the table below.



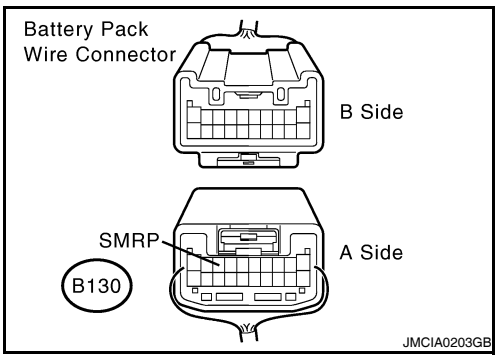
Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	8 (SMRP)	Ground	370 to 430 kΩ

OK or NG

OK >> Replace hybrid vehicle converter. (See HBB-103, "Removal and Installation")
NG >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation").

5. CHECK HARNESS AND CONNECTOR

1. Disconnect the E66 hybrid vehicle control ECU connector.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.



Battery pack wire		Ground	Voltage
Harness connector	Terminal		
B130	8 (SMRP)	Ground	Below 1V

NOTE:
Turn ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

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

P0AEE-276, P0AEE-277

Description

INFOID:0000000004212077

The MG ECU located in the inverter with converter assembly detects the temperature of the motor inverter using the temperature sensor built into the inverter with converter assembly. The inverter cooling system is the same as that for MG2 and MG1, and it operates independently of the engine cooling system. The characteristics of the motor inverter temperature sensor are the same as those of the boost converter temperature sensor. The MG ECU uses the signal from the motor inverter temperature sensor to check the effectiveness of the inverter cooling system. If necessary, the MG ECU will limit inverter output to prevent inverter overheating. The MG ECU also detects a malfunction of the front motor inverter temperature sensor or its circuit.

DTC Logic

INFOID:0000000004212078

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AEE	276	Motor inverter temperature sensor “A” circuit range/performance	Sudden change or hunting in the motor inverter temperature sensor	• Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU • Wire harness or connector
	277		Motor inverter temperature sensor output deviation	

Diagnosis Procedure

INFOID:0000000004212079

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A93-346	Inverter cooling system malfunction
P0A1D (all INF code)	Hybrid Powertrain Control Module
P0A1B (all INF code)	Drive Motor “A” Control Module

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

A or B or C

A >> GO TO 5.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

5. CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Correct the problem.

6. CHECK FUSE (NO. 67)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Replace fuse.

7. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 12.

10. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11. PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").
NG >> Check cooling fan system. (See EC-382, "Component Function Check").

12. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Add coolant.
NG >> GO TO 13.

13. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> GO TO 16.

14. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HYBRID VEHICLE CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Repair or replace harness or connectors.

15. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LIMK BOX

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle control ECU.
NG >> Repair or replace high voltage fuse and fusible link box.

16. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly.
NG >> Repair or replace harness or connector.

P0AEF-275, P0AF0-274

Description

INFOID:0000000004212080

The MG ECU located in the inverter with converter assembly detects the temperature of the motor inverter using the temperature sensor built into the inverter with converter assembly. The inverter cooling system is the same as that for MG2 and MG1, and it operates independently of the engine cooling system. The characteristics of the motor inverter temperature sensor are the same as those of the boost converter temperature sensor. The MG ECU uses the signal from the motor inverter temperature sensor to check the effectiveness of the inverter cooling system. If necessary, the MG ECU will limit inverter output to prevent inverter overheating. The MG ECU also detects a malfunction of the front motor inverter temperature sensor or its circuit.

DTC Logic

INFOID:0000000004212081

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AEF	275	Drive motor inverter temperature sensor “A” circuit low	Open or short to GND in the motor inverter temperature sensor circuit	Inverter with converter assembly
P0AF0	274	Drive motor inverter temperature sensor “A” circuit high	Short to +B in motor inverter temperature sensor circuit	

Diagnosis Procedure

INFOID:0000000004212082

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

>> COMPLETED

P1572-904

Description

INFOID:0000000004212083

When the brake pedal is depressed, ASCD brake switch is turned OFF and stop lamp switch is turned ON. The hybrid vehicle control ECU detects the state of the brake pedal by this input of two kinds (ON/OFF signal). Refer to HBC-66, "System Description" for the ASCD function.

DTC Logic

INFOID:0000000004212084

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P1572	904	ASCD brake switch	ASCD brake switch signal is not sent to hybrid vehicle control ECU for extremely long time while the vehicle is driving.	• Harness or connectors (ASCD brake switch circuit is open shorted.) • ASCD brake switch • Incorrect ASCD brake switch installation

Component Function Check

INFOID:0000000004212085

1.CHECK FOR ASCD BRAKE SWITCH FUNCTION

With CONSULT-III

1. Turn ignition switch ON.
2. Select “ASCD CANSEL SW” in “DATA MONITOR” mode with CONSULT-III.
3. Check “ASCD CANSEL SW” indication under the following conditions.

Monitor item	Condition		Indication
ASCD CANSEL SW	Brake pedal	Slightly depressed	ON
		Fully released	OFF

With GST

1. Turn ignition switch ON.
2. Check the voltage between hybrid vehicle control ECU harness connector and ground.

Hybrid vehicle control ECU		Ground	Condition		Voltage
Harness connector	Terminal				
E66	118 (ASCD brake switch signal)	Ground	Brake pedal	Slightly depressed	Approx. 0V
				Fully released	Battery voltage

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to HBC-483, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000004212086

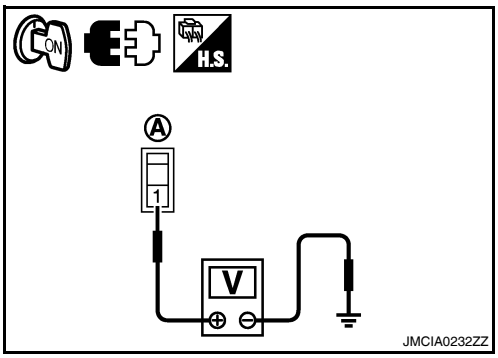
1.PRECONDITIONING

- 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. 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 ASCD BRAKE SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ASCD brake switch harness connector.
3. Turn ignition switch ON.
4. Check the voltage between ASCD brake switch harness connector and ground.



ASCD brake switch (A)		Ground	Voltage
Harness connector	Terminal		
E39	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3. DETECT MALFUNCTIONING PART

Check the following.
- Fuse block (J/B) connector E6
- Junction block connector E46, E48
- 10A fuse (No.3)
- Harness for open or short between ASCD brake switch and fuse

>> Repair open circuit or short to power in harness or connectors.

4. CHECK ASCD BRAKE SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect hybrid vehicle control ECU harness connector.
3. Check the continuity between ASCD brake switch harness connector and hybrid vehicle control ECU harness connector.

ASCD brake switch		Hybrid vehicle control ECU		Continuity
Harness connector	Terminal	Harness connector	Terminal	
E39	2	E66	118 (STI−)	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. DETECT MALFUNCTIONING PART

Check the following.
- Junction block connector E46, E50
- Harness for open or short between ASCD brake switch and hybrid vehicle control ECU

>> Repair open circuit or short to power in harness or connectors.

6. CHECK ASCD BRAKE SWITCH

Refer to HBC-485, "Component Inspection (ASCD Brake Switch)".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace ASCD brake switch.

7. CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".

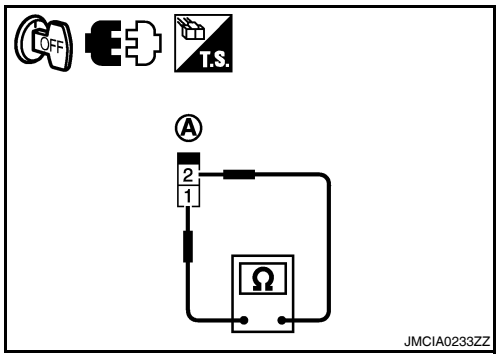
>> INSPECTION END

Component Inspection (ASCD Brake Switch)

INFOID:0000000004212087

1.CHECK ASCD BRAKE SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect ASCD brake switch harness connector.
3. Check the continuity between ASCD brake switch terminals under the following conditions.



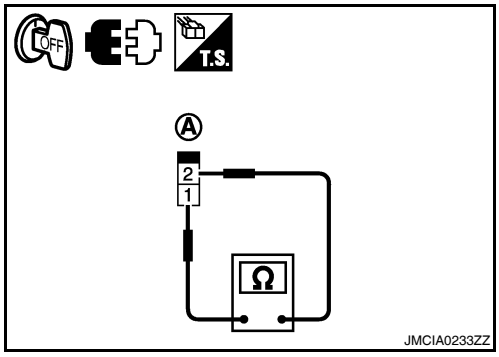
ASCD brake switch (A)	Condition		Continuity
Terminals			
1 and 2	Brake pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK ASCD BRAKE SWITCH-II

1. Adjust ASCD brake switch installation. Refer to BR-12, "Inspection and Adjustment".
2. Check the continuity between ASCD brake switch terminals under the following conditions.



ASCD brake switch (A)	Condition		Continuity
Terminals			
1 and 2	Brake pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace ASCD brake switch.

P1606-308

Description

INFOID:0000000004212088

The hybrid vehicle control ECU receives a signal that indicates a collision from the ACU (Air bag diagnosis sensor unit) to detect a collision. After detecting a collision, the hybrid vehicle control ECU shuts off the high-voltage systems for safety.

DTC Logic

INFOID:0000000004212089

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P1606	308	Collision detection	Shutoff signal from the ACU is determined.	• ACU • Hybrid vehicle control ECU

NOTE:
If P1608-308 is detected, the vehicle cannot start unless the DTC is cleared using CONSULT-III.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-486, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212090

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Proceed to
P1606 and P0A1D are output.	A
P1606 only is output.	B

A or B

A >> Go to inspection procedure relevant to output DTC. (P0A1D)
B >> GO TO 3.

3.CHECK SUPPLEMENTAL RESTRAINT SYSTEM

Troubleshoot the air bag system.

Result: There is a malfunction.

YES or NO

YES >> Repair or replace malfunctioning parts, component and area.
NO >> Replace ACU.

P1805-902

Description

INFOID:0000000004212091

Brake switch signal is applied to the hybrid vehicle control ECU through the stop lamp switch when the brake pedal is depressed. This signal is used mainly for the ASCD function and regenerative brake control.

DTC Logic

INFOID:0000000004212092

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P1805	902	Brake switch	A stop lamp switch signal is not sent to the hybrid vehicle control ECU for extremely long time while the vehicle is driving.	• Harness or connectors (Stop lamp switch circuit is open or shorted.) • Stop lamp switch • Stop lamp switch installation

Component Function Check

INFOID:0000000004212093

1.CHECK FOR STOP LAMP SWITCH FUNCTION

With CONSULT-III

1. Turn ignition switch ON.
2. Select “BRAKE SWITCH” in “DATA MONITOR” mode with CONSULT-III.
3. Check “BRAKE SWITCH” indication under the following conditions.

Monitor item	Condition		Indication
BRAKE SWITCH	Brake pedal	Slightly depressed	ON
		Fully released	OFF

With GST

1. Turn ignition switch ON.
2. Check the voltage between hybrid vehicle control ECU harness connector and ground.

Hybrid vehicle control ECU		Ground	Condition		Voltage
Harness connector	Terminal				
E66	148 (Stop lamp switch signal)	Ground	Brake pedal	Slightly depressed	Battery voltage
				Fully released	Approx. 0V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to HBC-488, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000004212094

1.PRECONDITIONING

- 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. 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 STOP LAMP SWITCH CIRCUIT

1. Turn ignition switch OFF.
2. Check the stop lamp when depressing and releasing the brake pedal.

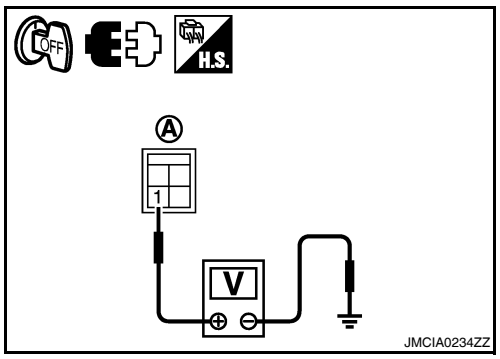
Brake pedal	Stop lamp
Fully released	Not illuminated
Slightly depressed	Illuminated

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 3.

3.CHECK STOP LAMP SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch harness connector.
3. Check the voltage between stop lamp switch harness connector and ground.



Stop lamp switch (A)		Ground	Voltage
Harness connector	Terminal		
E38	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Junction block connector E6
- 10A fuse (No. 7)
- Harness for open or short between stop lamp switch and battery

>> Repair open circuit or short to ground in harness or connectors.

5.CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect hybrid vehicle control ECU harness connector.
2. Check the continuity between hybrid vehicle control ECU harness connector and stop lamp switch harness connector.

Hybrid vehicle control ECU		Stop lamp switch		Continuity
Harness connector	Terminal	Harness connector	Terminal	
E66	148 (STP)	E38	2	Existed

3. Also check harness for short to ground.

Is the inspection result normal?

YES >> GO TO 7.
NG >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Joint connector E-4
- Harness for open or short between hybrid vehicle control ECU and stop lamp switch

>> Repair open circuit or short to ground in harness or connectors.

7.CHECK STOP LAMP SWITCH

Refer to HBC-490, "Component Inspection (Stop Lamp Switch)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace stop lamp switch.

8.CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".

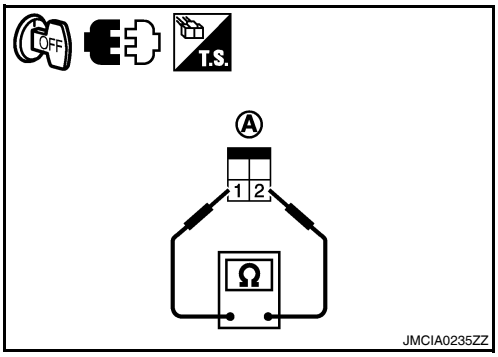
>> INSPECTION END

Component Inspection (Stop Lamp Switch)

INFOID:0000000004212095

1.CHECK STOP LAMP SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch harness connector.
3. Check the continuity between stop lamp switch terminals under the following conditions.



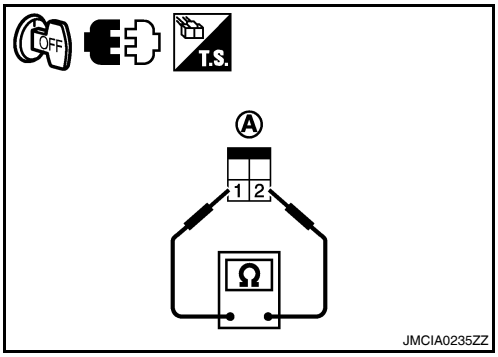
Stop lamp switch (A) Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK STOP LAMP SWITCH-II

1. Adjust stop lamp switch installation. Refer to BR-12, "Inspection and Adjustment".
2. Check the continuity between stop lamp switch terminals under the following conditions.



Stop lamp switch (A) Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace stop lamp switch.

P1805-903, P1805-923

Description

INFOID:0000000004212096

The brake switch signal is applied to the hybrid vehicle control ECU through the stop lamp switch when the brake pedal is depressed. The brake ECU also receives the stop lamp signal and sends this signal as a brake switch signal to the hybrid vehicle control ECU through CAN communication line.
The hybrid vehicle control ECU performs the rationality check for these two input signals.

DTC Logic

INFOID:0000000004212097

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P1805	903	Brake switch	Rationally incorrect voltage signal from the stop lamp switch (ON signal) is sent to hybrid vehicle control ECU, compared with the brake switch signal (OFF signal) sent from the brake ECU.	• Harness or connectors (Stop lamp switch circuit is open or shorted.) • Stop lamp switch • Brake ECU • Hybrid vehicle control ECU
P1805	923	Brake switch	Rationally incorrect voltage signal from the stop lamp switch (OFF signal) is sent to hybrid vehicle control ECU, compared with the brake switch signal (ON signal) sent from the brake ECU.	• Harness or connectors (Stop lamp switch circuit is open or shorted.) • Stop lamp switch • Brake ECU • Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Fully depress the brake pedal for at least 5 seconds.
3. Fully release the brake pedal for at least 5 seconds.
4. Check DTC.

Is DTC detected?

YES >> Go to HBC-491, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212098

1.PRECONDITIONING

- 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. 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 DTC FOR BRAKE ECU

Check DTC for the brake ECU. Refer to BRC-45, "CONSULT-III Function".

Is DTC detected?

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

3.CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT TO HYBRID VEHICLE CONTROL ECU FOR

With CONSULT-III

1. Turn ignition switch ON.
2. Select “BRAKE SWITCH” in “” mode with CONSULT-III.
3. Check “BRAKE SWITCH” indication under the following conditions.

Monitor item	Condition		Indication
BRAKE SWITCH	Brake pedal	Slightly depressed	ON
		Fully released	OFF

With GST

1. Turn ignition switch ON.
2. Check the voltage between hybrid vehicle control ECU harness connector and ground.

Hybrid vehicle control ECU		Ground	Condition		Voltage
Harness connector	Terminal				
E66	148 (Stop lamp switch signal)	Ground	Brake pedal	Slightly depressed	Battery voltage
				Fully released	Approx. 0V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 4.

4. CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT TO HYBRID VEHICLE CONTROL ECU FOR OPEN AND SHORT-II

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch harness connector.
3. Disconnect hybrid vehicle control ECU harness connector.
4. Check the continuity between hybrid vehicle control ECU harness connector and stop lamp switch harness connector.

hybrid vehicle control ECU		Stop lamp switch		Continuity
Harness connector	Terminal	Harness connector	Terminal	
E66	148 (STP)	E38	2	Existed

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

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

5. DETECT MALFUNCTIONING PART

Check the following.

- Joint connector E-4
- Harness for open or short between hybrid vehicle control ECU and stop lamp switch

>> Repair open circuit or short to ground or short to power in harness or connectors.

6. CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT TO BRAKE ECU FOR OPEN AND SHORT-II

1. Turn ignition switch OFF.
2. Check the continuity between brake ECU harness connector and stop lamp switch harness connector for open and short.
   Refer to BRC-148, "Wiring Diagram - BRAKE CONTROL SYSTEM -".

Is the inspection result normal?

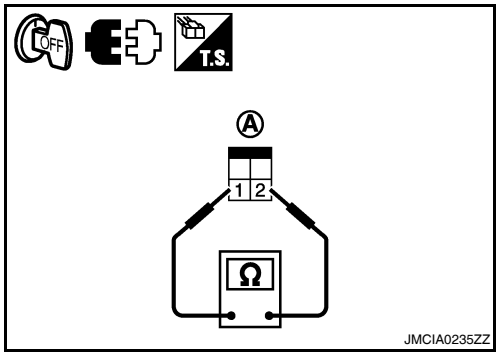
YES >> Replace brake ECU.
NG >> Repair or replace harness or connectors.

Component Inspection (Stop Lamp Switch)

INFOID:0000000004212099

1.CHECK STOP LAMP SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch harness connector.
3. Check the continuity between stop lamp switch terminals under the following conditions.



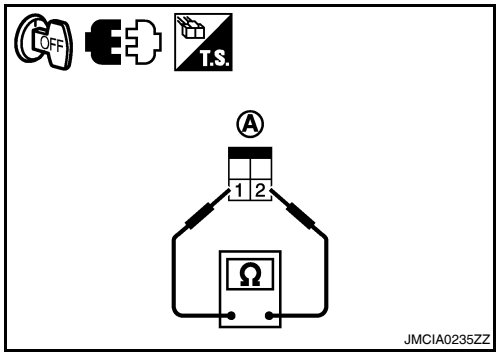
Stop lamp switch (A) Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK STOP LAMP SWITCH-II

1. Adjust stop lamp switch installation. Refer to BR-12, "Inspection and Adjustment".
2. Check the continuity between stop lamp switch terminals under the following conditions.



Stop lamp switch (A) Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

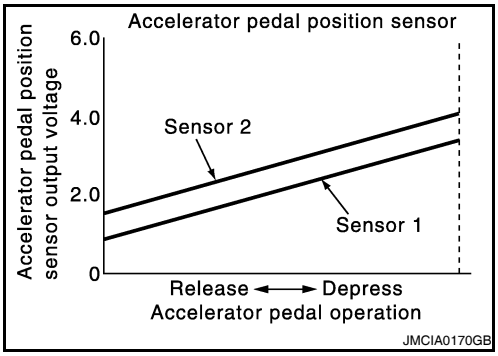
YES >> INSPECTION END
NO >> Replace stop lamp switch.

P2120-152, P2121-106, P2122-104, P2123-105, 2125-153

Description

INFOID:0000000004212100

The accelerator pedal position sensor is installed on the upper end of the accelerator pedal assembly. The sensor detects the accelerator position and sends a signal to the hybrid vehicle control ECU.
Accelerator pedal position sensor has two sensors. These sensors are a kind of potentiometers which transform the accelerator pedal position into output voltage, and emit the voltage signal to the hybrid vehicle control ECU. The sensor 1 signal is used to detect the accelerator pedal position and the sensor 2 signal is used as a confirmation to allow the detection of malfunction in the sensor itself. In addition, these sensors detect how much the accelerator pedal is depressed and feed the voltage signals to the hybrid vehicle control ECU. The hybrid vehicle control ECU judges the current opening angle of the accelerator pedal from these signals, and sends the engine speed request signal and engine power request signal to the ECM. The ECM controls the throttle control motor based on these signals. Furthermore, the hybrid vehicle control ECU uses these signals for operating motor torque.



Idle position of the accelerator pedal is determined by the hybrid vehicle control ECU receiving the signal from the accelerator pedal position sensor. The hybrid vehicle control ECU uses this signal for various engine operation.

DTC Logic

INFOID:0000000004212101

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P2120	152	Throttle/pedal position sensor/ switch “D” circuit	Main sensor circuit malfunction or level is not stable	• Wire harness or connector • Accelerator pedal assembly • Hybrid vehicle control ECU
P2121	106	Throttle/pedal position sensor/ switch “D” circuit range/performance	Internal error of the main sensor	
P2122	104	Throttle/pedal position sensor/ switch “D” circuit low input	Open or short to GND in the main sensor circuit	
P2123	105	Throttle/pedal position sensor/ switch “D” circuit high input	Short to +B in the main sensor circuit	
P2125	153	Throttle/pedal position sensor/ switch “E” circuit	Sub sensor circuit wiring malfunction or level is not stable	
P2126	109	Throttle/pedal position sensor/ switch “E” circuit range/performance	Internal error of the sub sensor	
P2127	107	Throttle/pedal position sensor/ switch “E” circuit low input	Open or short to GND in the sub sensor circuit	
P2128	108	Throttle/pedal position sensor/ switch “E” circuit high input	Short to +B in the sub sensor circuit	
P2138	110	Throttle/pedal position sensor/ switch “D”/“E” voltage correlation	Difference between the main sensor value and sub sensor value is large or small.	
P2138	154	Throttle/pedal position sensor/ switch “D”/“E” voltage correlation	Main or sub sensor circuit wiring malfunction	

Diagnosis Procedure

INFOID:0000000004212102

1.PRECONDITIONING

- 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. 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. READ VALUE OF CONSULT-III

1. Turn ignition switch ON.
2. Select “ACCEL SENSOR 1” and “ACCEL SENSOR 2” in “DATA MONITOR” mode with CONSULT-III.
3. Read the indication.

NOTE:
5V is described as 100% on the tester.

Pedal Condition	ACCEL SENSOR 1	ACCEL SENSOR 2
Not depressed	(8 to 28%) 0.4 to 1.4 V	(24 to 44%) 1.2 to 2.2 V
Fully depressed	(52 to 90%) 2.6 to 4.5 V	(68 to 100%) 3.4 to 5.3 V
Not depressed → Fully depressed → Not depressed (Accelerator pedal should be operated slowly)	Value changes progressively	Value changes progressively

OK or NG

OK >> Check for intermittent incident.
NG >> GO TO 3.

3. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

Refer to HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (ACCELERATOR LINK ROD ASSEMBLY CONNECTOR)

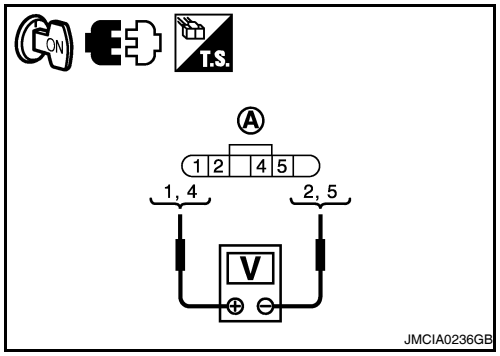
Check the connections of the accelerator link rod assembly connector.

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HYBRID VEHICLE CONTROL ECU

1. Disconnect the E40 accelerator pedal position sensor connector.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.



Accelerator pedal position sensor (A)		Accelerator pedal position sensor (A)		Voltage
Harness connector	Terminal	Harness connector	Terminal	
E40	4 (VC1)	E40	5 (GND1)	4.5 to 5.5V
	1 (VC2)		2 (GND2)	

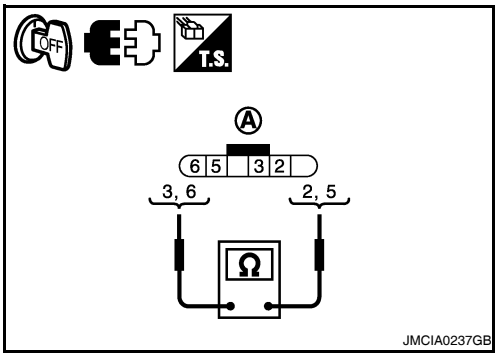
NOTE:
Turn ignition switch ON with the accelerator pedal position sensor connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

OK >> GO TO 6.
NG >> GO TO 8.

6. CHECK HYBRID VEHICLE CONTROL ECU

1. Turn ignition switch OFF.
2. Measure the resistance according to the value(s) in the table below.



Accelerator pedal position sensor (A)		Accelerator pedal position sensor (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E40	6 (VPA1)	E40	5 (GND1)	37 to 41 kΩ
	3 (VPA2)		2 (GND2)	

OK or NG

OK >> Replace accelerator pedal position sensor. (See ACC-3, "Removal and Installation").
NG >> GO TO 7.

7. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR PEDAL POSITION SENSOR)

1. Turn ignition switch OFF.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E66	147 (VPA)	Ground	Below 1V
	130 (EP1)		
	146 (VPA2)		
	129 (EP2)		

NOTE:
Turn ignition switch ON with the accelerator pedal position sensor and hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Accelerator pedal position sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	147 (VPA)	E40	6 (VPA1)	Below 1Ω
	113 (VCP1)		4 (VC1)	
	130 (EP1)		5 (GND1)	
	146 (VPA2)		3 (VPA2)	
	112 (VCP2)		1 (VC2)	
	129 (EP2)		2 (GND2)	

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	147 (VPA)	Ground	10 kΩ or higher
	113 (VCP1)		
	130 (EP1)		
	146 (VPA2)		
	112 (VCP2)		
	129 (EP2)		

Accelerator pedal position sensor		Ground	Resistance
Harness connector	Terminal		
E40	6 (VPA1)	Ground	10 kΩ
	4 (VC1)		
	5 (GND1)		
	3 (VPA2)		
	1 (VC2)		
	2 (GND2)		

OK or NG

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

8. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR PEDAL POSITION SENSOR)

1. Turn ignition switch OFF.
2. Disconnect connector E66 from the hybrid vehicle control ECU.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E66	147 (VPA)	Ground	Below 1V
	130 (EP1)		
	146 (VPA2)		
	129 (EP2)		

NOTE:
Turn ignition switch ON with the accelerator pedal position sensor and hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Accelerator pedal position sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	113 (VCP1)	E40	4 (VC1)	Below 1Ω
	130 (EP1)		5 (GND1)	
	112 (VCP2)		1 (VC2)	
	129 (EP2)		2 (GND2)	

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	113 (VCP1)	Ground	10 kΩ or higher
	130 (EP1)		
	112 (VCP2)		
	129 (EP2)		

Accelerator pedal position sensor		Ground	Resistance
Harness connector	Terminal		
E40	4 (VC1)	Ground	10 kΩ
	5 (GND1)		
	1 (VC2)		
	2 (GND2)		

OK or NG

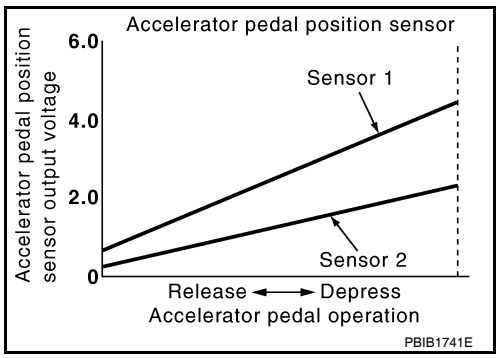
OK >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation")
NG >> Repair or replace harness or connector.

P2126-109, P2127-107, P2128-108, P2138-110, P2138-154

Description

INFOID:0000000004212103

The accelerator pedal position sensor is installed on the upper end of the accelerator pedal assembly. The sensor detects the accelerator position and sends a signal to the hybrid vehicle control ECU.
Accelerator pedal position sensor has two sensors. These sensors are a kind of potentiometers which transform the accelerator pedal position into output voltage, and emit the voltage signal to the hybrid vehicle control ECU. The sensor 1 signal is used to detect the accelerator pedal position and the sensor 2 signal is used as a confirmation to allow the detection of malfunction in the sensor itself. In addition, these sensors detect how much the accelerator pedal is depressed and feed the voltage signals to the hybrid vehicle control ECU. The hybrid vehicle control ECU judges the current opening angle of the accelerator pedal from these signals, and sends the engine speed request signal and engine power request signal to the ECM. The ECM controls the throttle control motor based on these signals. Furthermore, the hybrid vehicle control ECU uses these signals for operating motor torque.



Idle position of the accelerator pedal is determined by the hybrid vehicle control ECU receiving the signal from the accelerator pedal position sensor. The hybrid vehicle control ECU uses this signal for various engine operation.

DTC Logic

INFOID:0000000004212104

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P2120	152	Throttle/pedal position sensor/ switch “D” circuit	Main sensor circuit malfunction or level is not stable	• Wire harness or connector • Accelerator pedal assembly • Hybrid vehicle control ECU
P2121	106	Throttle/pedal position sensor/ switch “D” circuit range/performance	Internal error of the main sensor	
P2122	104	Throttle/pedal position sensor/ switch “D” circuit low input	Open or short to GND in the main sensor circuit	
P2123	105	Throttle/pedal position sensor/ switch “D” circuit high input	Short to +B in the main sensor circuit	
P2125	153	Throttle/pedal position sensor/ switch “E” circuit	Sub sensor circuit wiring malfunction or level is not stable	
P2126	109	Throttle/pedal position sensor/ switch “E” circuit range/performance	Internal error of the sub sensor	
P2127	107	Throttle/pedal position sensor/ switch “E” circuit low input	Open or short to GND in the sub sensor circuit	
P2128	108	Throttle/pedal position sensor/ switch “E” circuit high input	Short to +B in the sub sensor circuit	
P2138	110	Throttle/pedal position sensor/ switch “D”/“E” voltage correlation	Difference between the main sensor value and sub sensor value is large or small.	
P2138	154	Throttle/pedal position sensor/ switch “D”/“E” voltage correlation	Main or sub sensor circuit wiring malfunction	

Diagnosis Procedure

INFOID:0000000004212105

1.PRECONDITIONING

- 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. 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. READ VALUE OF CONSULT-III

1. Turn ignition switch ON.
2. Select “ACCEL SENSOR 1” and “ACCEL SENSOR 2” in “DATA MONITOR” mode with CONSULT-III.
3. Read the indication.

NOTE:
5V is described as 100% on the tester.

Pedal Condition	ACCEL SENSOR 1	ACCEL SENSOR 2
Not depressed	(8 to 28%) 0.4 to 1.4 V	(24 to 44%) 1.2 to 2.2 V
Fully depressed	(52 to 90%) 2.6 to 4.5 V	(68 to 100%) 3.4 to 5.3 V
Not depressed → Fully depressed → Not depressed (Accelerator pedal should be operated slowly)	Value changes progressively	Value changes progressively

OK or NG

OK >> Check for intermittent incident.
NG >> GO TO 3.

3. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

Refer to HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (ACCELERATOR LINK ROD ASSEMBLY CONNECTOR)

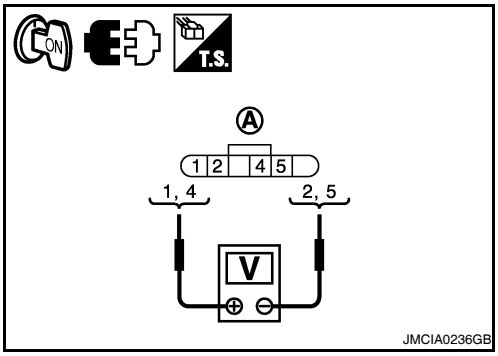
Check the connections of the accelerator link rod assembly connector.

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HYBRID VEHICLE CONTROL ECU

1. Disconnect the E40 accelerator pedal position sensor connector.
2. Turn ignition switch ON.
3. Measure the voltage according to the value(s) in the table below.



Accelerator pedal position sensor (A)		Accelerator pedal position sensor (A)		Voltage
Harness connector	Terminal	Harness connector	Terminal	
E40	4 (VC1)	E40	5 (GND1)	4.5 to 5.5V
	1 (VC2)		2 (GND2)	

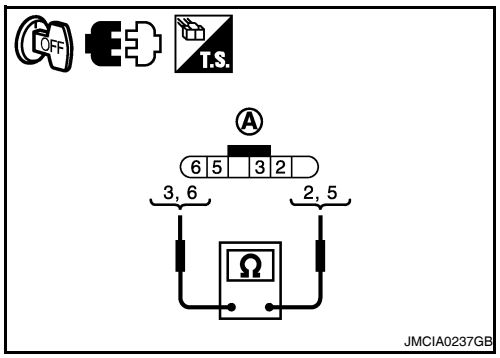
NOTE:
Turn ignition switch ON with the accelerator pedal position sensor connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

OK >> GO TO 6.
NG >> GO TO 8.

6. CHECK HYBRID VEHICLE CONTROL ECU

1. Turn ignition switch OFF.
2. Measure the resistance according to the value(s) in the table below.



Accelerator pedal position sensor (A)		Accelerator pedal position sensor (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E40	6 (VPA1)	E40	5 (GND1)	37 to 41 kΩ
	3 (VPA2)		2 (GND2)	

OK or NG

OK >> Replace accelerator pedal position sensor. (See ACC-3, "Removal and Installation").
NG >> GO TO 7.

7. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR PEDAL POSITION SENSOR)

1. Turn ignition switch OFF.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E66	147 (VPA)	Ground	Below 1V
	130 (EP1)		
	146 (VPA2)		
	129 (EP2)		

NOTE:
Turn ignition switch ON with the accelerator pedal position sensor and hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Accelerator pedal position sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	147 (VPA)	E40	6 (VPA1)	Below 1Ω
	113 (VCP1)		4 (VC1)	
	130 (EP1)		5 (GND1)	
	146 (VPA2)		3 (VPA2)	
	112 (VCP2)		1 (VC2)	
	129 (EP2)		2 (GND2)	

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	147 (VPA)	Ground	10 kΩ or higher
	113 (VCP1)		
	130 (EP1)		
	146 (VPA2)		
	112 (VCP2)		
	129 (EP2)		

Accelerator pedal position sensor		Ground	Resistance
Harness connector	Terminal		
E40	6 (VPA1)	Ground	10 kΩ
	4 (VC1)		
	5 (GND1)		
	3 (VPA2)		
	1 (VC2)		
	2 (GND2)		

OK or NG

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

8. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR PEDAL POSITION SENSOR)

1. Turn ignition switch OFF.
2. Disconnect connector E66 from the hybrid vehicle control ECU.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E66	147 (VPA)	Ground	Below 1V
	130 (EP1)		
	146 (VPA2)		
	129 (EP2)		

NOTE:
Turn ignition switch ON with the accelerator pedal position sensor and hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Accelerator pedal position sensor		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	113 (VCP1)	E40	4 (VC1)	Below 1Ω
	130 (EP1)		5 (GND1)	
	112 (VCP2)		1 (VC2)	
	129 (EP2)		2 (GND2)	

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	113 (VCP1)	Ground	10 kΩ or higher
	130 (EP1)		
	112 (VCP2)		
	129 (EP2)		

Accelerator pedal position sensor		Ground	Resistance
Harness connector	Terminal		
E40	4 (VC1)	Ground	10 kΩ
	5 (GND1)		
	1 (VC2)		
	2 (GND2)		

OK or NG

OK >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation")

NG >> Repair or replace harness or connector.

P2511-149

Description

INFOID:0000000004212106

The hybrid vehicle control ECU monitors the power resource VB voltage to detect an instantaneous interruption.

DTC Logic

INFOID:0000000004212107

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P2511	149	ECM/PCM power relay sense circuit intermittent	When the ignition switch ON (READY), the hybrid vehicle control ECU is reset.	• Wire harness or connector • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004212108

1.PRECONDITIONING

- 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. 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 BATTERY TERMINAL

Check the connection of the auxiliary battery terminal.

Result: The terminal is connected securely and there is no contact problem.

OK or NG

OK >> GO TO 3.
NG >> Connect securely.

3.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - IGCT RELAY)

1. Remove the IGCT relay from the high voltage fuse and fusible link box.
2. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		High voltage fuse and fusible link box		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	174 (VB)	V-1	5 (IGCT relay)	Below 1 Ω
	168 (VB2)			

OK or NG

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

5. CHECK FOR INTERMITTENT INCIDENT

Check for intermittent incident. (See GI-42, "Intermittent Incident")
- Check the connection and terminal contact pressure of connectors and wire harness between the hybrid vehicle control ECU and the high voltage fuse and fusible link box.
- When the ignition switch ON (READY), jiggle the connectors and wire harness between the hybrid vehicle control ECU and the high voltage fuse and fusible link box.

OK or NG

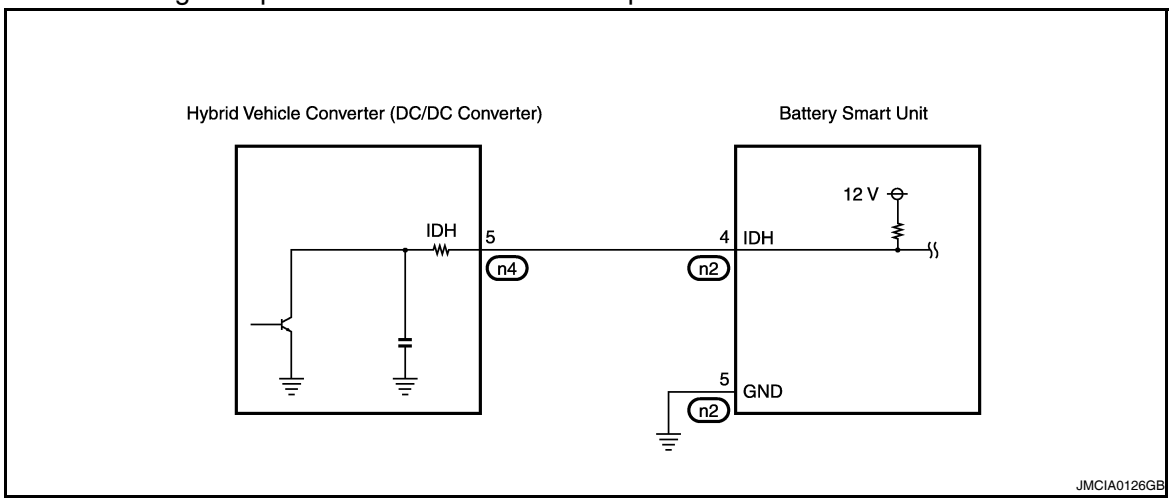
OK >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation").
NG >> Repair malfunctioning parts, component and area.

P2519-766

Description

INFOID:0000000004212109

The hybrid vehicle converter (DC/DC converter) sends IDH signals to the hybrid vehicle control ECU to inform the ECU of the cooling fan operation condition and the output current limitation condition due to overheating.



DTC Logic

INFOID:0000000004212110

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P2519	766	A/C request “A” circuit	Malfunction in the cooling fan operation condition signal circuit	• Battery smart unit • Hybrid vehicle converter (DC/DC converter) • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004212111

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Result: DTC P0AE6-225 is also output.

Is DTC detected?

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

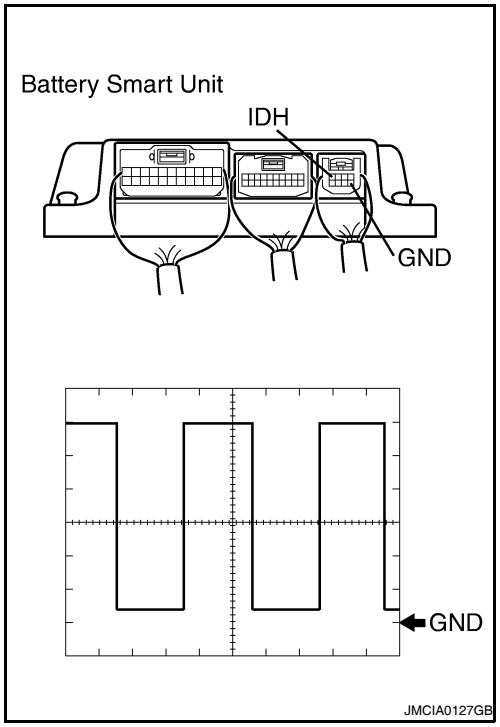
3.CHECK BATTERY SMART UNIT

CAUTION:

Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.
2. Connect an oscilloscope between the battery smart unit terminals specified in the table below, and measure the waveform.

Item	Contents
Terminal	IDH (n2-4) - GND (n2-5)
Equipment Setting	2 V/DIV, 2 ms./DIV
Condition	Ignition switch ON



Result: The waveform appears as shown in the illustration.

NOTE:
- For the removal and installation procedures related to inspection of the waveform of the battery smart unit, (See HBB-101, "Removal and Installation").
- The frequency of the waveform differs (100 to 900 kHz, 8 to 14 V) depending on operation conditions of the cooling fan of the hybrid vehicle converter (DC/DC converter).

OK or NG

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

4. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

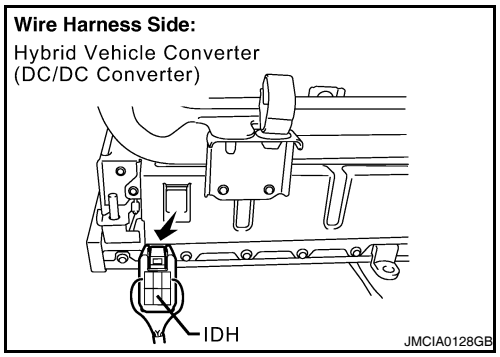
OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Check that the service plug grip is not installed.
3. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and Installation").
4. Turn ignition switch ON.
5. Measure the voltage according to the value(s) in the table below.

Hybrid Vehicle Converter		Ground	Voltage
Harness connector	Terminal		
n4	5 (IDH)	Ground	9 to 14V



NOTE:
Turn ignition switch ON with the hybrid vehicle converter (DC/DC converter) connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

OK >> Replace hybrid vehicle converter. (See HBB-103, "Removal and Installation").
NG >> GO TO 6.

6. CHECK CONNECTOR CONNECTION CONDITION (BATTERY SMART UNIT CONNECTOR)

CAUTION:

Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check the connection of the battery smart unit connector.

OK: The connector is connected securely and there are no contact problems.

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HYBRID VEHICLE CONVERTER)

CAUTION:

Be sure to wear insulated gloves.

1. Turn ignition switch OFF.
2. Check that the service plug grip is not installed.
3. Disconnect the n2 battery smart unit connector (See HBB-101, "Removal and Installation").
4. Turn ignition switch ON.
5. Measure the resistance according to the value(s) in the table below.

Battery Smart Unit		Hybrid Vehicle Converter (DC/DC Converter)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
n2	4 (IDH)	n4	5 (IDH)	Below 1Ω

Battery Smart Unit		Ground	Resistance
Harness connector	Terminal		
n2	4 (IDH)	Ground	10 kΩ or higher

Hybrid Vehicle Converter (DC/DC Converter)		Ground	Resistance
Harness connector	Terminal		
n4	5 (IDH)	Ground	10 kΩ or higher

OK or NG

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

P3000-388

Description

INFOID:0000000004212112

The hybrid vehicle control ECU alerts the driver and performs fail-safe control based on error signals received from the battery smart unit. This DTC is set when the SOC (state of charge) of the HV battery starts to drop as a result of leaving the shift lever in the N position, running out of fuel, or a malfunction in the HV control system.

DTC Logic

INFOID:0000000004212113

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3000	388	HV battery malfunction	Dischage inhibition control malfunction	• Fuel level • HV battery

Diagnosis Procedure

INFOID:0000000004212114

1.PRECONDITIONING

- 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. 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.
- If the vehicle is stopped or parked with the shift lever in the N position for a long time, DTC P3000-388 may be set because the HV battery cannot be charged.
- When the engine cannot be started, DTC P3000-388 may be set because the HV battery cannot be charged.

>> GO TO 2.

2.CHECK DTC OUTPUT (HYBRID SYSTEM)

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

Result: DTCs other than P3000-388 or P3000-389 are output.

Is DTC detected?

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

3.CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

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

Result: Engine control system DTCs are output.

Is DTC detected?

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

4.CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.

NG >> Refuel vehicle.

5. CHECK ENGINE START

1. Turn ignition switch ON (READY).
2. Check if the engine starts.

NOTE:

- Depressing the accelerator pedal with the shift lever in the P position will cause the engine to start.

OK: The engine starts.

- Do not turn ignition switch ON (READY) and OFF repeatedly because this may cause DTC P3000-389 to be set.

YES or NO

YES >> Leave vehicle in P position, and charge HV battery in idle status until idling stops.
NO >> Replace HV battery assembly. (See HBB-97, "Removal and Installation").

P3000-389

Description

INFOID:0000000004212115

The hybrid vehicle control ECU alerts the driver and performs fail-safe control based on error signals received from the battery smart unit.
This DTC is set if the HV battery is discharged excessively or the HV control system malfunctions.
NOTE:
If the HV battery voltage has dropped due to a malfunction in other components such as the inverter with converter assembly and the hybrid vehicle transmission assembly, recharging the HV battery will restore the voltage. If the HV battery voltage has dropped excessively after the vehicle was left for a long time, the HV battery will need to be replaced.

DTC Logic

INFOID:0000000004212116

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3000	389	HV battery malfunction	HV battery voltage drops	• Engine assembly • Hybrid transaxle • HV battery

Diagnosis Procedure

INFOID:0000000004212117

1.PRECONDITIONING

- 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. 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.
- If the vehicle is stopped or parked with the shift lever in the N position for a long time, DTC P3000-389 may be set because the HV battery cannot be charged.
- When the engine cannot be started, DTC P3000-389 may be set because the HV battery cannot be charged.

>> GO TO 2.

2.CHECK DTC OUTPUT (HYBRID SYSTEM)

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

Result: DTCs other than P3000-388 or P3000-389 are output.

NOTE:
If the HV battery voltage has dropped due to a malfunction in other components (inverter with converter assembly, hybrid transaxle), recharge or replace the HV battery and then repair the malfunctioning part.

Is DTC detected?

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

3.CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

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

Result: Engine control system DTCs are output.

Is DTC detected?

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

4. CHECK ENGINE START

1. Turn ignition switch ON (READY).
2. Check if the engine starts.

NOTE:
Depressing the accelerator pedal with the shift lever in the P position will cause the engine to start.

OK: The engine starts.

CAUTION:
Do not turn ignition switch ON (READY) repeatedly after duplicating the problem symptom indicated by DTC P3000-389 and clearing the DTCs. This may cause another problem to occur.

YES or NO

YES >> Leave vehicle in P position, and charge HV battery in idle status until idling stops.
NO >> GO TO 5.

5. CHECK CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

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

6. CHECK CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> GO TO 7.

7. REPAIR OR REPLACE ENGINE ASSEMBLY

>> GO TO 4.

8. REPLACE HYBRID TRANSAXLE

NOTE:
See TM-36, "Removal and Installation".

>> GO TO 4.

P3000-603

Description

INFOID:0000000004212118

The hybrid vehicle control ECU monitors its internal operation and detects malfunctions.

DTC Logic

INFOID:0000000004212119

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3000	603	HV battery malfunction	A HV battery inverter cooling system error signal is detected in the hybrid vehicle control ECU.	• Hybrid vehicle control ECU • HV battery assembly

Diagnosis Procedure

INFOID:0000000004212120

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

Result: DTCs other than P3000-603 are output.

Is DTC detected?

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

3.REPLACE HYBRID VEHICLE CONTROL ECU

Replace the hybrid vehicle control ECU (See HBC-644, "Removal and Installation").

>> GO TO 4.

4.CLEAR DTC

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

Result: DTC P0A09-591 is output.

>> GO TO 5.

5.RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

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

Result: DTCs other than P3000-603 are output.

< COMPONENT DIAGNOSIS >

Is DTC detected?

YES >> Replace HV battery assembly. (See HBB-105, "Removal and Installation").
NO >> COMPLETED

P3004-131

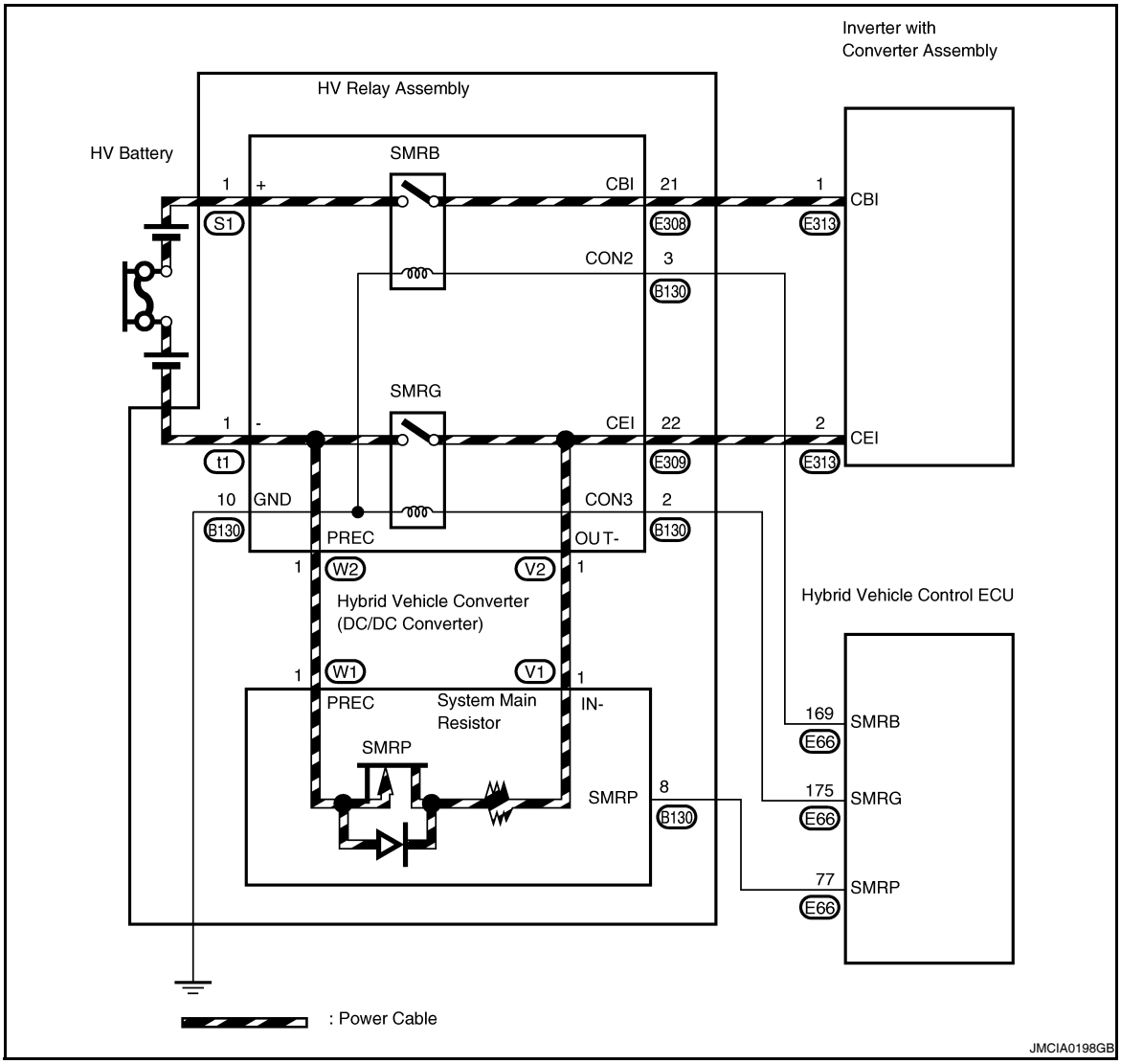
Description

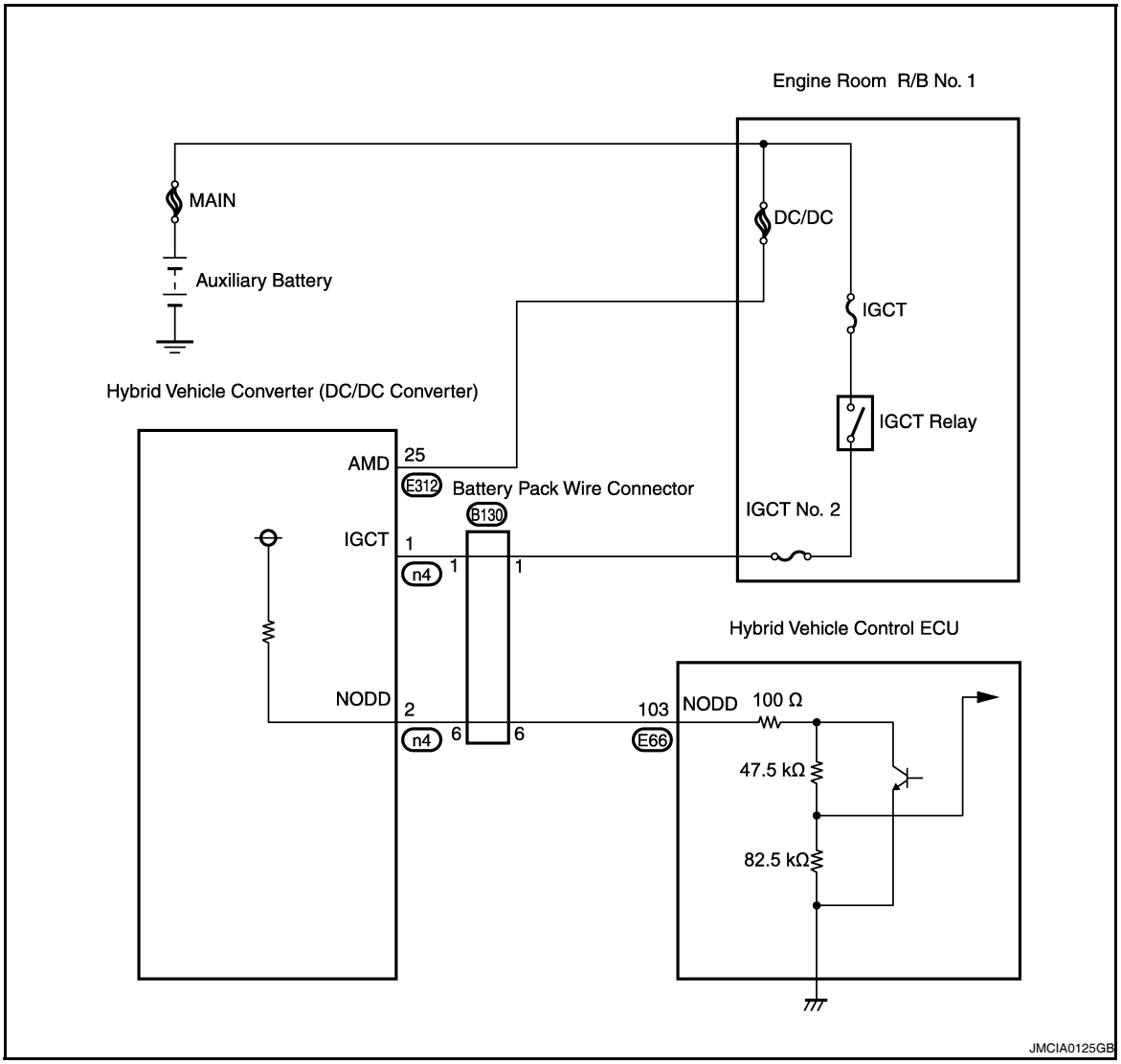
INFOID:0000000004212121

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
21
22
E308
E309
1
2
E313
CBI
CEI
CON2
3
B130
CON3
2
10
GND
PREC
OUT-
W2
V2
W1
V1
Hybrid Vehicle Converter
(DC/DC Converter)
PREC
System Main
Resistor
IN-
SMRP
8
Hybrid Vehicle Control ECU
169
175
77
SMRB
SMRG
SMRP
E66
: Power Cable
JMCIA0198GB



DTC Logic

INFOID:0000000004212122

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3004	131	Power cable malfunction	The inverter voltage is not boosted during precharge (time from when SMRP turns on until when SMRG turns on).	• HV relay assembly • Frame wire • Inverter with converter assembly • HV battery • Wire harness or connector • Hybrid vehicle converter (DC/DC converter)

Diagnosis Procedure

INFOID:0000000004212123

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Related Part
P0A95	Electric vehicle fuse circuit
P0AE7-224, P0AE6-225	SMRP control line circuit
P0ADC-226, P0ADB-227	SMRB control line circuit
P0A1F, P3105, P0AFA	Battery smart unit, VB sensor circuit
P0ABF, P0AC0, P0AC1, P0AC2	IB sensor circuit
P3004-800, 801	High-voltage power source line circuit
P0A1A-156, 658, 151, 155, 659 P0A1B-511, 164, 163, 512, 193, 786, 788, 661 P0A78-266, 267, 523, 586, P0A94-442	VH sensor circuit

Is DTC detected?

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

3.CHECK FREEZE FRAME DATA

1. Turn ignition switch ON.
2. Check DTC.
3. Read the freeze frame data for DTC P3004-131.

Result	Related Part
Inverter voltage (VH) is below 50 V and difference between HV battery voltage (PWR RESOURCE VB) and boost converter voltage (VL) is 50 V or less.	A
Other than above	B

A or B

A >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").
B >> GO TO 4.

4.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

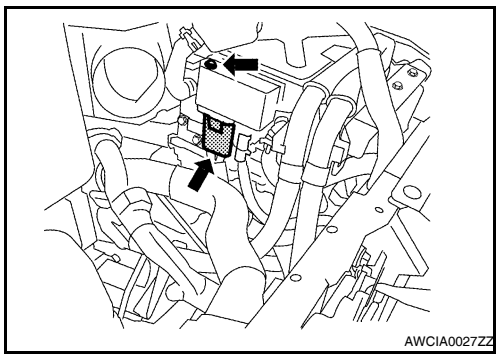
5.CHECK CONDITION OF FRAME WIRE CONNECTION(S) (INVERTER WITH CONVERTER ASSEMBLY SIDE)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip. (See HBC-632, "Precautions for Inspecting the Hybrid Control System")

2. Check the connections between the frame wire and the inverter with converter assembly.

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



OK or NG

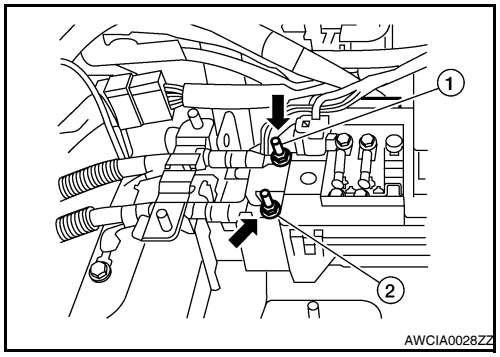
OK >> GO TO 6.
NG >> Connect securely.

6. CHECK CONDITION OF FRAME WIRE CONNECTION(S) (HV RELAY ASSEMBLY SIDE)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check the connections between the frame wire and the HV relay assembly.
   NOTE:
   For the removal and installation procedures related to inspection of the frame wire connection, (See HBB-105, "Removal and Installation").

Torque: 9.0 N*m (92 kgf*cm, 81 in.*lbf)



- 1: Frame wire connector h3 (–)
- 2: Frame wire connector h4 (+)

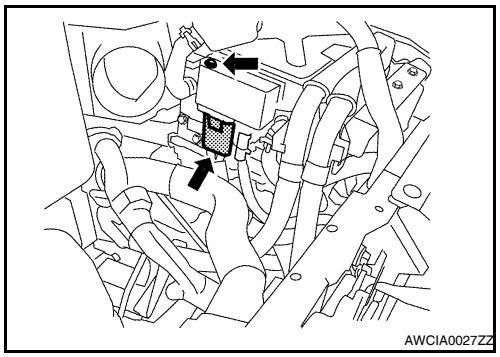
OK or NG

OK >> GO TO 7.
NG >> Connect securely.

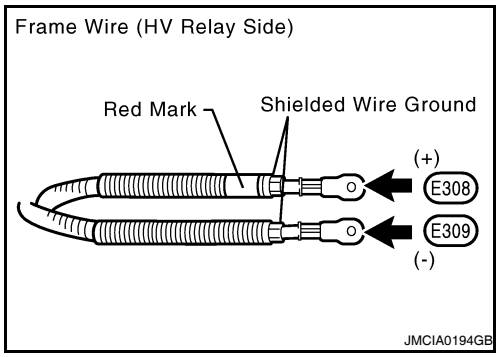
7. CHECK FRAME WIRE

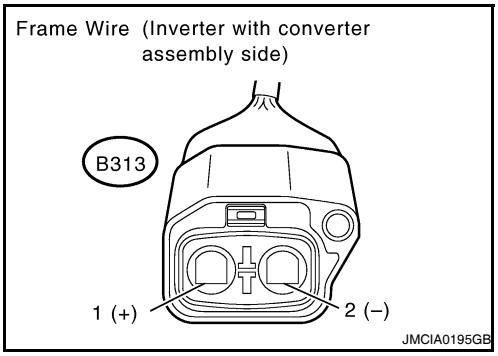
CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the frame wire from the inverter with converter assembly (See HBC-638, "Removal and Installation").
3. Disconnect the frame wire from the HV relay assembly (See HBB-105, "Removal and Installation").



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





Frame Wire (Inverter with Converter Assembly Side)		Frame Wire (HV Relay Assembly Side)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E313	1 (High voltage +)	E308	21 (High voltage +)	Below 1Ω
	2 (High voltage –)	E309	22 (High voltage –)	Below 1Ω

OK or NG

OK >> GO TO 8.
NG >> Replace frame wire.

8. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

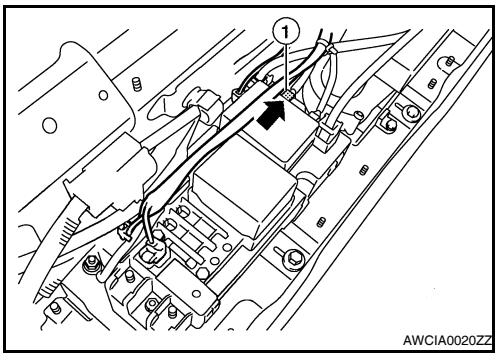
OK >> GO TO 9.
NG >> Connect securely.

9. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

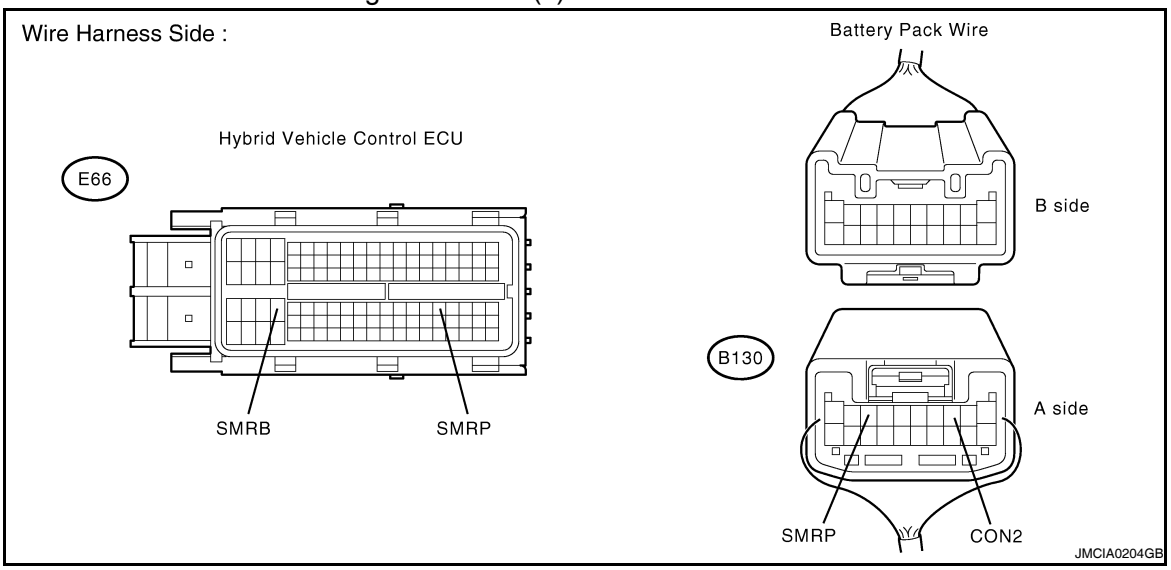
NOTE:
Be sure to wear insulated groves.

1. Check that the service plug grip is not installed.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Disconnect the B130 battery pack wire connector (See HBB-97, "Removal and Installation").
   NOTE:
   Due to the time required to disconnect the HV relay assembly and hybrid vehicle converter (DC/DC converter) connectors, the battery pack wire resistance check should be performed before these connectors are disconnected.

- Battery pack wire connector B130 (1)



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



Hybrid Vehicle Control ECU		Battery Pack Wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	169 (SMRB)	B130	3 (CON2)	Below 1Ω
	77 (SMRP)		8 (SMRP)	Below 1Ω

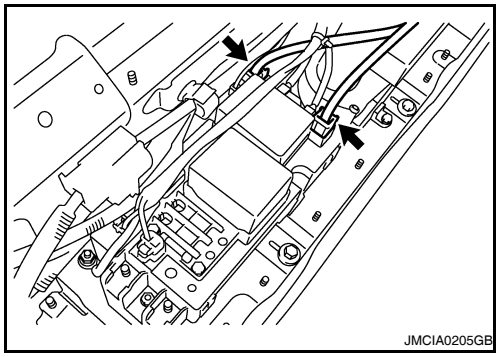
OK or NG

OK >> GO TO 10.
NG >> Repair or replace harness or connector.

10. CHECK CONDITION OF MAIN BATTERY CABLE CONNECTION(S)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check the connections between the main battery cable and the HV relay assembly.



DTC No.	Related Part
The connectors are connected securely and there are no contact problems.	A
The connectors are not connected securely.	B
The HV relay assembly connector is damaged.	C
The main battery cable is damaged.	D

NOTE:
The main battery cable and HV battery are supplied as one unit.

A, B, C or D

A >> GO TO 11.
B >> Connect securely.
C >> Replace HV relay assembly. (See HBB-105, "Removal and Installation").
D >> Replace HV battery assembly. (See HBB-97, "Removal and Installation").

11. CHECK HV BATTERY ASSEMBLY

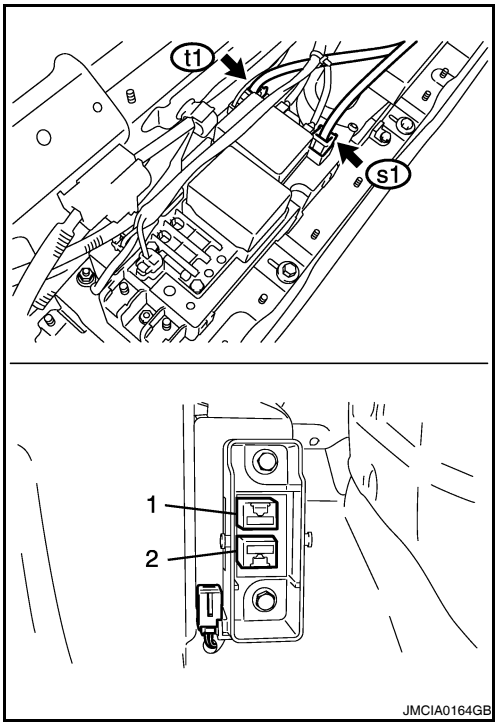
CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.

2. Disconnect the main battery cable from the HV relay assembly (See HBB-105, "Removal and Installation").
3. Measure the voltage according to the value(s) in the table below.

Harness connector		Service plug grip		Voltage
Harness connector	Terminal	Component connector	Terminal	
s1	1	—	1	114 to 190V
t1	1	—	2	90 to 190V

CAUTION:
Do not allow the probes of the electrical tester to contact each other during this inspection.



OK or NG

OK >> GO TO 12.
NG >> Replace HV battery assembly. (See HBB-97, "Removal and Installation").

12. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.
2. Check the connections of the HV relay assembly connectors.

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

NOTE:
For the removal procedure of the HV relay assembly connector, (See HBB-105, "Removal and Installation").

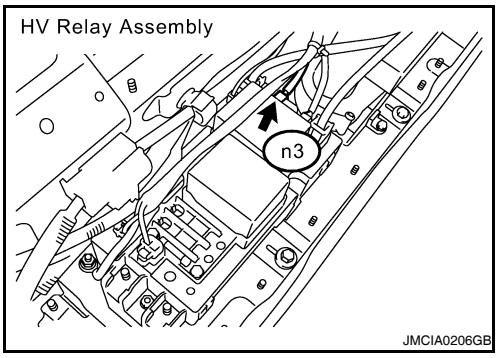
OK or NG

OK >> GO TO 13.
NG >> Connect securely.

13. CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR)

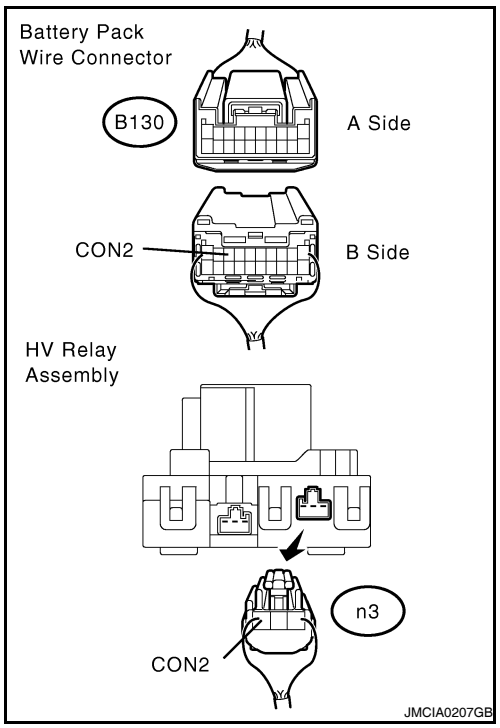
CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n3 HV relay assembly connector.



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

Battery pack wire connector		HV relay assembly		Resistance
Component connector	Terminal	Harness connector	Terminal	
B130	3 (CON2)	n3	3 (CON2)	Below 1Ω



OK or NG

OK >> GO TO 14.
NG >> Repair or replace harness or connector.

14. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

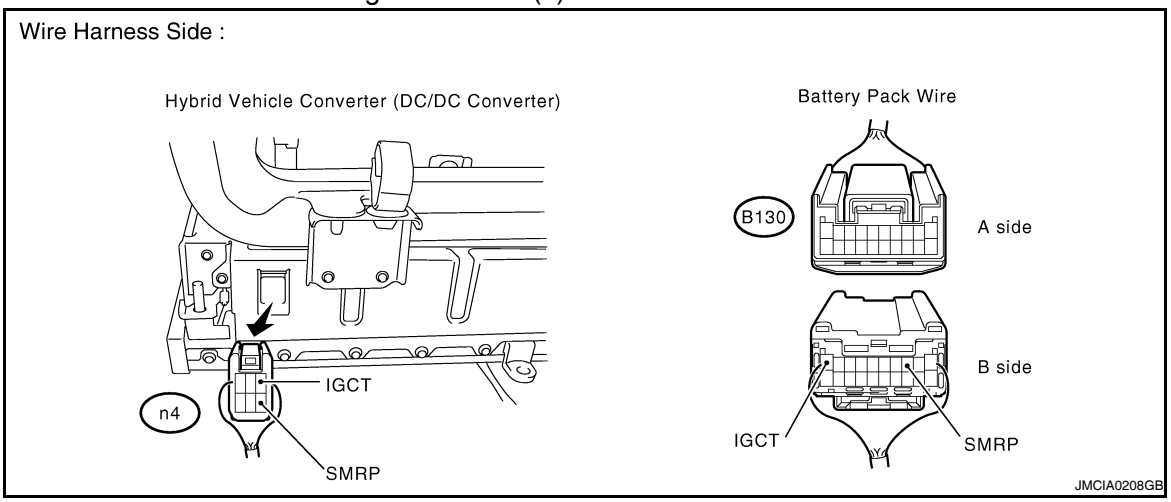
OK or NG

OK >> GO TO 15.
NG >> Connect securely.

15. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



Battery pack wire		Hybrid vehicle converter (DC/DC converter)		Resistance
Component connector	Terminal	Harness connector	Terminal	
B130	8 (SMRP)	n4	4 (SMRP)	Below 1Ω

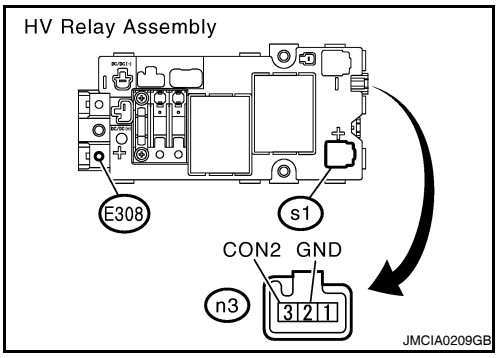
OK or NG

OK >> GO TO 16.
NG >> Repair or replace harness or connector.

16. INSPECT HV RELAY ASSEMBLY (SMRB)

CAUTION:
Be sure to wear insulated gloves and protective goggles.

1. Check that the service plug grip is not installed.
2. Remove the HV relay assembly from the vehicle (See HBB-105, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



HV relay assembly		HV relay assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E308	21	s1	1	Below 1Ω When battery voltage (12 V) applied to terminals n3-2 and n3-3)

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

HV relay assembly		HV relay assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
n3	3 (CON2)	n3	2 (GND)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

OK or NG

OK >> GO TO 17.
NG >> Replace hv relay assembly. (See HBB-105, "Removal and Installation")

17. CHECK FOR INTERMITTENT PROBLEM

NOTE:
If DTC P3004-131 is output again after performing the inspection, replace the hybrid vehicle converter (DC/DC converter). If DTC P3004-131 is not output, replace the HV relay assembly.

YES or NO

YES >> Replace hybrid vehicle converter. (See HBB-103, "Removal and Installation").
NO >> Replace hv relay assembly. (See HBB-105, "Removal and Installation").

P3004-132

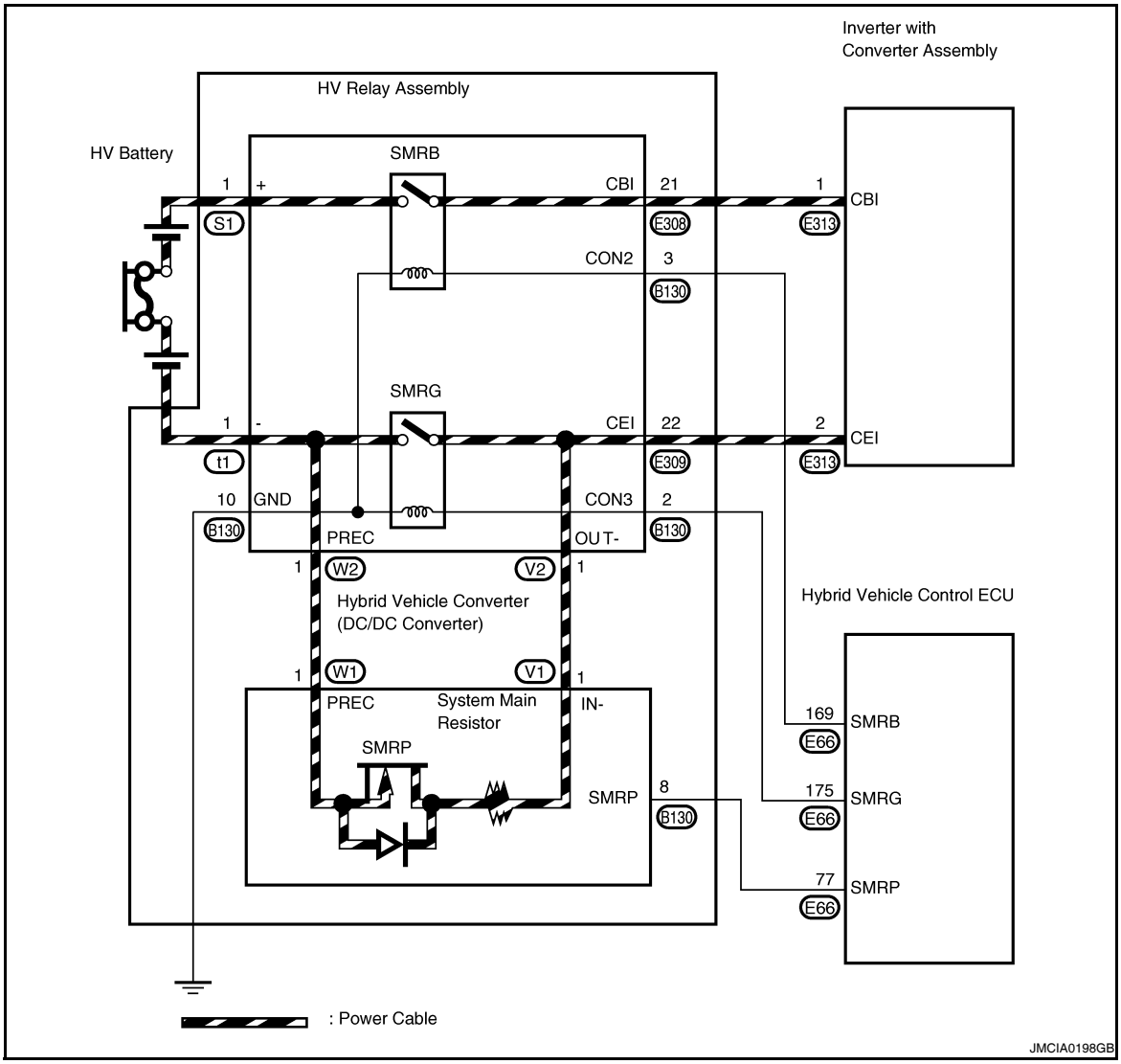
Description

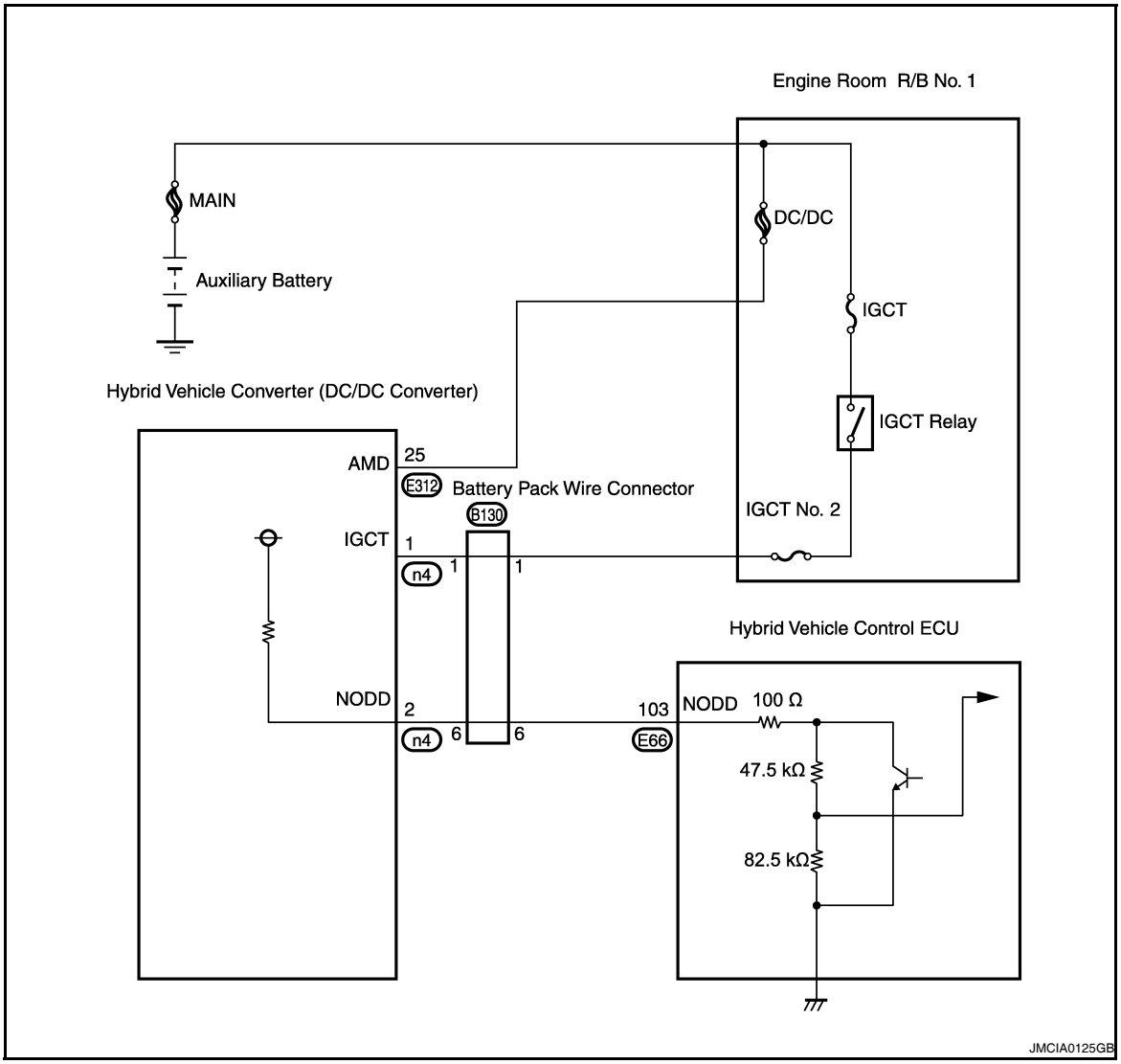
INFOID:0000000004212124

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
21
22
E308
E309
1
2
E313
CBI
CEI
CON2
3
B130
10
GND
CON3
2
PREC
OUT-
W2
V2
Hybrid Vehicle Converter
(DC/DC Converter)
W1
V1
PREC
System Main
Resistor
IN-
SMRP
8
Hybrid Vehicle Control ECU
169
SMRB
E66
175
SMRG
77
SMRP
: Power Cable
JMCIA0198GB



DTC Logic

INFOID:0000000004212125

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3004	132	Power cable malfunction	The inverter is not precharged	• HV relay assembly • Frame wire • Inverter with converter assembly • HV battery • Wire harness or connector

Diagnosis Procedure

INFOID:0000000004212126

1.PRECONDITIONING

- 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. 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 DTC OUTPUT

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

DTC No.	Related Part
P0A95	Electric vehicle fuse circuit
P0AE7-224, P0AE6-225	SMRP control line circuit
P0ADC-226, P0ADB-227	SMRB control line circuit
P0A1F, P3105, P0AFA	Battery smart unit circuit, VB sensor circuit
P0ABF, P0AC0, P0AC1, P0AC2	IB sensor circuit
P3004-131, 800, 801	High-voltage power source line circuit
P0A1A-156, 658, 151, 155, 659, P0A1B-511, 164, 163, 512, 193, 786, 788, 661 P0A78-266, 267, 523, 586, P0A94-442	VH sensor circuit

Is DTC detected?

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

3.CHECK FREEZE FRAME DATA

1. Turn ignition switch ON.
2. Check DTC.
3. Read the freeze frame data for DTC P3004-132.

Result	Proceed to
Difference between HV battery voltage (PWR RESOURCE VB) and boost converter voltage (VL) is 50V or less, difference between HV battery voltage (PWR RESOURCE VB) and inverter voltage (VH) is more than 70V, and difference between boost converter voltage (VL) and inverter voltage (VH) is more than 90V.	A
HV battery current (IB) is 3 A or more.	B
Other than above	C

A, B or C

A >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").
B >> Go to Diagnosis Procedure relevant to output DTC. (P3004-800)
C >> GO TO 4.

4.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

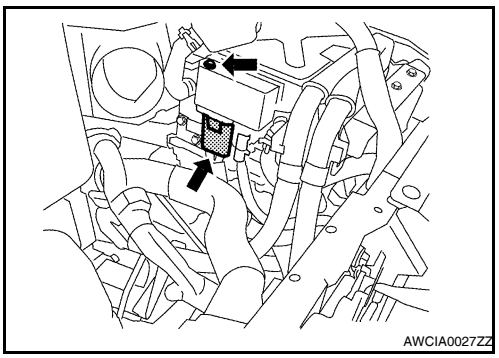
OK >> GO TO 5.
NG >> Connect securely.

5.CHECK CONDITION OF FRAME WIRE CONNECTION(S) (INVERTER WITH CONVERTER ASSEMBLY SIDE)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.

2. Check the connections between the frame wire and the inverter with converter assembly.



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

OK or NG

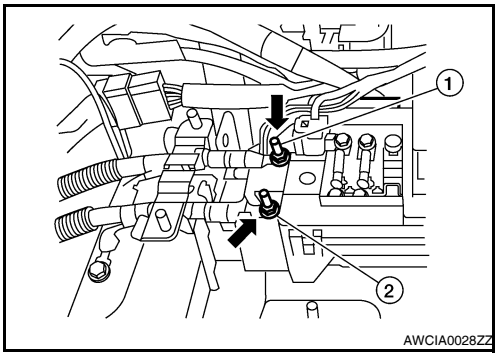
OK >> GO TO 6.
NG >> Connect securely.

6. CHECK CONDITION OF FRAME WIRE CONNECTION(S) (HV RELAY ASSEMBLY SIDE)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Check the connections between the frame wire and the HV relay assembly.
   NOTE:
   For the removal and installation procedures related to inspection of the frame wire connection, (See HBB-105, "Removal and Installation").

- 1: Frame wire connector h3 (–)
- 2: Frame wire connector h4 (+)



Torque: 9.0 N*m (92 kgf*cm, 81 in.*lbf)

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK FRAME WIRE

See HBC-517, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Replace frame wire.

8. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

See HBC-517, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> Repair or replace harness or connector.

10. CHECK CONDITION OF MAIN BATTERY CABLE CONNECTION(S)

See HBC-517, "Diagnosis Procedure".

A, B, C or D

A >> GO TO 11.
B >> Connect securely.
C >> Replace HV relay assembly. (See HBB-105, "Removal and Installation").
D >> Replace HV battery assembly. (See HBB-97, "Removal and Installation").

11. CHECK HV BATTERY ASSEMBLY

See HBC-517, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.
NG >> Replace HV battery assembly. (See HBB-97, "Removal and Installation").

12. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR)

See HBC-517, "Diagnosis Procedure"

OK or NG

OK >> GO TO 13.
NG >> Connect securely.

13. CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR)

See HBC-517, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> Repair or replace harness or connector.

14. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Connect securely.

15. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

See HBC-517, "Diagnosis Procedure".

OK or NG

OK >> GO TO 16.
NG >> Repair or replace harness or connector.

16. INSPECT HV RELAY ASSEMBLY (SMRB)

See HBC-517, "Diagnosis Procedure".

OK or NG

OK >> GO TO 17.
NG >> Replace hv relay assembly. (See HBB-105, "Removal and Installation").

17. CLEAR DTC

1. Turn ignition switch ON.
2. Read and record the DTCs and freeze frame data.
3. Clear the DTCs.

>> GO TO 18.

18. CHECK FOR INTERMITTENT PROBLEM

1. Check for intermittent incident (See GI-42, "Intermittent Incident").
2. Turn ignition switch ON (READY).
3. Check DTC.

Result	Proceed to
DTC P 3004-131 is output (SMRP may remain off).	A
DTC P3004-132 is output.	B
No DTC is output.	C

A, B or C

A >> Go to Diagnosis Procedure relevant to output DTC. (P3004-131)
B >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").

C >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").

P3004-800, P3004-801

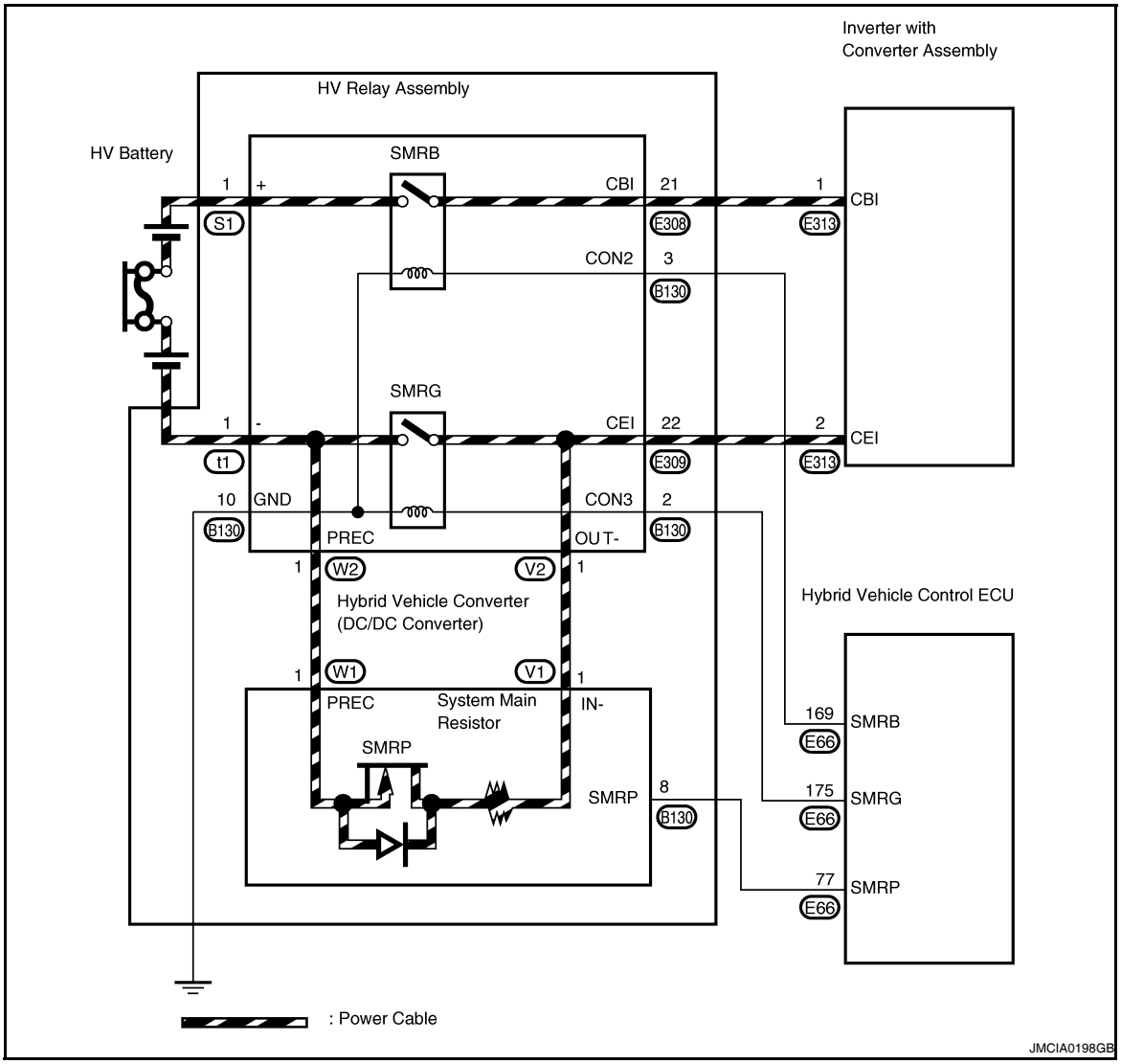
Description

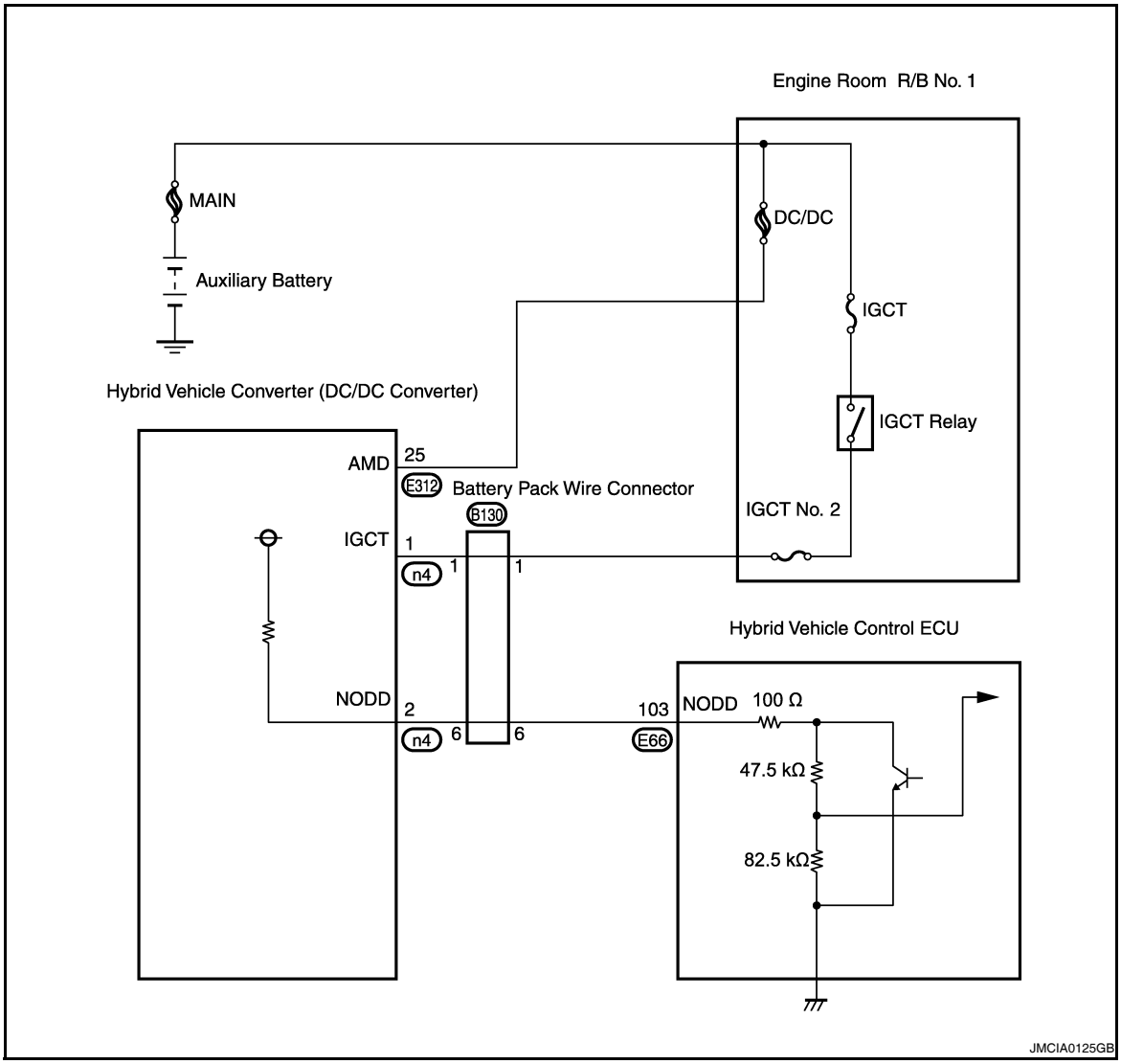
INFOID:0000000004212127

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
21
22
E308
E309
1
2
E313
CBI
CEI
CON2
3
B130
CON3
2
10
GND
B130
PREC
OUT-
W2
V2
Hybrid Vehicle Converter
(DC/DC Converter)
W1
V1
PREC
System Main
Resistor
SMRP
IN-
SMRP
8
B130
Hybrid Vehicle Control ECU
169
SMRB
E66
175
SMRG
E66
77
SMRP
E66
: Power Cable
JMCIA0198GB



DTC Logic

INFOID:0000000004212128

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3004	800	Power cable malfunction	Excessive overcurrent occurs during precharge (time from when SMRP turns on until when SMRG turns on).	• Wire harness or connector • Air conditioning harness assembly • Compressor with motor assembly • Inverter with converter assembly • HV relay assembly • Floor wire • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU
	801		Minimal overcurrent occurs during precharge (time from when SMRP turns on until when SMRG turns on).	

Diagnosis Procedure

INFOID:0000000004212129

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Related part
P0A09-265, P0A10-263	Hybrid vehicle converter circuit
P0AFA, P0A1F, P3105	VB sensor circuit, battery smart unit circuit
P0ABF, P0AC0, P0AC1, P0AC2	IB sensor circuit

Is DTC detected?

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

3. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

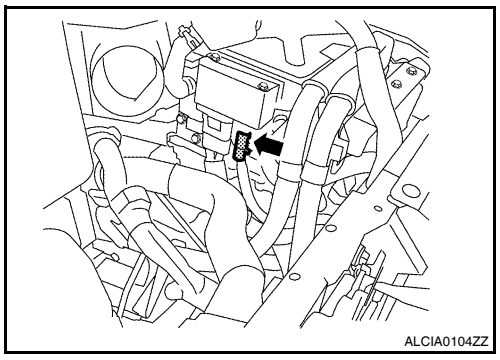
OK or NG

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

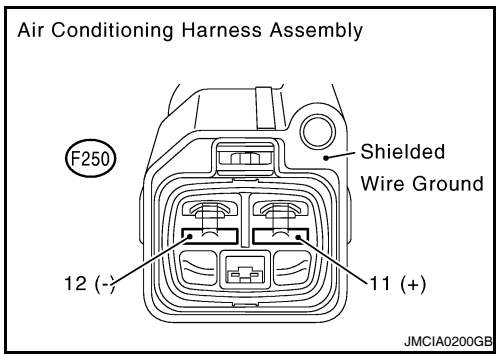
4. CHECK ELECTRIC COMPRESSOR

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip. (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.
2. Disconnect the air conditioning harness from the inverter with converter assembly (See HBC-638, "Removal and Installation").


ALCIA0104ZZ

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



Air conditioning harness assembly		Air conditioning harness assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F250	11	F250	12	100 kΩ or higher

NOTE:
- Do not use a megohmmeter.
- Make sure that the tester probes are connected to the correct terminals.

OK or NG

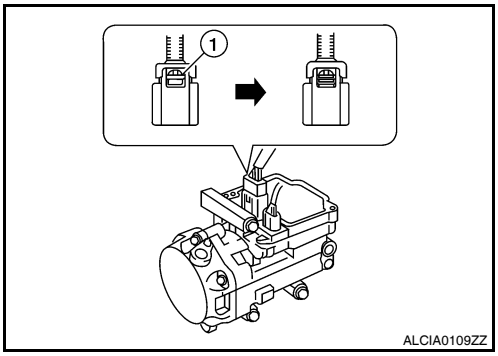
OK >> GO TO 6.
NG >> GO TO 5.

5. CHECK AIR CONDITIONING HARNESS ASSEMBLY

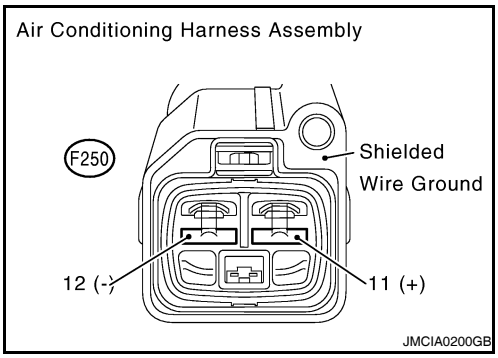
CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the air conditioning harness from the compressor with motor assembly.

- Green lock (1)



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



Air conditioning harness assembly		Air conditioning harness assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
F250	11	F250	12	10 MΩ or higher

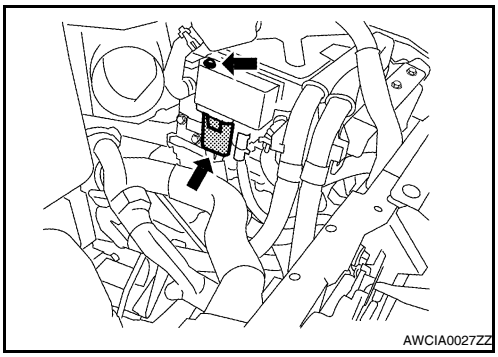
OK or NG

OK >> Replace electric compressor.
NG >> Replace air conditioning harness assembly.

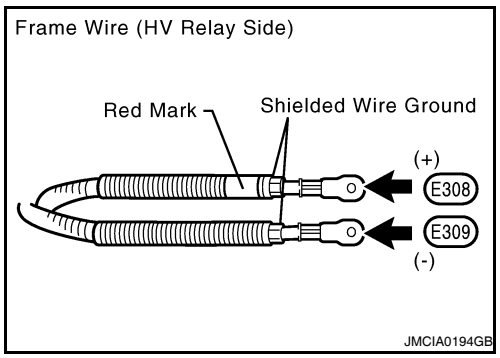
6. CHECK FRAME WIRE

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Remove the compressor fuse cover from the inverter with converter assembly.
3. Disconnect the frame wire from the inverter with converter assembly (See HBC-638, "Removal and Installation").
4. Disconnect the frame wire from the HV relay assembly (See HBB-105, "Removal and Installation").



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



Frame wire (HV relay side)		Frame wire (HV relay side)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E308	21 (High voltage +)	E309	22 (High voltage –)	10 kΩ or higher

OK or NG

OK >> GO TO 7.
NG >> Replace frame wire.

7. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

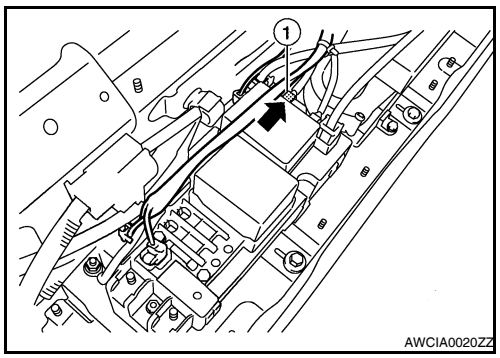
See HBC-140, "Diagnosis Procedure".

OK or NG

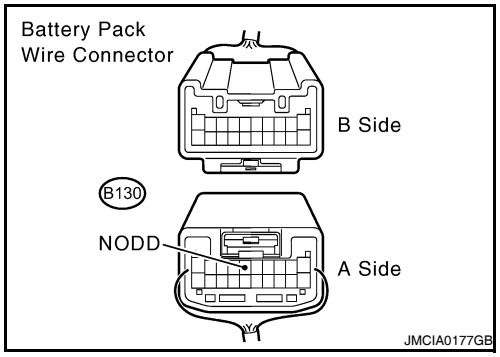
OK >> GO TO 8.
NG >> Connect securely.

8. CHECK HARNESS AND CONNECTOR

1. Turn ignition switch OFF.
2. Disconnect the B130 battery pack wire connector (1) (See HBB-97, "Removal and Installation").



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



Battery pack wire connector		Ground	Resistance
Harness connector	Terminal		
B130	6 (NODD)	Ground	120 to 140 kΩ

OK or NG

OK >> GO TO 9.
NG >> GO TO 13.

9. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

See HBC-140, "Diagnosis Procedure".

OK or NG

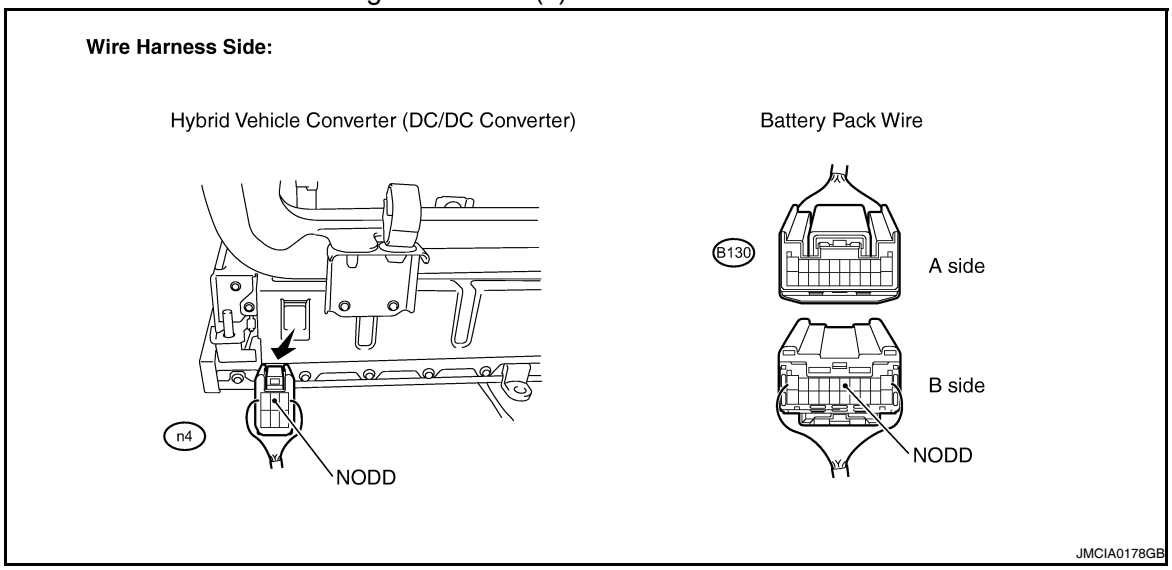
OK >> GO TO 10.
NG >> Connect securely.

10. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and Installation").

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



Battery pack wire		Hybrid vehicle converter (DC/DC converter)		Resistance
Component connector	Terminal	Harness connector	Terminal	
B130	6 (NODD)	n4	2 (NODD)	Below 1Ω

Battery pack wire		Ground	Resistance
Component connector	Terminal		
B130	6 (NODD)	Ground	10 kΩ or higher

Hybrid vehicle converter (DC/DC converter)		Ground	Resistance
Harness connector	Terminal		
n4	2 (NODD)	Ground	10 kΩ or higher

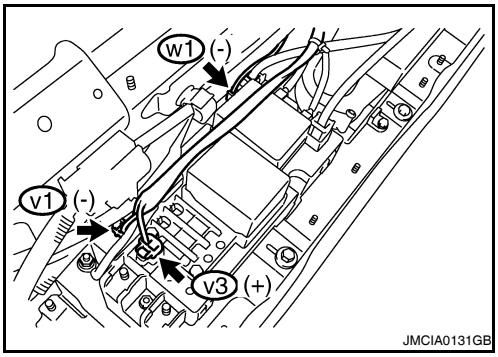
OK or NG

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

11. CHECK HYBRID VEHICLE CONVERTER

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the hybrid vehicle converter (DC/DC converter) connectors from the HV relay assembly (See HBB-103, "Removal and Installation").
3. Measure the resistance according to the value(s) in the table below.



Frame Wire		Frame Wire		Resistance
Component connector	Terminal	Component connector	Terminal	
v1	1 (High voltage –)	v3	1 (High voltage +)	100 kΩ or higher
v3	1 (High voltage +)	w1	1 (High voltage pre-charge)	1 MΩ or higher

NOTE:
- Do not use a megohmmeter.
- Make sure that the tester probes are connected to the correct terminals.

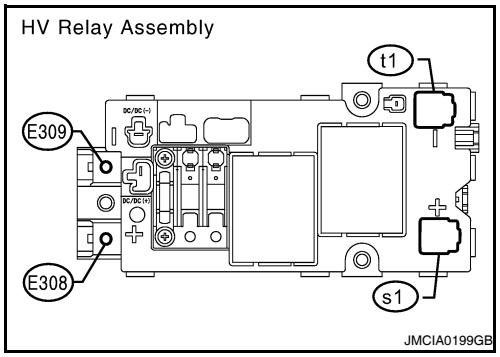
OK or NG

OK >> GO TO 12.
NG >> Replace hybrid vehicle converter. (See HBB-103, "Removal and Installation")

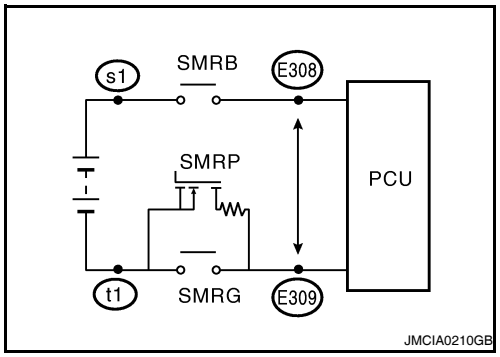
12.CHECK HV RELAY ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed.
2. Disconnect the high voltage connectors from the HV relay assembly (See HBB-105, "Removal and Installation").



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



HV relay assembly		HV relay assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E308	21	E309	22	10 kΩ or higher

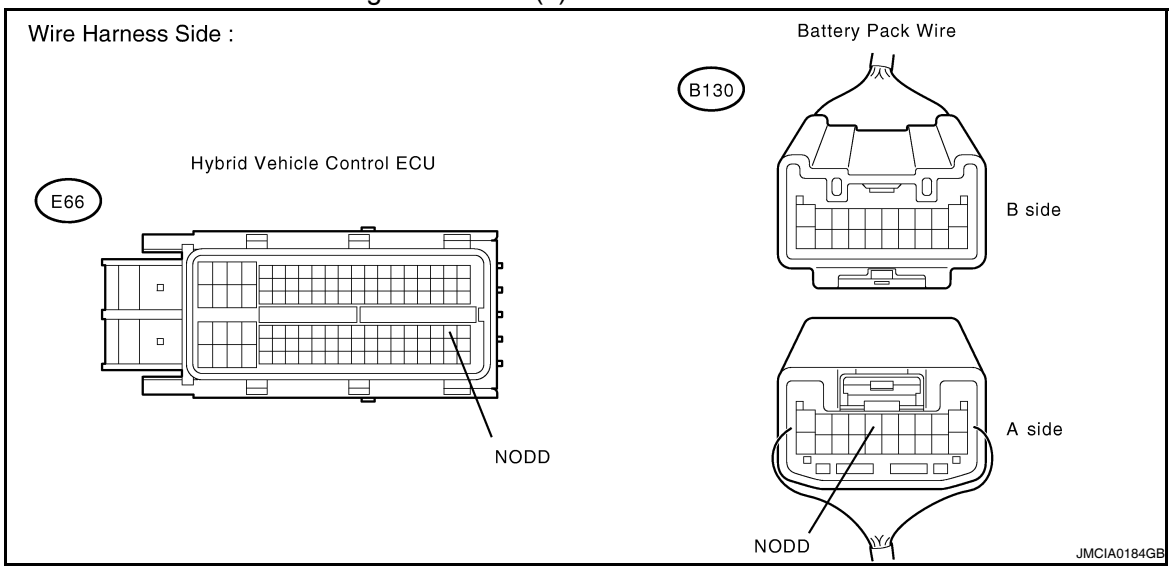
OK or NG

OK >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").
NG >> Replace HV relay assembly. (See HBB-105, "Removal and Installation")

13.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

1. Turn ignition switch OFF.
2. Disconnect the E66 hybrid vehicle control ECU connector.

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



Check for open

Hybrid vehicle control ECU		Battery pack wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	6 (NODD)	B130	103 (NODD)	Below 1Ω

Check for short

Battery pack wire		Ground	Resistance
Harness connector	Terminal		
B130	6 (NODD)	Ground	10kΩ or higher

Hybrid vehicle converter		Ground	Resistance
Harness connector	Terminal		
n4	2 (NODD)	Ground	10kΩ or higher

OK or NG

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

P3004-803

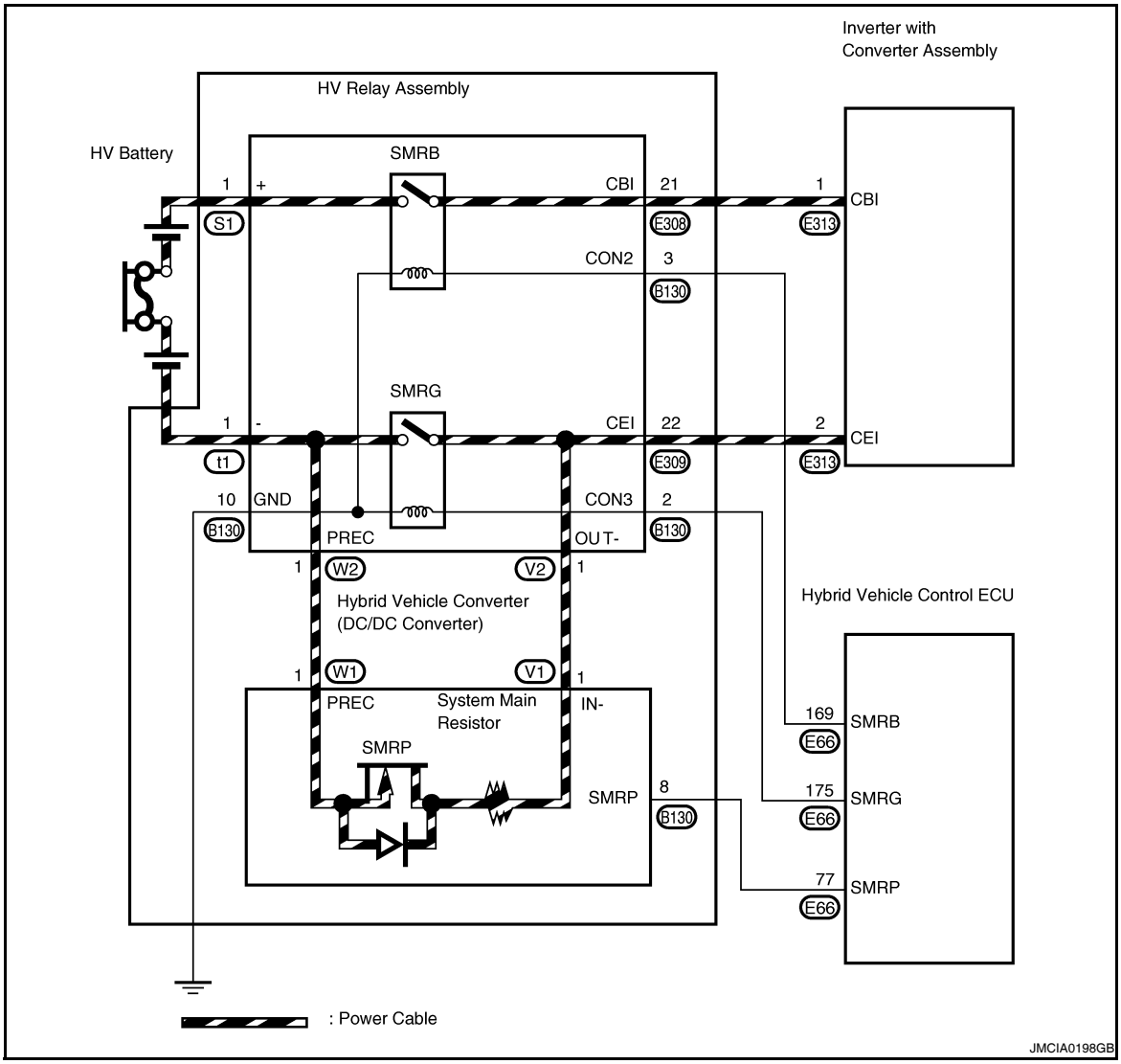
Description

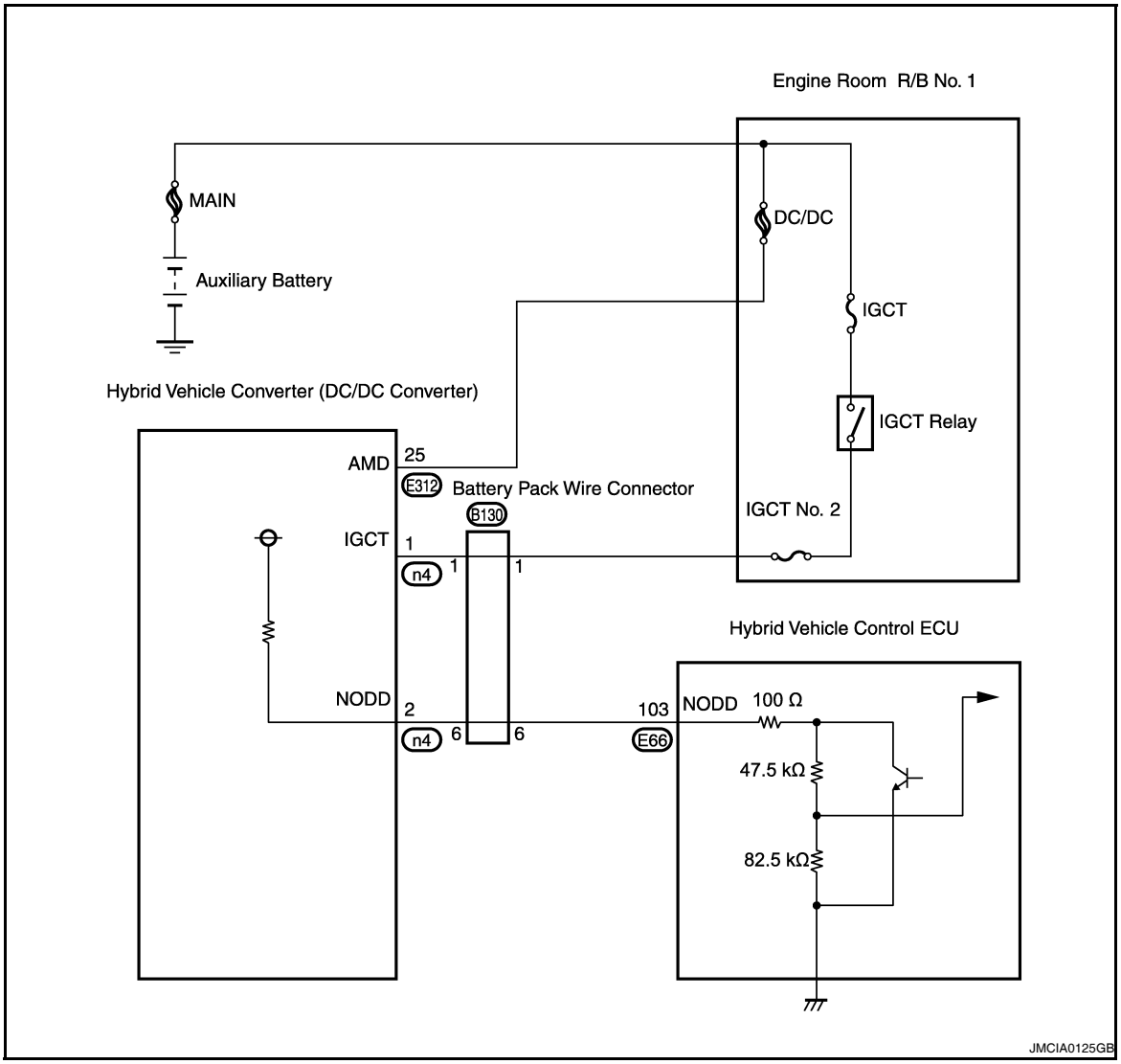
INFOID:0000000004212130

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in accordance with commands from the hybrid vehicle control ECU.
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
Open in AMD line	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
Open in IGCT line	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs

P0AE6-225 is output first because the time required for diagnosis is the shortest.


Inverter with
Converter Assembly
HV Relay Assembly
HV Battery
SMRB
SMRG
1
+
-
S1
t1
CBI
CEI
21
22
E308
E309
1
2
E313
CBI
CEI
CON2
3
B130
CON3
2
10
GND
PREC
OUT-
W2
V2
W1
V1
Hybrid Vehicle Converter
(DC/DC Converter)
PREC
System Main
Resistor
IN-
SMRP
8
Hybrid Vehicle Control ECU
169
175
77
SMRB
SMRG
SMRP
E66
: Power Cable
JMCIA0198GB



DTC Logic

INFOID:0000000004212131

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3004	803	Power cable malfunction	While the ignition switch ON (READY), the voltage in the inverter with converter assembly (VL, VH) decreases.	• Wire harness or connector • HV relay assembly

Diagnosis Procedure

INFOID:0000000004212132

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Part
P0A95, P0AFA	Open in electric vehicle fuse
P0ADF-229, P0AE0-228	SMRG control line
P0ADC-226, P0ADB-227	SMRB control line
P0A1A-156, 658, 659, 151, 155, P0A1B-511, 164, 163, 512, 193, 786, 788, 661, P0A78-266, 267, 523, 586, P0A94-442	VH sensor circuit

Is DTC detected?

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

3.CLEAR DTC

1. Turn ignition switch ON.
2. Read and record the DTCs and freeze frame data.
3. Clear DTC.

>> GO TO 4.

4.RECONFIRM DTC OUTPUT

1. Turn ignition switch ON (READY), move the shift lever to the D position, and depress both the accelerator pedal and brake pedal.
   NOTE:
   - Depressing both the accelerator pedal and brake pedal causes the HV battery current to flow and can be used to check that there is no problem with the high-voltage wiring.
   - Depressing both the accelerator pedal and brake pedal causes “ACCEL & BRK” in the inappropriate operation history data to be counted.
2. Check DTC.

Result	Proceed to
P3004-803 is output, or no DTCs are output.	A
Ignition switch is not turned ON (READY) and P3004-131 is output.	B

A or B

A >> GO TO 5.
B >> Go to Diagnosis Procedure relevant to output DTC. (P3004-131)

5.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Connect securely.

6.CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See HBC-140, "Diagnosis Procedure".

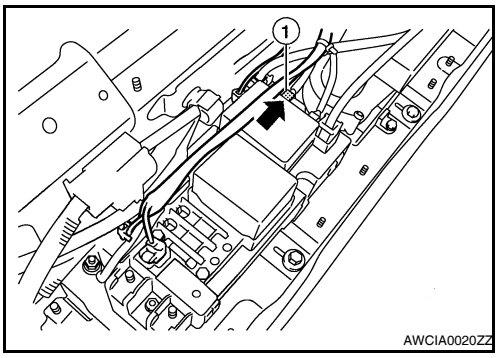
OK or NG

OK >> GO TO 7.
NG >> Connect securely.

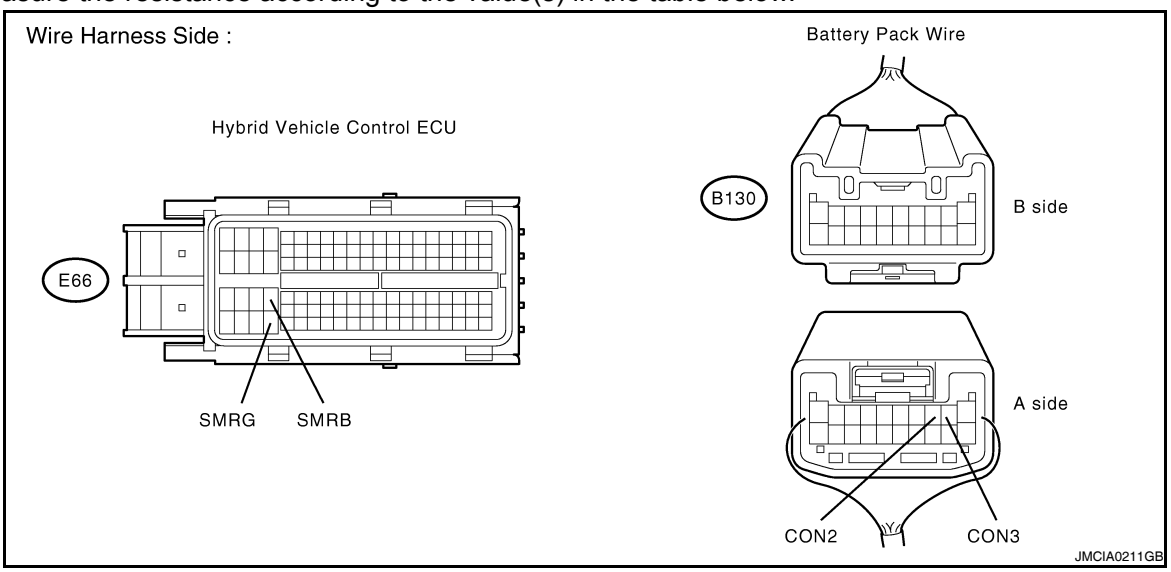
7.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip. (See HBC-633, "Precautions for the Hybrid Control System Activation")
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Disconnect the B130 battery pack wire connector (1) (See HBB-97, "Removal and Installation").
   NOTE:
   It takes time to disconnect the HV relay assembly and hybrid vehicle converter (DC/DC converter) connectors. Battery pack wire resistance check should be performed before these connectors are disconnected.



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



Hybrid vehicle control ECU		Battery pack wire		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	169 (SMRB)	B130	3 (CON2)	Below 1Ω
	175 (SMRG)		2 (CON3)	

OK or NG

OK >> GO TO 8.
NG >> Repair or replace harness or connector.

8. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR)

See HBC-517, "Diagnosis Procedure".

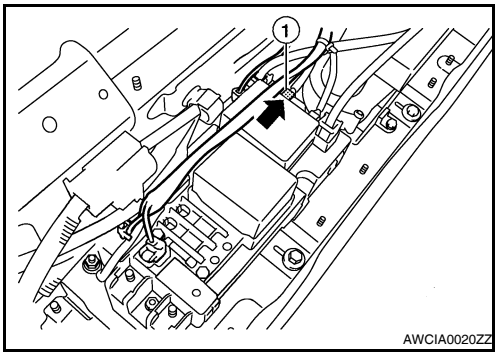
OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR)

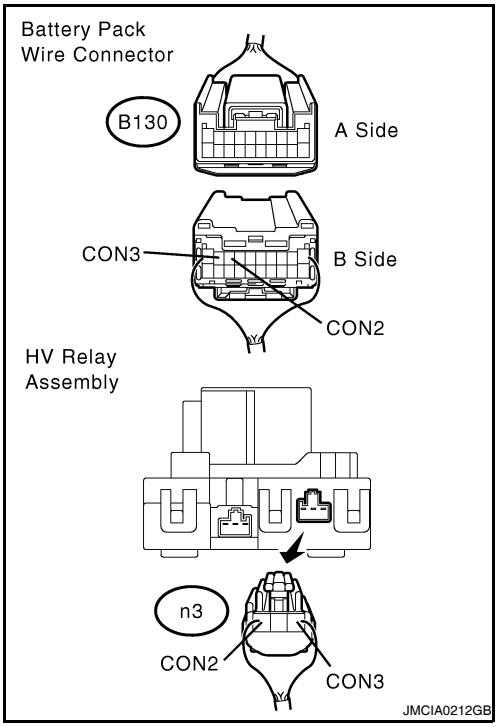
1. Check that the service plug grip is not installed.

2. Disconnect the n3 HV relay assembly connector.
NOTE:
For the removal and installation procedures related to the HV relay assembly connector, (See HBB-105, "Removal and Installation").



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

Battery pack wire connector		HV relay assembly		Resistance
Component connector	Terminal	Harness connector	Terminal	
B130	3 (CON2)	n3	3 (CON2)	Below 1Ω
	2 (CON3)		1 (CON3)	



OK or NG

OK >> Replace hv relay assembly. (See HBB-105, "Removal and Installation").

NG >> Repair or replace harness or connector.

P3108-535, P3108-536, P3108-538

Description

INFOID:0000000004212133

The hybrid vehicle control ECU detects a wiring malfunction in the serial communication line between the hybrid vehicle control ECU and the electric compressor.

DTC Logic

INFOID:0000000004212134

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3108	535	A/C amplifier communication circuit malfunction	Serial communication malfunction	• Wire harness or connector • Electric compressor • Hybrid vehicle control ECU
P3108	536		Compressor inverter malfunction	
P3108	538		Open in STB signal circuit	

NOTE:
DTC P3108-535 may be stored due to an open circuit in the SMRB circuit or SMRG circuit.

Diagnosis Procedure

INFOID:0000000004212135

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant diagnosis
P0ADB-227, P0ADC-226	SMRB circuit
P0ADF-229, P0AE0-228	SMRG circuit

Is DTC detected?

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

3.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ELECTRIC COMPRESSOR)

1. Disconnect the E65 hybrid vehicle control ECU connector.
2. Disconnect the F85 electric compressor connector.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E65	55 (CLK)	Ground	Below 1V
	54 (ITE)		
	53 (ETI)		
	56 (STB)		

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Compressor with motor assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E65	55 (CLK)	F85	1 (CLK)	Below 1Ω
	54 (ITE)		2 (DIN)	
	53 (ETI)		3 (DOUT)	
	56 (STB)		4 (STBI)	

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E65	55 (CLK)	Ground	10 kΩ or higher
	54 (ITE)		
	53 (ETI)		
	56 (STB)		

Compressor with motor assembly		Ground	Resistance
Harness connector	Terminal		
F85	1 (CLK)	Ground	10 kΩ or higher
	2 (DIN)		
	3 (DOUT)		
	4 (STBI)		

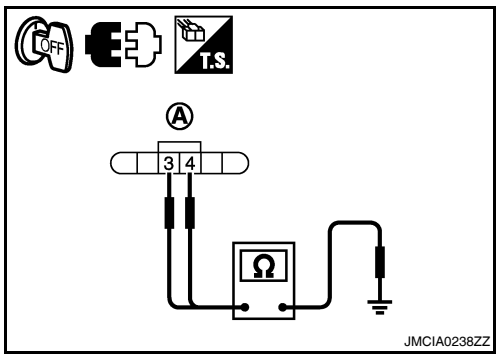
OK or NG

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

4. CHECK HYBRID VEHICLE CONTROL ECU

1. Turn ignition switch OFF.
2. Connect the hybrid vehicle control ECU connector.

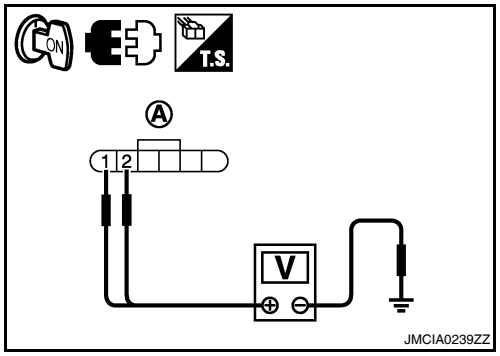
3. Measure the resistance according to the value(s) in the table below.



Compressor with motor assembly (A)		Ground	Resistance
Harness connector	Terminal		
F85	3 (DOUT)	Ground	10 kΩ or higher
	4 (STBI)		

4. Turn ignition switch ON.

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



Compressor with motor assembly (A)		Ground	Voltage
Harness connector	Terminal		
F85	1 (CLK)	Ground	10 to 14V
	2 (DIN)		

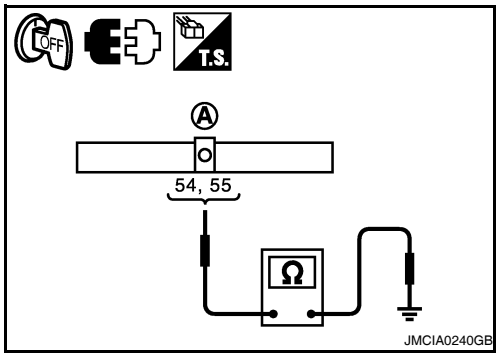
NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

OK >> GO TO 5.
NG >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation").

5. CHECK ELECTRIC COMPRESSOR

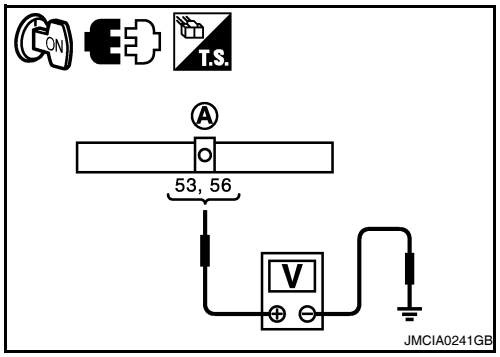
1. Turn ignition switch OFF.
2. Connect the electric compressor.
3. Disconnect the E65 hybrid vehicle control ECU connector.
4. Measure the resistance according to the value(s) in the table below.



Hybrid vehicle control ECU (A)		Ground	Resistance
Harness connector	Terminal		
E65	55 (CLK)	Ground	10 kΩ or higher
	54 (ITE)		

5. Turn ignition switch ON.

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



Hybrid vehicle control ECU (A)		Ground	Voltage
Harness connector	Terminal		
E65	53 (ETI)	Ground	10 to 14 V
	56 (STB)		

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

OK >> GO TO 6.
NG >> Replace electric compressor.

6.REPLACE HYBRID VEHICLE CONTROL ECU

Replace the hybrid vehicle control ECU (See HBC-644, "Removal and Installation").

>> GO TO 7.

7.CLEAR DTC

1. Turn ignition switch ON.
2. Read and record the DTCs and freeze frame data.
3. Clear DTC.

>> GO TO 8.

8.RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

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

Result: DTC P3108-535 or 538 is output.

Is DTC detected?

YES >> Replace electric compressor.
NO >> COMPLETED

P3110-139, P3110-223

Description

INFOID:0000000004212136

The hybrid vehicle control ECU monitors the IGCT relay and detects malfunctions.

DTC Logic

INFOID:0000000004212137

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3110	139	IGCT relay malfunction	There is a short to +B in the IGCT relay or the IGCT relay is stuck closed.	• Wire harness or connector • IGCT relay • Hybrid vehicle control ECU
	223		The IGCT relay remains stuck closed.	

Diagnosis Procedure

INFOID:0000000004212138

1.PRECONDITIONING

- 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. 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.
- If the battery voltage is applied to terminal +B, +B2, or MREL of the hybrid vehicle control ECU, even though the ignition switch OFF, the circuit is shorted to +B.

>> GO TO 2.

2.INSPECT RELAY (IGCT RELAY)

1. Remove the IGCT relay.
2. Measure the resistance according to the value(s) in the table below.

IGCT relay				Conditions	Resistance
Component connector	Terminal	Component connector	Terminal		
V - 1	3	V - 1	5	No current supply	10 kΩ or higher
				Apply battery voltage between 1 and 2	Below 1Ω

OK or NG

OK >> GO TO 3.
NG >> Replace IGCT relay.

3.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX)

1. Disconnect the E66 hybrid vehicle control ECU connector.
2. Remove the IGCT relay from the high voltage fuse and fusible link box.
3. Turn ignition switch ON.
4. Measure the voltage according to the value(s) in the table below.

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

Hybrid vehicle control ECU		Ground	Voltage
Connector	Terminal		
E66	166 (MREL)	Ground	Below 1V
	174 (VBR1)		
	168 (VBR2)		

OK or NG

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

P3136-914, P3136-915, P3136-916

Description

INFOID:0000000004212139

The hybrid vehicle control ECU monitors the connection status of the air bag diagnosis sensor unit (ACU) (communication) line. If the ECU detects a malfunction, it will alert the driver.

DTC Logic

INFOID:0000000004212140

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3136	914	ACU communication circuit	The pulse signal sent from ACU is not in the normal pattern.	• ACU communication line • ACU • Hybrid vehicle control ECU
	915	ACU communication circuit low	An excessively low voltage from ACU is sent to hybrid vehicle control ECU.	• ACU communication line • ACU • Hybrid vehicle control ECU
	916	ACU communication circuit high	An excessively high voltage from ACU is sent to hybrid vehicle control ECU.	• ACU communication line • ACU • Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-553, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212141

1.PRECONDITIONING

- 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. 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 DTC FOR ACU

1. Turn ignition switch ON.
2. Check DTC for ACU. Refer to SRC-14, "CONSULT-III Function (AIR BAG)".

Is DTC detected?

YES >> Go to diagnosis procedure relevant to output DTC.
NO >> GO TO 3.

3. CHECK HARNESS BETWEEN HYBRID VEHICLE CONTROL ECU AND ACU

1. Turn ignition switch OFF.
2. Disconnect hybrid vehicle control ECU harness connector E66.
3. Disconnect ACU harness connector M35.
4. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		ACU		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	138 (IVCS)	M35	19 (IVCS)	Below 1Ω

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	138 (IVCS)	Ground	10kΩ or higher

ACU		Ground	Resistance
Harness connector	Terminal		
M35	138 (IVCS)	Ground	10kΩ or higher

OK or NG

OK >> GO TO 5.
NG >> GO TO 4.

4. DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M89, E64
- Harness continuity between hybrid vehicle control ECU and ACU

>> Repair open circuit or short to ground or short to power in harness or connectors.

5. CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".
- Check the connection and terminal contact pressure of connectors and wire harness between the hybrid vehicle control ECU and ACU.
- Turn ignition switch ON, jiggle the connectors and wire harness.

Is the inspection result normal?

YES >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").
NO >> Repair or replace harness or connectors.

P3147-239, P3147-241

Description

INFOID:0000000004212142

The hybrid transaxle assembly consists of the planetary gear unit, MG1, and MG2. The gear unit uses the planetary gear to split engine output in accordance with a driving request while the vehicle is driven or the HV battery is charged. MG2 assists engine output while increasing vehicle driving force. MG2 also converts the energy, which is consumed in the form of heat during normal braking, into electrical energy and recover it into the HV battery to effect regenerative braking. MG1 supplies power, which is used for charging the HV battery or driving the MG2. It also controls the stepless transmission function of the hybrid transaxle by regulating the amount of electricity generated to change MG1 speed. In addition, the MG1 is used as a starter motor to start the engine. The transmission input damper absorbs the shock generated when the driving force from the engine is transmitted.

DTC Logic

INFOID:0000000004212143

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3147	239	Transmission malfunction	Hybrid transaxle input malfunction (shaft damaged)	• Engine assembly • Hybrid transaxle (shaft, gear) • Transmission input damper • Wire harness or connector • Inverter with converter assembly
P3147	241		Hybrid transaxle input malfunction (input damper system)	

Diagnosis Procedure

INFOID:0000000004212144

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (ENGINE CONTROL SYSTEM)

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

Result: DTCs are output.

Is DTC detected?

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

3.CHECK DTC OUTPUT (HYBRID SYSTEM)

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

Result	Proceed to
DTC P3147-240 or P3147-242 is output.	A
DTC P0A1D is output.	B
DTCs other than P3147-239 or P3147-241 are not output.	C

A or B or C

A >> Replace hybrid transaxle. (See TM-36, "Removal and Installation").
B >> Go to Diagnosis Procedure relevant to output DTC (P0A1D).
C >> GO TO 4.

4. CHECK CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> GO TO 13.

5. CHECK HARNESS AND CONNECTOR (ECM - CRANKSHAFT POSITION SENSOR)

See EC-252, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Repair or replace harness or connector.

6. RECONFIRM OUTPUT DTC (HYBRID SYSTEM)

1. Turn ignition switch ON.
2. Check for HV system DTCs, freeze frame data, and diagnosis information and note them down.

>> GO TO 7.

7. CLEAR DTC

1. Clear the DTCs of the HYBRID SYSTEM.

>> GO TO 8.

8. CHECK READY LIGHT ON

1. Turn ignition switch ON.
2. Select “MG1 REVOLUTION” and “ENGINE SPEED” in “DATA MONITOR” mode with CONSULT-III.
3. Turn ignition switch ON (READY).

OK: The READY light comes on.

NOTE:
If the READY light does not come on and the reading on the CONSULT-III shows DTC P3147-239 [Hybrid vehicle transaxle input malfunction (shaft damaged)], or the READY light comes on and MG1 turns but the engine does not crank, replace the hybrid transaxle and transmission input damper.

OK or NG

OK >> GO TO 9.
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation").

9. CHECK ENGINE RACING

1. Turn ignition switch ON.
2. While the READY light is on, depress the accelerator pedal for 10 seconds with the shift lever in the P position.

OK: The engine revs up.

NOTE:
If the engine does not rev up and the reading on the CONSULT-III shows DTC P3147-239 [Hybrid vehicle transaxle input malfunction (shaft damaged)], or MG1 turns but the engine does not crank, replace the hybrid transaxle and transmission input damper.

OK or NG

OK >> GO TO 10.
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation").

10. CHECK CREEP MOVEMENT

1. Depress the brake pedal, move the shift lever to the D position, and release the brake pedal.

OK: The wheels turn (creeping along).

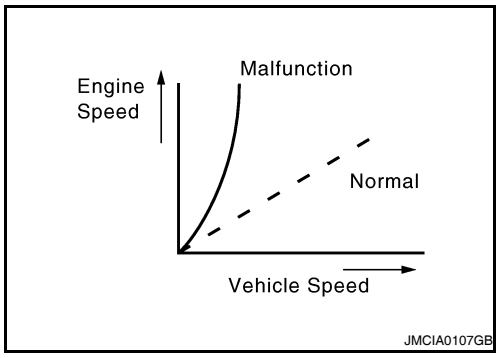
NOTE:
If the wheels do not turn and the reading on the CONSULT-III shows DTC P3147-239 [Hybrid transaxle input malfunction (shaft damage)], replace the hybrid transaxle.

OK or NG

OK >> GO TO 11.
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation").

11. CHECK ENGINE SPEED

1. While driving at the vehicle speed of more than 6 mph (10 km/h), fully depress the accelerator pedal to raise the engine speed.



OK: Engine speed increases smoothly (Check NOTE).

NOTE:
If the engine over-revs or the reading on the CONSULT-III shows DTC P3147-239 [Hybrid transaxle input malfunction (shaft damage)], replace the transmission input damper assembly.

OK or NG

OK >> GO TO 12.
NG >> Replace hybrid transaxle. (See TM-36, "Removal and Installation").

12. PERFORM SIMULATION TEST

1. Turn ignition switch ON (READY).
2. Perform a simulation test.
3. Drive the vehicle at a speed of 40 mph (65 km/h) or more (a speed that will not allow intermittent engine operation to occur).
4. Check DTC.

Result: DTC is detected.

Is DTC detected?

YES >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation").
NO >> Go to Diagnosis Procedure relevant to output DTC.

13. CHECK FRONT TIRE REVOLUTION

1. Turn ignition switch OFF and move the shift lever to the N position.
2. Lift up the vehicle.
3. Turn the crank pulley by hand to check if the front tires rotate.

CAUTION:
Do not turn ignition switch ON while performing this inspection. Be sure to turn ignition switch OFF because the engine may start.

OK: The front tires rotate.

OK or NG

OK >> Replace hybrid transaxle. (See TM-36, "Removal and Installation").
NG >> Repair or replace engine.

P3147-240, P3147-242

Description

INFOID:0000000004212145

The hybrid transaxle assembly consists of the planetary gear unit, MG1, and MG2. The gear unit uses the planetary gear to split engine output in accordance with a driving request while the vehicle is driven or the HV battery is charged. MG2 assists engine output while increasing vehicle driving force. MG2 also converts the energy, which is consumed in the form of heat during normal braking, into electrical energy and recover it into the HV battery to effect regenerative braking. MG1 supplies power, which is used for charging the HV battery or driving the MG2. It also controls the stepless transmission function of the hybrid transaxle by regulating the amount of electricity generated to change MG1 speed. In addition, the MG1 is used as a starter motor to start the engine. The transmission input damper absorbs the shock generated when the driving force from the engine is transmitted.

DTC Logic

INFOID:0000000004212146

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3147	240	Transmission malfunction	Generator lock	Hybrid Transaxle
	242		Planetary gear lock	

Diagnosis Procedure

INFOID:0000000004212147

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTCs other than P3147-240 and P3147-242 are output.

Is DTC detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.
NO >> Replace hybrid transaxle. (See TM-36, "Removal and Installation").

P3216-181, P3217-182

Description

INFOID:0000000004212148

The MG ECU located in the inverter with converter assembly detects the temperature of the reactor using a temperature sensor built into the inverter with converter assembly. The inverter cooling system is the same as that for MG2 or MG1, and operates independently of the engine cooling system. The MG ECU limits the load based on signals sent from the reactor temperature sensor in order to check the effect of the inverter cooling system and prevent overheating. The ECU also detects malfunctions in the reactor temperature sensor.

NOTE:

The reactor is a component with characteristics that resist changes in the current flow. The reactor will attempt to maintain the current flow. This characteristic stabilizes the current flowing to the HV battery.

The reactor is also used to boost the battery voltage which is supplied to the inverters.

DTC Logic

INFOID:0000000004212149

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3216	181	Reactor temperature sensor circuit low	Malfunction in the reactor temperature sensor wiring (short to GND)	Inverter with converter assembly
P3217	182	Reactor temperature sensor circuit high	Malfunction in the reactor temperature sensor wiring (open or short to +B)	

Diagnosis Procedure

INFOID:0000000004212150

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant diagnosis
P3226-562, 563	Boost converter temperature sensor

Is DTC detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.

NO >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").

P3221-314, P3221-315

Description

INFOID:0000000004212151

The MG ECU located in the inverter with converter assembly uses a temperature sensor that is built into the inverter with converter assembly to detect the generator inverter temperature. The inverter cooling system is the same as that for MG2 and MG1, and it operates independently of the engine cooling system. The characteristics of the generator inverter temperature sensor are the same as those of the boost converter temperature sensor. The MG ECU uses the signal from the generator inverter temperature sensor to check the effectiveness of the inverter cooling system. If necessary, the MG ECU will limit inverter output to prevent inverter overheating. The ECU also detects malfunctions in the wiring of the generator inverter temperature sensor, as well as in the sensor.

DTC Logic

INFOID:0000000004212152

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3221	314	Generator inverter temperature sensor circuit range/performance	Sudden change or hunting in the generator inverter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU
P3221	315		Generator inverter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan ECU • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004212153

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A93-346	Inverter cooling system malfunction
P0A1D (all INF code)	Hybrid Powertrain Control Module
P0A1B (all INF code)	Drive Motor “A” Control Module

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4.CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

A or B or C

A >> GO TO 5.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

5.CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Correct the problem.

6.CHECK FUSE (NO. 67)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Replace fuse.

7.CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8.CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

SeeHBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9.PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 12.

10.CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11.PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").

NG >> Check cooling fan system. (See EC-382, "Component Function Check").

12. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Add coolant.

13. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> GO TO 15.

14. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Repair or replace harness or connector.

15. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LIMK BOX

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation").
NG >> Repair or replace high voltage fuse and fusible link box.

16. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly
NG >> Repair or replace harness or connector.

P3222-313, P3223-312

Description

INFOID:0000000004212154

The MG ECU located in the inverter with converter assembly uses a temperature sensor that is built into the inverter with converter assembly to detect the generator inverter temperature. The inverter cooling system is the same as that for MG2 and MG1, and it operates independently of the engine cooling system. The characteristics of the generator inverter temperature sensor are the same as those of the boost converter temperature sensor. The MG ECU uses the signal from the generator inverter temperature sensor to check the effectiveness of the inverter cooling system. If necessary, the MG ECU will limit inverter output to prevent inverter overheating. The ECU also detects malfunctions in the wiring of the generator inverter temperature sensor, as well as in the sensor.

DTC Logic

INFOID:0000000004212155

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3222	313	Generator inverter temperature sensor circuit high/low	GND short in generator inverter temperature sensor circuit	Inverter with converter assembly
P3223	312	Generator inverter temperature sensor circuit high	Short to +B in generator inverter temperature sensor circuit	

Diagnosis Procedure

INFOID:0000000004212156

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

>> COMPLETED

P3226-562, P3226-563

Description

INFOID:0000000004212157

The MG ECU located in the inverter with converter assembly detects the temperature of the boost converter using a temperature sensor built into the inverter with converter assembly. The inverter cooling system is the same as that for MG2 and MG1, and it operates independently of the engine cooling system. The MG ECU uses the signal from the boost converter temperature sensor to check the effectiveness of the inverter cooling system. If necessary, the MG ECU will limit inverter output to prevent inverter overheating. The ECU also detects malfunctions in the boost converter temperature sensor.

DTC Logic

INFOID:0000000004212158

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3226	562	DC/DC Boost Converter Temperature Sensor	Sudden change in boost converter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU
P3226	563		Boost converter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:0000000004212159

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (HYBRID SYSTEM)

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

DTC No.	Relevant Diagnosis
P0A93-346	Inverter cooling system malfunction

Is DTC detected?

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

3.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

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

4. CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

A or B or C

A >> GO TO 5.
B >> Add coolant.
C >> Check for coolant leaks and add coolant.

5. CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 6.
NG >> Correct the problem.

6. CHECK FUSE (NO. 67)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Replace fuse.

7. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 8.
NG >> Connect securely.

8. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.
NG >> Connect securely.

9. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 10.
NG >> GO TO 12.

10. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.
NG >> Connect securely.

11. PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").
NG >> Check cooling fan system. (See EC-382, "Component Function Check").

12. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.
NG >> Add coolant.

13. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 14.
NG >> GO TO 16.

14. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU)

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.
NG >> Repair or replace harness or connector.

15. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

See HBC-362, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation").
NG >> Repair or replace high voltage fuse and fusible link box.

16. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)

See HBC-362, "Diagnosis Procedure".

OK or NG

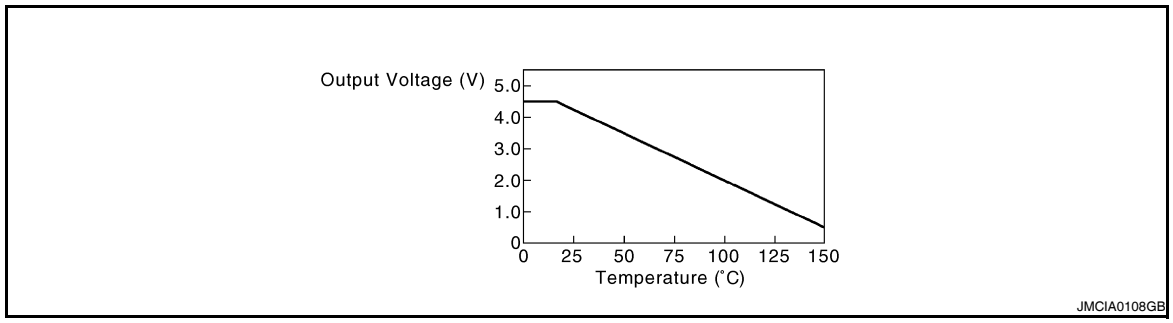
OK >> Replace water pump with motor & bracket assembly
NG >> Repair or replace harness or connector.

P3227-583, P3228-584

Description

INFOID:0000000004212160

The MG ECU uses a temperature sensor that is built into the boost converter to detect the boost converter temperature. The boost converter temperature sensor outputs a voltage that varies between 0 and 5 V in accordance with changes in the temperature. The higher the boost converter temperature, the lower the output voltage. Conversely, the lower the temperature, the higher the output voltage. The MG ECU limits the load based on signals transmitted by the boost converter temperature sensor, in order to prevent the converter from overheating. The MG ECU also detects malfunctions in the wiring of the boost converter temperature sensor, as well as in the sensor itself.



DTC Logic

INFOID:0000000004212161

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3227	583	Converter temperature sensor circuit low	Open or GND short in boost converter temperature sensor circuit	Inverter with converter assembly
P3228	584	Converter temperature sensor circuit high	Short to +B in boost converter temperature sensor circuit	

Diagnosis Procedure

INFOID:0000000004212162

1.PRECONDITIONING

- 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. 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.REPLACE INVERTER WITH CONVERTER ASSEMBLY

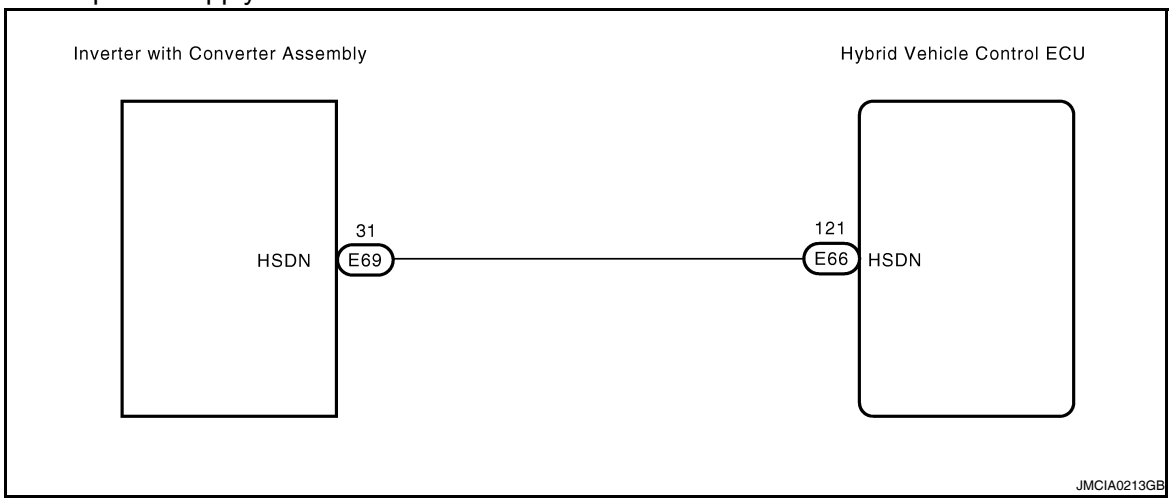
>> COMPLETED

P3232-749

Description

INFOID:0000000004212163

The hybrid vehicle control ECU sends a shutdown signal to the inverter with converter assembly (MG ECU) to shut down the power supply to the MG2.



DTC Logic

INFOID:0000000004212164

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3232	749	Open or short to B+ in blocking of HV gate connection	Short to GND in the emergency shutdown signal line while the gate is shut down.	• Wire harness or connector • Hybrid vehicle control ECU • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212165

1.PRECONDITIONING

- 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. 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.
- When attempting to reproduce the problem, turning ignition switch ON and OFF repeatedly makes it easier to reproduce the problem. Do not repeat the operations of turning ignition switch ON (READY) and turning ignition switch OFF as these will activate system main relay overheat protection.

>> GO TO 2.

2.CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - INVERTER WITH CONVERTER ASSEMBLY)

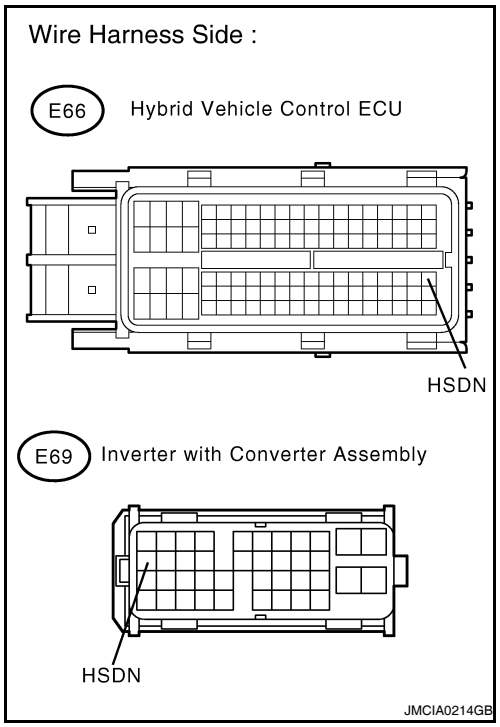
CAUTION:

Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-633, "Precautions for the Hybrid Control System Activation").
   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.
2. Disconnect the E66 hybrid vehicle control ECU connector.

3. Disconnect the E69 inverter with converter assembly connector.
4. Measure the resistance according to the value(s) in the table below.

Hybrid vehicle control ECU		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	121 (HSDN)	E69	31 (HSDN)	10 kΩ or higher



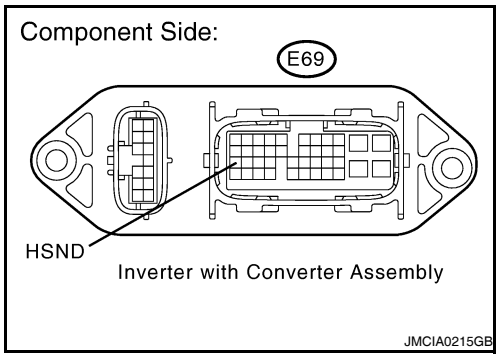
OK or NG

OK >> GO TO 3.
NG >> Repair or replace harness or connector.

3. CHECK INVERTER WITH CONVERTER ASSEMBLY

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

Inverter with converter assembly		Ground	Resistance
Component connector	Terminal		
E69	31 (HSDN)	Ground	2.65 to 3.55 kΩ



OK or NG

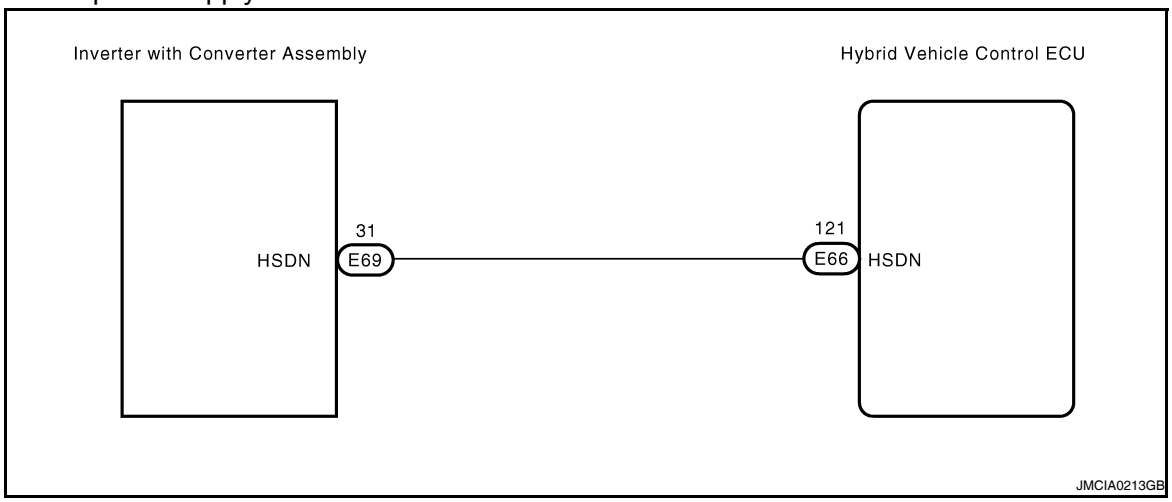
OK >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation").
NG >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").

P3233-750

Description

INFOID:0000000004212166

The hybrid vehicle control ECU sends a shutdown signal to the inverter with converter assembly (MG ECU) to shut down the power supply to the MG2.



DTC Logic

INFOID:0000000004212167

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3233	750	Short to B+ in blocking of HV gate connection	Open or short to +B in the emergency shutdown signal line when the gate is driving	• Wire harness or connector • Hybrid vehicle control ECU • Inverter with converter assembly

Diagnosis Procedure

INFOID:0000000004212168

1.PRECONDITIONING

- 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. 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 (HYBRID VEHICLE CONTROL ECU - INVERTER WITH CONVERTER ASSEMBLY)

CAUTION:

Be sure to wear insulated gloves.

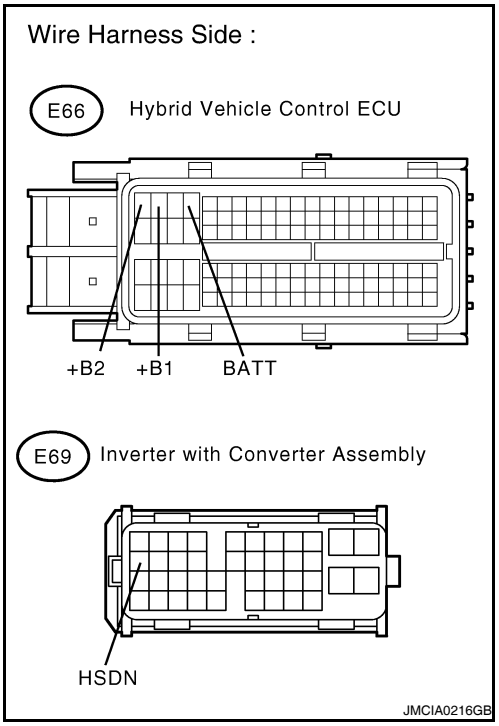
1. Turn ignition switch OFF and remove the service plug grip (See HBC-633, "Precautions for the Hybrid Control System Activation").
   NOTE:
   After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Disconnect the E69 inverter with converter assembly connector.
4. Turn ignition switch ON.

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

Inverter with converter assembly		Ground	Voltage
Harness connector	Terminal		
E69	31 (HSDN)	Ground	Below 1V

NOTE:
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

6. Turn ignition switch OFF.
7. Measure the resistance according to the value(s) in the table below.



Hybrid vehicle control ECU		Hybrid vehicle control ECU		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	121 (HSDN)	E66	174 (VB)	10 kΩ or higher
			168 (VB2)	
			165 (BATT)	

NOTE:
To check for a short to VB, ignition switch ON. However, the battery voltage is not applied to terminals VB and VB2 because the IGCT relay is not turned on with the E66 connector disconnected from the hybrid vehicle control ECU. Therefore, measure the resistance between terminals HSDN and VB and also between terminals HSDN and VB2.

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

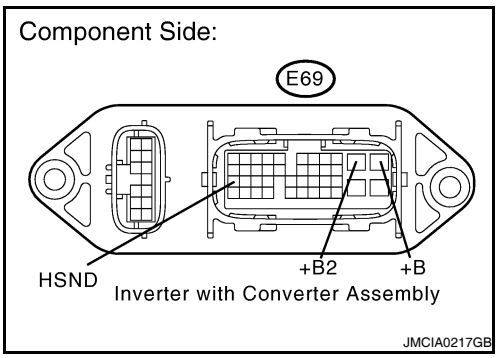
Hybrid vehicle control ECU		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	121 (HSDN)	E69	31 (HSDN)	Below 1Ω

OK or NG

OK >> GO TO 3.
NG >> Repair or replace harness or connector.

3. CHECK INVERTER WITH CONVERTER ASSEMBLY

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



Inverter with converter assembly		Inverter with converter assembly		Resistance
Component connector	Terminal	Component connector	Terminal	
E69	31 (HSDN)	E69	1 (+B)	10 kΩ or higher
			2 (+B2)	

Inverter with converter assembly		Ground	Resistance
Component connector	Terminal		
E69	31 (HSDN)	Ground	2.65 to 3.55 kΩ

OK or NG

OK >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation")
NG >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").

U0100-211, U0100-212, U0100-530

Description

INFOID:0000000004212169

The hybrid vehicle control ECU transmits and receives signals to and from the ECM, the brake ECU, the EPS control unit and network gateway ECU via CAN communication.

DTC Logic

INFOID:0000000004212170

DTC DETECTION LOGIC

If the hybrid vehicle control ECU detects a problem with CAN communication between the ECU and ECM, 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
U0100	211	Lost communication with ECM/ PCM “A”	Problem with CAN communication between the ECM and hybrid vehicle control ECU (communication error between ECUs)	CAN communication system
U0100	212		Problem with CAN communication between the ECM and hybrid vehicle control ECU (signal transmission error)	
U0100	530		Problem with CAN communication between the ECM and hybrid vehicle control ECU (CAN communication system malfunction)	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-572, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212171

Go to LAN-53, "Trouble Diagnosis Flow Chart".

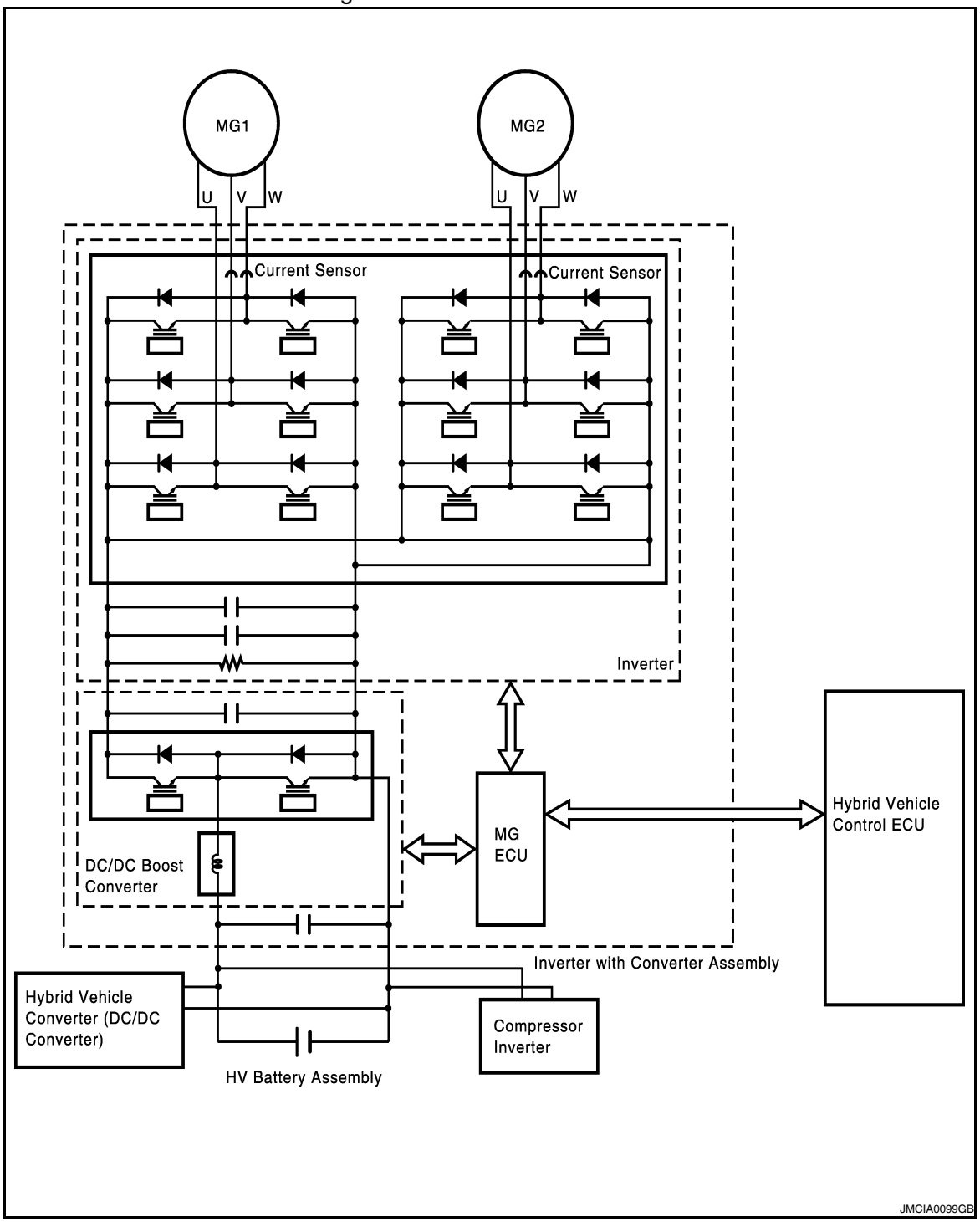
U0110-159, U0110-160, U0110-656, U0110-657

Description

INFOID:0000000004212172

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.
The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:0000000004212173

DTC DETECTION LOGIC

The inverter with converter assembly (MG ECU) controls MG2 based on commands from the hybrid vehicle control ECU via serial communication.
The inverter with converter assembly (MG ECU) monitors communication data and detects malfunctions.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
U0110	159	Lost communication with driver motor control module	Error in reception from the inverter with converter assembly (MG ECU) via serial communication (out of communication standard)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU
	160		Error in signal transmission to the inverter with converter assembly (MG ECU) via serial communication (no transmission, out of communication standard)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU
	656		Error in reception from the inverter with converter assembly (MG ECU) via serial communication (out of communication standard)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU
	657		Error in reception from the inverter with converter assembly (MG ECU) via serial communication (no reception)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-575, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212174

1.PRECONDITIONING

- 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. 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.
- If any of U0110-159, 160, 656 or 657 are detected, clearing DTCs using the CONSULT-III will cause DTC P0A1B-788 (power source IC reset) to be output. Proceed to troubleshooting without considering this code.
- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

>> GO TO 2.

2.CLEAR DTC (HYBRID SYSTEM)

1. Turn ignition switch ON.
2. Read and record the DTCs and freeze frame data.
3. Clear the DTCs.

>> GO TO 3.

3.RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

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

DTC U0110-159, 160, 656 or 657 is output

YES >> GO TO 4.
NO >> Check for intermittent incident. (See GI-42, "Intermittent Incident")

4. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.
NG >> Connect securely.

5. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT)

CAUTION:
Be sure to wear insulated gloves.

1. Turn ignition switch OFF and remove the service plug grip (See HBC-632, "Precautions for Inspecting the Hybrid Control 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.
2. Disconnect the E69 inverter with converter assembly connector.
3. Turn ignition switch ON.
4. Measure the resistance according to the value(s) in the table below.

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
E69	3 (GND1)	Ground	Below 1Ω
	4 (GND2)		

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

Inverter with converter assembly		Ground	Voltage
Harness connector	Terminal		
E69	1 (+B)	Ground	10 to 14V
	2 (+B2)		

NOTE:
Turn ignition switch ON with the low voltage connector of the inverter with converter assembly disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK or NG

OK >> GO TO 6.
NG >> Repair or replace power source circuit.

6. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.
NG >> Connect securely.

7. CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - INVERTER WITH CONVERTER ASSEMBLY)

1. Turn ignition switch OFF.
2. Disconnect the E66 hybrid vehicle control ECU connector.
3. Turn ignition switch ON.

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

Hybrid vehicle control ECU		Ground	Voltage
Harness connector	Terminal		
E66	184 (CLK+)	Ground	Below 1V
	178 (CLK-)		
	185 (REQ+)		
	179 (REQ-)		
	182 (HTM+)		
	176 (HTM-)		
	183 (MTH+)		
	177 (MTH -)		

NOTE:
Turn ignition switch ON with the low voltage connector of the inverter with converter assembly or hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

5. Turn ignition switch OFF.
6. Measure the resistance according to the value(s) in the table below.

Check for open

Hybrid vehicle control ECU		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	184 (CLK+)	E69	15 (CLK+)	Below 1Ω
	178 (CLK-)		24 (CLK-)	
	185 (REQ+)		18 (REQ+)	
	179 (REQ-)		27 (REQ-)	
	182 (HTM+)		17 (HTM+)	
	176 (HTM-)		26 (HTM-)	
	183 (MTH+)		19 (MTH+)	
	177 (MTH -)		28 (MTH -)	

Check for short

Hybrid vehicle control ECU		Ground	Resistance
Harness connector	Terminal		
E66	184 (CLK+)	Ground	10 kΩ or higher
	178 (CLK-)		
	185 (REQ+)		
	179 (REQ-)		
	182 (HTM+)		
	176 (HTM-)		
	183 (MTH+)		
	177 (MTH -)		

Check for short

Inverter with converter assembly		Ground	Resistance
Harness connector	Terminal		
E69	15 (CLK+)	Ground	10 kΩ or higher
	24 (CLK-)		
	18 (REQ+)		
	27 (REQ-)		
	17 (HTM+)		
	26 (HTM-)		
	19 (MTH+)		
	28 (MTH -)		

OK or NG

OK >> GO TO 8.
NG >> Repair or replace harness or connector.

8.CHECK HYBRID VEHICLE CONTROL ECU

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

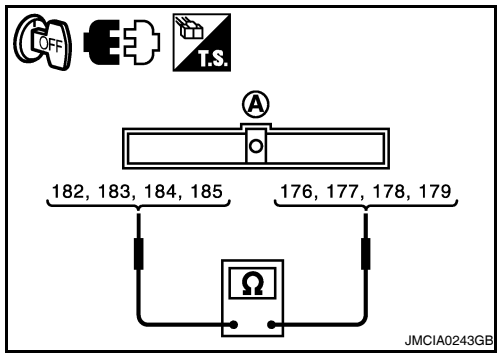
Inverter with converter assembly		Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E69	15 (CLK+)	E69	24 (CLK-)	109 to 139 Ω
	18 (REQ+)		27 (REQ-)	
	17 (HTM+)		26 (HTM-)	
	19 (MTH+)		28 (MTH -)	

OK or NG

OK >> GO TO 9.
NG >> Replace hybrid vehicle control ECU. (See HBC-644, "Removal and Installation")

9.CHECK INVERTER WITH CONVERTER ASSEMBLY

1. Turn ignition switch OFF.
2. Connect the inverter with converter assembly connector.
3. Disconnect the E66 hybrid vehicle control ECU connector.
4. Measure the resistance according to the value(s) in the table below.



Hybrid vehicle control ECU (A)		Hybrid vehicle control ECU (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E66	184 (CLK+)	E66	178 (CLK-)	109 to 139Ω
	185 (REQ+)		179 (REQ-)	
	182 (HTM+)		176 (HTM-)	
	183 (MTH+)		177(MTH-)	

OK or NG

OK >> GO TO 10.
NG >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").

10.CHECK NOISE SOURCE

NOTE:
Using non-genuine parts may cause electrical noise to be introduced.

Electrical noise is introduced

YES >> Repair or replace noise source.
NO >> GO TO 11.

11. REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> GO TO 12.

12. CLEAR DTC

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

DTC P0A09-591 is output

>> GO TO 13.

13. RECONFIRM DTC OUTPUT (HYBRID SYSTEM)

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

DTC U0110-159, 160, 656 or 657 is output

YES >> Replace inverter with converter assembly. (See HBC-638, "Removal and Installation").
NO >> Completed.

U0115-901

Description

INFOID:0000000004212175

The hybrid vehicle control ECU transmits and receives signals to and from the ECM through CAN communication line. When the ECM sends the same P-RUN signal to the hybrid vehicle control ECU for 2 seconds, the hybrid vehicle control ECU will set a DTC U0115-901.

DTC Logic

INFOID:0000000004212176

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
U0115	901	Lost communication with ECM/ PCM “B”	The hybrid vehicle control ECU receives malfunction signal of P-RUN signal from ECM.	• Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.
If DTC U0115-901 is displayed with DTC P0A1D-924 or P0A1D-925, first perform the diagnosis procedure for P0A1D-924, P0A1D-925.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-580, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212177

1.PRECONDITIONING

- 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. 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 CONTINUITY BETWEEN HYBRID VEHICLE CONTROL ECU AND ECM

Refer to LAN-4, "Description".

OK or NG

OK >> GO TO 3.
NG >> Repair or replace harness or connectors.

3.CHECK DTC OUTPUT (ENGINE)

1. Turn ignition switch ON.
2. Check DTC for engine control system.

Is DTC detected?

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

4. CHECK DTC OUTPUT (HYBRID SYSTEM)

1. Turn ignition switch OFF, wait at least 10 seconds and then turn ON.
2. Check DTC for hybrid vehicle control system.

Is DTC P0A1D-924 or P0A1D-925 detected?

YES >> GO TO 5.
NO >> INSPECTION END

5. REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> Go to HBC-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

U0129-220, U0129-222, U0129-528

Description

INFOID:0000000004212178

The hybrid vehicle control ECU transmits and receives signals to and from the ECM, the brake ECU, the EPS control unit and network gateway ECU via CAN communication.

DTC Logic

INFOID:0000000004212179

DTC DETECTION LOGIC

If the hybrid vehicle control ECU detects a problem with CAN communication between the ECU and the brake ECU, the hybrid vehicle control ECU will set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
U0129	220	Lost communication with brake system control	Problem with CAN communication between the brake ECU and hybrid vehicle control ECU (no signal reception)	CAN communication system
U0129	222		Problem with CAN communication between the brake ECU and hybrid vehicle control ECU (signal transmission error)	
U0129	528		Problem with CAN communication between the brake ECU and hybrid vehicle control ECU (CAN communication system malfunction)	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-582, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212180

Go to LAN-53, "Trouble Diagnosis Flow Chart".

U0129-529

Description

INFOID:0000000004212181

The hybrid vehicle control ECU transmits and receives signals to and from the ECM, the brake ECU, the EPS control unit and network gateway ECU via CAN communication.

DTC Logic

INFOID:0000000004212182

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
U0129	529	Lost communication with Brake System Control Module	The hybrid vehicle control ECU receives a malfunction signal from the brake ECU	• Brake ECU • Hybrid vehicle control ECU

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-583, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM TEST DRIVE

1. Drive the vehicle under the similar conditions to freeze frame data for a certain time.
   CAUTION:
   Always drive the vehicle in safe manner according to traffic conditions and obey all traffic laws when driving.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-583, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212183

1.PRECONDITIONING

- 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. 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 CONTINUITY BETWEEN HYBRID VEHICLE CONTROL ECU AND BRAKE ECU

Refer to LAN-4, "Description".

OK or NG

OK >> GO TO 3.
NG >> Repair or replace harness or connectors.

3. CHECK DTC OUTPUT (BRAKE)

1. Turn ignition switch ON.
2. Check DTC for brake system.

Is DTC detected?

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

4. REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> INSPECTION END

U0131-433, U0131-434

Description

INFOID:0000000004212184

The hybrid vehicle control ECU transmits and receives signals to and from the ECM, the brake ECU, the EPS control unit and network gateway ECU via CAN communication.

DTC Logic

INFOID:0000000004212185

DTC DETECTION LOGIC

If the hybrid vehicle control ECU detects a problem with CAN communication between the ECU and the EPS control unit, the hybrid vehicle control ECU will set a DTC.

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
U0131	433	Lost communication with EPS control module	Problem with CAN communication between the EPS control unit and hybrid vehicle control ECU (communication error between ECUs)	CAN communication system
U0131	434		Problem with CAN communication between the EPS control unit and hybrid vehicle control ECU (signal transmission error)	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-585, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212186

Go to LAN-53, "Trouble Diagnosis Flow Chart".

< COMPONENT DIAGNOSIS >

U0424-537

Description

INFOID:0000000004212187

If there is a malfunction in the Auto Amp. (Automatic air conditioner system), DTC U0424-537 will be output.

DTC Logic

INFOID:0000000004212188

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
U0424	537	Invalid Data Received from HVAC Control Module	Auto Amp. (Automatic air conditioner system) malfunction	Auto Amp. (Automatic air conditioner system)

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-586, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212189

1.PRECONDITIONING

- 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. 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 DTC OUTPUT (AIR CONDITIONING SYSTEM)

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

Air conditioning system DTCs are output

YES >> Go to air conditioning system.
NO >> Replace Auto Amp. (Automatic air conditioner system).

U1001-146, U1001-435U1001-594, U1001-827 U1001-919, U1001-920

Description

INFOID:0000000004212190

CAN (Controller Area Network) is a serial communication line for real time application. It is an on-vehicle multiplex communication line with high data communication speed and excellent error detection ability. Many electronic control units are equipped onto a vehicle, and each control unit shares information and links with other control units during operation (not independent). In CAN communication, control units are connected with 2 communication lines (CAN H line, CAN L line) allowing a high rate of information transmission with less wiring. Each control unit transmits/receives data but selectively reads required data only.

DTC Logic

INFOID:0000000004212191

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
U1001	146	Lost communication with BCM	When the hybrid vehicle control ECU is not transmitting or receiving CAN communication signal with BCM for 2 seconds or more.	CAN communication system
U1001	435		When the hybrid vehicle control ECU is not transmitting or receiving CAN communication signal with BCM for 2 seconds or more.	CAN communication system
U1001	919	Lost communication with IPDM E/R	When the hybrid vehicle control ECU is not transmitting or receiving CAN communication signal with IPDM E/R for 2 seconds or more.	CAN communication system
U1001	920		When the hybrid vehicle control ECU is not transmitting or receiving CAN communication signal with IPDM E/R for 2 seconds or more.	CAN communication system
U1001	594	Lost communication with controller (Auto AMP.)	When the hybrid vehicle control ECU is not transmitting or receiving CAN communication signal with controller (Auto AMP.) for 2 seconds or more.	CAN communication system
U1001	827		When the hybrid vehicle control ECU is not transmitting or receiving CAN communication signal with controller (Auto AMP.) for 2 seconds or more.	CAN communication system

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC confirmation procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to HBC-588, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000004212192

Go to LAN-16, "Trouble Diagnosis Flow Chart".

ASCD INDICATOR

Description

INFOID:0000000004212193

ASCD indicator lamp illuminates to indicate ASCD operation status. Lamp has two indicators, CRUISE and SET, and is integrated in combination meter.
CRUISE lamp illuminates when MAIN switch on ASCD steering switch is turned ON to indicated that ASCD system is ready for operation.
SET lamp illuminates when following conditions are met.
- CRUISE lamp is illuminated.
- SET/COAST switch on ASCD steering switch is turned ON while vehicle speed is within the range of ASCD setting.

SET lamp remains lit during ASCD control.
Refer to EC-45, "System Description" for the ASCD function.

Component Function Check

INFOID:0000000004212194

1.ASCD INDICATOR FUNCTION

Check ASCD indicator under the following conditions.

ASCD INDICATOR	CONDITION		SPECIFICATION
CRUISE LAMP	• Ignition switch: ON	• MAIN switch: Pressed at the 1st time →at the 2nd time	ON → OFF
SET LAMP	• MAIN switch: ON • When vehicle speed: Between 40 km/h (25 MPH) and 144 km/h (89 MPH)	• ASCD: Operating	ON
		• ASCD: Not operating	OFF

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to HBC-589, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000004212195

1.CHECK DTC

Check that DTC U1000 or U1001 is not displayed.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Perform trouble diagnosis for DTC U1000, U1001. Refer to EC-119, "Diagnosis Procedure".

2.CHECK COMBINATION METER OPERATION

Refer to MWI-35, "CONSULT-III Function (METER/M&A)".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Check combination meter circuit. Refer to MWI-5, "METER SYSTEM : System Diagram".

3.CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".

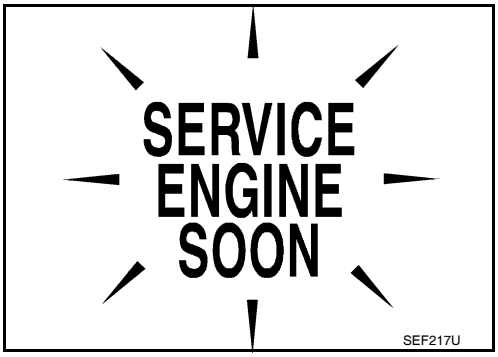
>> INSPECTION END

MALFUNCTION INDICATOR LAMP

Description

INFOID:0000000004212196

The Malfunction Indicator Lamp (MIL) is located on the combination meter.
The MIL will light up when the ignition switch is turned ON before the READY operation light comes on. This is a bulb check.
When the ignition switch is turned ON (READY) and READY operation light turns on, the MIL should go off. If the MIL remains on, the on board diagnostic system has detected a system malfunction.
For details, refer to HBC-590, "Diagnosis Procedure".



Component Function Check

INFOID:0000000004212197

1.CHECK MIL FUNCTION

1. Turn ignition switch ON.
2. Make sure that MIL lights up.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to HBC-590, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000004212198

1.CHECK DTC

Check that DTC U1000 or U1001 is not displayed.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Perform trouble diagnosis for DTC U1000, U1001. Refer to EC-119, "Diagnosis Procedure".

2.CHECK DTC WITH METER

Refer to MWI-35, "CONSULT-III Function (METER/M&A)".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace.

3.CHECK INTERMITTENT INCIDENT

Refer to GI-42, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace combination meter.
NO >> Repair or replace.

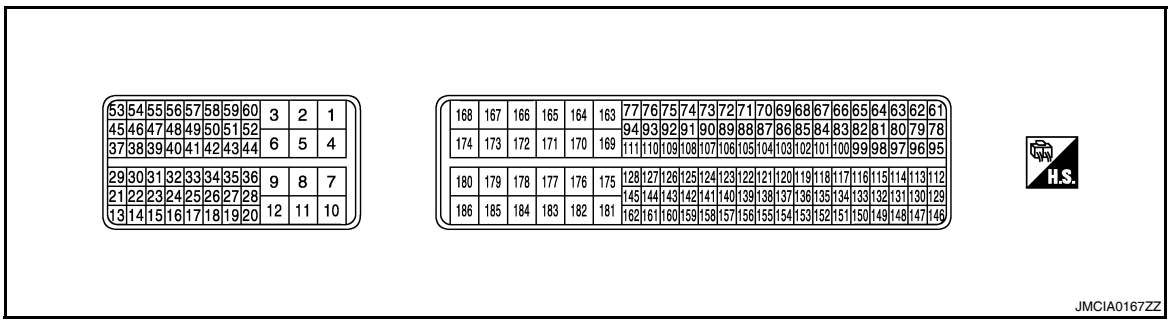
ECU DIAGNOSIS

HV ECU

Reference Value

INFOID:0000000004212199

TERMINAL LAYOUT



PHYSICAL VALUES

NOTE:

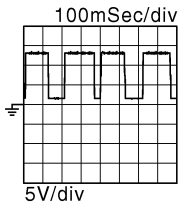
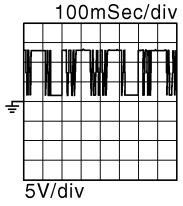
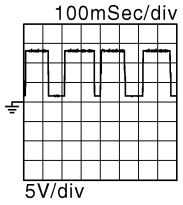
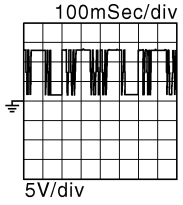
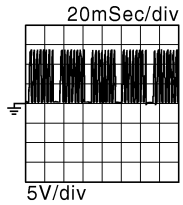
- The hybrid vehicle control ECU is located behind the passenger side instrument lower panel. For this inspection, remove passenger side instrument lower panel.
- Specification data are reference values and are measured between each terminal and ground.
- Pulse signal is measured by CONSULT-III.

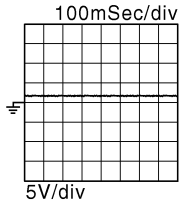
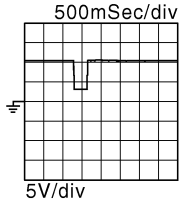
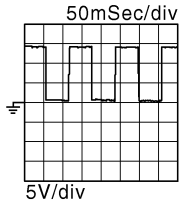
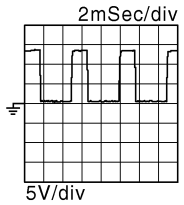
CAUTION:

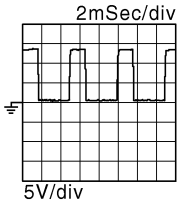
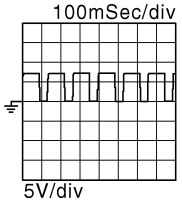
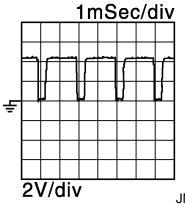
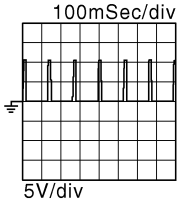
Do not use the hybrid vehicle control ECU ground terminals when measuring input/output voltage. Doing so may result in damage to the hybrid vehicle control ECUs transistor. Use a ground other than the hybrid vehicle control ECU terminals, such as the ground.

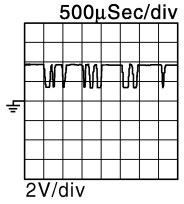
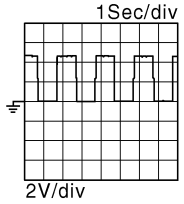
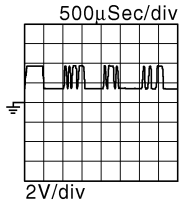
Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
10	Ground	B	hybrid vehicle control ECU ground	—	**[Ignition switch: READY]**	0V
11	Ground	B	hybrid vehicle control ECU ground	—	**[Ignition switch: READY]**	0V
12	Ground	B	hybrid vehicle control ECU ground	—	**[Ignition switch: READY]**	0V
13	Ground	L/R	Generator temperature sensor ground	—	**[Ignition switch: READY]**	0V
14	Ground	G/R	Generator temperature sensor	Input	**[Ignition switch: ON]** • Ambient temperature: 25°C (77°F)	3.4 - 4.9V
					[Ignition switch: ON] • Ambient temperature: 60°C (140°F)	2.2 - 3.3V
15	Ground	LG/R	Motor temperature sensor ground	—	**[Ignition switch: READY]**	0V
16	Ground	BR/R	Motor temperature sensor	Input	**[Ignition switch: ON]** • Ambient temperature: 25°C (77°F)	3.4 - 4.9V
					[Ignition switch: ON] • Ambient temperature: 60°C (140°F)	2.2 - 3.3V
20	Ground	W	Power supply for hybrid vehicle control ECU	Input	**[Ignition switch: OFF]**	BATTERY VOLTAGE (11 - 14V)

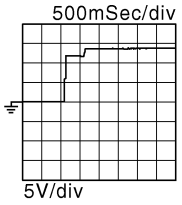
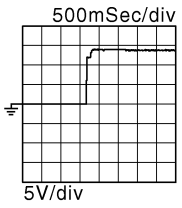
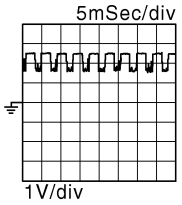
Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
37	Ground	R/B	BCM communication (PNP switch signal)	Output	**[Ignition switch: ON]** • Shift position: P or N	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Shift position: Except above	0 - 1.5V
45	Ground	V	PNP switch (P position signal)	Input	**[Ignition switch: ON]** • Shift position: P	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Shift position: Except above	0 - 1.5V
46	Ground	Y/B	PNP switch (R position signal)	Input	**[Ignition switch: ON]** • Shift position: R	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Shift position: Except above	0 - 1.5V
47	Ground	G/B	PNP switch (N position signal)	Input	**[Ignition switch: ON]** • Shift position: N	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Shift position: Except above	0 - 1.5V
48	Ground	L/B	PNP switch (D position signal)	Input	**[Ignition switch: ON]** • Shift position: D	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Shift position: Except above	0 - 1.5V
49	Ground	LG/B	PNP switch (B position signal)	Input	**[Ignition switch: ON]** • Shift position: B	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Engine stopped • Shift position: Except above	0 - 1.5V
50	Ground	GR/B	PNP switch (RV position signal)	Input	**[Ignition switch: ON]** • Shift position: R	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Shift position: Except above	0 - 1.5V
51	Ground	P/B	PNP switch (FD position signal)	Input	**[Ignition switch: ON]** • Shift position: D or B	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Engine stopped • Shift position: Except above	0 - 1.5V
52	Ground	W/R	PNP switch (MJ position signal)	Input	**[Ignition switch: ON]** • Shift position: P, R, N, D or B	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON] • Shift position: Except above	0 - 1.5V

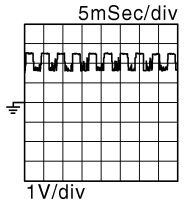
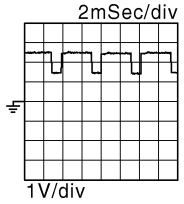
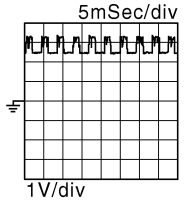
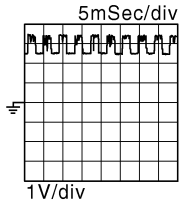
Terminal No. +	Terminal No. –	Wire color	Description: Signal name	Description: Input/ Output	Condition	Value (Approx.)
53	Ground	R	Compressor inverter communication	—	**[Ignition switch: READY]** • A/C system: Not operating	 JMCIA0001GB The wave form will vary depending on the content of the digital communication (digital signal).
					[Ignition switch: READY] • A/C system: Operating	 JMCIA0002GB The wave form will vary depending on the content of the digital communication (digital signal).
54	Ground	Y	Compressor inverter communication	—	**[Ignition switch: READY]** • A/C system: Not operating	 JMCIA0001GB The wave form will vary depending on the content of the digital communication (digital signal).
					[Ignition switch: READY] • A/C system: Operating	 JMCIA0002GB The wave form will vary depending on the content of the digital communication (digital signal).
55	Ground	L	Compressor inverter communication	—	**[Ignition switch: READY]**	 JMCIA0005GB The wave form will vary depending on the content of the digital communication (digital signal).

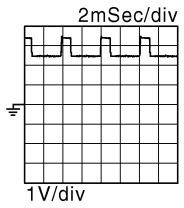
Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
56	Ground	W	Compressor inverter communication	—	**[Ignition switch: READY]**	 JMCIA0006GB The wave form will vary depending on the content of the digital communication (digital signal).
60	Ground	P	Power supply for PNP switch	—	**[Ignition switch: ON]**	BATTERY VOLTAGE (11 - 14V)
77	Ground	L/B	HV battery assembly (SMRP operation signal)	—	**[Ignition switch: ON to READY]**	 JMCIA0007GB
82	Ground	G/B	Back up lamp relay	Output	**[Ignition switch: ON]** • Shift position: R	0 - 1.5V
					[Ignition switch: ON] • Shift position: Except above	BATTERY VOLTAGE (11 - 14V)
94	Ground	GR/R	MG ECU communication (Interlock switch signal)	Input	**[Ignition switch: ON]** • Service plug grip: Connect	0 - 1.5V
					[Ignition switch: ON] • Service plug grip: Disconnect	BATTERY VOLTAGE (11 - 14V)
100	Ground	L	ECM (PHASE signal)	Input	**[Engine is running]** • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle.	 JMCIA0008GB The pulse cycle becomes shorter as the engine speed increased.
101	Ground	P	ECM (POS signal)	Input	**[Engine is running]** • Idle speed	 JMCIA0009GB The pulse cycle becomes shorter as the engine speed increased.

Terminal No. +	Terminal No. –	Wire color	Description: Signal name	Description: Input/ Output	Condition	Value (Approx.)
102	Ground	L/O	Brake ECU (Vehicle speed signal)	Input	**[Ignition switch: READY]** • Vehicle speed: 20 km/h (12 MPH)	 JMCIA0009GB The higher the vehicle speed, the shorter the cycle.
103	Ground	GR	HV battery assembly (DC/DC converter operation signal)	Input	**[Ignition switch: ON]**	0.1 - 0.5V
					[Ignition switch: READY]	5 - 7V
104	Ground	G/R	HV battery assembly (DC/DC converter operation signal)	Input	**[Ignition switch: ON]**	 JMCIA0011GB The cycle will vary depending on the specified voltage of the hybrid vehicle converter.
105	Ground	Y/R	HV battery blower fan motor	—	**[Ignition switch: ON]** • During ACTIVE TEST	 JMCIA0122GB
109	Ground	R	Inverter water pump	—	**[Ignition switch: READY]**	 JMCIA0012GB
112	Ground	O	Sensor power supply (Accelerator pedal position sensor 2)	—	**[Ignition switch: ON]**	5V
113	Ground	O/L	Sensor power supply (Accelerator pedal position sensor 1)	—	**[Ignition switch: ON]**	5V
118	Ground	G/B	ASCD brake switch	Input	**[Ignition switch: OFF]** • Brake pedal: Fully released	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: OFF] • Brake pedal: Slightly depressed	0 - 1.5V
121	Ground	L/W	MG ECU communication (MG shutdown signal)	Input	**[Ignition switch: ON]** **[Ignition switch: READY]**	0 - 1.5V
129	Ground	W/L	Sensor ground (Accelerator pedal position sensor 2)	—	**[Ignition switch: READY]**	0V

Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
130	Ground	L/G	Sensor ground (Accelerator pedal position sensor 1)	—	**[Ignition switch: READY]**	0V
133	Ground	L/R	HV battery assembly (Battery smart unit communication signal)	Input	**[Ignition switch: ON]**	 JMCIA0013GB The wave form will vary depending on the content of the digital communication (digital signal).
138	Ground	G/O	Air bag diagnosis sensor unit (Air bag activation signal)	Input	**[Ignition switch: READY]**	 JMCIA0014GB
146	Ground	W	Accelerator pedal position sensor 2	Input	**[Ignition switch: ON]** • Engine stopped • Shift position: P • Accelerator pedal: Fully released	1.0 - 2.2V
					[Ignition switch: ON] • Engine stopped • Shift position: P • Accelerator pedal: Fully depressed	3.4 - 5.3V
147	Ground	L/Y	Accelerator pedal position sensor 1	Input	**[Ignition switch: ON]** • Engine stopped • Shift position: P • Accelerator pedal: Fully released	0.4 - 1.4V
					[Ignition switch: ON] • Engine stopped • Shift position: P • Accelerator pedal: Fully depressed	2.6 - 4.5V
148	Ground	R/G	Stop lamp switch	Input	**[Ignition switch: ON]** • Brake pedal: Fully released	0 - 1.5V
					[Ignition switch: ON] • Brake pedal: Slightly depressed	BATTERY VOLTAGE (11 - 14V)
150	Ground	L/G	HV battery assembly (Battery smart unit communication signal)	Input	**[Ignition switch: ON]**	 JMCIA0015GB The wave form will vary depending on the content of the digital communication (digital signal).

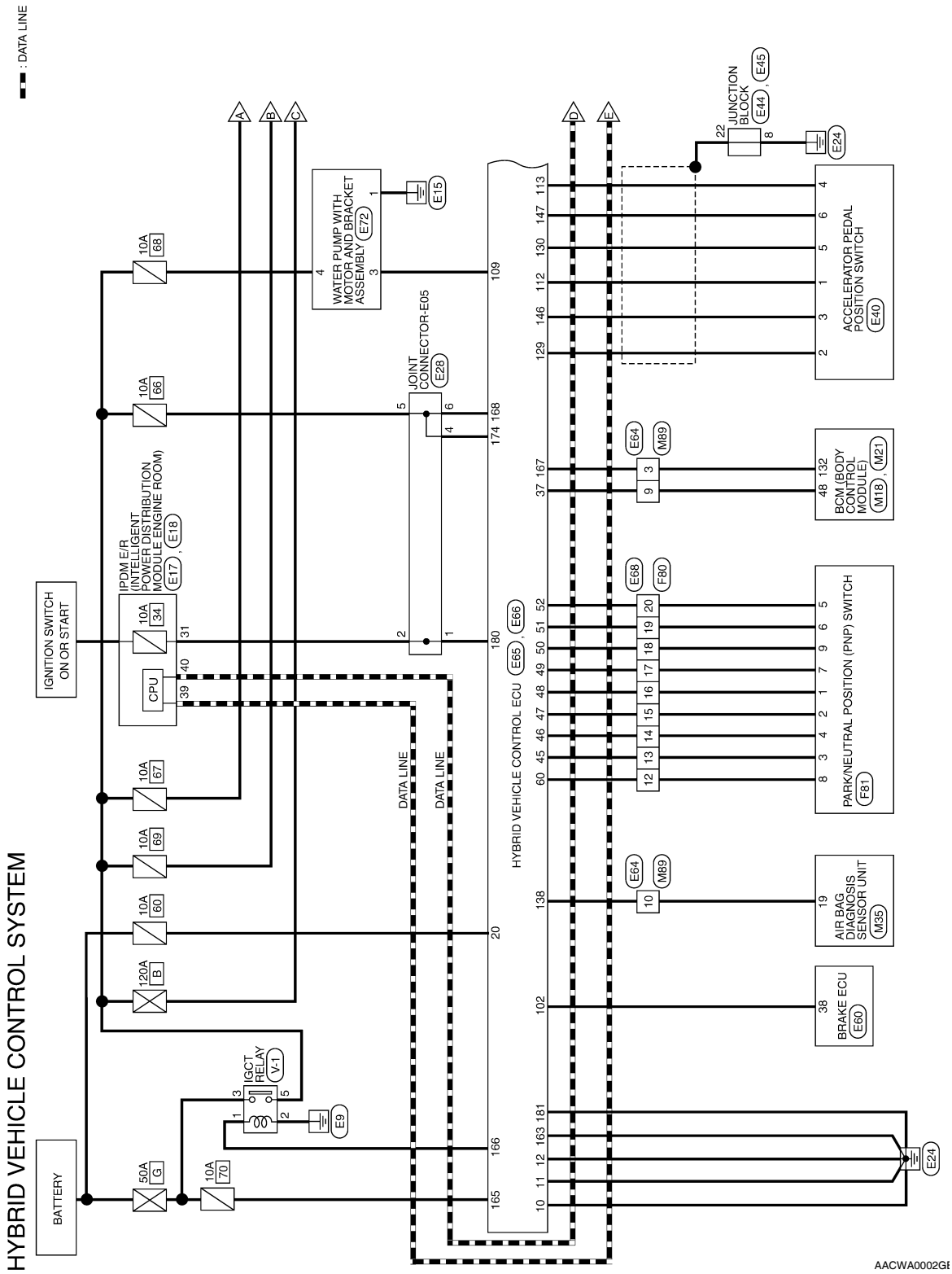
Terminal No. +	Terminal No. –	Wire color	Description Signal name	Description Input/ Output	Condition	Value (Approx.)
163	Ground	B	hybrid vehicle control ECU ground	—	**[Ignition switch: READY]**	0V
165	Ground	W/G	Power supply for hybrid vehicle control ECU	Input	**[Ignition switch: OFF]**	BATTERY VOLTAGE (11 - 14V)
166	Ground	BR/Y	IGCT relay	Output	**[Ignition switch: ON]**	BATTERY VOLTAGE (11 - 14V)
167	Ground	R	BCM communication (Start signal)	Input	**[Ignition switch: ON]**	BATTERY VOLTAGE (11 - 14V)
168	Ground	R/G	Power supply for hybrid vehicle control ECU	Input	**[Ignition switch: ON]**	BATTERY VOLTAGE (11 - 14V)
169	Ground	W/B	HV battery assembly (SMRB operation signal)	—	**[Ignition switch: ON to READY]**	 JMCIA0016GB
170	Ground	P	CAN communication line (TOYOTA)	Input/ Output	—	—
171	Ground	L	CAN communication line (TOYOTA)	Input/ Output	—	—
172	Ground	P	CAN communication line (NISSAN)	Input/ Output	—	—
173	Ground	L	CAN communication line (NISSAN)	Input/ Output	—	—
174	Ground	R/G	Power supply for hybrid vehicle control ECU	Input	**[Ignition switch: ON]**	BATTERY VOLTAGE (11 - 14V)
175	Ground	Y/B	HV battery assembly (SMRG operation signal)	—	**[Ignition switch: ON to READY]**	 JMCIA0017GB
176	Ground	LG	MG ECU communication	—	**[Ignition switch: READY]**	 JMCIA0018GB The wave form will vary depending on the content of the digital communication (digital signal).

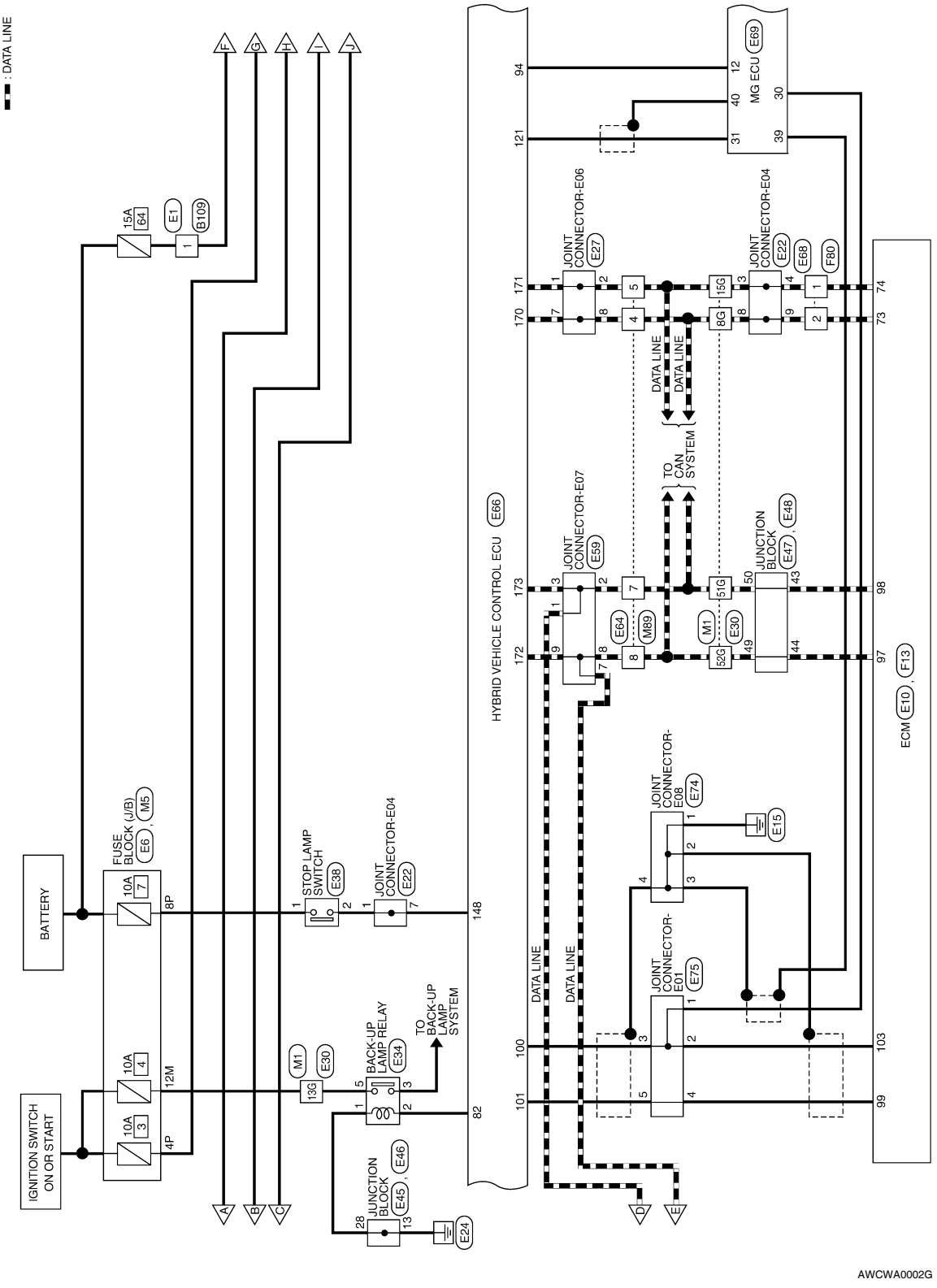
Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
177	Ground	Y/L	MG ECU communication	Input	**[Ignition switch: READY]**	 JMCIA0019GB The wave form will vary depending on the content of the digital communication (digital signal).
178	Ground	L/O	MG ECU communication	Input/ Output	**[Ignition switch: READY]**	2V
179	Ground	BR	MG ECU communication	Input/ Output	**[Ignition switch: READY]**	 JMCIA0020GB
180	Ground	G/W	Ignition switch signal	Input	**[Ignition switch: ON]**	BATTERY VOLTAGE (11 - 14V)
181	Ground	B	hybrid vehicle control ECU ground	—	**[Ignition switch: READY]**	0V
182	Ground	V	MG ECU communication	—	**[Ignition switch: READY]**	 JMCIA0021GB The wave form will vary depending on the content of the digital communication (digital signal).
183	Ground	Y/G	MG ECU communication	Input	**[Ignition switch: READY]**	 JMCIA0022GB The wave form will vary depending on the content of the digital communication (digital signal).
184	Ground	W/L	MG ECU communication	Input/ Output	**[Ignition switch: READY]**	3V

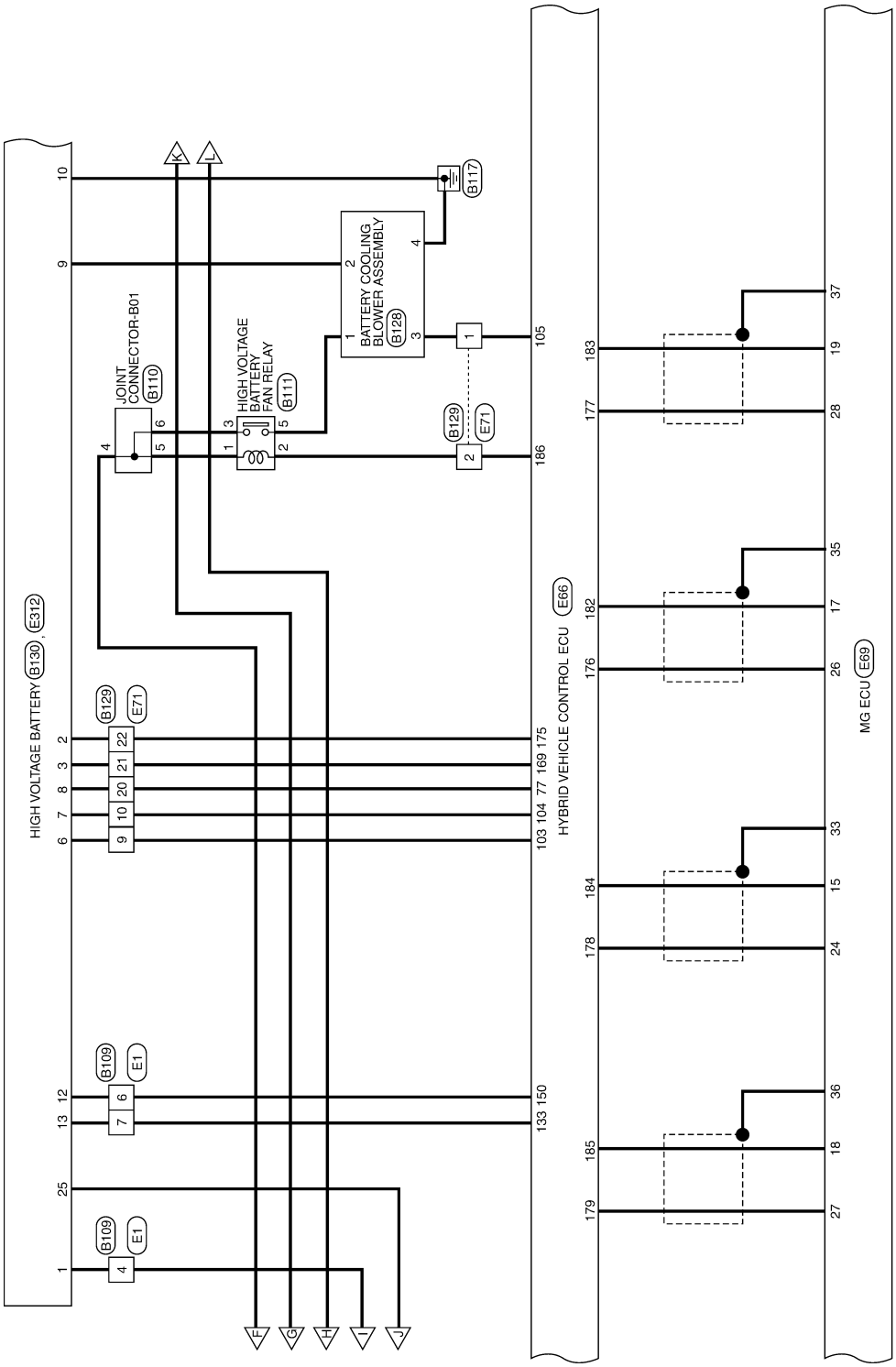
Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
185	Ground	Y	MG ECU communication	Input/ Output	**[Ignition switch: READY]**	 JMCIA0023GB
186	Ground	GR/R	HV battery blower fan relay	Input	**[Ignition switch: OFF]**	BATTERY VOLTAGE (11 - 14V)
					[Ignition switch: ON]	0V

Wiring Diagram

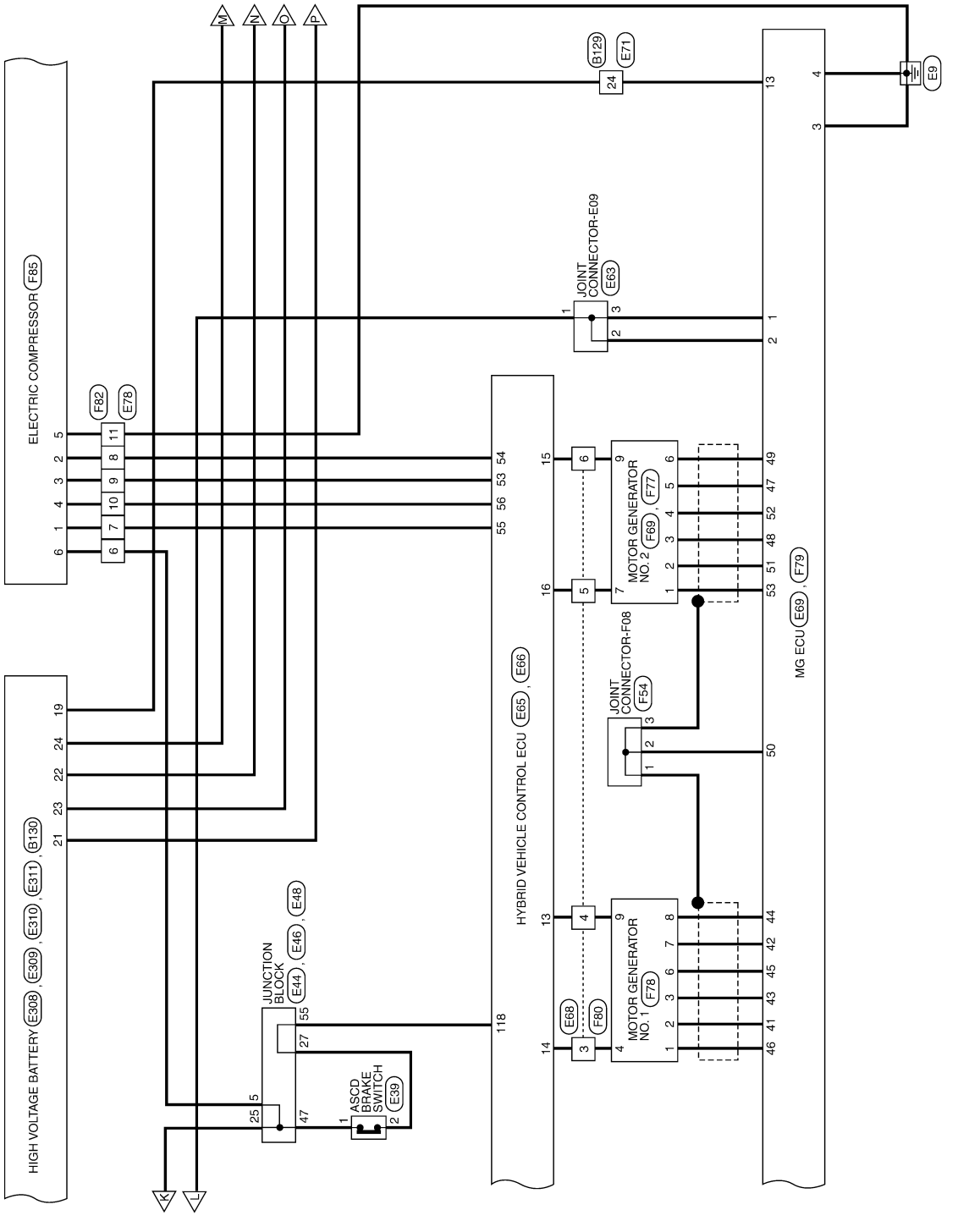
INFOID:0000000004212200

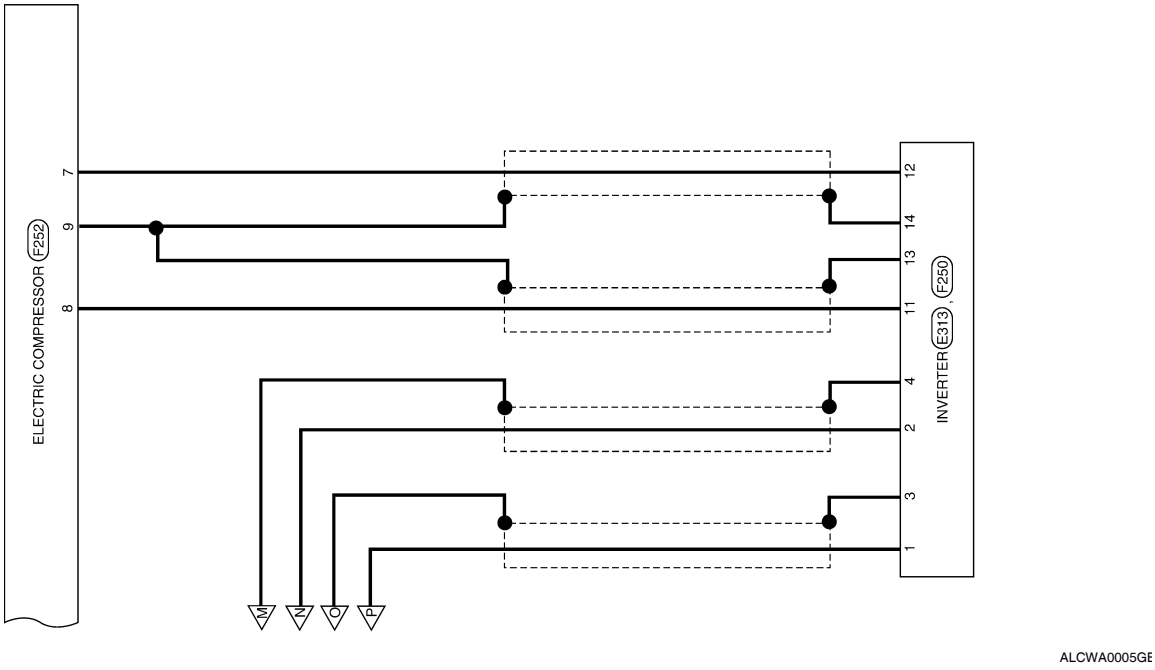



: DATA LINE
BATTERY
IGNITION SWITCH ON OR START
FUSE BLOCK (J/B) M5, E6
15A 64
10A 7
10A 4
10A 3
8P
12M
4P
E1
B109
1
STOP LAMP SWITCH E38
JOINT CONNECTOR-E04 E22
BACK-UP LAMP RELAY E34
TO BACK-UP LAMP SYSTEM
M1 E30
13G
JUNCTION BLOCK E45, E46
28
13
E24
148
82
HYBRID VEHICLE CONTROL ECU E66
94
121
171
170
173
172
100
101
DATA LINE
JOINT CONNECTOR-E06 E27
JOINT CONNECTOR-E04 E22, E68, F80
15G
8G
TO CAN SYSTEM
JOINT CONNECTOR-E07 E59
E64
M89
51G
52G
M1 E30
JUNCTION BLOCK E47, E48
50
49
43
44
MG ECU E69
12
40
30
31
39
74
73
98
97
103
99
ECM E10, F13
JOINT CONNECTOR-E08 E74
E15
JOINT CONNECTOR-E01 E75
A
B
C
D
E
F
G
AWCWA0002G


HIGH VOLTAGE BATTERY B130, E312
JOINT CONNECTOR-B01 B110
HIGH VOLTAGE BATTERY FAN RELAY B111
BATTERY COOLING BLOWER ASSEMBLY B128
B117
B129
E71
B109
E1
HYBRID VEHICLE CONTROL ECU E66
MG ECU E69
K
L
F
G
H
I
J

AWCWA0003G


ELECTRIC COMPRESSOR F85
F82
E78
HIGH VOLTAGE BATTERY E308, E309, E310, E311, B130
JUNCTION BLOCK E44, E46, E48
ASCD BRAKE SWITCH E39
HYBRID VEHICLE CONTROL ECU E65, E66
JOINT CONNECTOR-E09 E63
B129
E71
E9
MOTOR GENERATOR NO. 2 F69, F77
JOINT CONNECTOR-F08 F54
MOTOR GENERATOR NO. 1 F78
E68
F80
MG ECU E69, F79
AWCWA0004G

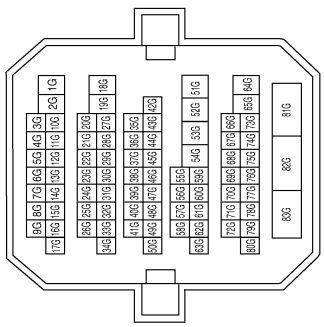


ALCWA0005GE

HYBRID VEHICLE CONTROL SYSTEM CONNECTORS

Connector No.	M1
Connector Name	WIRE TO WIRE
Connector Color	WHITE

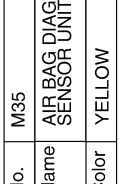
H.S.



Terminal No.	Color of Wire	Signal Name
8G	BR	–
13G	O	–
15G	Y	–
51G	L	–
52G	P	–

Connector No.	M5
Connector Name	FUSE BLOCK (J/B)
Connector Color	WHITE

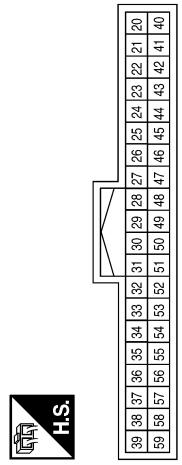
H.S.



Terminal No.	Color of Wire	Signal Name
12M	O	–

Connector No.	M18
Connector Name	BCM (BODY CONTROL MODULE)
Connector Color	GREEN

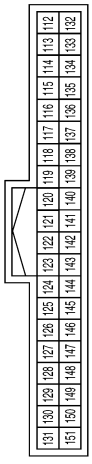
H.S.



Terminal No.	Color of Wire	Signal Name
48	R/B	–

Connector No.	M21
Connector Name	BCM (BODY CONTROL MODULE)
Connector Color	GRAY

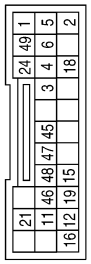
H.S.



Terminal No.	Color of Wire	Signal Name
132	R	–

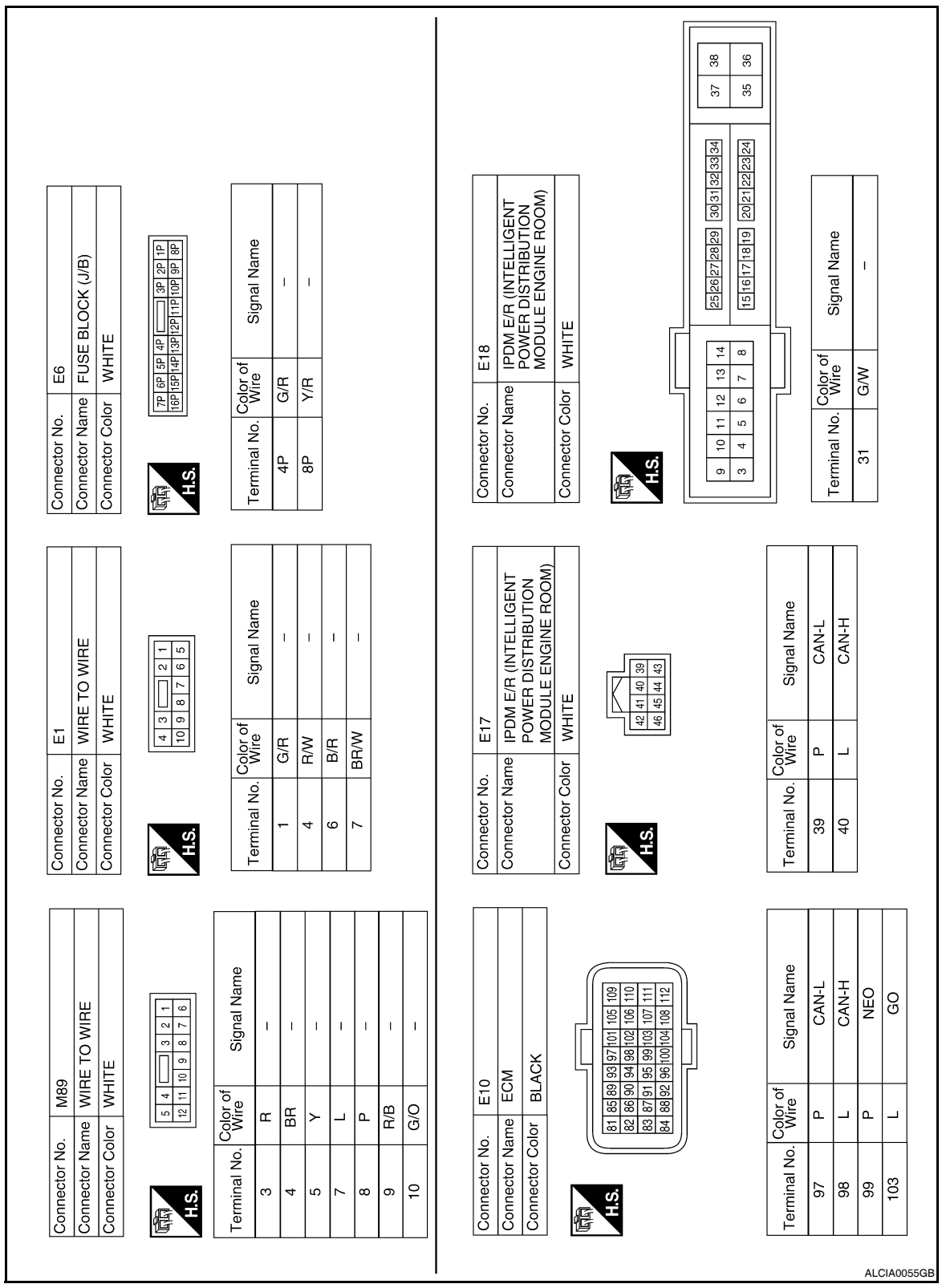
Connector No.	M35
Connector Name	AIR BAG DIAGNOSIS SENSOR UNIT
Connector Color	YELLOW

H.S.



Terminal No.	Color of Wire	Signal Name
19	G/O	IVCS

ALCIA0054GB


Connector No. M89
Connector Name WIRE TO WIRE
Connector Color WHITE
H.S.
5 4 3 2 1
12 11 10 9 8 7 6
Terminal No. Color of Wire Signal Name
3 R –
4 BR –
5 Y –
7 L –
8 P –
9 R/B –
10 G/O –
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. E6
Connector Name FUSE BLOCK (J/B)
Connector Color WHITE
H.S.
7P 6P 5P 4P 3P 2P 1P
16P 15P 14P 13P 12P 11P 10P 9P 8P
Terminal No. Color of Wire Signal Name
4P G/R –
8P Y/R –
Connector No. E10
Connector Name ECM
Connector Color BLACK
H.S.
81 85 89 93 97 101 105 109
82 86 90 94 98 102 106 110
83 87 91 95 99 103 107 111
84 88 92 96 100 104 108 112
Terminal No. Color of Wire Signal Name
97 P CAN-L
98 L CAN-H
99 P NEO
103 L GO
Connector No. E17
Connector Name IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Color WHITE
H.S.
42 41 40 39
46 45 44 43
Terminal No. Color of Wire Signal Name
39 P CAN-L
40 L CAN-H
Connector No. E18
Connector Name IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Color WHITE
H.S.
9 10 11 12 13 14
3 4 5 6 7 8
25 26 27 28 29 30 31 32 33 34 37 38
15 16 17 18 19 20 21 22 23 24 35 36
Terminal No. Color of Wire Signal Name
31 G/W –
ALCIA0055GB

Connector No.	E22
Connector Name	JOINT CONNECTOR-E04
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	R/G	–
3	Y	–
4	Y	–
7	R/G	–
8	BR	–
9	BR	–

Connector No.	E27
Connector Name	JOINT CONNECTOR-E06
Connector Color	BLUE

H.S.

Terminal No.	Color of Wire	Signal Name
1	Y	–
2	Y	–
7	BR	–
8	BR	–

Connector No.	E28
Connector Name	JOINT CONNECTOR-E05
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	G/W	–
2	G/W	–
3	G/W	–
4	R/G	–
5	R/G	–
6	R/G	–

Connector No.	E30
Connector Name	WIRE TO WIRE
Connector Color	WHITE

H.S.

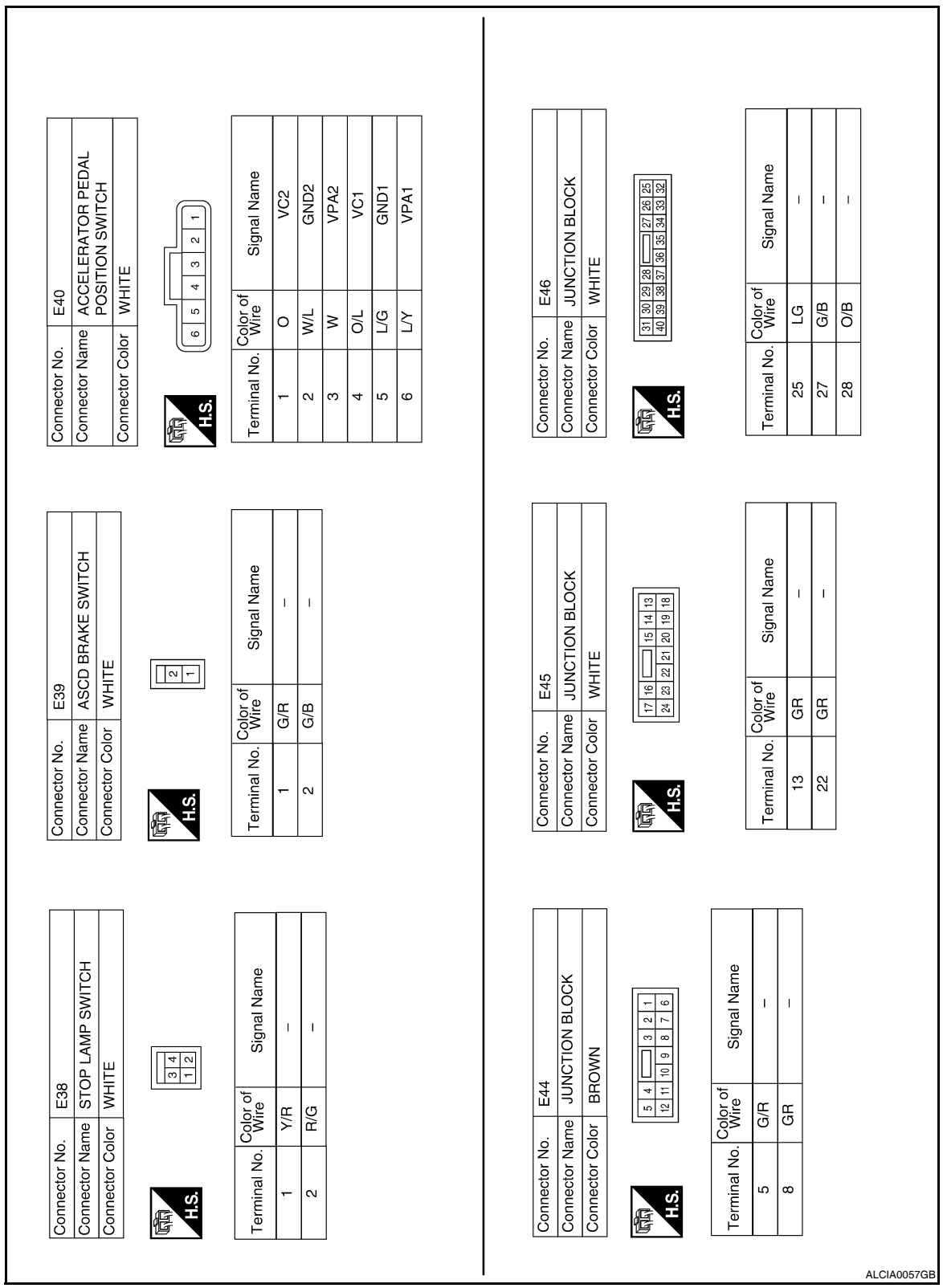
Terminal No.	Color of Wire	Signal Name
8G	BR	–
13G	O	–
15G	Y	–
51G	L	–
52G	P	–

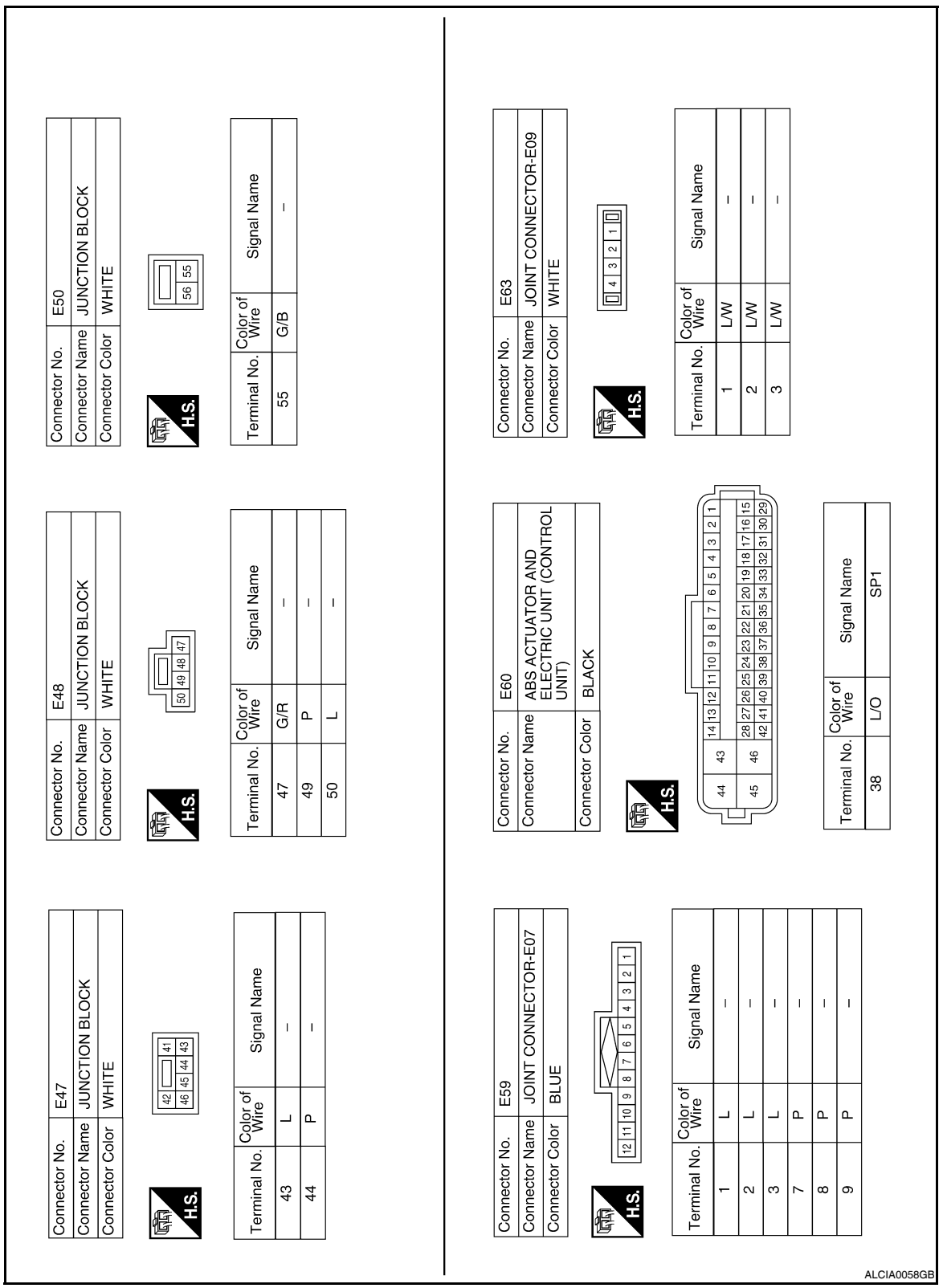
Connector No.	E34
Connector Name	BACK-UP LAMP RELAY
Connector Color	BLUE

H.S.

Terminal No.	Color of Wire	Signal Name
1	O/B	–
2	Y	–
3	P/B	–
5	O	–

ALCIA0056GB


Connector No. E38
Connector Name STOP LAMP SWITCH
Connector Color WHITE
H.S.
3 4
1 2
Terminal No. Color of Wire Signal Name
1 Y/R –
2 R/G –
Connector No. E39
Connector Name ASCD BRAKE SWITCH
Connector Color WHITE
H.S.
2
1
Terminal No. Color of Wire Signal Name
1 G/R –
2 G/B –
Connector No. E40
Connector Name ACCELERATOR PEDAL POSITION SWITCH
Connector Color WHITE
H.S.
6 5 4 3 2 1
Terminal No. Color of Wire Signal Name
1 O VC2
2 W/L GND2
3 W VPA2
4 O/L VC1
5 L/G GND1
6 L/Y VPA1
Connector No. E44
Connector Name JUNCTION BLOCK
Connector Color BROWN
H.S.
5 4 3 2 1
12 11 10 9 8 7 6
Terminal No. Color of Wire Signal Name
5 G/R –
8 GR –
Connector No. E45
Connector Name JUNCTION BLOCK
Connector Color WHITE
H.S.
17 16 15 14 13
24 23 22 21 20 19 18
Terminal No. Color of Wire Signal Name
13 GR –
22 GR –
Connector No. E46
Connector Name JUNCTION BLOCK
Connector Color WHITE
H.S.
31 30 29 28 27 26 25
40 39 38 37 36 35 34 33 32
Terminal No. Color of Wire Signal Name
25 LG –
27 G/B –
28 O/B –
ALCIA0057GB


Connector No. E47
Connector Name JUNCTION BLOCK
Connector Color WHITE
H.S.
42 41
46 45 44 43
Terminal No. Color of Wire Signal Name
43 L –
44 P –
Connector No. E48
Connector Name JUNCTION BLOCK
Connector Color WHITE
H.S.
50 49 48 47
Terminal No. Color of Wire Signal Name
47 G/R –
49 P –
50 L –
Connector No. E50
Connector Name JUNCTION BLOCK
Connector Color WHITE
H.S.
56 55
Terminal No. Color of Wire Signal Name
55 G/B –
Connector No. E59
Connector Name JOINT CONNECTOR-E07
Connector Color BLUE
H.S.
12 11 10 9 8 7 6 5 4 3 2 1
Terminal No. Color of Wire Signal Name
1 L –
2 L –
3 L –
7 P –
8 P –
9 P –
Connector No. E60
Connector Name ABS ACTUATOR AND ELECTRIC UNIT (CONTROL UNIT)
Connector Color BLACK
H.S.
44 43
45 46
14 13 12 11 10 9 8 7 6 5 4 3 2 1
28 27 26 25 24 23 22 21 20 19 18 17 16 15
42 41 40 39 38 37 36 35 34 33 32 31 30 29
Terminal No. Color of Wire Signal Name
38 L/O SP1
Connector No. E63
Connector Name JOINT CONNECTOR-E09
Connector Color WHITE
H.S.
4 3 2 1
Terminal No. Color of Wire Signal Name
1 L/W –
2 L/W –
3 L/W –
ALCIA0058GB

Connector No.	E64
Connector Name	WIRE TO WIRE
Connector Color	WHITE

H.S.

1	2	3		4	5
6	7	8	9	10	11	12

Terminal No.	Color of Wire	Signal Name
3	R	–
4	BR	–
5	Y	–
7	L	–
8	P	–
9	R/B	–
10	G/O	–

Connector No.	E65
Connector Name	HYBRID VEHLCLE CONTROL ECU
Connector Color	BLACK

H.S.

63	54	55	56	57	58	59	60	3	2	1
45	46	47	48	49	50	51	52			
37	38	39	40	41	42	43	44	6	5	4
29	30	31	32	33	34	35	36	9	8	7
21	22	23	24	25	26	27	28			
13	14	15	16	17	18	19	20	12	11	10

Terminal No.	Color of Wire	Signal Name
10	B	EO2
11	B	EO1
12	B	E12
13	L/R	GMTG
14	G/R	GMT
15	LG/R	MMTG

Terminal No.	Color of Wire	Signal Name
16	BR/R	MMT
20	W	S
37	R/B	SHNP
45	V	P
46	Y/B	R
47	G/B	N
48	L/B	D
49	LG/B	B
50	GR/B	RV
51	P/B	FD
52	W/R	MJ
53	R	ETI
54	Y	ITE
55	L	CLK
56	W	STB
60	P	+BS

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Terminal No.	Color of Wire	Signal Name
130	L/G	EP1 (GND-A1)
133	L/R	BTH+
138	G/O	IVCS
146	W	VPA2 (APS2)
147	L/Y	VPA (APSI)
148	R/G	STP (BRAKE)
150	L/G	BTH-
163	B	EI
165	W/G	BATT
166	BR/Y	MREL (SSOFF)
167	R	ST2
168	R/G	VB2 (VBR2)
169	W/B	SMRB
170	P	CAN L (CAN-1L)
171	L	CAN H (CAN-1H)
172	P	CAN- (CAN-2L)
173	L	CAN+ (CAN-2H)
174	R/G	VB (VBR1)
175	Y/B	SMRG
176	LG	HTM-
177	Y/L	MTH-
178	L/O	CLK-
179	BR	REQ-
180	G/W	IGSW
181	B	EC
182	V	HTM+
183	Y/G	MTH+
184	W/L	CLK+
185	Y	REQ+
186	GR/R	FCTL

Connector No.	E66
Connector Name	HYBRID VEHICLE CONTROL 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
82	G/B	BL
94	GR/R	ILK (CONNSW)
100	L	GI (PHASE)
101	P	NEI (POS)
102	L/O	SPDI
103	GR	NODD
104	G/R	VLO
105	Y/R	SIO
109	R	IWP
112	O	VCP2 (AVCC2)
113	O/L	VCP1 (AVCC1)
118	G/B	STI - (BNCSW)
121	L/W	HSDN
129	W/L	EP2 (GND-A2)

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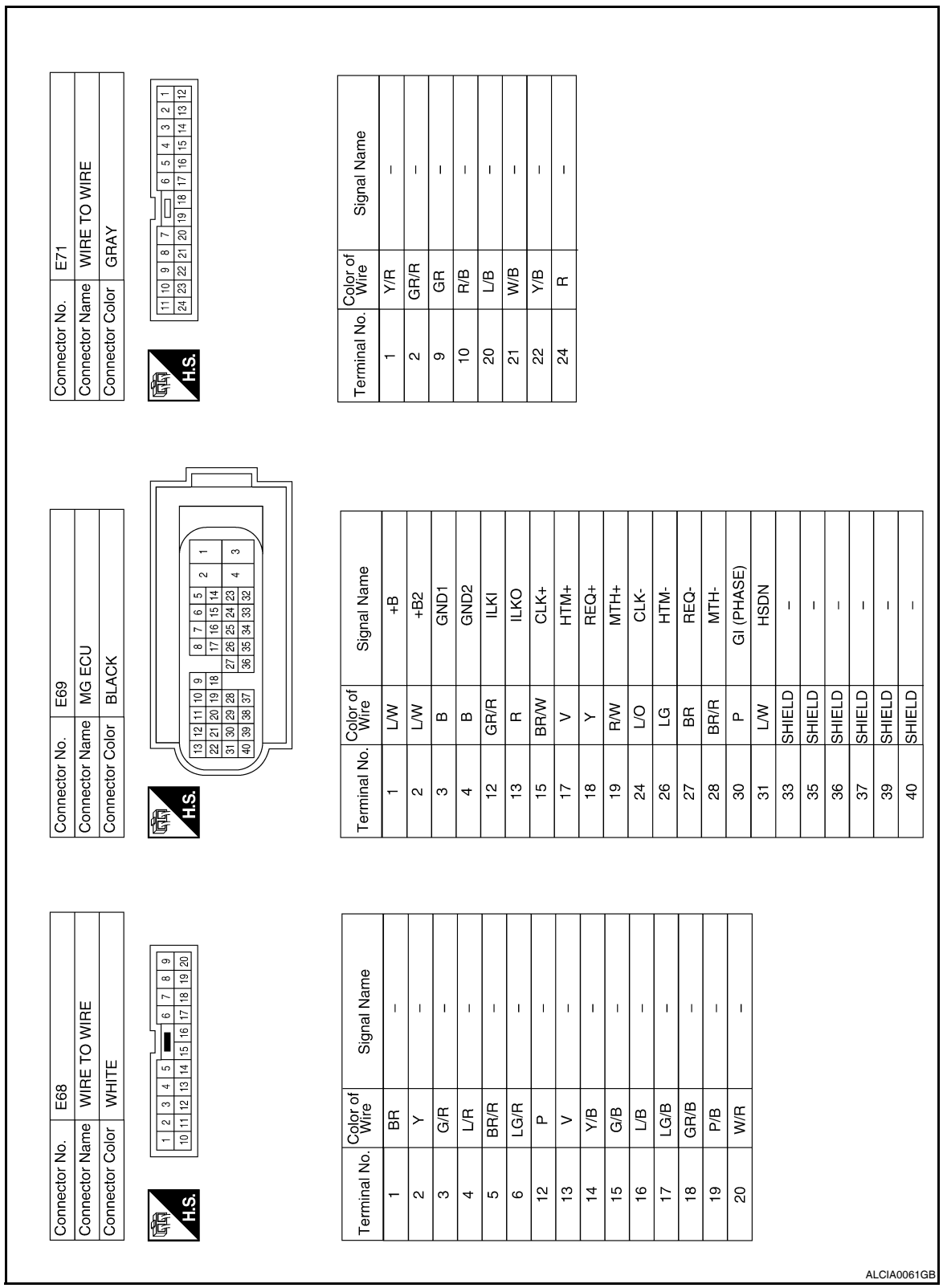

Connector No.	E68
Connector Name	WIRE TO WIRE
Connector Color	WHITE

H.S.

1	2	3	4	5		6	7	8	9
10	11	12	13	14	15	16	17	18	19	20

Terminal No.	Color of Wire	Signal Name
1	BR	–
2	Y	–
3	G/R	–
4	L/R	–
5	BR/R	–
6	LG/R	–
12	P	–
13	V	–
14	Y/B	–
15	G/B	–
16	L/B	–
17	LG/B	–
18	GR/B	–
19	P/B	–
20	W/R	–

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
1	L/W	+B
2	L/W	+B2
3	B	GND1
4	B	GND2
12	GR/R	ILKI
13	R	ILKO
15	BR/W	CLK+
17	V	HTM+
18	Y	REQ+
19	R/W	MTH+
24	L/O	CLK-
26	LG	HTM-
27	BR	REQ-
28	BR/R	MTH-
30	P	GI (PHASE)
31	L/W	HSDN
33	SHIELD	–
35	SHIELD	–
36	SHIELD	–
37	SHIELD	–
39	SHIELD	–
40	SHIELD	–

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	–

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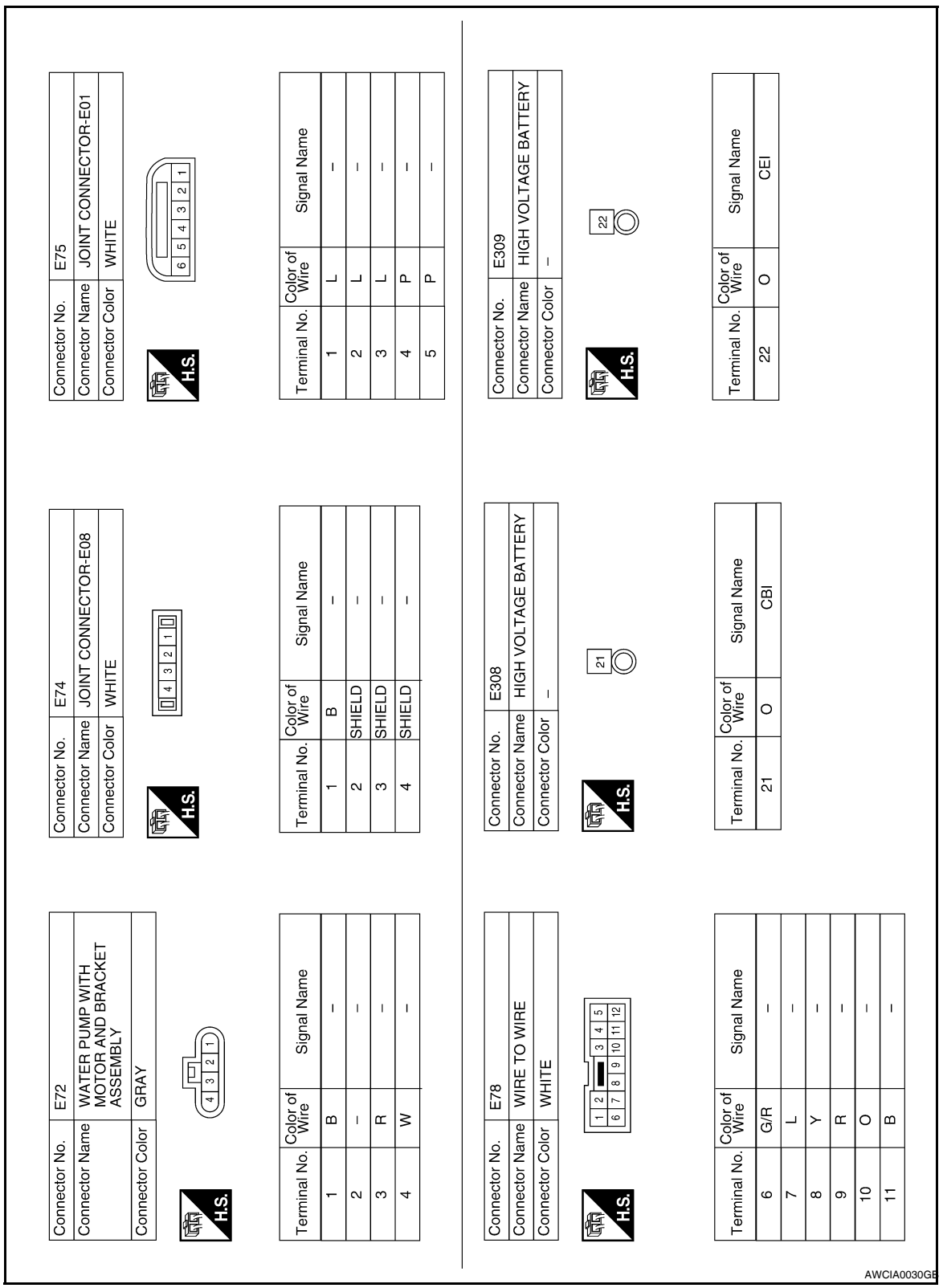

Connector No.	E72
Connector Name	WATER PUMP WITH MOTOR AND BRACKET ASSEMBLY
Connector Color	GRAY

H.S.

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

Connector No.	E74
Connector Name	JOINT CONNECTOR-E08
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	–
2	SHIELD	–
3	SHIELD	–
4	SHIELD	–

Connector No.	E75
Connector Name	JOINT CONNECTOR-E01
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	L	–
2	L	–
3	L	–
4	P	–
5	P	–

Connector No.	E78
Connector Name	WIRE TO WIRE
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
6	G/R	–
7	L	–
8	Y	–
9	R	–
10	O	–
11	B	–

Connector No.	E308
Connector Name	HIGH VOLTAGE BATTERY
Connector Color	–

H.S.

Terminal No.	Color of Wire	Signal Name
21	O	CBI

Connector No.	E309
Connector Name	HIGH VOLTAGE BATTERY
Connector Color	–

H.S.

Terminal No.	Color of Wire	Signal Name
22	O	CEI

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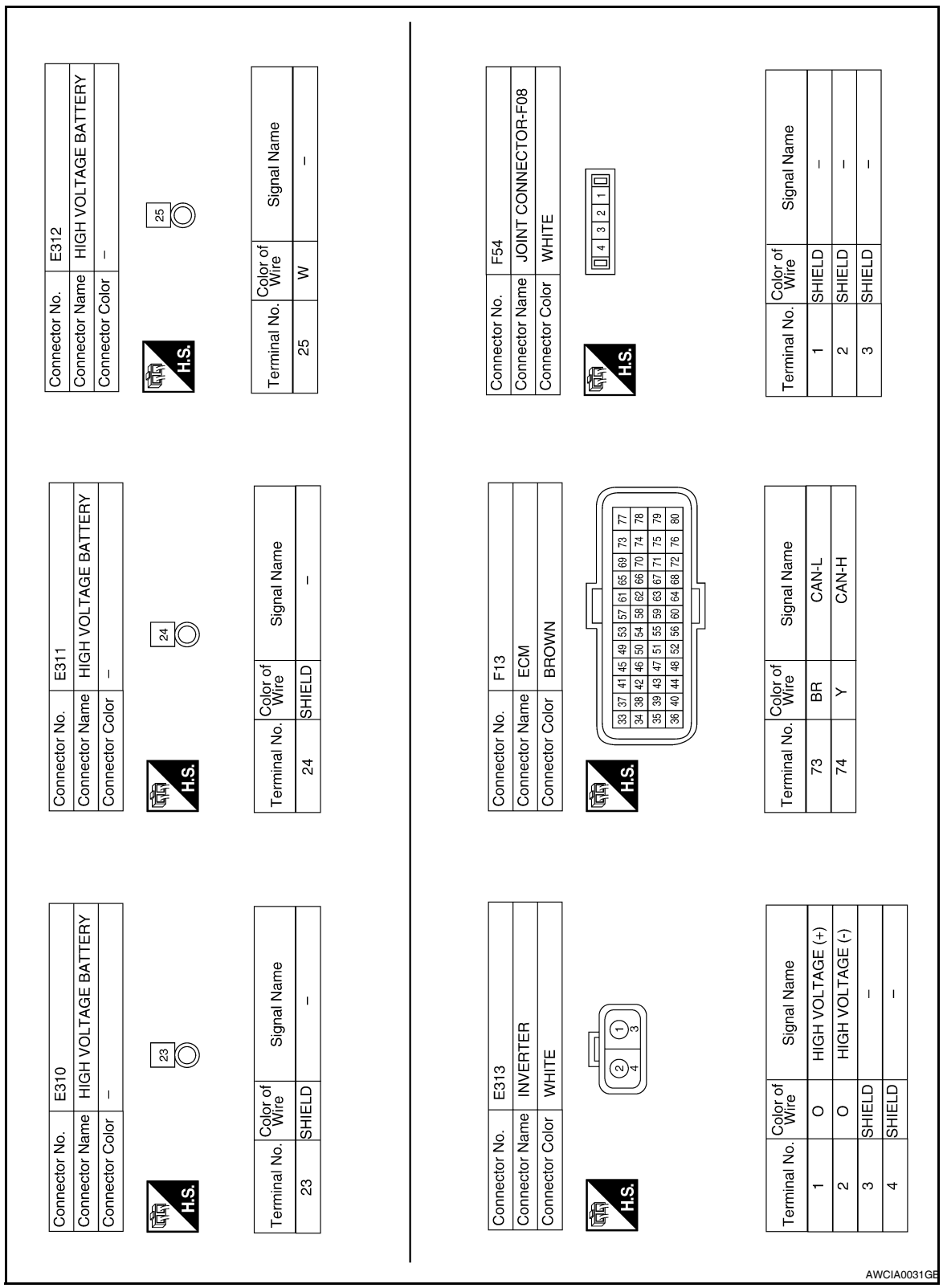
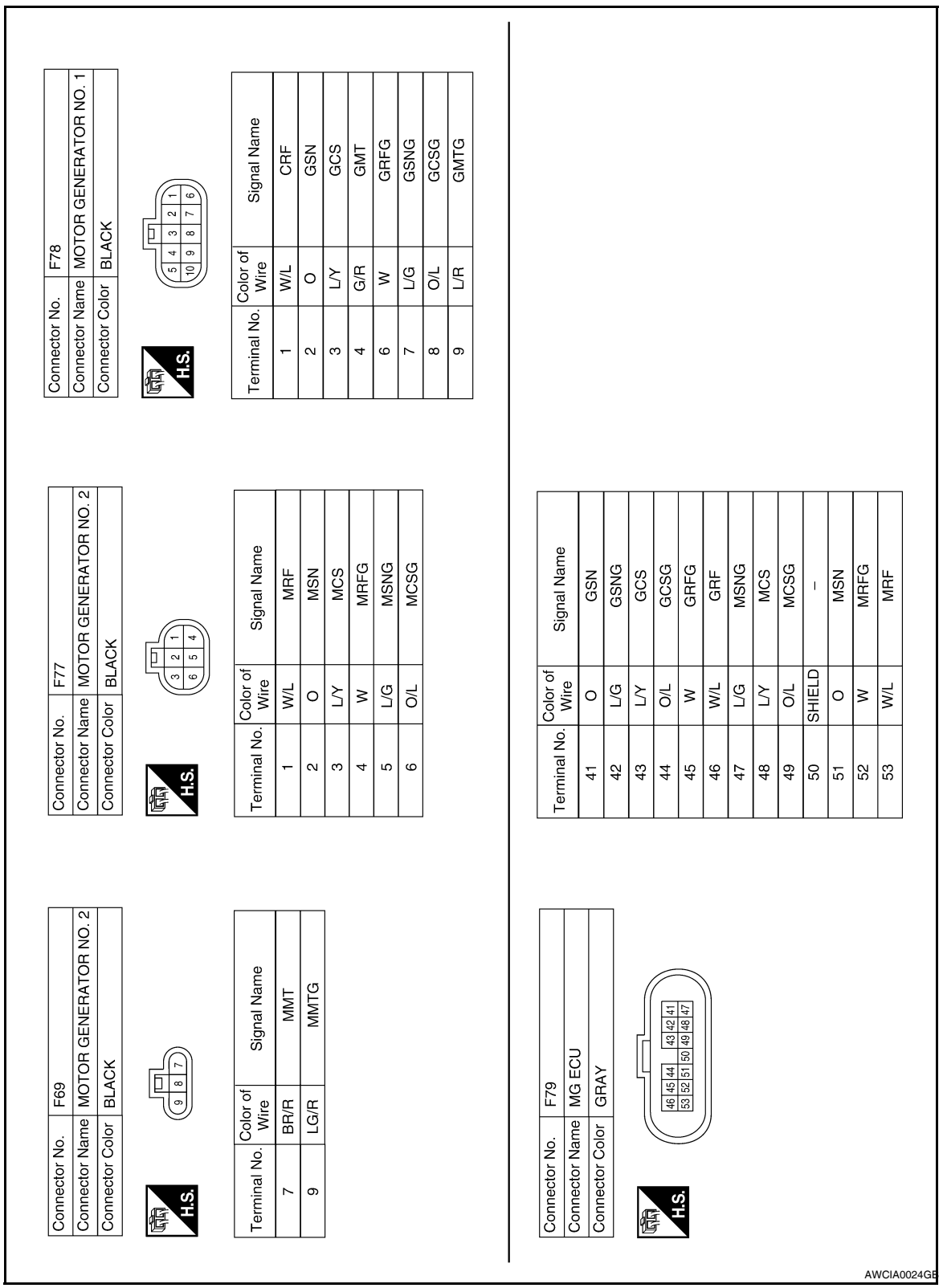

Connector No. E310
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
23
Terminal No. Color of Wire Signal Name
23 SHIELD –
Connector No. E311
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
24
Terminal No. Color of Wire Signal Name
24 SHIELD –
Connector No. E312
Connector Name HIGH VOLTAGE BATTERY
Connector Color –
H.S.
25
Terminal No. Color of Wire Signal Name
25 W –
Connector No. E313
Connector Name INVERTER
Connector Color WHITE
H.S.
2 1
4 3
Terminal No. Color of Wire Signal Name
1 O HIGH VOLTAGE (+)
2 O HIGH VOLTAGE (-)
3 SHIELD –
4 SHIELD –
Connector No. F13
Connector Name ECM
Connector Color BROWN
H.S.
33 37 41 45 49 53 57 61 65 69 73 77
34 38 42 46 50 54 58 62 66 70 74 78
35 39 43 47 51 55 59 63 67 71 75 79
36 40 44 48 52 56 60 64 68 72 76 80
Terminal No. Color of Wire Signal Name
73 BR CAN-L
74 Y CAN-H
Connector No. F54
Connector Name JOINT CONNECTOR-F08
Connector Color WHITE
H.S.
4 3 2 1
Terminal No. Color of Wire Signal Name
1 SHIELD –
2 SHIELD –
3 SHIELD –
AWCIA0031GB



Connector No.	F69
Connector Name	MOTOR GENERATOR NO. 2
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
7	BR/R	MMT
9	LG/R	MMTG

Connector No.	F77
Connector Name	MOTOR GENERATOR NO. 2
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	W/L	MRF
2	O	MSN
3	L/Y	MCS
4	W	MRFG
5	L/G	MSNG
6	O/L	MCSG

Connector No.	F78
Connector Name	MOTOR GENERATOR NO. 1
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	W/L	CRF
2	O	GSN
3	L/Y	GCS
4	G/R	GMT
6	W	GRFG
7	L/G	GSNG
8	O/L	GCSG
9	L/R	GMTG

Connector No.	F79
Connector Name	MG ECU
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
41	O	GSN
42	L/G	GSNG
43	L/Y	GCS
44	O/L	GCSG
45	W	GRFG
46	W/L	GRF
47	L/G	MSNG
48	L/Y	MCS
49	O/L	MCSG
50	SHIELD	–
51	O	MSN
52	W	MRFG
53	W/L	MRF

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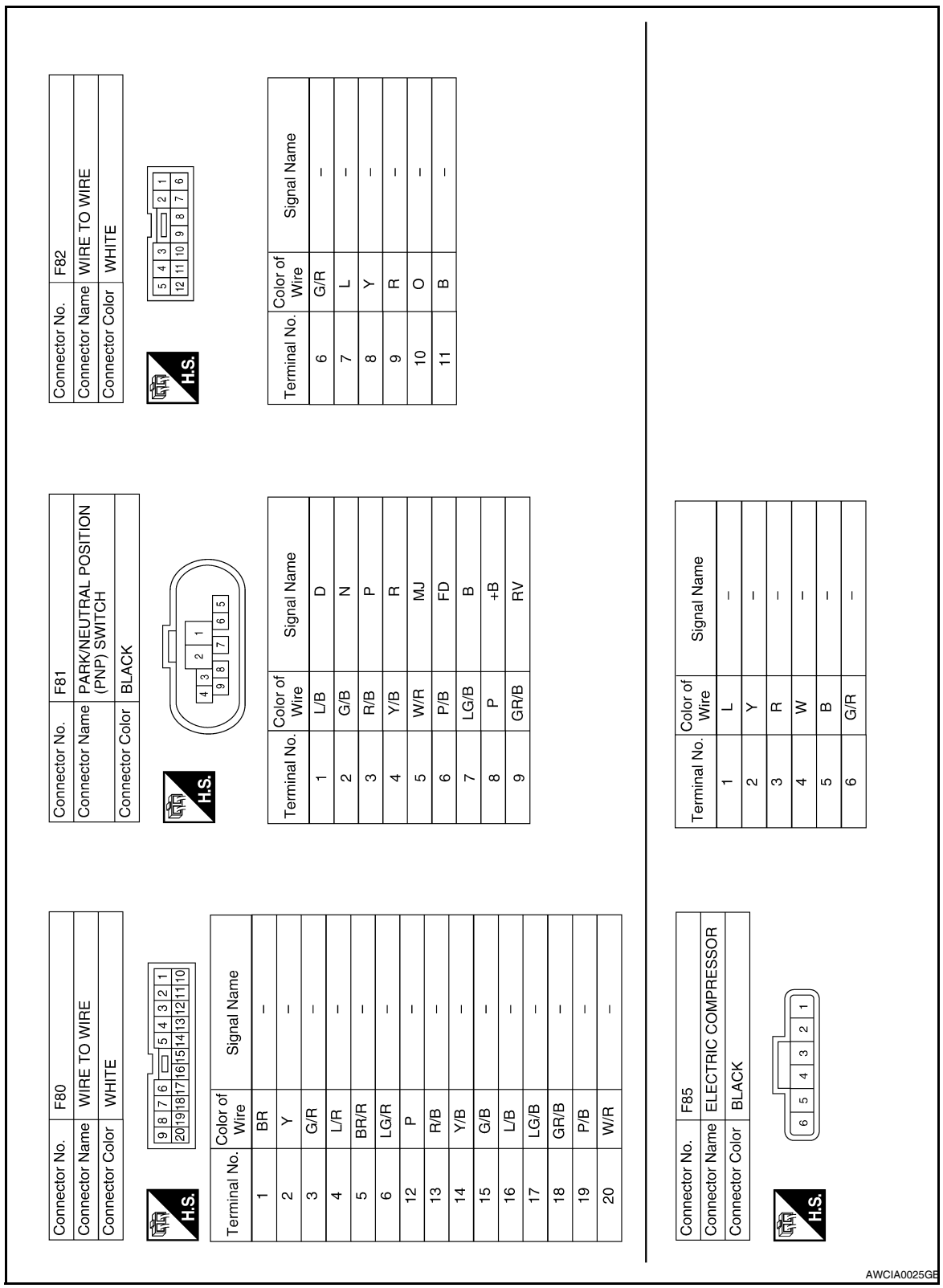
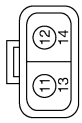

Connector No. F80
Connector Name WIRE TO WIRE
Connector Color WHITE
H.S.
9 8 7 6 5 4 3 2 1
20 19 18 17 16 15 14 13 12 11 10
Terminal No. Color of Wire Signal Name
1 BR –
2 Y –
3 G/R –
4 L/R –
5 BR/R –
6 LG/R –
12 P –
13 R/B –
14 Y/B –
15 G/B –
16 L/B –
17 LG/B –
18 GR/B –
19 P/B –
20 W/R –
Connector No. F81
Connector Name PARK/NEUTRAL POSITION (PNP) SWITCH
Connector Color BLACK
H.S.
4 3 2 1
9 8 7 6 5
Terminal No. Color of Wire Signal Name
1 L/B D
2 G/B N
3 R/B P
4 Y/B R
5 W/R MJ
6 P/B FD
7 LG/B B
8 P +B
9 GR/B RV
Connector No. F82
Connector Name WIRE TO WIRE
Connector Color WHITE
H.S.
5 4 3 2 1
12 11 10 9 8 7 6
Terminal No. Color of Wire Signal Name
6 G/R –
7 L –
8 Y –
9 R –
10 O –
11 B –
Connector No. F85
Connector Name ELECTRIC COMPRESSOR
Connector Color BLACK
H.S.
6 5 4 3 2 1
Terminal No. Color of Wire Signal Name
1 L –
2 Y –
3 R –
4 W –
5 B –
6 G/R –
AWCIA0025GB

Connector No.	F250
Connector Name	INVERTER
Connector Color	WHITE

H.S.



Terminal No.	Color of Wire	Signal Name
11	O	ACPB (+)
12	O	ACPE (-)
13	SHIELD	–
14	SHIELD	–

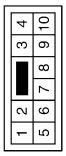
Connector No.	F252
Connector Name	ELECTRIC COMPRESSOR
Connector Color	ORANGE

H.S.

Terminal No.	Color of Wire	Signal Name
7	O	–
8	O	–
9	SHIELD	–

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

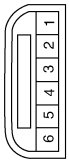
H.S.



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	G/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	–

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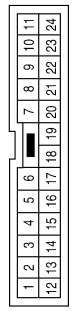
Connector No.	B129
Connector Name	WIRE TO WIRE
Connector Color	GRAY

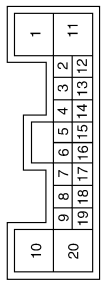
H.S.



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	–

Connector No.	B130
Connector Name	HIGH VOLTAGE BATTERY
Connector Color	WHITE

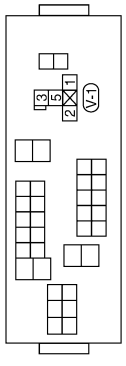
H.S.



Terminal No.	Color of Wire	Signal Name
1	R/W	IGCT (LH6)
2	Y/B	CON3
3	W/B	CON2
6	GR	NODD
7	R/B	VLO
8	L/B	SMRP
9	B/Y	VM
10	B	GND
12	B/R	BTH-
13	BR/W	BTH+
19	R	ILK

Connector No.	V-1
Connector Name	HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX
Connector Color	–

T.S.



Terminal No.	Color of Wire	Signal Name
1	BR/Y	IGCT_CONT
2	B	GND
3	–	BATT
5	–	V_BATT

AWCIA0033GB

DTC Index

INFOID:0000000004212201

×:Applicable —: Not applicable

DTC	CONSULT-III display		GST display	FRZF Information data	Hybrid system warning light	High voltage battery warning light	Charge warning light	MIL	Trip	Reference page
	INF code	Item								
P0335*2	524	CKP SENSOR	—	x	x	—	—	—	1	EC-251
P0338	885	CKP SENSOR CIRCUIT	—	—	x	—	—	—	1	HBC-107
P0340*2	525	CMP SENSOR	—	x	x	—	—	—	1	EC-126 and EC-255
P0343	747	CMP SENSOR CIRCUIT	—	x	x	—	—	—	1	HBC-109
P0343	886	CMP SENSOR CIRCUIT	—	x	x	—	—	—	1	HBC-112
P0560	117	HV ECU POWER SUPLY	×	—	x	—	—	x	1	HBC-114
P0616	142	START SIGNAL/CIRC	—	—	x	—	—	—	1	HBC-116
P062F	143	EEPROM(HV ECU)	—	—	x	—	—	—	1	HBC-118
P0705	757	SHIFT POS SWITCH	—	x	x	—	—	—	1	HBC-119
P0705	758	SHIFT POS SWITCH	—	x	x	—	—	—	1	HBC-119
P0851	775	N SIGNAL LINE	—	x	x	—	—	—	1	HBC-119
P0A01	725	INV COOL SENSOR	—	x	x	—	—	—	1	HBC-125
P0A01	726	INV COOL SENSOR	—	x	x	—	—	—	1	HBC-125
P0A02	719	INV COOL SEN(GND)	—	—	x	—	—	—	1	HBC-128
P0A03	720	INV COOL SEN(OPEN)	—	—	x	—	—	—	1	HBC-128
P0A08	101	DC/DC CONVERTER	—	x	—	—	x	—	1	HBC-129
P0A08	264	DC/DC CONVERTER	—	x	—	—	x	—	1	HBC-132
P0A09	265	DC/DC STAT CIRC LO	—	—	—	—	x	—	1	HBC-138
P0A09	591	DC/DC STAT CIRC LO	—	—	—	—	x	—	1	HBC-140
P0A0D	350	ILK SWITCH CIRCUIT	—	—	x	—	—	—	1	HBC-144
P0A0D	351	ILK SWITCH CIRCUIT	—	—	x	—	—	—	1	HBC-144
P0A0F*2	204	ENGINE STOP	—	x	x	—	—	—	1	EC-328
P0A0F*2	205	ENGINE STOP	—	x	x	—	—	—	1	EC-325
P0A0F	238	ENGINE STOP	—	x	x	—	—	—	1	HBC-151
P0A0F*2	533	ENGINE STOP	—	x	x	—	—	—	1	EC-331
P0A0F*2	534	ENGINE STOP	—	x	x	—	—	—	1	EC-331
P0A10	263	DC/DC STAT CIRC HI	—	—	—	—	x	—	1	HBC-156
P0A10	592	DC/DC STAT CIRC HI	—	—	—	—	x	—	1	HBC-159
P0A1A	151	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-163
P0A1A	155	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-163
P0A1A	156	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-163
P0A1A	158	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-163
P0A1A	166	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-163
P0A1A	200	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-164
P0A1A	658	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-169
P0A1A	659	MG ECU(MG1)	x	x	x	—	—	x	1	HBC-169
P0A1A	791	MG ECU(MG1)	x	—	x	—	—	x	1	HBC-169

DTC	CONSULT-III display		GST display	FRZF Information data	Hybrid system warning light	High voltage battery warning light	Charge warning light	MIL	Trip	Reference page
	INF code	Item								
P0A1A	792	MG ECU(MG1)	x	—	x	—	—	x	1	HBC-164
P0A1A	793	MG ECU(MG1)	x	—	x	—	—	x	1	HBC-164
P0A1B	163	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-170
P0A1B	164	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-170
P0A1B	168	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-171
P0A1B	192	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-170
P0A1B	193	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-170
P0A1B	195	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-170
P0A1B	198	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-170
P0A1B	511	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-176
P0A1B	512	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-176
P0A1B	661	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-176
P0A1B	786	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-176
P0A1B	788	MG ECU(MG2)	x	x	x	—	—	x	1	HBC-177
P0A1B	794	MG ECU(MG2)	x	—	x	—	—	x	1	HBC-176
P0A1B	795	MG ECU(MG2)	x	—	x	—	—	x	1	HBC-171
P0A1B	796	MG ECU(MG2)	x	—	x	—	—	x	1	HBC-171
P0A1D	134	HV ECU	x	x	x	—	—	x	1	HBC-182
P0A1D	135	HV ECU	x	x	x	—	—	x	1	HBC-182
P0A1D	140	HV ECU	x	x	x	—	—	x	1	HBC-183
P0A1D	141	HV ECU	x	—	x	—	—	x	1	HBC-184
P0A1D	144	HV ECU	x	x	x	—	—	x	1	HBC-185
P0A1D	145	HV ECU	x	x	x	—	—	x	1	HBC-185
P0A1D	148	HV ECU	x	—	x	—	—	x	1	HBC-186
P0A1D	162	HV ECU	x	x	x	—	—	x	1	HBC-187
P0A1D	179	HV ECU	x	x	x	—	—	x	1	HBC-188
P0A1D	187	HV ECU	x	—	x	—	—	x	1	HBC-189
P0A1D	390	HV ECU	x	—	x	—	—	x	1	HBC-190
P0A1D	393	HV ECU	x	x	x	—	—	x	1	HBC-191
P0A1D	570	HV ECU	x	x	x	—	—	x	1	HBC-182
P0A1D	721	HV ECU	x	x	x	—	—	x	1	HBC-192
P0A1D	722	HV ECU	x	x	x	—	—	x	1	HBC-192
P0A1D	723	HV ECU	x	x	x	—	—	x	1	HBC-192
P0A1D	765	HV ECU	x	x	x	—	—	x	1	HBC-192
P0A1D	787	HV ECU	x	x	x	—	—	x	1	HBC-192
P0A1D	821	HV ECU	x	x	x	—	—	x	1	HBC-187
P0A1D	822	HV ECU	x	x	x	—	—	x	1	HBC-187
P0A1D	823	HV ECU	x	x	x	—	—	x	1	HBC-187
P0A1D	924	HV ECU	x	—	x	—	—	x	1	HBC-193
P0A1D	925	HV ECU	x	—	x	—	—	x	1	HBC-193
P0A1F	129	HV BATT SMART UNIT	x	x	x	—	—	x	1	HBC-194
P0A1F	150	HV BATT SMART UNIT	x	x	x	—	—	x	1	HBC-196

DTC	CONSULT-III display		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	157	HV BATT SMART UNIT	x	x	x	—	—	x	1	HBC-198
P0A2B	248	MG2 TEMP SENSOR	—	x	x	—	—	—	1	HBC-198
P0A2B	250	MG2 TEMP SENSOR	—	x	x	—	—	—	1	HBC-198
P0A2C	247	MG2 TEMP SEN(GND)	—	—	x	—	—	—	1	HBC-199
P0A2D	249	MG2 TEMP SEN(OPEN)	—	—	x	—	—	—	1	HBC-199
P0A37	258	MG1 TEMP SENSOR	—	x	x	—	—	—	1	HBC-203
P0A37	260	MG1 TEMP SENSOR	—	x	x	—	—	—	1	HBC-203
P0A38	257	MG1 TEMP SEN(GND)	—	—	x	—	—	—	1	HBC-205
P0A39	259	MG1 TEMP SEN(OPEN)	—	—	x	—	—	—	1	HBC-205
P0A3F	243	MG2 RSLVR INT/SHRT	x	x	x	—	—	x	1	HBC-209
P0A40	500	MG2 RSLVR RANGEout	x	x	x	—	—	x	1	HBC-209
P0A41	245	MG2 RESOLVER CIRCT	x	x	x	—	—	x	1	HBC-209
P0A4B	253	MG1 RSLVR INT/SHRT	x	x	x	—	—	x	1	HBC-212
P0A4C	513	MG1 RSLVR RANGEout	x	x	x	—	—	x	1	HBC-212
P0A4D	255	MG1 RESOLVER CIRCT	x	x	x	—	—	x	1	HBC-212
P0A51	174	MG2 ECU INTERNAL	—	x	x	—	—	—	1	HBC-214
P0A60	288	MG2 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-216
P0A60	290	MG2 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-216
P0A60	294	MG2 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-216
P0A60	501	MG2 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-216
P0A63	296	MG2 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-218
P0A63	298	MG2 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-218
P0A63	302	MG2 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-218
P0A63	502	MG2 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-218
P0A72	326	MG1 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-220
P0A72	328	MG1 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-220
P0A72	333	MG1 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-220
P0A72	515	MG1 CRNT SENSOR(V)	x	x	x	—	—	x	1	HBC-220
P0A75	334	MG1 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-222
P0A75	336	MG1 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-222
P0A75	341	MG1 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-222
P0A75	516	MG1 CRNT SENSOR(W)	x	x	x	—	—	x	1	HBC-222
P0A78	113	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-225
P0A78	121	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-230
P0A78	128	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-238
P0A78	266	MG2 INV PERFORM	x	—	x	—	—	x	1	HBC-243
P0A78	267	MG2 INV PERFORM	x	—	x	—	—	x	1	HBC-243
P0A78	279	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-246
P0A78	282	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-250
P0A78	284	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-253
P0A78	286	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-260
P0A78	287	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-267

DTC	CONSULT-III display		GST display	FRZF Information data	Hybrid system warning light	High voltage battery warning light	Charge warning light	MIL	Trip	Reference page
	INF code	Item								
P0A78	306	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-271
P0A78	503	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-275
P0A78	504	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-275
P0A78	505	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-280
P0A78	506	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-280
P0A78	510	MG2 INV PERFORM	x	x	x*1	—	—	x	1	HBC-285
P0A78	523	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-288
P0A78	586	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-291
P0A78	806	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-294
P0A78	807	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-299
P0A78	808	MG2 INV PERFORM	x	x	x	—	—	x	1	HBC-294
P0A7A	122	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-302
P0A7A	130	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-308
P0A7A	322	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-313
P0A7A	324	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-320
P0A7A	325	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-327
P0A7A	344	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-331
P0A7A	517	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-335
P0A7A	518	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-335
P0A7A	522	MG1 INV PERFORM	x	x	x*1	—	—	x	1	HBC-340
P0A7A	809	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-343
P0A7A	810	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-348
P0A7A	811	MG1 INV PERFORM	x	x	x	—	—	x	1	HBC-343
P0A90	251	MG2 PERFORMANCE	x	x	x	—	—	x	1	HBC-350
P0A90	509	MG2 PERFORMANCE	x	x	x	—	—	x	1	HBC-353
P0A92	261	MG1 PERFORMANCE	x	x	x	—	—	x	1	HBC-356
P0A92	521	MG1 PERFORMANCE	x	x	x	—	—	x	1	HBC-359
P0A93	346	MG COOLING SYSTEM	x	x	x	—	—	x	1	HBC-362
P0A94	127	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-367
P0A94	172	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-372
P0A94	442	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-376
P0A94	547	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-378
P0A94	548	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-382
P0A94	549	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-378
P0A94	550	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-384
P0A94	553	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-386
P0A94	554	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-392
P0A94	555	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-396
P0A94	556	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-392
P0A94	557	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-398
P0A94	585	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-403

DTC	CONSULT-III display		GST display	FRZF Information data	Hybrid system warning light	High voltage battery warning light	Charge warning light	MIL	Trip	Reference page
	INF code	Item								
P0A94	587	BOOST CONVERTER	x	x	x	—	—	x	1	HBC-404
P0A94	589	BOOST CONVERTER	x	—	x	—	—	x	1	HBC-407
P0A94	590	BOOST CONVERTER	x	—	x	—	—	x	1	HBC-407
P0AA1	231	SMR B/G	—	x	x*1	—	—	—	1	HBC-410
P0AA1	233	SMR B/G	—	x	x*1	—	—	—	1	HBC-413
P0AA4	232	SMR G	—	x	x*1	—	—	—	1	HBC-417
P0AA6	526	INSULATION RESIST	—	x	x*1	—	—	—	1	HBC-420
P0AA6	611	INSULATION RESIST	—	x	x*1	—	—	—	1	HBC-420
P0AA6	612	INSULATION RESIST	—	x	x*1	—	—	—	1	HBC-420
P0AA6	613	INSULATION RESIST	—	x	x*1	—	—	—	1	HBC-420
P0AA6	614	INSULATION RESIST	—	x	x*1	—	—	—	1	HBC-420
P0AA7	727	ISOLATION SENSOR	—	x	x	—	—	—	1	HBC-433
P0AC0	817	HVBAT CUR/SEN FRE	x	—	x	—	—	—	1	HBC-434
P0ADB	227	SMR B(GND)	—	—	x	—	—	—	1	HBC-438
P0ADC	226	SMR B(OPEN)	—	—	x	—	—	—	1	HBC-438
P0ADF	229	SMR G(GND)	—	—	x	—	—	—	1	HBC-444
P0AE0	228	SMR G(OPEN)	—	—	x	—	—	—	1	HBC-444
P0AE2	161	SMR P	—	x	x	—	—	—	1	HBC-450
P0AE2	773	SMR P	—	x	x	—	—	—	2	HBC-458
P0AE6	225	SMR P(OPEN)	x	—	x	—	—	x	1	HBC-462
P0AE7	224	SMR P(+B)	x	—	x	—	—	x	1	HBC-476
P0AEE	276	MG2 INV TMP SENSOR	x	x	x	—	—	—	1	HBC-479
P0AEE	277	MG2 INV TMP SENSOR	x	x	x	—	—	—	1	HBC-479
P0AEF	275	MG2 INV TMP/S(OPN)	x	—	x	—	—	—	1	HBC-482
P0AF0	274	MG2 INV TMP/S(+B)	x	—	x	—	—	—	1	HBC-482
P1572	904	ASCD BRAKE SW	—	—	—	—	—	—	1	HBC-483
P1606	308	COLLISION SIGNAL	—	—	x*1	—	—	—	1	HBC-486
P1610	909	LOCK MODE	—	—	—	—	—	—	1	SEC-40
P1611	908	ID DISCORD IMM-HV	—	—	—	—	—	—	1	SEC-43
P1612	926	CHAIN OF HV-IMMU	—	—	—	—	—	—	1	SEC-45
P1615	906	DIFFERENCE OF KEY	—	—	—	—	—	—	1	SEC-43
P1805	902	BRAKE SWITCH CIRC	—	—	—	—	—	—	1	HBC-488
P1805	903	BRAKE SW ITCH CIRC	—	—	—	—	—	—	1	HBC-491
P1805	923	BRAKE SW ITCH CIRC	—	—	—	—	—	—	1	HBC-491
P2120	152	APP SEN(CIRCUIT)	—	—	x	—	—	—	1	HBC-494
P2121	106	APP SENSOR(RANGE)	—	x	x	—	—	—	1	HBC-494
P2122	104	APP SENSOR(OPEN)	—	—	x	—	—	—	1	HBC-494
P2123	105	APP SENSOR(+B)	—	—	x	—	—	—	1	HBC-494
P2125	153	APP SENSOR(CIRCUIT)	—	—	x	—	—	—	1	HBC-494
P2126	109	APP SENSOR(RANGE)	—	x	x	—	—	—	1	HBC-499

DTC	CONSULT-III display		GST display	FRZF Information data	Hybrid system warning light	High voltage battery warning light	Charge warning light	MIL	Trip	Reference page
	INF code	Item								
P2127	107	APP SENSOR(OPEN)	—	—	x	—	—	—	1	HBC-499
P2128	108	APP SENSOR(+B)	—	—	x	—	—	—	1	HBC-499
P2138	110	APP SENSOR	—	x	x	—	—	—	1	HBC-499
P2138	154	APP SENSOR	—	—	x	—	—	—	1	HBC-499
P2511	149	POWER SUPLY(RESET)	—	—	x	—	—	—	1	HBC-504
P2519	766	HV BAT IDH CIRCUIT	—	x	—	—	x	—	1	HBC-506
P3000	388	HV BAT MALFUNCTION	—	—	—	x	—	—	1	HBC-509
P3000	389	HV BAT MALFUNCTION	—	—	x	—	—	—	1	HBC-511
P3000	603	HV BAT MALFUNCTION	—	—	x	—	—	—	1	HBC-513
P3004	131	POWER CABLE MALFUN	—	x	x	—	—	—	2	HBC-517
P3004	132	POWER CABLE MALFUN	—	x	x	—	—	—	1	HBC-527
P3004	133	POWER CABLE MALFUN	—	—	x	—	—	—	1	HBC-190
P3004	800	POWER CABLE MALFUN	—	x	x	—	—	—	1	HBC-534
P3004	801	POWER CABLE MALFUN	—	x	x	—	—	—	1	HBC-534
P3004	803	POWER CABLE MALFUN	—	x	x	—	—	—	1	HBC-543
P3108	535	A/C COMM CIRCUIT	—	x	—	—	—	—	1	HBC-547
P3108	536	A/C COMM CIRCUIT	—	x	—	—	—	—	1	HBC-547
P3108	538	A/C COMM CIRCUIT	—	x	—	—	—	—	1	HBC-547
P3110	139	IGCT RELAY	—	—	x	—	—	—	1	HBC-551
P3110	223	IGCT RELAY	—	—	x	—	—	—	1	HBC-551
P3136	914	A/BAG COMM CIRCUIT	—	—	x	—	—	—	1	HBC-553
P3136	915	A/BAG COMM CIRCUIT	—	—	x	—	—	—	1	HBC-553
P3136	916	A/BAG COMM CIRCUIT	—	—	x	—	—	—	1	HBC-553
P3147	239	TRANSAXLE	—	x	x	—	—	—	1	HBC-555
P3147	240	TRANSAXLE	—	x	x	—	—	—	1	HBC-558
P3147	241	TRANSAXLE	—	x	x	—	—	—	1	HBC-555
P3147	242	TRANSAXLE	—	x	x	—	—	—	1	HBC-558
P3216	181	REACT TMP/SEN(GND)	—	—	x	—	—	—	1	HBC-559
P3216	182	REACT TMP/SEN(OPEN)	—	—	x	—	—	—	1	HBC-559
P3221	314	MG1 INV TMP SENSOR	x	x	x	—	—	—	1	HBC-560
P3221	315	MG1 INV TMP SENSOR	x	x	x	—	—	—	1	HBC-560
P3222	313	MG1 INV TMP/S(OPN)	x	—	x	—	—	—	1	HBC-563
P3223	312	MG1 INV TMP/S(+B)	x	—	x	—	—	—	1	HBC-563
P3226	562	BOOST CONV TMP SEN	x	x	x	—	—	—	1	HBC-564
P3226	563	BOOST CONV TMP SEN	x	x	x	—	—	—	1	HBC-564
P3227	583	B/CNV TMP SEN(OPN)	x	—	x	—	—	—	1	HBC-567
P3228	584	B/CNV TMP SEN(+B)	x	—	x	—	—	—	1	HBC-567
P3232	749	HV GATE CONN(GND)	—	—	x	—	—	—	1	HBC-568
P3233	750	HV GATE CONN(+B)	—	—	x	—	—	—	1	HBC-570
U0100	211	LOST COMM (ECM)	—	—	x	—	—	x	1	HBC-572
U0100	212	LOST COMM (ECM)	—	—	x	—	—	x	1	HBC-572
U0100	530	LOST COMM (ECM)	—	—	x	—	—	x	1	HBC-572

DTC	CONSULT-III display		GST display	FRZF Information data	Hybrid system warning light	High voltage battery warning light	Charge warning light	MIL	Trip	Reference page
	INF code	Item								
U0110	159	LOST COMM (MG ECM)	—	x	x	—	—	—	1	HBC-574
U0110	160	LOST COMM (MG ECM)	—	x	x	—	—	—	1	HBC-574
U0110	656	LOST COMM (MG ECM)	—	x	x	—	—	—	1	HBC-574
U0110	657	LOST COMM (MG ECM)	—	x	x	—	—	—	1	HBC-574
U0115	901	LOST COMM (COUNT)	—	—	—	—	—	—	1	HBC-580
U0129	220	LOST COMM (BRAKE)	—	—	—	—	—	—	1	HBC-582
U0129	222	LOST COMM (BRAKE)	—	—	—	—	—	—	1	HBC-582
U0129	528	LOST COMM (BRAKE)	—	—	—	—	—	—	1	HBC-582
U0129	529	LOST COMM (BRAKE)	—	—	x	—	—	—	1	HBC-583
U0131	433	LOST COMM (EPS)	—	—	—	—	—	—	1	HBC-585
U0131	434	LOST COMM (EPS)	—	—	—	—	—	—	1	HBC-585
U0424	537	HVAC COTROL UNIT	—	x	—	—	—	—	1	HBC-586
U1001	146	CAN COMM CIRCUIT	—	—	x	—	—	—	1	HBC-587
U1001	435	CAN COMM CIRCUIT	—	—	x	—	—	—	1	HBC-587
U1001	594	CAN COMM CIRCUIT	—	—	—	—	—	—	1	HBC-587
U1001	827	CAN COMM CIRCUIT	—	—	—	—	—	—	1	HBC-587
U1001	919	CAN COMM CIRCUIT	—	—	x	—	—	—	1	HBC-587
U1001	920	CAN COMM CIRCUIT	—	—	x	—	—	—	1	HBC-587

*1: Warning light illuminates until the DTC is cleared from the hybrid vehicle control ECM memory.

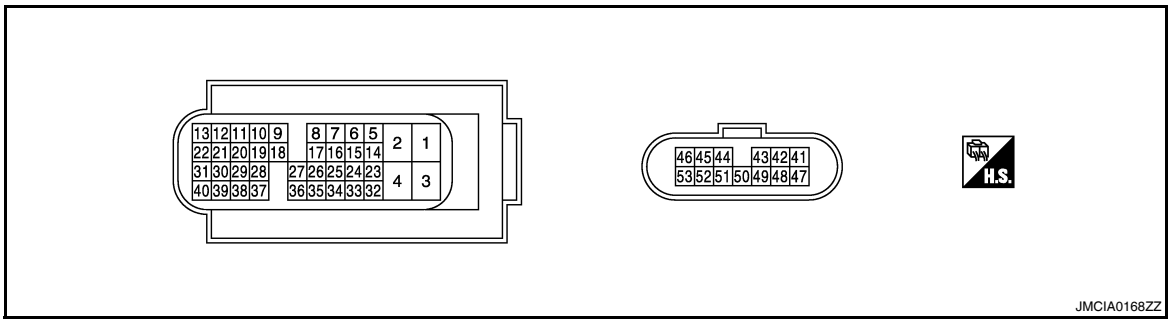
*2: This DTC indicates that a malfunction exists in the engine control system. So, erase the DTC in the hybrid vehicle control ECU memory, then perform the corresponding trouble diagnosis referring the work flow in EC section.

MG ECU

Reference Value

INFOID:0000000004212202

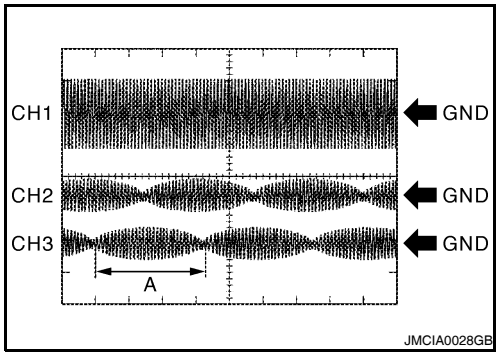
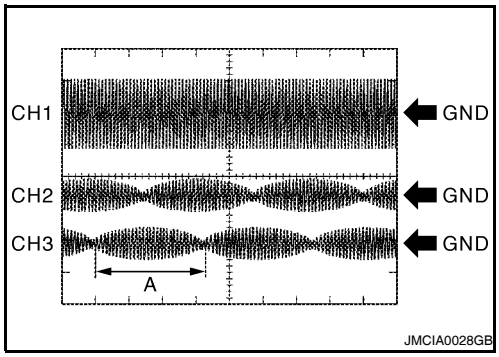
TERMINAL LAYOUT

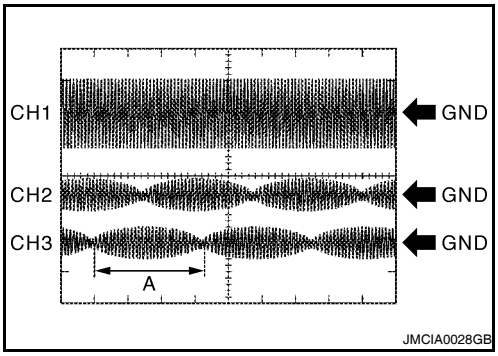
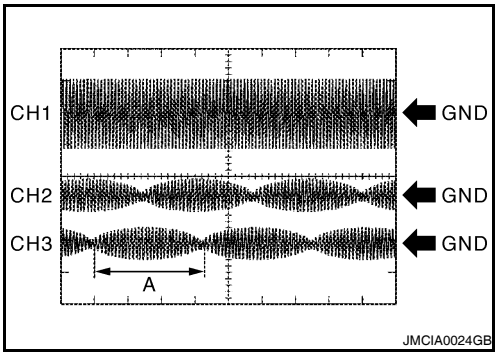
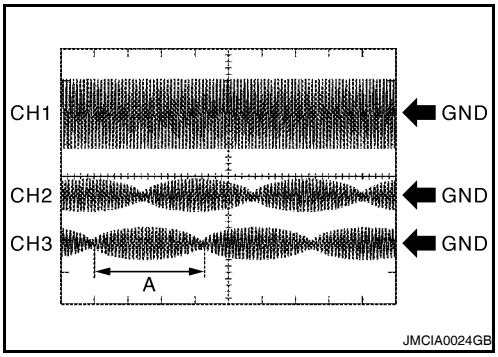


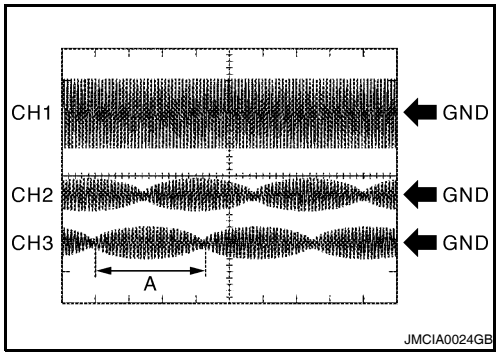
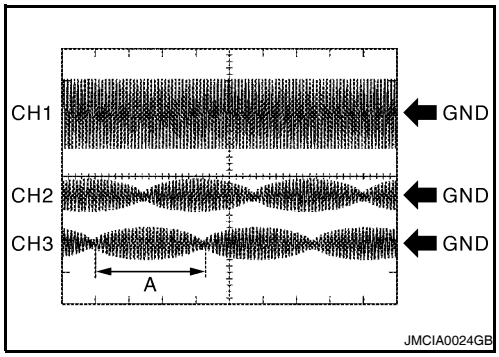
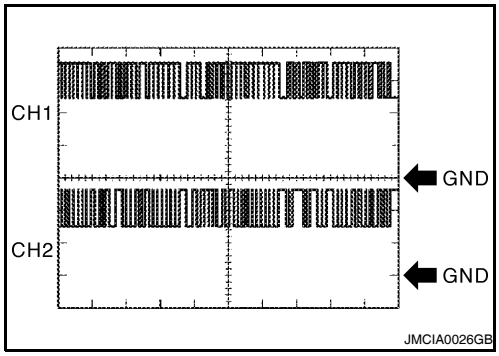
PHYSICAL VALUES

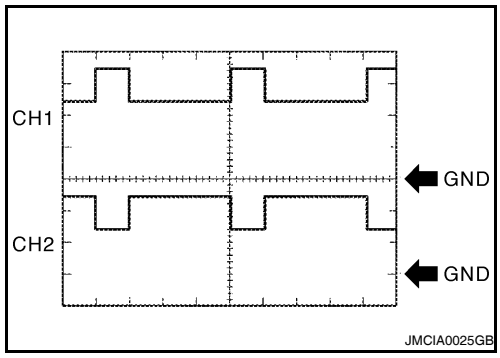
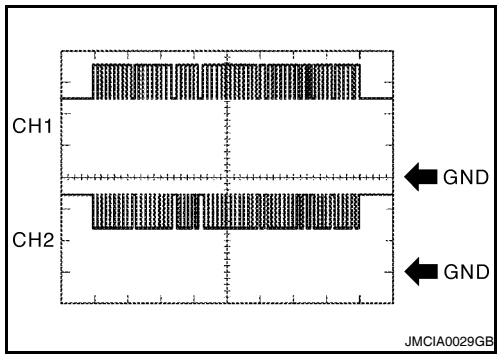
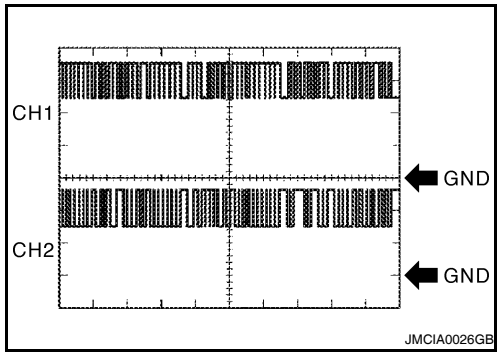
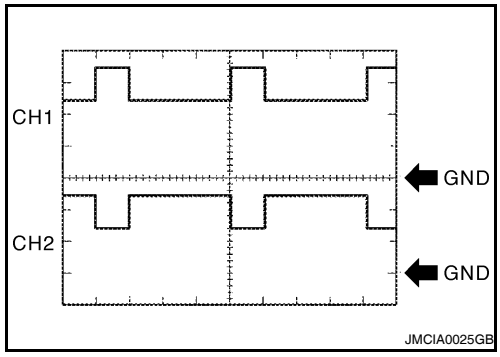
NOTE:

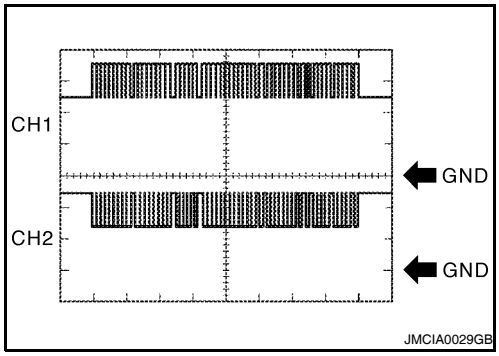
- Do not measure voltage or waveform directly at the sealed side of the inverter with converter assembly connectors. Doing so may damage the connectors because these connectors are waterproof.
- Oscilloscope waveform samples are provided here for informational purposes. Noise and fluttering waveforms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

Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
41	42	O - L/G	Generator resolver signal	Input/ Output	**[Ignition switch: READY]** • Generator resolver: Stopped or running	Refer to CH2 signal. Pulse cycle A becomes shorter as the rotor speed increased. 
43	44	L/Y - O/L	Generator resolver signal	Input/ Output	**[Ignition switch: READY]** • Generator resolver: Stopped or running	Refer to CH3 signal. Pulse cycle A becomes shorter as the rotor speed increased. 

Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
46	45	W/L - W	Generator resolver signal	Input/ Output	**[Ignition switch: READY]** • Generator resolver: Stopped or running	Refer to CH1 signal. Pulse cycle A becomes shorter as the rotor speed increased. 
48	49	L/Y - O/L	Motor resolver signal	Input/ Output	**[Ignition switch: READY]** • Motor resolver: Running	Refer to CH3 signal. Pulse cycle A becomes shorter as the rotor speed increased. 
51	47	O - L/G	Motor resolver signal	Input/ Output	**[Ignition switch: ON]** • Motor resolver: Running	Refer to CH2 signal. Pulse cycle A becomes shorter as the rotor speed increased. 

Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
53	52	W/L - W	Motor resolver signal	Input/ Output	**[Ignition switch: READY]** • Motor resolver: Running	Refer to CH1 signal. Pulse cycle A becomes shorter as the rotor speed increased. 
31	3	L/W - B	MG shutdown signal	Output	**[Ignition switch: READY]**	0 - 1V
30	3	P - B	PHASE signal	Input	**[Ignition switch: ready]** • Engine: Idle	The pulse cycle becomes shorter as the engine speed increased. 
28	3	BR/R - B	Communication signal from MG ECU to hybrid vehicle control ECU	Output	**[Ignition switch: ON]**	Refer to CH2 signal. The waveform will vary depending on the content of the digital communication (digital signal). 

Terminal No. +	Terminal No. –	Wire color	Description: Signal name	Description: Input/ Output	Condition	Value (Approx.)
27	3	BR - B	Communication request signal	Input/ Output	**[Ignition switch: ON]**	Refer to CH2 signal. 
26	3	LG - B	Communication signal from hybrid vehicle control ECU to MG ECU	Input	**[Ignition switch: ON]**	Refer to CH2 signal. The waveform will vary depending on the content of the digital communication (digital signal). 
24	3	L/O - B	Communication clock signal	Input/ Output	**[Ignition switch: ON]**	10 - 14V
19	3	R/W - B	Communication signal from MG ECU to hybrid vehicle control ECU	Output	**[Ignition switch: ON]**	Refer to CH1 signal. The waveform will vary depending on the content of the digital communication (digital signal). 
18	3	Y - B	Communication request signal	Input/ Output	**[Ignition switch: ON]**	Refer to CH1 signal. 

Terminal No.		Wire color	Description		Condition	Value (Approx.)
+	–		Signal name	Input/ Output		
17	3	V - B	Communication signal from hybrid vehicle control ECU to MG ECU	Input	**[Ignition switch: ON]**	Refer to CH1 signal. The waveform will vary depending on the content of the digital communication (digital signal). 
15	3	BR/W - B	Communication clock signal	Input/ Output	**[Ignition switch: ON]**	10 - 14V
2	3	L/W - B	MG ECU power source	Input/ Output	**[Ignition switch: ON]**	10 - 14V
1	3	L/W - B	MG ECU power source	Input/ Output	**[Ignition switch: ON]**	10 - 14V
13	3	R - B	Interlock switch signal	Input	**[Ignition switch: ON]** • Compressor fuse cover and service plug grip: Installed correctly	Below 1V
					[Ignition switch: ON] • Compressor fuse cover and service plug grip: Detached	10 - 14V
12	3	GR/R - B	Interlock switch signal	Output	**[Ignition switch: ON]** • Compressor fuse cover and service plug grip: Installed correctly	Below 1V
					[Ignition switch: ON] • Compressor fuse cover and service plug grip: Detached	10 - 14V

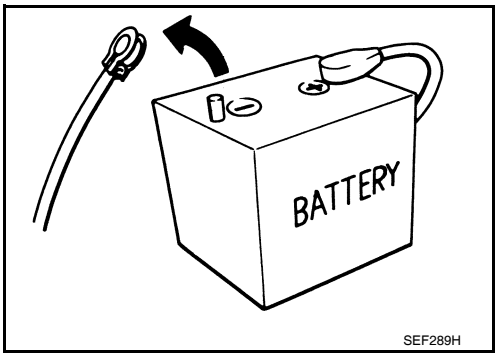
PRECAUTION

PRECAUTIONS

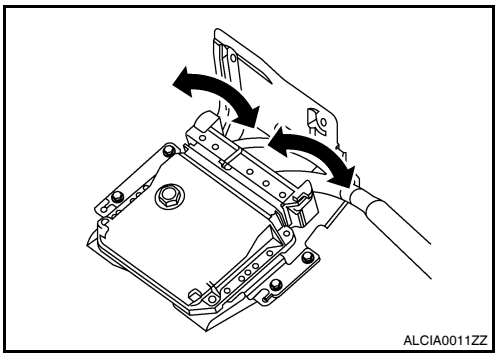
General Precautions

INFOID:0000000004212203

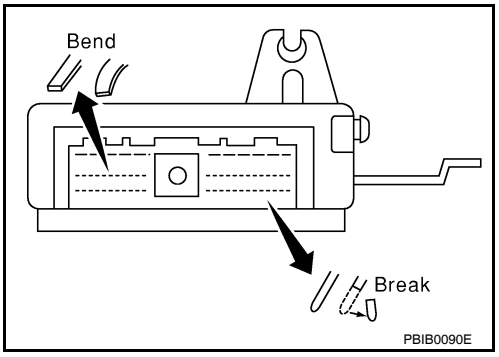
- **Always use a 12 volt battery as power source.**
- **Do not attempt to disconnect battery cables while engine is running.**
- **Do not disassemble ECUs.**
- **If the battery is disconnected, the following emission-related diagnostic information will be lost within 3 minutes.**
  - **Diagnostic trouble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



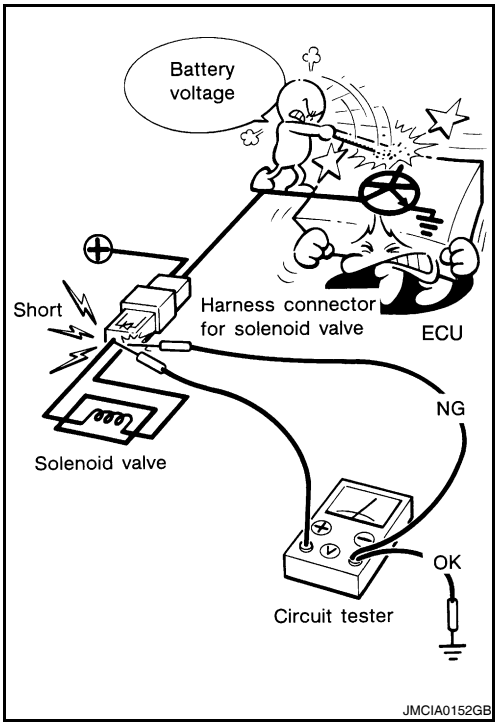
- **When connecting the hybrid vehicle control ECU harness connector, fasten it securely with a lever as far as it will go as shown in the figure.**



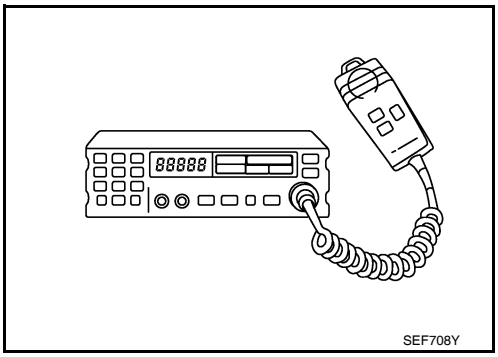
- **When connecting or disconnecting pin connectors into or from the hybrid vehicle control ECU, take care not to damage pin terminals (bend or break).**
  Make sure that there are not any bends or breaks on the hybrid vehicle control ECU pin terminal, when connecting pin connectors.
- **Securely connect 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:0000000004212204

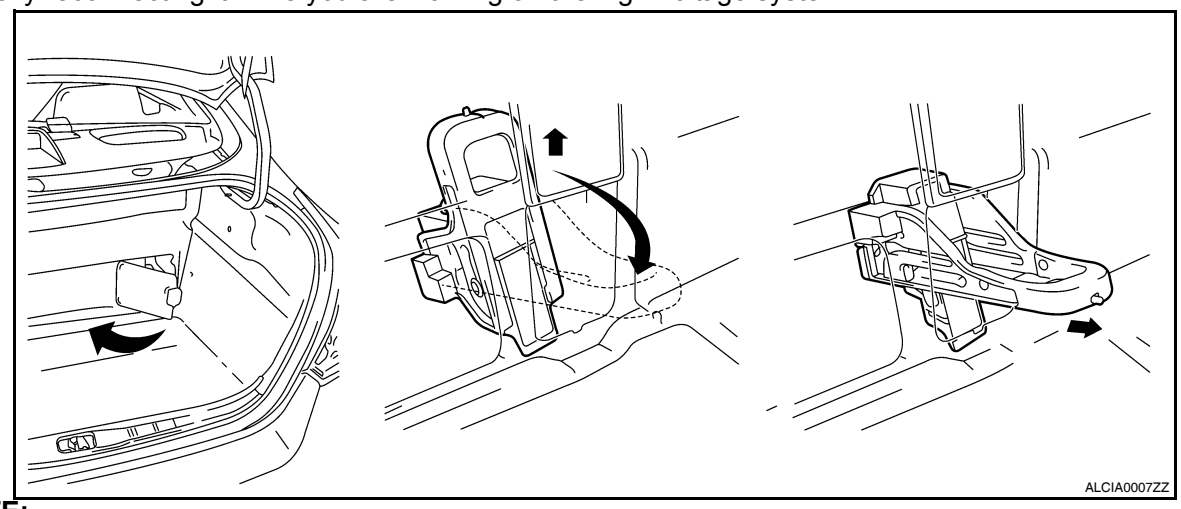
Refer to GI-24, "Precautions For High-Voltage System".

Precautions for Inspecting the Hybrid Control System

INFOID:0000000004212205

- 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:0000000004212206

- 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:0000000004212207

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.**

Precaution for replacing hybrid vehicle control ECU

INFOID:0000000004212208

When replacing the hybrid vehicle control ECU, never remove the waterproof sheet.

NOTE:

The hybrid vehicle control ECU is covered with a waterproof sheet. If the waterproof sheet is peeled off, the labels on the hybrid vehicle control ECU will be removed together with the waterproof sheet. Consequently important data printed on the label for warranty procedure will be lost.

Necessary for Steering Wheel Rotation After Battery Disconnect

INFOID:0000000004466822

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.

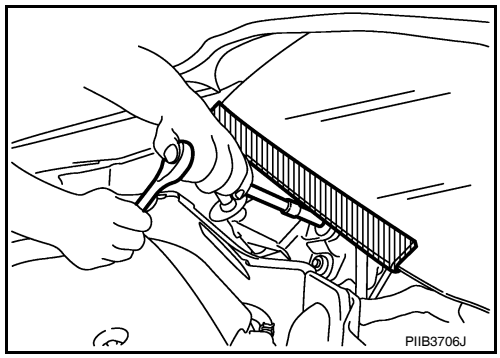
OPERATION PROCEDURE

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:0000000004212209

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

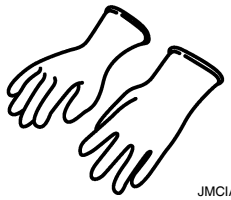


PREPARATION

PREPARATION

Commercial Service Tools

INFOID:0000000004212211

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

ON-VEHICLE MAINTENANCE

COOLANT(FOR INVERTER)

Inspection

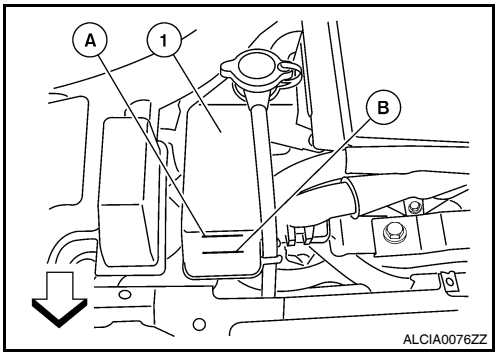
INFOID:0000000004212212

WARNING:

- **Never remove the inverter cooling reservoir tank cap when the engine or inverter are hot. Serious burns could occur from high pressure coolant escaping from the inverter coolant reservoir tank.**
- **Wrap a thick cloth around the cap. Slowly push down and turn cap a quarter turn to allow built-up pressure to escape. Carefully remove the cap by pushing down and turning it all the way.**

CHECKING COOLANT LEVEL (INVERTER COOLING SYSTEM)

1. Check if the coolant level in the inverter cooling reservoir tank (1) is within MIN (B) to MAX (A) when coolant is cool.
   - ⇐: Front
2. Adjust inverter cooling system coolant level as necessary. Refer to HBC-636, "Replacement".



CHECKING COOLANT CONDITION (INVERTER COOLING SYSTEM)

- Check for excessive deposits of dirt or rust in the inverter cooling system coolant.
- If the coolant contains excessive dirt or rust, replace the inverter cooling system coolant. Refer to HBC-636, "Replacement".

Replacement

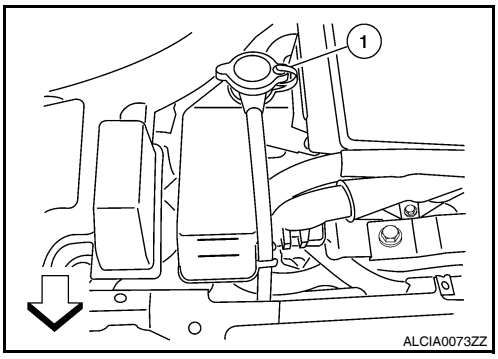
INFOID:0000000004212213

DRAINING COOLANT

WARNING:

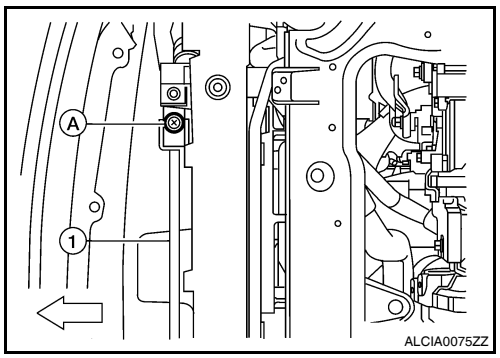
- **Never remove the inverter cooling reservoir tank cap when the engine or inverter are hot. Serious burns could occur from high pressure coolant escaping from the inverter coolant reservoir tank.**
- **Wrap a thick cloth around the cap. Slowly push down and turn cap a quarter turn to allow built-up pressure to escape. Carefully remove the cap by pushing down and turning it all the way.**

1. Remove the inverter cooling reservoir tank cap (1).
   - ⇐: Front



2. Remove the engine under cover. Refer to EXT-12, "Removal and Installation".

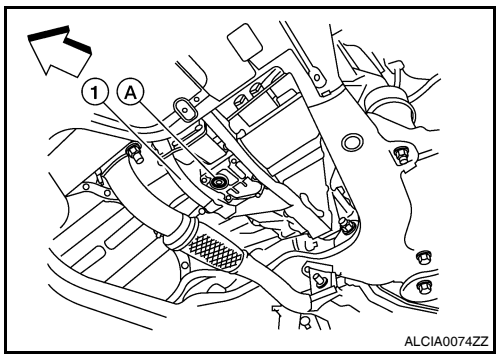
3. Loosen the drain plug (A) on the sub radiator (1) and drain the coolant.
   • ⇐: Front



4. Remove the coolant drain plug (A) from the transaxle (1) and drain coolant.
   • ⇐: Front
5. Install the coolant drain plug with a new gasket to the transaxle.

   Coolant drain plug : 35.3 - 43.1 N·m (3.6 - 4.4 kg-m, 26 - 32 ft-lb)

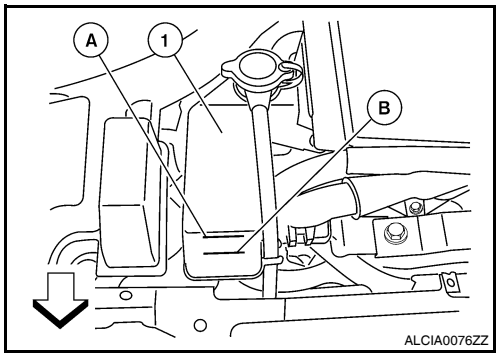
   CAUTION:
   Do not reuse gasket.
6. Tighten the drain plug on the sub radiator.



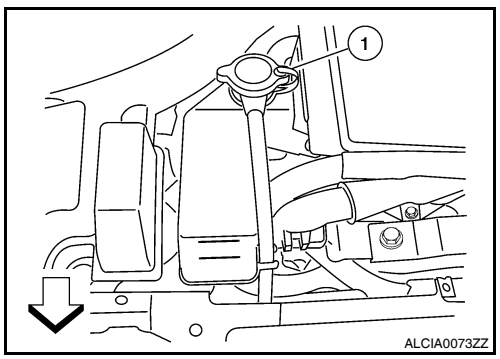
   Drain plug : 0.78 - 1.56 N·m (0.08 - 0.15 kg-m, 7 - 13 in-lb)

FILLING COOLANT

1. Slowly pour coolant into the inverter cooling reservoir tank (1) until the coolant level reaches MAX (A).
   • ⇐: Front
2. Turn ignition switch ON.
3. Select “INV WATER PUMP” in “ACTIVE TEST” mode with CONSULT-III, then operate the inverter cooling system coolant pump while continuing to fill the inverter cooling reservoir tank. Keep the coolant level between MIN (B) and MAX (A).
   CAUTION:
   Do not allow the coolant level in the reservoir tank to get too low when filling to avoid air being drawn into the Inverter cooling system.



4. When no air bubbles can be seen in the inverter cooling reservoir tank, fill the tank until the coolant level reaches MAX.
5. Install the inverter cooling reservoir tank cap (1) and inspect the system for leaks.
   • ⇐: Front

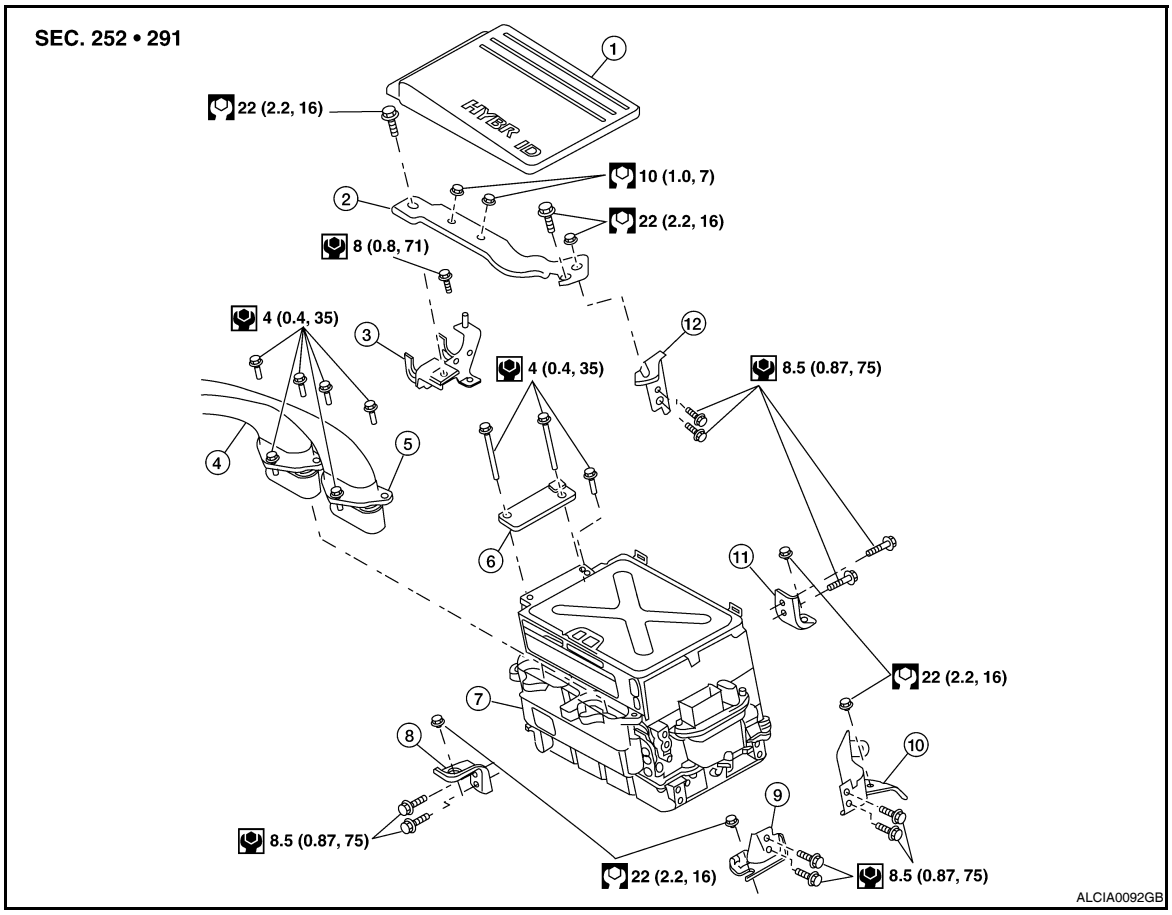


REMOVAL AND INSTALLATION

INVERTER WITH CONVERTER ASSEMBLY

Exploded View

INFOID:0000000004212214



1. Inverter cover
2. Upper center bracket
3. Upper RH bracket
4. MG1 harness connector
5. MG2 harness connector
6. Terminal cover
7. Inverter
8. Lower RH bracket
9. Lower LH bracket
10. Rear LH bracket
11. Rear RH bracket
12. Upper LH bracket

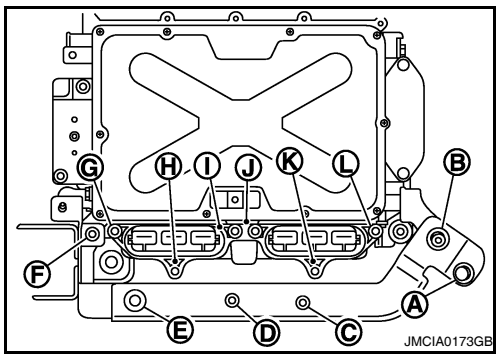
Removal and Installation

INFOID:0000000004212215

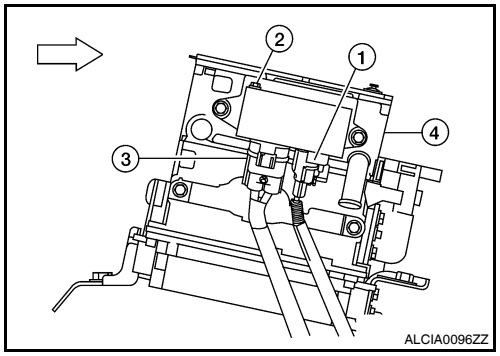
REMOVAL

1. Drain the coolant from the inverter cooling system. Refer to HBC-636, "Replacement".
2. Remove the inverter cover.
3. Remove the air cleaner and air duct. Refer to EM-24, "Removal and Installation".
4. Remove the nuts and bolts from the upper center bracket.
5. Remove the inverter upper center bracket.
6. Remove the hoses and bolts from the inverter cooling reservoir tank.
7. Remove the inverter cooling reservoir tank from the vehicle.

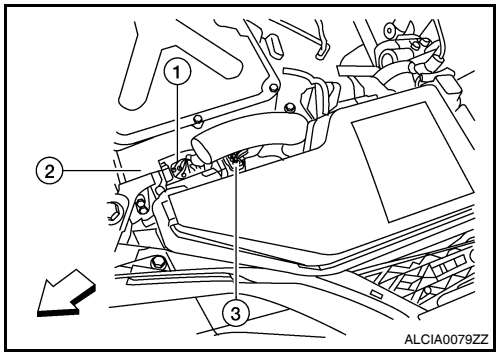
8. Disconnect the MG1 and MG2 connectors from the inverter as follows.
   1. Remove bolts G, I, J and L as shown.
   2. Remove bolts H and K as shown.
   3. Disconnect the MG1 and MG2 connectors from the inverter.
9. Remove the MG1 and MG2 harness clips from the bracket and set the MG1 and MG2 harness aside.
10. Remove the coolant hoses from the inverter.
11. Remove the upper RH bracket bolt and bracket from the inverter.
12. Remove the terminal cover bolt and terminal cover from the inverter.



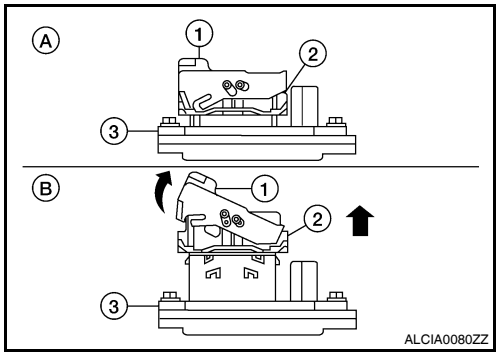
13. Disconnect the electric compressor inverter connector (1) from the inverter (4).
    - ⇐: Front
14. Remove the frame wire inverter connector bolt (2) and disconnect the frame wire inverter connector (3) from the inverter (4).



15. Disconnect the engine room harness connector (1) from the inverter (2).
    - EGI harness connector (3)
    - ⇐: Front

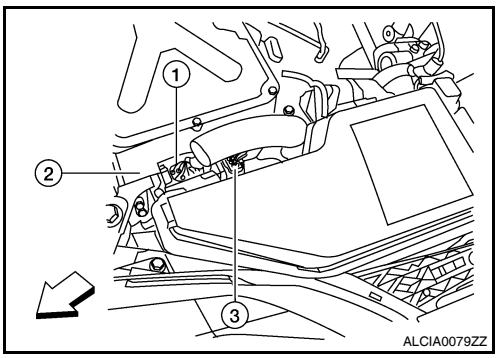


    - A: Locked position
    - B: Unlocked position
    1. Lift up and swing the connector lock lever (1) to unlock the connector.
    2. Pull up on the engine room harness connector (2) to disconnect it from the inverter (3).



16. Remove the engine room harness clip from the bracket and set the engine room harness aside.

17. Disconnect the EGI harness connector (3) from the inverter (2).
    - Engine room harness connector (1)
    - ⇐: Front



18. Remove the inverter nuts.
19. Remove the inverter from the vehicle.
20. Remove any necessary brackets from the inverter.

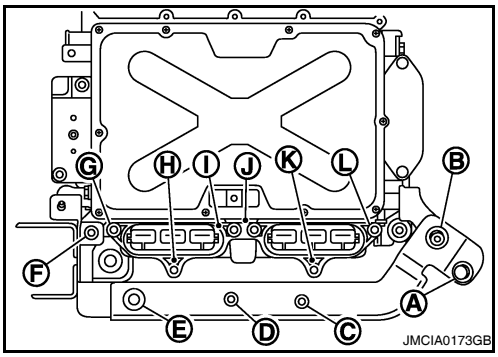
INSTALLATION

Installation is in the reverse order of removal.

NOTE:

- When installing the inverter, lower RH bracket, lower LH bracket, rear LH bracket, rear RH bracket and upper LH bracket should be attached to the inverter in advance.
- When lower RH bracket, lower LH bracket, rear LH bracket, rear RH bracket and upper LH bracket are attached to the inverter, they should be touched to anti-rotation at the boss of the inverter.
- When tightening bolts, perform the following procedure:

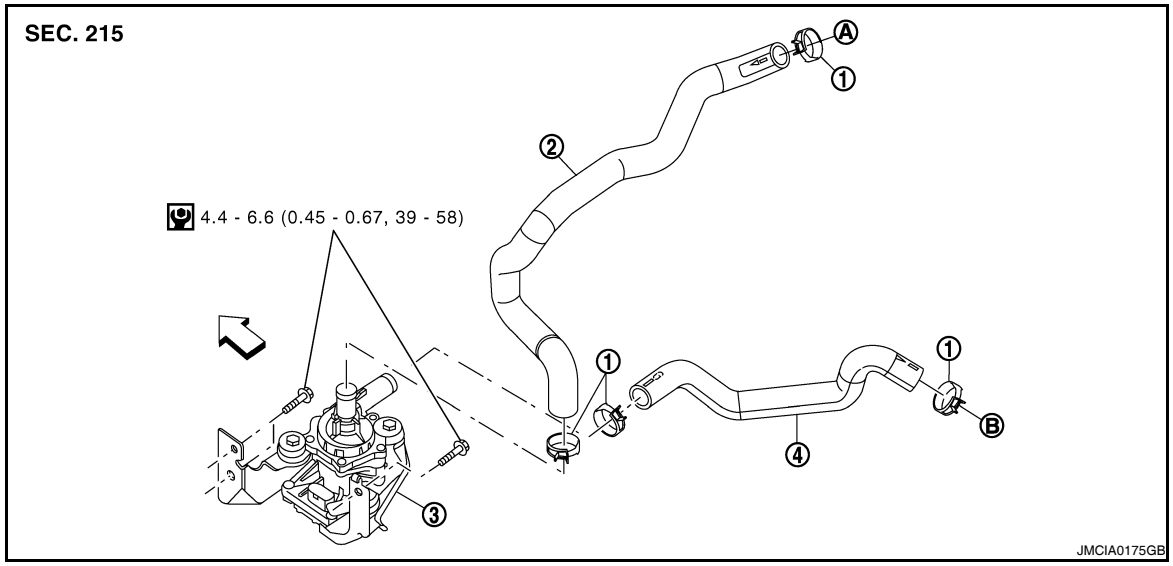
- Temporarily tighten the bolts A, B, E, F.
- Connect MG1 harness connector and MG2 harness connector.
- Fully tighten the bolts H, K.
- Fully tighten the bolts G, I, J and L.
- Fully tighten the bolt F.
- Fully tighten the bolts A, B, C, D, E.



WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

Exploded View

INFOID:0000000004212216



1. Clamp
2. Water inlet hose
3. Water pump with motor and bracket assembly
4. Water outlet hose
A. To inverter coolant reservoir tank
B. To transaxle

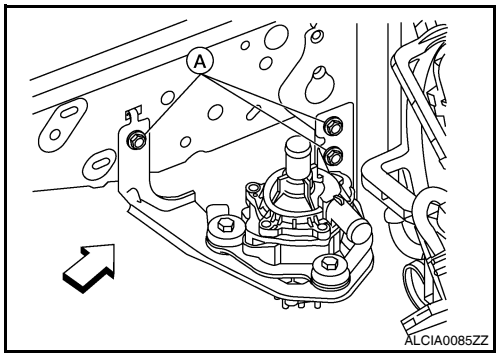
⇐: Front

Removal and Installation

INFOID:0000000004212217

REMOVAL

1. Drain the coolant from the inverter cooling system. Refer to HBC-636, "Replacement".
2. Disconnect the water inlet hose and water outlet hose from the water pump with motor and bracket assembly.
3. Remove the bolts (A) from the water pump with motor and bracket assembly and remove from the vehicle.
   - ⇐: Front



Installation

Installation is in the reverse order of removal.

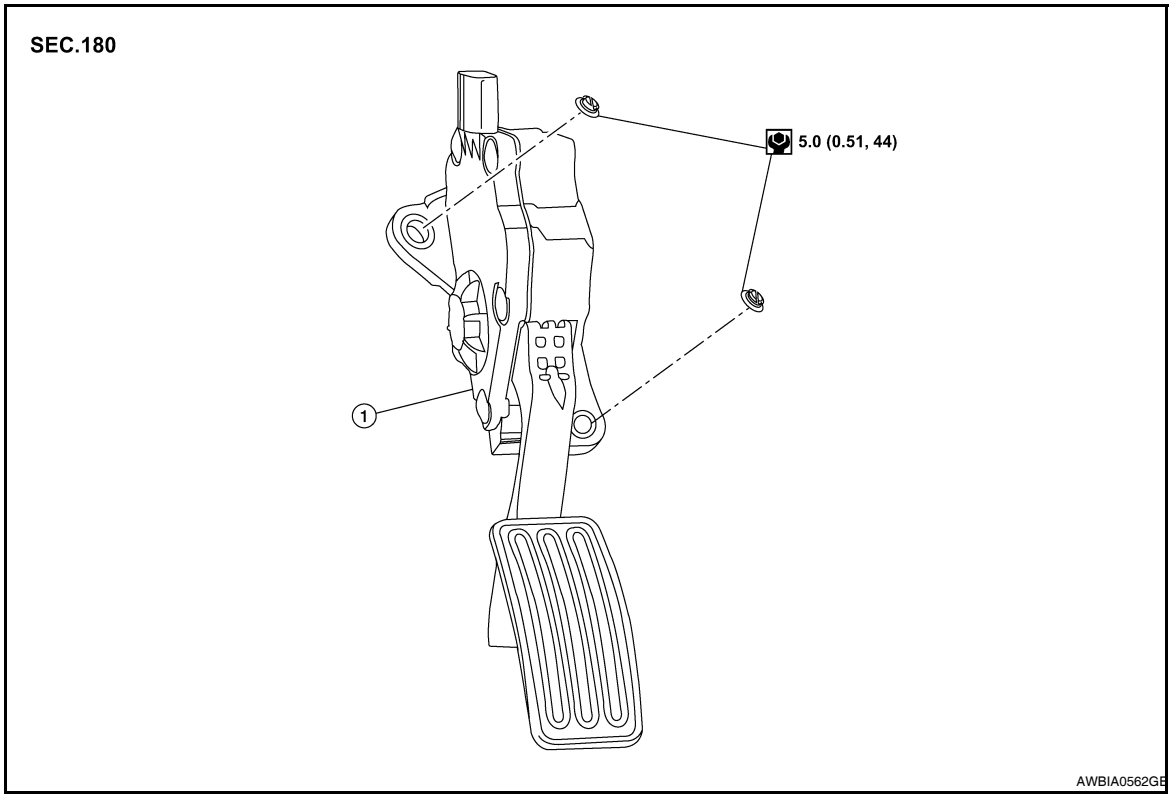
NOTE:

Do not use the power tool.

ACCELERATOR PEDAL POSITION SENSOR

Exploded View

INFOID:0000000004513183



1. Accelerator pedal assembly

Removal and Installation

INFOID:0000000004513184

REMOVAL

1. Disconnect the 12-volt battery negative terminal.
2. Disconnect the accelerator position sensor electrical connector.
3. Remove the accelerator pedal nuts.
4. Remove the accelerator pedal assembly.
   - For electrical inspection of the accelerator pedal position sensor. Refer to HBC-499, "Description".

   CAUTION:
   - **Do not disassemble the pedal assembly.**
   - **Avoid impact from dropping during handling.**
   - **Keep the pedal assembly away from water.**

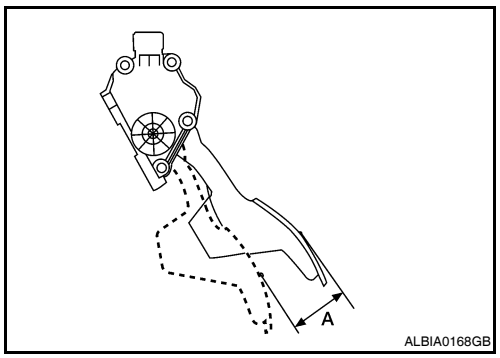
INSTALLATION

Installation is in the reverse order of removal.

- Check the accelerator pedal for smooth operation. There should be no binding or sticking when applying or releasing the accelerator pedal.

- Check that the accelerator pedal moves through the full specified distance of pedal travel.

Pedal travel (A) : 51.1 mm (2.01 in)



CAUTION:
When the harness connector of the accelerator pedal position sensor is disconnected, perform the "Accelerator pedal released position learning". Refer to HBC-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

HV ECU

Precaution for replacing hybrid vehicle control ECU

INFOID:0000000004212220

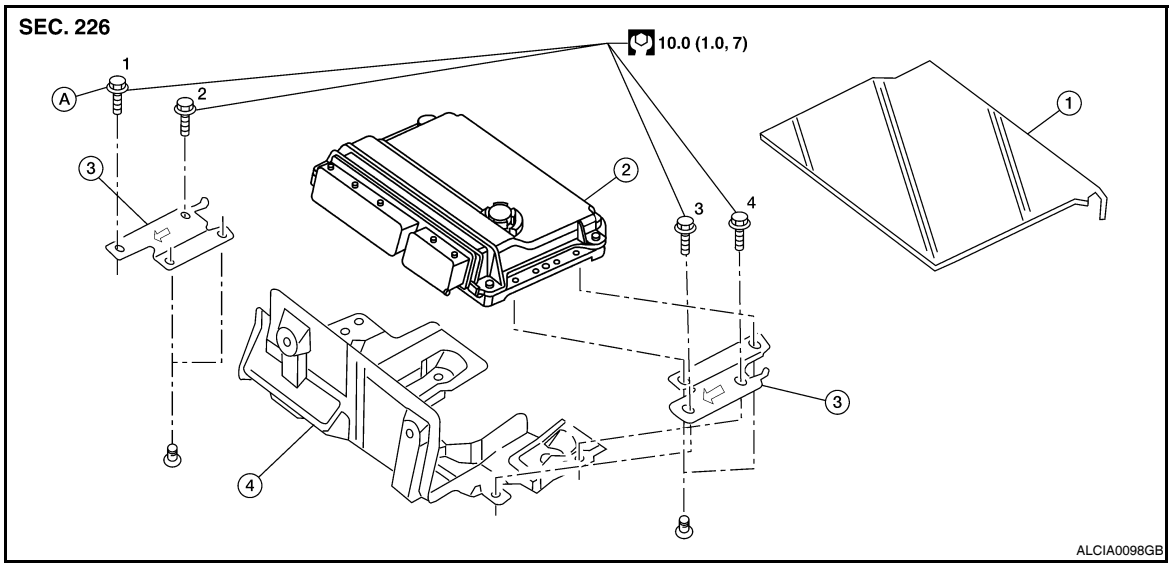
When replacing the hybrid vehicle control ECU, never remove the waterproof sheet.

NOTE:

The hybrid vehicle control ECU is covered with a waterproof sheet. If the waterproof sheet is peeled off, the labels on the hybrid vehicle control ECU will be removed together with the waterproof sheet. Consequently important data printed on the label for warranty procedure will be lost.

Exploded View

INFOID:0000000004212221



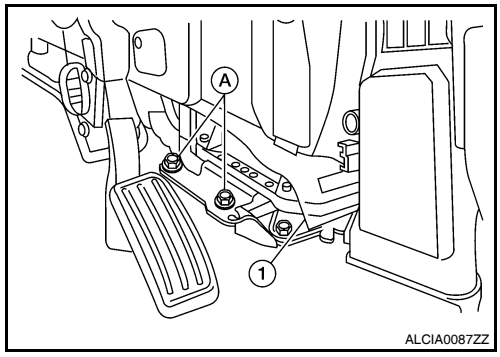
1. Waterproof sheet
2. HV ECU
3. HV ECU bracket
4. Mounting bracket
A. Bolt
⇐: Front

Removal and Installation

INFOID:0000000004212222

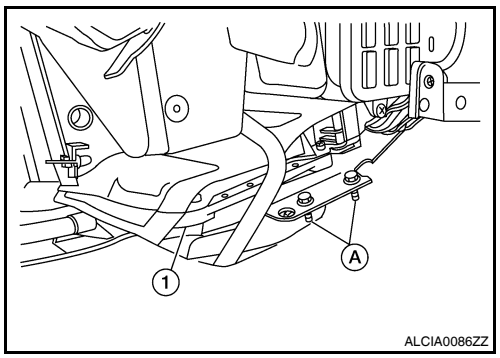
REMOVAL

1. Remove the console side finisher LH. Refer to IP-12, "Removal and Installation".
2. Remove the bolts (A) from the HV ECU (1).



3. Remove the instrument side panel RH. Refer to IP-12, "Removal and Installation".

4. Remove the bolts (A) from the HV ECU (1).
5. Disconnect the drain hose from the heater and cooling unit assembly.
6. Pull out the HV ECU to RH side.
7. Disconnect the HV ECU harness connector from the HV ECU, and remove the HV ECU from the vehicle.
8. If necessary, remove the screws and HV ECU brackets from the HV ECU.

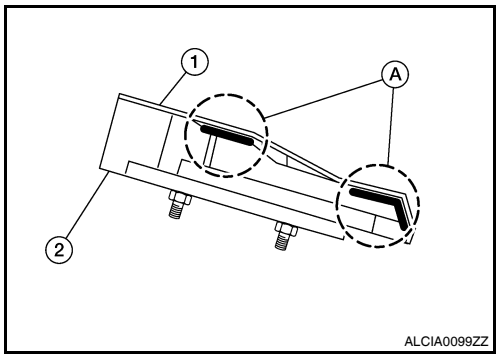


INSTALLATION

Installation is in the reverse order of removal.

NOTE:

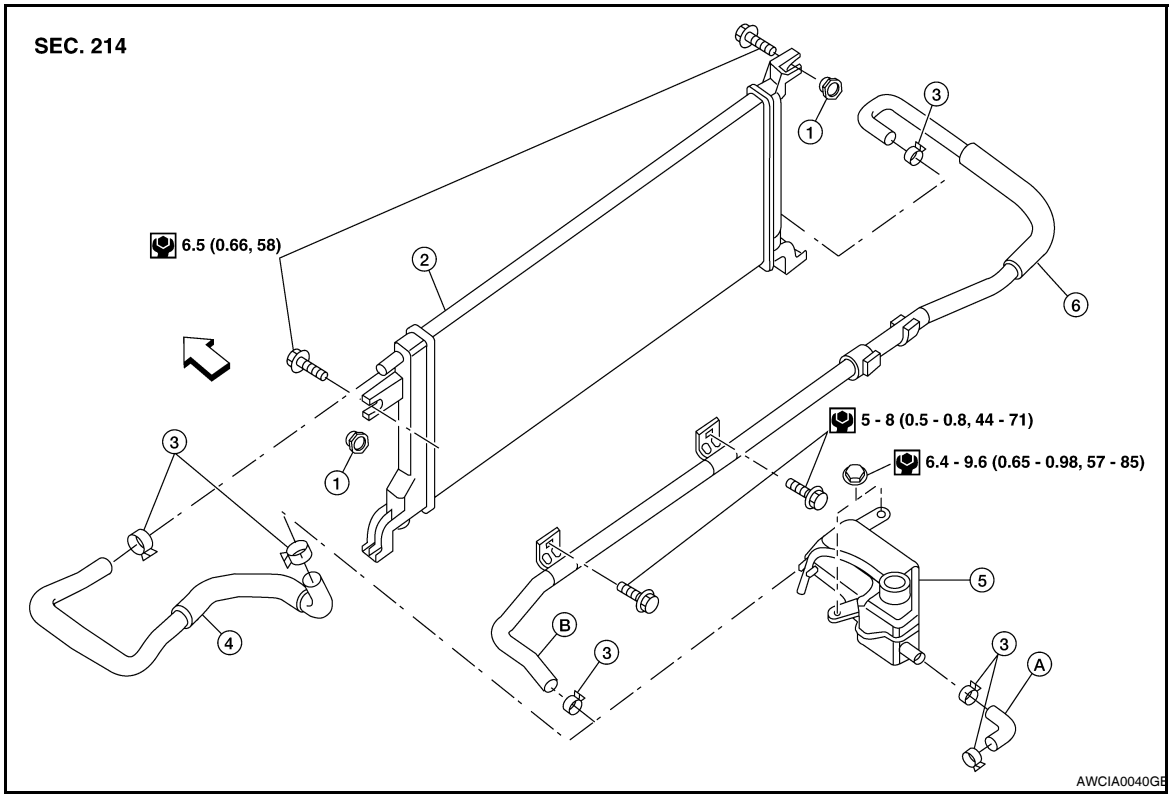
- When tightening the bolts, perform the following procedure and refer to HBC-644, "Exploded View".
- Temporarily tighten bolt (A) first.
- Tighten the other bolts in numerical order to the specified torque.
- Tighten bolt (A) to the specified torque.
- If installing a new HV ECU, apply the waterproof sheet (1) to the HV ECU (2) as shown. Center the waterproof sheet on the HV ECU and press down on the adhesive area (A) to secure the waterproof sheet to the HV ECU.



SUB RADIATOR

Exploded View

INFOID:0000000004212223



1. Rubber bushing
2. Sub radiator
3. Clamp
4. Upper outlet hose
5. Inverter coolant reservoir tank
6. Lower inlet hose
A. To inverter
B. To transaxle
⇐ Front

Removal and Installation

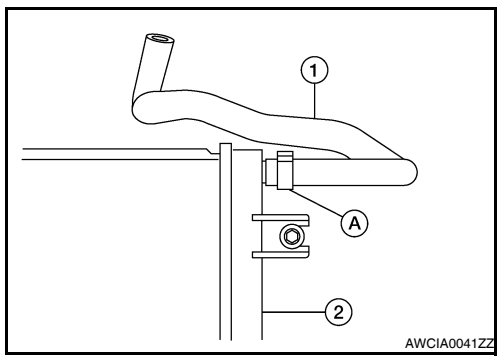
INFOID:0000000004212224

REMOVAL

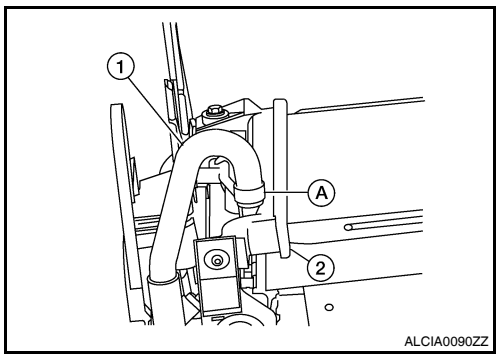
CAUTION:

Do not damage or scratch the radiator and condenser assembly and sub radiator core when removing.

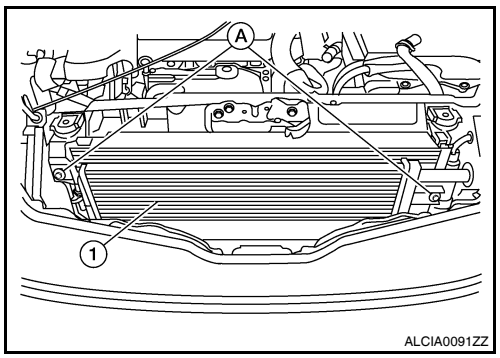
1. Drain the coolant from the inverter cooling system. Refer to HBC-636, "Replacement".
2. Remove the air duct. Refer to EM-24, "Removal and Installation".
3. Remove the front grille. Refer to EXT-16, "Removal and Installation".
4. Disconnect the clamp (A) and the upper outlet hose (1) from the sub radiator (2).



5. Disconnect the clamp (A) and the lower inlet hose (1) from the sub radiator (2).



6. Remove the bolts (A), then remove the sub radiator (1) from the vehicle.



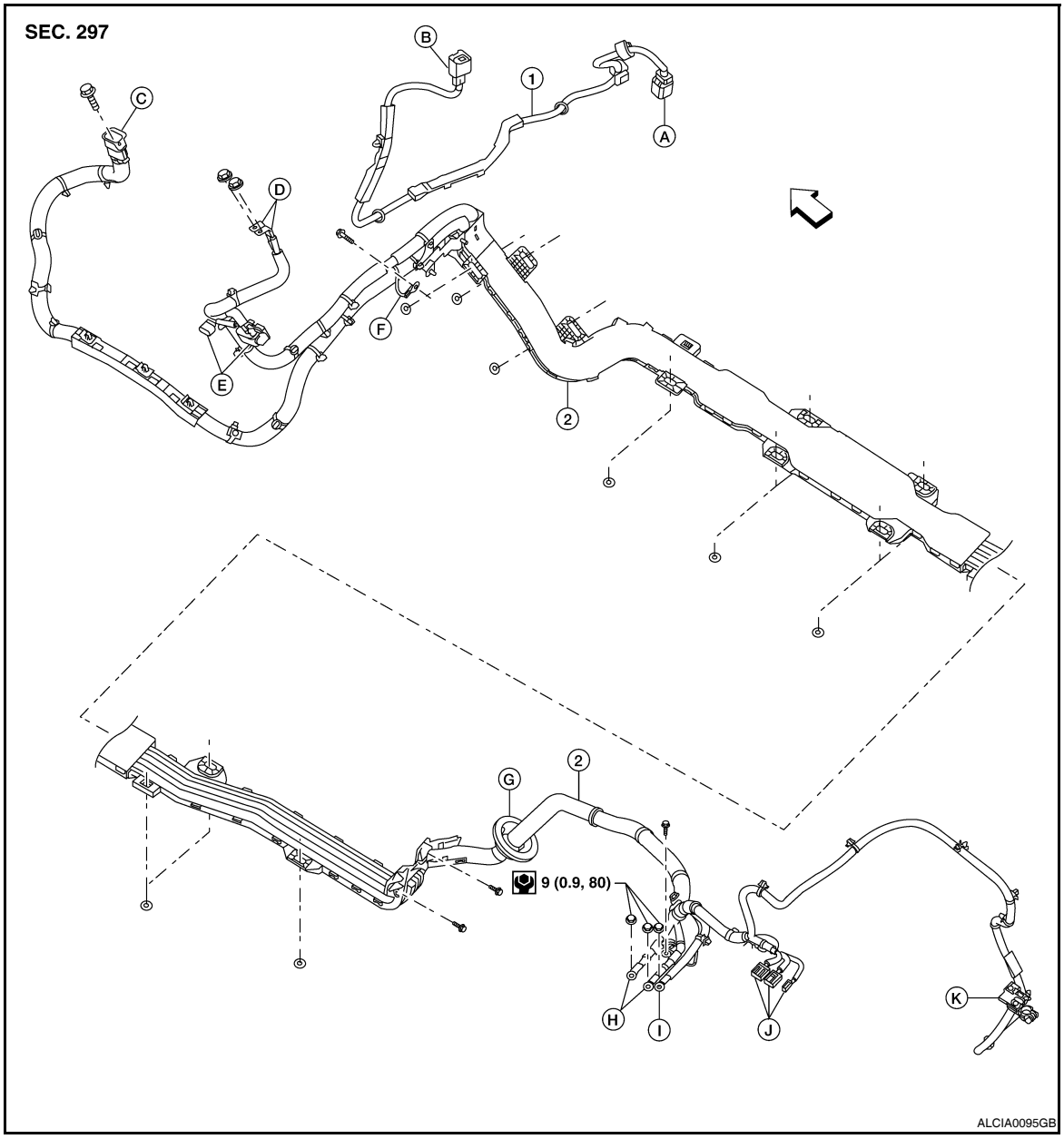
INSTALLATION

Installation is in the reverse order of removal.

FRAME WIRE

Exploded View

INFOID:0000000004212225



1.	Frame wire (electric compressor)	2.	Frame wire (main)	A.	Electric compressor connector
B.	Electric compressor inverter connector	C.	Frame wire inverter connector	D.	HV fuse box terminals
E.	EPS ECU connectors	F.	EPS ECU bonding wire	G.	Grommet
H.	Frame wire terminals to HV battery	I.	12 volt terminal to HV battery	J.	DC/DC converter connectors
K.	12 volt terminal to 12 volt battery	⇐:	Front		

Removal and Installation

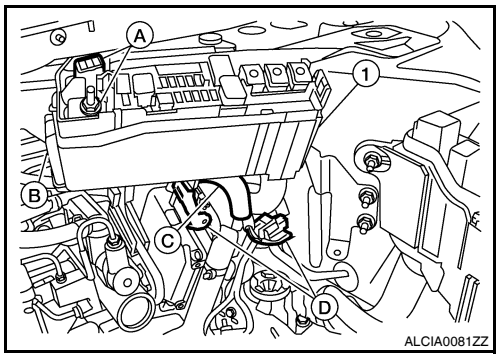
INFOID:0000000004212226

FRAME WIRE (MAIN)

Removal

1. Disconnect the positive 12 volt terminal from the 12 volt battery. Refer to PG-69, "Removal and Installation".

2. Remove the rear seat. Refer to SE-22, "Removal and Installation".
3. Remove the fuel tank. Refer to FL-11, "Removal and Installation".
4. Remove the 12 volt positive battery cable retaining clips from the trunk compartment.
5. Disconnect the DC/DC converter connectors. Refer to STC-60, "Removal and Installation".
6. Remove the DC/DC converter harness retaining clip from the HV battery assembly.
7. Remove the frame wire from the HV battery assembly. Refer to HBB-97, "Removal and Installation".
8. Disconnect the 12 volt terminal and cable retaining clip from the HV battery assembly. Refer to HBB-97, "Removal and Installation".
9. Remove the frame wire harness retaining clips from the vehicle interior.
10. Remove the air cleaner and air duct. Refer to EM-24, "Removal and Installation".
11. Remove the inverter cover and terminal cover from the inverter. Refer to HBC-638, "Removal and Installation".
12. Remove the frame wire inverter connector bolt and disconnect the frame wire inverter connector from the inverter. Refer to HBC-638, "Removal and Installation".
13. Remove the HV fuse box cover from the HV fuse box (1).
14. Remove the HV fuse box terminal cap and nuts (A) from the HV fuse box (1).
15. Open the HV fuse box side cover (B) and remove the harness retaining clip (C) and HV fuse box terminals from the HV fuse box (1).
16. Disconnect the EPS ECU connectors (D). Refer to STC-58, "Removal and Installation".
17. Remove the EPS ECU harness retaining clips from the engine room.
18. Remove the EPS ECU bonding wire bolt.



19. Remove the frame wire harness retaining clips from the engine room.
20. Remove the RH member pin stay. Refer to EM-71, "Removal and Installation".
21. Remove the frame wire retainer nuts and bolts from the underside of vehicle.
22. Remove the frame wire harness assembly with grommet from floor pass through and underside of vehicle.
23. Remove the frame wire harness from the engine room clip and remove the frame wire harness from the engine room.

Installation

Installation is in the reverse order of removal.

FRAME WIRE (ELECTRIC COMPRESSOR)

Removal

1. Remove the air cleaner and air duct. Refer to EM-24, "Removal and Installation".
2. Remove the front terminal cover bolt from the inverter cover and disconnect the electric compressor inverter connector from the inverter. Refer to HBC-638, "Removal and Installation".
3. Disconnect the electric compressor connector from the electric compressor. Refer to HA-31, "Removal and Installation".
4. Remove the front engine mounting insulator and bracket bolts. Refer to EM-71, "Removal and Installation".
5. Remove the electric compressor frame wire harness clips and electric compressor frame wire harness from the vehicle.

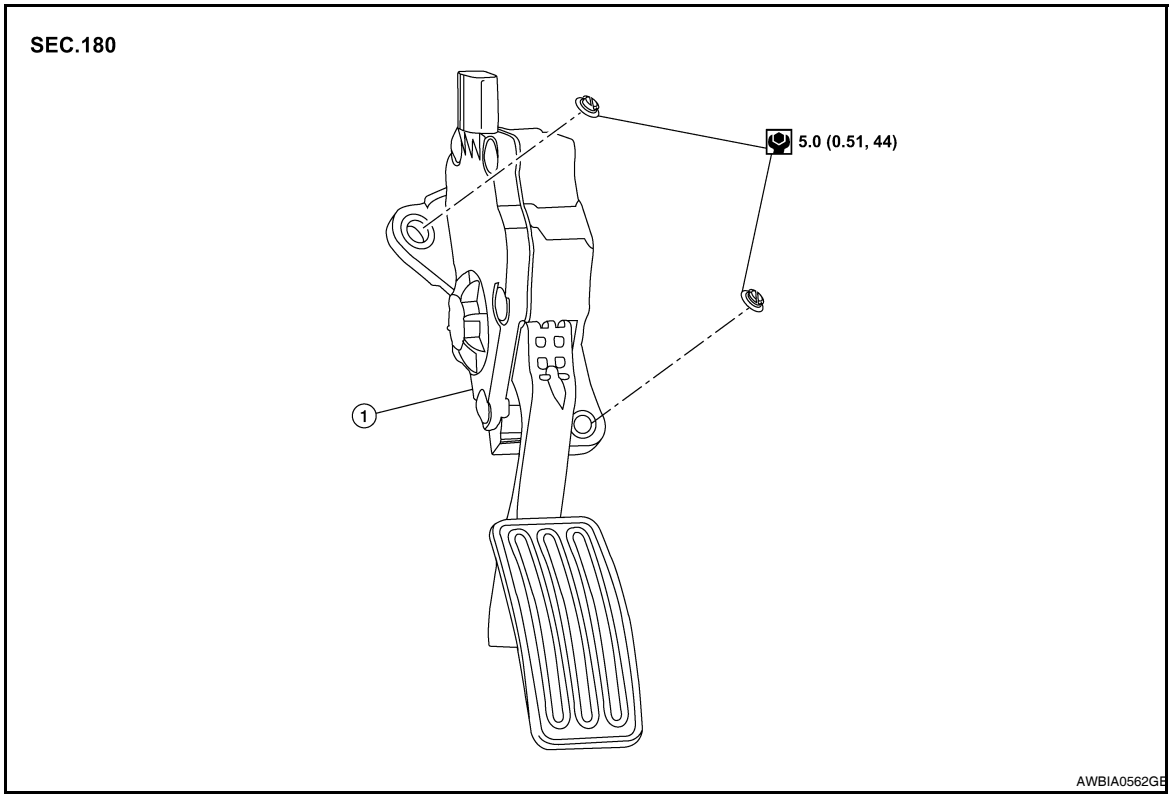
Installation

Installation is in the reverse order of removal.

ACCELERATOR PEDAL ROD

Exploded View

INFOID:0000000004513181



1. Accelerator pedal assembly

Removal and Installation

INFOID:0000000004513182

REMOVAL

1. Disconnect the 12-volt battery negative terminal.
2. Disconnect the accelerator position sensor electrical connector.
3. Remove the accelerator pedal nuts.
4. Remove the accelerator pedal assembly.
   - For electrical inspection of the accelerator pedal position sensor. Refer to HBC-499, "Description".

   CAUTION:
   - **Do not disassemble the pedal assembly.**
   - **Avoid impact from dropping during handling.**
   - **Keep the pedal assembly away from water.**

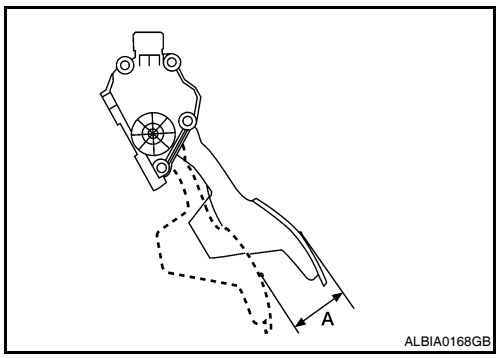
INSTALLATION

Installation is in the reverse order of removal.

- Check the accelerator pedal for smooth operation. There should be no binding or sticking when applying or releasing the accelerator pedal.

- Check that the accelerator pedal moves through the full specified distance of pedal travel.

Pedal travel (A) : 51.1 mm (2.01 in)



CAUTION:
When the harness connector of the accelerator pedal position sensor is disconnected, perform the "Accelerator pedal released position learning". Refer to HBC-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".