SECTION HBC B HYBRID CONTROL SYSTEM HBC

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DIAGNOSIS AND REPAIR WORKFLOW

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< BASIC INSPECTION >

BASIC INSPECTION DIAGNOSIS AND REPAIR WORKFLOW

Work Flow	725 B
DETAILED FLOW	
1.VEHICLE BROUGHT TO WORK SHOP	HBC
>> GO TO 2.	D
2. CUSTOMER PROBLEM ANALYSIS	
Get the detailed information from the customer about the symptom (the condition and the environment whe the incident/malfunction occurred) using the "DIAGNOSTIC WORK SHEET".	en E
>> GO TO 3.	F
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.	G
>> GO TO 4.	Н
4. CHECK DTC AND SAVE FREEZE FRAME DATA	
 Check DTC. Perform the following procedure if DTC is displayed. Record DTC and freeze frame data. 	I
 Study the relationship between the cause detected by DTC and the symptom described by the custome Check related service bulletins for information. Clear DTC. 	r. J
>> GO TO 5.	K
5.CONDUCT VISUAL INSPECTION	
Check the vehicle visually.	L
>> GO TO 6.	
6.CONFIRM THE SYMPTOM	M
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.	N
NOTE:	
If the engine does not start, perform steps 7 to 8 first. <u>Is the malfunction occur?</u>	0
YES >> GO TO 8.	
NO >> GO TO 7. 7. DUPLICATE CONDITIONS THAT PRODUCE SYMPTOMS	Р
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.

DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

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. >> GO TO 10.

NO

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

Repair or replace the malfunctioning part.

Reconnect parts or connectors, disconnected during Diagnosis Procedure, again after repair and replace-2. ment.

>> GO TO 13.

13. CONDUCT CONFIRMATION TEST

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

>> INSPECTION END

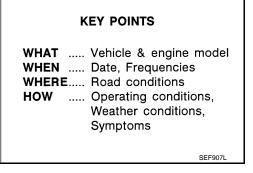
Diagnostic Work Sheet

DESCRIPTION

There are many operating conditions that lead to the malfunction of Hvbrid 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.



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DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

WORK SHEET SAMPLE

Model & Year VIN			
ncident Date Manuf.Date			
n Service Date			
Fuel and fuel filler cap		Vehicle ran out of fuel causing misfire Jel filler cap was left off or incorrectly screwed on	
		Fuel filler cap was left off or incorrectly screwed on. "WARNING RANGEmpg" is displayed in the meter.	
Symptoms	□Startability	Impossible to "BEADY"	
		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		
		Unstable High idle	
	Driveability		
		Lack of power	
		I Exhaust backtire	
		□ Shock at starting engine	
	SOC status	SOC ; Low(white) Low(blue) Mid High	
		Possible to charge SOC at engine running Impossible to charge SOC	
ncident occurrence			
		□ In the morning	
		□ In the daytime	
Frequency		I □ All the time	
		Under certain conditions Sometimes	
Weather conditions	Weather		
		Snowing Others []	
	Temperature	Hot	
		U Warm	
		□ Humid F	
Engine conditions			
		Engine speed : 0 2000 4000 6000 8000 rom	
Road conditions			
		□ Highway □ Off road (up/down) □ Slope (up/down)	
		□ Slope (up/down)	
Driving conditions		Not affected At starting	
		At starting While starting At starting	
		□ At racing □ While accelerating	
		U while accelerating	
		While cruising While decelerating	
		□ While turning (RH/RL) Vehicle speed ; 0 10 20 30 40 50 60 MPH	
		Shift position DP DR DN DD DB DNone (Not displayed)	
Malfunction indicator lamp	1	Turned on	
READY operation indicato	r light	Not turned on Turned on	
	n nynt	□ Not turned on	
Hybrid system warning lig	ht		
Hight voltage battery warn	ina liaht	□ Not turned on □ 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 Turned on	
ASCD SET lamp		□ Turned on □ Not turned on	
		□ Flashing (if ASCD CRUISE lamp is turned on)	

< BASIC INSPECTION >

INSPECTION AND ADJUSTMENT ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT

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

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 Reguirement

1.PERFORM INITIALIZATION OF NATS SYSTEM AND REGISTRATION OF ALL NATS IGNITION KEY IDS Refer to <u>SEC-9, "ECM RE-COMMUNICATING FUNCTION : Special Repair Requirement"</u>.

>> END

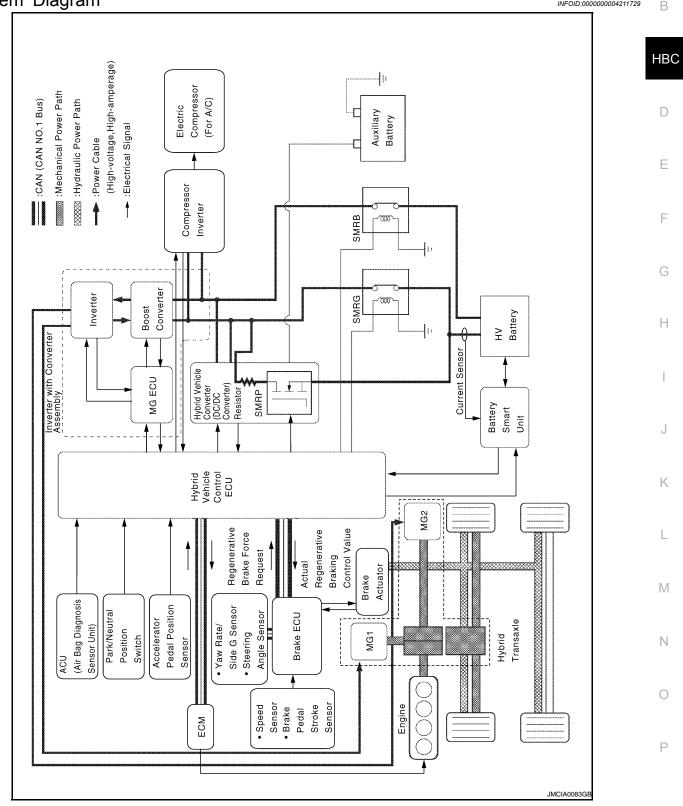
< FUNCTION DIAGNOSIS >

FUNCTION DIAGNOSIS HYBRID CONTROL SYSTEM

System Diagram



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System Description

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DESCRIPTION

< FUNCTION DIAGNOSIS >

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 highefficiency QR25DE engine.

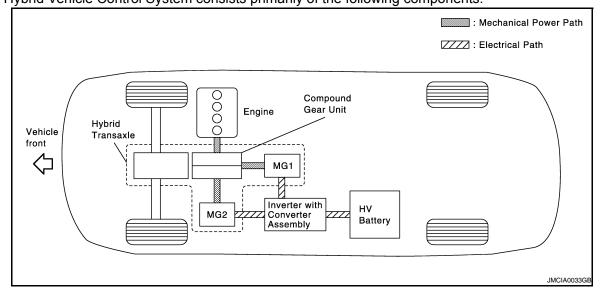
Fuel Economy Performance

- 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:



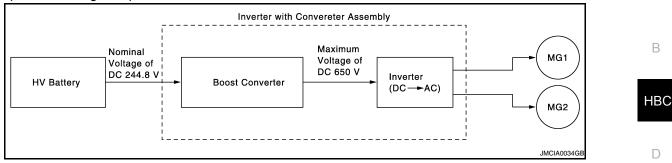
Variable-Voltage System

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-

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< FUNCTION DIAGNOSIS >

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.



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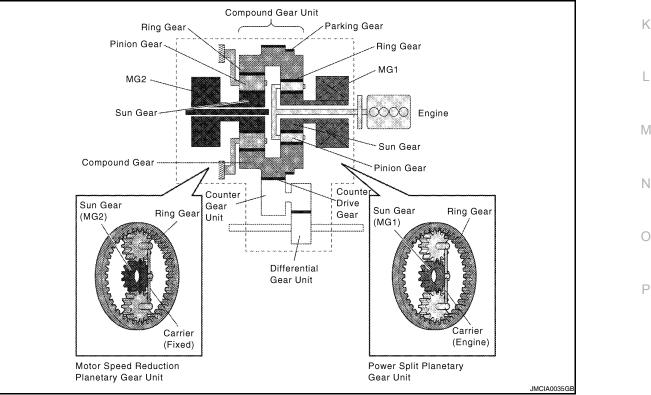
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Clutch-Less System

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.



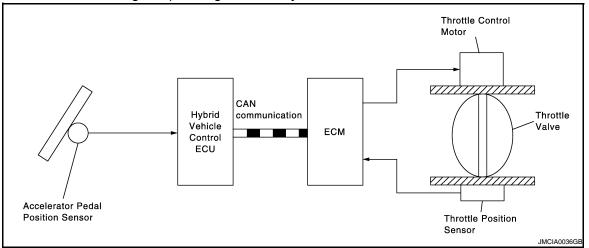
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Link-Less

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.



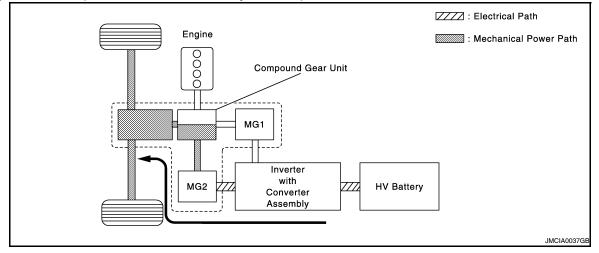
Regenerative Brake

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

< FUNCTION DIAGNOSIS >

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.

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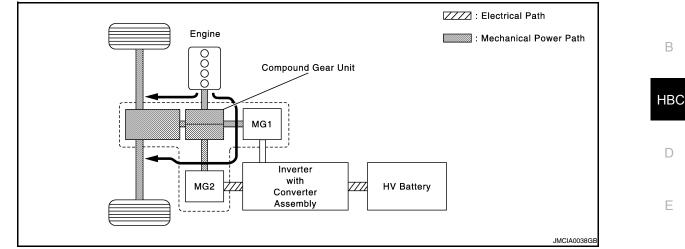
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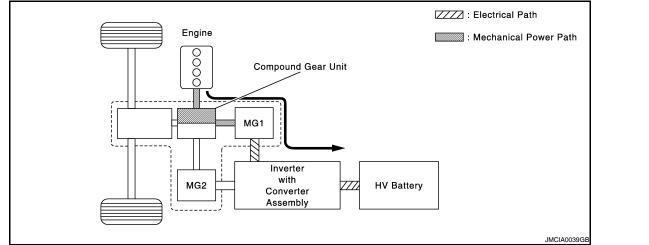
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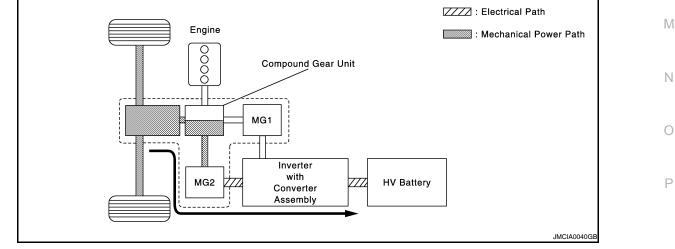
Charge The HV Battery

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 electri-cal energy and used to recharge the HV battery by means of MG2.



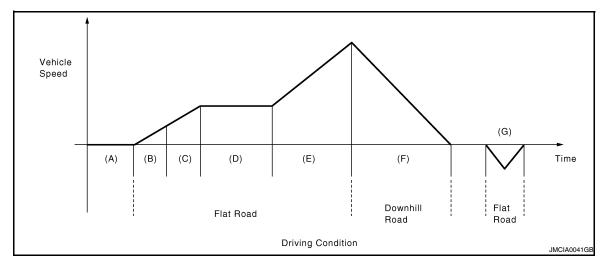
SYSTEM OPERATION

General

< FUNCTION DIAGNOSIS >

- 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

D.

B. Starting with MG2

E.

During Full Throttle Acceleration F.

C.

- Driving with MG2 and Engine
- During Deceleration Driving

Speed Cruising

During Low Load and Constant-

G. During Reverse Driving

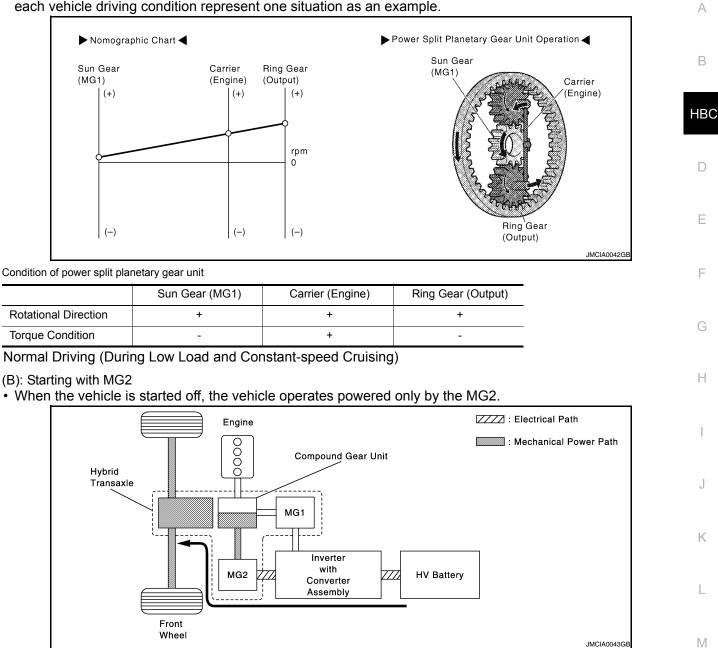
How to Read a Nomographic Chart

- 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.

< FUNCTION DIAGNOSIS >

• 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.



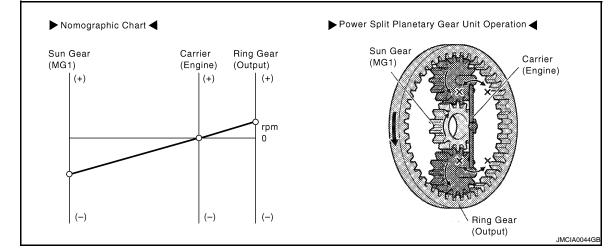
• When the vehicle starts off under normal conditions, it runs using the motive force of MG2. While driving under this condition, the rotational speed of the carrier is 0 rpm due to the engine being inactive. In addition,

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0

< FUNCTION DIAGNOSIS >

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).

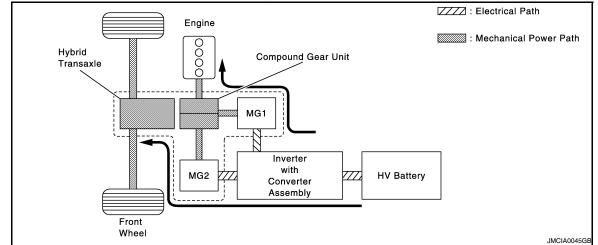


Condition of power split planetary gear unit

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

(C): Driving with MG2 and Starting Engine

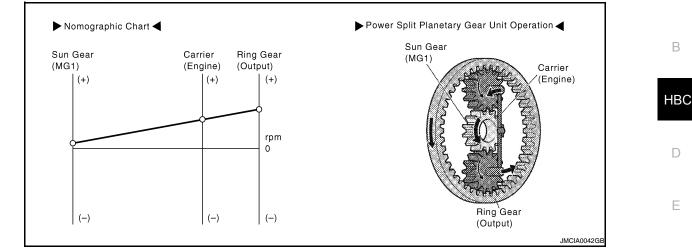
• If the required drive torque increases when driving with MG2 only, MG1 is activated to start the engine. In addition, if any one of the items monitored by the hybrid vehicle control ECU such as the SOC condition, the battery temperature, the engine coolant temperature or the electrical load condition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

< FUNCTION DIAGNOSIS >

 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.

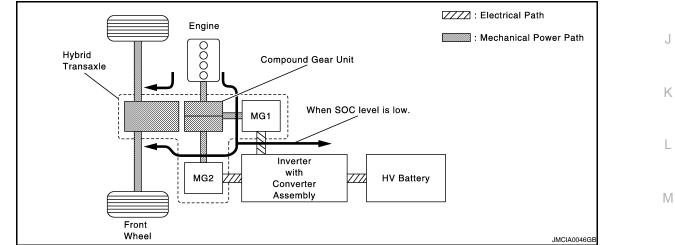


Condition of power split planetary gear unit

	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.

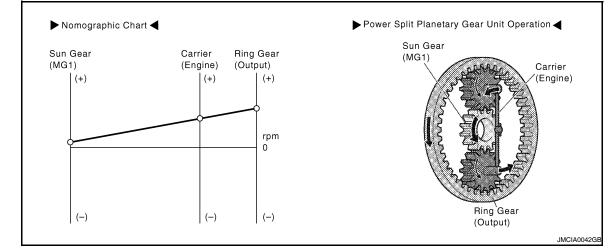
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< FUNCTION DIAGNOSIS >

• 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.

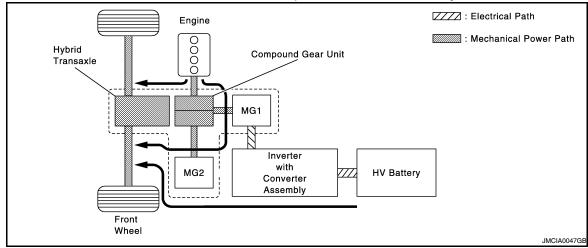


Condition of power split planetary gear unit

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

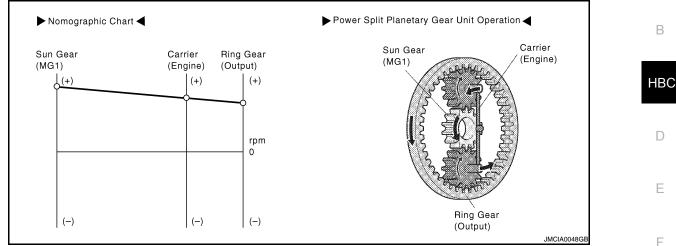
(E): During Full Throttle Acceleration

• 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.



< FUNCTION DIAGNOSIS >

• 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".



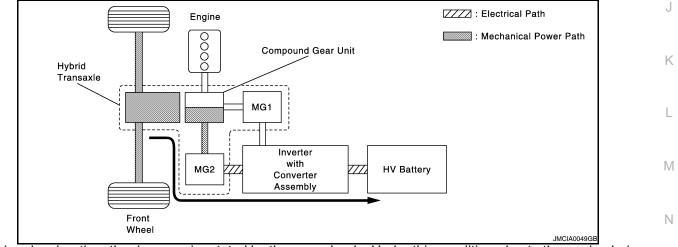
Condition of power split planetary gear unit

	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

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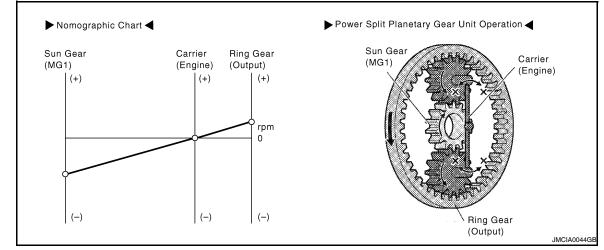
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< FUNCTION DIAGNOSIS >

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



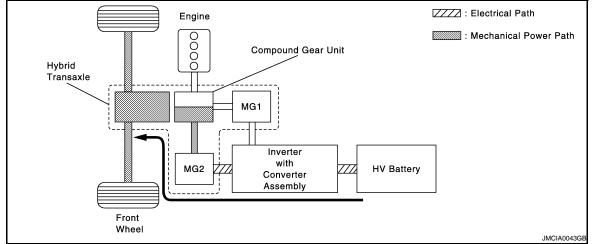
Condition of power split planetary gear unit

	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.

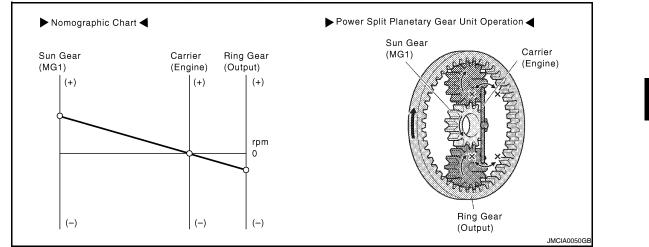
 During reverse driving, when any of the SOC condition, battery temperature, engine coolant temperature and electrical load condition reaches a specified level, the engine may start. The following illustration represents the condition when the engine is not driving.



• The conditions of the planetary gear are opposite to those described in "Starting and Driving with MG2".

< FUNCTION DIAGNOSIS >

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	-



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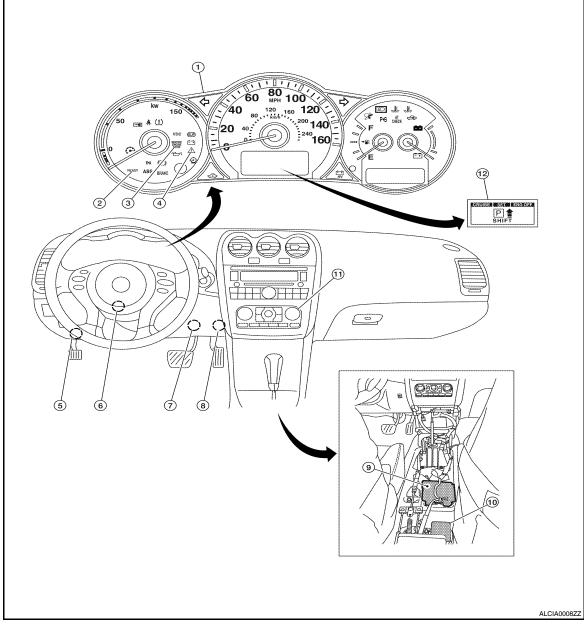
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< FUNCTION DIAGNOSIS >

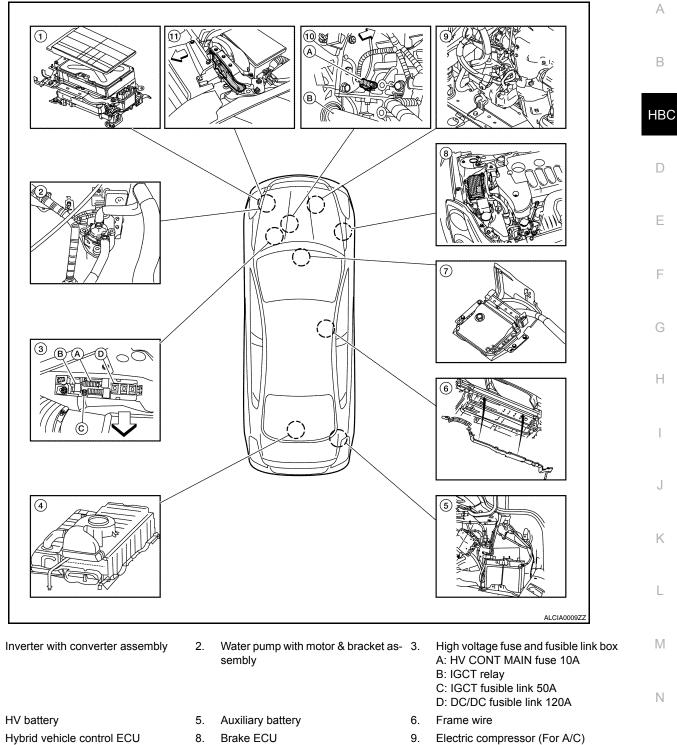
Component Parts Location

INFOID:000000004211731



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

< FUNCTION DIAGNOSIS >



4.

1.

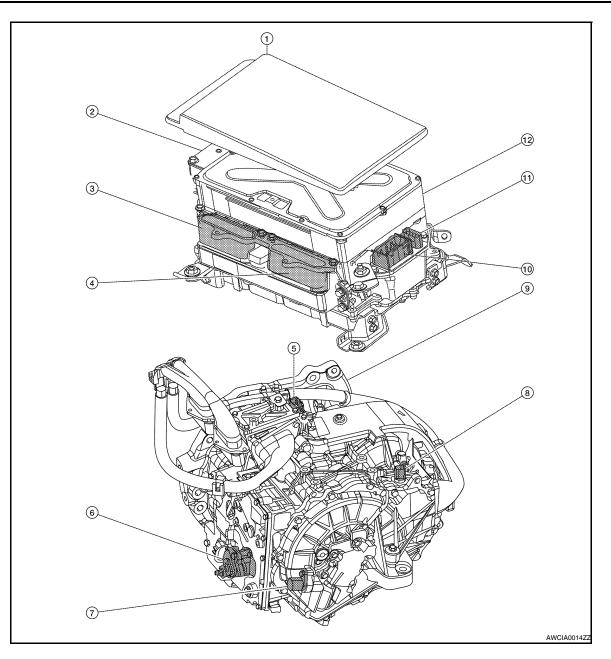
- 7. (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- √ Vehicle front

- 11. ECM

Ο

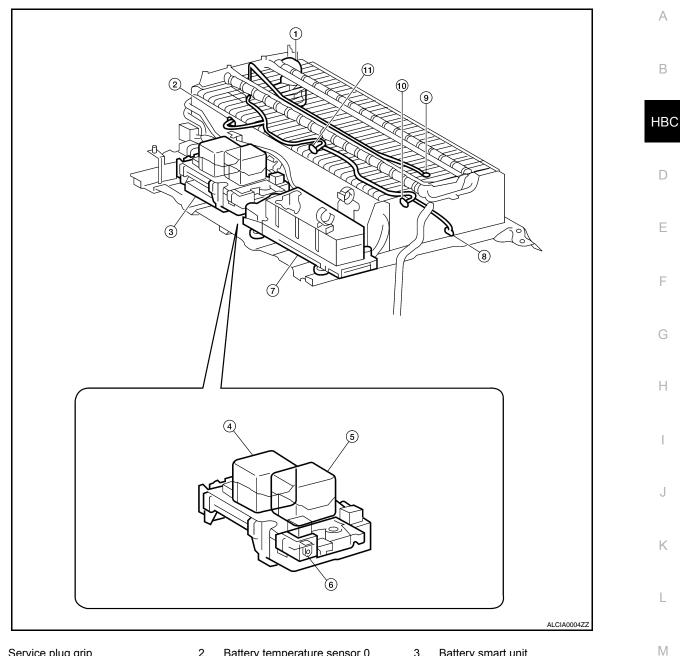
Ρ

< FUNCTION DIAGNOSIS >



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

< FUNCTION DIAGNOSIS >



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

Ο

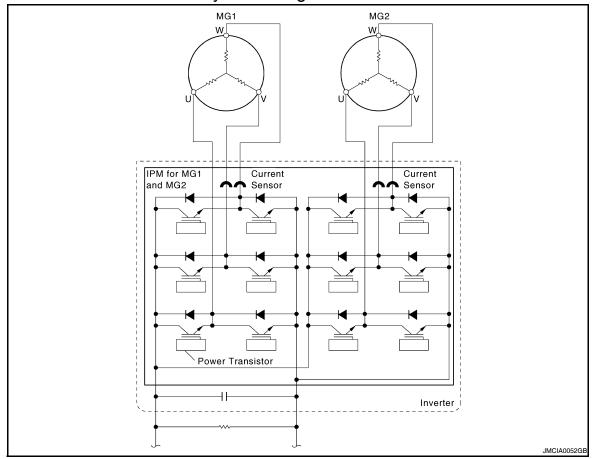
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< FUNCTION DIAGNOSIS >

HYBRID TRANSAXLE MOTOR AND GENERATOR

MOTOR AND GENERATOR : System Diagram

INFOID:000000004211732



MOTOR AND GENERATOR : System Description

INFOID:000000004211733

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.

< FUNCTION DIAGNOSIS >

 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 <u>HBC-51, "System Diagram"</u>.

nverter cooling system (for Inverter, MG	G1 and MG2) on <u>HBC-51, "System Diagram"</u> .	A
MG2	MG1	B HE D F
//G1 Specifications	Hybrid Transaxle JMCIA0051GB	
Type	Permanent magnet motor	
Function	Generate, engine starter	
Maximum system voltage*	DC 650 V	
Inverter cooling system	Water-cooled	
MG2 Specifications		
Туре	Permanent Magnet Motor	k
	6	
Function	Generate, Drive Front Wheels	
Function Maximum System Voltage*		
	Generate, Drive Front Wheels	L
Maximum System Voltage*	Generate, Drive Front Wheels DC 650 V	L

*: 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.

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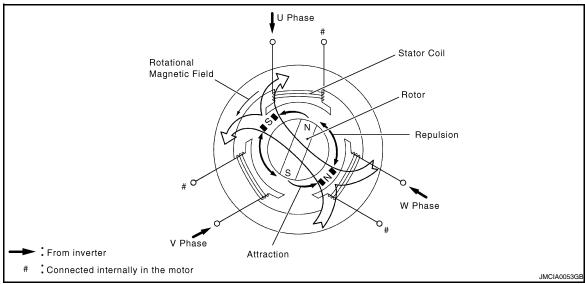
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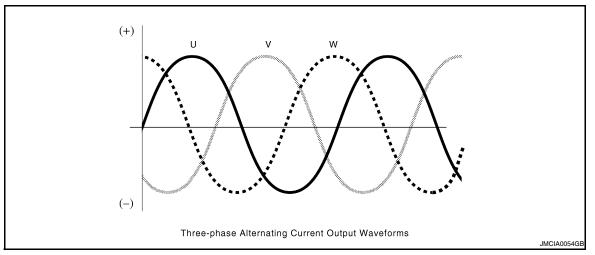
The generated torque is for all practical purposes proportionate to the amount of current, and the rotational speed is controlled by the frequency of the alternating current.

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.

< FUNCTION DIAGNOSIS >

• 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.

< FUNCTION DIAGNOSIS >

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

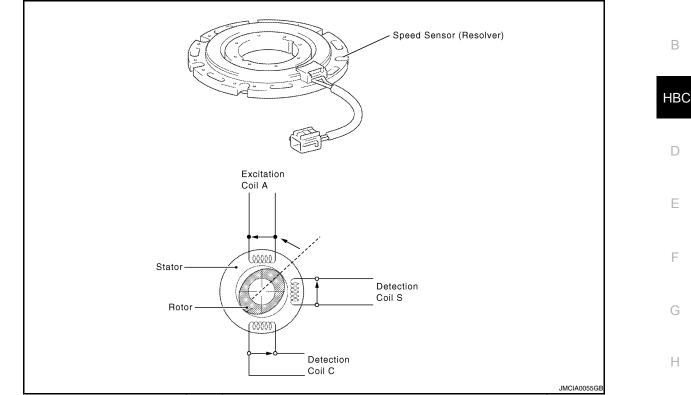
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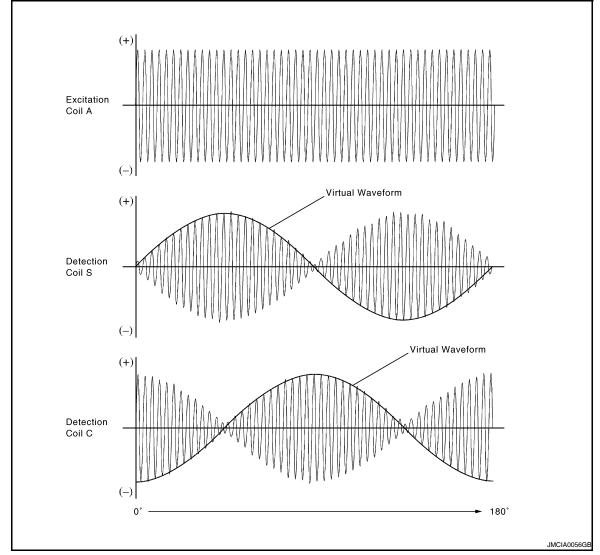
Ρ



- 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.

< FUNCTION DIAGNOSIS >

• 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.

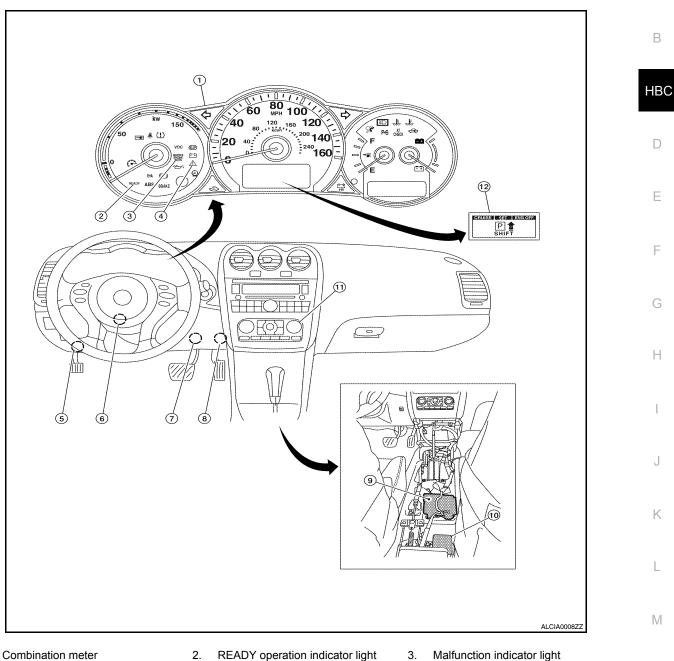


< FUNCTION DIAGNOSIS >

MOTOR AND GENERATOR : Component Parts Location

INFOID:000000004211734

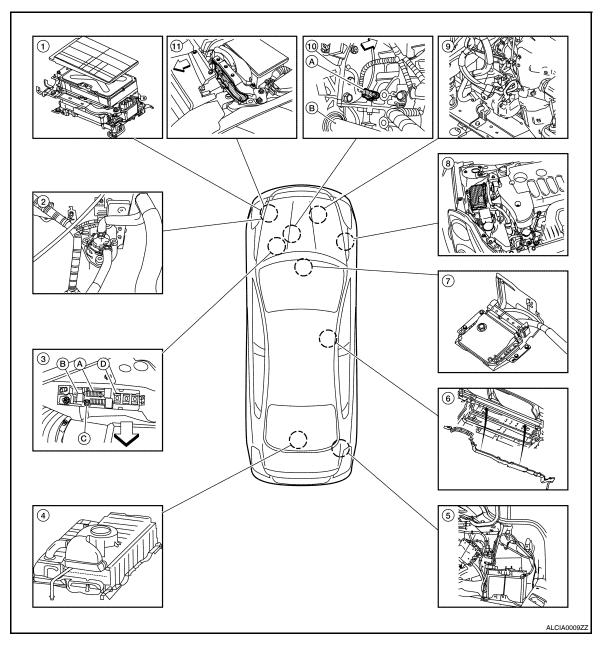
А



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

Ν

< FUNCTION DIAGNOSIS >



1. Inverter with converter assembly

2. Water pump with motor & bracket as- 3. sembly

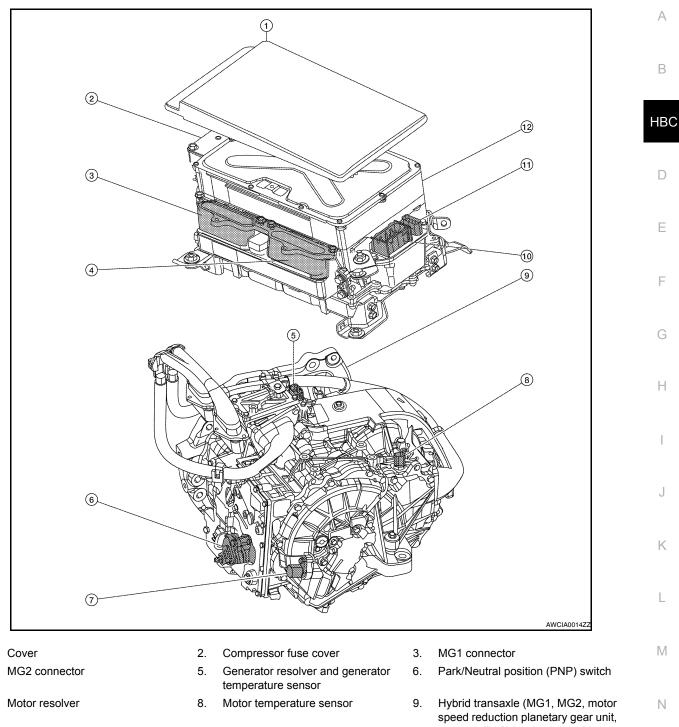
High voltage fuse and fusible link box A: HV CONT MAIN fuse 10A B: IGCT relay C: IGCT fusible link 50A D: DC/DC fusible link 120A

- 4. HV battery
- 7. Hybrid vehicle control ECU (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- √ Vehicle front

- 5. Auxiliary battery
- 8. Brake ECU
- 11. ECM

- 6. Frame wire
- 9. Electric compressor (For A/C)

< FUNCTION DIAGNOSIS >



10. Inverter with converter assembly connector (MG ECU)

1.

4.

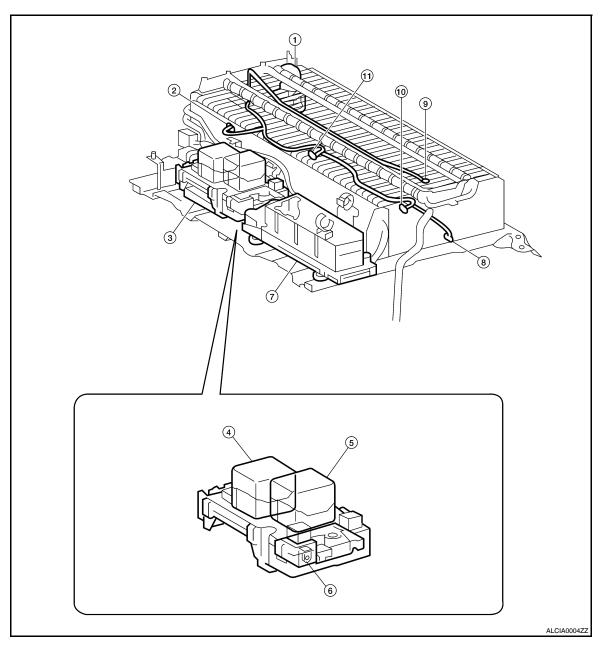
7.

- 11. Inverter with converter assembly connector (Resolver)
- power split planetary gear unit)
- 12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

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< FUNCTION DIAGNOSIS >

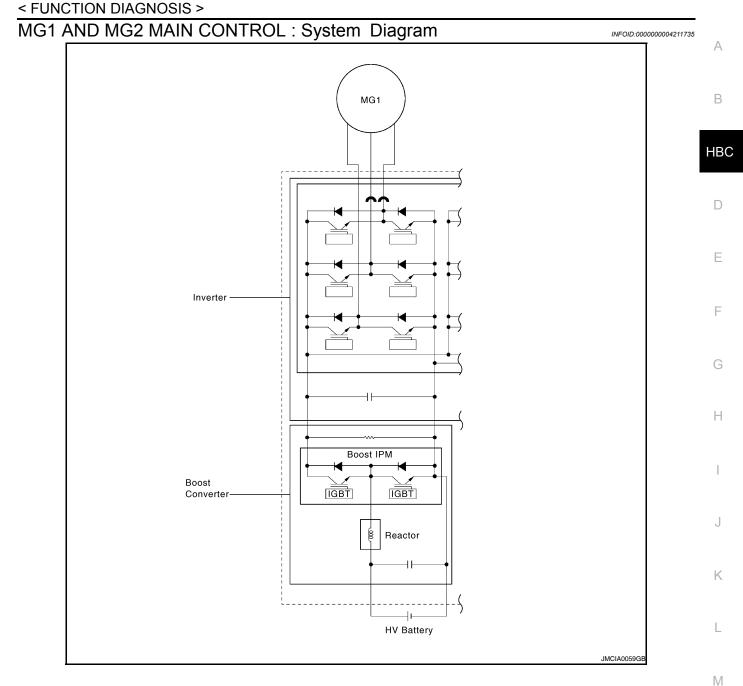


- 1. Service plug grip
- 4. SMRG
- 7. Hybrid vehicle converter

10. Battery temperature sensor 2

- 2. Battery temperature sensor 0
- 5. SMRB
- 8. Battery temperature sensor 3
- 11. Battery temperature sensor 1
- 3. Battery smart unit
- 6. Battery current sensor
- 9. Intake air temperature sensor

MG1 AND MG2 MAIN CONTROL



MG1 AND MG2 MAIN CONTROL : System Description

INFOID:000000004211736

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) Ρ switch ON and OFF to control the individual motors in accordance with the driving or generation operation.

MOTOR DRIVE OPERATION

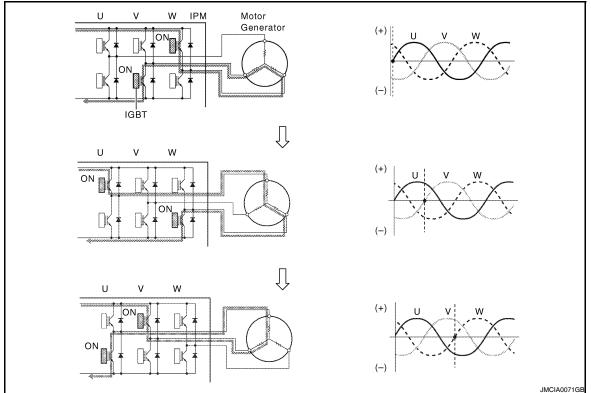
· The illustration below describes the basic control for driving a motor. The IGBTs (Insulated Gate Bipolar Transistors) in the IPM switch ON and OFF to supply a three-phase alternating current to the motor.

HBC-39

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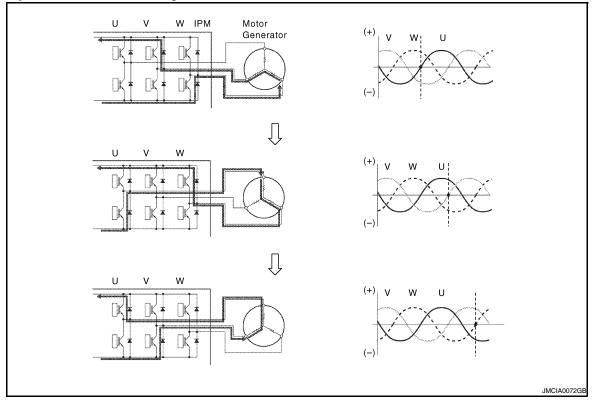
< FUNCTION DIAGNOSIS >

 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.

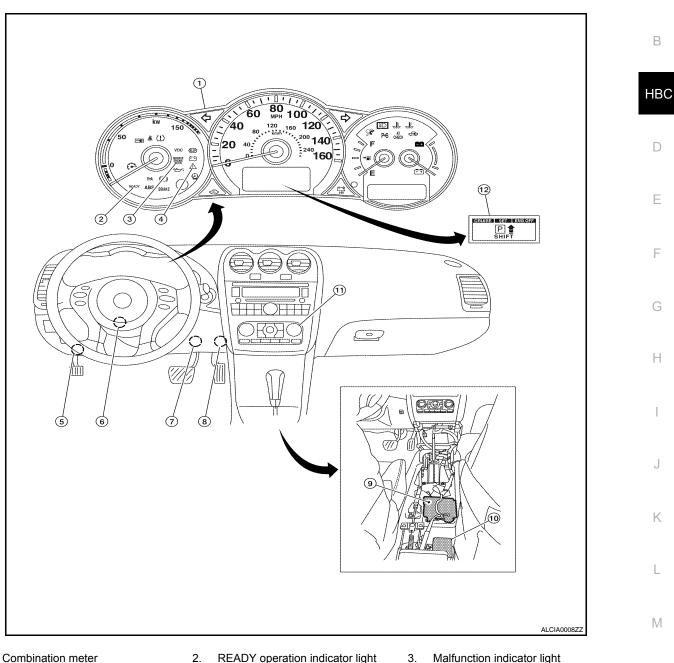


< FUNCTION DIAGNOSIS >

MG1 AND MG2 MAIN CONTROL : Component Parts Location



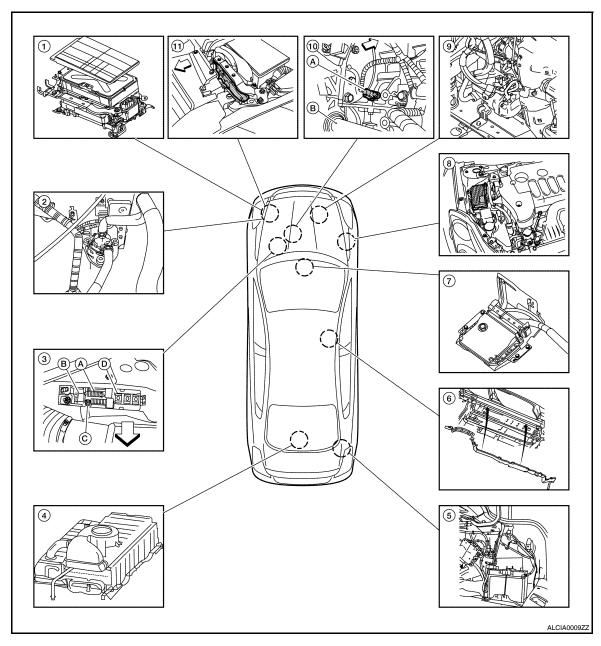
А



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

Ν

< FUNCTION DIAGNOSIS >



1. Inverter with converter assembly

2. Water pump with motor & bracket as- 3. sembly

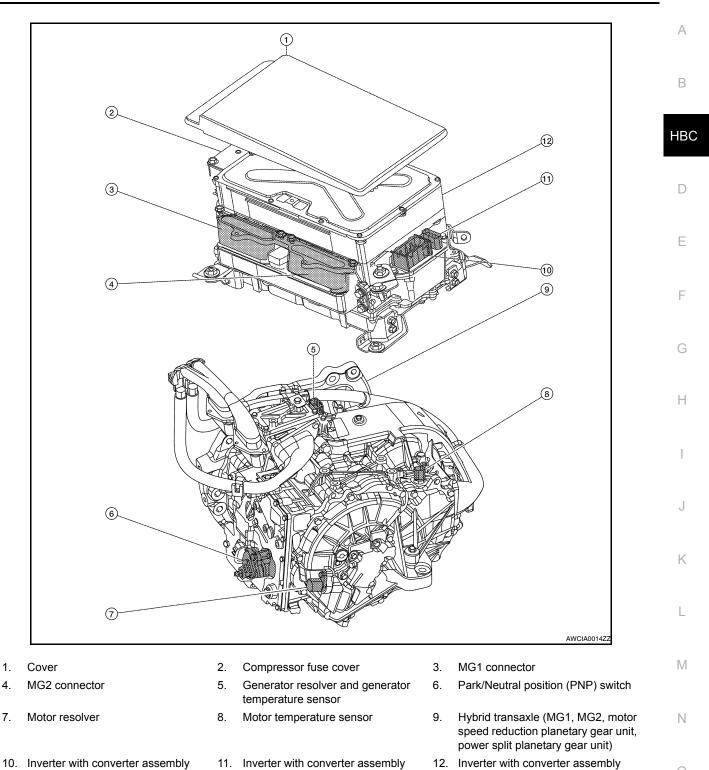
High voltage fuse and fusible link box A: HV CONT MAIN fuse 10A B: IGCT relay C: IGCT fusible link 50A D: DC/DC fusible link 120A

- 4. HV battery
- 7. Hybrid vehicle control ECU (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- ∠ Vehicle front

- 5. Auxiliary battery
- 8. Brake ECU
- 11. ECM

6. Frame wire9. Electric compressor (For A/C)

< FUNCTION DIAGNOSIS >

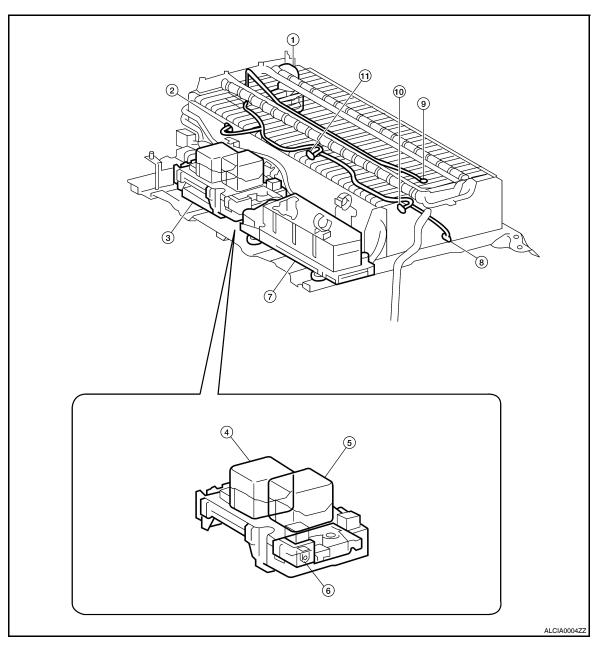


- 10. Inverter with converter assembly connector (MG ECU)
- 11. Inverter with converter assembly connector (Resolver)

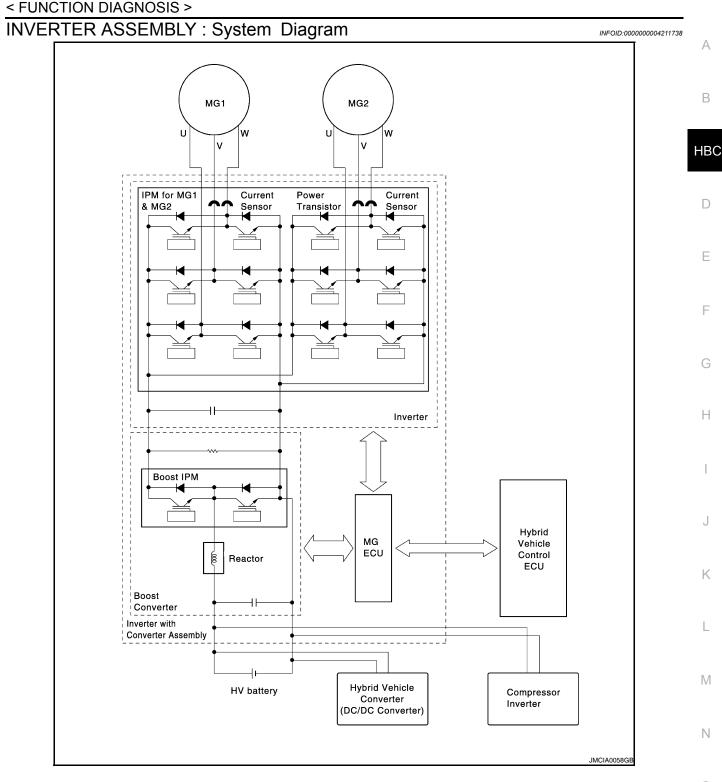
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(Boost converter, inverter, MG ECU)

< FUNCTION DIAGNOSIS >



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



INVERTER ASSEMBLY : System Description

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Ρ

GENERAL

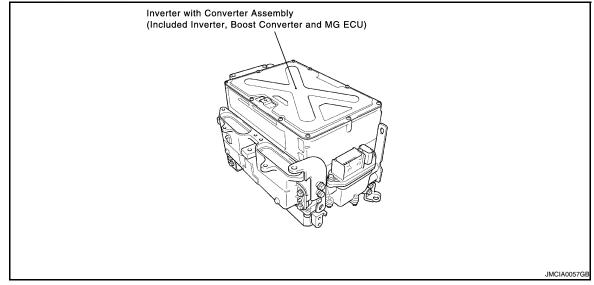
- The inverter converts the high-voltage direct current of the HV battery into three-phase alternating current for driving MG1 and MG2.
- The activation of the power transistors is controlled by the hybrid vehicle control ECU, via the MG ECU. In
 addition, the inverter transmits information that is needed 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.

HBC-45

< FUNCTION DIAGNOSIS >

- 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 <u>HBC-61</u>, "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 <u>HBC-45</u>, "INVERTER <u>ASSEMBLY : System Diagram</u>".



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 <u>HBC-45</u>, "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

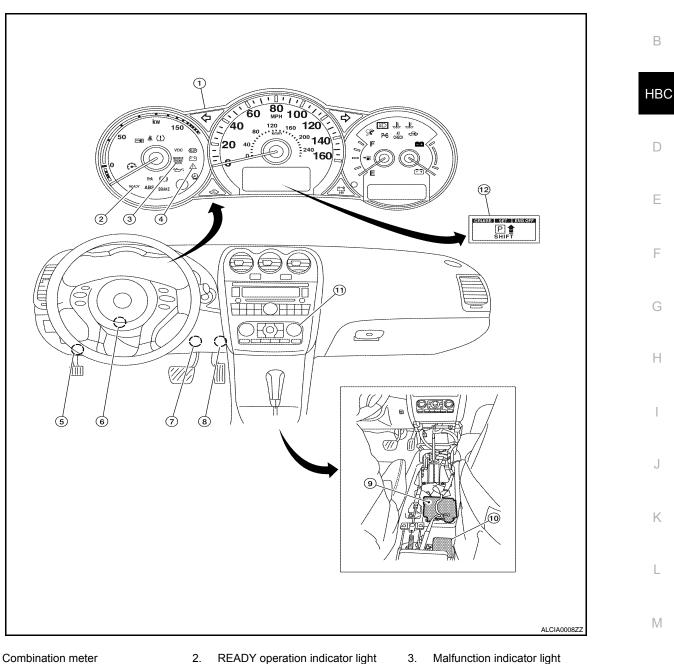
- The MG ECU is provided in the inverter assembly. In accordance with the signals received from the hybrid vehicle control ECU, the MG ECU controls the inverter and boost converter in order to drive MG1 or MG2 or cause them to generate electricity.
- The MG ECU transmits information that is required 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.

< FUNCTION DIAGNOSIS >

INVERTER ASSEMBLY : Component Parts Location

INFOID:000000004211740

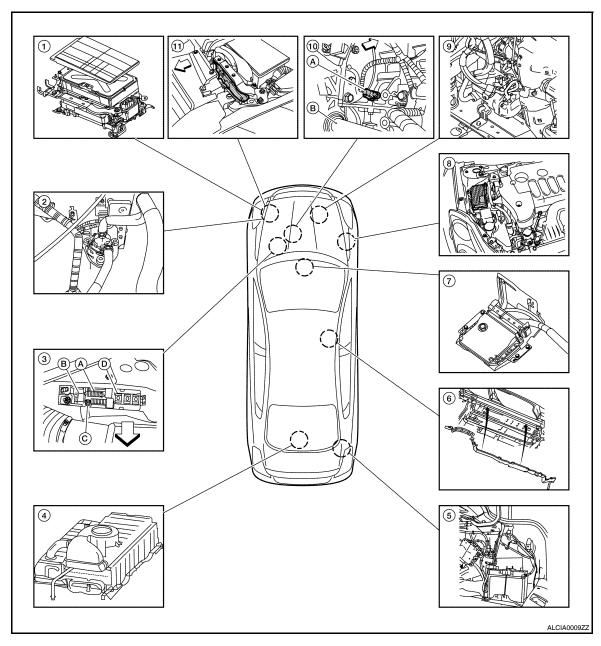
А



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

Ν

< FUNCTION DIAGNOSIS >



1. Inverter with converter assembly

Water pump with motor & bracket as- 3. 2. sembly

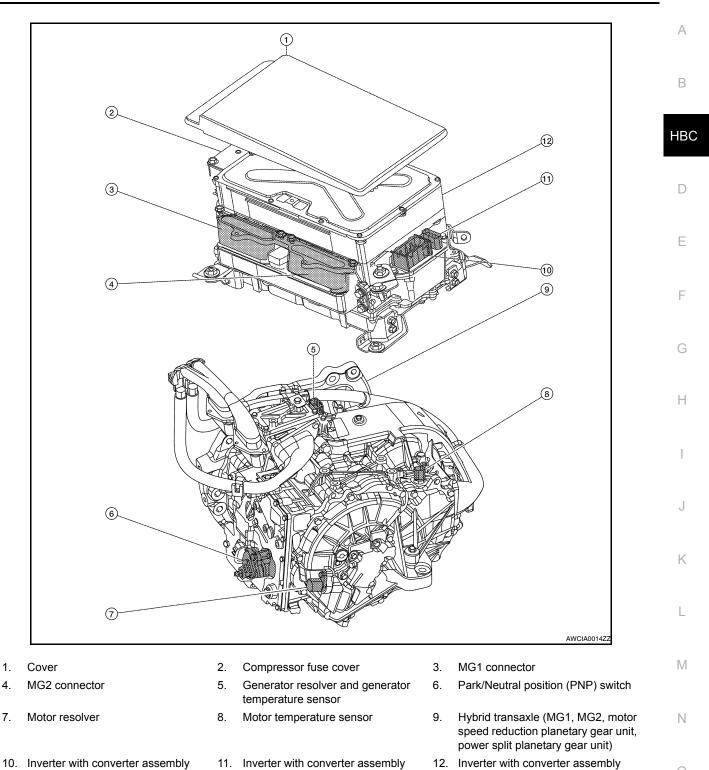
High voltage fuse and fusible link box A: HV CONT MAIN fuse 10A B: IGCT relay C: IGCT fusible link 50A D: DC/DC fusible link 120A

- HV battery 4.
- Hybrid vehicle control ECU 7. (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- ∠ Vehicle front

- 5. Auxiliary battery
- 8. Brake ECU
- 11. ECM

- 6. Frame wire
- 9. Electric compressor (For A/C)

< FUNCTION DIAGNOSIS >

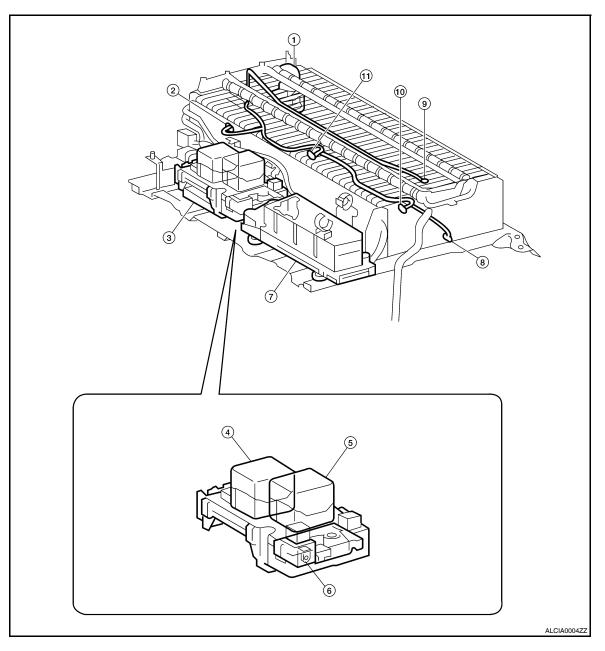


- 10. Inverter with converter assembly connector (MG ECU)
- 11. Inverter with converter assembly connector (Resolver)

(Boost converter, inverter, MG ECU)

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< FUNCTION DIAGNOSIS >



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

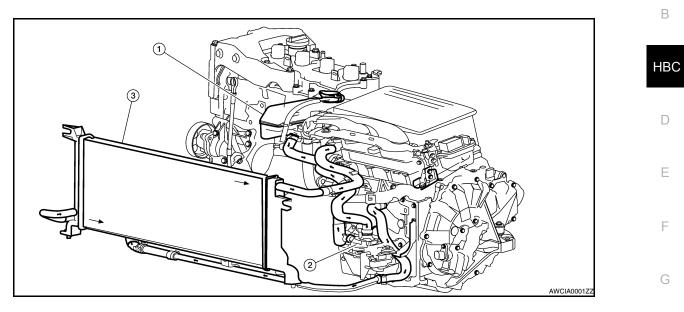
< FUNCTION DIAGNOSIS >

COOLING SYSTEM FOR INVERTER, MG1 AND MG2

System Diagram

INFOID:000000004211741

А



1. Coolant reservoir

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

System Description

INFOID:000000004211742

Н

- 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 J 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)	s) 7/8 gal (3/4 gal, 3.2)	
	Туре		NISSAN Genuine Long Life Coolant (LLC) or the equivalent	L
	Maintenance Intervals	First Time	60,000 miles (96,000 km) or 48 months	
		Subsequent	Every 30,000 miles (48,000 km) or 24 months	M

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.

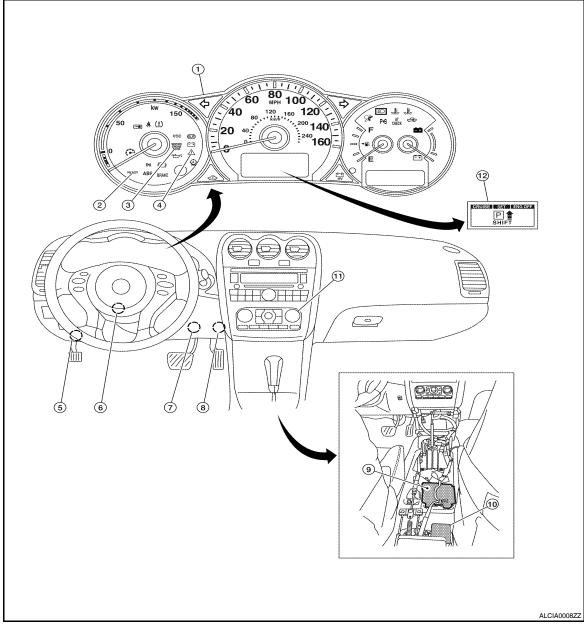
Other types of coolant solutions may damage your inverter cooling system.

Outside temperature down to		
distilled water	Anti-freeze	water or
°C °F distined water		distilled water
-35 -30 50% 50%	50%	50%
		SMA947CA

< FUNCTION DIAGNOSIS >

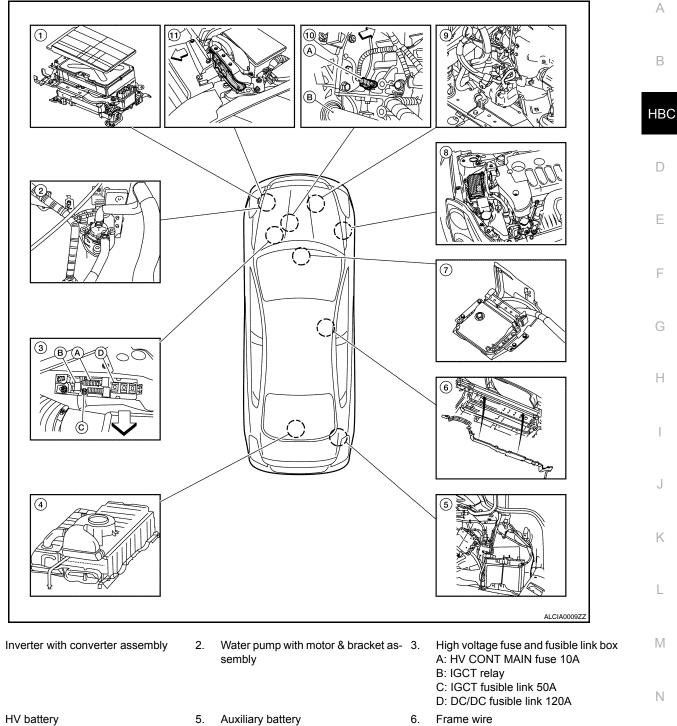
Component Parts Location

INFOID:000000004211743



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

< FUNCTION DIAGNOSIS >



9.

- 7. Hybrid vehicle control ECU (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- √ Vehicle front

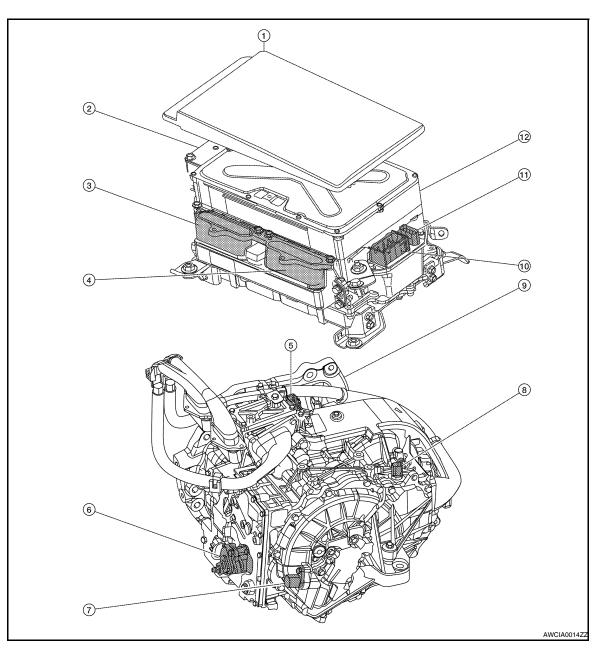
1.

4.

- 8. Brake ECU
- 11. ECM

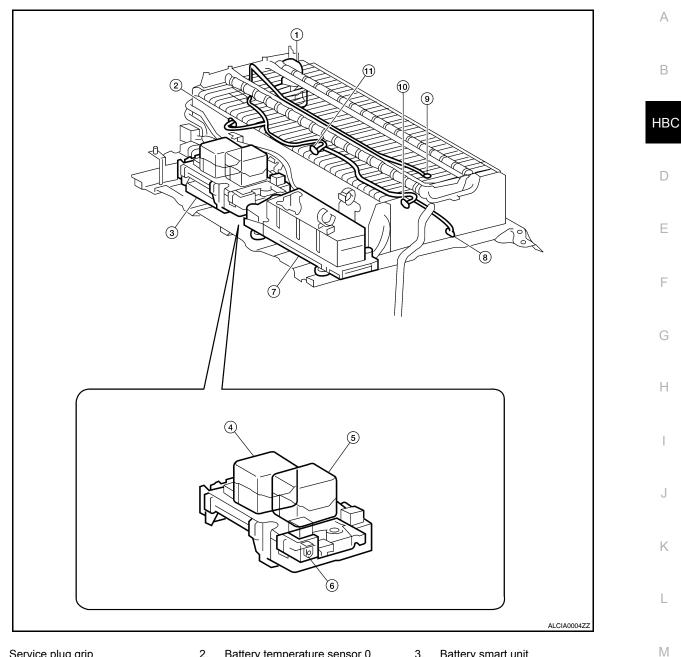
- Electric compressor (For A/C)
 - Ρ

< FUNCTION DIAGNOSIS >



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

< FUNCTION DIAGNOSIS >



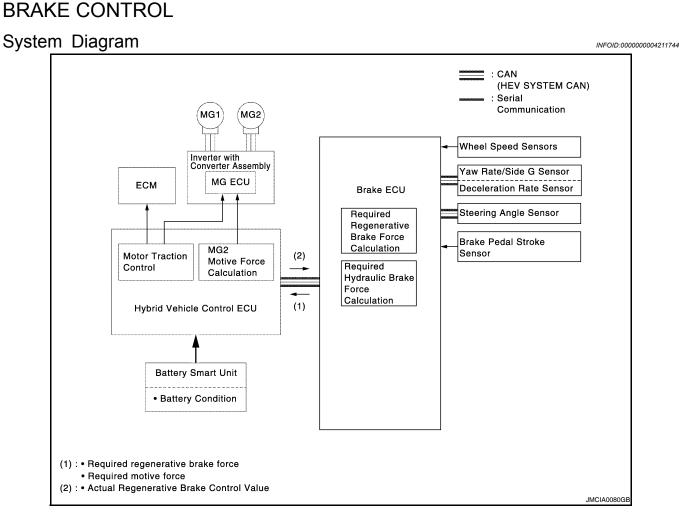
- Service plug grip 1.
- SMRG 4.
- 7. Hybrid vehicle converter
- Battery temperature sensor 2 10.
- Battery temperature sensor 0 2.
- 5. SMRB
- 8. Battery temperature sensor 3
- 11. Battery temperature sensor 1
- 3. Battery smart unit
- 6. Battery current sensor
- 9. Intake air temperature sensor

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< FUNCTION DIAGNOSIS >



System Description

INFOID:000000004211745

- 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.

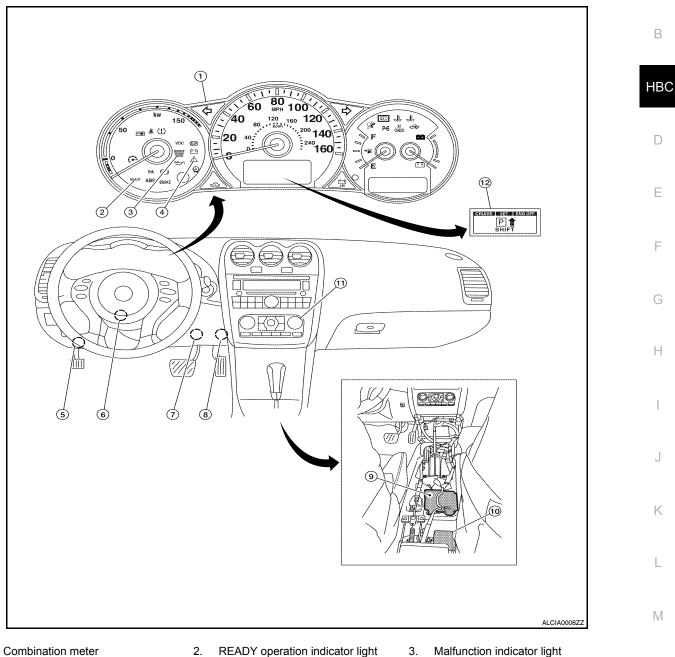
• The brake ECU outputs a request to the hybrid vehicle control ECU to effect motor traction control while the vehicle is operating under TCS function control. The hybrid vehicle control ECU controls the engine, MG1, and MG2 in accordance with the present driving conditions in order to suppress the motive force.

< FUNCTION DIAGNOSIS >

Component Parts Location

INFOID:000000004211746

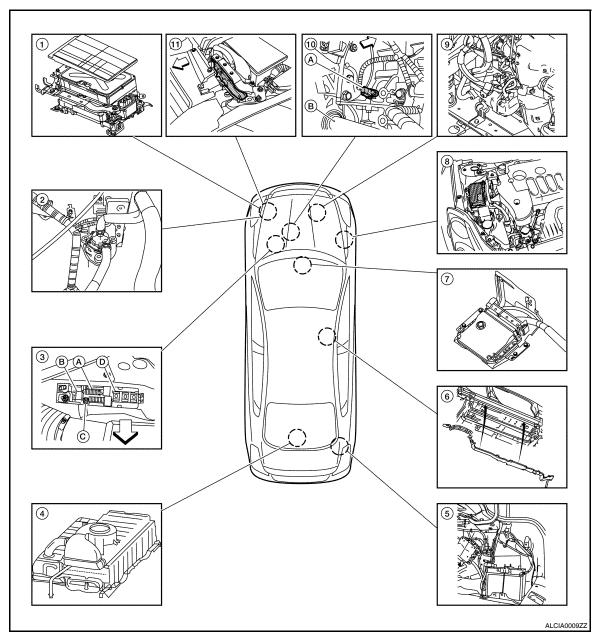
А



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



1. Inverter with converter assembly

2. Water pump with motor & bracket as- 3. sembly

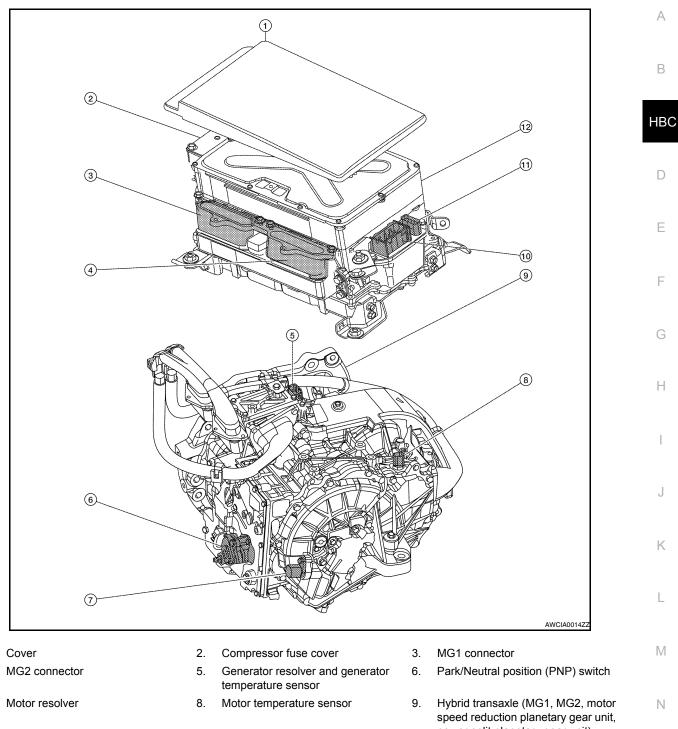
High voltage fuse and fusible link box A: HV CONT MAIN fuse 10A B: IGCT relay C: IGCT fusible link 50A D: DC/DC fusible link 120A

- 4. HV battery
- 7. Hybrid vehicle control ECU (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- √ Vehicle front

- 5. Auxiliary battery
- 8. Brake ECU
- 11. ECM

6. Frame wire9. Electric compressor (For A/C)

< FUNCTION DIAGNOSIS >



10. Inverter with converter assembly connector (MG ECU)

1.

4.

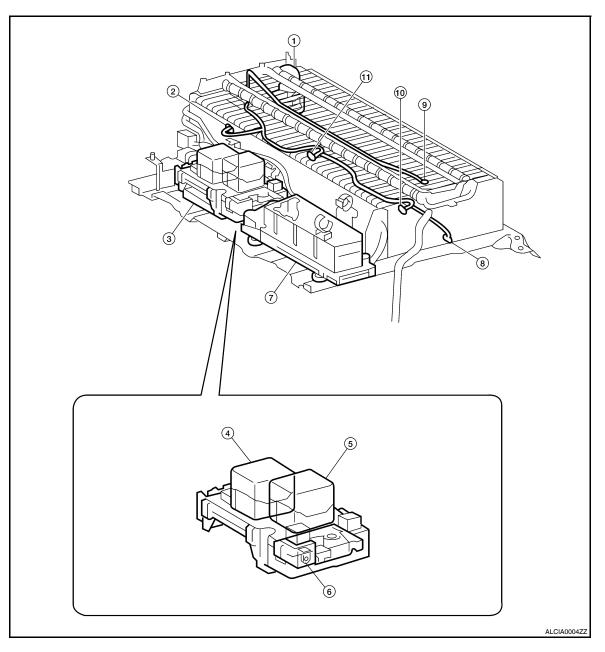
7.

- 11. Inverter with converter assembly connector (Resolver)
- power split planetary gear unit)
- 12. Inverter with converter assembly (Boost converter, inverter, MG ECU)

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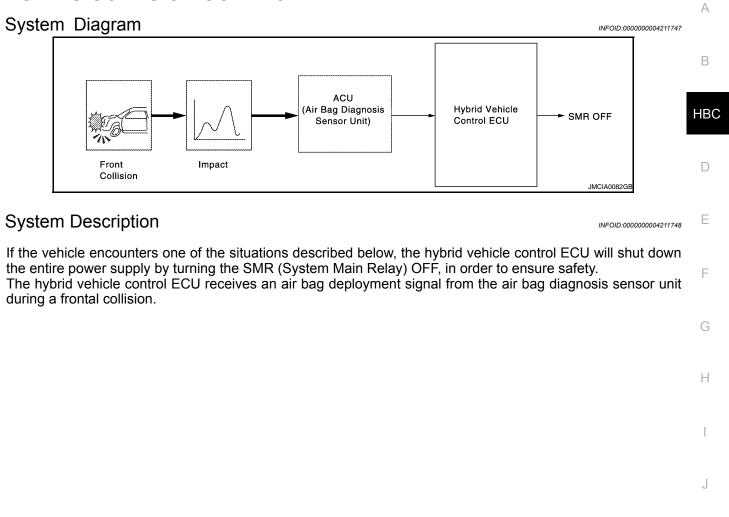
< FUNCTION DIAGNOSIS >



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

< FUNCTION DIAGNOSIS >

DURING COLLISION CONTROL



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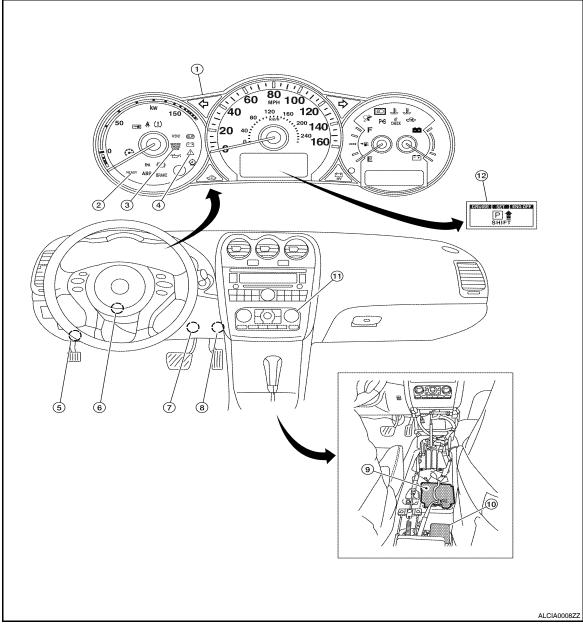
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HBC-61

< FUNCTION DIAGNOSIS >

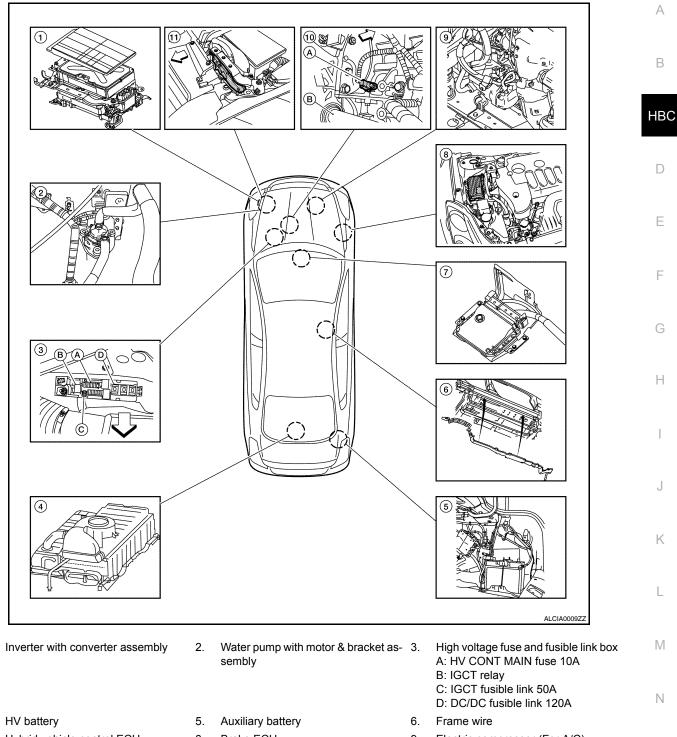
Component Parts Location

INFOID:000000004211749



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

< FUNCTION DIAGNOSIS >



4.

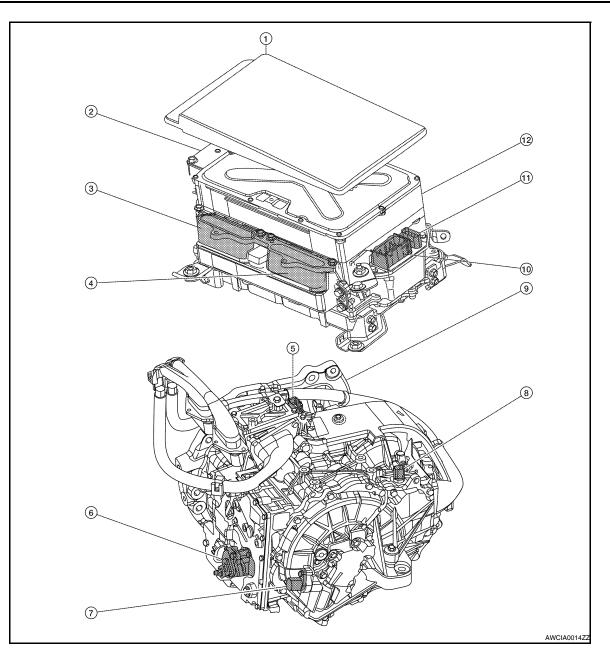
1.

- Hybrid vehicle control ECU 7. (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- √ Vehicle front

- Brake ECU 8.
- 11. ECM

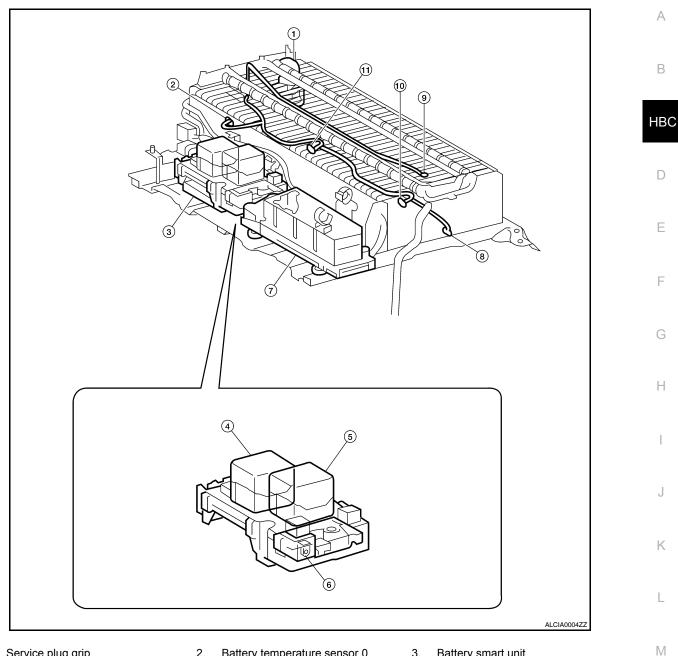
- 9. Electric compressor (For A/C) Ο
 - Ρ

< FUNCTION DIAGNOSIS >



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

< FUNCTION DIAGNOSIS >



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

Ο

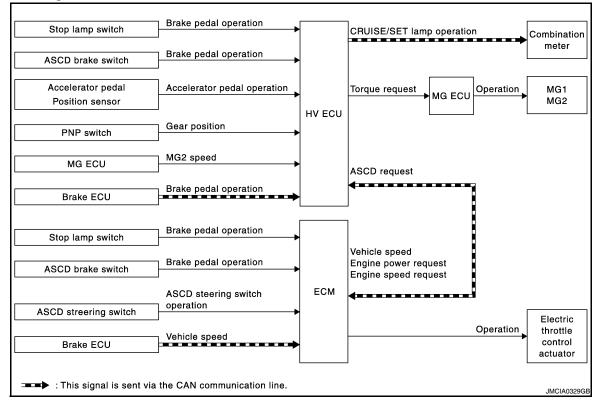
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< FUNCTION DIAGNOSIS >

AUTOMATIC SPEED CONTROL DEVICE (ASCD)

System Diagram



System Description

INFOID:000000004211751

INFOID:000000004211750

INPUT/OUTPUT SIGNAL CHART

Input			ECU		Outp	Output		
Sensor	Signal			ECO	Signal			Actuator
Stop lamp switch	Brake pedal operation				CRUISE lamp operation*			Combina-
ASCD brake switch	Brake pedal operation				SET lamp operati		tion meter	
Accelerator pedal position sensor	Accelerator pedal opera	tion						
PNP switch	Gear position				Torque request	st MG ECU	Operation	MG1 MG2
MG ECU	MG2 speed			Hybrid vehicle				
Brake ECU	Brake pedal operation*			control				
Stop lamp switch	Brake pedal operation	ECM		- ECU	Vehicle speed* Engine power request* Engine speed request*	ECM	Operation	Electric throttle control actuator
ASCD brake switch	Brake pedal operation		ASCD request*					
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).

< FUNCTION DIAGNOSIS >

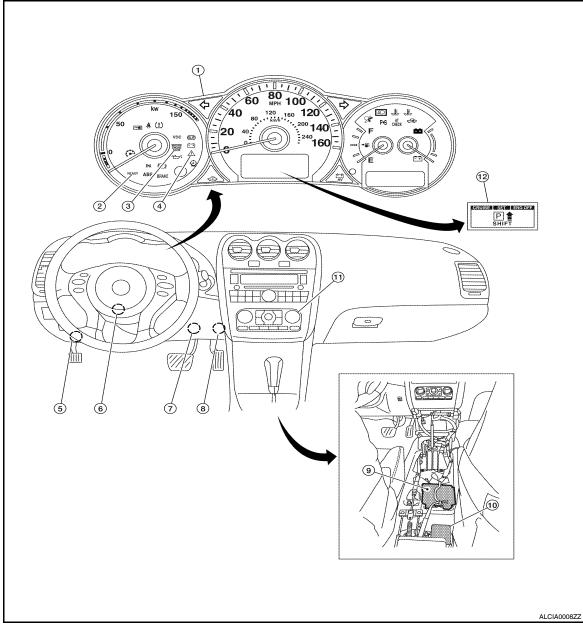
The hybrid vehicle control ECU receives signals from each switch, sensor, control unit, and maintains constant vehicle speed by optimizing the use of the engine and motor driving force. Operation status of ASCD is indicated by CRUISE lamp and SET lamp in combination meter. If any malfunction occurs in ASCD system, it automatically deactivates control. NOTE: Always drive vehicle in safe manner according to traffic conditions and obey all traffic laws.	A
SET OPERATION	HBC
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.	D
 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 	F
 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 opera- 	G
 tion 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. 	Н
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.	J
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.	K
 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) 	L
	Μ
	N

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< FUNCTION DIAGNOSIS >

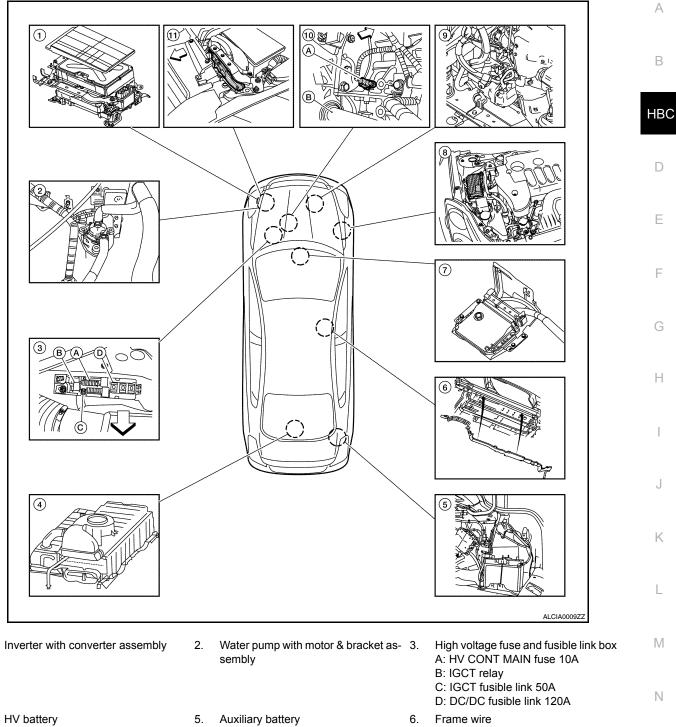
Component Parts Location

INFOID:000000004211752



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

< FUNCTION DIAGNOSIS >



9.

Electric compressor (For A/C)

- 7. Hybrid vehicle control ECU (located under heater box assembly)
- 10. A: Crankshaft position sensor B: Axle
- √ Vehicle front

1.

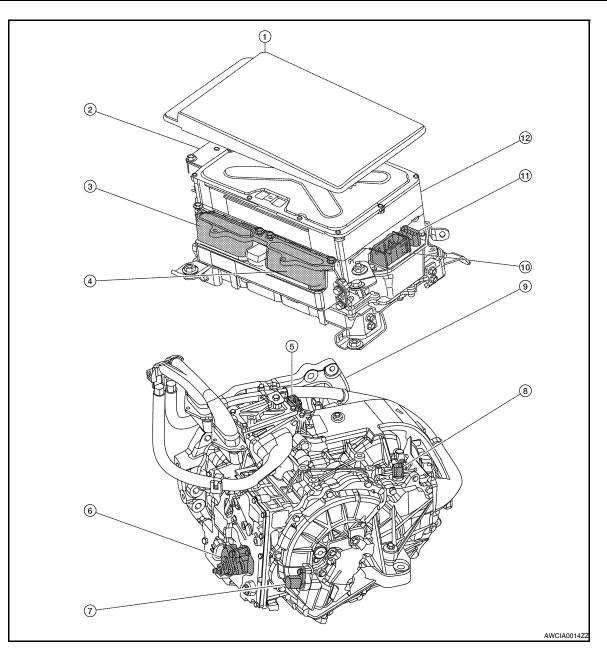
4.

- 8. Brake ECU
- 11. ECM

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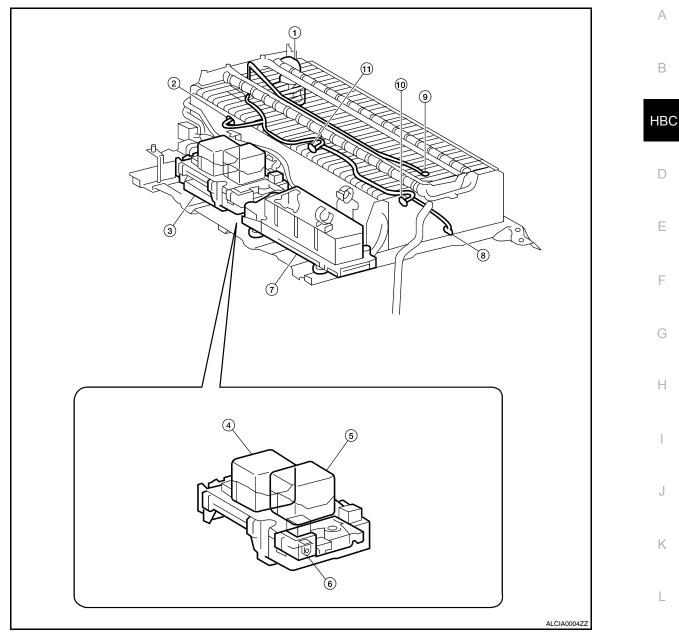
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< FUNCTION DIAGNOSIS >



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

< FUNCTION DIAGNOSIS >



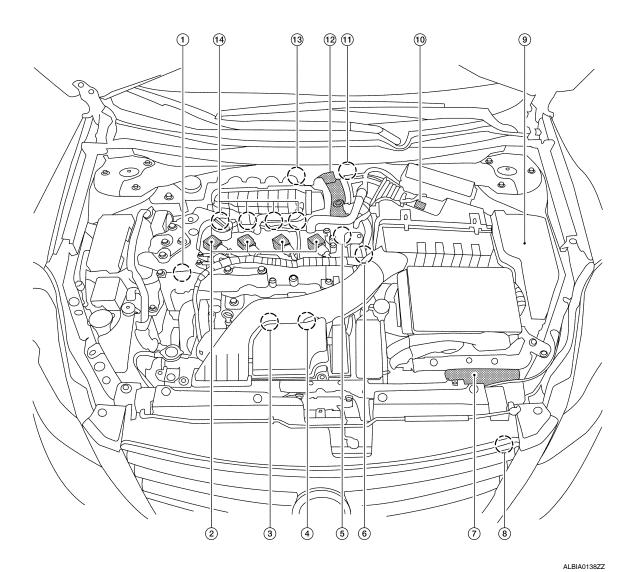
- 1. Service plug grip
- 4. SMRG
- 7. Hybrid vehicle converter
- 10. Battery temperature sensor 2
- 2. Battery temperature sensor 0
- 5. SMRB
- 8. Battery temperature sensor 3
- 11. Battery temperature sensor 1
- 3. Battery smart unit
- 6. Battery current sensor
- 9. Intake air temperature sensor

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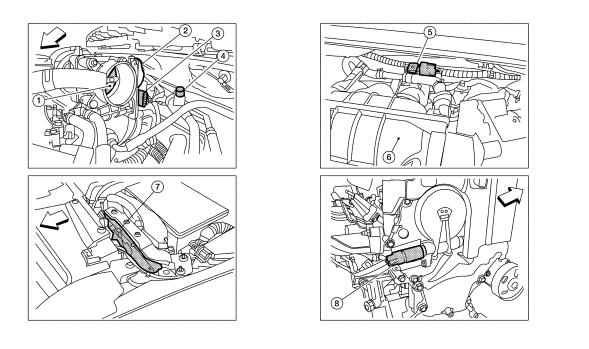
- 1. Intake valve timing control solenoid valve
- 4. Air fuel ratio (A/F) sensor 1
- 7. ECM
- 10. Mass air flow sensor (with intake temperature sensor)
- 13. EVAP canister purge volume control 14. Fuel injector solenoid valve
- 2. Ignition coil (with power transistor) and spark plug
- 5. Camshaft position sensor (PHASE) 6.
- 8. Refrigerant pressure sensor
- 11. EVAP service port

- Knock sensor,
- Crankshaft position sensor (POS)
- Engine coolant temperature sensor
- 9. IPDM E/R

3.

12. Electric throttle control actuator (with built in throttle position sensor and throttle control motor)

< FUNCTION DIAGNOSIS >



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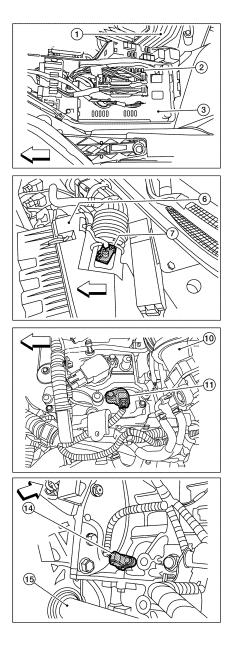
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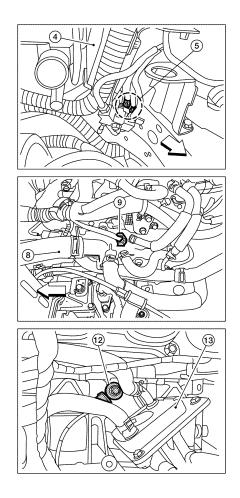
- ALBIA0160ZZ
- Μ Electric throttle control actuator Electric throttle control actuator har-2. 3. ness connector EVAP canister purge volume control 6. Intake manifold collector 5. solenoid valve Ν 8. Intake valve timing control solenoid valve Ο
- Throttle valve 1.
- EVAP service port 4.
- 7. ECM
- C: Vehicle front

< FUNCTION DIAGNOSIS >



- 1. Air cleaner assembly
- EPS control unit (view with air cleaner assembly removed)
- 7. Mass air flow sensor (with intake temperature sensor)
- 10. Intake manifold collector
- 13. Engine oil cooler
- C: Vehicle front

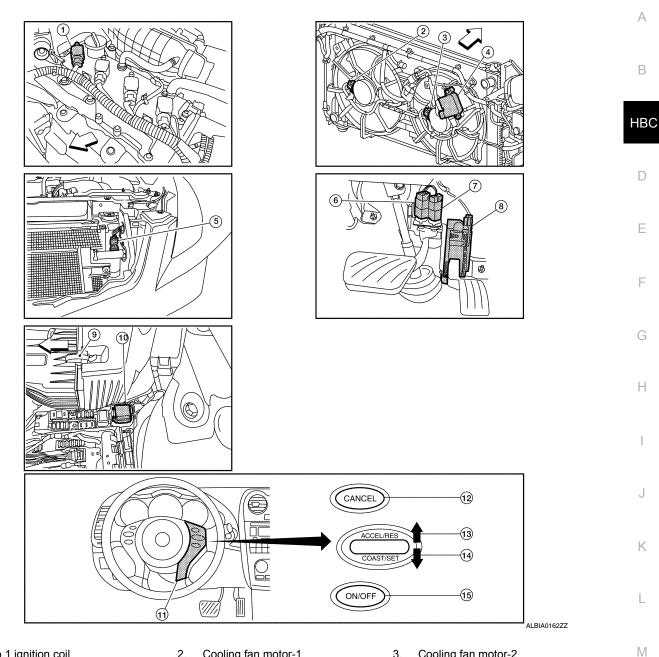
- 2. Fuel pump fuse
- 5. Engine grounds
- 8. Upper radiator hose
- 11. Camshaft position sensor (PHASE)
- 14. Crankshaft position sensor (POS)



ALBIA0161ZZ

- 3. IPDM E/R
- 6. Air cleaner assembly
- 9. Engine coolant temperature sensor
- 12. Knock sensor
- 15. Drive shaft RH

< FUNCTION DIAGNOSIS >

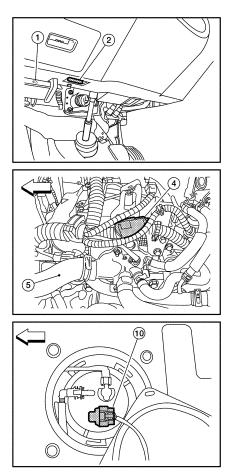


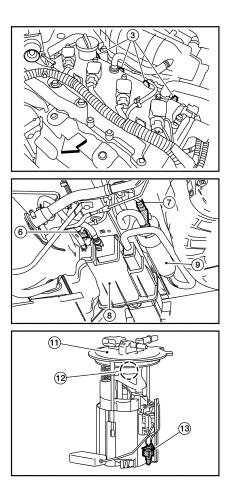
- No.1 ignition coil 1.
- Cooling fan control module 4.
- 7. ASCD brake switch
- 10. Cooling fan relay-1
- 13. RESUME/ACCELERATE switch
- C: Vehicle front

- 2. Cooling fan motor-1
- Refrigerant pressure sensor 5.
- 8. Accelerator pedal position sensor
- 11. ASCD steering switch
- 14. SET/COAST switch
- Cooling fan motor-2 3.
- 6. Stop lamp switch
- 9. Air cleaner assembly
- 12. CANSEC switch
- 15. MAIN switch

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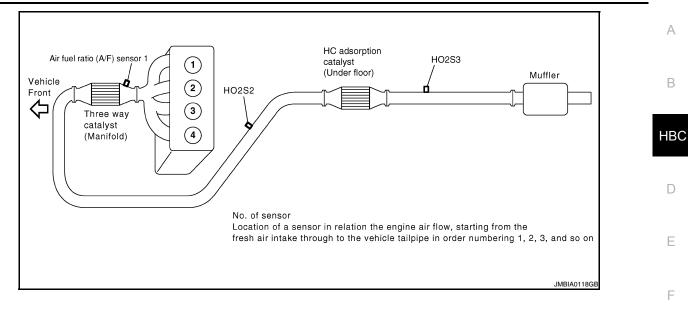
- Hood opener handle 1.
- Condenser-2 4.
- 7. EVAP canister vent control valve
- 10. Fuel level sensor unit and fuel pump 11. Fuel pump assembly harness connector (This illustration is view with rear seat cushion and inspection hole cover removed.)
- 13. Fuel tank temperature sensor

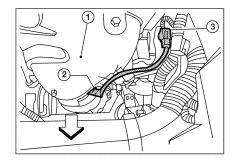
- Data link connector 2.
- 5. Upper radiator hose
- EVAP canister (MAIN) 8.

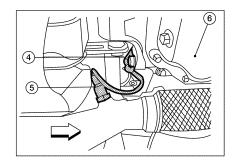


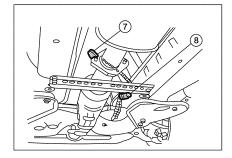
- Fuel injector harness connector 3.
- EVAP control system pressure sen-6. sor
- EVAP canister (SUB) 9.
- 12. Fuel pressure regulator

< FUNCTION DIAGNOSIS >









- 1. Exhaust manifold cover
- 4. Heated oxygen sensor 2 harness connector
- 7. Heated oxygen sensor 3

C: Vehicle front

Component Description

2. Air fuel ratio (A/F) sensor 1

- 5. Heated oxygen sensor 2
- 8. Heated oxygen sensor 3 harness connector
- connector 6. Oil pan

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INFOID:000000004211753

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Air fuel ratio (A/F) sensor 1 harness

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:000000004211754

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 DSYSTEM CAN.

Refer to LAN-27, "CAN Communication Signal Chart", about CAN communication for detail.

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< FUNCTION DIAGNOSIS >

ON BOARD DIAGNOSTIC (OBD) SYSTEM

Diagnosis Description

INFOID:000000004211755

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 <u>HBC-619</u>, "<u>DTC Index</u>".

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 <u>HBC-619</u>, <u>"DTC Index"</u>.

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 <u>HBC-619</u>, "<u>DTC Index</u>".

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

(B) 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

< FUNCTION DIAGNOSIS >

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.

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INFOID:000000004211756

- 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	D
MIL	Turns off	3 (pattern B)	
DTC, Freeze Frame Data	No display	40 (pattern A)	Е

<Driving Pattern A>

Engine °C (°F) coolant i temperature i (1) Engine	e coolant temperature should go over 71°C (160°F).	F
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-	G
IGN ^I ON IGN ^I OFF (3) Ignition	 (2) Engine coolant temperature should change more than 22°C (72°F) after starting engine. n switch should be changed from "ON" to "OFF". 	-

• 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

FUNCTION

Diagnostic test mode	Function	
ECU Identification	The hybrid vehicle control ECU part number can be read.	M
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.	N
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.	IN

*: 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 <u>HBC-619, "DTC Index"</u>.)

DATA MONITOR MODE

Data Monitor **NOTE:**

< FUNCTION DIAGNOSIS >

- 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	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
MIL STATUS						MIL status/ ON or OFF	MIL ON: OFF	Constant ON: Repair in accor- dance with de- tected DTCs
CCM MONITOR						Comprehensive compo- nent monitor/ ON or OFF	_	_
INT/A TEMP SEN (Intake Air Tem- perature Sensor)	х	х	х	х		Intake air temperature/ Min.: -40°C, Max.: 140°C	Constant: Same as ambient air tempera- ture	_
ENG RUN TIME						Elapsed time after starting engine/ Min.: 0 s, Max.: 65,535 s	_	_
DTC ON RUN DIST (MIL ON Run Dis- tance)						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 en- gine is warmed up after clearing DTCs/ Min.: 0, Max.: 255	MIL OFF, engine cool- ant temperature in- creases from below 22°C (71.6°F) before starting the engine to above 70°C (158°F) after starting the en- gine: Increases once	_
DTC CLEAR RUN (DTC Clear Run Distance)						Drive distance after clear- ing DTCs/ Min.: 0 km, Max.: 65,535 km	_	_
ACCEL SEN- SOR 1 (Accelerator Ped- al Position #1)	х	х	x	х		Accelerator pedal position sensor 1/ Min.: 0%, Max.: 100%	Accelerator pedal de- pressed: Changes with accelerator pedal pressure	_
ACCEL SEN- SOR 2 (Accelerator Ped- al Position #2)	х	х	х	х		Accelerator pedal position sensor 2/ Min.: 0%, Max.: 100%	Accelerator pedal de- pressed: Changes with accelerator pedal pressure	_

< FUNCTION DIAGNOSIS >

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note	A
MIL ON RUN TIME (MIL ON Engine Run Time)						Engine running time after a malfunction occurs/ Min.: 0 min, Max.: 65,535 min	_	_	HBC
DTC CLEAR MIN (DTC Clear Min)						Elapsed time after clear- ing DTCs/ Min.: 0 min, Max.: 65,535 min	_	_	D
CCM SRT STA- TUS (Comprehensive Component Moni- toring SRT Sta- tus)						Comprehensive compo- nent monitoring SRT sta- tus/ ON or OFF		_	E
CCM DIAG STA- TUS (Comprehensive Component Moni- toring Diagnosis Status)						Comprehensive compo- nent monitoring diagnosis status/ ON or OFF	_	_	G
MG2 REVOLU- TION [Motor (MG2) Revolution]	х	х	х	х		Motor (MG2) revolution/ Min.: -16,383 rpm, Max.: 16,256 rpm	_	_	1
MG2 TORQUE [Motor (MG2) Torque]	х	х	х	х		Motor (MG2) torque/ Min.: -512 N·m, Max.: 508 N·m		_	J
MG1 REVOLU- TION [Generator (MG1) Revolution]	х	х	х	х		Generator (MG1) revolu- tion/ Min.: -16,383 rpm, Max.: 16,256 rpm	_	_	K
MG1 TORQUE [Generator (MG1) Torque]	х	х	х	х		Generator (MG1) torque/ Min.: -512 N·m, Max.: 508 N·m	_	_	L
POWER RE- QUEST (Request Power)	х	х	х	х		Request engine power/ Min.: 0 W, Max.: 320,000 W	_	_	Μ
TARGET ENG SPEED (Target Engine Revolution)	x	x	х	х		Target engine speed/ Min.: 0 rpm, Max.: 8,000 rpm	_	_	Ν
ENGINE SPEED (Engine Speed)	х	х	х	х		Engine speed/ Min.: 0 rpm, Max.: 8,000 rpm	Idling: 950 to 1,050 rpm	_	0
SOC (State of Charge)	х	х	х	х		Battery state of charge/ Min.: 0%, Max.: 100%	Constant: 0 to 100%		
WOUT (Wout Control Power)	х	х	х	х		Discharge (Wout) control power value/ Min.: 0 W, Max.: 81,600 W	26,000 W or less	_	Ρ
WIN (Win Control Power)	x	х	х	x		Charge (Win) control power value/ Min.: -40,800 W, Max.: 0 W	-25,000 W or more	_	

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	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 load- ing movement: 4 Revving in P posi- tion: 6 	
MG1 INV TEMP [Inverter Temper- ature (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 sen- sor circuit
MG2 INV TEMP [Inverter Temper- ature (MG2)]	x	x	x	x		Motor (MG2) inverter tem- perature/ 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 sen- sor circuit
MG1 MOTOR TEMP [Generator (MG1) Temperature)]	x	x	x	x		Generator (MG1) temper- ature/ 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 sen- sor circuit
MG2 MOTOR TEMP [Motor (MG2) Temperature]	x	x	x	x		Motor (MG2) tempera- ture/ 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 sen- sor circuit
PWR RE- SOURCE VB (Power Resource VB)	х	х	х	х		HV battery voltage/ Min.: 0 V, Max.: 510 V	READY light ON: 200 to 340 V	_

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note	A
PWR RE- SOURCE IB (Power Resource IB)	x	x	х	х		HV battery current/ Min.: -256 A, Max.: 254 A	_	_	HBC
SHIFT POSITION (Shift Sensor Shift Position)	х	х	х	х		Shift lever position	P, R, N, D or B	_	D
VEHICLE SPEED [Vehicle Speed (Resolver)]	х	х	х	х		Vehicle speed (Resolver)/ Min.: -256 km/h, Max.: 254 km/h	Same as vehicle speed	_	E
SHIFT SW P		х				PNP switch (P position)/ ON or OFF	P position: ON Except P position: OFF	_	
SHIFT SW R		х				PNP switch (R position)/ ON or OFF	R position: ON Except R position: OFF	_	F
SHIFT SW N		х				PNP switch (N position)/ ON or OFF	N position: ON Except N position: OFF	_	G
SHIFT SW D		х				PNP switch (D position)/ ON or OFF	D position: ON Except D position: OFF	_	Η
SHIFT SW B		х				PNP switch (B position)/ ON or OFF	B position: ON Except B position: OFF	_	
SHIFT SW FD		х				PNP switch (FD position)/ ON or OFF	D or B position: ON Except D or B posi- tion: OFF	_	J
SHIFT SW RV		х				PNP switch (RV position)/ ON or OFF	R position: ON Except R position: OFF	_	K
SHIFT SW MJ		х				PNP switch (MJ position)/ ON or OFF	P, R, N, D or B posi- tion: ON	_	L
REGEN EXEC TORQ (Regenerative Brake Execution Torque)		x				Regenerative brake exe- cution torque/ Min.: 0 N·m, Max.: 186 N·m	_	_	Μ
REGEN RQST TORQ (Regenerative Brake Request Torque)	x	x	x	x		Regenerative brake re- quest torque/ Min.: 0 N·m, Max.: 186 N·m	Vehicle speed 30 km/ h (19 mph) and mas- ter cylinder hydraulic pressure -200 N·m: Changes with brake pedal pressure	_	N
MCYL CTRL TORQ (Master Cylinder Control Torque)	x	x	х	x		Braking torque that is equivalent to master cylin- der hydraulic pressure/ Min.: -2,040 N·m, Max.: 0 N·m	Brake pedal de- pressed: Changes with brake pedal pressure	_	Ρ

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
L-TEMP ST JUDGE (Low Tempera- ture Start Judge- ment Number of Times)						Time of low temperature start judging/ Min.: 0, Max.: 65,535	_	_
L-TEMP ST TIME (Low Tempera- ture Start Judge- ment Time)						Low temperature starting accumulation time/ Min.: 0, Max.: 67,107,840	_	_
DCDC CMD VOL (DC) (DC/DC Convert- er Command Volt- age)					х	Target auxiliary battery voltage (DC/DC Convert- er)/ Min.: 0 V, Max.: 20 V	_	_
DCDC FAN MODE (DC/DC Convert- er Cooling Fan Mode)					х	Hybrid vehicle converter (DC/DC converter) cool- ing fan mode/ Min.: 0%, Max.: 255%	_	_
INV COOLANT TMP (Inverter Coolant Temperature)		x	х			Inverter coolant tempera- ture/ Min.: -128°C, Max.: 127°C	Cold start \rightarrow Fully warmed up: Gradually rises	_
DCDC VLO DUTY [DC/DC Convert- er Control Duty Ratio (VLO)]		x			x	DC/DC converter control duty ratio/ Min.: 0%, Max.: 99%	_	_
DCDC CTRL MODE (DC/DC Convert- er 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 Convert- er Target Voltage)					х	Target volume of DC/DC converter/ Min.:0V, Max.: 19.92V	_	_
AMBIENT TEMP (Ambient Air Tem- perature)	х	х	х	х		Ambient air temperature/ Min.: -40°C, Max.: 215°C	Ignition switch ON (IG): Same as ambi- ent air temperature	_
AMB/S CIRC SHORT (Ambient Air Tem- perature Sensor Circuit Short					х	Ambient air temperature sensor circuit short/ ON or OFF	OFF: Normal	_
AMB/S CIRC OPEN (Ambient Air Tem- perature Sensor Circuit Open)					х	Ambient air temperature sensor circuit open/ ON or OFF	OFF: Normal	_

< FUNCTION DIAGNOSIS >

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Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note	A
DCDC CONDI- TION (DC/DC Convert- er Feedback Con- dition)		x			x	DC/DC converter condi- tion/ Min.:0, Max.: 30	 0, 1: Normal 2, 3: DC/DC Con- verter Cooling Re- quest to Air Conditioner 	_	HBC
LOAD CONDI- TION (Loading Condi- tion)						Driving (Loading) condi- tion	 0: Generator load: MG1 1: Motor load: MG2 	_	D
DRIVING PAT- TEN 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 	_	E
DRIVING PAT- TEN 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 	_	G H I
DRIVING PAT- TEN 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 	_	J K
ENG STOP RQST (Engine Stop Re- quest)	х	х	х	х		Engine stop request/ ON or OFF	Requesting engine stop: ON	_	L
ENG IDLING RQST (Engine Idling Re- quest)	х	х	х	х		Engine idling request/ ON or OFF	Requesting idle: ON	_	Μ
HV BATT CHG RQST (HV Battery Charging Re- quest)	x	x	x	x		HV battery charging re- quest/ ON or OFF	Requesting HV bat- tery charging: ON	_	N
AIRCON RE- QUEST (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	_	Ρ
ENG WARM UP RQST (Engine Warming Up Request)	x	x	x	x		Engine warming up re- quest/ ON or OFF	Requesting engine warm-up: ON	_	

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
ACCEL DEG (The Difference Degree of an Ac- celerator)	х	х	x	х		Accelerator pedal de- pressed angle/ Min.: 0%, Max.: 100%	Accelerator pedal de- pressed: Changes with accel- erator pedal pressure	_
VL (VL-Voltage Be- fore Boosting)		х	х			High voltage before boosting/ Min.: 0 V, Max.: 510 V	READY ON: Practi- cally 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 sen- sor circuit
VH (VH-Voltage After Boosting)		х	х			High voltage after boost- ing/ 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 sen- sor circuit
CONVERTER TEMP (Converter Tem- perature)	x	x	x	x		Boost converter tempera- ture/ 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 sen- sor circuit
CRANK POSI- TION (Crank Position)		х				Crankshaft position/ Min.: -90 deg, Max.: 90 deg	_	_
SMRG (System Main Re- lay Status-SMRG)		х				Operating condition of system main relay SMRG/ ON or OFF	READY ON: ON	_
SMRB (System Main Re- lay Status-SMRB)		х				Operating condition of system main relay SMRB/ ON or OFF	READY ON: ON	_
SMRP (System Main Re- lay Status-SMRP)		х				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 exe- cution value/ Min.: -512 N·m, Max.: 508 N·m	After full-load acceler- ation with READY light ON and engine stopped: Within \pm 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 acceler- ation with READY light ON and engine stopped: Within ± 20% of MG1 TORQ	_

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	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]			х			MG1 control mode	_	_
MG1 CARRIR FREQ [Genera- tor (MG1) Carrier Frequency]			х			MG1 carrier frequency/ 10 kHz/ 5 kHz/ 2.5 kHz/ 1.25 kHz		_
MG2 CTRL MODE [Motor (MG2) Control Mode]			х			MG2 control mode		_
MG2 CARRIR FREQ [Motor (MG2) Carrier Frequen- cy]			x			MG2 carrier frequency/ 10 kHz/ 5 kHz/ 2.5 kHz/ 1.25 kHz	_	_
BOOST RATIO (Converter Boost- ing 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 Consump- tion Power)	х	х	x	х		A/C consumption power/ Min.: 0 kW, Max.: 5 kW		_
MG1 GATE STA- TUS [Generator (MG1) Gate Status]		х	х			MG1 gate status/ ON or OFF	Shutting down gener- ator inverter: ON	_
MG2 GATE STA- TUS [Motor (MG2) Gate Status]		х	х			MG2 gate status/ ON or OFF	Shutting down motor inverter: ON	_
CNV GATE STA- TUS (Boost Converter Gate Status)		х	x			Boost converter gate sta- tus/ ON or OFF	Shutting down boost converter: ON	_
A/C GATE STA- TUS (Air Conditioner Gate Status)		х	x			A/C gate status/ ON or OFF	While compressor in- verter is being shutoff: ON	_
CNV CARRIER FREQ (Converter Carri- er Frequency)			х			Converter signal carrier frequency/ 5kHz/ 10kHz	5kHz/ 10kHz	_

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
SUB BATTERY VOLT [Sub Battery Volt- age (Batt)]		х			x	Auxiliary battery voltage (Batt)/ Min.: 0 V, Max.: 19.92 V	Equivalent to battery voltage	_
BATTERY VOLT [Battery voltage (VB)]	х	х	х	х		Auxiliary battery voltage (VB)/ Min.: 0 V, Max.: 19.92 V	Equivalent to sub bat- tery voltage	
ACCEL SEN- SOR M (Accelerator Ped- al Position Sensor Main)		x				Accelerator pedal position sensor main/ Min.: 0%, Max.: 100%	Accelerator pedal de- pressed: Changes with accelerator pedal pressure	_
ACCEL SEN- SOR S (Accelerator Ped- al Position Sensor Sub)		x				Accelerator pedal position sensor sub/ Min.: 0%, Max.: 100%	Accelerator pedal de- pressed: Changes with accelerator pedal pressure	_
ENG SPEED (NEI) [Engine Speed (NEI)]		х				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)]		х				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 Convert- er 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 cir- cuit If the value is between 1.0V to 2.788V: DC/DC convert- er malfunction
DCDC OUTPUT VOLT (DC/DC Convert- er Output Volt- age)					x	DC/DC converter output voltage change signal/ Min.: 0V, Max.: 4.98V	IGN ON: Under 1V and over 1V repeat- edly	If the value is al- ways under 1V: GND short in cir- cuit If the value is al- ways over 1V: +B short in cir- cuit
A/B CRASH SIG- NAL (Air Bag Commu- nication Signal)		х				A/bag communication sig- nal/ Min.: 0, Max.: 32	IGN ON: After 7 sec- ond: 1	0: Circuit abnor- mality (+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	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note	A
ENG OIL/P WARN/L (Engine Oil Pres- sure Warning Light Signal)						Engine oil pressure warn- ing light signal ON or OFF	ENG RUN: OFF	If the signal is ON during en- gine running, check engine oil level and pres- sure.	B
READY LMP SIGNAL (Ready Lamp Sig- nal)						Ready signal/ ON or OFF	READY ON: ON	_	D
START SW SIG- NAL (Start Switch Sig- nal)						Start switch signal/ ON or OFF	Start switch ON: ON	_	E
IGN SW SIGNAL (Ignition Switch Signal)						Ignition switch signal/ ON or OFF	Ignition switch ON: ON	_	G
IGCTRLY OPRT SIG (IGCT Relay Op- eration Signal)						IGCT relay port monitor/ ON or OFF	While ignition switch is ON: ON	_	Н
BATT FAN RE- LAY (HV Battery Cool- ing Fan Relay Op- eration Signal)				x		Battery cooling fan relay drive signal port/ ON or OFF	IGN ON: ON	_	I
SMRP MNTR (System Main Re- lay-SMRP Opera- tion Signal Monitor)		х				Precharge relay monitor/ ON or OFF	READY ON: OFF	_	J
SMRB MNTR (System Main Re- lay-SMRB Opera- tion Signal Monitor)		х				High voltage power on re- lay signal monitor(+)/ ON or OFF	READY ON: ON	_	L
SMRG MNTR (System Main Re- lay-SMRG Opera- tion Signal Monitor)		x				High voltage power on re- lay signal monitor(–)/ ON or OFF	READY ON: ON	_	M
CHARGE WARN/ L (Charge Warning Light Signal)						Charge warning signal/ ON or OFF	READY ON: OFF	_	0
HV BATT WARN/ L (High-Voltage Battery Warning Light Signal)						Main battery low voltage warning signal/ ON or OFF	READY ON: OFF	_	P
HV SYSTEM WARN/L (Hybrid System Warning Light Signal)						Caution lamp signal/ ON or OFF	READY ON: OFF	_	

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
ENG OFF LAMP SIG (EV Mode Indica- tor Signal)						Engine off lamp signal/ ON or OFF	Engine OFF: ON	_
SET LAMP SIG- NAL (Cruise Set Switch Indicator Signal)						ASCD execute flag/ ON or OFF	When the cruise con- trol main switch is pushed: ON	_
ASCD LAMP SIGNAL (Cruise Main Switch Indicator Signal)						Cruise lamp request sig- nal/ ON or oFF	While the vehicle speed is controlled by the cruise control sys- tem: ON	_
PNP SW SIGNAL (Shift PNP Signal)		х				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 Sig- nal)						Drivers side door switch signal/ ON or OFF	While the door is opened: ON	_
BRAKE SIGNAL (Brake Operation Signal)		х				Brake operation signal/ ON or OFF	Brake pedal de- pressed: ON	_
ASCD CANSEL SW (ASCD Cancel Switch Signal)		x				ASCD brake switch sig- nal/ ON or OFF	Brake pedal de- pressed: ON	_
BRAKE SWITCH (Brake Switch Signal)		х				Stop lamp switch signal/ ON or OFF	Brake pedal de- pressed: ON	_
INTERLOCK SW (Interlock Switch Signal)		х				Interlock switch signal/ ON or OFF	IGN ON: OFF	_
BATTERY SOC (Battery State of Charge)				х		Battery state of charge/ Min.: 0%, Max.: 127.5%	_	_
IB BATTERY (Current Value of Battery Pack)				х		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)				х		Battery cooling fan intake air temperature/ Min.: -327.68°C, Max.: 327.67°C	_	_
VMF FAN VOLT 1 (VMF Fan Motor voltage 1)				х		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	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note	A
AUX BATT VOLT (Auxiliary Battery Voltage)				х		Auxiliary battery voltage/ Min.: -25.6 V, Max.: 25.4 V	Equivalent to auxiliary battery voltage.	_	В
WIN (Charge Control Value)				х		Charge control wattage/ Min.: -64 kW, Max.: 63.5 kW	-25 kW or more	_	HBC
WOUT (Discharge Con- trol Value)				х		Discharge control watt- age/ Min.: 0 kW, Max.: 63.5 kW	26 kW or less	_	D
DELTA SOC (Delta SOC)				x		Difference between maxi- mum and minimum val- ues of SOC/ Min.: 0%, Max.: 100%	READY light ON, en- gine stopped and no electrical load: 0 to 60%	_	E
SBLW RQST [Cooling Fan Stop Control Request (Stand by Blow- er)]				x		Battery blower motor stop control request (standby blower)/ ON or OFF	While blower motor stop control is re- quested: ON	_	F
COOLING FAN 1 (Cooling Fan Mode 1)				х		Battery blower motor ac- tuation mode/ Min.: 0, Max.: 40	Stopped: 0 Low to high speed ac- tuation: 1 to 40	_	Н
ECU CTRL MODE (ECU Control Mode)				х		ECU control mode/ Min.: 0, Max.: 4	_	_	I
BATT TEMP 1 to 4 (Temperature of Battery TB 1 to 4)				х		Temperature of HV bat- tery 1 to 4/ Min.: -327.68°C, Max.: 327.67°C	Undisturbed for 1 day: Same as ambient air temperature	_	J
NUM OF BATT (The Number of Battery Block)				х		The number of battery blocks/ Min.: 0, Max.: 255	Always: 17	_	K
BLOW TIME (Accumulated Time of Battery LOW)				х		Accumulated time of bat- tery low/Battery low time Min.: 0, Max.: 65,535	_	_	L
DCIH TIME (Accumulated Time of DC Inhib- it)				x		Accumulated time of DC inhibit/DC inhibit time Min.: 0, Max.: 65,535	_	_	N
BHI TIME (Accumulated Time of Battery too High)				х		Accumulated time of bat- tery too high/Battery too high time Min.: 0, Max.: 65,535	_	_	0
HTMP TIME (Accumulated Time of Hot Tem- perature)				х		Accumulated time of hot temperature/Hot tempera- ture time Min.: 0, Max.: 65,535	_	_	Ρ
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	_	

< FUNCTION DIAGNOSIS >

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note
MIN BAT BLOCK (Minimum Bat- tery Block No)				х		Battery block number with minimum voltage/ Min.: 1, Max.: 255	One of numbers 1 to 17	_
BAT BLOCK MAX V (Battery Block Minimum Voltage)				х		Battery block maximum voltage/ Min.: -327.68 V, Max.: 327.67 V	SOC 55 to 60%: 18 V or less	_
MAX BAT BLOCK (Maximum Bat- tery Block No.)				х		Battery block number with maximum voltage/ Min.: 1, Max.: 255	One of numbers 1 to 17	_
R1 to R17 INTNL RESIST (Internal Resis- tance R01 to R17)				х		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 Di- rection Signal)						Wheel round direction sig- nal/ Min.: 0, Max.: 2	 0: Step 1: Backward 2: Forward 	_
EGY FLW [E TO W]						Energy flow signal [En- gine 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 [En- gine 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		х				Analysis Data 2/ Min.: 0, Max.: 65535	0 or More	_
ANALYSIS DATA3		х				Analysis Data 3/ Min.: 0, Max.: 65535	0 or More	_
ANALYSIS DATA4		х				Analysis Data 4/ Min.: 0, Max.: 65535	0 or More	

< FUNCTION DIAGNOSIS >

Monitored item	VEHI- CLE	HY- BRID CONT	MO- TOR GEN- ERA- TOR	HV BAT- TERY	DCDC CONV	Measurement Item/ Range	Normal Condition	Diagnostic Note	A
CAL/LD VALUE	х	х				Calculated Load Value Min.:0%, Max.:100%	 Idling: 10 - 35% 2,500 rpm: 10 - 35% 	_	
COOLANT TEMP	х	х	х		х	Engine coolant tempera- ture Min: –40°C, Max.: 215°C	 Engine is warmed up: More than 70°C (158°F) 	_	HBC
ABSOL TH·P/S	х	х				Throttle valve opening an- gle Min.: 0%, Max.: 100%		_	D
THROTTLE POS	х	х				Throttle position sensor Min.: 0%, Max.: 100%		_	E
ENG TRQ CRCT VAL (Engine Torque Correction Value)		х				Engine torque correction value/ Min.: 0, Max.: 1.992	Always: 1.0 to 1.5	_	F
HISTORY DTC (The Number of History DTC)						Number of DTCs which 40 trips (warm-up cycles) have not completed for.	_	_	G
ALL DTC (The Number of Current DTC)						Number of all DTCs/ Min.: 0, Max.: 127	_	_	Н
ENG COOLANT TMP (Engine coolant temperature)	х	х	х	х	х	Engine coolant tempera- ture/ Min.: -40°C, Max.: 215°C	_	_	I

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. J

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 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 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	E
MG1 MOTOR TEMP [Generator (MG1) Temperature]	Generator inverter temperature/ Min.: -50°C, Max.: 205°C	Generator temperature	Н
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	
GN 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 DN]	Generator inverter temperature/ Min.: -50°C, Max.: 205°C	Generator inverter temperature	
MG2 INV TEMP Inverter Temperature (MG2) After IGN DN]	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

< FUNCTION DIAGNOSIS >

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
NFORMATION 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
/EC 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

- 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]			
SFT BEF RDY[L/T]		Chiff lover moved with DEADY light blighing	
SFT BEF RDY[B/O]	 Shift gear before READY 	Shift lever moved with READY light blinking	
SFT BEF RDY[B/T]	_		
N RNG CTRL1[L/O]			
N RNG CTRL1[L/T]	N range control in helf shift	Shift position connet be determined	
N RNG CTRL1[B/O]	 N range control in half shift 	Shift position cannot be determined	
N RNG CTRL1[B/T]	_		
N RNG CTRL2[L/O]			
N RNG CTRL2[L/T]	N range control by busy shift	N position control offected due to frequent chifting energian	
N RNG CTRL2[B/O]	 N range control by busy shift 	N position control effected due to frequent shifting operation	
N RNG CTRL2[B/T]			
S/ACC IN N[L/O]			
S/ACC IN N[L/T]	Stop appelerator in N range	Accelerator pedal depressed in N position	
S/ACC IN N[B/O]	 Step accelerator in N range 		
S/ACC IN N[B/T]	_		
AUX BATT LO[L/O]		Auxiliary battery voltage below 9.5 V	
AUX BATT LO[L/T]	- Auxiliary Battery Low		
AUX BATT LO[B/O]			
AUX BATT LO[B/T]	_		
HV INTERMIT[L/O]			
HV INTERMIT[L/T]	Hybrid vehicle control ECU Intermittent	Instantaneous open circuit at IGN SW terminal of the hybrid	
HV INTERMIT[B/O]	incident	vehicle control ECU	
HV INTERMIT[B/T]	_		
MG2 TEMP HI[L/O]			
MG2 TEMP HI[L/T]	Motor (MC2) tomperature high	Motor (MC2) tomporature race above 162°C (224°E)	
MG2 TEMP HI[B/O]	 Motor (MG2) temperature high 	Motor (MG2) temperature rose above 162°C (334°F)	
MG2 TEMP HI[B/T]			
MG1 TEMP HI[L/O]			
MG1 TEMP HI[L/T]	Concreter (MC1) termerature high	Concreter (MC1) temperature rece chose 460%C (024%E)	
MG1 TEMP HI[B/O]	 Generator (MG1) temperature high 	Generator (MG1) temperature rose above 162°C (334°F)	
MG1 TEMP HI[B/T]			
MG2 INV HI[L/O]			
MG2 INV HI[L/T]	Inverter temperature (MC2) bich	Motor inverter temperature read above 1979C (2499E)	
MG2 INV HI[B/O]	 Inverter temperature (MG2) high 	Motor inverter temperature rose above 127°C (248°F)	
MG2 INV HI[B/T]			

< FUNCTION DIAGNOSIS >

CONSULT-III Display	Operation	Count Condition		
MG1 INV HI[L/O]				
MG1 INV HI[L/T]	Investor temperature (MC1) high		Inverter temperature (MC1) high	Concreter investor temperature race shows 197°C (242°E)
MG1 INV HI[B/O]	 Inverter temperature (MG1) high 	Generator inverter temperature rose above 127°C (248°F)		
MG1 INV HI[B/T]				
HV BATT LOW[L/O]				
HV BATT LOW[L/T]	Main Battery low voltage	Battery state of charge dropped below 30%		
HV BATT LOW[B/O]		Battery state of charge dropped below 50%		
HV BATT LOW[B/T]				
RESIST O/H[L/O]				
RESIST O/H[L/T]	Resister over heat	System main resistor overheated		
RESIST O/H[B/O]		System main resistor overheated		
RESIST O/H[B/T]				
COOLANT HT[L/O]				
COOLANT HT[L/T]		Inverter coolant forecast temperature rose above 65°C		
COOLANT HT[B/O]	 Coolant heating 	(149°F)		
COOLANT HT[B/T]				
CONVERTER H[L/O]				
CONVERTER H[L/T]	Converter beating	Roost converter temperature ross shows 120°C (248°E)		
CONVERTER H[B/O]	 Converter heating 	Boost converter temperature rose above 120°C (248°F)		
CONVERTER H[B/T]				
BKWRD SHIFT[L/O]				
BKWRD SHIFT[L/T]	 Shift backward direction 	Shifted to R while moving forward or shifted to D or B while		
BKWRD SHIFT[B/O]		moving in reverse		
BKWRD SHIFT[B/T]				
PREVENT STY[L/O]				
PREVENT STY[L/T]	Brevention control of staving	Engine speed stays in resonance frequency hand		
PREVENT STY[B/O]	 Prevention control of staying 	Engine speed stays in resonance frequency band		
PREVENT STY[B/T]				
ACCEL & BRK[L/O]				
ACCEL & BRK[L/T]	Appelorator and broke depression	Path appalarator and brake padala depressed		
ACCEL & BRK[B/O]	 Accelerator and brake depressing 	or and brake depressing Both accelerator and brake pedals depressed		
ACCEL & BRK[B/T]	RK[B/T]			

ACTIVE TEST MODE

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Test Item

NOTE:

· Using the CONSULT-III to perform active tests allows relays, actuators and other items to be operated with-Ο out 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.

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< FUNCTION DIAGNOSIS >

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 speed-ometer 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 be- ing 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 posi- tion other than P	Ignition switch ON, HV system normal, not in maintenance mode, and other active tests not be- ing done
COMPRESSION TEST (Compression Test)	To crank the engine contin- uously 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 de- pressed.
INV WATER PUMP (Activate the Water Pump)	To activate the inverter wa- ter pump continuously	ON or OFF	Activates the inverter water pump continuously	Ignition switch ON, in- verter 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

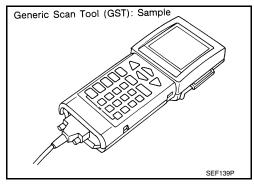
Diagnosis Tool Function

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.



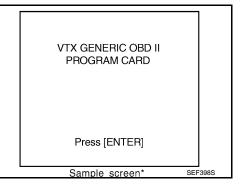
FUNCTION

< FUNCTION DIAGNOSIS >

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 <u>HBC-619</u> , " <u>DTC Index</u> ".
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-relat- ed powertrain components/systems that are continuously monitored during normal driving con- ditions.
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.

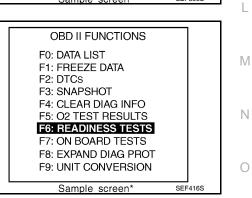
INSPECTION PROCEDURE

- 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.
- 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.



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< FUNCTION DIAGNOSIS >

INSPECTION MODE MODE 1

MODE 1 : Diagnosis Description

INFOID:000000004211758

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.

Туре	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

- 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:

INSPECTION MODE

< FUNCTION DIAGNOSIS >

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

(B) 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:000000004211759

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.

Туре	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. 	G
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.	Ц

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.

(P) With CONSULT-III

Ĭ.	Turn ignition switch OFF and wait at least 10 seconds.	L
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.	Μ
5.	Check that high voltage battery warning light is blinking in the combination meter.	
6.	Turn ignition switch ON (READY).	
	Without CONSULT-III	Ν
1	Turn ignition switch OFF and wait at least 10 seconds.	14
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.	0
	Fully depress the accelerator pedal.	
_	Fully release the accelerator pedal.	
5.	Shift the selector lever to N position.	Ρ
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.

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INSPECTION MODE

< FUNCTION DIAGNOSIS >

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

DEACTIVATING PROCEDURE

CAUTION:

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

(I) 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

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:000000004211761

INFOID:000000004211760

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 connectorHybrid vehicle control ECU
отс со	NFIRMAT	TION PROCEDURE		
1.PREC		NING		
least 10 s TESTING	econds be CONDIT	efore conducting the next	eviously conducted, always turn igr test. re, confirm that battery voltage is	
>	>> GO TO	2.		
-		CONFIRMATION PROC	EDURE	
		vitch ON (READY).		
 Shift Depression Chec 	the selecto ess the ac k DTC.	or lever to P position.	ngine and keep the engine running f	or at least 5 seconds.
	>> Go to L	IBC-107, "Diagnosis Proc CTION END	<u>edure"</u> .	
Diagnos	sis Proc	edure		INFOID:00000004211762
1.PREC		NING		
converte plug gri other te	er assemb p to preve chnicians	oly, take safety precautio ent electrical shocks. Afte from accidentally reconne	or disconnecting the low voltage on ns such as wearing insulated glow r removing the service plug grip, pu ecting it while you are working on the	es and removing the service at it in your pocket to prevent e high-voltage system.
connect	ors or terr	ninals.	ait for at least 10 minutes before tou	
•	for at lea er assemb	•	I to discharge the high-voltage cap	acitor inside the inverter with
>	>> GO TO	2.		
2. снес	K HARNE	SS BETWEEN HYBRID	VEHICLE CONTROL ECU AND EC	Μ
1 Turni	ianition sv	vitch OFF		

- Turn ignition switch OFF.
 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.

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< COMPONENT DIAGNOSIS >

Check for open

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

Check for short

Hybrid vehicl	e control ECU			
Harness connector	Terminal		Resistance	
E66	101 (NEI)	Ground	$10k\Omega$ or higher	

ECM			
Harness connector	Terminal	Ground	Resistance
E10	99 (NEO)	Ground	$10k\Omega$ 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 <u>HBC-644</u>, "Removal and Installation").

NO >> Repair or replace harness or connectors.

P0343-747

Description

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

HBC INFOID:000000004211764

INFOID:000000004211763

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 	Е

Diagnosis Procedure

INFOID:000000004211765

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 Н 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 Proce-L dure"). NO
- >> GO TO 3.
- ${f 3}.$ CHECK ENGINE START
- Check if the engine can start. 1.
- Check DTC for "ENGINE". 2.

Result	Proceed to	
The engine cannot start.	В	
The engine can start and DTC P0335 or P0340 is output within 10 seconds.	В	0
The engine can start and DTC P0335 and P0340 are not output after 10 seconds.	A	

A or B

А >> 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)

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- 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.

<u>OK or NG</u>

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 <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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 co		
Harness connector	Terminal	Harness connector	Terminal	Resistance
E10	103 (GO)	E69	30 (GI)	Below 1Ω

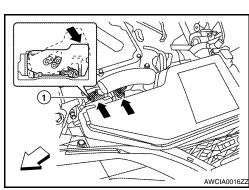
Check for short

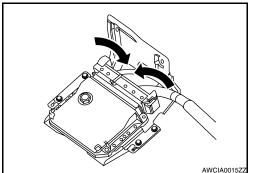
E	CM		Resistance
Harness connector	Terminal	Ground	
E10	103 (GO)	Ground	$10k\Omega$ or higher

Inverter with cor	nverter assembly		
Harness connector	Terminal	Ground	Resistance
E69	30 (GI)	Ground	$10k\Omega$ or higher

<u>OK or NG</u>

OK >> GO TO 8.





P0343-747

< COMPONENT DIAGNOSIS >

NG	>> GO TO 7.	
7.DF	FCT MAI FUNCTIONING PART	

Check the following.

• Joint connector E-01

· Harness continuity between ECM and inverter with converter assembly

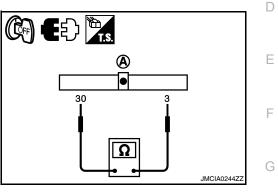
>> Repair open circuit or short to ground or short to power in harness or connectors.

8.check inverter with converter assembly

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

Check for open

	h converter bly (A)	Inverter with converter assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	
E69	30 (GI)	E69	3 (GND1)	10 k Ω or higher



NOTE:

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

<u>OK or NG</u>

 OK
 >> GO TO 9.

 NG
 >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>).

 9.CHECK INTERMITTENT INCIDENT

 Refer to <u>GI-42, "Intermittent Incident"</u>.

 >> INSPECTION END

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P0343-886

Description

INFOID:000000004211766

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:000000004211767

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 connectorHybrid 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:000000004211768

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.

Hybrid vehicl	e control ECU	E		
Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	100 (GI)	E10	103 (GO)	Below 1Ω

Check for short

Hybrid vehicl	e control ECU			
Harness connector	Terminal	Ground	Resistance	
E66	100 (GI)	Ground	$10k\Omega$ or higher	

E	СМ			
Harness connector	lerminal		Resistance	
E10	103 (GO)	Ground	$10k\Omega$ or higher	

<u>OK or NG</u>

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 G	GI-42, "Intermittent Incident".	J
Is the insp	pection result normal?	
YES >	Replace hybrid vehicle control ECU (See <u>HBC-644, "Removal and Installation"</u>).	
NO >	> Repair or replace harness or connectors.	Κ

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P0560-117

Description

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:000000004211770

INFOID:000000004211769

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 connectorHybrid vehicle control ECU

Diagnosis Procedure

INFOID:000000004211771

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".

<u>OK or NG</u>

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	Hybrid vehicle control ECU		High voltage fuse and fusible link box	
Harness connector	Terminal	Component connector	Terminal	Resistance
E65	165 (BATT)	-	10A fuse (No. 70) downstream side	Below 1Ω
Check for short	:			
Hybrid vehic	Hybrid vehicle control ECU			_
Harness connector	Terminal	Ground	Resistance	
E65	165 (BATT)	Ground	10kΩ or higher	_
				-

High voltage luse	and fusible link box			
Component connector	Terminal	Ground	Resistance	
-	10A fuse (N0. 70) downstream side	Ground	$10k\Omega$ or higher	
IOTE: Vhen taking me ne fuse holder o		tester, do not a	pply excessive f	prce to the tester probes to avoid damaging
0 <u>K or NG</u> OK >> GO NG >> Rep	TO 4. air or replace harn	ess or connecto	or.	
· ·	•			SITIVE TERMINAL)
. Disconnect	he positive and ne resistance accord	gative terminal	s from the auxilia	ry battery.
Check for open				
High voltage fuse	and fusible link box			
Component connector	Terminal	Battery	Resistance	
-	10A fuse (No. 70) upstream side	Positive (+) bat- tery terminal	Below 1Ω	
Check for short				
High voltage fuse	and fusible link box			
Component connector	Terminal	Ground	Resistance	_
-	10A fuse (No. 70) upstream side	Ground	$10k\Omega$ or higher	
<u> OK or NG</u>				
OK >> GO NG >> Rep	TO 5. air or replace harn	ess or connecto)r	
- '	DTC OUTPUT (H			
			(VI)	
f DTC P0560-11 out, check for inf		because there r	nay be a malfun	vehicle control ECU. If the DTC is not out- ction in the wire harness or connector.
Turn ignition sy Select "DELF- Recheck for D	DIAG RESULTS" r	node.		
	is output again.			
DTC P0560-117				
YES >> Rep	lace hybrid vehicle	control ECU (S	See <u>HBC-644, "F</u>	emoval and Installation").
YES >> Rep	lace hybrid vehicle ck for intermittent			

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P0616-142

DTC Logic

INFOID:000000004211772

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 connectorHybrid vehicle control ECUBCM

Diagnosis Procedure

INFOID:000000004211773

1.PRECONDITIONING

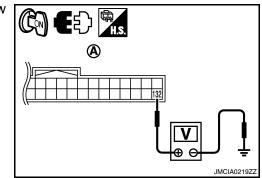
- Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your 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	Л (A)		
Harness connector	Terminal	Ground	Voltage
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		
Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	167 (ST2)	M21	132 (ST-CONT)	Below 1 Ω

<u>OK or NG</u>

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.

P0616-142

< COMPONENT DIAGNOSIS >	>
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4. Clear the DTCs.	A
>> GO TO 5.	~
5.RECONFIRM DTC OUTPUT	В
 Turn ignition switch OFF and leave the vehicle as it is for approximately 5 seconds. Turn ignition switch ON again. Recheck for DTCs. 	
DTC P0616-142 is output again.	HBC
YES >> Replace hybrid vehicle control ECU (See <u>HBC-644</u> , " <u>Removal and Installation</u> "). NO >> Check for intermittent incident (See <u>GI-42</u> , " <u>Intermittent Incident</u> ").	D
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P062F-143

Description

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

DTC Logic

INFOID:000000004211775

INFOID:000000004211774

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 <u>HBC-118</u>, "Diagnosis Procedure".

NO >> INSPECTION END

Diagnosis Procedure

INFOID:000000004211776

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

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:000000004211778 HBC

INFOID:000000004211777

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	E
758	Circuit	a (1)			
P0851	775	Park / Neutral Switch Input Circuit Low	N signal line malfunction	Hybrid vehicle control ECU	F

Diagnosis Procedure

INFOID:000000004211779

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)

 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	Р	R	Ν	D	В	
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	



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< COMPONENT DIAGNOSIS >

	Shift Position					
Data Monitor	Р	R	Ν	D	В	
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 po	sition switch (A)			
Harness connector	Terminal	Ground	Voltage	
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)

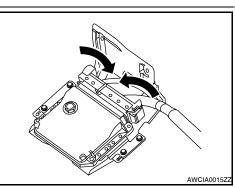
- Check the connections of the hybrid vehicle control ECU connectors.
- Confirm that the lever is securely engaged.
- Confirm that the connector does not come out when its body is pulled.

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

OK or NG

OK >> GO TO 7.

NG >> Connect securely.



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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.

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< COMPONENT DIAGNOSIS >

Hybrid vehicle control ECU			
Harness connector	Terminal	Ground	Ground Voltage
45 (P)	60 (+BS)		
	45 (P)	-	
	46 (R)		
	47 (N)		
E65	48 (D)	Ground	Below 1 V
	49 (B)	-	
	50 (RV)	-	
	51 (FD)	-	
5	52 (MJ)		

NOTE:

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

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

Check for open

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

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

< COMPONENT DIAGNOSIS >

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

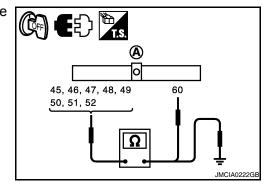
OK or NG

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	Hybrid vehicle control ECU (A)		Hybrid veh ECl	Resistance	
position	Harness connector	Terminal	Harness connector	Terminal	Resistance
Р	E65	60 (+BS)	E65	45 (P)	Below 1Ω
F	E00 00 (+B2)		E03	52 (MJ)	DEIOM 175

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

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< COMPONENT DIAGNOSIS >

Shift lever	Hybrid vehicle control ECU (A)		Hybrid veh ECl	Resistance		
	Harness connector	Terminal	Harness connector	Terminal	Resistance	
N	E65	60 (+BS)	E65	47 (N)	Below 1Ω	
N	E65 60 (+BS)		L03	52 (MJ)	Delow 122	

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

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

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Check	101	SHOL

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

NOTE:

*: The resistance between terminals 60 and 47 should be 4.2 to 5.2 k Ω . OK or NG

< COMPONENT DIAGNOSIS >

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

9. CHECK FOR INTERMITTENT INCIDENT

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

OK or NG

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

P0A01-725, P0A01-726

Description

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

DTC Logic

INFOID:000000004211781

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A01	725	Motor electronics coolant tem- perature sensor circuit range/ performance	Sudden change in inverter cool- ant 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 tem- perature 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:000000004211782

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 P0493-346 detected?			

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".

<u>OK or NG</u>

OK >> GO TO 4.

NG >> Connect securely.

4.CHECK QUANTITY OF INVERTER COOLANT

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INFOID:000000004211780

P0A01-725, P0A01-726

< COMPONENT DIAGNOSIS >

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.	В
Coolant leaks are evident.	С

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 $\mathbf{1}\Omega$

<u>OK or NG</u>

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 <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 8.

NG >> Connect securely.

 $\mathbf{8}$.check connector connection condition (water pump with motor & bracket assembly connector)

See <u>HBC-362</u>, "Diagnosis Procedure".

OK or NG

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

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

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 10.

NG >> GO TO 12.

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

See <u>HBC-362</u>, "Diagnosis Procedure".

OK or NG

OK >> GO TO 11.

NG >> Connect securely.

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

P0A01-725, P0A01-726

< COMPONENT DIAGNOSIS >	
See HBC-362, "Diagnosis Procedure".	
<u>OK or NG</u>	А
 OK >> Replace inverter with converter assembly (See <u>HBC-638</u>, "<u>Removal and Installation</u>"). NG >> Check cooling fan system (See <u>EC-382</u>, "<u>Component Function Check</u>"). 	
12.PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)	В
See <u>HBC-362, "Diagnosis Procedure"</u> .	
OK or NG	HBO
OK >> Add coolant. NG >> GO TO 13.	
13. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY	D
See <u>HBC-362, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	Е
OK >> GO TO 14. NG >> GO TO 15.	
14.CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV	F
CONTROL ECU)	
See <u>HBC-362. "Diagnosis Procedure"</u> .	
OK or NG OK >> Replace hybrid vehicle control ECU (See HBC-644, "Removal and Installation").	G
 OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "<u>Removal and Installation</u>"). NG >> Repair or replace harness or connector. 	
15. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX	Н
Refer to PG-65, "Terminal Arrangement".	
<u>OK or NG</u>	
OK >> GO TO 16. NG >> Replace high voltage fuse and fusible link box.	
NG >> Replace high voltage fuse and fusible link box. 16. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)	
See <u>HBC-362, "Diagnosis Procedure"</u> .	J
<u>OK or NG</u>	
OK >> Replace water pump with motor & bracket assembly.	Κ
NG >> Repair or replace harness or connector.	
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P0A02-719, P0A03-720

Description

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:000000004211784

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:000000004211785

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

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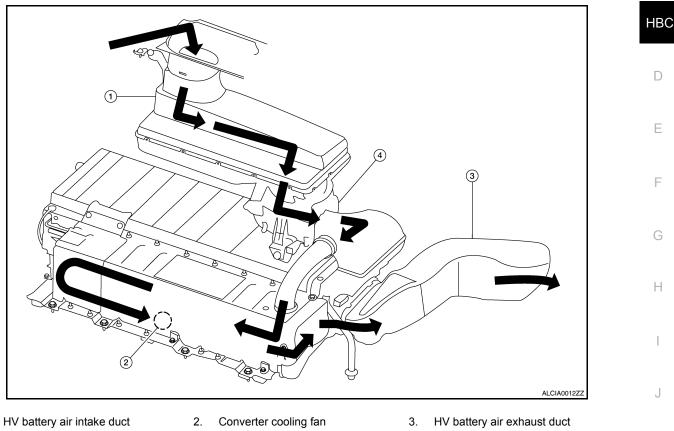
P0A08-101

Description

INFOID:000000004211786

А

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).



4. Battery cooling blower assembly

DTC Logic

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DTC DETECTION LOGIC

DTC N	lo. INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause	5.4
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 	N

Diagnosis Procedure

INFOID:000000004211788

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 <u>HBB-103</u>, "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.

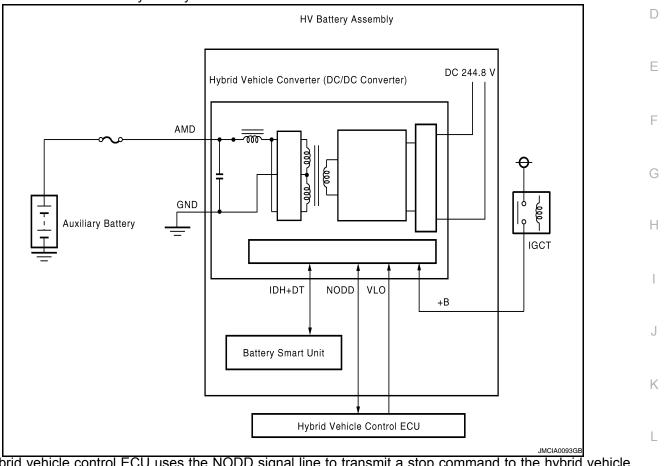
P0A08-264

Description

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 Ν if it detects a malfunction.

В

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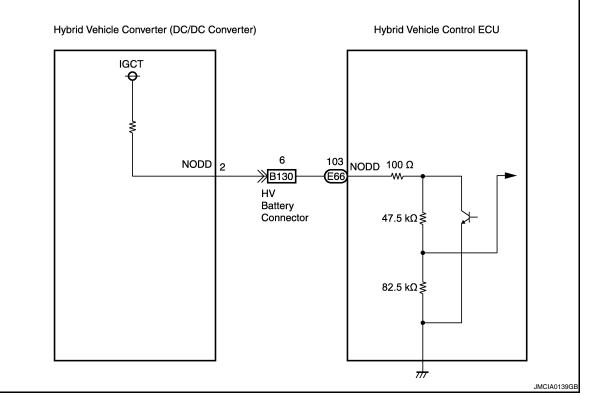
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DTC Logic

INFOID:000000004211790

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:000000004211791

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.

P0A08-264

< COMPONENT DIAGNOSIS >

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 or NG OK >> GO TO 5. NG >> Connect securely. 5. CHECK HARNESS AND CONNECTOR (RESISTANCE VALUE OF NODD INSIDE HYBRID VEHICLE CONTROL ECU) 1 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. Image: Section Register the resistance according to the value(s) in the table below. Image: Section Register the resistance according to the value(s) in the table below. Image: Section Register the resistance according to the value(s) in the table below. Image: Section Register the resistance according to the value(s) in the table below. Image: Section Register the resistance connector Image: Section Register the resistance according to the value(s) in the table below. Image: Section Register the	DTC No.			Relevant Diagnosis	А
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OK >> GO TO 7. NG >> Connect securely.		securely and t	here are no contact	,	
NG >> Connect securely.	•				
7.CHECK HV RELAY ASSEMBLY (HIGH VOLTAGE FUSE)					
	7. CHECK HV RELAY ASSEMI	BLY (HIGH VOL	TAGE FUSE)		

P0A08-264

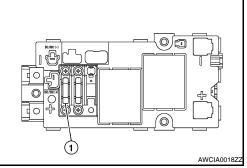
< COMPONENT DIAGNOSIS >

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

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



<u>UK OF NG</u>

OK >> GO TO 8.

NG >> Replace high voltage fuse.

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

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.

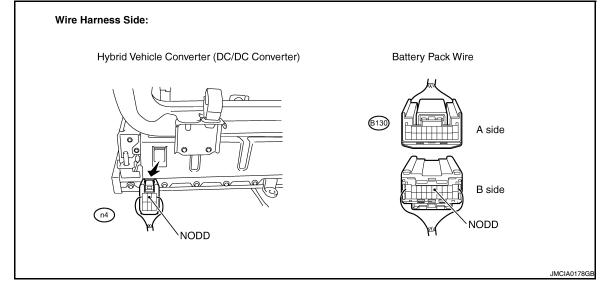
NG >> Connect securely.

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.
- Disconnect the hybrid vehicle converter connector (DC/DC converter) (See HBB-103, "Removal and 2. Installation").
- 3. Turn ignition switch ON.
- Measure the voltage according to the value(s) in the table below. 4.



Battery pack wire			
Harness connector	Terminal	Ground	Voltage
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.

- Turn ignition switch OFF. 5.
- 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)		Pasis	tance
Harness connector	Terminal	Harness connector	T	erminal	110010	ance
B130	6 (NODD)	n4	2	(NODD)	Belo	w 1Ω
Check for short						
Batter	/ pack wire					
Harness connector	Terminal	Ground	ł	Resista	ance	
B130	6 (NODD)	Ground	ł	$10k\Omega$ or	higher	

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Hybrid vehicle converter (DC/DC converter)		Ground	Resistance
Harness connector	Terminal	Ground	resistance
n4	2 (NODD)	Ground	$10k\Omega$ or higher

OK or NG

OK >> GO TO 10.

NG >> Repair or replace harness or connector.

10. CHECK HYBRID VEHICLE CONVERTER

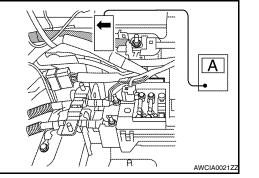
- 1. Connect all the disconnected connectors.
- 2. Install the service plug grip.
- 3. Measure the current output from the hybrid vehicle converter (DC/DC converter) with the headlight position switch and blower motor switch in the HI position, and the rear window defogger turned on (*1).
- 4. Measure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

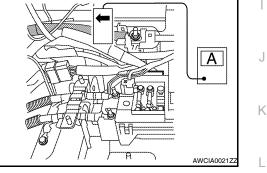
Item	Specified condition
Current flowing from the hybrid vehicle converter (DC/DC converter)	60 to 140 A
Auxiliary battery voltage	13 to 15 V

OK or NG

OK >> GO TO 11.

NG >> Replace hybrid vehicle converter (See <u>HBC-644, "Removal and Installation")</u> .	IVI
11.CHECK FOR INTERMITTENT INCIDENT	
1. Check for intermittent incident (See <u>GI-42, "Intermittent Incident"</u>).	Ν
YES or NO	
 YES >> Repair or replace malfunctioning parts, component and area. NO >> Replace hybrid vehicle converter (See <u>HBC-644, "Removal and Installation"</u>). 	0
12. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - HV BATTERY)	
 Disconnect the hybrid vehicle control ECU harness connector E66. Turn ignition switch ON. 	Ρ







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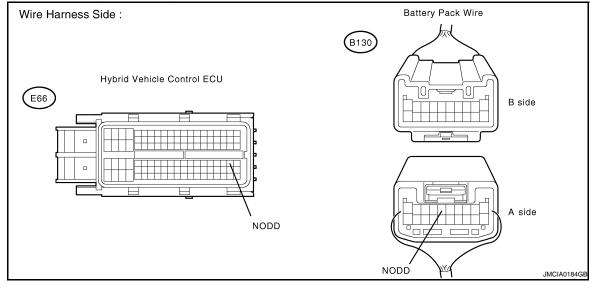
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P0A08-264

< COMPONENT DIAGNOSIS >

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



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

Check for short

Hybrid vehicl	e control ECU		
Harness connector	Terminal	Ground	Resistance
E66	103 (NODD)	Ground	$10k\Omega$ or higher

Battery pack wire			
Harness connector	Terminal	Ground	Resistance
B130	6 (NODD)	Ground	$10k\Omega$ or higher

OK or NG

OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "Removal and Installation").

NG >> Repair or replace harness or connector.

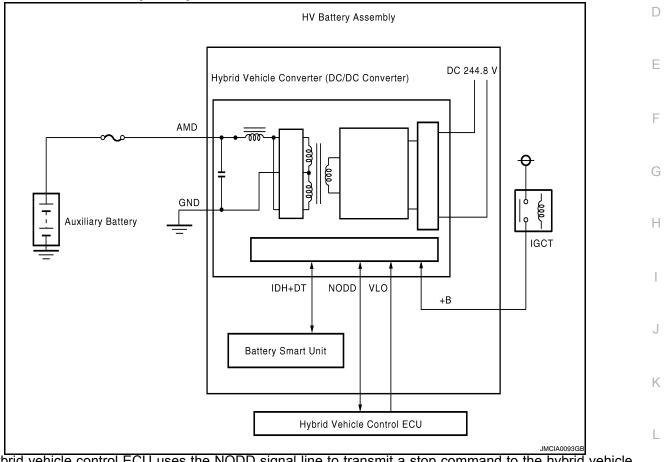
P0A09-265

Description

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.



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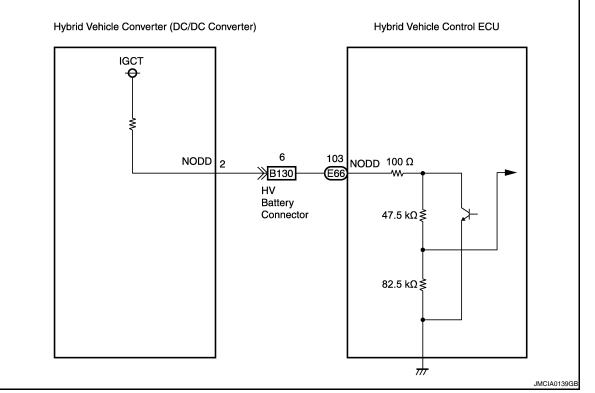
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INFOID:000000004211792



DTC Logic

INFOID:000000004211793

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A09	265	DC/DC Converter Status Cir- cuit 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:000000004211794

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)

P0A09-265

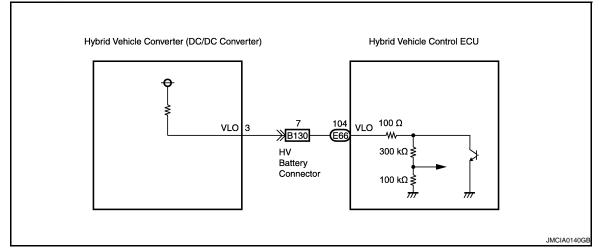
< COMPONENT DIAGNOSIS >	
See <u>HBC-109</u> , "Diagnosis Procedure".	-
OK or NG	А
OK >> GO TO 4.	
NG >> Connect securely.	В
4. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)	
See <u>HBC-140, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	HB(
OK >> GO TO 5. NG >> COnnect securely.	
-	D
5. CHECK HARNESS AND CONNECTOR (RESISTANCE VALUE OF NODD INSIDE HYBRID VEHICLE CONTROL ECU)	D
See <u>HBC-132, "Diagnosis Procedure"</u> .	-
<u>OK or NG</u>	E
OK >> GO TO 6.	
NG >> GO TO 8.	
6. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)	F
See <u>HBC-140</u> , "Diagnosis Procedure".	-
<u>OK or NG</u>	G
OK >> GO TO 7.	0
NG >> Connect securely.	
7. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HYBRID VEHICLE CON-	. Н
VERTER)	
See HBC-132, "Diagnosis Procedure".	
OK or NG	I
OK >> Replace hybrid vehicle converter (See <u>HBC-644</u> , "Removal and Installation").	
NG >> Repair or replace harness or connector.	J
8. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE	
CONNECTOR)	-
See <u>HBC-132</u> , "Diagnosis Procedure".	K
OK or NG	
 OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "<u>Removal and Installation</u>"). NG >> Repair or replace harness or connector. 	L
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P0A09-591

Description

INFOID:000000004211795

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:000000004211796

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:000000004211797

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 <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

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.

 $\mathbf{b}.$ CHECK HYBRID VEHICLE CONTROL ECU

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

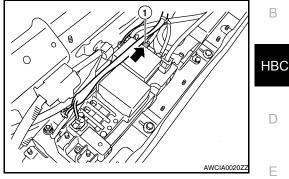
Item	Contents	
Terminal (A side)	7 (VLO) - 10 (GND)	
Equipment Setting	5 V/DIV, 50 ms./DIV	
Condition	Ignition switch ON	

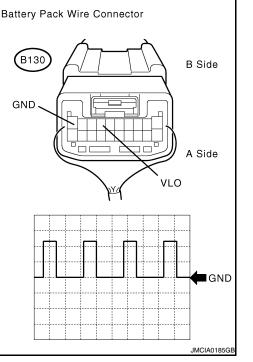
NOTE:

Perform this inspection with the battery pack wire connected.

OK or NG

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

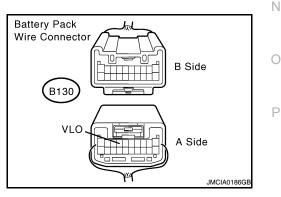




6. Check harness and connector (resistance value inside hybrid vehicle control ECU)

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

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



OK or NG

OK >> GO TO 7.

NG >> GO TO 9.

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

CAUTION:

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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.

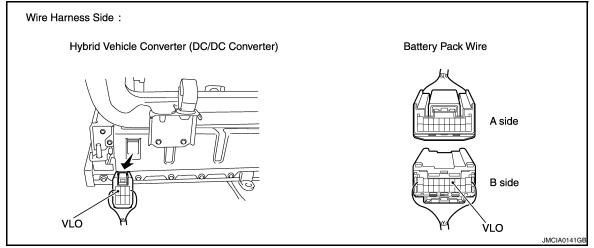
Hybrid Vehicle Converter (DC/DC Converter) :

 ${f 8}$.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 <u>HBB-103</u>, "<u>Removal and</u> <u>Installation</u>").
- 3. Measure the resistance according to the value(s) in the table below.



Check for open

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

Check for short

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

	cle converter converter)	Ground	Resistance	
Harness connector	Terminal	Ground	Resistance	
n4	3 (VLO)	Ground	10 k Ω or higher	

OK or NG

P0A09-591

		ID CONNEC	TOR (HYE	BRID VEHICLE	CONTROL ECU - BATTERY PACK WIRE	
	ect the hybrid			rness connector		В
Check for of		e according	to the value	e(s) in the table b	elow.	
	e control ECU	Batter	y pack wire		-	HB
Harness connector	Terminal	Harness connector	Termin	Resistance		D
E66	104 (VLO)	B130	7 (VLC)) Below 1Ω	_	D
Check for sh	nort				_	_
Hybrid ve	hicle control EC	U				E
Harness connector	Termir		Ground	Resistance		F
E66	104 (VI	_0)	Ground	10 k Ω or higher		1
Hybrid ve	ehicle control EC	U				G
Harness	Termi	nal	Ground	Resistance		
connector						
B130	7 (VL	O)	Ground	10 k Ω or higher		Η
B130 OK or NG. OK >> O NG >> F D.CLEAR . Reconne 2. Turn ignit	GO TO 10 Repair or repla DTC ct all harness tion switch ON	ace harness connectors N.	or connect	or. ed.		H I J
B130 OK or NG. OK >> C NG >> F O.CLEAR Reconne Turn ignit Read and Clear the	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs.	ace harness connectors N.	or connect	or. ed.		H I K
B130 OK or NG. OK >> C NG >> F D.CLEAR . Reconne . Turn ignit . Read and . Clear the >> C	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11.	ace harness connectors N.)TCs and fre	or connect disconnect eze frame	or. ed. data.		l J
B130 OK or NG. OK >> C NG >> F IO.CLEAR Reconne Read and Clear the >> C II.RECON	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11. FIRM DTC OI	ace harness connectors N.)TCs and fre UTPUT (HYE	or connect disconnect eze frame	or. ed. data.		J
B130 OK or NG. OK >> G NG >> F O.CLEAR . Reconne . Turn ignit . Clear the >> G II.RECON . Turn ignit . Check D	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11. FIRM DTC OI tion switch ON TC.	ace harness connectors N. DTCs and fre UTPUT (HYE	or connect disconnect eze frame	or. ed. data.		I K L
B130 OK or NG. OK >> C NG >> F O.CLEAR . Reconne . Turn ignit . Read and . Clear the . Clear the . Clear the . Turn ignit . Check D . DTC P0A0	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11. FIRM DTC OI tion switch ON TC. 9-591 detecte	ace harness connectors N. TCs and fre UTPUT (HYE	or connect disconnect eze frame BRID SYST	or. ed. data. "EM)		J
B130 OK or NG. OK >> C NG >> F D.CLEAR . Reconne . Turn ignit . Read and . Clear the . Clear the . Clear the . Turn ignit . Turn ignit . Turn ignit . Check D <u>s DTC P0A0</u> YES >> F	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11. FIRM DTC OI tion switch ON TC. 9-591 detecte	ace harness connectors N. TCs and fre UTPUT (HYE	or connect disconnect eze frame BRID SYST	or. ed. data. "EM)	emoval and Installation").	J K L
B130 OK or NG. OK >> C NG >> F O.CLEAR . Reconne . Turn ignit . Read and . Clear the . Clear the . Clear the . Clear b . Turn ignit . Check D . Turn ignit . Check D . DTC P0A0 YES >> F NO >> C	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11. FIRM DTC OR tion switch ON TC. 9-591 detected Replace hybrid	ace harness connectors N. DTCs and fre UTPUT (HYE N. ed? d vehicle con	or connecte disconnect eze frame BRID SYST	or. ed. data. "EM)	emoval and Installation").	J K L
B130 OK or NG. OK >> C NG >> F O.CLEAR . Reconne . Turn ignit . Read and . Clear the . Clear the . Clear the . Clear b . Check D . Turn ignit . Check D . Turn ignit . Check D . Turn ignit . Check D . Turn ignit . Check D . Check D	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11. FIRM DTC ON tion switch ON TC. <u>9-591 detecte</u> Replace hybrid GO TO 12. FOR INTERM	ace harness connectors N. DTCs and fre UTPUT (HYE N. ed? d vehicle con	or connect disconnect eze frame BRID SYST	or. ed. data. "EM)		I J K
B130 OK or NG. OK >> C NG >> F O.CLEAR . Reconne . Turn ignit . Read and . Clear the . Clear the . Clear the . Check D <u>s DTC P0A0</u> YES >> F NO >> C I2.CHECK . Check fo <u>OK or NG</u>	GO TO 10 Repair or repla DTC ct all harness tion switch ON d record the D DTCs. GO TO 11. FIRM DTC OR tion switch ON TC. <u>9-591 detecte</u> Replace hybrid GO TO 12. FOR INTERN r intermittent i	ace harness connectors N. DTCs and fre UTPUT (HYE N. d vehicle con MITTENT ING	or connect disconnect eze frame BRID SYST trol ECU (S CIDENT <u>GI-42, "In</u>	or. ed. data. ⁻ EM) See <u>HBC-644, "F</u>		J K L

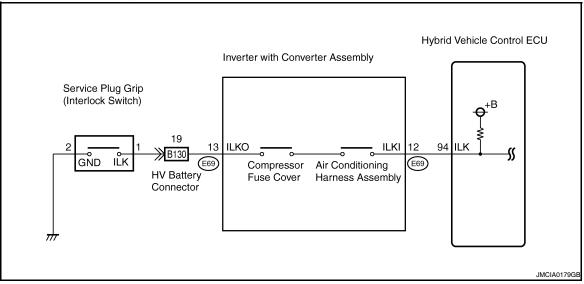
P0A0D-350, P0A0D-351

Description

INFOID:000000004211798

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:000000004211799

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:000000004211800

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.

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< COMPONENT DIAGNOSIS >	
>> GO TO 2.	
2.CHECK DTC OUTPUT (HYBRID SYSTEM)	А
 Turn ignition switch ON. Check DTC. 	D
Is DTC P0A1D detected?	В
YES >> Go to inspection procedure relevant to output DTC.	
NO >> GO TO 3. 3 of EAD DTO (UNDERD) Devote (U)	HBC
3.CLEAR DTC (HYBRID SYSTEM)	
 Turn ignition switch ON. Read and record the DTC and freeze frame data. Clear the DTC. 	D
>> GO TO 4.	Е
4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY)	
CAUTION:	F
Be sure to wear insulated gloves.	Г
 Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System</u>"). 	
2. Check if the inverter with converter assembly is installed correctly.	G
The inverter with converter assembly is installed correctly.	
YES >> GO TO 5. NO >> Connect securely.	Н
5.RECONFIRM DTC OUTPUT (HYBRID SYSTEM)	
1. Turn ignition switch ON.	1
2. Recheck DTC.	I
Is DTC P0A0D-350 or P0A0D-351 detected again?	
YES >> GO TO 6. NO >> GO TO 15.	J
6. CHECK SERVICE PLUG GRIP	
	Κ
Be sure to wear insulated gloves.	
1. Check if the service plug grip is installed correctly.	
NOTE: For the removal and installation procedures, (See <u>HBC-632</u> , "Precautions for Inspecting the Hybrid Con-	L
trol System").	
The service plug grip is installed correctly.	M
YES >> GO TO 7. NO >> Connect securely.	
7. CHECK INVERTER WITH CONVERTER ASSEMBLY (COMPRESSOR FUSE COVER INSTALLATION	Ν
CONDITION)	
CAUTION:	_
 Be sure to wear insulated gloves. 1. Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>. "Precautions for Inspecting the link brid Control Con	0
Hybrid Control System").	D
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< COMPONENT DIAGNOSIS >

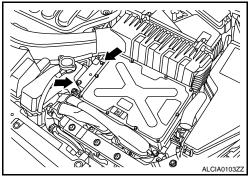
2. Check if the compressor fuse cover of the inverter with converter assembly is installed correctly.

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.



$\mathbf{8}$. CHECK AIR CONDITIONING HARNESS ASSEMBLY (AIR CONDITIONING HARNESS ASSEMBLY CONNECTION CONDITION)

CAUTION:

Be sure to wear insulated gloves.

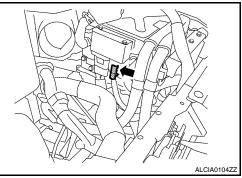
- 1. Check that the service plug grip is not installed.
- Check if the air conditioning harness assembly connector is connected correctly.

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.

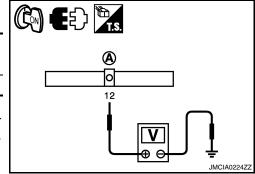
Inverter with converter assembly (A)		Ground	Voltage	
Harness connector	Terminal	Ground	voltage	
E69	12 (ILKI)	Ground	9 to 14 V	

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.



< COMPONENT DIAGNOSIS >

11.CHECK INVERTER WITH CONVERTER ASSEMBLY CAUTION:

- Be sure to wear insulated gloves.
- 1. Turn ignition switch OFF.
- Measure the resistance according to the value(s) in the table below.

Inverter with converter assem- bly			onverter assem- ly	Resistance
Component connector	Terminal	Component connector	Terminal	Resistance
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 <u>HBC-140</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 13.

NG >> Connect securely.

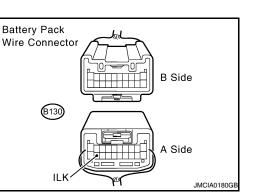
13.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - BATTERY PACK WIRE)

- 1. Connect the inverter with converter assembly harness connector.
- 2. Disconnect the battery pack wire harness connector B130. (See <u>HBB-97</u>, "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	Ground	voltage	
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.



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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 <u>HBC-632</u>, "Precautions for Inspecting the Hybrid Control System".

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

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

<u>OK or NG</u>

OK >> GO TO 15.

NG >> GO TO 16.

15.CHECK CONNECTOR CONNECTION CONDITION (INTERLOCK CIRCUIT)

1. Check the connections of each connector.

HBC-147

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

<u>OK or NG</u>

- 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.

 Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "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.

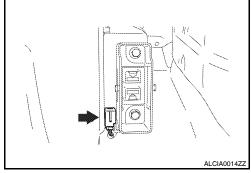
NG >> Replace service plug grip.

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.



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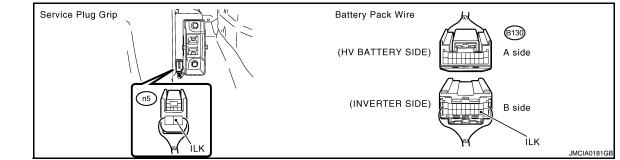
18. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - SERVICE PLUG GRIP)

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	Resistance	
B130	19 (ILK)	n5	1 (ILK)	Below 1Ω	



HBC-148

< COMPONENT DIAGNOSIS >

- 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.

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

- Check the condition of the compressor fuse cover interlock. 3.
 - Dirt or foreign objects have not entered the connection
 - There is no evidence of contamination.

OK or NG

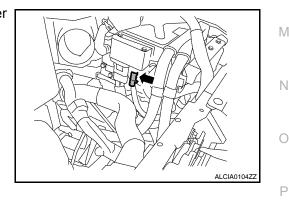
- OK >> GO TO 20.
- NG >> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").

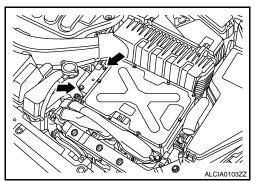


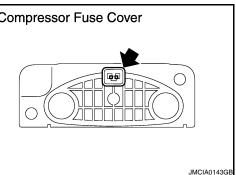
CAUTION:

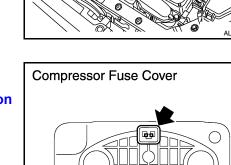
Be sure to wear insulated gloves.

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









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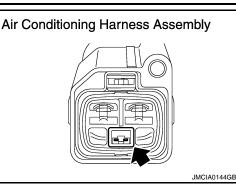
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- 3. Check the condition of the air conditioning harness assembly interlock.
 - Dirt or foreign objects have not entered the connection
 There is no evidence of contamination.

OK or NG

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



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

Refer to <u>HBC-109</u>, "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		
Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	94 (ILK)	E69	12 (ILKI)	Below 1Ω

OK or NG

OK >> Replace hybrid vehicle control ECU (See <u>HBC-644, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

The hybrid vehicle control ECU detects this DTC and effects fail-safe control if the engine or hybrid transaxle

< COMPONENT DIAGNOSIS >

P0A0F-238

Description

INFOID:000000004211801

gear has seized up, or foreign objects have been caught in either of them. Hybrid Transaxle HBC Generator Motor D 000CЕ Engine F Н -Ring Gear -Sun Gear (Motor) **Ring Gear** Pinion Gear Sun Gear (Generator) Pinion Gear Motor Speed Reduction Planetary Gear Unit Power Split Planetary Gear Unit JMCIA0094GB

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:000000004211802

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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 transax- le input malfunction (engine sys- tem)]	 Engine Hybrid transaxle (shaft, gear) Transmission input damper Wire harness or connector Hybrid vehicle control ECU 	N

Diagnosis Procedure

INFOID:000000004211803

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.

HBC-151

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P0A0F-238

< COMPONENT DIAGNOSIS >

• 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".

<u>OK or NG</u>

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:

P0A0F-238

< COMPONENT DIAGNOSIS >

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.

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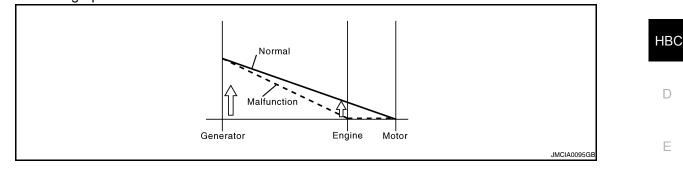
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- If this DTC (P0A0F-238) is output, the HV battery may be dead and DTC P3000-388 or P3000-389 may be output.
- Refer to the graph for data list confirmation of "MG1 REVOLUTION" and "ENGINE SPEED". 4.



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").

\frown		
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	>> GO TO 11.	
	>> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
11 .c⊦	IECK 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:

HBC-153

P0A0F-238

< COMPONENT DIAGNOSIS >

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.

<u>OK or NG</u>

- OK >> Replace hybrid vehicle control ECU (See <u>HBC-644, "Removal and Installation"</u>).
- 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 <u>TM-36, "Removal and Installation"</u>).
- NG >> Check and repair engine.

P0A10-263

< COMPONENT DIAGNOSIS >

P0A10-263

Description

INFOID:000000004211804

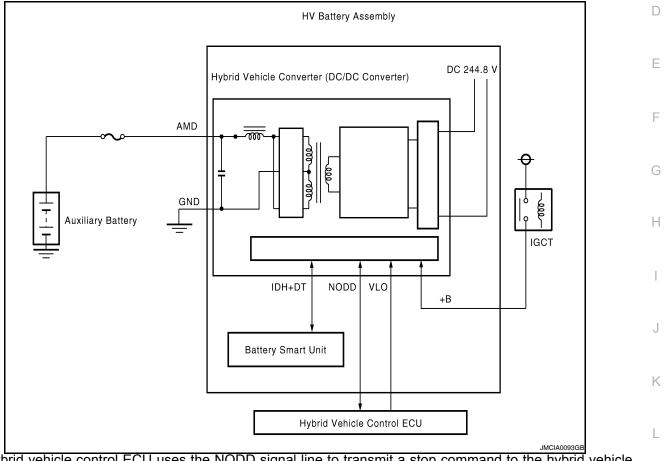
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The hybrid vehicle converter (DC/DC converter) converts the DC 244.8 V of the HV battery into DC 12 V in order to supply power to areas such as the vehicle's lighting, audio, and ECU systems. In addition, it charges the auxiliary battery.

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.



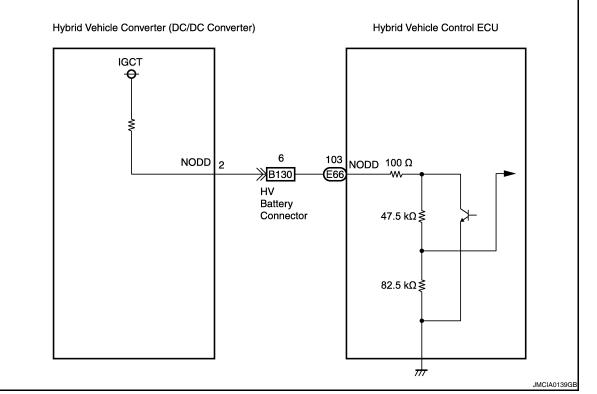
The hybrid vehicle control ECU uses the NODD signal line to transmit a stop command to the hybrid vehicle converter (DC/DC converter) and receive signals indicating the normal or abnormal condition of the 12 V charging system.

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.

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DTC Logic

INFOID:000000004211805

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:000000004211806

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.
- $\mathbf{3}$. CHECK HARNESS AND CONNECTOR
- 1. Turn ignition switch OFF.

P0A10-263

< COMPONENT DIAGNOSIS >

- 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	oack wire			
Harness connector	lerminal		Voltage	
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

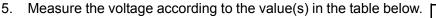
OK >> GO TO 4. NG >> GO TO 5.

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

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.



Battery	pack wire		
Component connector	' Iorminai		Voltage
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.

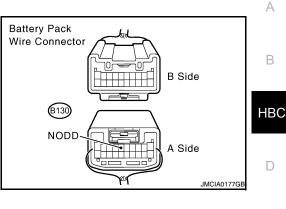
- Turn ignition switch OFF. 6.
- 7. Measure the resistance according to the value(s) in the table below.

Battery pack	wire connector			
Component connector	· Jerminal		Resistance	
B130	6 (NODD)	Each of the other terminals	10 k Ω or higher	

OK or NG

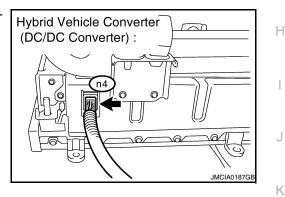
OK >> Replace hybrid vehicle converter (See <u>HBC-644, "Removal and Installation"</u>).

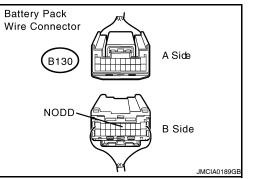
NG >> Repair or replace harness or connector.





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HBC-157

P0A10-263

< COMPONENT DIAGNOSIS >

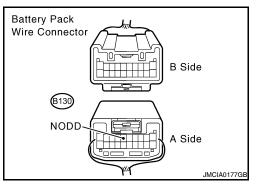
$5. {\sf check harness and connector (hybrid vehicle control ecu - battery pack wire)}$

- 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	oack wire			
Harness connector	lerminal		Voltage	
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 <u>HBC-644, "Removal and Installation"</u>).
- NG >> Repair or replace harness or connector.

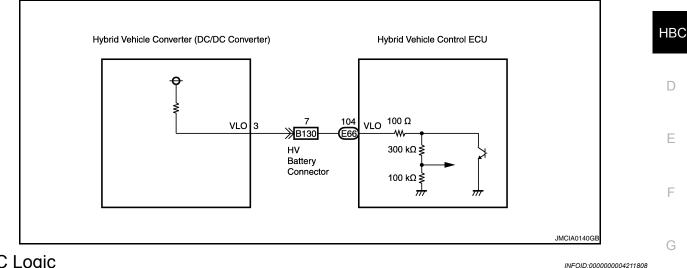
P0A10-592

Description

INFOID:000000004211807

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



DTC Logic

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INFOID:000000004211809

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 mal- function (+B short)	Wire harness or connectorHybrid vehicle control ECU

Diagnosis Procedure

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

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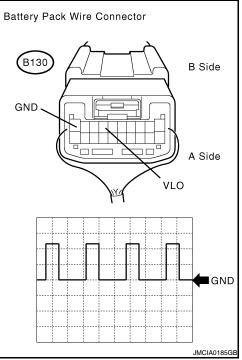
1. Connect an oscilloscope between the battery pack wire terminals specified in the table below, and measure the waveform.

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.

<u>OK or NG</u>				
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	oack wire		
Harness connector	Terminal	Ground	Voltage
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.

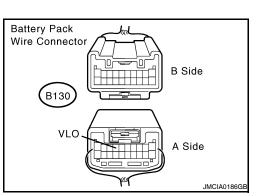
CAUTION:

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.



P0A10-592

< COMPONENT DIAGNOSIS > 3. Disconnect the hybrid vehicle converter (DC/DC converter) con-Hybrid Vehicle Converter nector n4. \overline{n} А (DC/DC Converter) : 4. Turn ignition switch ON. В HBC JMCIA0187GE D 5. Measure the voltage according to the value(s) in the table below. Wire Harness Side : Ε Battery Pack Wire Hybrid Vehicle Converter (DC/DC Converter) B130 F A side B side Н n4 λιο VLO JMCIA0188GE Battery pack wire Ground Voltage Component Terminal connector B130 7 (VLO) Below 1V Ground Κ Hybrid vehicle converter (DC/DC converter) L Ground Voltage Harness Terminal connector n4 3 (VLO) Ground Below 1V Μ 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. Ν OK or NG OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "Removal and Installation"). NG >> Repair or replace harness or connector. Ο **5.**CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR) Ρ 1. Turn ignition switch OFF. 2. Disconnect E66 hybrid vehicle control ECU harness connector. 3. Turn ignition switch ON.

P0A10-592

< COMPONENT DIAGNOSIS >

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

Battery	oack wire			
Component connector	Terminal	Ground	Voltage	
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 <u>HBC-644</u>, "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 <u>HBC-644</u>, "Removal and Installation").

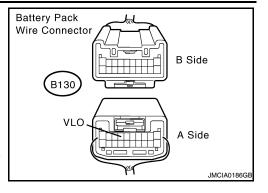
NO >> GO TO 8.

8.CHECK FOR INTERMITTENT INCIDENT

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

<u>OK or NG</u>

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



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

< COMPONENT DIAGNOSIS >

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

Description

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

DTC Logic

INFOID:000000004211811

INFOID:000000004211810

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	E
	151		Run pulse error		
	155		A/D error		
P0A1A	156	Generator Control Module	ROM-RAM error	Inverter with converter assembly (MG ECU)	F
	158		CPU recognition error		
	166		R/D converter NM stop error		G
	658		ALU error		G
	659		Communication error (from MG1 to MG2)		
	791		R/D converter communication error		Н

Diagnosis Procedure

INFOID:000000004211812

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	M
Refer to HBC-638, "Removal and Installation".	
>> COMPLETED	Ν
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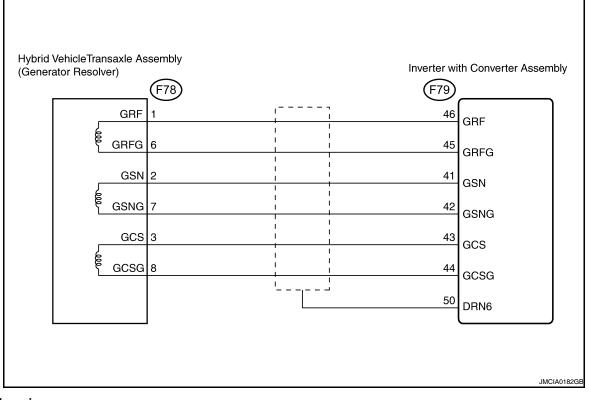
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P0A1A-200, P0A1A-792, P0A1A-793

Description

INFOID:000000004211813

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



DTC Logic

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:000000004211815

INFOID:000000004211814

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.

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< COMPONENT DIAGNOSIS >

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

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• 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					
DT	C No.	Relevant	Diagnosis		D
P0A4B-253, P0A4	C-513, P0A4D-255	Generator re	solver circuit		
Is any DTC dete YES >> Go NO >> GO	to Diagnosis Pro	ocedure relevan	t to output DTC.		E
3.CHECK CON NECTOR)	INECTOR CON	INECTION CON	IDITION (INVE	RTER WITH CONVERTER ASSEMBLY CON-	F
See <u>HBC-109,</u> "	Diagnosis Proc	<u>edure"</u> .			C
<u>OK or NG</u>					G
4	nnect securely.				Н
4.CHECK CON	INECTOR CON	NECTION CON	DITION (GENE	RATOR RESOLVER CONNECTOR)	
		e generator reso <mark>ected securely</mark>		no contact problems.	
OK or NG OK >> GO NG >> Cor	TO 5. inect securely.				J
5.CHECK HAR	NESS AND CO	NNECTOR (INV	ERTER WITH C	CONVERTER ASSEMBLY - GENERATOR RE-	17
SOLVER)					Κ
CAUTION: Be sure to wea 1. Turn ignitior NOTE:		ves. Id remove the se	ervice plug grip.		L
After remov the repair m 2. Disconnect	anual because	plug grip, do no this may cause a converter asse	a malfunction.	witch to READY position, unless instructed by onnector F79.	M
		ling to the value	(s) in the table t	elow.	Ν
Inverter with cor	overter assembly				
Harness	Terminal	Ground	Voltage		0

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

< COMPONENT DIAGNOSIS >

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.

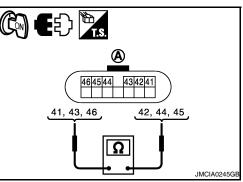
NG >> Repair or replace harness or connector.

6.CHECK GENERATOR RESOLVER

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

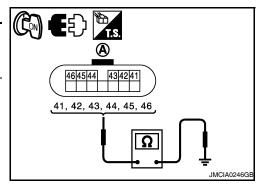
Check for open

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

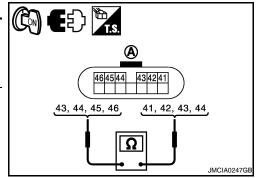


3. Measure the resistance according to the value(s) in the table below.

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



	onverter assem- r (A)	Inverter with converter assem- bly (A)		Resistance
Harness connector	Terminal	Harness connector	Terminal	Resistance
			44 (GCSG)	
	46 (GRF)		43 (GCS)	-
	40 (GRF) 45 (GRFG)		41 (GSN)	
			42 (GSNG)	
		1	44 (GCSG)	
F79		F79	43 (GCS)	10 kΩ or high-
F79			41 (GSN)	er
			42 (GSNG)	
	44 (0000)		41 (GSN)	
	44 (GCSG)		42 (GSNG)	
	42 (CCS)	†	41 (GSN)	
	43 (GCS)		42 (GSNG)	



OK or NG

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

NG >> GO TO 7.

< COMPONENT DIAGNOSIS >

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

- 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	
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Inverter with converter assembly		Motor generator No.1		
Harness connector	Terminal	Harness connector	Terminal	Resistance
	46 (GRF)		1 (GRF)	Below 1 Ω
	45 (GRFG)	F78 -	6 (GRFG)	
F79	41 (GSN)		2 (GSN)	
175	42 (GSNG)		7 (GSNG)	
	43 (GCS)		3 (GCS)	
	44 (GCSG)		8 (GCSG)	

Check for short

Inverter with cor	nverter assembly			
Harness Terminal		Ground	Resistance	
	46 (GRF)		10 kΩ or higher	
	45 (GRFG)			
F79	41 (GSN)	Ground		
175	42 (GSNG)	Ground		
	43 (GCS)			
	44 (GCSG)			

Check for short

Motor gen	erator N0.1			
Harness connector Terminal		Ground	Resistance	
	1 (GRF)		10 kΩ or higher	
	6 (GRFG)	Ground		
F78	2 (GSN)			
F70	7 (GSNG)	Ground		
	3 (GCS)			
	8 (GCSG)			

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< COMPONENT DIAGNOSIS >

Inverter with co	Inverter with converter assembly		nverter assembly	
Harness connector	Terminal	Harness connector Terminal		Resistance
	46 (GRF)		45 (GRFG)	
	43 (GCS)		44 (GCSG)	-
	41 (GSN)		42 (GSNG)	_
	46 (GRF)		44 (GCSG)	-
	46 (GRF)		43 (GCS)	-
	46 (GRF)		41 (GSN)	
	46 (GRF)		42 (GSNG)	=
F79	45 (GRFG)	F79	44 (GCSG)	10 k Ω or higher
	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)	1

NOTE:

The generator resolver is not available separately. If it requires replacement, replace the hybrid transaxle. OK or NG

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

P0A1A-658, P0A1A-659, P0A1A-791

Description

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

DTC Logic

INFOID:000000004211817

INFOID:000000004211816

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	E
	151	151	Run pulse error		
	155		A/D error		
	156		ROM-RAM error		
P0A1A	158	Generator Control Module	CPU recognition error	Inverter with converter assembly (MG ECU)	
PUATA	166		R/D converter NM stop error		G
	658		ALU error		G
	659		Communication error (from MG1 to MG2)		
	791		R/D converter communication error		Н

Diagnosis Procedure

INFOID:000000004211818

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 N

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

< COMPONENT DIAGNOSIS >

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

Description

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

DTC Logic

INFOID:000000004211820

INFOID:000000004211819

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		IPM positive power source error	
P0A1B	164		IPM negative power source error	
P0A1B	192		A/D error	
P0A1B	193		ROM-RAM error	
P0A1B	195	Drive Motor "A" Control Module	CPU recognition error	
P0A1B	198		R/D converter NM stop error	Inverter with converter assembly (MG ECU)
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:000000004211821

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

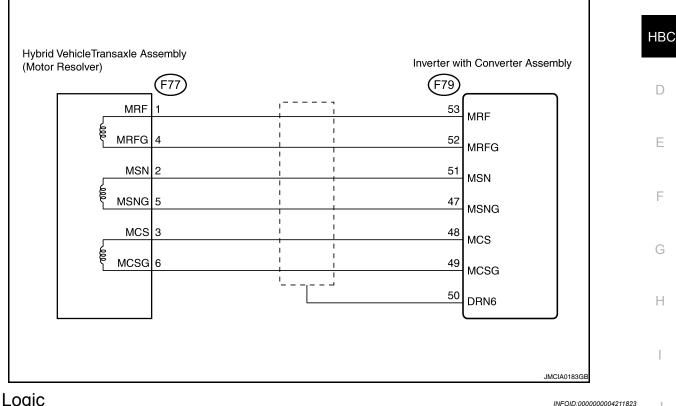
Description

INFOID:000000004211822

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



DTC Logic

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
	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
P0A1B	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:000000004211824

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

HBC-171

P0A1B-168, P0A1B-795, P0A1B-796

< COMPONENT DIAGNOSIS >

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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

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.

b.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-ER)

Be sure to wear insulated gloves.

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

P0A1B-168, P0A1B-795, P0A1B-796

< COMPONENT DIAGNOSIS >

NOTE:

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

OK or NG

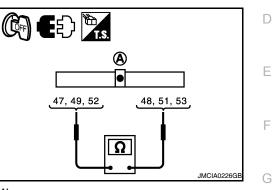
- OK >> GO TO 6.
- NG >> Repair or replace harness or connector.

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



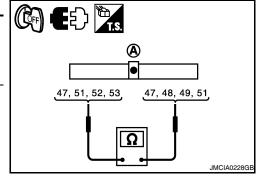
Measure the resistance according to the value(s) in the table below.

Check	for	short	

OK or NG OK

Check for short				
Inverter with conv	verter assembly (A)			
Harness connector	Terminal	Ground Res	Resistance	<u> </u>
	53 (MRF)	- Ground		47, 48, 49, 51, 52, 53
	52 (MRFG)		Ground 10 kΩ or higher	
F79	51 (MSN)			
F79	47 (MSNG)			
	48 (MCS)			— —
	49 (MCSG)			

Inverter with converter assem- bly (A)		Inverter with converter assem- bly (A)		Resistance	
Harness connector	Terminal	Harness connector	Terminal	Resistance	
			51 (MSN)		
	53 (MRF)		49 (MCSG)		
	52 (MRF)		48 (MCS)		
			47 (MSNG)		
			51 (MSN)		
F70		570	49 (MCSG)	10 k Ω or high	
F79		F79	48 (MCS)	er	
			47 (MSNG)		
			48 (MCS)		
	51 (MSN)		49 (MCSG)		
	47 (MSNC)		48 (MCS)		
	47 (MSNG)		47 (MSNG)		



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>> Replace inverter with converter assembly (See HBC-638, "Removal and Installation"). **HBC-173**

NG >> GO TO 7.

 $7. \mbox{CHECK}$ 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 assem- bly		Motor generator No.2		Resistance
Harness connector	Terminal	Harness connector	Terminal	Resistance
	53 (MRF)		1 (MRF)	
	52 (MRFG)	F77	4 (MRFG)	
F79	51 (MSN)		2 (MSN)	Below 1 Ω
F79	47 (MSNG)		5 (MSNG)	Below 1 22
	48 (MCS)		3 (MCS)	
	49 (MCSG)	1	6 (MCSG)	

Check for short

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

Check for short

Motor gen	erator N0.2			
Harness connector	Ierminal		Resistance	
	1 (MRF)			
	4 (MRFG)		10 k Ω or higher	
F77	2 (MSN)	Ground		
FII	5 (MSNG)	Ground		
	3 (MCS)			
	6 (MCSG)			

P0A1B-168, P0A1B-795, P0A1B-796

< COMPONENT DIAGNOSIS >

Inverter with converter assem- bly		Inverter with converter assem- bly		Desistance
Harness connector	Terminal	Harness connector	Terminal	Resistance
	53 (MRF)		52 (MRFG)	
	51 (MSN)	-	47 (MSNG)	
	48 (MCS)		49 (MCSG)	
	53 (MRF)		51 (MSN)	
	53 (MRF)		49 (MCSG)	
·	53 (MRF)		48 (MCS)	
	53 (MRF)		47 (MSNG)	
F79	52 (MRFG)	F79	51 (MSN)	10 kΩ or high- er
	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)	1	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 <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

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

< COMPONENT DIAGNOSIS >

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

Description

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

DTC Logic

INFOID:000000004211826

INFOID:000000004211825

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		IPM positive power source error	
P0A1B	164		IPM negative power source error	
P0A1B	192		A/D error	
P0A1B	193		ROM-RAM error	
P0A1B	195	Drive Motor "A" Control	CPU recognition error	
P0A1B	198		R/D converter NM stop error	Inverter with converter assembly (MG ECU)
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:000000004211827

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

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.

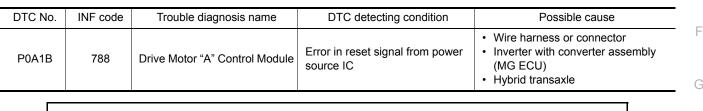
DTC Logic

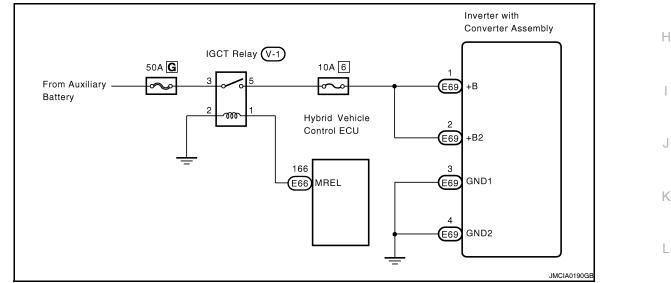
INFOID:000000004211829

INFOID:000000004211828

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.





Diagnosis Procedure

INFOID:000000004211830

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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".

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<u>OK or NG</u>

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 <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System</u>").

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 Terminal		Resistance
E69	1 (+B)	V-1	5 (IGCT relay)	Below 1 Ω
L09	2 (+B2)	v-1	J (IGCT leidy)	

Inverter with cor	nverter assembly		Resistance
Harness connector	Terminal	Ground	
E69	3 (GND1)	Ground	Below 1 Ω
E09	4 (GND2)	Ground	Below 1 22

Check for short

Inverter with cor	nverter assembly		
Harness connector		Ground	Resistance
E69	1 (+B)	Ground	150 Ω or higher
E09	2 (+B2)	Ground	150 22 OF Higher

5. Remove 10A fuse (No. 67).

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

Check for short

Inverter with cor	nverter assembly		
Harness Terminal		Ground	Resistance
E69	1 (+B)	Ground	10 k Ω or higher
209	2 (+B2)	Ground	

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.

P0A1B-788

< COMPONENT DIAGNOSIS >

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:

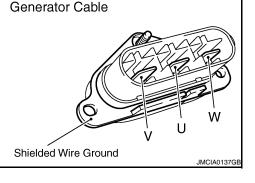
Be sure to wear insulated gloves.

- 1. Check that the service plug grip is not installed.
- Disconnect the generator cable and motor cable from the inverter with converter assembly (See HBC-638, "Removal and Installation").
- 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 m Ω
V	W	56 to 62 m Ω
W	U	56 to 62 m Ω



NOTE:

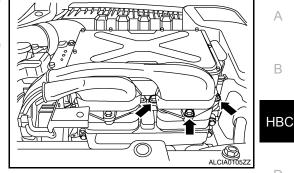
To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 20°C.

HBC-179

R20 = Rt / [1 + 0.00393 X (T - 20)]

The calculation is based on the following:

- **R20** : Resistance at 20°C (m Ω)
- Rt : Measured resistance (m Ω)
- T. : Temperature when the resistance is measured (°C)



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< COMPONENT DIAGNOSIS >

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		
V	Body ground and shielded wire ground	20 $M\Omega$ or higher
W		

OK or NG

OK >> GO TO 7.

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

1.INSPECT HYBRID TRANSAXLE (MG2)

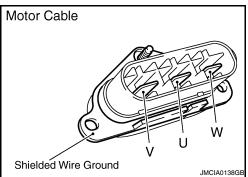
CAUTION:

Be sure to wear insulated gloves.

- 1. Check that the service plug grip is not installed.
- Disconnect the generator cable and motor cable from the inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").
- 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 m Ω
V	W	66.5 to 73.5 m Ω
W	U	66.5 to 73.5 m Ω



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 (m Ω)
- **Rt** : Measured resistance (m Ω)

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		
V	Body ground and shielded wire ground	20 M Ω or higher
W		

OK or NG

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

P0A1B-788

< COMPONENT DIAGNOSIS >

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

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P0A1D-134, P0A1D-135, P0A1D-570

Description

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

DTC Logic

INFOID:000000004211832

INFOID:000000004211831

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
	134			
P0A1D	135	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU
	570			

Diagnosis Procedure

INFOID:000000004211833

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".

P0A1D-140

Description

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

DTC Logic

INFOID:000000004211835

INFOID:000000004211836

INFOID:000000004211834

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

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

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P0A1D-141

Description

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

DTC Logic

INFOID:000000004211838

INFOID:000000004211837

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:000000004211839

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".

P0A1D-144, P0A1D-145

Description

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

DTC Logic

INFOID:000000004211841

INFOID:000000004211840

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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	E
P0A1D	144	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU	
	145				

Diagnosis Procedure

INFOID:000000004211842

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".

P0A1D-148

Description

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

DTC Logic

INFOID:000000004211844

INFOID:000000004211843

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:000000004211845

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".

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

< COMPONENT DIAGNOSIS >

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

Description

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

DTC Logic

INFOID:000000004211847

INFOID:000000004211846

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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	F
	821				
	822				
	823				G

Diagnosis Procedure

INFOID:000000004211848

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

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P0A1D-179

Description

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

DTC Logic

INFOID:000000004211850

INFOID:000000004211849

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:000000004211851

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".

P0A1D-187

Description

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

DTC Logic

INFOID:000000004211853

INFOID:000000004211854

INFOID:000000004211852

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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	E
P0A1D	187	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU	

Diagnosis Procedure

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".

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P0A1D-390, P3004-133

Description

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

DTC Logic

INFOID:000000004211856

INFOID:000000004211855

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 ve- hicle control ECU	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:000000004211857

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 <u>HBC-644</u>, "Removal and Installation").

P0A1D-393

Description

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

DTC Logic

INFOID:000000004211859

INFOID:000000004211860

INFOID:000000004211858

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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	Е
_	P0A1D	393	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU	

Diagnosis Procedure

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
 H 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".

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

< COMPONENT DIAGNOSIS >

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

Description

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

DTC Logic

INFOID:000000004211862

INFOID:000000004211861

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			
P0A1D	722			
P0A1D	723	Hybrid Powertrain Control Module	ECU internal error	Hybrid vehicle control ECU
P0A1D	765			
P0A1D	787			

Diagnosis Procedure

INFOID:000000004211863

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".

P0A1D-924, P0A1D-925

Description

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

DTC Logic

INFOID:000000004211865

INFOID:000000004211864

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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 D 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	E
P0A1D	924	Hybrid Powertrain Control Module	ECU internal error is detected. (Resister value stuck-CAN BUS 1)	Hybrid vehicle control ECU	E
P0A1D	925	Hybrid Powertrain Control Module	ECU internal error is detected. (Resister value stuck-CAN BUS 2)	Hybrid vehicle control ECU	Г

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

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

>> GO TO 2. 2.PERFORM DTC CONFIRMATION PROCEDURE	I
 Turn ignition switch ON and wait at least 5 seconds. Check DTC. <u>Is DTC detected?</u> YES >> Go to <u>HBC-193, "Diagnosis Procedure"</u>. NO >> INSPECTION END 	J
Diagnosis Procedure	
1.PRECONDITIONING	L
 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. 	M
 Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly. 	
>> GO TO 2.	0
2.REPLACE HYBRID VEHICLE CONTROL ECU	Ρ
Refer to <u>HBC-644, "Removal and Installation"</u> .	

>> INSPECTION END

HBC-193

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P0A1F-129

Description

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

DTC Logic

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 mal- function	Battery smart unit

Diagnosis Procedure

INFOID:000000004211869

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)

2. Check DTC.

HBC-194

INFOID:000000004211867

INFOID-000000004211868

^{1.} Turn ignition switch ON.

P0A1F-129

< COMPONENT DIAGNOSIS >

DTC No. Relevant Diagnosis P0A60 (all INF codes) Drive motor "A" Phase W current P0A72 (all INF codes) Generator Phase W current P0A75 (all INF codes) Generator Phase W current NO >> Go to Diagnosis Procedure relevant to output DTC. NO >> Replace battery smart unit (See HBB-101, "Removal and Installation").			
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.			
P0A72 (all INF codes)Generator Phase V currentP0A75 (all INF codes)Generator Phase W currentIs DTC detected?YES >> Go to Diagnosis Procedure relevant to output DTC.			
P0A75 (all INF codes)Generator Phase W currentIs DTC detected?YES>> Go to Diagnosis Procedure relevant to output DTC.			
Is DTC detected? YES >> Go to Diagnosis Procedure relevant to output DTC.			
YES >> Go to Diagnosis Procedure relevant to output DTC.		s) Generator Phase W current	
YES >> Go to Diagnosis Procedure relevant to output DTC. NO >> Replace battery smart unit (See <u>HBB-101, "Removal and Installation"</u>).			
	YES >> Go to Diagn	nosis Procedure relevant to output DTC. ttery smart unit (See HBB-101, "Removal and Insta	llation")
			<u>ilation</u>).

P0A1F-150, P0A1F-157

Description

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:000000004211871

INFOID:000000004211870

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 dis- charge.	 Battery smart unit Wire harness or connector Auxiliary battery Fuse (No. 68) IGCT relay

Diagnosis Procedure

INFOID:000000004211872

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 <u>HBC-</u><u>80, "Diagnosis Description"</u>).

>> 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 <u>HBC-632</u>, "<u>Precautions for Inspecting the</u> <u>Hybrid Control System</u>").
- 2. Remove the luggage compartment trim cover front (See INT-27, "Removal and Installation").
- 3. Disconnect the frame wire (See <u>HBC-648, "Removal and Installation"</u>).
- 4. Remove the battery bracket sub-assembly (See <u>HBB-97, "Removal and Installation"</u>).

HBC-196

P0A1F-150, P0A1F-157

< COMPONENT DIAGNOSIS >

- 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.
- Measure the voltage according to the value(s) in the table below. 8.

Battery s	Battery smart unit		Battery smart unit	
Harness connector	Terminal	Harness connector	Terminal	Voltage
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.

Measure the resistance of the fuse. 2.

Resistance : Below 10

OK or NG

OK >> GO TO 5.

NG >> Replace fuse.

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

CAUTION:

Be sure to wear insulated gloves.

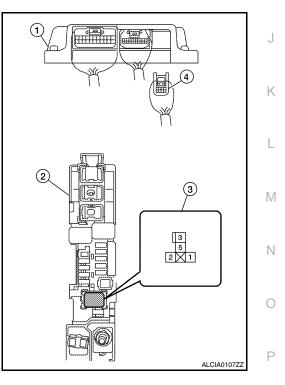
- 1. Install the 10A fuse to the high voltage fuse and fusible link box.
- 2. Remove the IGCT relay (3) from the high voltage fuse and fusible link box (2).
- 3. Disconnect connector n2 (4) from the battery smart unit (1).
- 4. Measure the resistance according to the value(s) in the table below.

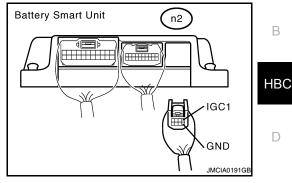
Battery smart unit		high voltage fuse and fusible link box		Resistance
Harness connector	Terminal	Harness connector	Terminal	Resistance
n2	1 (IGC1)	V-1	5 (IGCT relay)	Below 1 Ω

OK or NG

OK >> Check and repair power source circuit.

NG >> Repair or replace harness or connector.







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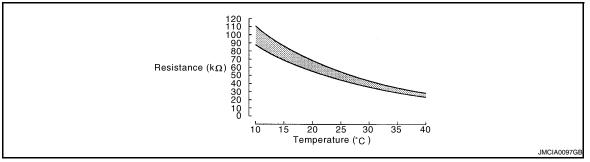
В

P0A2B-248, P0A2B-250

Description

INFOID:000000004211873

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:000000004211874

DTC DETECTION LOGIC

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A2B 248 Drive Motor "A" Temperature Sensor Circuit Range / Perfor-		Motor temperature sensor mal- function	Hybrid transaxle (Motor temperature	
1 0/20	250	mance	Motor temperature sensor per- formance problem	sensor)

Diagnosis Procedure

INFOID:000000004211875

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.

<u>OK or NG</u>

- OK >> GO TO 3.
 - >> Connect securely.
- **3**.REPLACE HYBRID TRANSAXLE

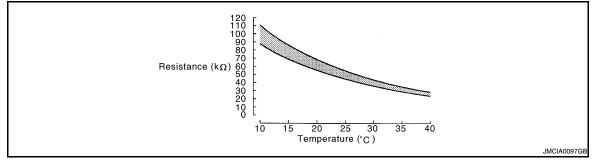
Refer to TM-36, "Removal and Installation".

P0A2C-247, P0A2D-249

Description

INFOID:000000004211876

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:000000004211877

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 tem- perature sensor circuit	 Wire harness or connector Hybrid vehicle control ECU Hybrid transaxle (Motor temperature sensor)

Diagnosis Procedure

INFOID:000000004211878

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 M converter assembly.

>> GO TO 2.

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

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 3.

NG >> Connect securely.

 $\mathbf{3}$. 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.

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<u>OK or NG</u>

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	В	С	
-50°C (-58°F)	205°C (401°F) or more	Same as actual temperature	

<u>A or B or C</u>

A >> GO TO 5.

B >> GO TO 7.

C >> Check for intermittent incident (See <u>GI-42, "Intermittent Incident"</u>).

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

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

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 vehicl	e control ECU		
Harness connector	lerminal		Voltage
E65	16 (MMT)	Ground	Below 1 V
205	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 vehicl	Hybrid vehicle control ECU		Motor temperature sensor		
Harness connector	Terminal	Harness connector Terminal		Resistance	
E65	16 (MMT)	F69	7 (MMT)	Below 1 Ω	
205	15 (MMTG)	109	9 (MMTG)	Below 1 32	

P0A2C-247, P0A2D-249

< COMPONENT DIAGNOSIS >

Hybrid vehicl Harness						
Harness	e control ECU					А
connector	Terminal	Ground	Resistan	ce		
E65	16 (MMT) 15 (MMTG)	Ground	10 kΩ or hi	gher		В
						HB
Motor tempe	erature sensor					
Harness connector	Terminal	Ground	Resistan	се		D
F69	7 (MMT) 9 (MMTG)	Ground	10 k Ω or hi	gher		
OK or NG						E
OK >> F NG >> F 7 .READ VA	Repair or repla	ce harness MONITOR	or connecto (MG1 MOT	rs. OR TEMP)	emoval and Installation").	F
 Turn igni Select "M 	tion switch ON	l		ess connector F DR mode with C		G
Disul						Н
	ayed tempera	iture :-5	0°C (-58°F)			
OK or NG						
	Replace hybrid	transaxle (S	See <u>1M-36.</u>	"Removal and li	<u>istallation"</u>).	
^					ONTROL ECU - MOTOR TEMPERATUR	
SENSOR)						
,	ect the hybrid					
		ehicle contr	ol ECU hari	ness connector		J
	ect the motor to			ness connector l nector F69.		
		emperature	sensor conr		E65.	
	the resistance	emperature	sensor conr	nector F69.	E65.	J
3. Measure Check for o	the resistance	emperature e according f	sensor conr	nector F69. (s) in the table b	E65.	J
3. Measure Check for o	the resistance	emperature e according f	sensor conr to the value	r Resistance	E65.	J
3. Measure Check for of Hybrid vehicl Harness connector	the resistance pen e control ECU	emperature e according t Motor temp Harness connector	sensor conr to the value	r Resistance	E65.	J K L
3. Measure Check for op Hybrid vehicl Harness	the resistance pen e control ECU Terminal	emperature e according t Motor temp Harness	sensor conr to the value perature senso Termina	r Resistance Below 1Ω	E65.	J K L
3. Measure Check for of Hybrid vehicl Harness connector	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG)	emperature e according t Motor temp Harness connector	sensor conr to the values perature senso Termina 7 (MMT)	r Resistance Below 1Ω	E65.	J K L
3. Measure Check for op Hybrid vehicl Harness connector E65 Check for sl	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG)	Motor temp Harness connector F69	sensor conr to the values perature senso Termina 7 (MMT)	r Resistance Below 1Ω	E65.	J K L
3. Measure Check for op Hybrid vehicl Harness connector E65 Check for sl	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG)	Motor temp Harness connector F69	sensor conr to the values perature senso Termina 7 (MMT)	r Resistance Below 1Ω	E65.	J K L M
3. Measure Check for of Hybrid vehicl Harness connector E65 Check for sl Hybrid ve Harness connector	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG) nort ehicle control ECU	Motor temp Harness connector F69	sensor conr to the values perature senso Termina 7 (MMT) 9 (MMTC Ground	r Resistance Below 1Ω Resistance	E65.	K L M
3. Measure Check for of Hybrid vehicl Harness connector E65 Check for sl Hybrid ve Harness	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG) nort ehicle control ECU Termin	Motor temp Harness connector F69	sensor conr to the value perature senso Termina 7 (MMT) 9 (MMTC	the table b (s) in the table b Resistance Below 1Ω	E65.	J K L M
3. Measure Check for of Hybrid vehicl Harness connector E65 Check for sl Hybrid ve Harness connector	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG) nort ehicle control ECU Termin 16 (MM	Motor temp Harness connector F69	sensor conr to the values perature senso Termina 7 (MMT) 9 (MMTC Ground	r Resistance Below 1Ω Resistance	E65.	J K L M
3. Measure Check for op Hybrid vehicl Harness connector E65 Check for sl Hybrid ve Harness connector E65	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG) nort ehicle control ECU Termin 16 (MM	Motor temp Harness connector F69	sensor conr to the values perature senso Termina 7 (MMT) 9 (MMTC Ground	r Resistance Below 1Ω Resistance	E65.	J K L M N O
3. Measure Check for op Hybrid vehicl Harness connector E65 Check for sl Hybrid ve Harness connector E65	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG) nort ehicle control ECU Termin 16 (MM 15 (MM	Motor temp Harness connector F69	sensor conr to the values perature senso Termina 7 (MMT) 9 (MMTC Ground	r Resistance Below 1Ω Resistance	E65.	J K L M N O
3. Measure Check for of Hybrid vehicl Harness connector E65 Check for sl Hybrid ve Harness connector E65 E65 Motor te Harness	the resistance pen e control ECU Terminal 16 (MMT) 15 (MMTG) nort ehicle control ECU Termir 16 (MM 15 (MM	emperature e according f Motor temp Harness connector F69 J J al IT) TG)	sensor conr to the values perature senso Termina 7 (MMT) 9 (MMTC Ground Ground	r Resistance Resistance Resistance Resistance 10 kΩ or higher	E65.	J K L M N

HBC-201

P0A2C-247, P0A2D-249

< COMPONENT DIAGNOSIS >

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

P0A37-258, P0A37-260

Description

INFOID:000000004211879

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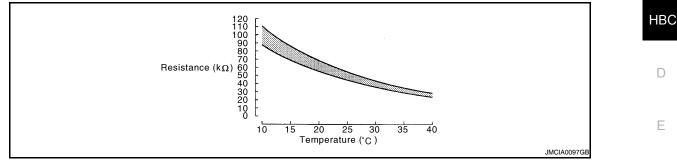
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The resistance of the thermistor built into the motor temperature sensor changes in accordance with changes В in MG2 temperature. The lower the MG2 temperature, the more the thermistor resistance. Conversely, the more the temperature, the lower the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



DTC Logic

INFOID:000000004211880

DTC DETECTION LOGIC

DTC No. **INF** Code Trouble diagnosis name DTC detecting condition Possible cause Generator temperature sensor Н 258 malfunction Hybrid transaxle (Generator temper-Generator Temperature Sensor P0A37 Circuit Range/Performance ature sensor) Generator temperature sensor 260 performance problem

Diagnosis Procedure

INFOID:000000004211881

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 connec-TOR)

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".

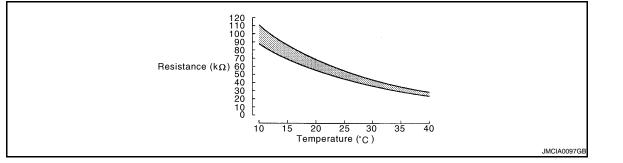
HBC-203

P0A38-257, P0A39-259

Description

INFOID:000000004211882

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:000000004211883

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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) 	ŀ
P0A39	259	Generator Temperature Sensor Circuit High	Open or +B short in generator tem- perature sensor circuit	 Wire harness or connector Hybrid vehicle control ECU Hybrid transaxle (Generator temperature sensor) 	1

Diagnosis Procedure

DTC DETECTION LOGIC

INFOID:000000004211884

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 <u>HBC-109</u>, "Diagnosis Procedure".

OK or NG

OK >> GO TO 3.

NG >> Connect securely.

 $\mathbf{3}$.check connector connection condition (generator temperature sensor connector)

Check the connections of the generator temperature sensor connector.

HBC-205

- 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.

А	В	С	
50°C (-58°F)	205°C (401°F) or more	Same as actual temperature	

<u>A or B or C</u>

A >> GO TO 5.

B >> GO TO 7.

C >> Check for intermittent incident (See <u>GI-42, "Intermittent Incident"</u>).

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 <u>TM-36. "Removal and Installation"</u>).

NG >> GO TO 6.

6.CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - GENERATOR TEMPERA-TURE 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 vehicl	e control ECU			
Harness connector	lerminal		Voltage	
E65	14 (GMT)	Ground	Below 1 V	
E05	13 (GMTG)	Ground	Below I v	

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.

P0A38-257, P0A39-259

COMPONE Check for ope		15 >				
•	e control ECU	Generato	or tem	perature sensor		-
Harness connector	Terminal	Harnes		Terminal	Resistance	
E65	14 (GMT) 13 (GMTG)	- F78	78 4 (GMT) 9 (GMTG)		— Below 1 Ω	-
Check for sho	ort					-
Hybrid v	ehicle control ECL	J				-
Harness connector	Termi	nal	C	Ground	Resistance	
E65	14 (GI	VT)	Ċ	Ground	10 k Ω or higher	_
200	13 (GN	ITG)		Jiouna	le kil er nigher	_
						_
	r temperature sens	sor	C	Ground	Resistance	
Harness connector	Termi	nal	,	Siouna	Resistance	
F7 0	4 (GN	<i>И</i> Т)				_
F78	9 (GM	TG)	(Ground	10 k Ω or higher	
NG >> Re READ VAL	epair or replace UE OF DATA N	e harness /IONITOR	or co (MG	nnector. 2 MOTOR TI		al and Installation"). 8.
4. Read the	indication.				ode with CONSU	JLT-111.
	yed temperati	ure :-	50°C	(-58°F)		
	eplace hybrid t O TO 8.	ransaxle (See	<u> [M-36, "Rem</u>	oval and Installa	i <u>tion"</u>).
B. CHECK HA		CONNEC	TOR	(HYBRID VE	HICLE CONTR	OL ECU - GENERATOR TEMPERA-
1. Disconneo 2. Disconneo	t the hybrid ve t the generato	r temperat	ture s	ensor harne	connector E65. ss connector F7 the table below.	8.
Check for ope		1				_
•	e control ECU			perature sensor		
Harness connector	Terminal	Harnes		Terminal	Resistance	_
E65	14 (GMT) 13 (GMTG)	- F78		4 (GMT) 9 (GMTG)	Below 1 Ω	
Check for sho	ort					-
Hybrid v	ehicle control ECL	J				-
Harness connector	Termi	nal	C	Ground	Resistance	
	14 (GI	MT)				_

HBC-207

10 $k\Omega$ or higher

Ground

E65

13 (GMTG)

P0A38-257, P0A39-259

< COMPONENT DIAGNOSIS >

Generator tem	perature sensor			
Harness connector	lerminal		Resistance	
F78	4 (GMT)	Ground	10 k Ω or higher	
FTO	9 (GMTG)	Ground		

OK or NG

OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "Removal and Installation").

NG >> Repair or replace harness or connector.

P0A3F-243, P0A40-500, P0A41-245

< COMPONENT DIAGNOSIS >

P0A3F-243, P0A40-500, P0A41-245

Description

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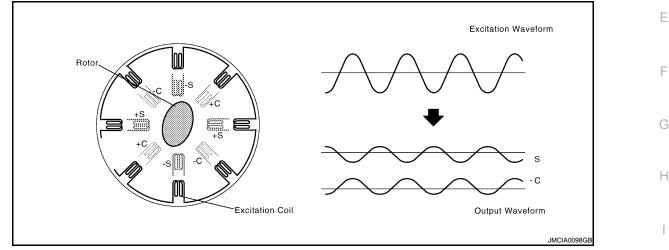
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A resolver is a sensor that detects the position of the magnetic poles, which are indispensable for ensuring _B highly efficient control of MG2 and MG1.

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:000000004211886

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.

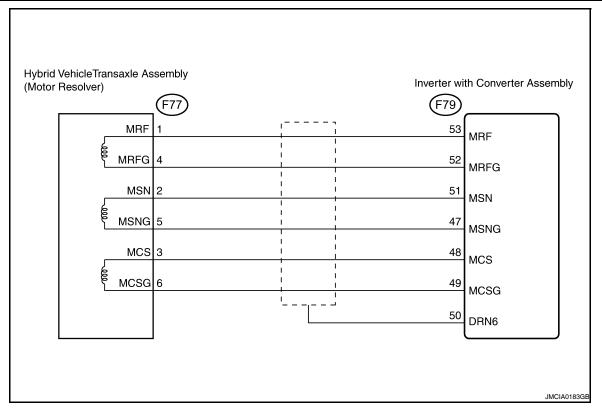
DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause	L
P0A3F	243	Drive Motor "A" Position Sensor Circuit	Interphase short in motor resolver circuit	 Wire harness or connector Hybrid transaxle (Motor resolver) Inverter with converter assembly 	
P0A40	500	Drive Motor "A" Position Sensor Circuit Range/Performance	Motor resolver output is out of nor- mal range	 Wire harness or connector Hybrid transaxle (Motor resolver) Inverter with converter assembly 	IV
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 	N

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P0A3F-243, P0A40-500, P0A41-245

< COMPONENT DIAGNOSIS >



Diagnosis Procedure

INFOID:000000004211887

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 <u>HBC-109. "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 3.

NG >> Connect securely.

 $\mathbf{3}$. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-ER)

See HBC-171. "Diagnosis Procedure".

HBC-210

P0A3F-243, P0A40-500, P0A41-245

< COMPONENT DIAGNOSIS >	
OK or NG	
OK >> GO TO 4. NG >> Repair or replace harness or connector.	A
4.CHECK MOTOR RESOLVER	
See HBC-171, "Diagnosis Procedure".	— В
OK or NG	
OK >> GO TO 5.	HBC
NG >> Replace inverter with converter assembly (See <u>HBC-638</u> , <u>"Removal and Installation"</u>) 5. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	D
OK or NG	
OK >> GO TO 6.	Е
NG >> Connect securely.	
6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOL	_V-
ER) See HBC-171, "Diagnosis Procedure".	F
OK or NG	
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	G
NG >> Repair or replace harness or connector.	
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P0A4B-253, P0A4C-513, P0A4D-255

Description

INFOID:000000004211888

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.

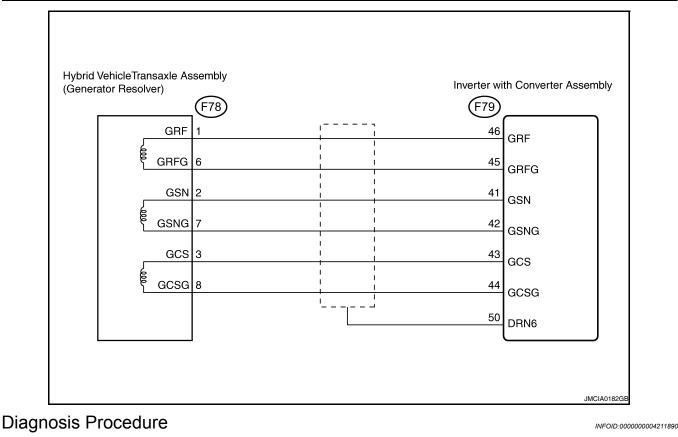
DTC Logic

INFOID:000000004211889

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 re- solver circuit	 Wire harness or connector Hybrid transaxle (Generator resolver) Inverter with converter assembly



1.PRECONDITIONING

P0A4B-253, P0A4C-513, P0A4D-255

< COMPONENT DIAGNOSIS >

 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. 	A B HBC D E
>> GO TO 2.	
2. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-	F
NECTOR)	
See HBC-109, "Diagnosis Procedure".	
OK or NG	G
OK >> GO TO 3.	
NG >> Connect securely.	Н
3. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-	
SOLVER)	
See <u>HBC-164, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> GO TO 4.	J
NG >> Repair or replace harness or connector.	
4.CHECK GENERATOR RESOLVER	
See <u>HBC-164, "Diagnosis Procedure"</u> .	Κ
OK or NG	
 OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). NG >> GO TO 5. 	L
5. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	
See <u>HBC-164</u> , "Diagnosis Procedure".	M
OK or NG	
OK >> GO TO 6.	
NG >> Connect securely.	Ν
6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-	
SOLVER)	\cap
See <u>HBC-164, "Diagnosis Procedure"</u> .	0
OK or NG	
OK>> Replace hybrid transaxle (See TM-36 , "Removal and Installation").NG>> Repair or replace harness or connector.	Ρ

P0A51-174

Description

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

DTC Logic

INFOID:000000004211892

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 connectorInverter with converter assembly

Diagnosis Procedure

INFOID:000000004211893

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	
DA60 (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.

 $\mathbf{3}$. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY)

See <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

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 <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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.

HBC-214

INFOID:000000004211891

P0A51-174

< COMPONENT DIAGNOSIS >

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

OK or NG

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

NG >> Repair or replace harness or connector.

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P0A60-288, P0A60-290, P0A60-294, P0A60-501

Description

INFOID:000000004211894

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:000000004211895

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 assemblyService plug grip
P0A60	290	Drive Motor "A" Phase V Current	Malfunction in motor inverter current sensor (phase V main sensor)	Inverter with converter assemblyService 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 sen- sors 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 assemblyService plug grip
P0A63	298	Drive Motor "A" Phase W Current	Malfunction in motor inverter current sensor (phase W main sensor)	Inverter with converter assemblyService 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 sen- sors offset)	 Inverter with converter assembly Service plug grip

Diagnosis Procedure

INFOID:000000004211896

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

P0A60-288, P0A60-290, P0A60-294, P0A60-501

< COMPONENT DIAGNOSIS >

4

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.	А
>> 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.

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P0A63-296, P0A63-298, P0A63-302, P0A63-502

Description

INFOID:000000004211897

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:000000004211898

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 assemblyService plug grip
P0A60	290	Drive Motor "A" Phase V Current	Malfunction in motor inverter current sensor (phase V main sensor)	Inverter with converter assemblyService 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 assemblyService plug grip
P0A60	501	Drive Motor "A" Phase V Current	Malfunction in motor inverter current sensor (phase V main and sub sen- sors offset)	Inverter with converter assemblyService plug grip
P0A63	296	Drive Motor "A" Phase W Current	Malfunction in motor inverter current sensor (phase W sub sensor)	Inverter with converter assemblyService plug grip
P0A63	298	Drive Motor "A" Phase W Current	Malfunction in motor inverter current sensor (phase W main sensor)	Inverter with converter assemblyService 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 assemblyService plug grip
P0A63	502	Drive Motor "A" Phase W Current	Malfunction in motor inverter current sensor (phase W main and sub sen- sors offset)	Inverter with converter assemblyService plug grip

Diagnosis Procedure

INFOID:000000004211899

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

P0A63-296, P0A63-298, P0A63-302, P0A63-502

< COMPONENT DIAGNOSIS >

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	В
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.	HB
>> Replace service plug grip.	
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P0A72-326, P0A72-328, P0A72-333, P0A72-515

Description

INFOID:000000004211900

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:000000004211901

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 assemblyService plug grip
P0A72	328	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main sensor)	Inverter with converter assemblyService plug grip
P0A72	333	Generator Phase V Current	Malfunction in generator inverter current sensor (Performance problem or open phase V)	Inverter with converter assemblyService plug grip
P0A72	515	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main and sub sensors offset)	Inverter with converter assemblyService plug grip
P0A75	334	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W sub sensor)	Inverter with converter assemblyService plug grip
P0A75	336	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main sensor)	Inverter with converter assemblyService plug grip
P0A75	341	Generator Phase W Current	Malfunction in generator inverter current sensor (Performance problem or open phase W)	Inverter with converter assemblyService plug grip
P0A75	516	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main and sub sensors offset)	Inverter with converter assemblyService plug grip

Diagnosis Procedure

INFOID:000000004211902

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

P0A72-326, P0A72-328, P0A72-333, P0A72-515

< COMPONENT DIAGNOSIS >

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.	А
>> 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. HBC

>> Replace service plug grip.

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P0A75-334, P0A75-336, P0A75-341, P0A75-516

Description

INFOID:000000004211903

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:000000004211904

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 assemblyService plug grip
P0A72	328	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main sensor)	Inverter with converter assemblyService plug grip
P0A72	333	Generator Phase V Current	Malfunction in generator inverter current sensor (Performance problem or open phase V)	Inverter with converter assemblyService plug grip
P0A72	515	Generator Phase V Current	Malfunction in generator inverter current sensor (phase V main and sub sensors offset)	Inverter with converter assemblyService plug grip
P0A75	334	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W sub sensor)	Inverter with converter assemblyService plug grip
P0A75	336	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main sensor)	Inverter with converter assemblyService plug grip
P0A75	341	Generator Phase W Current	Malfunction in generator inverter current sensor (Performance problem or open phase W)	Inverter with converter assemblyService plug grip
P0A75	516	Generator Phase W Current	Malfunction in generator inverter current sensor (phase W main and sub sensors offset)	Inverter with converter assemblyService plug grip

Diagnosis Procedure

INFOID:000000004211905

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

P0A75-334, P0A75-336, P0A75-341, P0A75-516

< COMPONENT DIAGNOSIS >

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.

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>> Replace service plug grip. 4. CONNECT SECURELY	В
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.	HBC
>> Replace service plug grip.	D
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P0A78-113

Description

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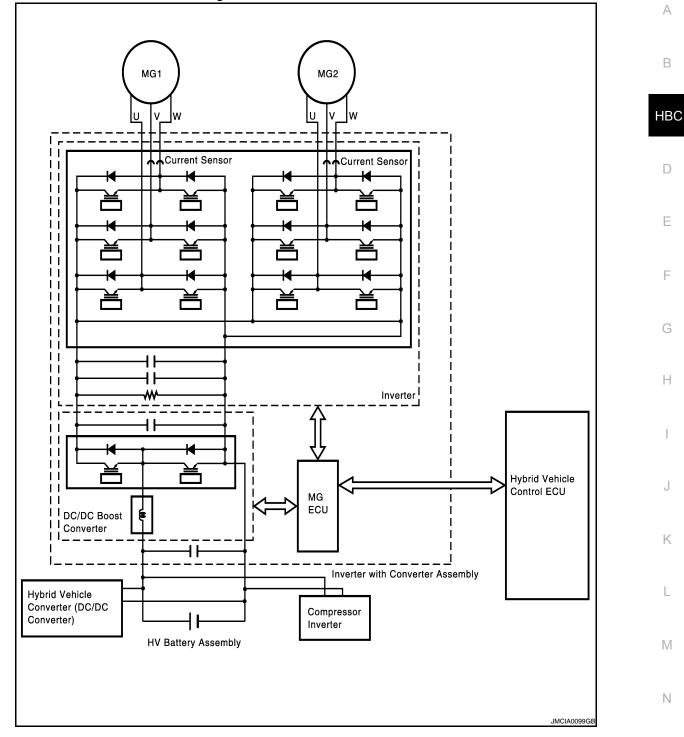
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211907

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 Perfor- mance	Motor inverter fail signal detection (overcurrent due to system mal- function)	Wire harness or connectorHybrid transaxleInverter with converter assembly

< COMPONENT DIAGNOSIS >

Diagnosis Procedure

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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See <u>HBC-109</u>, "Diagnosis Procedure".

OK or NG

< COMPONENT DIAGNOSIS >	
NG >> CONNECT SECURELY	
4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-	А
SOLVER)	
See <u>HBC-164, "Diagnosis Procedure"</u> .	В
OK or NG	
OK >> GO TO 5. NG >> Repair or replace harness or connector.	
5. CHECK GENERATOR RESOLVER	HB(
See <u>HBC-164</u> , "Diagnosis Procedure".	
<u>OK or NG</u>	D
OK >> GO TO 6.	
NG >> GO TO 12.	Е
6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-	
See <u>HBC-171, "Diagnosis Procedure"</u> .	F
<u>OK or NG</u> OK >> GO TO 7.	
NG >> Repair or replace harness or connector.	G
7. CHECK MOTOR RESOLVER	
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK or NG	Н
OK >> GO TO 8.	
NG >> GO TO 14.	
8. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	J
<u>OK or NG</u> OK >> GO TO 9.	0
NG >> Tighten to specified torque.	
9. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	Κ
See HBC-177, "Diagnosis Procedure".	
OK or NG	L
OK >> GO TO 10.	
NG >> Tighten to specified torque.	
10.INSPECT HYBRID TRANSAXLE (MG1)	M
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	Ν
OK >> GO TO 11. NG >> Replace hybrid transaxle (See <u>TM-36</u> , "Removal and Installation".)	
11.INSPECT HYBRID TRANSAXLE (MG2)	\sim
See HBC-177, "Diagnosis Procedure".	0
OK or NG	
OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u> .)	Ρ
NG >> Replace hybrid transaxle (See TM-36, "Removal and Installation".)	
12. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	
See <u>HBC-164, "Diagnosis Procedure"</u> .	

<u>OK or NG</u>

OK >> GO TO 13.

< COMPONENT DIAGNOSIS >

NG >> Connect securely.

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

See <u>HBC-164</u>, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>.)

NG >> Repair or replace harness or connector.

14. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 15.

NG >> Connect securely.

15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>.)

NG >> Repair or replace harness or connector.

P0A78-121

Description

INFOID:000000004211909

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.

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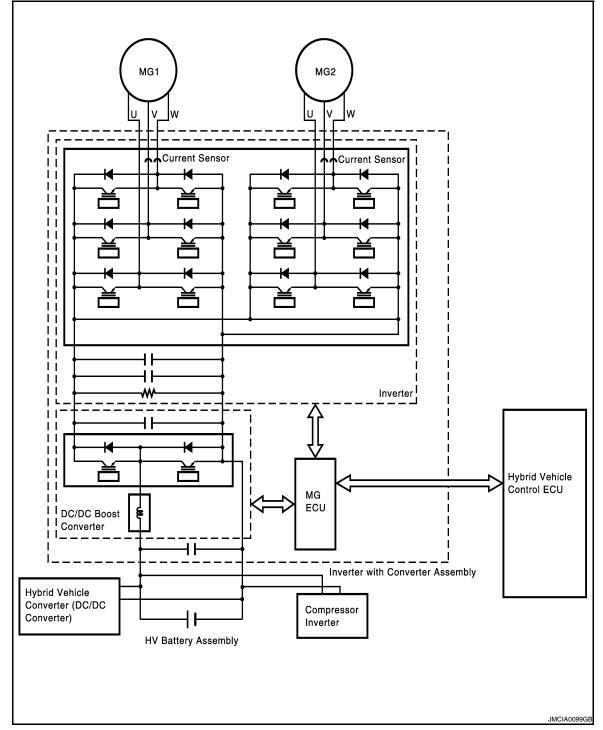
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211910

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

< COMPONENT DIAGNOSIS >

Diagnosis Procedure

INFOID:000000004211911

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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 HBC 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.

< COMPONENT DIAGNOSIS >

NG >> GO TO 3.

 $\mathbf{3}.$ 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 - GENERATOR RE-SOLVER) See HBC-164, "Diagnosis Procedure". OK or NG OK >> GO TO 5. NG >> Repair or replace harness or connector. **b**.CHECK GENERATOR RESOLVER See HBC-164, "Diagnosis Procedure". OK or NG OK >> GO TO 6. NG >> GO TO 21. **O**.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-ER) 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. $\mathbf{8}$. 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. >> Tighten to specified torque. NG 10.INSPECT HYBRID TRANSAXLE (MG1) See HBC-177, "Diagnosis Procedure". OK or NG OK >> GO TO 11. >> Replace hybrid transaxle (See page HX-10) NG **11**.INSPECT HYBRID TRANSAXLE (MG2) See HBC-177, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 12.

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

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:**

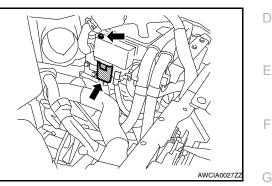
After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.

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.



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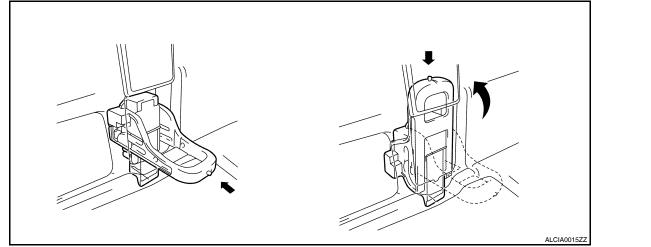
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13. CHECK SERVICE PLUG GRIP

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.

<u>OK or NG</u>

OK >> GO TO 14.

NG >> Replace service plug grip.

14.CHECK SERVICE PLUG GRIP

Service Plug Grip

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JMCIA0193GE

< COMPONENT DIAGNOSIS >

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

Service		
Component connector	' Iorminai	
_	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 <u>HBC-527, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 16.

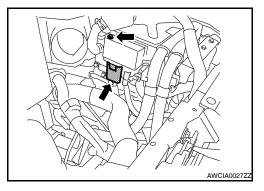
NG >> Tighten to specified torque.

16.CHECK FRAME WIRE

CAUTION:

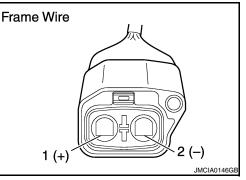
Be sure to wear insulated gloves and protective goggles.

- 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)		ame wire (HV relay side) Frame wire (Inverter with con- verter assembly side)		Resistance
Harness connector	Terminal	Harness connector	arness	
E308	1 (high volt- age+)	E313	1 (high volt- age+)	Below 1 Ω
E309	1 (high volt- age-)	LUIU	2 (high volt- age-)	Below 1 Ω



< COMPONENT DIAGNOSIS >

5. Using a megohmmeter (500 V range), measure the insulation Frame Wire (HV Relay Side) resistance according to the value(s) in the table below. А NOTE: Be sure to set the megohmmeter to 500 V when performing this Shielded Wire Ground Red Mark test. Using a setting higher than 500 V can result in damage to В (+)the component being inspected. E308 E309 Frame wire (HV relay side) HBC Ground Resistance Harness Terminal connector JMCIA0194G 1 (high volt-Body ground and shielded D E308 10 M Ω or higher wire ground age+) Body ground and shielded 1 (high volt-E309 10 M Ω or higher age-) wire ground Е Frame wire (HV relay side) Frame wire (HV relay side) Resistance Harness Harness F Terminal Terminal connector connector E308 E309 10 $M\Omega$ or higher 1 (high voltage+) 1 (high voltage-) OK or NG OK >> GO TO 17. NG >> Replace frame wire. Н 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, HV Relay Assembly "Removal and Installation").) O 3. Measure the resistance according to the value(s) in the table below. 0 K HV relay assembly HV relay assembly (s1 Resistance Component Component Terminal Terminal CON2 GND connector connector Below 1 Ω 1 (high **(**n3) 321 [When battery voltage (12 V) is E308 1 volts1 JMCIA0196GE applied to n3 terminals 2 age+) (GND) and 3 (CON2)] M 4. Measure the resistance according to the value(s) in the table below. Frame wire (HV relay side) Frame wire (HV relay side) Ν Resistance Harness Harness Terminal Terminal connector connector 18.8 to 32.1 Ω at -35 to 80°C (-31 n3 3 (CON2) n3 2 (GND) to 176°F)

OK or NG

OK >> GO TO 18.

NG >> Replace HV relay assembly (See <u>HBB-105</u>, "Removal and Installation").

18.INSPECT HV RELAY ASSEMBLY (SMRG)

CAUTION:

Be sure to wear insulated gloves and protective goggles.

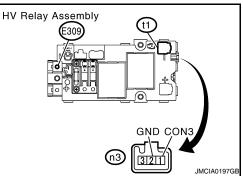
1. Check that the service plug grip is not installed.

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< COMPONENT DIAGNOSIS >

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

HV relay assembly		HV relay assembly		
Component connector	Terminal	nal Component connector Terminal		Resistance
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 a	issembly	HV relay assembly al Component connector Terminal		
Component connector	Terminal			Resistance
n3	1 (CON3)	n3	2 (GND)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

<u>OK or NG</u>

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

NG >> Replace HV relay assembly (See <u>HBB-105</u>, "Removal and Installation").

19.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 20.

NG >> Connect securely.

20. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

21. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See HBC-164, "Diagnosis Procedure".

<u>OK or NG</u>

- 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 <u>TM-36, "Removal and Installation"</u>).
- NG >> Repair or replace harness or connector.

P0A78-128

Description

INFOID:000000004211912

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.

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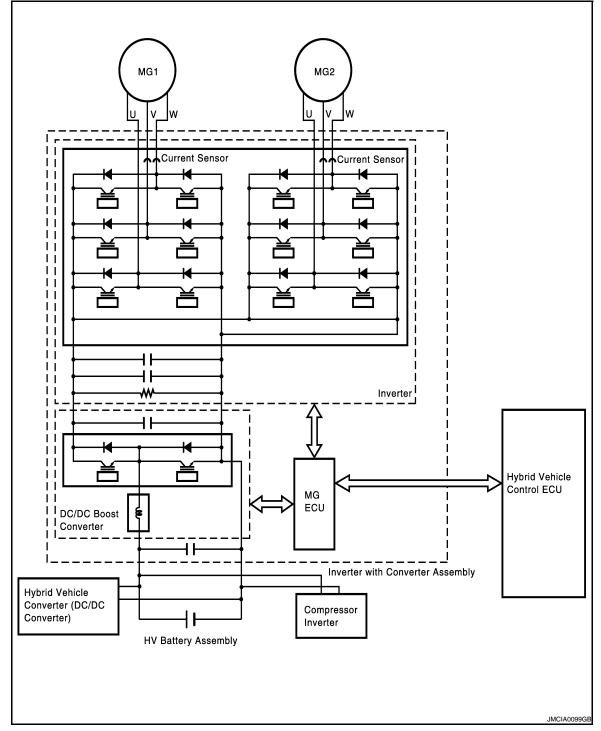
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211913

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 connectorHybrid transaxleInverter with converter assembly

< COMPONENT DIAGNOSIS >

Diagnosis Procedure

INFOID:000000004211914

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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 HBC 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. <u>Is DTC detected?</u>

YES >> Go to Diagnosis Procedure relevant to output DTC.

NO >> GO TO 3.

 $\mathbf{3}$. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See <u>HBC-109, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 4.

NG >> Connect securely.

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-SOLVER)

See <u>HBC-164</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 5.

NG >> Repair or replace harness or connector.

5.CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

OK or NG

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

6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-

ER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 7.

NG >> Repair or replace harness or connector.

7. CHECK MOTOR RESOLVER

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 8.

NG >> GO TO 14.

8.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTOR CONDITION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Tighten to specified torque.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 10.

NG >> Tighten to specified torque.

10.INSPECT HYBRID TRANSAXLE (MG1)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

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

11.INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

OK or NG

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

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

12. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 13.

< COMPONENT DIAGNOSIS >	-
NG >> Connect securely.	
13. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	{ '
RESOLVER) See <u>HBC-164, "Diagnosis Procedure"</u> .	-
<u>OK or NG</u>	[
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	_
NG >> Repair or replace harness or connector.	Н
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 RE	-
	-
See <u>HBC-171, "Diagnosis Procedure"</u> . <u>OK or NG</u>	
OK >> Replace hybrid transaxle (See <u>TM-36</u> , " <u>Removal and Installation</u> ").	
NG $>>$ Repair or replace harness or connector.	(
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P0A78-266, P0A78-267

Description

INFOID:000000004211915

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.

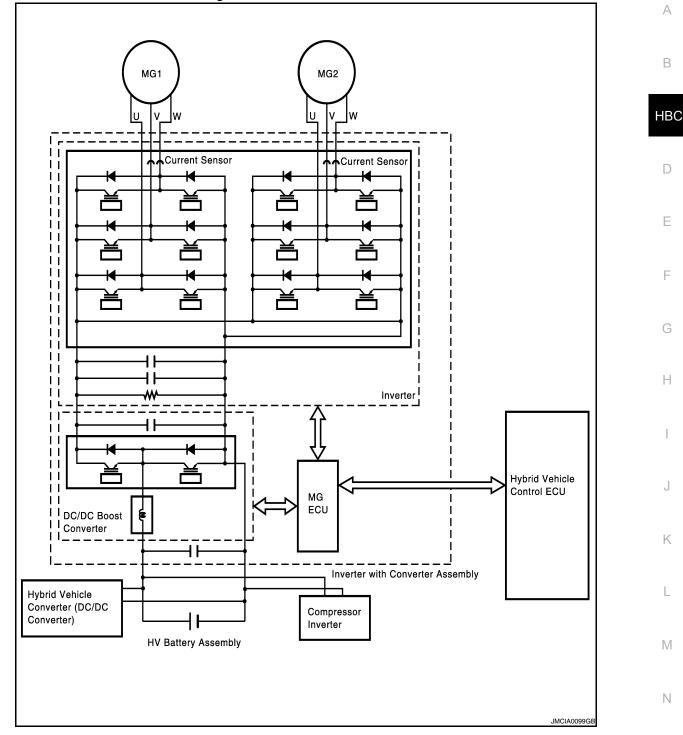
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

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.

P0A78-266, P0A78-267

< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211916

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 Moto	Drive Motor "A" Inverter	Open or short to GND in the inverter voltage (VH) signal line	Inverter with converter assembly
PUATS	267	Performance	Short to +B in the inverter voltage (VH) signal line	inverter with converter assembly

Diagnosis Procedure

INFOID:000000004211917

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:000000004211918

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.

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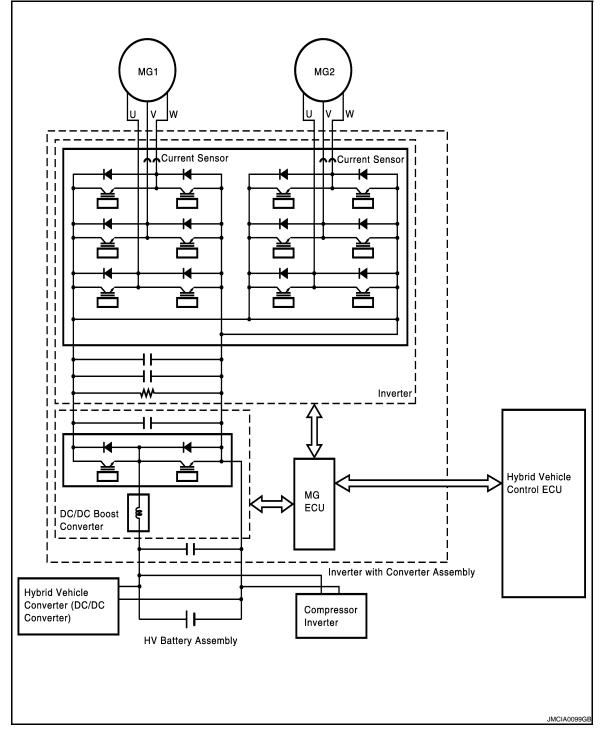
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211919

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

< COMPONENT DIAGNOSIS > Diagnosis Procedure

Diagnosis i roccuure

INFOID:000000004211920

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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 HBC 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
0A1A (all INF codes)	Generator Control Module
DA1B (all INF codes)	Drive Motor "A" Control Module
0A72 (all INF codes)	Generator Phase V Current
A75 (all INF codes)	Generator Phase W Current
A60 (all INF codes)	Drive Motor "A" Phase V Current
A63 (all INF codes)	Drive Motor "A" Phase W Current
A4B-253	Generator Position Sensor Circuit
44D-255	Generator Position Sensor Circuit Low
A4C-513	Generator Position Sensor Circuit Range/Performance
\3F-243	Drive Motor "A" Position Sensor Circuit
41-245	Drive Motor "A" Position Sensor Circuit Low
440-500	Drive Motor "A" Position Sensor Circuit Range / Performance
A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor "A" Inverter Performance
A94-585, 587, 589, 590, 554, 555, 556	DC/DC Converter Performance
A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance
004-803	High Voltage Power Resource
ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
ADC-226	Hybrid Battery Positive Contactor Control Circuit High
ADF-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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

>> Replace inverter with converter assembly (See <u>HBC-638</u>, "<u>Removal and Installation</u>"). >> Connect securely. OK

NG

P0A78-282

Description

INFOID:000000004211921

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.

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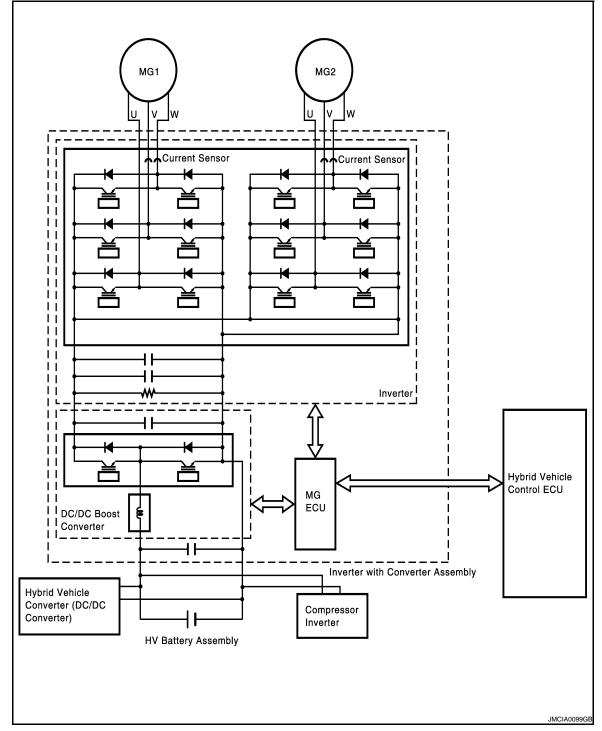
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211922

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

< COMPONENT DIAGNOSIS >

Diagnosis Procedure

А

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	В			
 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.	D			
>> GO TO 2.				
2. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-	E			
NECTOR)				
See <u>HBC-109</u> , "Diagnosis Procedure".				
OK or NG	F			
 OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). NG >> Connect securely. 				
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P0A78-284

Description

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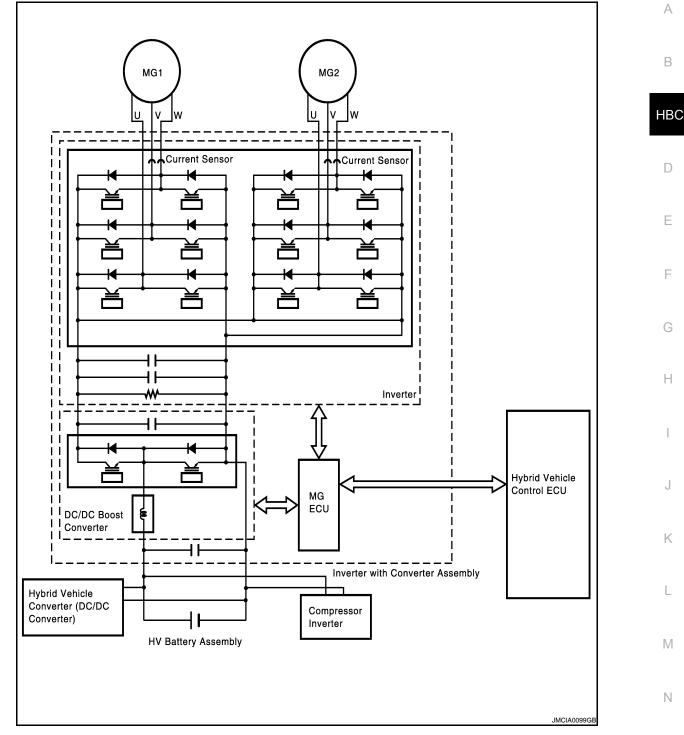
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211925

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:000000004211926

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.

HBC-254

< COMPONENT DIAGNOSIS >

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.

 $\mathbf{3}$.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.	В
Coolant leaks are evident.	С

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.

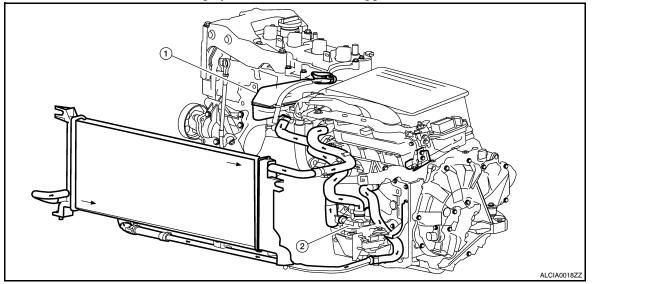
<u>A or B or C</u>

- 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.

2.



1 Coolant reservoir

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.

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NO >> Replace fuse.

$\mathbf{6}$. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

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.

<u>OK or NG</u>

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 <u>EC-382</u>, "Component Function Check").

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

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 12.

NG >> Connect securely.

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

See <u>HBC-164, "Diagnosis Procedure"</u>.

HBC-256

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

22. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 23.

NG >> CONNECT SECURELY

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

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36. "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

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

See <u>HBC-362, "Diagnosis Procedure"</u>.

OK or NG

OK >> Add coolant.

NG >> GO TO 25.

25. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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 <u>HBC-644</u>, "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".

<u>OK or NG</u>

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 <u>HBC-362</u>, "Diagnosis Procedure".

OK or NG

OK >> Replace water pump with motor & bracket assembly.

NG >> Repair or replace harness or connector.

P0A78-286

Description

INFOID:000000004211927

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.

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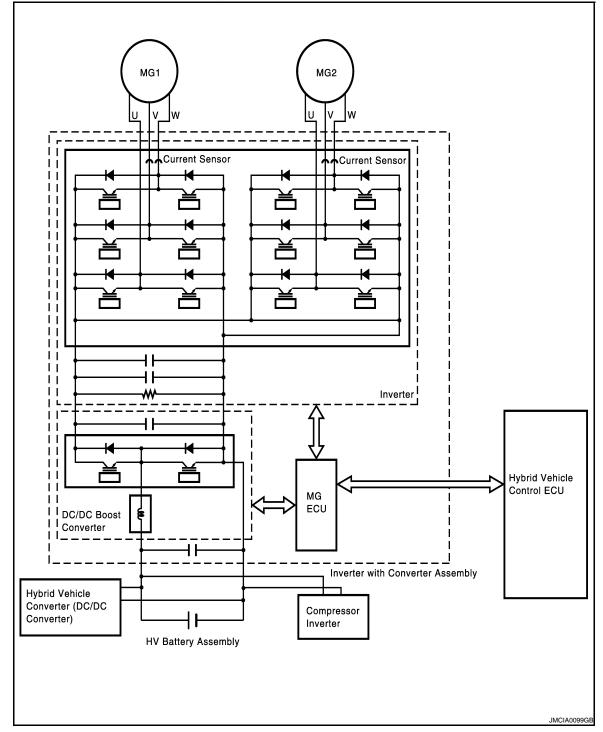
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211928

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	А
P0A78 286	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 	В
			Hybrid transaxleInverter with converter assemblyHybrid vehicle control ECU	HBC	

Diagnosis Procedure

INFOID:000000004211929

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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.

HBC-261

< COMPONENT DIAGNOSIS >

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.		
Coolant leaks are evident.	С	

NOTE:

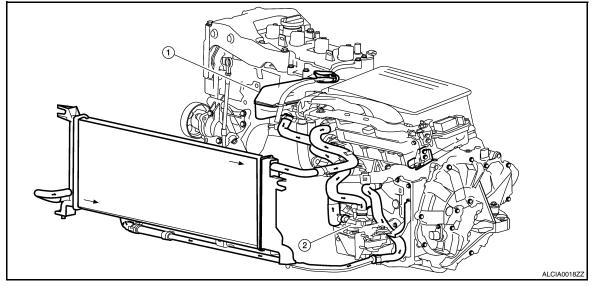
After repairing the coolant leaks and adding coolant, perform the "INV WATER PUMP" and "COOLING FAN SPD" in "ACTIVE TEST" mode with CONSULT-III and make sure that there are no malfunctions.

A or B or C

- >> GO TO 4. А
- В >> Add coolant.
- С >> 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

Water pump with motor and bracket 2. assembly

OK or NG

OK >> GO TO 5. NG >> Correct the problem. 5.CHECK FUSE

- 1.
- Turn ignition switch OFF. Remove the 10A fuse (No. 67). 2.
- Check the resistance of the fuse. 3.

Resistance: Below 1 Ω

Is the inspection result normal?

>> Install the 10A fuse (No. 67). GO TO 6. YES

< COMPONENT DIAGNOSIS >
NO >> Replace fuse.
6. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)
See HBC-109, "Diagnosis Procedure".
<u>OK or NG</u>
OK >> GO TO 7. >> Connect securely.
7. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEM-
BLY CONNECTOR)
Check the connection of the water pump with motor & bracket assembly connector.
The connector is connected securely and there are no contact problems.
<u>OK or NG</u>
OK >> GO TO 8. NG >> Connect securely.
8.PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)
 Reconnect all harness connectors removed. Turn ignition switch ON.
 Perform "INV WATER PUMP" in "ACTIVE TEST" mode with CONSULT-III. 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)
 Turn ignition switch ON. 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 <u>EC-382, "Component Function Check"</u>).
11. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-
NECTOR)
See HBC-109, "Diagnosis Procedure".
<u>OK or NG</u>
OK >> GO TO 12.
NG >> Connect securely.
12.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR
RESOLVER)
See <u>HBC-164, "Diagnosis Procedure"</u> .

OK or NG

OK >> GO TO 13.

NG >> Repair or replace harness or connector.

13. CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 14.

NG >> GO TO 20.

14. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 15.

NG >> Repair or replace harness or connector.

15.CHECK MOTOR RESOLVER

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 16. NG >> GO TO 22.

NG >> GO | O 22.

16. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-TION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 17.

NG >> Tighten to specified torque.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 18.

NG >> Tighten to specified torque.

18. INSPECT HYBRID TRANSAXLE (MG1)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 19.

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

19. INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

OK or NG

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

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

20.check connector connection condition (generator resolver connector)

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 21.

NG >> Connect securely.

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

See HBC-164, "Diagnosis Procedure".

< COMPONENT DIAGNOSIS >	
OK or NG	
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	А
NG >> Repair or replace harness or connector.	
22. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	В
See <u>HBC-171, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> GO TO 23. NG >> CONNECT SECURELY	HB
23. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-	
SOLVER)	D
See <u>HBC-171, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	E
NG >> Repair or replace harness or connector.	
24. PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)	F
See <u>HBC-362, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> Add coolant. NG >> GO TO 25.	G
25. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY	Н
See <u>HBC-362. "Diagnosis Procedure"</u> .	
<u>OK or NG</u> OK >> GO TO 26.	
NG >> GO TO 27.	
26. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV	
CONTROL ECU)	J
See HBC-362. "Diagnosis Procedure".	
OK or NG	
OK >> Replace hybrid vehicle control ECU (See <u>HBC-644, "Removal and Installation"</u>).	Κ
NG >> Repair or replace harness or connector.	
27. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX	L
Refer to PG-65, "Terminal Arrangement".	
OK or NG	5.4
OK >> GO TO 28. NG >> Replace high voltage fuse and fusible link box.	M
28. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)	
See <u>HBC-362. "Diagnosis Procedure"</u> .	Ν
<u>OK or NG</u>	
OK >> Replace water pump with motor & bracket assembly.	~
NG >> Repair or replace harness or connector.	0

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P0A78-287

Description

INFOID:000000004211930

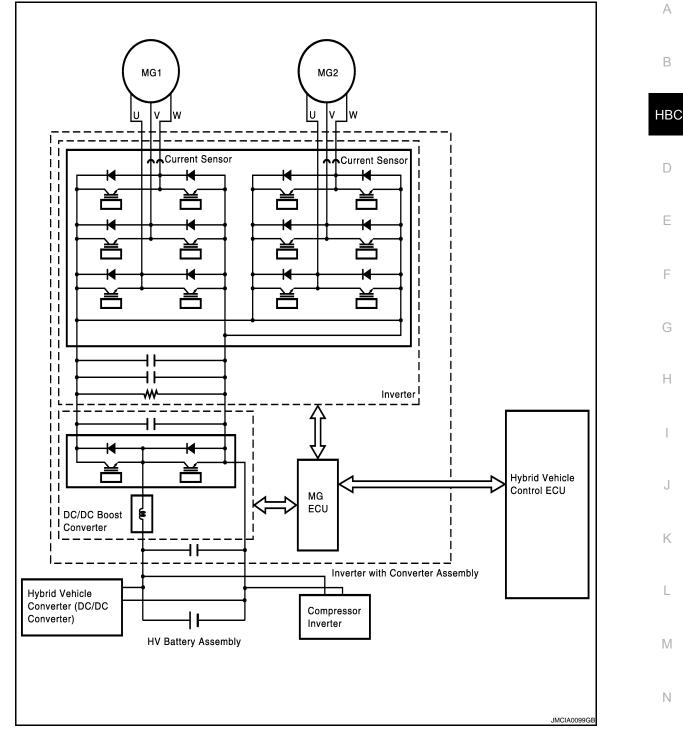
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211931

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 as- sembly malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:000000004211932

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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

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

NG >> Connect securely.

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Description

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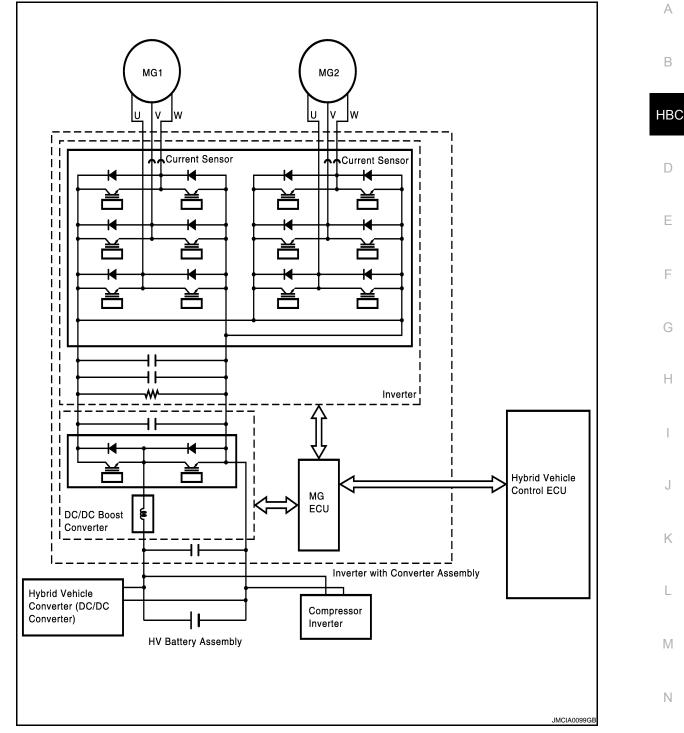
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211934

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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 Per- formance	Motor torque execution monitoring malfunction	Hybrid transaxleInverter with converter assembly

Diagnosis Procedure

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 <u>HBC-109</u>, "Diagnosis Procedure".

OK or NG

HBC-272

OK NG	>> GO TO 4. >> Connect securely.	A
	ECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	
	<u> 3C-177, "Diagnosis Procedure"</u> .	В
<u>OK or N</u>		D
OK NG	>> GO TO 5. >> Tighten to specified torque.	
	PECT HYBRID TRANSAXLE (MG2)	HBC
	3C-177, "Diagnosis Procedure".	_
OK or N	-	D
OK NG	>> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	E
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P0A78-503, P0A78-504

Description

INFOID:000000004211936

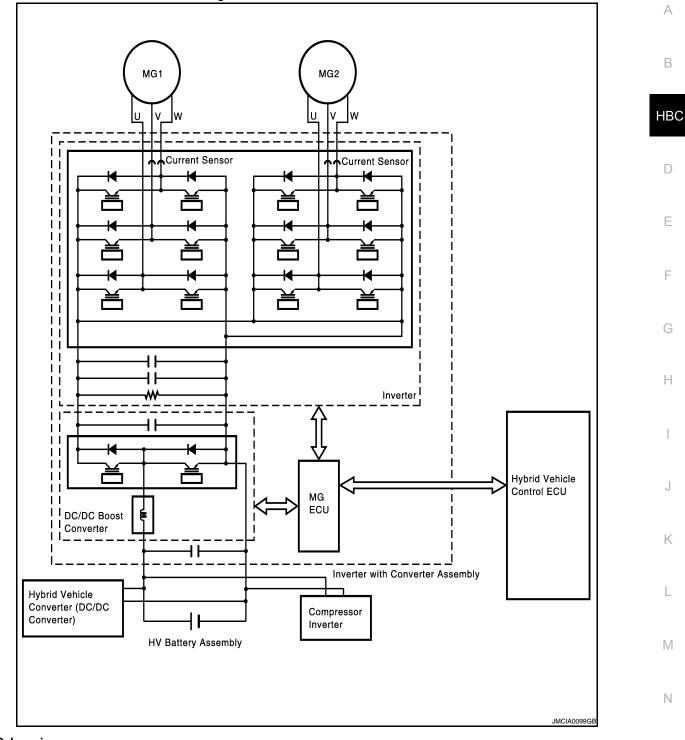
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211937

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.

< COMPONENT DIAGNOSIS >

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A78	503	Drive Motor "A" Inverter	Motor inverter overvoltage signal de- tection (overvoltage due to MG ECU malfunction)	 Wire harness or connector Inverter with converter assembly
P0A78 Performance 504	Performance	Motor inverter overvoltage signal de- tection (overvoltage due to hybrid transaxle malfunction)	Hybrid transaxle	

Diagnosis Procedure

INFOID:000000004211938

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.

HBC-276

FUA70-503, FUA70-504	
< COMPONENT DIAGNOSIS >	
Is DTC detected?	-
YES >> Go to Diagnosis Procedure relevant to output DTC. NO >> GO TO 3.	А
${\it 3.}$ CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON	I-
NECTOR)	В
See <u>HBC-109, "Diagnosis Procedure"</u> .	_
<u>OK or NG</u>	HE
OK >> GO TO 4.	
NG >> Connect securely.	
${f 4}$. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV	- D
ER)	_
See <u>HBC-171, "Diagnosis Procedure"</u> .	E
OK or NG	
OK >> GO TO 5. NG >> Repair or replace harness or connector.	
5. CHECK MOTOR RESOLVER	F
	_
See <u>HBC-171, "Diagnosis Procedure"</u> . <u>OK or NG</u>	_
OK 01 NG OK >> GO TO 8.	(
NG >> GO TO 6.	
6. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	ŀ
See <u>HBC-171, "Diagnosis Procedure"</u> .	_
<u>OK or NG</u>	
OK >> GO TO 7.	I
NG >> Connect securely.	
7. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVRTER ASSEMBLY - MOTOR RESOLV	/
ER)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	_
<u>OK or NG</u>	ŀ
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
NG >> Repair or replace harness or connector.	
8. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE	-
SOLVER)	_
See <u>HBC-164. "Diagnosis Procedure"</u> .	N
OK or NG	
OK >> GO TO 9. NG >> Repair or replace harness or connector.	ľ
9. CHECK GENERATOR RESOLVER	ľ
See <u>HBC-164, "Diagnosis Procedure"</u> .	-
OK or NG	C
OK >> GO TO 10.	
NG >> GO TO 14.	F
10. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	Г
See <u>HBC-177, "Diagnosis Procedure"</u> .	-
OK or NG	
OK >> GO TO 11.	
NG >> Tighten to specified torque.	
11. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION COND	i -

< COMPONENT DIAGNOSIS >

TION)

See HBC-177, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 12.

NG >> Tighten to specified torque.

12.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 13.

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

13.INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

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

14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Connect securely.

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

See HBC-164, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36. "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

P0A78-505, P0A78-506

Description

INFOID:000000004211939

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.

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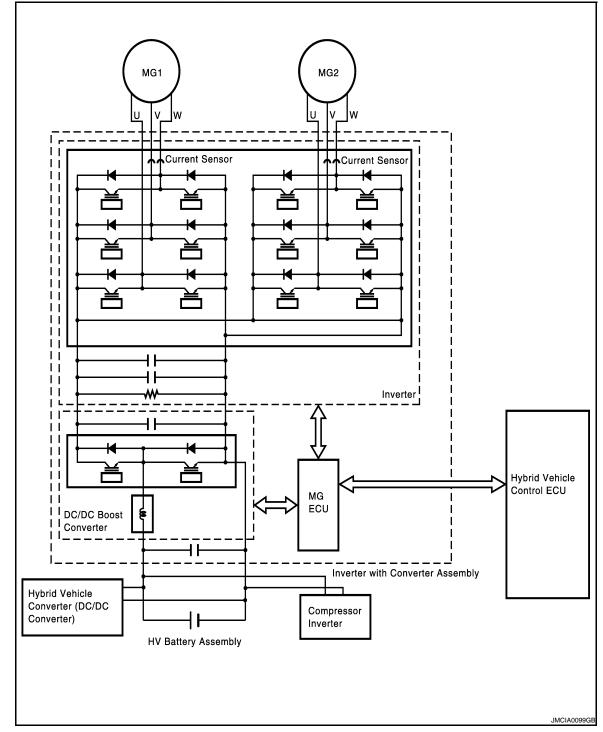
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211940

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.

< COMPONENT DIAGNOSIS >

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	Α
D0479	505	Drive Motor "A" Inverter	Motor inverter fail signal detection (overcurrent due to MG ECU mal- function)	 Wire harness or connector Hybrid transaxle Inverter with converter assembly 	В
P0A78 —	506	Performance	Motor inverter fail signal detection (overcurrent due to hybrid transax- le malfunction)	 Wire harness or connector Hybrid transaxle Inverter with converter assembly 	HB

Diagnosis Procedure

INFOID:000000004211941

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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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 4.

NG >> Connect securely.

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-ER)

See HBC-171, "Diagnosis Procedure".

OK or NG

OK >> GO TO 5.

NG >> Repair or replace harness or connector.

5. CHECK MOTOR RESOLVER

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 8.

NG >> GO TO 6.

6.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 7.

NG >> Connect securely.

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

See HBC-171, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> Replace hybrid transaxle assembly. (See <u>TM-36. "Removal and Installation"</u>.)

NG >> Repair or replace harness or connector.

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

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 10. NG >> GO TO 14.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Tighten to specified torque.

11. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-TION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 12.

NG >> Tighten to specified torque.

< COMPONENT DIAGNOSIS >	
12.INSPECT HYBRID TRANSAXLE (MG1)	Δ
See <u>HBC-177, "Diagnosis Procedure"</u> .	\square
OK or NG	
OK >> GO TO 13.	В
NG >> Replace hybrid transaxle. (See <u>TM-36, "Removal and Installation"</u> .)	
13.INSPECT HYBRID TRANSAXLE (MG2)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	HBC
OK or NG	
 OK >> Replace inverter with converter assembly. (See <u>HBC-638, "Removal and Installation"</u>.) NG >> Replace hybrid transaxle. (See <u>TM-36, "Removal and Installation"</u>.) 	D
14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	
See <u>HBC-164. "Diagnosis Procedure"</u> .	Е
OK or NG	
OK >> GO TO 15. NG >> Connect securely.	F
15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	
RESOLVER)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	G
<u>OK or NG</u>	
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	Н
NG >> Repair or replace harness or connector.	
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P0A78-510

Description

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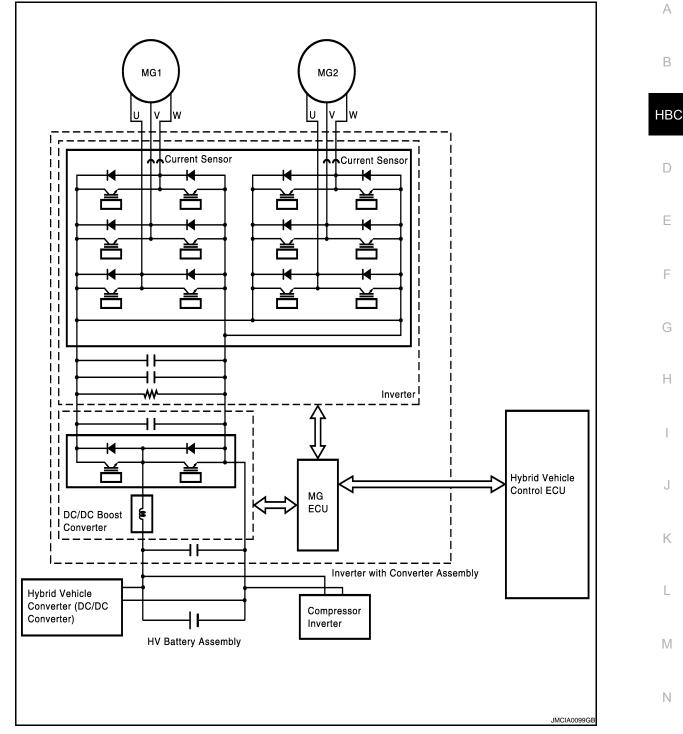
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211943

DTC DETECTION LOGIC

Upon receiving a motor gate shutdown signal from the MG ECU, the inverter forcibly stops MG2 by turning off $$_{\rm P}$$ 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.

< COMPONENT DIAGNOSIS >

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.

INFOID:000000004211944

Diagnosis Procedure

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.

 $2. {\sf CHECK \ CONNECTOR \ CONNECTION \ CONDITION \ (INVERTER \ WITH \ CONVERTER \ ASSEMBLY \ CONNECTOR)}$

See HBC-109, "Diagnosis Procedure".

OK or NG

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

NG >> Connect securely.

P0A78-523

Description

INFOID:000000004211945

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.

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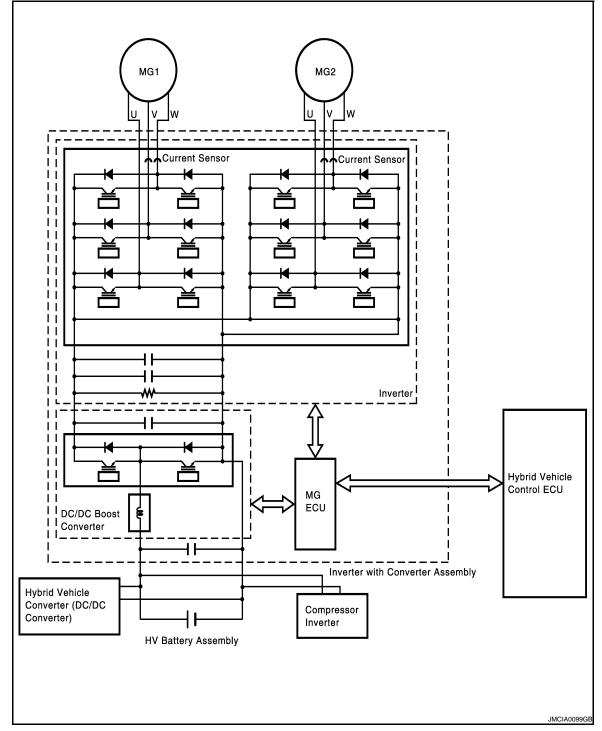
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211946

DTC DETECTION LOGIC

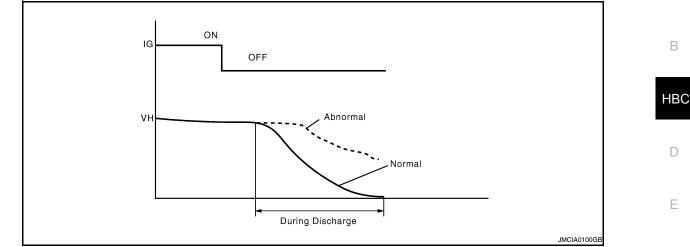
The hybrid vehicle control ECU monitors the inverter voltage (VH) sensor signal. If the hybrid vehicle control ECU detects a fault in the sensor signal, the hybrid vehicle control ECU interprets this as a VH sensor malfunction. The hybrid vehicle control ECU will illuminate the MIL and set a DTC.

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

HBC-288

< COMPONENT DIAGNOSIS >

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:000000004211947

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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.

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 DIC detected?

- YES >> Go to Diagnosis Procedure relevant to output DTC.
- NO >> Replace inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").

Description

INFOID:000000004211948

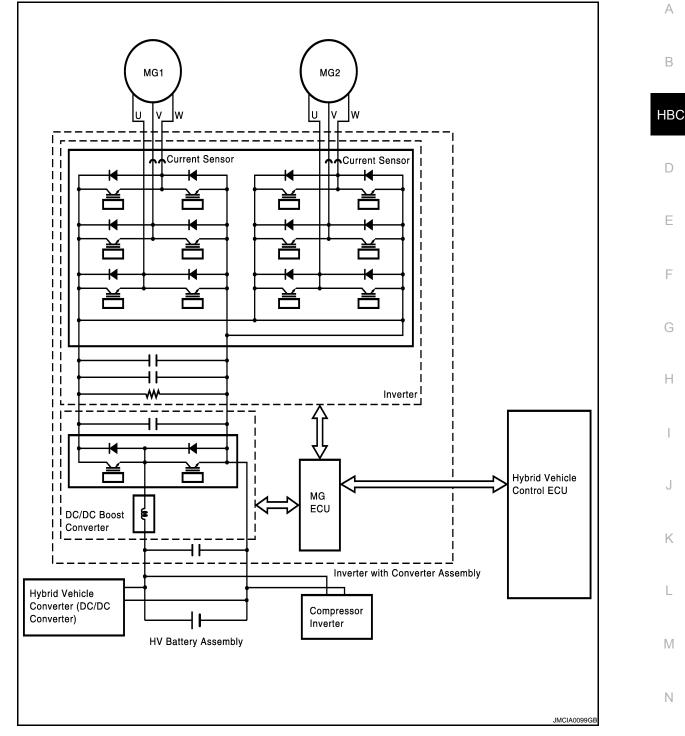
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211949

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:000000004211950

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 <u>HBC-638, "Removal and Installation"</u>).

P0A78-806, P0A78-808

Description

INFOID:000000004211951

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.

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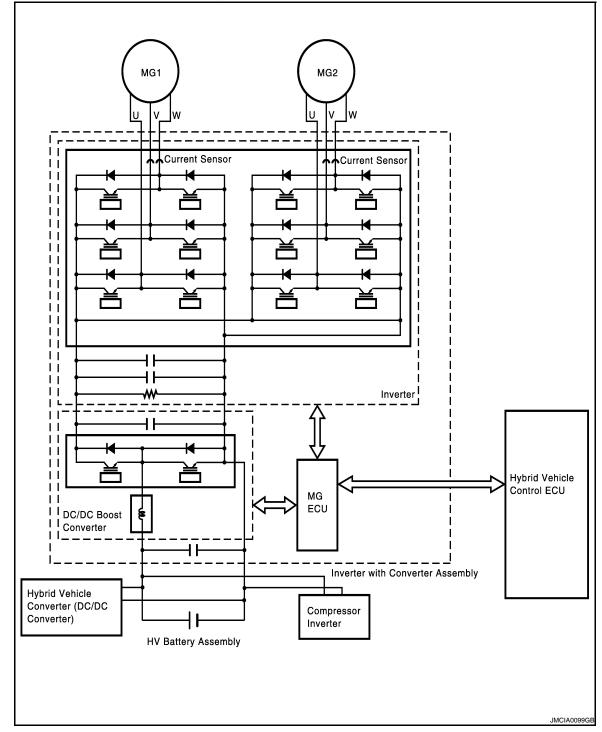
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P0A78-806, P0A78-808

< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211952

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.

P0A78-806, P0A78-808

< COMPONENT DIAGNOSIS >

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	А
P0A78	806	Drive Motor "A" Inverter	Abnormal motor current value de- tection (MG ECU malfunction)	Wire harness or connectorHybrid transaxleInverter with converter assembly	В
FUATO	808	Performance	Abnormal motor current value de- tection (Hybrid transaxle malfunc-	 Wire harness or connector Hybrid transaxle 	
			tion)	Inverter with converter assembly	HRC

Diagnosis Procedure

INFOID:000000004211953

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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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 4.

NG >> Connect securely.

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-ER)

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".

<u>OK or NG</u>

OK >> GO TO 6.

NG >> GO TO 12.

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

See <u>HBC-164</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 7.

NG >> Repair or replace harness or connector.

7.CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 8.

NG >> GO TO 13.

 $\mathbf{8}$. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Tighten to specified torque.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 10.

NG >> Tighten to specified torque.

10.INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

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

11.INSPECT HYBRID TRANSAXLE (MG1)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

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

12. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

P0A78-806, P0A78-808

< COMPONENT DIAGNOSIS >	
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK or NG	А
OK >> GO TO 14.	
NG >> Connect securely.	D
13. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	В
See <u>HBC-164, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	HBC
OK >> GO TO 15.	
NG >> Connect securely.	
14. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-	D
SOLVER)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	_
<u>OK or NG</u>	E
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
NG >> Repair or replace harness or connector.	F
15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	I
RESOLVER)	
See <u>HBC-164, "Diagnosis Procedure"</u> .	G
<u>OK or NG</u>	
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
NG >> Repair or replace harness or connector.	Н
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P0A78-807

Description

INFOID:000000004211954

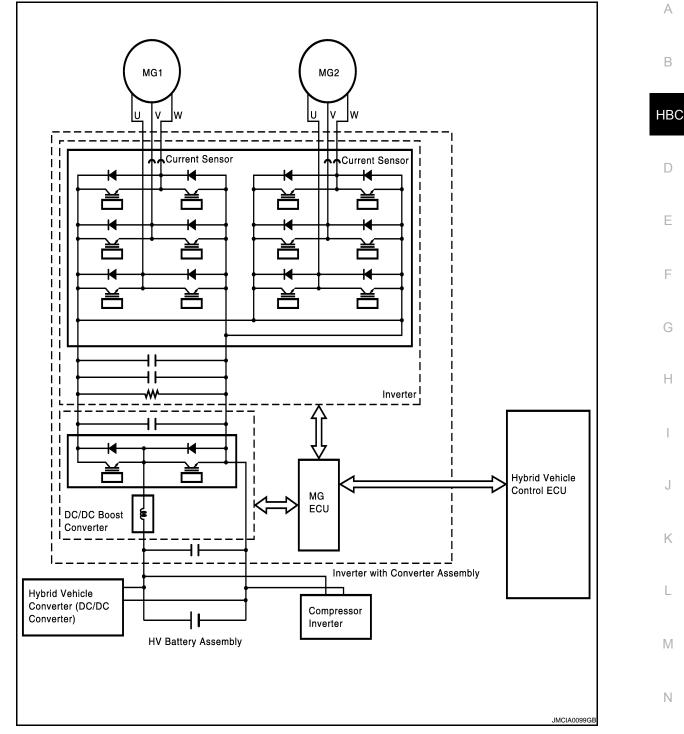
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211955

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 detec- tion (Inverter malfunction)	Inverter with converter assembly

Diagnosis Procedure

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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See <u>HBC-109, "Diagnosis Procedure"</u>.

OK or NG

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

NG >> Connect securely.

P0A7A-122

Description

INFOID:000000004211957

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.

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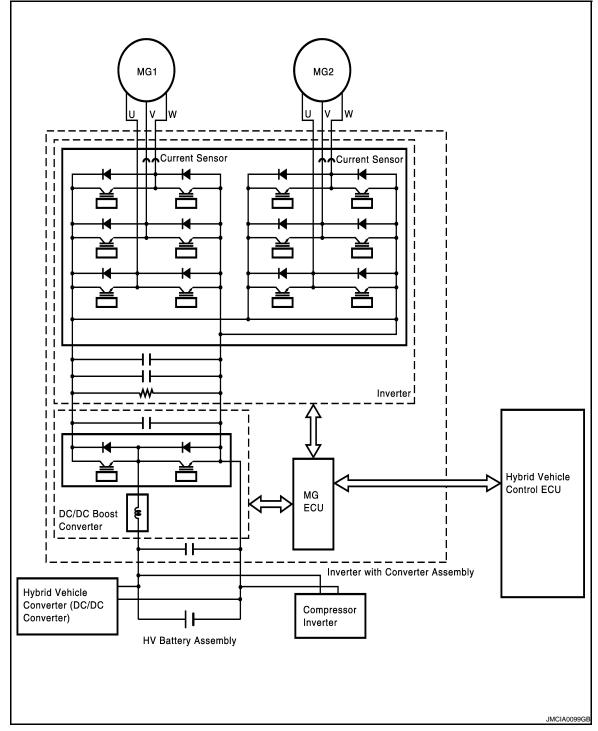
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211958

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.

< COMPONENT DIAGNOSIS >

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	А
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 	В
		-			HBC

Diagnosis Procedure

INFOID:000000004211959

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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. <u>Is DTC detected?</u>

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.

<u>OK or NG</u>

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.

<u>OK or NG</u>

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.

<u>OK or NG</u>

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.

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 <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace engine assembly.

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

See <u>HBC-109, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 8.

NG >> Connect securely.

8.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-SOLVER)

< COMPONENT DIAGNOSIS >	
See <u>HBC-164, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	А
OK >> GO TO 9.	
NG >> Repair or replace harness or connector.	В
9. CHECK GENERATOR RESOLVER	D
See <u>HBC-164, "Diagnosis Procedure"</u> .	
OK or NG	HB
OK >> GO TO 10. NG >> GO TO 16.	
10. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-	D
SOLVER) See <u>HBC-171, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	Ε
OK >> GO TO 11.	
NG >> Repair or replace harness or connector.	
11.CHECK MOTOR RESOLVER	F
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK or NG	G
OK >> GO TO 12.	
NG >> GO TO 18.	
12. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-	Н
TION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	1
<u>OK or NG</u>	
OK >> GO TO 13. NG >> Tighten to specified torque.	
13. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	J
See <u>HBC-177, "Diagnosis Procedure"</u> .	Κ
OK or NG	
OK >> GO TO 14. NG >> Tighten to specified torque.	
14.INSPECT HYBRID TRANSAXLE (MG1)	L
See HBC-177, "Diagnosis Procedure".	
<u>OK or NG</u>	M
OK >> GO TO 15.	IVI
NG >> Replace hybrid transaxle (See <u>TM-36. "Removal and Installation"</u>).	
15.INSPECT HYBRID TRANSAXLE (MG2)	Ν
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	0
 OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). 	0
16. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	Р
See <u>HBC-164</u> , "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 <u>TM-36. "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

 $18. {\tt check \ connector \ connection \ condition \ (motor \ resolver \ connector)}$

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 19.

NG >> Repair or replace harness or connector.

19. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See HBC-171, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

P0A7A-130

Description

INFOID:000000004211960

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.

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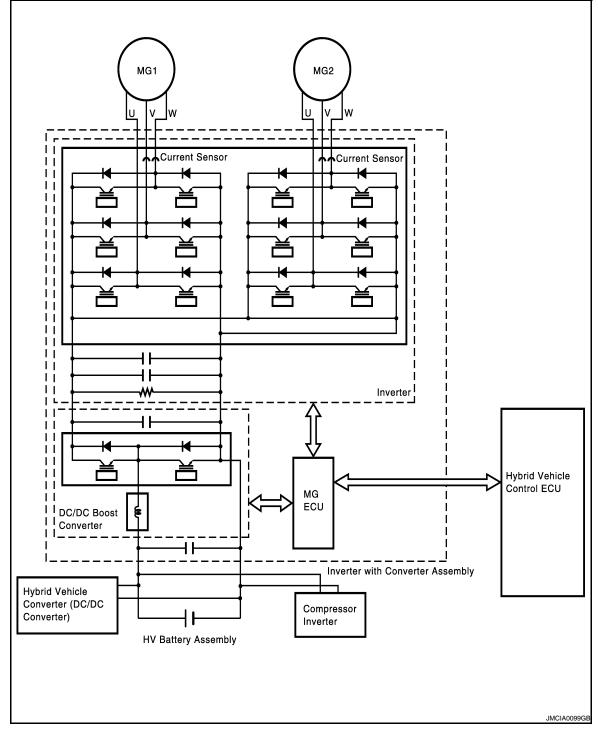
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211961

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	А
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 	В

Diagnosis Procedure

INFOID:000000004211962

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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.

P0A7A-130 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 >> GO TO 7. OK 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"). >> Repair or replace engine assembly. NG 7. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-NECTOR) See HBC-109, "Diagnosis Procedure". OK or NG OK >> GO TO 8. NG >> Connect securely. f 8.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-SOLVER) 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 RE-SOLVER) 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

< COMPONENT DIAGNOSIS >	
OK >> GO TO 12.	
NG >> GO TO 18.	А
12.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI- TION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	В
<u>OK or NG</u>	
	HB
NG >> lighten to specified torque.	пр
13. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	D
<u>OK or NG</u>	
OK >> GO TO 14.	Е
NG >> Tighten to specified torque.	
14.INSPECT HYBRID TRANSAXLE (MG1)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	F
OK or NG	
OK >> GO TO 15. NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	G
15.INSPECT HYBRID TRANSAXLE (MG2)	G
See <u>HBC-177, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	Н
OK >> Replace inverter with converter assembly (See <u>HBC-638</u> , "Removal and Installation").	
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	1
16. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	1
See <u>HBC-164, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	J
OK >> GO TO 17.	
NG >> Connect securely.	Κ
17. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	1.
RESOLVER)	
See <u>HBC-164, "Diagnosis Procedure"</u> . <u>OK or NG</u>	L
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
NG >> Repair or replace harness or connector.	M
18. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	Ν
OK >> GO TO 19.	
NG >> Repair or replace harness or connector.	0
19. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-	
SOLVER)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	Ρ
<u>OK or NG</u> OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
No se Replace hybrid transakie (See <u>Hirso, Removal and Installation</u>).	

NG >> Repair or replace harness or connector.

P0A7A-322

Description

INFOID:000000004211963

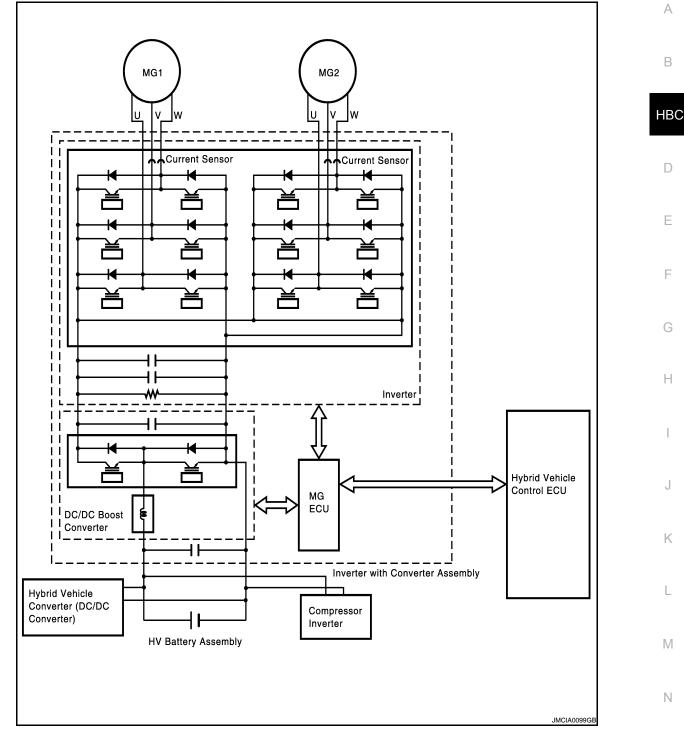
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211964

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:000000004211965

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:

< COMPONENT DIAGNOSIS >

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.

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replace the inverter with converter assembly.	
Is DTC detected?	
YES >> Go to Diagnosis Procedure relevant to output DTC.	В
NO >> GO TO 3.	
3. CHECK AMOUNT OF GASOLINE	
See <u>HBC-303</u> , "Diagnosis Procedure".	HBC
<u>OK or NG</u>	
OK >> GO TO 4.	D
NG >> Refuel vehicle.	
4.CHECK ENGINE START	_
See HBC-303, "Diagnosis Procedure".	E
<u>OK or NG</u>	
OK >> GO TO 7. NG >> GO TO 5.	F
	1
5.INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)	_
See <u>HBC-303, "Diagnosis Procedure"</u> .	G
<u>OK or NG</u>	
OK >> GO TO 7.	
NG >> GO TO 6.	Н
6.INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)	_
See <u>HBC-303, "Diagnosis Procedure"</u> .	1
<u>OK or NG</u>	I
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
NG >> Repair or replace engine assembly.	J
CHECK QUANTITY OF INVERTER COOLANT	_
See <u>HBC-362, "Diagnosis Procedure"</u> .	
<u>A or B or C</u>	K
A >> GO TO 8.	
 B >> Add coolant. C >> Check for coolant leaks and add coolant. 	1
	L
8. CHECK COOLANT HOSE	_
See <u>HBC-362, "Diagnosis Procedure"</u> .	M
<u>OK or NG</u>	
OK >> GO TO 9. NG >> Correct the problem.	
NG >> Correct the problem. 9.CHECK FUSE	Ν
	_
 Remove the 10A fuse (No. 68). Check the resistance of the fuse. 	0
Resistance: Below 1 Ω	
Is the inspection result normal?	Р
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".	-

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Connect securely.

11.CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET AS-SEMBLY CONNECTOR)

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 12.

NG >> Connect securely.

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

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 13.

NG >> GO TO 28.

 $13. {\tt check \ connector \ connection \ condition \ (cooling \ fan \ motor \ connector)}$

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 14.

NG >> Connect securely.

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

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 15.

NG >> Check cooling fan system (See <u>EC-382, "Component Function Check"</u>).

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

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 16.

NG >> Connect securely.

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

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 17.

NG >> Repair or replace harness or connector.

17.CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 18.

NG >> GO TO 24.

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

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 19.

NG >> Repair or replace harness or connector.

19.CHECK MOTOR RESOLVER

See <u>HBC-171, "Diagnosis Procedure"</u>.

D0 4 7 4 2 2 2

PUA/A-322	
< COMPONENT DIAGNOSIS >	
OK or NG	
OK >> GO TO 20.	
NG >> GO TO 26.	
20.check inverter with converter assembly (generator cable connection condi-	
TION)	
See HBC-177, "Diagnosis Procedure".	_
OK or NG	ł
OK >> GO TO 21.	
NG >> Tighten to specified torque.	
21. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	
See <u>HBC-177</u> , "Diagnosis Procedure".	
OK or NG	
OK >> GO TO 22.	
NG >> Tighten to specified torque.	
22.INSPECT HYBRID TRANSAXLE (MG1)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> GO TO 23.	
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
23.INSPECT HYBRID TRANSAXLE (MG2)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> Replace inverter with converter assembly (See <u>HBC-638</u> , "Removal and Installation").	
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	
See <u>HBC-164, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> GO TO 25.	
NG >> Connect securely.	
25. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	
RESOLVER)	
See <u>HBC-164, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> Replace hybrid transaxle (See <u>TM-36</u> , "Removal and Installation").	
NG >> Repair or replace harness or connector.	
26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> GO TO 27.	
NG >> Repair or replace harness or connector.	
27.check harness and connector (inverter with converter assembly - motor re-	
SOLVER)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> Replace hybrid transaxle (See <u>TM-36. "Removal and Installation"</u>).	
NG >> Repair or replace harness or connector.	
28.PERFORM ACTIVE TEST WITH CONSULT-III (INV WATER PUMP)	

HBC-317

See HBC-362, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> Add coolant.

NG >> GO TO 29.

29. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See HBC-362, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 30.

NG >> GO TO 31.

30. Check harness and connector (water pump with motor & bracket assembly - HV control ecu)

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> Replace hybrid vehicle control ECU (See <u>HBC-644. "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

31.CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

Refer to PG-65, "Terminal Arrangement".

<u>OK or NG</u>

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 <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace water pump with motor & bracket assembly.

NG >> Repair or replace harness or connector.

P0A7A-324

Description

INFOID:000000004211966

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.

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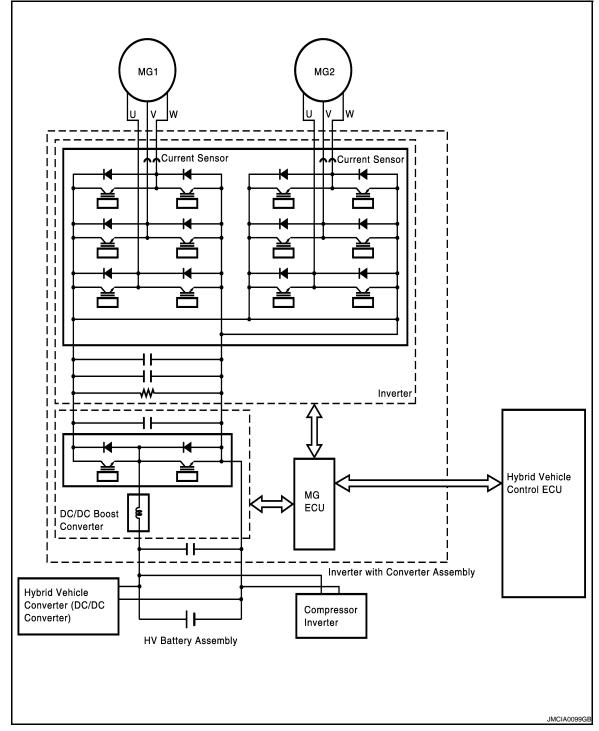
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211967

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	А
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 	B

Diagnosis Procedure

INFOID:000000004211968

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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
0A4D-255 Generator Position Sensor Circuit Low	
P0A4C-513	Generator Position Sensor Circuit Range/Performance
A3F-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

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.

\mathbf{3}. CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 4.

NG >> Refuel vehicle.

4.CHECK ENGINE START

See <u>HBC-303, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 7.

NG >> GO TO 5.

5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See <u>HBC-303</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 7.

NG >> GO TO 6.

6. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See <u>HBC-303, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace engine assembly.

7.CHECK QUANTITY OF INVERTER COOLANT

See HBC-362, "Diagnosis Procedure".

<u>A or B or C</u>

- A >> GO TO 8.
- B >> Add coolant.
- C >> Check for coolant leaks and add coolant.

8.CHECK COOLANT HOSE

See <u>HBC-362, "Diagnosis Procedure"</u>.

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 <u>HBC-109, "Diagnosis Procedure"</u>.

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 20.

NG >> GO TO 26.

20.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-TION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 21.

NG >> Tighten to specified torque.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 22.

NG >> Tighten to specified torque.

22. INSPECT HYBRID TRANSAXLE (MG1)

See <u>HBC-177, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 23.

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

23.INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

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

24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 25.

NG >> Connect securely.

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

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 27.

NG >> Repair or replace harness or connector.

27. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36. "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

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

See <u>HBC-362</u>, "Diagnosis Procedure".

< COMPONENT DIAGNOSIS >	
OK or NG	-
OK >> Add coolant. NG >> GO TO 29	
29. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY	
See <u>HBC-362. "Diagnosis Procedure"</u> .	_
OK or NG	
OK >> GO TO 30. NG >> GO TO 31.	ŀ
30. Check harness and connector (water pump with motor & bracket assembly - h	V
CONTROL ECU)	
See HBC-362, "Diagnosis Procedure".	_
OK or NG	
 OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "<u>Removal and Installation</u>"). NG >> Repair or replace harness or connector. 	
31. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX	
Refer to PG-65, "Terminal Arrangement".	_
<u>OK or NG</u>	
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 <u>HBC-362. "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> Replace water pump with motor & bracket assembly.	
NG >> Repair or replace harness or connector.	

P0A7A-325

Description

INFOID:000000004211969

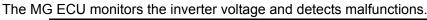
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

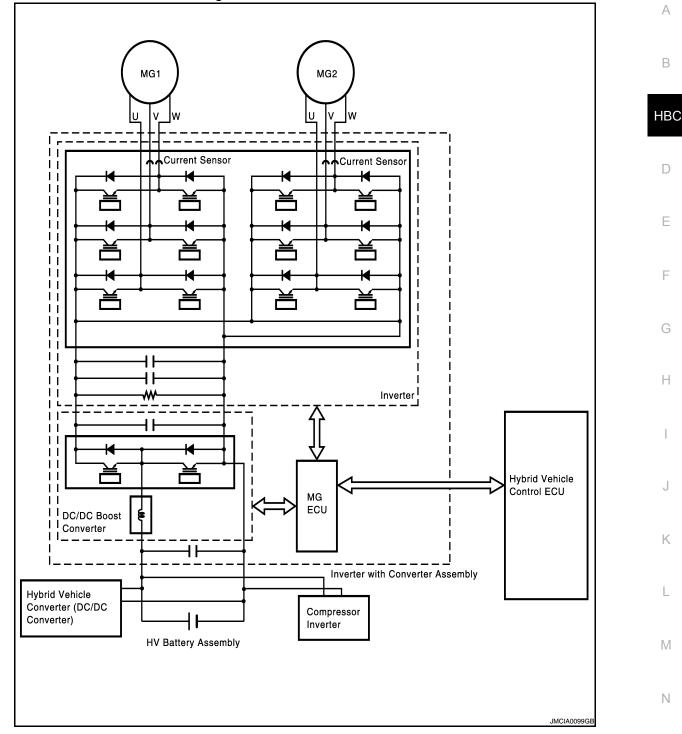
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

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.

P0A7A-325

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211970

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:000000004211971

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.

 $\mathbf{3}$.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)

See <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

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

NG >> Connect securely.

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P0A7A-344

Description

INFOID:000000004211972

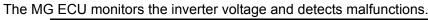
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

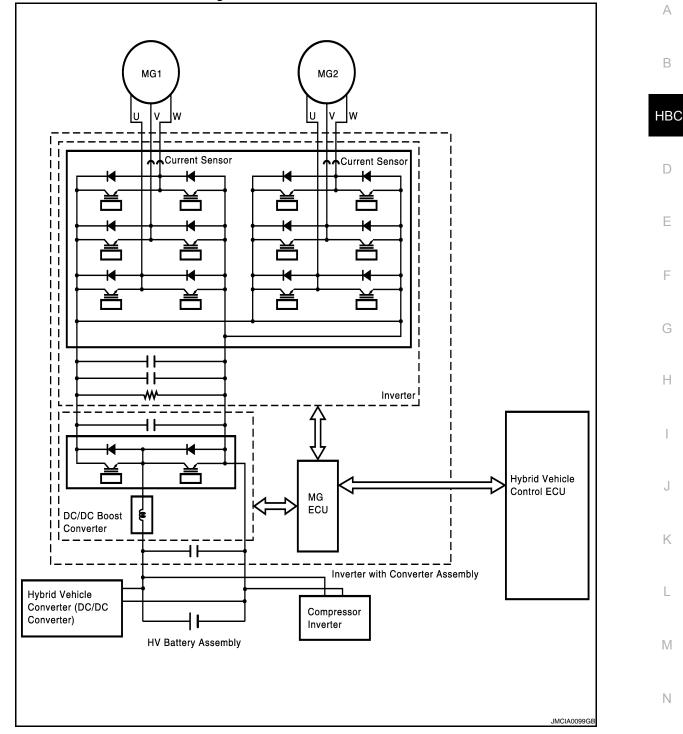
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

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.

P0A7A-344

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211973

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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 transaxleInverter with converter assembly

Diagnosis Procedure

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. <u>Is DTC detected?</u>

YES >> Go to Diagnosis Procedure relevant to output DTC.

NO >> GO TO 3.

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

See <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

< COMPONENT DIAGNOSIS :	>
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OK >> GO TO 4. NG >> Connect securely.	А
4. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION	I)
See <u>HBC-177, "Diagnosis Procedure"</u> .	В
OK or NG	
OK >> GO TO 5. NG >> Tighten to specified torque.	
5.INSPECT HYBRID TRANSAXLE (MG1)	HBC
See <u>HBC-177, "Diagnosis Procedure"</u> .	_
OK or NG	D
 OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). 	E
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P0A7A-517, P0A7A-518

Description

INFOID:000000004211975

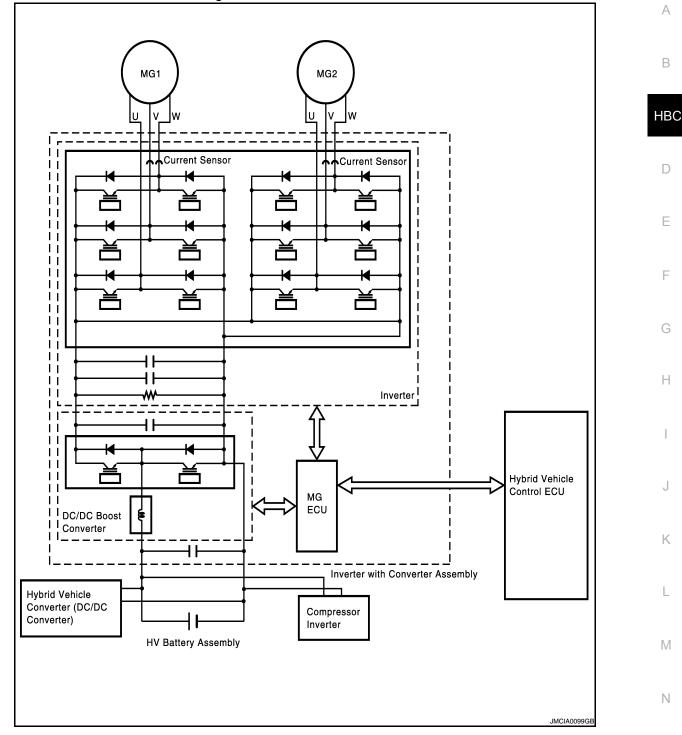
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211976

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.

< COMPONENT DIAGNOSIS >

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0A7A	517	Generator Inverter	Generator inverter fail signal detection (overcurrent due to MG ECU malfunction)	Wire harness or connectorHybrid transaxleInverter with converter assembly
	518	Performance	Generator inverter fail signal detection (overcurrent due to hybrid transaxle mal- function)	Wire harness or connectorHybrid transaxleInverter with converter assembly

Diagnosis Procedure

INFOID:000000004211977

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.

 $\mathbf{3}.$ Check connector connection condition (inverter with converter assembly con-

< COMPONENT DIAGNOSIS >	
NECTOR)	
See <u>HBC-109. "Diagnosis Procedure"</u> .	А
<u>OK or NG</u>	
OK >> GO TO 4. NG >> Connect securely.	В
4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-	
See <u>HBC-171, "Diagnosis Procedure"</u> .	HBC
OK or NG	
OK >> GO TO 5.	D
NG >> Repair or replace harness or connector.	
5. CHECK MOTOR RESOLVER	
See <u>HBC-171, "Diagnosis Procedure"</u> .	Е
<u>OK or NG</u>	
OK >> GO TO 8.	F
NG >> GO TO 6.	
6. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	G
<u>OK or NG</u>	
OK >> GO TO 7. NG >> Connect securely.	Н
/ .CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV- ER)	
See <u>HBC-164. "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). NG >> Repair or replace harness or connector.	J
8. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-	
SOLVER)	Κ
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> GO TO 9.	L
NG >> Repair or replace harness or connector.	
9. CHECK GENERATOR RESOLVER	M
See <u>HBC-171, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> GO TO 10. NG >> GO TO 14.	Ν
10. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	0
See <u>HBC-177, "Diagnosis Procedure"</u> .	
<u>OK or NG</u> OK >> GO TO 11.	D
NG >> Tighten to specified torque.	Ρ
11. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-	
TION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> GO TO 12.	

< COMPONENT DIAGNOSIS >

NG >> Tighten to specified torque.

12.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 13.

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

13.INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

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

14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

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 <u>TM-36. "Removal and Installation"</u>).
- NG >> Repair or replace harness or connector.

P0A7A-522

Description

INFOID:000000004211978

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.

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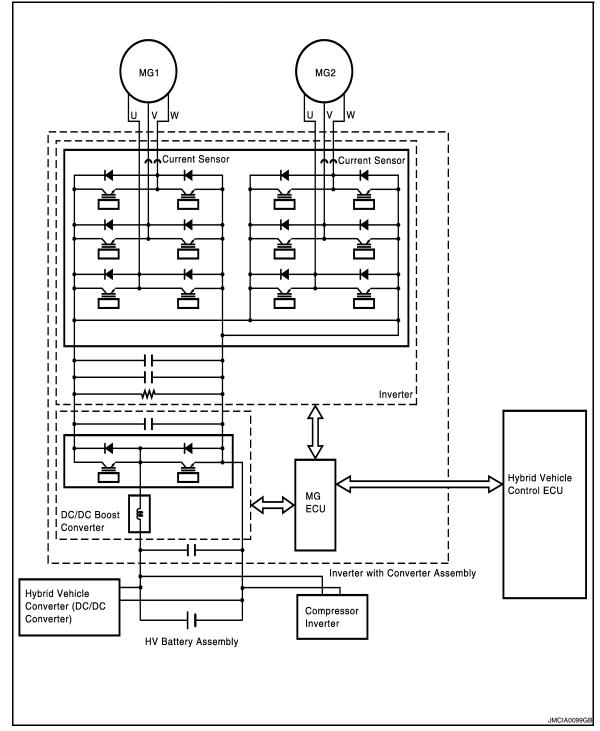
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P0A7A-522

< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211979

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.

P0A7A-522

< COMPONENT DIAGNOSIS >

DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause	А
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

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. 	D E
	G
See <u>HBC-109, "Diagnosis Procedure"</u> .	Н
OK or NG OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). NG >> Connect securely.	
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HBC

INFOID:000000004211980

P0A7A-809, P0A7A-811

Description

INFOID:000000004211981

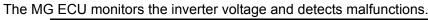
The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU 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.

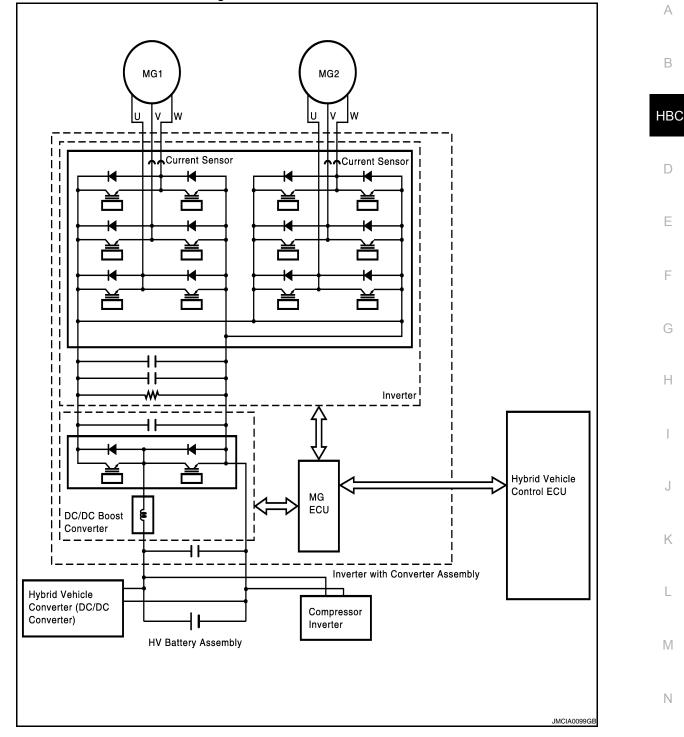
The MG ECU uses a voltage sensor, which is built into the inverter, to detect boosted high voltage to allow control of the voltage boost.

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.

P0A7A-809, P0A7A-811

< COMPONENT DIAGNOSIS >





DTC Logic

INFOID:000000004211982

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.

P0A7A-809, P0A7A-811

< COMPONENT DIAGNOSIS >

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	
	809	Generator Inverter Performance	Abnormal generator current value detection (MG ECU malfunction)	Wire harness or connectorHybrid transaxleInverter with converter assembly	
P0A7A	811		Abnormal generator current value detection (hybrid transaxle mal-function)	Wire harness or connectorHybrid transaxleInverter with converter assembly	

Diagnosis Procedure

INFOID:000000004211983

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)

P0A7A-809, P0A7A-811

< COMPONENT DIAGNOSIS >	
See HBC-109. "Diagnosis Procedure".	
OK or NG	А
OK >> GO TO 4.	
NG >> Connect securely.	В
4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-	
See <u>HBC-171, "Diagnosis Procedure"</u> .	HBC
<u>OK or NG</u> OK >> GO TO 5.	
NG >> Repair or replace harness or connector.	D
5. CHECK MOTOR RESOLVER	D
See HBC-171, "Diagnosis Procedure".	
OK or NG	Ε
OK >> GO TO 6.	
NG >> GO TO 12.	_
6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-	F
SOLVER)	
See <u>HBC-164</u> , "Diagnosis Procedure".	G
OK or NG	
OK >> GO TO 7.	
NG >> Repair or replace harness or connector.	Η
CHECK GENERATOR RESOLVER	
See <u>HBC-164</u> , "Diagnosis Procedure".	
OK or NG	
OK >> GO TO 8. NG >> GO TO 13.	
	J
8. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	K
OK or NG	I.
OK >> GO TO 9. NG >> Tighten to specified torque.	
9. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)	L
See <u>HBC-177, "Diagnosis Procedure"</u> .	в. 4
OK >> GO TO 10.	Μ
NG >> Tighten to specified torque.	
10.INSPECT HYBRID TRANSAXLE (MG2)	Ν
See HBC-177, "Diagnosis Procedure".	
OK or NG	
OK >> GO TO 11.	0
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
11 .INSPECT HYBRID TRANSAXLE (MG1)	Ρ
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> Replace inverter with converter assembly (See <u>HBC-638</u> , " <u>Removal and Installation</u> ").	
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
12. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 14.

NG >> Connect securely.

 $13. {\tt check \ connector \ connection \ condition \ (generator \ resolver \ connector)}$

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 15.

NG >> Connect securely.

14.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36. "Removal and Installation"</u>).

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 <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

P0A7A-810

Description

INFOID:000000004211984

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.

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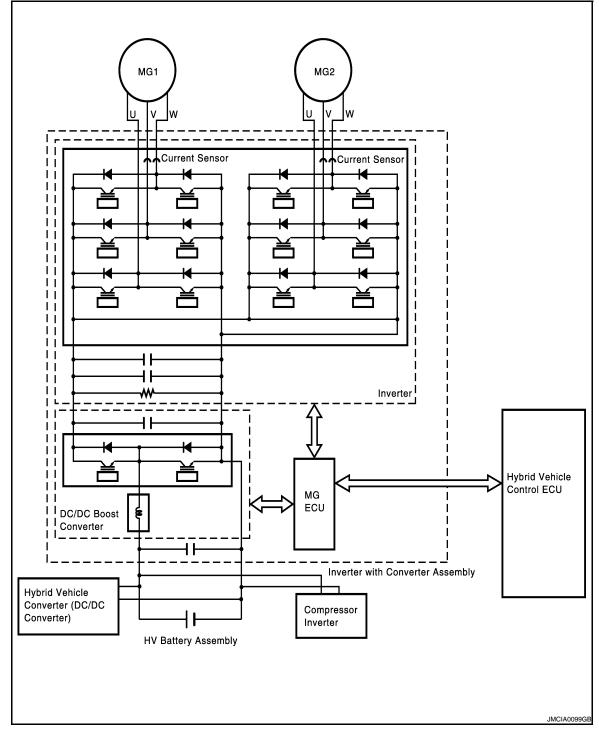
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P0A7A-810

< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004211985

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

P0A7A-810

< COMPONENT DIAGNOSIS >

Diagnosis Procedure

INFOID:000000004211986

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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 HBC 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/Perfor- mance	
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.

 ${f 3.}$ CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-NECTOR)

See HBC-109, "Diagnosis Procedure".

OK or NG

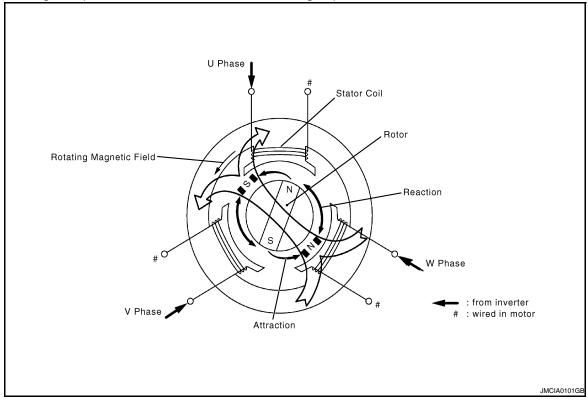
OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>).

NG >> Connect securely.

P0A90-251

Description

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:000000004211988

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:000000004211989

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.

HBC-350

INFOID:000000004211987

>> GO TO 2.

$2. {\sf CHECK} \, {\sf DTC} \, {\sf OUTPUT} \, ({\sf HYBRID} \, {\sf SYSTEM})$

Turn ignition switch ON. Check DTC.

OK

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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
P0A1D (Except INF code 390) Hybrid Powertrain Control Module	
	P0A60 (all INF codes), P0A63 (all INF codes)
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
P0A90-251 may be set due to a n case, first troubleshoot the output Then, perform a test to attempt to DTC detected? YES >> Go to Diagnosis Procedur NO >> GO TO 3.	DTCs in the table above. reproduce the problems, and check that no DTCs are output.
P0A90-251 may be set due to a n case, first troubleshoot the output Then, perform a test to attempt to DTC detected? YES >> Go to Diagnosis Procedur NO >> GO TO 3. SIMULATION TEST Test-drive the vehicle at a speed of	DTCs in the table above. reproduce the problems, and check that no DTCs are output. re relevant to output DTC.
P0A90-251 may be set due to a n case, first troubleshoot the output Then, perform a test to attempt to DTC detected? YES >> Go to Diagnosis Procedur NO >> GO TO 3. SIMULATION TEST Test-drive the vehicle at a speed of Check DTC.	DTCs in the table above. reproduce the problems, and check that no DTCs are output. re relevant to output DTC. of 40 km/h for approximately 1 minute.
P0A90-251 may be set due to a n case, first troubleshoot the output Then, perform a test to attempt to DTC detected? YES >> Go to Diagnosis Procedur NO >> GO TO 3. SIMULATION TEST Test-drive the vehicle at a speed of Check DTC.	DTCs in the table above. reproduce the problems, and check that no DTCs are output. re relevant to output DTC. of 40 km/h for approximately 1 minute.
P0A90-251 may be set due to a n case, first troubleshoot the output Then, perform a test to attempt to DTC detected? YES >> Go to Diagnosis Procedur NO >> GO TO 3. SIMULATION TEST Test-drive the vehicle at a speed of Check DTC. DTC output P0A78-306 or P0A90-509 is output	DTCs in the table above. reproduce the problems, and check that no DTCs are output. re relevant to output DTC. of 40 km/h for approximately 1 minute.
P0A90-251 may be set due to a n case, first troubleshoot the output Then, perform a test to attempt to DTC detected? YES >> Go to Diagnosis Procedur NO >> GO TO 3. SIMULATION TEST Test-drive the vehicle at a speed of Check DTC. DTC output P0A90-251 is output or no DTC is output	DTCs in the table above. reproduce the problems, and check that no DTCs are output. re relevant to output DTC. of 40 km/h for approximately 1 minute.
P0A90-251 may be set due to a n case, first troubleshoot the output Then, perform a test to attempt to DTC detected? YES >> Go to Diagnosis Procedur NO >> GO TO 3. SIMULATION TEST Test-drive the vehicle at a speed of Check DTC. DTC output P0A78-306 or P0A90-509 is output P0A90-251 is output or no DTC is output P0A90-251 is output or no DTC is output or B A >> Go to Diagnosis Procedur B >> GO TO 4. CHECK CONNECTOR CONNECT ECTOR) ee <u>HBC-109, "Diagnosis Procedure" K or NG</u>	DTCs in the table above. reproduce the problems, and check that no DTCs are output. re relevant to output DTC. of 40 km/h for approximately 1 minute. Proceed to A B re relevant to output DTC. TON CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-

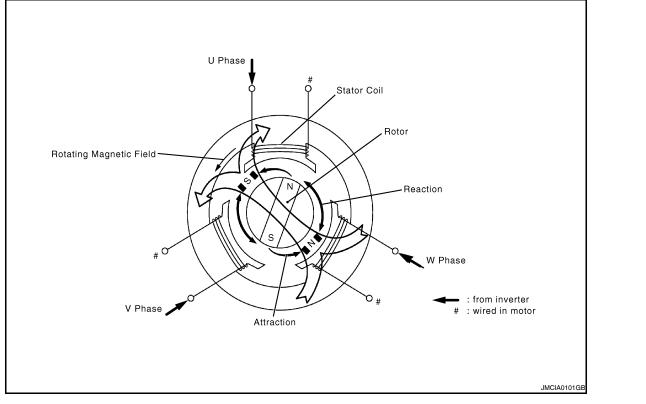
>> Replace hybrid transaxle (See TM-36, "Removal and Installation").

NG >> Tighten to specified torque.

P0A90-509

Description

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 HBC 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 torgue in an efficient manner, even at high speeds.



DTC Logic

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 	Ν

Diagnosis Procedure

INFOID:000000004211992

INFOID:000000004211991

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.

HBC-353

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INFOID:000000004211990

>> 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 <u>HBC-109</u>, "Diagnosis Procedure".

OK or NG

OK >> GO TO 4.

NG >> Connect securely.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 5.

NG >> Tighten to specified torque.

5.INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

P0A90-509

< COMPONENT DIAGNOSIS >

- >> Replace inverter with converter assembly (See <u>HBC-638</u>, "<u>Removal and Installation</u>"). >> Replace hybrid transaxle (See <u>TM-36</u>, "<u>Removal and Installation</u>"). OK
- NG

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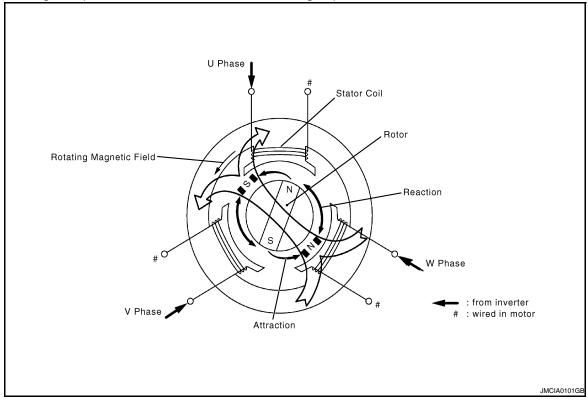
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P0A92-261

Description

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:000000004211994

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 de- terioration or same phase short circuit	Hybrid transaxle

Diagnosis Procedure

INFOID:000000004211995

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.

$2. {\sf CHECK} \, {\sf DTC} \, {\sf OUTPUT} \, ({\sf HYBRID} \, {\sf SYSTEM})$

Turn ignition switch ON.
 Check DTC.

DTC No.	Relevant Diagnosis	HBC
P0A1A (all INF codes), P0A1B (all INF codes)	MG ECU circuit malfunction	
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module	D
P0A3F-243, P0A40-500, P0A41-245	Motor resolver circuit malfunction	D
P0A4B-253, P0A4C-513, P0A4D-255	Generator resolver circuit malfunction	
P0A51-174	MG ECU circuit malfunction	Е
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	F
P0A7A-344, 522	Generator inverter malfunction	
P0A90-509	MG2 malfunction	C
P0A92-521	MG1 malfunction	G
P0A94-585, 587, 589, 590	Boost converter circuit	
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault	Н
P3004-132	Power Cable Malfunction	
P3233-750	HV gate shutdown wiring malfunction	
YES >> Go to Diagnosis Procedure rel NO >> GO TO 3. 3.SIMULATION TEST 1. Leave the vehicle for 1 minute with the NOTE: If the accelerator pedal is depressed w	·	K
2. Check DTC.		M
DTC output	Proceed to	
P0A7A-344 or P0A92-521 is output	A	Ν
P0A92-261 is output or no DTC is output	В	
A or B A >> Go to Diagnosis Procedure rel B >> GO TO 4.	evant to output DTC.	0
4.CHECK CONNECTOR CONNECTION	CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-	
NECTOR)		Р
See HBC-109, "Diagnosis Procedure".		
<u>OK or NG</u>		
OK >> GO TO 5. NG >> Connect securely.		

HBC-357

 $5. {\tt check inverter with converter assembly (generator cable connection condition)}$

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See HBC-177, "Diagnosis Procedure".

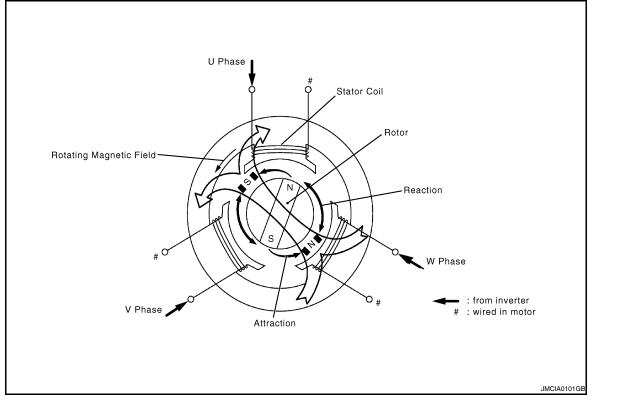
OK or NG

- >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). >> Tighten to specified torque. OK
- NG

P0A92-521

Description

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 HBC 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 torgue in an efficient manner, even at high speeds.



DTC Logic

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 transaxleInverter with converter assembly	Ν

Diagnosis Procedure

INFOID:000000004211998

INFOID:000000004211997

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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.

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INFOID:000000004211996

>> 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 <u>HBC-109, "Diagnosis Procedure"</u>.

OK or NG

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

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 5.

NG >> Tighten to specified torque.

5.INSPECT HYBRID TRANSAXLE (MG1)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

P0A92-521

< COMPONENT DIAGNOSIS >

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

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P0A93-346

Description

INFOID:000000004211999

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:000000004212000

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:000000004212001

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".

<u>OK or NG</u>

OK >> GO TO 4.

 Check for coolant leaks. 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.	В
Coolant leaks are evident. NOTE:	С
After repairing the coolant leaks and adding coolant, perform the "INV WATER PUMF FAN SPD" in "ACTIVE TEST" mode with CONSULT-III and make sure that there are no or B or C A >> GO TO 5. B >> Add coolant. C >> Check for coolant leaks and add coolant.	P" and "COOLIN malfunctions.
CHECK COOLANT HOSE Check if the hoses of the inverter cooling system are kinked or clogged.	
	ALCIA0018ZZ
1 Coolant reservoir 2. Water pump with motor and bracket assembly	
DK or NG OK >> GO TO 6. NG >> Correct the problem. CHECK FUSE	
 Turn ignition switch OFF. Remove the 10A fuse (No. 67). Check the resistance of the fuse. 	
Resistance: Below 1 Ω	
s the inspection result normal? YES >> GO TO 7. NO >> Replace fuse.	U CONNECTOR

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 8.

NG >> Connect securely.

 $\mathbf{8}$. 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.

<u>OK or NG</u>

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.
- 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.

<u>OK or NG</u>

- OK >> GO TO 12.
- NG >> Check cooling fan system (See <u>EC-382, "Component Function Check"</u>).

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.

<u>OK or NG</u>

P0A93-346

< COMPONE	NT DIAGNO	SIS >					
NG >> R	eplace water	pump with	motor &	bracket as	sembly.	"Removal and Installation").	А
13.PERFOF	RM ACTIVE T	EST WITH	I CONSU	LT-III (INV		ЛР)	
 Turn ignit Perform " During the 	ion switch ON INV WATER F e test, open tl	PUMP" in " he sub res	ACTIVE	TEST" with	n CONSULT-I	assembly several times. II. ere are ripples in the coolant. Continue	В
the active NOTE:	test for at lea	ist 1 minut	e.				HBC
stops dr • The wat • After re	opping. ter pump moto pairing the co	or operates olant leaks	s even in s and add	maintenar ling coolar	nce mode. ht, perform the	e "INV WATER PUMP" and "COOLING	D
FAN SP	D" active test						Е
	dd coolant.		300 1030			Timilate.	
	O TO 14.						F
14.снеск							
 Remove t Apply 12 		No. 67). am termin	al of the			e high voltage fuse and fusible link box	G
The w	ater pump or	perates.					Η
4. Install the	10A fuse to t	he high vo	Itage fuse	e and fusib	le link box.		
OK or NG	0 70 45						Ι
	O TO 15. O TO 17.						
15.снеск	HARNESS AI	ND CONN	ECTOR (WATER P		NOTOR & BRACKET ASSEMBLY - HV	J
CONTROL EC	CU)						
	ct the water p the resistance						K
Check for op	en						
Hybrid vehicle	e control ECU	Water purr	p with moto assembly	or & bracket		-	L
Harness connector	Terminal	Harnes connect	is .	Terminal	Resistance		B. 4
E66	109 (IWP)	E72		3 (SWP)	Below 1 Ω	_	Μ
Check for sh	ort					_	
	ehicle control EC		Groun	d	Resistance		Ν
Harness conne			Crown	4	10 10	-	
E66	109 (I	VVP)	Groun	d	10 kΩ	-	0
Water pump wit	h motor & bracke	et assembly				-	
Harness conne		minal	Grou	Ind	Resistance		Ρ
E72	3 (5	SWP)	Grou	ind	10 kΩ	_	
OK or NG						_	
	O TO 16. epair or repla	ce harness	s or conne	ector.			

 $16. {\tt check harness and connector (water pump with motor power source circuit)}$

- 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

H				
Component connector Terminal		Component connector	' Ierminai	
_	Fuse (No. 67) upstream side	_	IGCT relay terminal 5	Below 1 Ω

<u>OK or NG</u>

- OK >> Replace hybrid vehicle control ECU (See <u>HBC-644, "Removal and Installation"</u>).
- 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	resistance
E66	109 (IWP)	E72	3 (SWP)	Below 1 Ω

Water pump with moto	r & bracket assembly	Ground	Resistance	
Harness connector Terminal		Ground	Resistance	
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	resistance
_	Fuse (No. 68) downstream side	E72	4 (+B)	Below 1 Ω

Check for short

Hybrid vehicl	e control ECU	Ground	Resistance
Harness connector Terminal		Ground	Resistance
E66	109 (IWP)	Ground	$10k\Omega$ or higher

Water pump with mot	or & bracket assembly	Ground	Resistance
Harness connector	Terminal	Crodina	Resistance
E72	3 (SWP)	Ground	$10k\Omega$ or higher

OK or NG

OK >> Replace water pump with motor & bracket assembly.

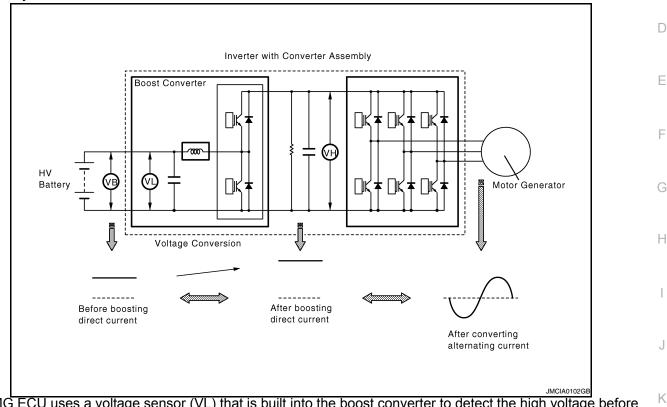
NG >> Repair or replace harness or connector.

P0A94-127

Description

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 HBC 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:000000004212003

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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	I
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 	0

Diagnosis Procedure

INFOID:000000004212004

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

HBC-367

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INFOID:000000004212002

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< COMPONENT DIAGNOSIS >

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. <u>Is DTC detected?</u>

OK >> Go to Diagnosis Procedure relevant to output DTC.

NG >> GO TO 3.

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

See <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

< COMPONENT DIAGNOSIS >	
OK >> GO TO 4.	
NG >> Connect securely.	А
4. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RE-	
SOLVER) See <u>HBC-164, "Diagnosis Procedure"</u> .	В
OK or NG	
OK >> GO TO 5.	
NG >> Repair or replace harness or connector.	ΗB
5.CHECK GENERATOR RESOLVER	
See <u>HBC-164, "Diagnosis Procedure"</u> .	D
OK or NG	
OK >> GO TO 6. NG >> GO TO 20.	Ε
6. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-	
ER)	F
See HBC-171, "Diagnosis Procedure".	
OK or NG	
OK >> GO TO 7.	G
NG >> Repair or replace harness or connector. 7.CHECK MOTOR RESOLVER	
	Н
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK >> GO TO 8.	
NG >> GO TO 18.	
8.CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	J
OK or NG	
OK >> GO TO 9.	
NG >> Tighten to specified torque.	K
9. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	L
OK or NG	
OK >> GO TO 10. NG >> Tighten to specified torque.	
	M
10.INSPECT HYBRID TRANSAXLE (MG1)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	Ν
OK or NG	
OK >> GO TO 11. NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
11.INSPECT HYBRID TRANSAXLE (MG2)	0
See <u>HBC-177, "Diagnosis Procedure"</u> .	Р
OK or NG OK >> GO TO 12.	٢
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
12. CHECK INVERTER WITH CONVERTER ASSEMBLY (HIGH VOLTAGE CONNECTOR CONNECTION	
CONDITION)	
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	

OK >> GO TO 13.

NG >> Connect securely.

13.CHECK SERVICE PLUG GRIP

See HBC-231, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 14.

NG >> Replace service plug grip.

14. CHECK CONDITION OF FRAME WIRE CONNECTIONS (HV RELAY ASSEMBLY SIDE)

See <u>HBC-543, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 15.

NG >> Tighten to specified torque.

15.CHECK FRAME WIRE

See HBC-177, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 16.

NG >> Replace frame wire (See <u>HBC-648</u>, "Removal and Installation").

16. INSPECT HV RELAY ASSEMBLY (SMRB)

See <u>HBC-231, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 17.

NG >> Replace HV relay assembly (See <u>HBB-105</u>, "Removal and Installation").

17.INSPECT HV RELAY ASSEMBLY (SMRG)

See <u>HBC-231, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

NG >> Replace HV relay assembly (See <u>HBB-105</u>, "Removal and Installation").

18. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 19.

NG >> Connect securely.

19. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY-MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36</u>, "Removal and Installation").

NG >> Repair or replace harness or connector.

20. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See <u>HBC-164, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 21.

NG >> Connect securely.

 $\begin{array}{l} \textbf{21.check harness and connector (inverter with converter assembly - generator resolver)} \end{array}$

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

< COMPONENT DIAGNOSIS >

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

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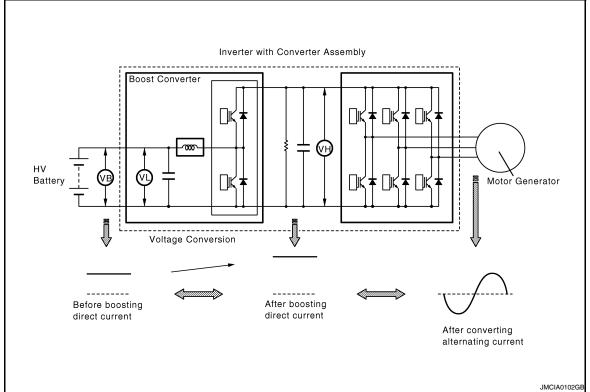
P0A94-172

Description

INFOID:000000004212005

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:000000004212006

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:000000004212007

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.

< COMPONENT DIAGNOSIS >

• 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
0A1D (Except INF code 390)	Hybrid Powertrain Control Module
0A1A (all INF codes)	Generator Control Module
0A1B (all INF codes)	Drive Motor "A" Control Module
DA72 (all INF codes)	Generator Phase V Current
A75 (all INF codes)	Generator Phase W Current
A60 (all INF codes)	Drive Motor "A" Phase V Current
A63 (all INF codes)	Drive Motor "A" Phase W Current
A4B-253	Generator Position Sensor Circuit
A4D-255	Generator Position Sensor Circuit Low
A4C-513	Generator Position Sensor Circuit Range/Performance
A3F-243	Drive Motor "A" Position Sensor Circuit
441-245	Drive Motor "A" Position Sensor Circuit Low
440-500	Drive Motor "A" Position Sensor Circuit Range/Performance
78-266, 267, 523, 586, 284, 505, 287, 506, 113, 286, , 279, 504, 306, 806, 807, 808, 128	Drive Motor "A" Inverter Performance
A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549,	DC/DC Converter Performance
7A-322, 517, 325, 518, 122, 324, 344, 809, 810, 811,	Generator Inverter Performance
92-521	Hybrid Generator Performance
\ 90-509	Drive Motor "A" Performance
AA6-526	Hybrid Battery Voltage System Isolation Fault
AA6-613	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 Μ 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?

IS DTC detected?	
YES >> Go to Diagnosis Procedure relevant to output DTC.	N
NO >> GO TO 3.	
3. CHECK AMOUNT OF GASOLINE)
See <u>HBC-303, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> GO TO 4.	2
NG >> Refuel vehicle.	
4. CHECK ENGINE START	

See HBC-303, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7. NG >> GO TO 5.

HBC-373

В

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5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See <u>HBC-303</u>, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.

NG >> GO TO 6.

\mathbf{6}. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See <u>HBC-303, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace engine assembly.

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

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 8.

NG >> Connect securely.

 ${f 8}$. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See <u>HBC-164</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See <u>HBC-164</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 10. NG >> GO TO 16.

10. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Repair or replace harness or connector.

11.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 12.

NG >> GO TO 18.

12. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-TION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 13.

NG >> Tighten to specified torque.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

< COM	IPONENT DIAGNOSIS >	
OK NG	>> GO TO 14. >> Tighten to specified torque.	А
14.IN	ISPECTION HYBRID TRANSAXLE (MG1)	
See HE	3C-177, "Diagnosis Procedure".	В
<u>OK or N</u>	NG	D
OK	>> GO TO 15.	
NG 1 E	>> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	HBC
IJ.IN	ISPECTION HYBRID TRANSAXLE (MG2)	
See <u>HE</u>	3C-177, "Diagnosis Procedure".	6
<u>OK or I</u>		D
OK NG	>> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	F
16. ci	HECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	E
See HE	3C-164, "Diagnosis Procedure".	
<u>OK or N</u>	NG	F
OK	>> GO TO 17.	
NG	>> Connect securely.	
	HECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	G
RESOL	,	
	<u>3C-164, "Diagnosis Procedure"</u> .	Н
OK or N		
OK NG	>> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). >> Repair or replace harness or connector.	
-	HECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	
	3C-171, "Diagnosis Procedure".	
OK or N		J
OK	>> GO TO 19.	
NG	>> Connect securely.	
19. ci	HECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-	Κ
SOLVE		
See HE	3C-171, "Diagnosis Procedure".	
<u>OK or N</u>	NG	_
OK NG	>> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). >> Repair or replace harness or connector.	Μ
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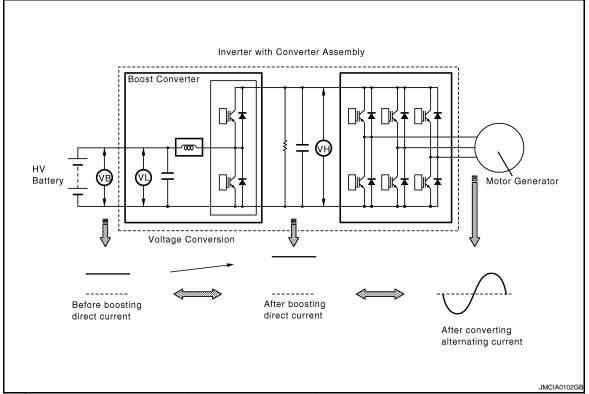
P0A94-442

Description

INFOID:000000004212008

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:000000004212009

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:000000004212010

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.

< COMPONENT DIAGNOSIS >

- 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.

Check DTC.

DTC No.	Relevant Diagnosis
P0A1D (Except INF code 390)	Hybrid Powertrain Control Module
0A1A (all INF codes)	Generator Control Module
0A1B (all INF codes)	Drive Motor "A" Control Module
0A72 (all INF codes)	Generator Phase V Current
A75 (all INF codes)	Generator Phase W Current
A60 (all INF codes)	Drive Motor "A" Phase V Current
A63 (all INF codes)	Drive Motor "A" Phase W Current
A4B-253	Generator Position Sensor Circuit
A4D-255	Generator Position Sensor Circuit Low
A4C-513	Generator Position Sensor Circuit Range/Performance
A3F-243	Drive Motor "A" Position Sensor Circuit
41-245	Drive Motor "A" Position Sensor Circuit Low
40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
78-266, 267, 306, 510, 523, 586, 505, 287, 506, 503, 504, 806, 807, 808	Drive Motor "A" Inverter Performance
94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549	DC/DC Converter Performance
7A-517, 325, 344, 518, 522, 809, 810, 811	Generator Inverter Performance
A92 (all INF codes)	Hybrid Generator Performance
A90 (all INF codes)	Hybrid Generator Performance
AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
000 (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. \mathbb{N}

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 <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

NG >> Connect securely.

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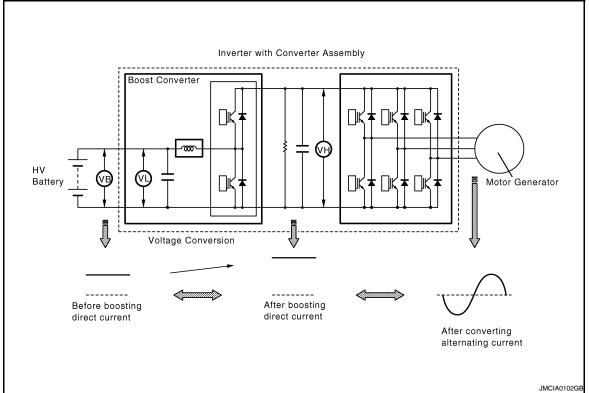
P0A94-547, P0A94-549

Description

INFOID:000000004212011

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:000000004212012

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		Boost converter overvoltage signal detection (overvoltage due to MG ECU malfunction)	Wire harness or connectorInverter with converter assemblyHybrid transaxle
1 0/134	549		Boost converter overvoltage signal detection (overvoltage due to hybrid transaxle malfunction)	Wire harness or connectorInverter with converter assemblyHybrid transaxle

P0A94-547, P0A94-549

< COMPONENT DIAGNOSIS > Diagnosis Procedure

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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 HBC 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
0A40-500	Drive Motor "A" Position Sensor Circuit Range / Perfor- mance
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
3004-803	High Voltage Power Resource
20ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
20ADC-226	Hybrid Battery Positive Contactor Control Circuit High
20ADF-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.

 $\mathbf{3}.$ check connector connection condition (inverter with converter assembly connector)

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 4.

NG >> Connect securely.

4.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-ER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 5.

NG >> Repair or replace harness or connector.

5.CHECK MOTOR RESOLVER

See HBC-171, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 8.

NG >> GO TO 6.

6. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 7.

NG >> Connect securely.

/.CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-ER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

 $\mathbf{8}$. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER)

See HBC-164, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 10.

NG >> GO TO 14.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 11.

NG >> Tighten to specified torque.

11. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-TION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 12.

NG >> Tighten to specified torque.

12.INSPECT HYBRID TRANSAXLE (MG1)

P0A94-547, P0A94-549

< COMPONENT DIAGNOSIS >	
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG A	1
OK >> GO TO 13.	
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	<u>,</u>
13.INSPECT HYBRID TRANSAXLE (MG2)	2
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	ЗC
OK >> GO TO 14.	
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
14.CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR))
See <u>HBC-164</u> , "Diagnosis Procedure".	
<u>OK or NG</u>	-
OK >> GO TO 15.	-
NG >> Connect securely.	
15. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR $_{\rm F}$	-
RESOLVER)	
See <u>HBC-164</u> , "Diagnosis Procedure".	
<u>OK or NG</u> G	6
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
NG >> Repair or replace harness or connector.	
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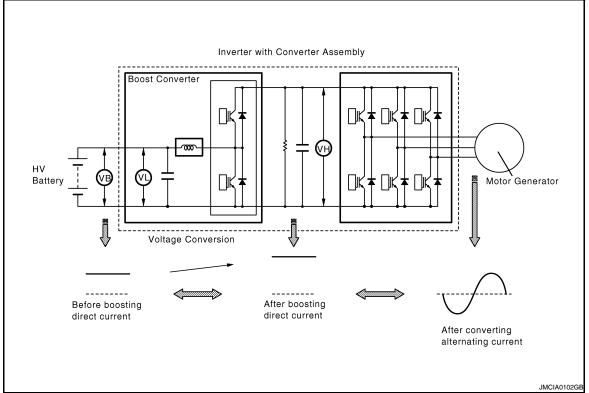
P0A94-548

Description

INFOID:000000004212014

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:000000004212015

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 sig- nal detection (overvoltage due to inverter malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:000000004212016

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

< COMPONENT DIAGNOSIS >

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.

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- 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
0A4C-513	Generator Position Sensor Circuit Range/Performance
0A3F-243	Drive Motor "A" Position Sensor Circuit
0A41-245	Drive Motor "A" Position Sensor Circuit Low
)A40-500	Drive Motor "A" Position Sensor Circuit Range / Perfor- mance
0A78-266, 267, 523, 586, 505, 287, 506, 806, 807, 808	Drive Motor "A" Inverter Performance
0A94-585, 587, 589, 590, 554, 555, 556	DC/DC Converter Performance
0A7A-517, 325, 518, 809, 810, 811	Generator Inverter Performance
3004-803	High Voltage Power Resource
0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
0ADC-226	Hybrid Battery Positive Contactor Control Circuit High
0ADF-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.

 $\mathbf{3}$.check connector connection condition (inverter with converter assembly connector)

See <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

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

NG >> Connect securely.

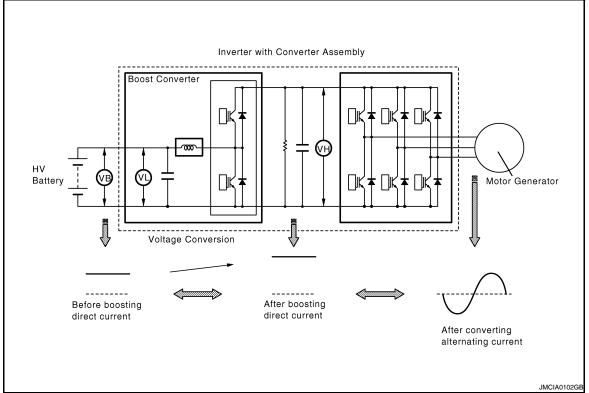
P0A94-550

Description

INFOID:000000004212017

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:000000004212018

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:000000004212019

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.

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conne • Waitir	disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage ectors or terminals. ng for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with erter assembly.	А
-	>> GO TO 2.	В
2. CHE	ECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-	
NECTO	DR)	HBC
See HE	3C-109, "Diagnosis Procedure".	
<u>OK or N</u>	NG	D
OK NG	>> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>). >> Connect securely.	D

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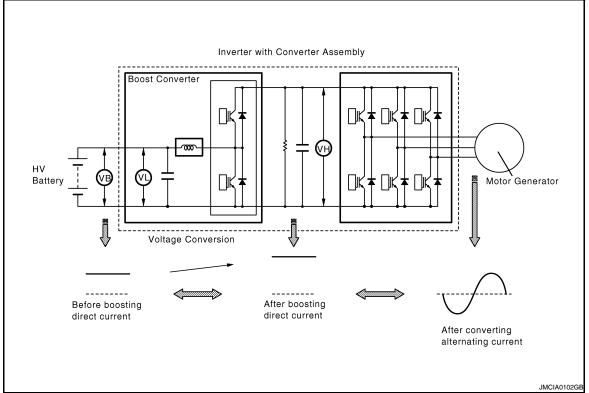
P0A94-553

Description

INFOID:000000004212020

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:000000004212021

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

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Diagnosis Procedure

INFOID:000000004212022

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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 HBC 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 P 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 <u>HBC-303</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 4.

NG >> Refuel vehicle.

4.CHECK ENGINE START

See <u>HBC-303</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 7.

NG >> GO TO 5.

5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

See <u>HBC-303, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 7.

NG >> GO TO 6.

\mathbf{6}. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See <u>HBC-303, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace engine assembly.

I.CHECK QUANTITY OF INVERTER COOLANT

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>A or B or C</u>

- A >> GO TO 8.
- B >> Add coolant.
- C >> Check for coolant leaks and add coolant.

8.CHECK COOLANT HOSE

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Correct the problem.

9.CHECK FUSE (NO. 67)

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 10.

NG >> Replace fuse.

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

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Connect securely.

11. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET AS-SEMBLY CONNECTOR)

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 12.

NG >> Connect securely.

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

See <u>HBC-362</u>, "Diagnosis Procedure".

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< COMPONENT DIAGNOSIS >	_
OK >> GO TO 13.	
NG >> GO TO 28.	
13. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)	_
See <u>HBC-362, "Diagnosis Procedure"</u> .	
OK or NG	
OK >> GO TO 14. NG >> Connect securely.	I
14. PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)	
See <u>HBC-362</u> , "Diagnosis Procedure".	-
OK or NG	
OK >> GO TO 15.	
NG >> Check cooling fan system (See <u>EC-382, "Component Function Check"</u>).	
15. check connector connection condition (inverter with converter assembly con	-
NECTOR)	
See <u>HBC-109, "Diagnosis Procedure"</u> .	-
OK or NG	
OK >> GO TO 16.	
NG >> Connect securely.	
16. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	{
RESOLVER)	_
See <u>HBC-164, "Diagnosis Procedure"</u> .	
<u>DK or NG</u>	
OK >> GO TO 17. NG >> Repair or replace harness or connector.	
17. CHECK GENERATOR RESOLVER	
See <u>HBC-164, "Diagnosis Procedure"</u> .	-
<u>DK or NG</u>	
OK >> GO TO 18.	
NG >> GO TO 24.	
18.check harness and connector (inverter with converter assembly - motor re	-
SOLVER)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	-
<u>OK or NG</u>	
OK >> GO TO 19.	
NG >> Repair or replace harness or connector.	
19. CHECK MOTOR RESOLVER	_
See <u>HBC-171, "Diagnosis Procedure"</u> .	
<u>OK or NG</u>	
OK >> GO TO 20. NG >> GO TO 26.	
20.check inverter with converter assembly (generator cable connection condi	_
ION)	-
See <u>HBC-177, "Diagnosis Procedure"</u> .	-
DK 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".	-
Juo Huo-HH, Diagnosis Housaule.	

<u>OK or NG</u>

OK >> GO TO 22.

NG >> Tighten to specified torque.

22.INSPECT HYBRID TRANSAXLE (MG1)

See HBC-177, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 23.

NG >> Replace hybrid transaxle.

23. INSPECT HYBRID TRANSAXLE (MG2)

See HBC-177, "Diagnosis Procedure".

<u>OK or NG</u>

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

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

24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 25.

NG >> Connect securely.

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

See <u>HBC-164, "Diagnosis Procedure"</u>.

OK or NG

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 27.

NG >> Connect securely.

27. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

28. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See <u>HBC-362, "Diagnosis Procedure"</u>.

OK or NG

OK >> Add coolant.

NG >> GO TO 29.

29.CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 30.

NG >> GO TO 32.

30. Check harness and connector (water pump with motor & bracket assembly - HV control ecu)

See <u>HBC-362</u>, "Diagnosis Procedure".

< COMPONENT DIAGNOSIS >	
OK or NG	•
OK >> GO TO 31.	A
NG >> Repair or replace harness or connector.	
31. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX	B
See HBC-362, "Diagnosis Procedure".	D
OK or NG	
OK >> Replace hybrid vehicle control ECU. Refer to <u>HBC-12</u> , "ADDITIONAL SERVICE WHEN REPLAC	HBC
ING 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)	_
	D
See <u>HBC-362, "Diagnosis Procedure"</u> .	
OK or NG	E
 OK >> Replace water pump with motor & bracket assembly. NG >> Repair or replace harness or connector. 	
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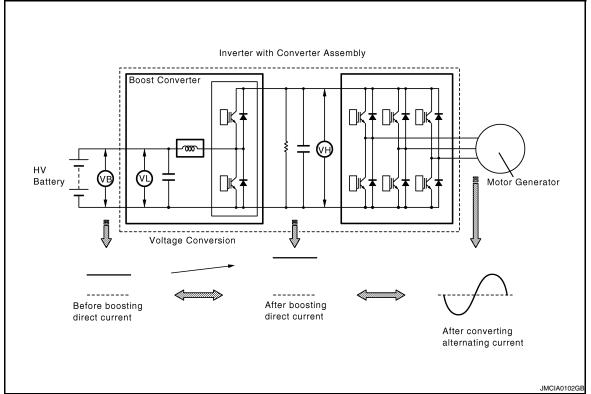
P0A94-554, P0A94-556

Description

INFOID:000000004212023

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:000000004212024

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 sig- nal detection (overcurrent due to MG ECU malfunction)	Wire harness or connectorHybrid transaxleInverter with converter assembly
	556		Boost converter inverter fail sig- nal detection (overcurrent due to hybrid transaxle malfunction)	Wire harness or connectorHybrid transaxleInverter with converter assembly

Diagnosis Procedure

INFOID:000000004212025

1.PRECONDITIONING

P0A94-554, P0A94-556

< COMPONENT DIAGNOSIS >

- Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with ٠ 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.

 ${f 3.}$ 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.

 ${f 4}$. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLV-

ER)

See HBC-171, "Diagnosis Procedure".

OK or NG

>> GO TO 5. OK

NG >> Repair or replace harness or connector. HBC

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5. CHECK MOTOR RESOLVER

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 8.

NG >> GO TO 6.

6.CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

See HBC-171, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 7.

NG >> Connect securely.

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

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

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

See <u>HBC-164, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 9.

NG >> Repair or replace harness or connector.

9.CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 10.

NG >> GO TO 14.

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

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Tighten to specified torque.

11.CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-TION)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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 <u>TM-36, "Removal and Installation"</u>).

13.INSPECT HYBRID TRANSAXLE (MG2)

See <u>HBC-177, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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

P0A94-554, P0A94-556

< COMPONENT DIAGNOSIS >	
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
14. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	А
See <u>HBC-164</u> , "Diagnosis Procedure".	
OK or NG	В
OK >> GO TO 15. NG >> Connect securely.	
	HBC
RESOLVER)	
See <u>HBC-164, "Diagnosis Procedure"</u> .	D
OK or NG	D
 OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). NG >> Repair or replace harness or connector. 	
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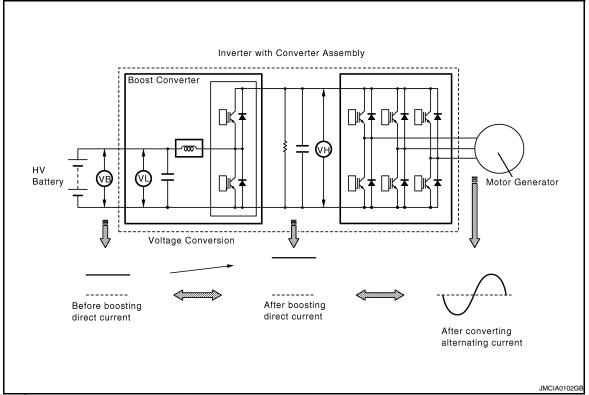
P0A94-555

Description

INFOID:000000004212026

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:000000004212027

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 invert- er assembly malfunction)	Inverter with converter assembly

Diagnosis Procedure

INFOID:000000004212028

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.

P0A94-555

< COMPONENT DIAGNOSIS >

- 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) $^{\mbox{\scriptsize M}}$

See <u>HBC-109</u>, "Diagnosis Procedure".

OK or NG

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

NG >> Connect securely.

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P0A94-557

Description

For a description of the boost converter, (See <u>HBC-376</u>, "<u>Description</u>"). 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:000000004212030

INFOID:000000004212029

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:000000004212031

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	1	А
P0A3F-243	Drive Motor "A" Position Sensor Circuit		
P0A41-245	Drive Motor "A" Position Sensor Circuit Low		В
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	н	IBC
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		D
P0A92-521	Hybrid Generator Performance		
P0A90-509	Drive Motor "A" Performance		Ε
NOTE:			
	unction which also causes DTCs in the table above to able above. After troubleshooting all output DTCs, be		F

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?

	\sim
YES >> Go to Diagnosis Procedure relevant to output DTC. NO >> GO TO 3.	G
3. CHECK AMOUNT OF GASOLINE	
See HBC-303, "Diagnosis Procedure".	— Н
OK or NG	
OK >> GO TO 4.	I
NG >> Refuel vehicle.	
4.CHECK ENGINE START	
See HBC-303, "Diagnosis Procedure".	J
OK or NG	
OK >> GO TO 7.	K
NG >> GO TO 5.	Γ
5. INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)	
See HBC-303, "Diagnosis Procedure".	L
<u>OK or NG</u>	
OK >> GO TO 7.	
NG >> GO TO 6.	M
6. INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)	
See HBC-303, "Diagnosis Procedure".	N
OK or NG	
OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	
NG >> Repair or replace engine assembly.	0
7. CHECK QUANTITY OF INVERTER COOLANT	_
See HBC-362, "Diagnosis Procedure".	_
A.B or C	P

<u>A,B or C</u>

A >> GO TO 8.

B >> Add coolant.

C >> Check for coolant leaks and add coolant.

8. CHECK COOLANT HOSE

See HBC-362, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Correct the problem.

9.CHECK FUSE (NO. 67)

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 10.

NG >> Replace fuse.

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

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Connect securely.

11.CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET AS-SEMBLY CONNECTOR)

See <u>HBC-362, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 12. NG >> Connect secure

NG >> Connect securely.

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

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 13.

NG >> GO TO 28.

 $13. {\tt check \ connector \ connection \ condition \ (cooling \ fan \ motor \ connector)}$

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 14.

NG >> Connect securely.

14.PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 15.

NG >> Check cooling fan system (See <u>EC-382, "Component Function Check"</u>).

 $15. {\tt check\ connector\ connection\ condition\ (inverter\ with\ converter\ assembly\ connector)}$

See <u>HBC-109, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 16.

NG >> Connect securely.

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

See <u>HBC-164, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 17.

NG >> Repair or replace harness or connector

17.CHECK GENERATOR RESOLVER

See <u>HBC-164, "Diagnosis Procedure"</u>.

< COMPONENT DIAGNOSIS >	
OK or NG	
OK >> GO TO 18. NG >> GO TO 24.	А
18. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-	
SOLVER)	В
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK or NG	HBC
OK >> GO TO 19.	TIBO
NG >> Repair or replace harness or connector.	
19. CHECK MOTOR RESOLVER	D
See <u>HBC-171, "Diagnosis Procedure"</u> .	
OK or NG	Е
OK >> GO TO 20. NG >> GO TO 26.	
20. CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDI-	
TION)	F
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	G
OK >> GO TO 21.	G
NG >> Tighten to specified torque.	
21. CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)	Н
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	I
OK >> GO TO 22.	1
NG >> Tighten to specified torque.	
22.INSPECT HYBRID TRANSAXLE (MG1)	J
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG	K
OK >> GO TO 23. NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	TX.
23.INSPECT HYBRID TRANSAXLE (MG2)	
	L
See <u>HBC-177, "Diagnosis Procedure"</u> .	
OK or NG OK >> Replace inverter with converter assembly (See <u>HBC-638</u> , "Removal and Installation").	M
NG $>>$ Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).	IVI
24. CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)	
See HBC-164, "Diagnosis Procedure".	Ν
OK or NG	
OK >> GO TO 25.	0
NG >> Connect securely.	0
25. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR	
RESOLVER)	Ρ
See <u>HBC-164. "Diagnosis Procedure"</u> .	
OK or NG	
 OK >> Replace hybrid transaxle (See <u>TM-36. "Removal and Installation"</u>). NG >> Repair or replace harness or connector. 	
26. CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)	
See <u>HBC-171, "Diagnosis Procedure"</u> .	

<u>OK or NG</u>

OK >> GO TO 27.

NG >> Connect securely.

27. CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RE-SOLVER)

See <u>HBC-171, "Diagnosis Procedure"</u>.

OK or NG

OK >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).

NG >> Repair or replace harness or connector.

28. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)

See HBC-362, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> Add coolant.

NG >> GO TO 29.

29. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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 <u>HBC-362</u>, "Diagnosis Procedure".

OK or NG

OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "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

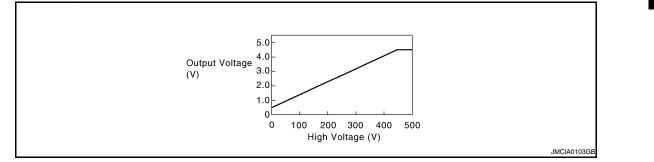
OK >> Replace water pump with motor & bracket assembly.

NG >> Repair or replace harness or connector.

P0A94-585

Description

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

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INFOID:000000004212034

INFOID:000000004212032

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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) sen- sor performance problem	Inverter with converter assembly

Diagnosis Procedure

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)

	rn ignition switch ON. neck DTC.	0
<u>Is DTC</u>	detected?	
YES	>> Go to Diagnosis Procedure relevant to output DTC.	
NO	>> Replace inverter with converter assembly (See HBC-638, "Removal and Installation").	P

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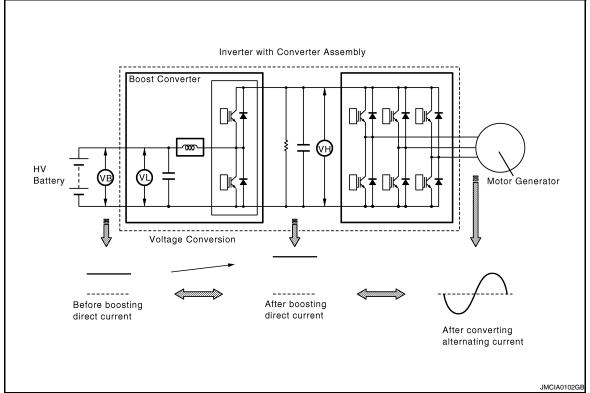
P0A94-587

Description

INFOID:000000004212035

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:000000004212036

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 assemblyBattery smart unit

Diagnosis Procedure

INFOID:000000004212037

1.PRECONDITIONING

P0A94-587

< COMPONENT DIAGNOSIS >

- 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 B >> Replace inverter with converter assem C >> Go to inspection procedure relevant to D >> GO TO 3. 3.CLEAR DTC	bly (See HBC-638, "Removal and Installation").	
 Turn ignition switch ON. Read and record the DTCs and freeze frame c Clear the DTCs. >> GO TO 4. 	ata.	
 Turn ignition switch ON (READY) and move th Turn the A/C switch to the MAX COOL position Confirm that "PWR RESOURCE IB" is more th Leave the vehicle in the condition specified in the 	. (*2) an 3A in "DATA MONITOR" mode with CONSULT-III. (*3)	
 Turn the A/C switch to the MAX COOL position Confirm that "PWR RESOURCE IB" is more th Leave the vehicle in the condition specified in a NOTE: 	. (*2) an 3A in "DATA MONITOR" mode with CONSULT-III. (*3) teps (*2) and (*3) above for 15 seconds. (*4) n, move the shift lever to the P position and start the engine	
 Turn ignition switch ON (READY) and move th Turn the A/C switch to the MAX COOL position Confirm that "PWR RESOURCE IB" is more th Leave the vehicle in the condition specified in a NOTE: If the low battery charge warning light comes o to charge the HV battery. After the engine stop 	. (*2) an 3A in "DATA MONITOR" mode with CONSULT-III. (*3) teps (*2) and (*3) above for 15 seconds. (*4) a, move the shift lever to the P position and start the engine s, perform steps (*1) through (*5) again.	
 Turn ignition switch ON (READY) and move th Turn the A/C switch to the MAX COOL position Confirm that "PWR RESOURCE IB" is more th Leave the vehicle in the condition specified in a NOTE: If the low battery charge warning light comes o to charge the HV battery. After the engine stop Check DTC. (*5) 	. (*2) an 3A in "DATA MONITOR" mode with CONSULT-III. (*3) teps (*2) and (*3) above for 15 seconds. (*4) a, move the shift lever to the P position and start the engine s, perform steps (*1) through (*5) again.	
 Turn ignition switch ON (READY) and move th Turn the A/C switch to the MAX COOL position Confirm that "PWR RESOURCE IB" is more th Leave the vehicle in the condition specified in a NOTE: If the low battery charge warning light comes o to charge the HV battery. After the engine stop Check DTC. (*5) 	. (*2) an 3A in "DATA MONITOR" mode with CONSULT-III. (*3) teps (*2) and (*3) above for 15 seconds. (*4) a, move the shift lever to the P position and start the engine s, perform steps (*1) through (*5) again.	

A,B,C,D or E

P3004-132

No DTC is output.

A >> Replace battery smart unit (See <u>HBB-101</u>, "Removal and Installation").

Power Cable Malfunction

- B >> Replace inverter with converter assembly (See <u>HBC-638</u>, "<u>Removal and Installation</u>").
- C >> Leave vehicle in P position, and charge HV battery in idle status until idling stops (perform steps (*1) through (*5).

D

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D >> Replace battery smart unit (See <u>HBB-101, "Removal and Installation"</u>).

HBC-405

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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	В
P3000-388	Discharge inhibition	С
P3004-132	Power Cable Malfunciton	D
No DTC is output.	-	E

A.B.C.D or E

- A >> Replace battery smart unit (See <u>HBB-101, "Removal and Installation"</u>).
- B >> Replace inverter with converter assembly (See page <u>HBC-638, "Removal and Installation"</u>).
- 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 <u>HBB-101, "Removal and Installation"</u>).
- 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.	А
Only 3 is satisfied.	В
1, 2 and 3 are satisfied (normal condition).	С

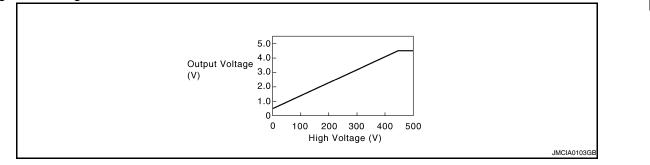
<u>A, B or C</u>

- A >> Replace inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").
- B >> Replace battery smart unit (See <u>HBB-101, "Removal and Installation"</u>).
- C >> Replace battery smart unit (See <u>HBB-101, "Removal and Installation"</u>).

P0A94-589, P0A94-590

Description

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:000000004212039

INFOID:000000004212038

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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	DC/DC Convenier Performance	Short to +B in the boost converter voltage (VL) sensor circuit		

Diagnosis Procedure

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.
- Μ 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

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>> COMPLETED

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INFOID:000000004212040

P0AA1-231

Description

INFOID:000000004212041

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.

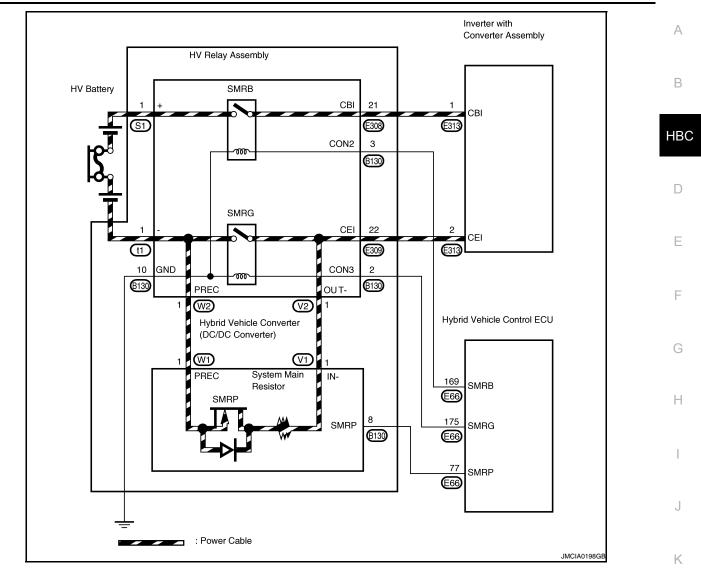
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
	DC/DC converter malfunction	P0A08-264	May not occur
Onen in AND line	Open in VLO, short to GND	P0A09-591	May not occur
Open in AMD line	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.

P0AA1-231

< COMPONENT DIAGNOSIS >



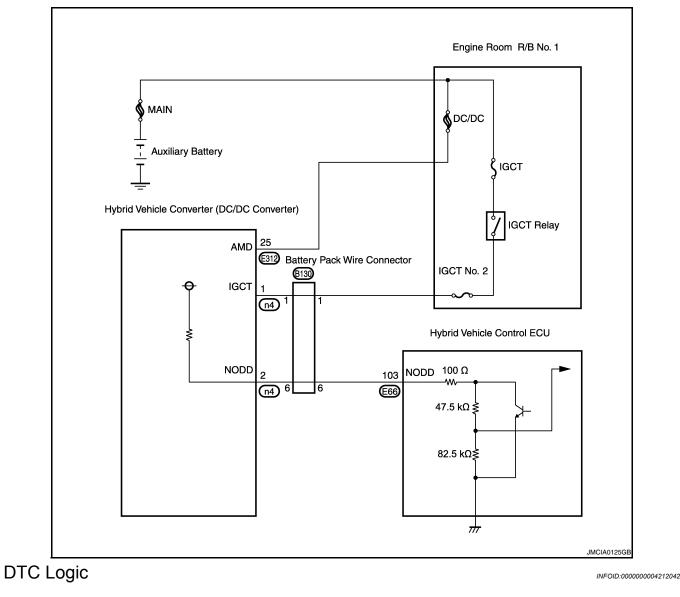
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DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AA1	231	Hybrid Battery Positive Contac- tor 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:000000004212043

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.

2. CHECK DTC OUTPUT (HYBRID SYSTEM)

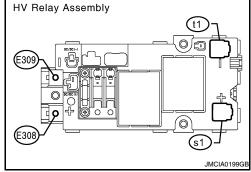
1. Turn ignition switch ON.

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 DT NO >> GO TO 3.	C.
3. CHECK FREEZE FRAME DATA	
 Turn ignition switch ON. Read output DTCs. Read the freeze frame data of P0AA1-231. 	Dracood to
Result	Proceed to
Boost converter voltage (VL) is less than 60 V.	A
Denot convertence $(V_{I}) = (0, V_{I})$	
Boost converter voltage (VL) is 60 V or more.	В
A or B A >> Replace inverter with converter assembly (See <u>-</u>	
A or B A >> Replace inverter with converter assembly (See <u>H</u> B >> GO TO 4.	
A or B A >> Replace inverter with converter assembly (See <u>H</u> B >> GO TO 4. 4. CHECK HV RELAY ASSEMBLY	
A or B A >> Replace inverter with converter assembly (See <u>H</u> B >> GO TO 4.	IBC-638. "Removal and Installation").

- For the removal and installation procedures related to inspection of the HV relay assembly, (See <u>HBB-105</u>, "Removal and Installation").
- 2. Measure the resistance according to the value(s) in the table H below.

HV Relay Assembly		HV Relay Assembly			
	Component connector	Terminal	Component connector	Terminal	Resistance
	E308	21	s1	1	10 k Ω or higher



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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 <u>HBC-638</u>, "Removal and Installation").

P0AA1-233

Description

Refer to the description for DTC P0AE6-225 (See <u>HBC-460</u>, "<u>Description</u>"). 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

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	E
P0AA1	233	Hybrid Battery Positive Contac- tor Circuit Stuck Closed	System main relays B, and G on the HV battery positive and neg- ative sides are stuck closed.		F

Diagnosis Procedure

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	-

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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.

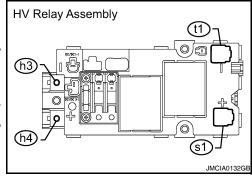
 Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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 <u>HBB-105</u>, "<u>Removal and Installa-</u> <u>tion</u>").
- Measure the resistance according to the value(s) in the table below. (SMRB inspection) (*1)

HV Relay Assembly		HV Relay Assembly		
Component connector	Terminal	Component connector	Terminal	Resistance
h4	1	s1	1	10 k Ω or higher



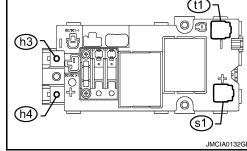
NOTE:

• 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 HV Relay Assembly below. (SMRG inspection) (*2)

HV Relay	HV Relay Assembly HV Relay Assembly			
Component connector	Terminal	Component connector	Terminal	Resistance
h3	1	t1	1	10 k Ω 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).	В

<u>A or B</u>

A >> Replace HV relay assembly (See <u>HBB-105</u>, "Removal and Installation").

B >> Replace HV relay assembly (See <u>HBB-105, "Removal and Installation"</u>).

P0AA4-232

Description

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	
	DC/DC converter malfunction	P0A08-264	May not occur	_
	Open in VLO, short to GND	P0A09-591	May not occur	
Open in AMD line	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.

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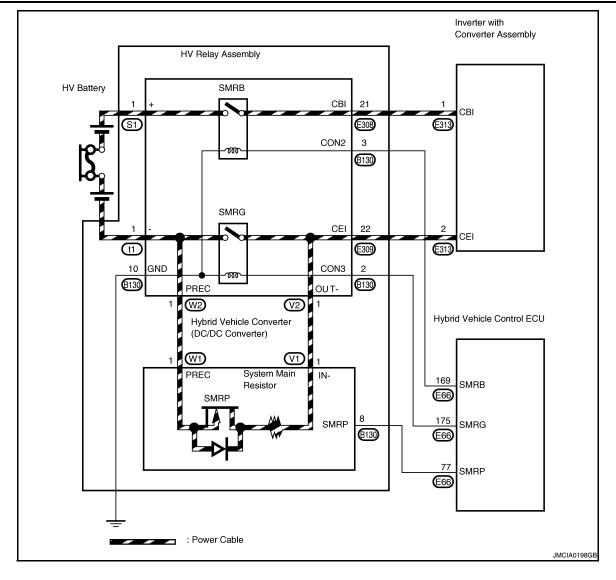
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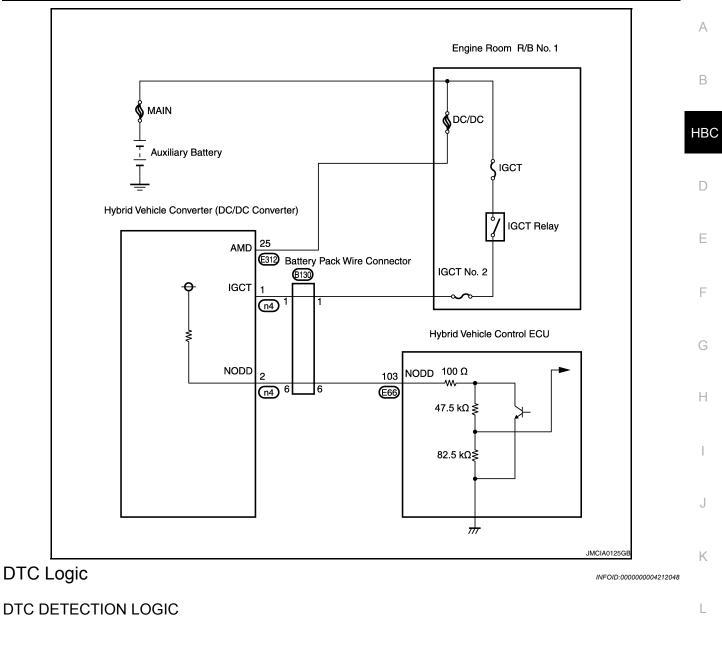
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P0AA4-232

< COMPONENT DIAGNOSIS >





DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	M
P0AA4	232	Hybrid Battery Negative Con- tactor Circuit Stuck Closed	System main relay G on the HV battery negative side is stuck closed.	 HV relay assembly Inverter with converter assembly	N

Diagnosis Procedure

INFOID:000000004212049

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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.	В

<u>A or B</u>

A >> Replace inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").

B >> GO TO 4.

4.CHECK HV RELAY ASSEMBLY

CAUTION:

Be sure to wear insulated gloves.

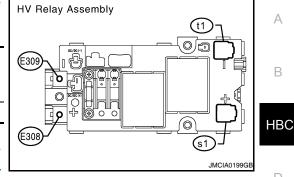
1. Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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	
Component connector	Terminal	Component connector	Terminal	Resistance
E309	22	t1	1	10 k Ω or higher
NOTE				



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 Е resistance can determine that this is either a present or past malfunction.

OK or NG

- OK >> Replace inverter with converter assembly (See <u>HBC-638, "Removal and Installation"</u>).
- NG >> Replace HV relay assembly (See <u>HBB-105, "Removal and Installation"</u>).



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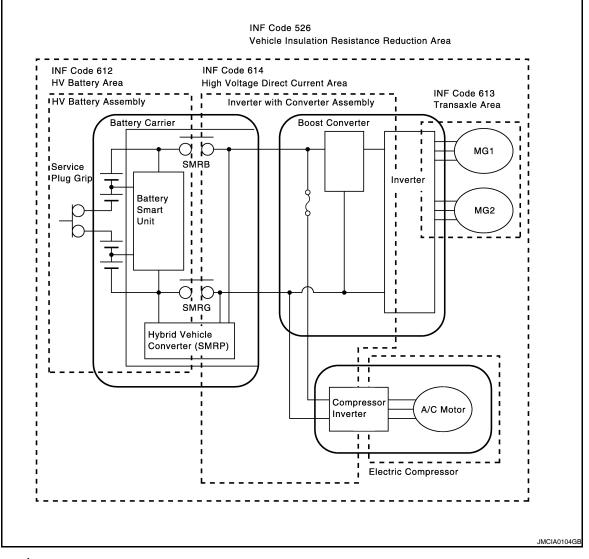
< COMPONENT DIAGNOSIS >

P0AA6-526, P0AA6-611, P0AA6-612, P0AA6-613, P0AA6-614

Description

INFOID:000000004212050

The hybrid vehicle control ECU monitors the battery smart unit and detects insulation malfunctions in the high-voltage system.



DTC Logic

INFOID:000000004212051

DTC DETECTION LOGIC

< COMPONENT DIAGNOSIS >

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 com- pressor 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 hy- brid transaxle area is decreased.	Hybrid transaxleInverter 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

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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.

< COMPONENT DIAGNOSIS >

Output DTC	Proceed to
Only P0AA6 is output.	A
P0AA6 and P0A1D (Hybrid vehicle control ECU malfunction) are output.	В
P0AA6 and P0AA7-727 (Malfunction in the battery smart unit) are output.	С
P0AA6 and P0A1F (Battery smart unit malfunction) are output.	D

<u>A, B, C or D</u>

- 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 <u>HBB-101, "Removal and Installation"</u>).

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.	В
526 and 612 (decrease in the insulation resistance of the HV battery area) are output.	С
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

<u>A, B, C or D</u>

- 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:

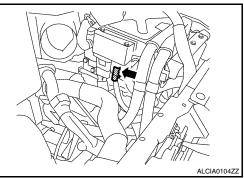
Be sure to wear insulated gloves.

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

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.

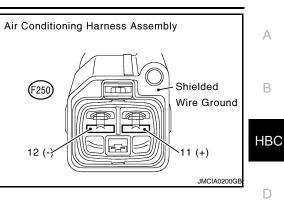


HBC-423

< COMPONENT DIAGNOSIS >

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	Ground	Resistance	
F250	12 (–)	Ground	3 M Ω or higher	
F230	11 (+)	Ground	5 IVIS2 OF HIGHEI	
Air Conditioning Harness Assembly		shielded wire	Resistance	
Harness connector	Terminal	ground	i vesistance	
5050	12 (–)	shielded wire	2 MO or higher	
F250	11 (+)	ground	3 M Ω or higher	



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<u>OK or NG</u>

OK >> GO TO 5.

NG >> GO TO 8.

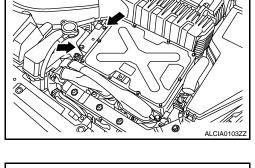
5. CHECK INVERTER WITH CONVERTER ASSEMBLY

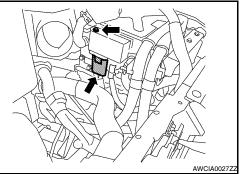
CAUTION:

Be sure to wear insulated gloves.

- 1. Check that the service plug grip is not installed.
- Remove the compressor fuse cover from the inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").







< COMPONENT DIAGNOSIS >

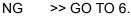
- Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.
 NOTE:
 - Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.
 - Perform this inspection with the air conditioning harness assembly disconnected from the inverter with converter assembly.

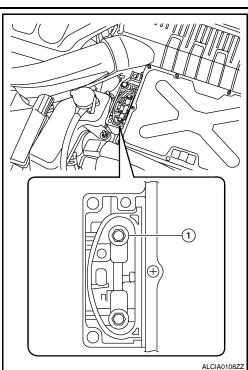
Inverter with conve	rter assembly	Ground	Resistance
Harness connector	Terminal	Ground	Resistance
Compressor fuse	-	Ground	1.0 M Ω or higher

- A/C fuse (1)

<u>OK or NG</u>

OK >> GO TO 9.





6.INSPECT HYBRID TRANSAXLE (MG2)

CAUTION:

Be sure to wear insulated gloves.

1. Check that the service plug grip is not installed. **NOTE:**

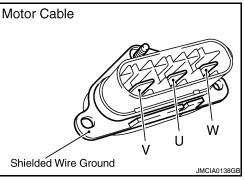
After removing the service plug grip, do not turn ignition switch ON. (READY), unless instructed by the service manual because this may cause a malfunction.

- 2. Disconnect the motor cable and generator cable from the inverter with converter assembly (See <u>HBC-638</u>, "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 Moto according to the value(s) in the table below.
 - 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	Ground	Resistance
	U	Ground	20 M Ω or higher
—	V		
	W		



Motor Cable		Shielded wire	Resistance
Harness connector	Terminal	ground	i vesistarice
	U		
—	V	Shielded wire	20 $M\Omega$ or higher
	W		

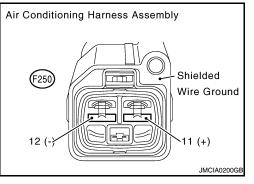
< COMPONENT DIAGNOSIS >

OK >> GO TO 7. NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>).					А	
7.INSPECT HY	•	•				
	ne service plug gr	ip is not installed			В	
2. Check the co	nnectors connec	tion.			HBC	
Dirt or for of contan		ve not entered th	ne connection, or	there is no evidence		
according to	gohmmeter set to the value(s) in th		re the resistance	Generator Cable	D	
ing this te		ng higher than	/ when perform- 500 V can result ted.		Е	
Generat	tor Cable	- · ·		(O)	F	
Harness connector	Terminal	Ground	Resistance	V U ···		
	U			Shielded Wire Ground	G	
_	V W	Ground	20 M Ω or higher			
					Н	
Generator Cable Shielded wire Resistance						
Harness connector	Terminal	ground	i vesistarice		I	
	U V	Shielded wire	20 MO as hisbar			
—	W	ground	20 M Ω or higher		J	
OK or NG			<u> </u>			
OK >> Replace inverter with converter assembly (See <u>HBC-638</u> , " <u>Removal and Installation</u> "). K						
NG >> Replace hybrid transaxle (See <u>TM-36, "Removal and Installation"</u>). 8.CHECK AIR CONDITIONING HARNESS ASSEMBLY						
					L	
Be sure to wear			o niug grin (Soo H	IPC 622 "Dressutions for Inspecting the		
Hybrid Control	 Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System</u>"). 					
	NOTE: After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the ser-					
vice manual because this may cause a malfunction.					Ν	
 2. Disconnect the air conditioning harness assembly from the electric compressor. - Green lock (1) 				0		
					Ρ	
				ALCIA0109ZZ		

< COMPONENT DIAGNOSIS >

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	Ground	Resistance
F250	12 (–)	Ground	$3 \ \text{M}\Omega$ or higher
F250	11 (+)		
Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal	Ground	Resistance
5250	12 (–)	Shielded wire	2 MO or higher
F250	11 (+)	ground	3 M Ω or higher



<u>OK or NG</u>

OK >> Go to air conditioning system.

NG >> Replace air conditioning harness assembly.

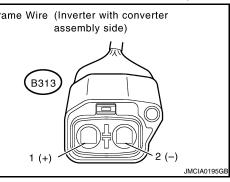
9.CHECK FRAME WIRE

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.

Battery smart unit		Ground	Resistance
Harness connector	Terminal	Ground	Resistance
E308	21 (+)	Ground	10 M Ω or higher
E309	22 (-)		



Battery smart unit		Ground	Resistance
Harness connector	Terminal	Ground	Resistance
E308	21 (+)	Shielded wire	10 M Ω or higher
E309	22 (–)	ground	TO MIS2 OF HIGHER

OK or NG

OK >> GO TO10.

NG >> Replace frame wire.

10.CHECK HV BATTERY AREA

CAUTION:

Be sure to wear insulated gloves.

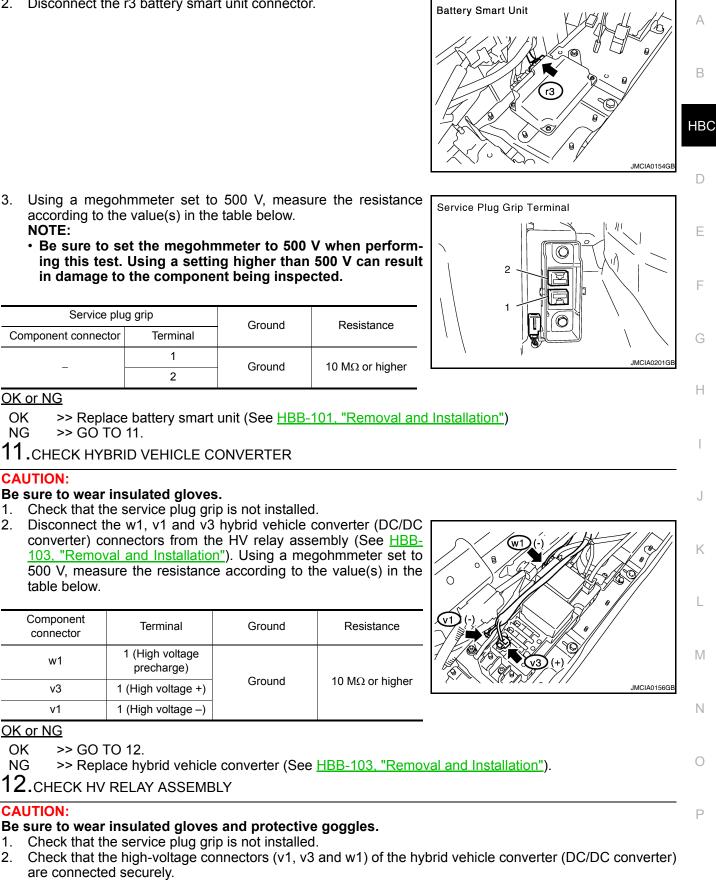
1. Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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.

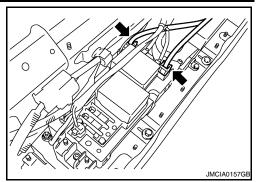
< COMPONENT DIAGNOSIS >

2. Disconnect the r3 battery smart unit connector.



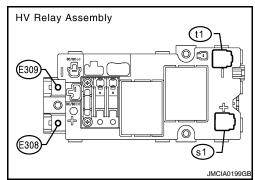
< COMPONENT DIAGNOSIS >

 Disconnect the high voltage connectors of the HV battery from the HV relay assembly (See <u>HBB-105</u>, "<u>Removal and Installa-</u> <u>tion</u>").



4. Using a megohmmeter set to 500 V, measure the resistance resist

HV Relay Assembly			
Component connector	Terminal	Ground	Resistance
E308	1 (High voltage +)	Ground	10 $M\Omega$ 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			
Component connector	Terminal	Ground	Voltage
E308	21 (High voltage +)	Ground	Below 1 V
E309	22 (High voltage –)	Giouna	Delow I v

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 <u>HBB-97</u>, "Removal and Installation").

NG >> Replace HV relay assembly (See <u>HBB-105</u>, "Removal and Installation").

13. CHECK HIGH VOLTAGE DIRECT CURRENT AREA

CAUTION:

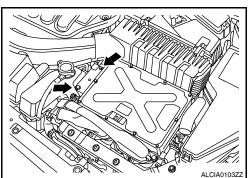
Be sure to wear insulated gloves.

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

NOTE:

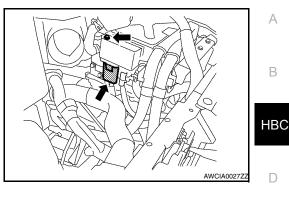
After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.

2. Remove the compressor fuse cover from the inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").



< COMPONENT DIAGNOSIS >

3. Disconnect the frame wire from the inverter with converter assembly.



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- 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	Ground	Resistance
E313	1 (High voltage +)	Ground	10 M Ω or higher
	2 (High voltage –)		

Frame Wire (Inverter with converter assembly side) B313 1 (+) 2(-)JMCIA0195GB

OK or NG

OK >> GO TO 14.

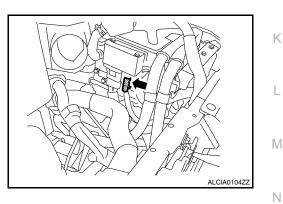
NG >> GO TO 16.

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").



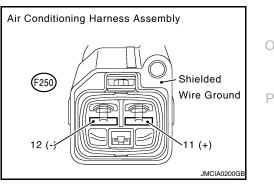
3. Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below.

Air Conditioning Harness Assembly		Ground	Resistance
Harness connector	Terminal	Ground	Resistance
F250	12 (–)	Ground	$3 \ \text{M}\Omega$ or higher
	11 (+)	Cround	

OK or NG

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

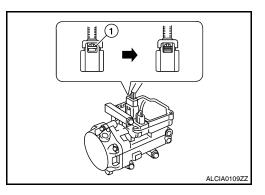
NG >> GO TO 15.



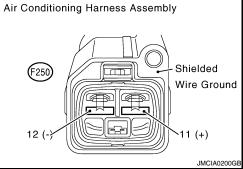
15. CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:

- Be sure to wear insulated gloves.
- 1. Check that the service plug grip is not installed.
- Disconnect the air conditioning harness assembly from the electric compressor.
- Green lock (1)



- 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	Ground	i vesisidille
F250	12 (–)	Ground	10 M Ω or higher
	11 (+)	Glound	

Air Conditioning H	larness Assembly	Ground	Resistance
Harness connector	Terminal	Ground	
F250	12 (–)	Shielded wire	10M Ω or higher
1 200	11 (+)	ground	TOWE2 OF HIGHER

OK or NG

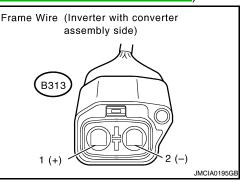
- OK >> Go to air conditioning system.
- NG >> Replace air conditioning harness assembly.
- 16.CHECK FRAME WIRE

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").
- 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 (H	Frame Wire (HV Relay Side)		Resistance
Harness connector	Terminal	Ground	Resistance
E308	1 (+)	Ground	10 M Ω or higher
E309	1 (–)		



< COMPONENT DIAGNOSIS >

Frame Wire (HV Relay Side)		- Ground	Resistance		А
Harness connector	Terminal				
E308	1 (+)	Shielded wire	10M Ω or higher		В
E309	1 (–)	ground	TOWIS2 OF Higher		_
	⁻ O 17. ace frame wire. 3RID VEHICLE (CONVERTER			HE
 Check that th Disconnect th converter) co <u>105. "Remov</u> 500 V, mease table below. NOTE: Be sure to ing this test 	ne w1, v1 and v3 onnectors from th al and Installatio ure the resistanc set the megohist. Using a setti	ip is not installed by hybrid vehicle of the HV relay asse <u>n"</u>). Using a meg the according to the mmeter to 500 M ng higher than	converter (DC/DC embly (See <u>HBB-</u> gohmmeter set to ne value(s) in the / when perform- 500 V can result		E F
Frame Wire (H	•	Ground	Resistance	- JMCIA0156GB	ŀ
Harness connector Terminal		C.C.a.i.a		_	
w1	1 (High voltage precharge)	Ground	10 M Ω or higher		
v3	1 (High voltage +)	Ground			
v1	1 (High voltage –)				
NG >> Repla		e converter (See	<u>-105, "Removal a</u> <u>HBB-103, "Remo</u>	nd Installation") val and Installation").	ŀ
 Check that th Remove the verter assem Disconnect t 	compressor fuse bly (See <u>HBC-63</u>	ip is not installed cover from the <u>8, "Removal and</u> able and motor	inverter with con-		N N
				ALCIA0103ZZ	F

< COMPONENT DIAGNOSIS >

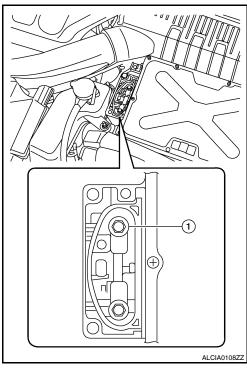
- Using a megohmmeter set to 500 V, measure the resistance according to the value(s) in the table below. NOTE:
 - Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Inverter with conver	ter assembly	Ground	Resistance	
Component connector	Terminal	Ground		
Compressor fuse	_	Ground	1.0 M Ω or higher	

- A/C fuse (1)

<u>OK or NG</u>

- OK >> Replace hybrid transaxle (See <u>TM-36</u>, "<u>Removal and</u> <u>Installation</u>").
- NG >> Replace inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").



P0AA7-727

Description

The hybrid vehicle control ECU monitors the insulation monitoring circuit located in the battery smart unit and В detects a malfunction.

DTC Logic

DTC DETECTION LOGIC

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		Trouble diagnosis nome	DTC datasting condition	Dessible source	
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	E

Diagnosis Procedure

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 Н 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

HBC-433

INFOID:000000004212053

INFOID:000000004212054

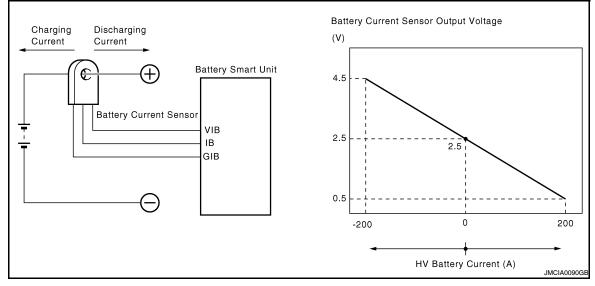
INFOID:000000004212055

P0AC0-817

Description

INFOID:000000004212056

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:000000004212057

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 assemblyBattery smart unit

Diagnosis Procedure

INFOID:000000004212058

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.

P0AC0-817

< COMPONENT DIAGNOSIS >

Result	Proceed to		А
P0AC0-817 only is output.	A		
P0A1F-123 is also output.	В		В
A or B			D
A >> GO TO 3.			
B >> Go to Diagnosis Proce		put DTC.	HBC
3.REPLACE HV RELAY ASSEMB			
Refer to HBB-105, "Removal and Ir	nstallation".		D
			D
>> GO TO 4.			
4. CLEAR DTC			Е
1. Turn ignition switch ON.	l franza frama data		
 Read and record the DTCs and Clear DTC. 	a freeze frame data.		F
			1
>> GO TO 5.			
5. SIMULATION TEST			G
1. Turn ignition switch ON (READ	Y).		
2. Drive the vehicle under the sin		eeze frame data.	Н
>> GO TO 6.			
6.CHECK DTC OUTPUT (HYBRII	D SYSTEM)		
1. Stop vehicle.			
2. Check DTC again.			J
	December	_	J
Result	Proceed to		
P0AC0-817 is not output.	A		Κ
P0AC0-817 is output again.	В	_	
A >> INSPECTION END B >> Replace battery smart	unit (See HBB-101.	"Removal and Installation").	L
		,	
			M
			Ν

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P0ADB-227, P0ADC-226

Description

INFOID:000000004212059

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.

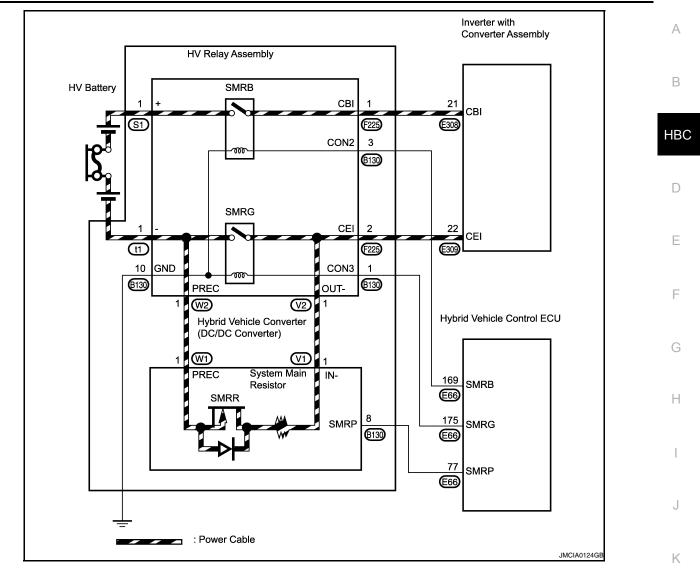
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
	DC/DC converter malfunction	P0A08-264	May not occur
Onen in AMD line	Open in VLO, short to GND	P0A09-591	May not occur
Open in AMD line	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
Open in IGCT line	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.

P0ADB-227, P0ADC-226

< COMPONENT DIAGNOSIS >



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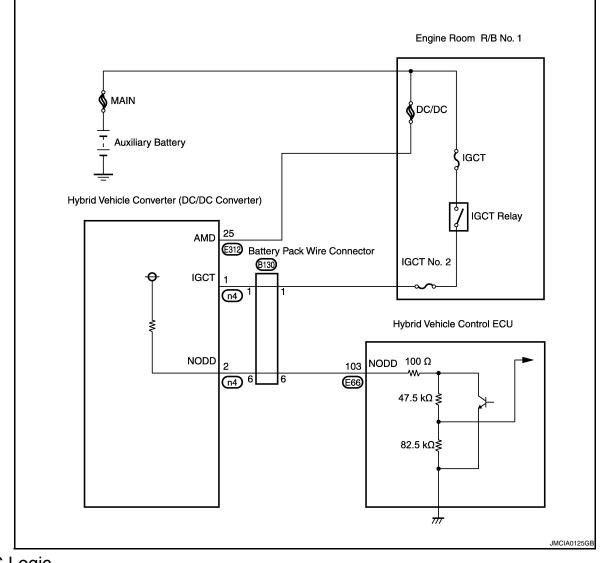
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P0ADB-227, P0ADC-226

< COMPONENT DIAGNOSIS >



DTC Logic

INFOID:000000004212060

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0ADB	227	Hybrid Battery Positive Contac- tor Control Circuit Low	Short to GND in the SMRB circuit	Wire harness or connectorHV relay assemblyHybrid vehicle control ECU
P0ADC	226	Hybrid Battery Positive Contac- tor 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:000000004212061

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.

See <u>HBC-109</u>), "Diagnosis	Procedu	<u>re"</u> .			
	O TO 3. Connect secur	elv				
-		2	СТІОІ	N CONDIT	ION (BATTER	Y PACK WIRE CONNECTOR)
See <u>HBC-140</u>						,
	GO TO 4. Connect secur	ely.				
4		•	NECT	OR (HYB	RID VEHICLE	CONTROL ECU - BATTERY PACK WIRE
CONNECTOR				,		
	ion switch Of ct the E66 hy		iolo or	ontrol ECI	Loopportor	
3. Disconne	ect the B130 b	attery pa				
	tion switch ON		to the	e value(e)	in the table be	
. Weasure	the voltage a	ccoruniy		e value(3)		low.
Hybrid Vehicl	e Control ECU					
Harness	Terminal	Grou	und	Voltage	!	
			e hybr		control ECU co	onnector disconnected causes other DTCs to
E66 NOTE: Turn ignit be stored 6. Turn ignit 7. Measure	ion switch ON I. Clear the D ion switch OF the resistanc	N with the TCs after FF.	e hybr r perfo	id vehicle orming this	control ECU co	
E66 NOTE: Turn ignit be stored 5. Turn ignit 7. Measure Check for op	ion switch ON I. Clear the D ion switch OF the resistanc	N with the TCs after FF. e accord	e hybr r perfo ling to	id vehicle orming this the value	control ECU co s inspection.	
E66 NOTE: Turn ignit be stored 6. Turn ignit 7. Measure Check for op Hybrid Vehicle	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU	N with the TCs after FF. e accord	e hybr r perfo ling to attery F	rid vehicle orming this the value Pack wire	control ECU co s inspection. (s) in the table	below.
E66 NOTE: Turn ignit be stored 5. Turn ignit 7. Measure Check for op	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal	N with the TCs after FF. e accord	e hybr r perfo ling to attery F	rid vehicle orming this the value Pack wire Termina	control ECU co s inspection. (s) in the table	below.
E66 NOTE: Turn ignit be stored 5. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB)	N with the TCs after FF. e accord Ba Hame	e hybr r perfo ling to attery F ess ector	rid vehicle orming this the value Pack wire	control ECU co s inspection. (s) in the table	below.
E66 NOTE: Turn ignit be stored 5. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66 Check for sh	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB)	V with the TCs after F. e accord Ba Harne conner B13	e hybr r perfo ling to attery F ess ector	rid vehicle orming this the value Pack wire Termina	control ECU co s inspection. (s) in the table	below.
E66 NOTE: Turn ignit be stored 6. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66 Check for sh Hybrid Ve	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB) nort chicle Control EC	N with the TCs after F. e accord Ba Harne conned B13	e hybr r perfo ling to attery F ess ector 30	rid vehicle orming this the value Pack wire Termina	control ECU co s inspection. (s) in the table	below.
E66 NOTE: Turn ignit be stored 6. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66 Check for sh Hybrid Ve	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB) nort chicle Control EC ctor Termi	V with the TCs after F. e accord Harne connee B13	e hybr r perfo ling to attery F ess ector 30 G	rid vehicle orming this the value Pack wire Termina 3 (CON2	control ECU co s inspection. (s) in the table Resistance Resistance	below.
E66 NOTE: Turn ignit be stored 5. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66 Check for sh Hybrid Ve	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB) nort chicle Control EC	V with the TCs after F. e accord Harne connee B13	e hybr r perfo ling to attery F ess ector 30 G	rid vehicle orming this the value Pack wire Termina 3 (CON2	control ECU co s inspection. (s) in the table Resistance	below.
E66 NOTE: Turn ignit be stored 5. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66 Check for sh Hybrid Ve Harness connect	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB) nort chicle Control EC ctor Termi	V with the TCs after F. e accord Harne connee B13	e hybr r perfo ling to attery F ess ctor 30 G G	rid vehicle orming this the value Pack wire Termina 3 (CON2 Ground	control ECU co s inspection. (s) in the table Resistance 2) Below 1 Ω Resistance 10 kΩ or highe	below.
E66 NOTE: Turn ignit be stored 6. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66 Check for sh Hybrid Ve Harness connect	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB) nort chicle Control EC ctor Termi 169 (SM	N with the TCs after F. e accord Harne conned B13	e hybr r perfo ling to attery F ess ctor 30 G G	rid vehicle orming this the value Pack wire Termina 3 (CON2	control ECU co s inspection. (s) in the table Resistance Resistance	below.
E66 NOTE: Turn ignit be stored 6. Turn ignit 7. Measure Check for op Hybrid Vehicle Harness connector E66 Check for sh Hybrid Ve Harness connec E66 Batt	ion switch ON I. Clear the D ion switch OF the resistanc pen e Control ECU Terminal 169 (SMRB) nort chicle Control ECC ctor Termi 169 (SM	V with the TCs after F. e accord Harne connee B13 CU nal MRB)	e hybr r perfo ling to attery F ess ector 30 G G	rid vehicle orming this the value Pack wire Termina 3 (CON2 Ground	control ECU co s inspection. (s) in the table Resistance 2) Below 1 Ω Resistance 10 kΩ or highe	below.

P0ADB-227, P0ADC-226

< COMPONENT DIAGNOSIS >

NG >> Connect securely.

 $6. {\sf CHECK} \text{ HARNESS} \text{ and CONNECTOR} ({\sf BATTERY} \text{ PACK} \text{ WIRE CONNECTOR} - {\sf HV} \text{ RELAY} \text{ ASSEMBLY})$

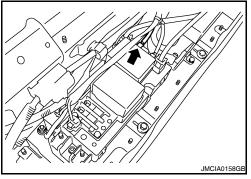
CAUTION:

Be sure to wear insulated gloves.

- 1. Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).
- 2. Disconnect the n3 HV relay assembly connector (See <u>HBB-105</u>, <u>"Removal and Installation"</u>).
- 3. Turn ignition switch ON.
- 4. Measure the voltage according to the value(s) in the table below. **NOTE:**

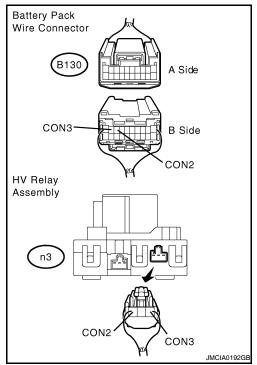
Turn ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

Battery Pack V	Vire Connector	Ground	Voltage
Harness connector	Terminal	Ground	voltage
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					
Harness connector	-	Terminal		ness iector	Terminal		Resistance	
B130	3	6 (CON2)	r	າ3	3 (CON2	2)	Below 1 Ω	
Check for sh	ort							
Battery Pa	ack W	/ire Connec	tor	G	Ground		Resistance	
Harness conne	ctor	Termi	nal	Ground			Resistance	
B130	B130 3 (CO			G	Ground	1	$0 \ k\Omega$ or higher	

P0ADB-227, P0ADC-226

< COMPONENT DIAGNOSIS >

HV Relay	Assembly	у	0	Ground	Resistance		А
Harness connector	Ter	rminal		biouriu	Resistance		
n3	3 (0	CON2)	Ģ	Ground	10 k Ω or higher		В
0 <u>K or NG</u> OK >> GO T NG >> Repa CHECK HARN	air or rep			[·] connecto)R	Dr.		HBC
AUTION: e sure to wear . Connect the l	insulat battery	t ed glov pack wi	res. re conne	ctor.	lue(s) in the table		D
below.						HV Relay Assembly	E
HV Relay			(Ground	Resistance		_
Harness connector		rminal					F
n3	2 ((GND)	(Ground	Below 1 Ω		
/ <u>K or NG</u> OK >> GO T NG >> Repa		olace ha	rness or	- connecto	or.	n3 GND	G
.INSPECT HV	•					JMCIA0159GB	Н
	ne servio HV relag	ce plug y asser	grip is no ably from	ot installed the vehic	d. cle (See <u>HBB-105, "</u>	"Removal and Installation").	I
. Measure the below.	resista	nce aco	cording 1	to the val	lue(s) in the table	HV Relay Assembly	J
HV Relay Assemb	y H	V Relay A	ssembly				
Component connector Termi	Inal	mponent nnector	Terminal		Resistance		K
h4 1		s1	1	plied to te	Below 1 Ω ttery voltage (12 V) ap- rminals n3-2 and n3-3] 0 k Ω or higher	CON2 GND IIIII IIIII JMCIA0147GB	L
 Measure the below. 	resista	ince acc	cording 1	to the val	lue(s) in the table		Μ
HV Relay Asser	mbly	ΗV	Relay As	sembly			Ν
Component connector	erminal	Compo		Terminal	Resis	tance	0
n3 3 ((CON2)	na	3	2 (GND)	18.8 to 32.1 Ω at -35 to	o 80°C (-31 to 176° F)	0
OK or NG OK >> Repla							

P0ADF-229, P0AE0-228

Description

INFOID:000000004212062

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.

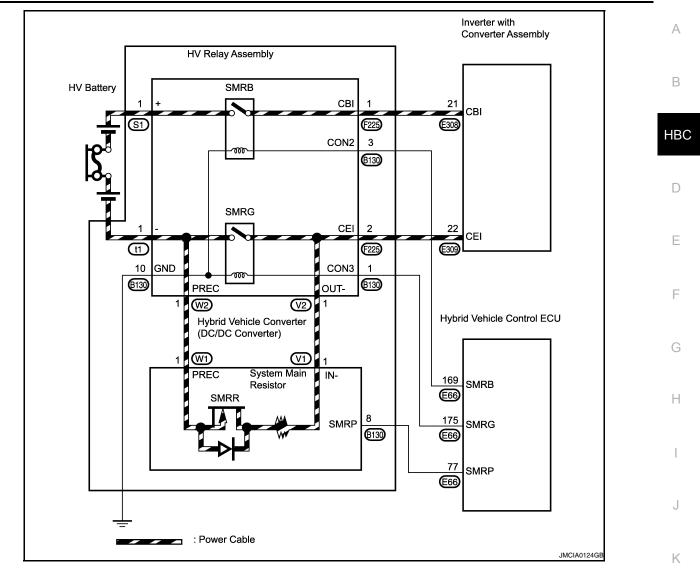
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.

When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
	DC/DC converter malfunction	P0A08-264	May not occur
Onen in AND line	Open in VLO, short to GND	P0A09-591	May not occur
Open in AMD line	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
	Open in NODD, short to GND	P0A09-265	Occurs
Onen in ICCT line	Open in VLO, short to GND	P0A09-591	Occurs
Open in IGCT line	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.

< COMPONENT DIAGNOSIS >



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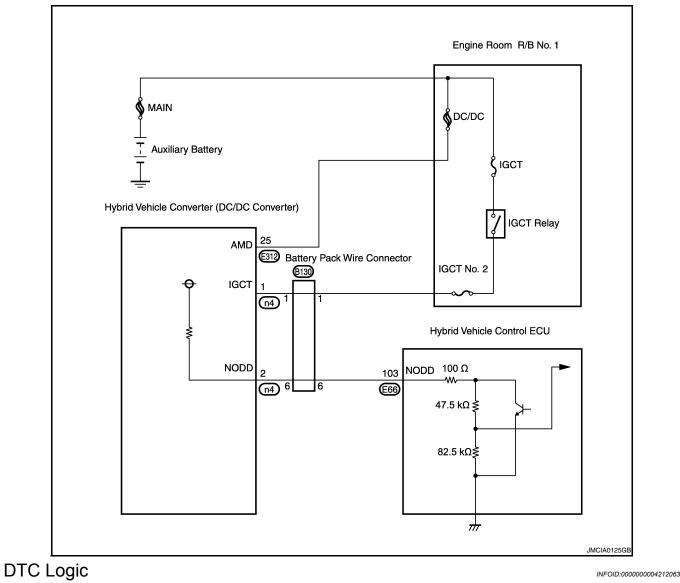
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< COMPONENT DIAGNOSIS >



DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0ADF	229	Hybrid Battery Negative Con- tactor Control Circuit Low	Short to GND in the SMRG circuit	Wire harness or connectorHV relay assemblyHybrid vehicle control ECU
P0AE0	228	Hybrid Battery Negative Con- tactor 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:000000004212064

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.

< COMPONE	ENT DIAGNO	SIS >			
Waiting for converter a		inutes is req	uired to dise	charge the high-voltage capacitor inside the inverter with	А
>> (GO TO 2.				
•		CONNECTIC		ION (HYBRID VEHICLE CONTROL ECU CONNECTOR)	В
See <u>HBC-10</u>	9, "Diagnosis I	Procedure".			
					HBC
	GO TO 3. Connect secur	ely.			
3.снеск с	ONNECTOR	CONNECTIC	N CONDITI	ION (BATTERY PACK WIRE CONNECTOR)	D
See <u>HBC-14</u>), "Diagnosis I	Procedure".			
OK >> (GO TO 4.				Е
4	Connect secur	•			
		D CONNEC	TOR (HYBR	RID VEHICLE CONTROL ECU - BATTERY PACK WIRE	F
	,				
. Disconne	tion switch OF ect the E66 hy	brid vehicle o			G
	ect the B130 b tion switch ON		vire connecto	or.	
			ne value(s) ii	n the table below.	
					Η
	le Control ECU	Ground	Voltago		
Harness connector	Terminal	Ground	Voltage		
E66	175 (SMRG)	Ground	Below 1 V		
DTCs to 5. Turn igni	be stored. Cle tion switch OF	ar the DTCs F.	after perform	hicle control ECU connector disconnected causes other ming this inspection. s) in the table below.	J
Check for o	pen	-			
Hybrid Vehicl	e Control ECU	Battery	Pack wire		
Harness connector	— · ·			Desistance	L
	Terminal	Harness connector	Terminal	Resistance	L
E66	175 (SMRG)		Terminal 2 (CON3)		L
E66 Check for sl	175 (SMRG)	connector			L
Check for sl Hybrid Ve	175 (SMRG)	Connector B130 U	2 (CON3)	Below 1 Ω	L M
Check for sl	175 (SMRG) nort	Connector B130			
Check for sl Hybrid Ve Harness	175 (SMRG) nort ehicle Control EC	Connector B130 U nal	2 (CON3)	Below 1 Ω	
Check for sl Hybrid Ve Harness connector E66	175 (SMRG) nort ehicle Control EC Termir 175 (SM	Connector B130 U nal	2 (CON3) Ground	Below 1 Ω Resistance	Ν
Check for sl Hybrid Ve Harness connector E66 Bat Harness	175 (SMRG) nort ehicle Control EC Termir	connector B130 U nal IRG) (2 (CON3) Ground	Below 1 Ω Resistance	Ν
Check for sl Hybrid Ve Harness connector E66 Bat	175 (SMRG) nort ehicle Control EC Termir 175 (SM tery Pack wire	connector B130 U nal IRG) (nal	2 (CON3) Ground Ground	Below 1 Ω Resistance 10 kΩ or higher	N

OK NG

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

< COMPONENT DIAGNOSIS >

5. CHECK CONNECTOR CONNECTION CONDITION (HV RELAY CONNECTOR)

See <u>HBC-450, "Diagnosis Procedure"</u>.

OK >> GO TO 6.

NG >> Connect securely.

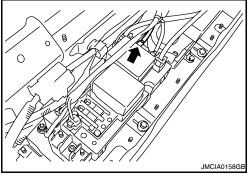
6. CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HV RELAY ASSEMBLY)

CAUTION:

Be sure to wear insulated gloves.

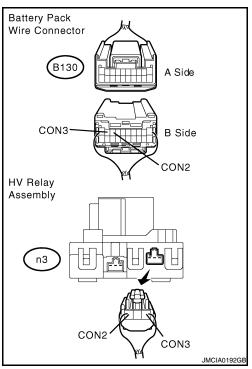
- 1. Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).
- 2. Disconnect the n3 HV relay assembly connector (See <u>HBB-105</u>, <u>"Removal and Installation"</u>).
- 3. Turn ignition switch ON.
- 4. Measure the 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 P	ack Wire Connector		
Harness connector	Terminal	Ground	Voltage
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 \	Vire Connector	HV Relay		
Harness connector	Terminal	Harness connector Terminal		Resistance
B130	2 (CON3)	n3	1 (CON3)	Below 1 Ω

COMPONENT DIAGNOSIS >

Check for	or short					
Batter	y Pack Wire	e Connector				
Harnes		Terminal		Ground	Resistance	
B130	C	2 (CON3)		Ground	10 k Ω or higher	
Н	IV Relay As	ssembly				
Harne connec		Terminal		Ground	Resistance	
n3		1 (CON3)		Ground	10 k Ω or higher	
NG >	> GO TO > Repair < HARNE			or connecto OR	pr.	
Be sure to	o wear in ect the ba ure the re	nsulated gl attery pack resistance	wire conn		ue(s) in the table	HV Relay Assembly
F	HV Relay As	ssembly		Crown d	Desistant	
Harness co	onnector	Terminal		Ground	Resistance	
n3		2 (GND)		Ground	Below 1 Ω	
OK > NG > B.INSPEC CAUTION Be sure to I. Check	> GO TO > Repair CT HV RI : o wear in < that the	or replace ELAY ASS nsulated gl service plu	EMBLY (S oves and ig grip is i	I protective	e goggles.	"Removal and Installation").
OK > NG > B.INSPEC CAUTION Be sure to 1. Check 2. Remo 3. Measu below	> GO TO > Repair CT HV RI : o wear in (that the ve the HV ure the ro	or replace ELAY ASS isulated gl service plu V relay ass resistance	EMBLY (S oves and ig grip is r embly fro according	SMRB) I protective not installed m the vehic	e goggles.	GND JMCIA0159G
OK > NG > B.INSPEC CAUTION Be sure to 1. Check 2. Remo 3. Measu below	> GO TO > Repair CT HV RI : o wear in < that the ve the HV ure the re	or replace ELAY ASS service plu V relay ass resistance a HV Relay Compo-	EMBLY (S oves and ig grip is r embly fro	SMRB) I protective not installed m the vehic to the val	e goggles. J. Sle (See <u>HBB-105.</u>	"Removal and Installation").
NG > 8.INSPEC CAUTION Be sure to 1. Check 2. Remo 3. Measu below HV Relay Compo- nent con-	 > GO TO > Repair CT HV RI o wear in < that the ove the HV ure the residuent of th	or replace ELAY ASS service plu V relay ass resistance a HV Relay Compo- nent con-	EMBLY (S oves and ig grip is r embly fro according	SMRB) I protective not installed m the vehic to the val [When batt plied to ter	e goggles. d. cle (See <u>HBB-105.</u> ue(s) in the table Resistance Below 1 Ω tery voltage (12 V) ap- minals n3-2 and n3-1]	"Removal and Installation").
OK > NG > B.INSPEC CAUTION Be sure to 1. Check 2. Remo 3. Measu below. HV Relay Compo- nent con- nector h3	 > GO TO > Repair CT HV RI CT HV RI<!--</td--><td>or replace ELAY ASS service plu V relay ass esistance a HV Relay Compo- nent con- nector t1</td><td>EMBLY (S oves and ig grip is r embly fro according Assembly Terminal</td><td>SMRB) I protective not installed m the vehic to the val [When batt plied to ter 10</td><td>e goggles. d. cle (See <u>HBB-105,</u> ue(s) in the table Resistance Below 1 Ω tery voltage (12 V) ap-</td><th>"Removal and Installation"). HV Relay Assembly (1) (3) (3) (3) (3) (3) (3) (3) (3</th>	or replace ELAY ASS service plu V relay ass esistance a HV Relay Compo- nent con- nector t1	EMBLY (S oves and ig grip is r embly fro according Assembly Terminal	SMRB) I protective not installed m the vehic to the val [When batt plied to ter 10	e goggles. d. cle (See <u>HBB-105,</u> ue(s) in the table Resistance Below 1 Ω tery voltage (12 V) ap-	"Removal and Installation"). HV Relay Assembly (1) (3) (3) (3) (3) (3) (3) (3) (3
OK > NG > 8.INSPEC CAUTION Be sure to 1. Check 2. Remo 3. Measu below HV Relay Compo- nent con- nector h3	 > GO TO > Repair CT HV RI CT HV RI<!--</td--><td>or replace ELAY ASS service plu V relay ass resistance a HV Relay Compo- nent con- nector t1</td><td>EMBLY (S oves and ig grip is r embly fro according Assembly Terminal</td><td>SMRB) I protective not installed to the vehic to the val [When batt plied to ter 10 o the value</td><td>e goggles. d. cle (See <u>HBB-105,</u> ue(s) in the table Resistance Below 1 Ω tery voltage (12 V) ap- minals n3-2 and n3-1] 0 kΩ or higher</td><th>"Removal and Installation"). HV Relay Assembly (1) (3) (3) (3) (3) (3) (3) (3) (3</th>	or replace ELAY ASS service plu V relay ass resistance a HV Relay Compo- nent con- nector t1	EMBLY (S oves and ig grip is r embly fro according Assembly Terminal	SMRB) I protective not installed to the vehic to the val [When batt plied to ter 10 o the value	e goggles. d. cle (See <u>HBB-105,</u> ue(s) in the table Resistance Below 1 Ω tery voltage (12 V) ap- minals n3-2 and n3-1] 0 k Ω or higher	"Removal and Installation"). HV Relay Assembly (1) (3) (3) (3) (3) (3) (3) (3) (3

OK or NG

NG

n3

1 (CON3)

OK >> Replace hybrid vehicle control ECU (See <u>HBC-644</u>, "Removal and Installation").

>> Replace HV relay assembly (See HBB-105, "Removal and Installation").

2 (GND)

n3

18.8 to 32.1 Ω at -35 to 80°C (-31 to 176° F)

P0AE2-161

Description

INFOID:000000004212065

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.

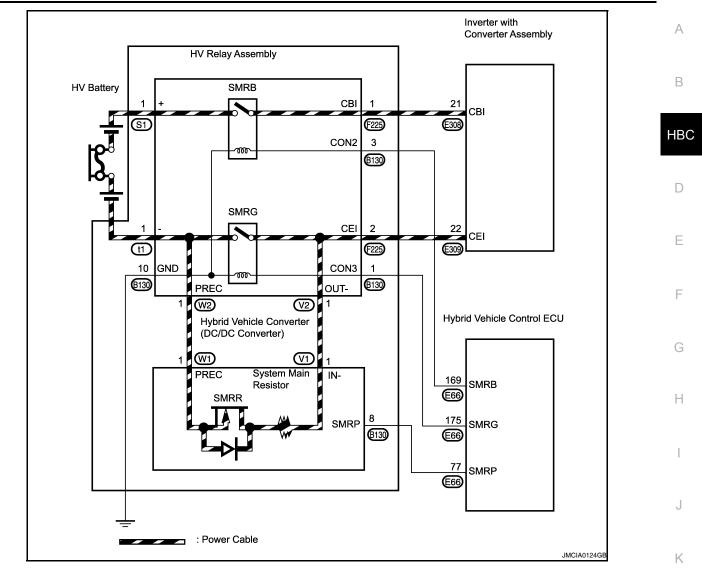
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition	
	DC/DC converter malfunction	P0A08-264	May not occur	
Onen in AND line	Open in VLO, short to GND	P0A09-591	May not occur	
Open in AMD line	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.

P0AE2-161

< COMPONENT DIAGNOSIS >



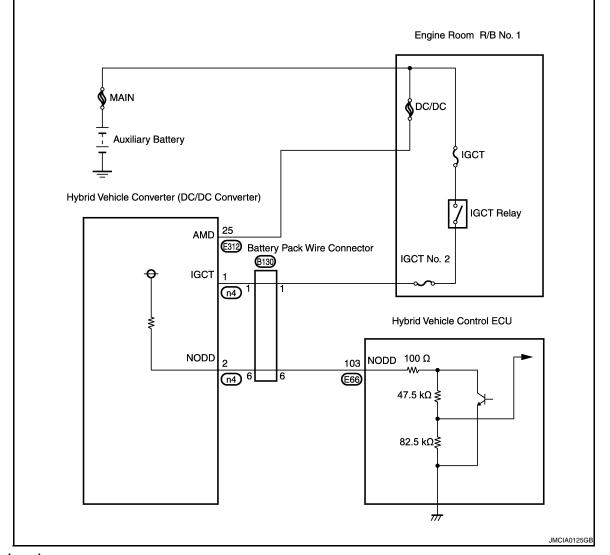
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DTC Logic

INFOID:000000004212066

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 Con- tactor 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:000000004212067

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.

P0AE2-161

< COMPONENT	DIAGNOSIS >				
Waiting for at le converter assen		s required to disc	harge the high-vo	oltage capacitor inside the inverter with	А
>> GO T	O 2.				
2.CHECK DTC	OUTPUT (HVHYB	RID SYSTEM)			В
 Turn ignition s Check DTC. 	switch ON.				HB
P0AE0-22	8 is output				
Is DTC detected?					D
YES >> Go to NO >> GO T	Diagnosis Proce	dure relevant to o	utput DTC.		
•		CTION CONDITIO	ON (HYBRID VEH	IICLE CONTROL ECU CONNECTOR)	E
See <u>HBC-109</u> , "D			- X	,	
OK or NG					F
OK >> GO T NG >> Conn	O 4. ect securely.				Г
4		CTION CONDITIO	ON (BATTERY PA	CK WIRE CONNECTOR)	
	nnection of the ba				G
	ector is connecte no contact probl	-			Η
NOTE:					
	val and installatic or (See <u>HBB-97, "</u>			n of the connection of the battery pack	I
OK or NG			,		
OK >> GO T NG >> Conn	O 5. ect securely.				J
5.CHECK HYBR	-				
			HBB-97. "Remov	val and Installation").	Κ
2. Measure the	resistance accord	ing to the value(s)) in then table belo	w.	
Batten/ Pack V	Vire Connector				L
Harness connector	Terminal	Ground	Resistance		
B130	8 (SMRP)	Ground	370 to 430 kΩ		M
OK or NG					
OK >> GO T NG >> GO T					Ν
•				NTROL ECU - BATTERY PACK WIRE	IN
CONNECTOR)			D VEINCEE COI	THE LOO - BATTERT FACT WITE	
1. Disconnect th	ne E66 hybrid veh	icle control ECU.			0
 Turn ignition : Measure the 	switch ON. voltage according	to the value(s) in	the table below		
					Ρ
Hybrid Vehicl	e 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	e Control ECU	Battery Pack Wire				
Harness connector	Terminal		Harness connector Terminal		Resistance	
E66	175 (SMRG)	B130 2 (CON3		3)	Below 1 Ω	
Check for she	Check for short					
Hybrid Ve	ehicle Control ECU	J				
Harness connector	Terminal		Ground		Resistance	

Battery F	Pack Wire			
Harness connector	Terminal	Ground	Resistance	
B130	2 (CON3)	Ground	10 k Ω or higher	

<u>OK or NG</u>

E66

OK >> GO TO 7.

NG >> Repair or replace harness or connector.

175 (SMRG)

 $7. {\sf CHECK} \ {\sf CONNECTOR} \ {\sf CONNECTION} \ {\sf CONDITION} \ ({\sf HV} \ {\sf RELAY} \ {\sf CONNECTOR})$

Ground

CAUTION:

Be sure to wear insulated gloves.

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

10 k Ω or higher

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 <u>HBB-105</u>, "<u>Removal and Installation</u>").

OK or NG

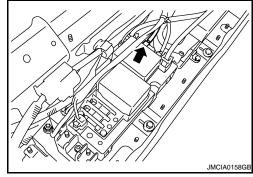
- OK >> GO TO 8.
- NG >> Connect securely.

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.



P0AE2-161

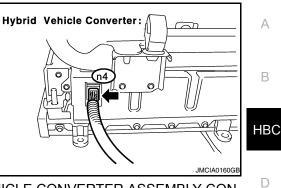
< COMPONENT DIAGNOSIS >

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.



Hybrid Vehicle Converter

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9. Check connector connection condition (Hybrid vehicle converter assembly con-NECTOR)

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.
- Turn ignition switch ON. 3.
- Measure the voltage 4.

sure the	e voltage accordi	ng to the value(s) in the table below.	
Battery F	Pack Wire			
ness ector	Terminal	Ground	Voltage	
30	8 (SMRP)	Ground	Below 1 V	

B130 NOTE:

Harness

connector

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.

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

Check for open

Battery Pack Wire		Hybrid Vehicle DC Co	Resistance	
Harness connector	Terminal	Harness connector Terminal		Resistance
B130	8 (SMRP)	n4	4 (SMRP)	Below 1 Ω

Check for short

Battery Pack Wire Connector			
Harness connector	Terminal	Ground	Resistance
B130	8 (SMRP)	Ground	10 k Ω or higher

	verter (DC/DC Con- ter)	Ground	Resistance
Harness connector	Terminal	Cround	
n4	4 (SMRP)	Ground	10 k Ω or higher

OK or NG

OK >> GO TO 11.

NG >> Repair or replace harness or connector.

11.INSPECT HV RELAY ASSEMBLY (SMRG)

See <u>HBC-444, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Repair or replace harness or connector.

NG >> Inspect HV relay assembly (SMRG) (See <u>HBB-105</u>, "Removal and Installation").

12.INSPECT HV RELAY ASSEMBLY (SMRG)

See <u>HBC-444, "Diagnosis Procedure"</u>.

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 Vehicl	e Control ECU	Ground	Voltage	
Harness connector	Terminal	Ground	voltage	
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 Vehicl	e Control ECU	Battery F	Pack Wire	
Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	77 (SMRP)	B130	8 (SMRP)	Below 1 Ω

Check for short

Hybrid Vehicl	e Control ECU	Ground	Resistance
Harness connector Terminal		Ground	Resistance
E66	77 (SMRP)	Ground	10 k Ω or higher

Battery F	Pack Wire	Ground	Resistance
Harness connector Terminal		Ground	Resistance
B130	8 (SMRP)	Ground	10 k Ω or higher

<u>0</u>	K	or	NG	

- OK
- >> Replace hybrid vehicle control ECU.>> Repair or replace harness or connector. NG

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P0AE2-773

Description

INFOID:000000004212068

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.

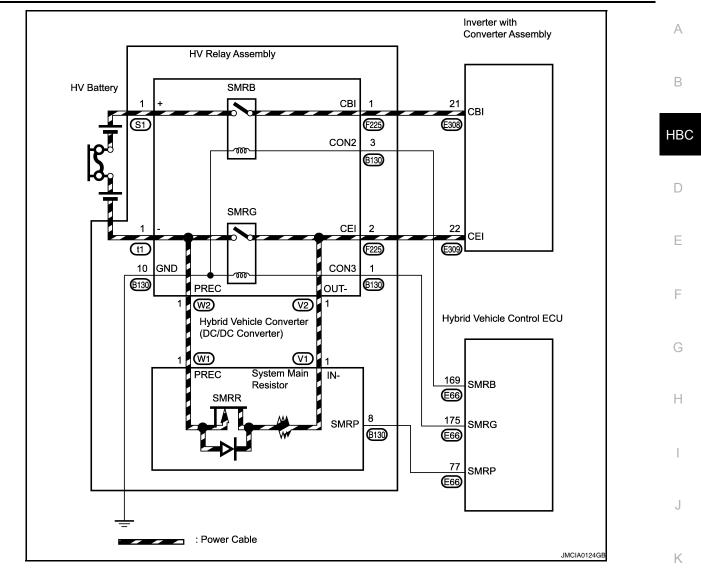
When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
Open in AMD line	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
Open in IGCT line	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.

P0AE2-773

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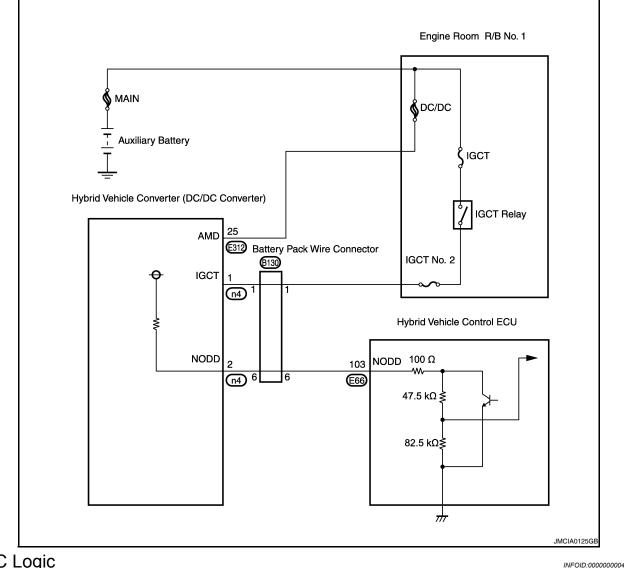
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DTC Logic

INFOID:000000004212069

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AE2	773	Hybrid Battery Precharge Con- tactor 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:000000004212070

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.

Turn ignition switch OFF and remove the service plug grip (See page <u>HBC-632</u>, "<u>Precautions for Inspect-ing the Hybrid Control System</u>").

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.

Resistance

10 kΩ or higher

- 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.

Harness

connector

v1

NOTE:

Harness

connector

w1

OK or NG

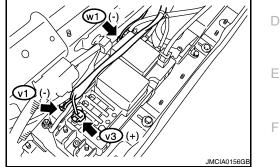
OK

Frame Wire

Terminal

1 (Pre-

charge+)



If the resistance is between 28.5 and 31.5 Ω , it can be determined that the SMRP is stuck closed.

Frame Wire

Terminal

1 (High volt-

age -)

NG	>> Replace hybrid vehicle converter (See <u>HBB-103, "Removal and Installation"</u>).
3.сне	ECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)
See <u>HB</u>	3C-109, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 4.

NG >> Connect securely.

>> GO TO 3.

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

See <u>HBC-140, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid vehicle converter (See page <u>HBB-103</u>, "Removal and Installation").

NG >> Connect securely.

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P0AE6-225

Description

INFOID:000000004212071

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.

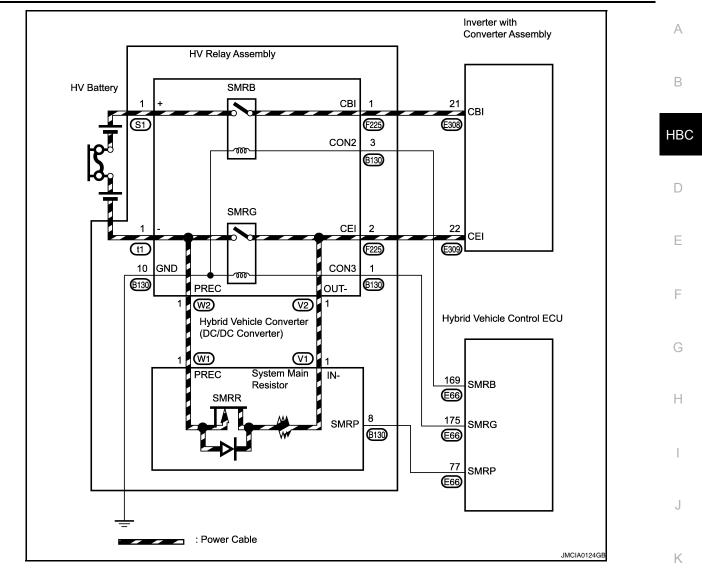
The SMR system is composed of three SMRs and one system main resistor. SMRB and SMRG are located on the HV relay assembly in the battery carrier under the HV battery. SMRP and the system main resistor are located in the hybrid vehicle converter (DC/DC converter) assembly in the battery carrier.

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
	DC/DC converter malfunction	P0A08-264	May not occur
	Open in VLO, short to GND	P0A09-591	May not occur
Open in AMD line	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
Open in IGCT line	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.



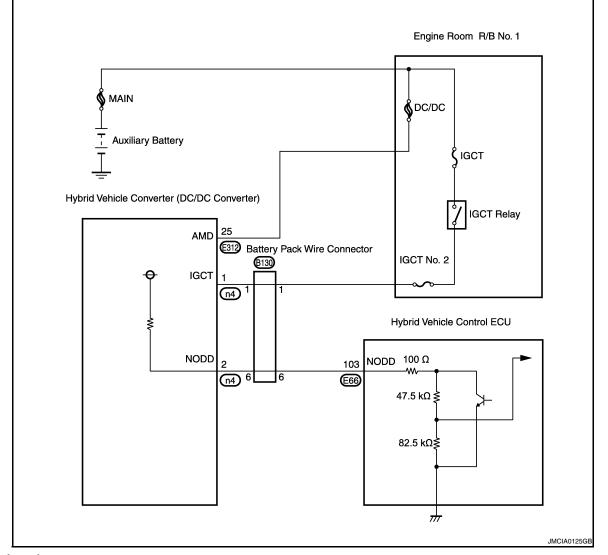
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DTC Logic

INFOID:000000004212072

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 con- tactor 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:000000004212073

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.

< COMPONENT DIAGNOSIS >

- 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.

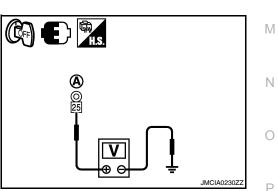
>> GO TO 2.

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	
	0	_	0	0	0		
Only AMD open circuit inspec- tion	0	_	_	0	0	А	
	0		_	_	0		
		0	0	0	0		
Only IGCT open circuit inspec- tion		0	_		0	В	
	_	0	_	0	0		
AMD and IGCT open circuit in-	_	_	0	0	0	С	
spections	—	—	_	0	0	C	
AMD and IGCT open circuit and SMRP system inspections	_	_	_	_	0	D	
NOTE: • O : DTCs that are out • — : DTCs that are no 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 (i output AUXILIARY E F.				MD TERMINAI	L VOLTAGE	
2. Measure the voltage ac	ccording to the	e value(s) in	the table below				
Auxiliary battery		Cround	Valtaga		H.S.		
Harness connector Termin	nal	Ground	Voltage				

— Positive (+)		Ground	9 to 14V
	cle converter nverter) (A)	Ground	Voltage
Harness connector Terminal			
E312 25 (AMD)		Ground	9 to 14V



<u>OK or NG</u>

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.

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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 <u>HBC-109</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 6.

NG >> Connect securely.

 $\mathbf{6}$.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.

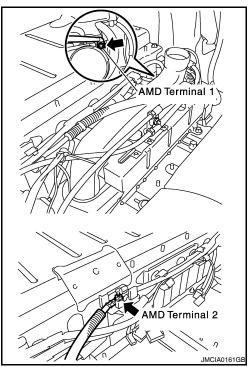
Result 1:

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	Fiocedule	FIOCEDUIE LO	
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.	В	
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	С	
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.	В	

<u>A, B or C</u>

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.

< COMPONENT DIAGNOSIS >

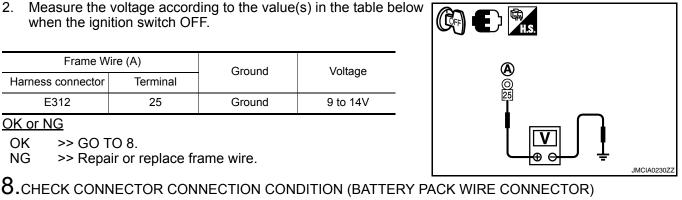
2. Measure the voltage according to the value(s) in the table below when the ignition switch OFF.

Frame W	/ire (A)	Ground	Voltage
Harness connector Termina		Ground	voltage
E312	25	Ground	9 to 14V

OK or NG

OK >> GO TO 8.

NG >> Repair or replace frame wire.



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See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.

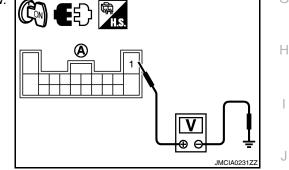
NG >> Connect securely.

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	e connector (A)	Ground	Voltage	
Harness connector Terminal		Ground	voltage	
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	Harness connector Terminal		resistance	
B130	8 (SMRP)	Ground	370 to 430 k Ω	

OK or NG

OK >> GO TO 11.

NG >> GO TO 13.

11. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)	Ν
There is a second contraction of the second	

See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 12.

NG >> Connect securely.

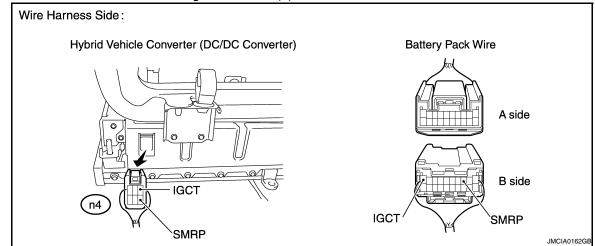
12. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE Ρ CONNECTOR)

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 vehi	cle converter	
Harness connector	Terminal	Harness connector	Terminal	Resistance
B130	1 (IGCT)	n4	1 (IGCT)	Below 1Ω
B130	8 (SMRP)	114	4 (SMRP)	Delow 122

Battery p	ack wire	Ground	Resistance	
Harness connector	Terminal	Ground	Resistance	
B130	1 (IGCT)	Ground	10 k Ω or higher	
B130	8 (SMRP)	Ground	TO K22 OF Higher	

Hybrid vehic	le converter	Ground	Resistance	
Harness connector	Harness connector Terminal		Resistance	
n4	1 (IGCT)	Ground	10 k Ω or higher	
114	4 (SMRP)	Ground	TO KS2 OF HIGHEI	

OK or NG

- OK >> Replace hybrid vehicle converter (See <u>HBB-103</u>, "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.
- Disconnect the E66 hybrid vehicle control ECU connector. 2.
- Measure the resistance according to the value(s) in the table below. 3.

Check for open

Hybrid vehicle control ECU				Battery	back wire		
Harness connector	-	Terminal	Harness connector		Termina	I	Resistance
E66	77	7 (SMRP)	B130		8 (SMRF	')	Below 1Ω
Check for sh	Check for short						
Hybrid vehicle control ECU			U	C	Ground		Resistance
Harness conne	ctor	Terminal		C	Jouria		Resistance
E66		77 (SM	RP)	G	Ground	1	$0 \ k\Omega$ or higher

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Battery pa	ck wire				А
Harness connector	Terminal	Ground	Resistance		
B130	8 (SMRP)	Ground	10 k Ω or higher		
OK or NG	, ,		Ũ		В
OK >> Repla NG >> Repai	r or replace har	ness or connect	or.	noval and Installation"). /IINAL AND AMD TERMINAL)	НВС
 Turn ignition s Measure the v 		g to the value(s) in the table below.		D
Frame	Wire	Ground	Voltage		E
Harness connector	Terminal				
_	AMD	Ground	9 to 14 V		
OK or NG					F
OK >> GO TO					
NG >> GO TO					0
15.CHECK FUS					G
1. Check the fus	ble link (letter E	B) and the fusible	e link (letter G) for in	nproper installation and for open circuits.	
They are o	onnected secu	urely. There are	no open circuits i	n the fusible links.	Н
OK or NG		-			
OK >> GO T(D 16.				
NG >> Repla	ce fusible link.				I
16. СНЕСК НУВ	RID VEHICLE	CONVERTER (A	MD TERMINAL CO	ONNECTION CONDITION)	
		eze frame data.			J
		inal from the au terminals 1 and			
3. Check for loos	seness of AIVID	terminals 1 and	Ζ.		K
Result 1:					IX.
AMD	terminal 1 : 8	.0 N·m (82 kg-f	-cm, 71 in-lbf)		
Result 2:				AMD Terminal 1	L
AMD	terminal 2 : 9	.0 N·m (92 kgf-	cm, 80 in-lbf)	AND ICHIMA I	
4. Make sure to	disconnect the	terminals 1 and	2 to check for arc		ЪЛ
marks.					Μ
Deput 0					
Result 2:					Ν
Inere	e are no arc ma	arks.			
					0
					Р
				AMD Terminal 2	
				2 Bran.	
				JMCIA0161GB	

< COMPONENT DIAGNOSIS >

Result 1		Procedure	Procedure to
Result 1	Result 2	Procedure	
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.	А
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.	В
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	С
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.	В

<u>A, B or C</u>

A B >> GO TO 17.

- >> Repair or replace malfunctioning parts, component or area.
- C >> Tighten to specified torque.

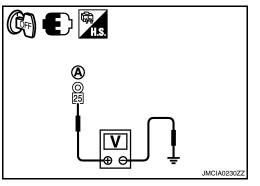
17. CHECK TERMINAL VOLTAGE (AMD TERMINAL)

1. Turn ignition switch OFF.

2. Measure the voltage according to the value(s) in the table below when the ignition switch OFF.

Auxiliar	y battery	Ground	Voltage	
Harness connector	Terminal	Ground		
_	positive (+)	Ground	9 to 14V	

•	cle converter nverter) (A)	Ground	Voltage				
Harness connector	Terminal						
E312	25 (AMD)	Ground	9 to 14V				
OK or NG							
OK >> Replace hybrid vehicle converter (See <u>HBB-103</u> , <u>"Removal and Installation"</u>).							



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

NG

OK >> GO TO 19.

NG >> Replace fuse.

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

See <u>HBC-140, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 20.

NG >> Connect securely.

20. CHECK HARNESS AND CONNECTOR

>> Repair or replace frame wire.

1. Disconnect the battery pack wire connector (See <u>HBB-97, "Removal and Installation"</u>).

2. Turn ignition switch ON.

P0AE6-225

< COMPONENT DIAGNOSIS >

3. Measure the voltage according to the value(s) in the table below. А Battery pack wire connector (A) Ground Voltage Harness connector Terminal В B130 1 (IGCT) Ground 9 to 14V OK or NG OK >> GO TO 21. HBC NG >> Repair or replace harness or connector. 21. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) D See HBC-140, "Diagnosis Procedure". OK or NG Е OK >> GO TO 22. NG >> Connect securely. 22. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE F CONNECTOR) **CAUTION:** Be sure to wear insulated gloves. Check that the service plug grip is not installed. 1. Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and 2. Installation"). Н 3. Measure the resistance according to the value(s) in the table below. Wire Harness Side : Hybrid Vehicle Converter (DC/DC Converter) **Battery Pack Wire** OT A side Κ B side IGCT IGCT JMCIA0163GE Μ Hybrid vehicle converter Battery pack wire (DC/DC converter) Ν Resistance Harness Harness Terminal Terminal connector connector B130 1 (IGCT) 1 (IGCT) n4 Below 1Ω Battery pack wire Ground Resistance Ρ Harness connector Terminal B130 1 (IGCT) Ground 10 k Ω or higher

P0AE6-225

< COMPONENT DIAGNOSIS >

Hybrid vehicle converter (DC/DC converter)		Ground	Resistance
Harness connector	Terminal		
n4	1 (IGCT)	Ground	10 k Ω or higher

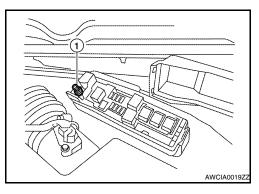
OK or NG

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

$23. {\sf CHECK} \ {\sf FRAME} \ {\sf WIRE} \ {\sf (AUXILIARY} \ {\sf BATTERY} \ {\sf POSITIVE} \ {\sf TERMINAL} \ {\sf AND} \ {\sf AMD} \ {\sf TERMINAL})$

- 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.

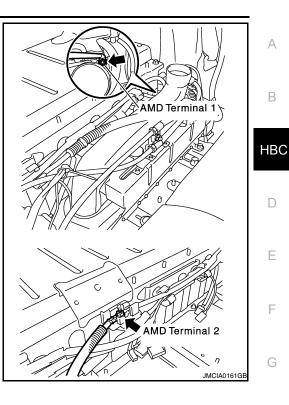
Result 1:

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.



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Result 1		Procedure	Procedure to	
Result 1	Result 2	Fiocedule	FIOCEDUIE IO	
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.	В	
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	С	
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.	В	

<u>A. B or C</u>

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	Ground	vollage	
_	positive (+)	Ground	9 to 14V	

P0AE6-225

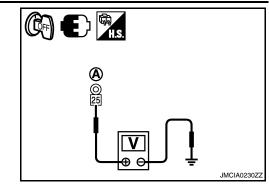
< COMPONENT DIAGNOSIS >

Hybrid vehicle converter (DC/DC converter)		Ground	Voltage	
Harness connector	Terminal			
E312	25 (AMD)	Ground	9 to 14V	

<u>OK or NG</u>

OK >> GO TO 27.

NG >> Repair or replace frame wire.



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

See <u>HBC-140, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 28.

NG >> Connect securely.

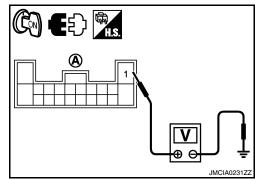
28.CHECK HARNESS AND CONNECTOR

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	Ground	volidye
B130	1 (IGCT)	Ground	9 to 14V

>> Repair or replace harness or connector.



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

See HBC-140, "Diagnosis Procedure".

<u>OK or NG</u>

OK or NG OK >

NG

- OK >> GO TO 30.
- NG >> Connect securely.

>> GO TO 29.

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 <u>HBB-103</u>, "<u>Removal and</u> <u>Installation</u>").

3. Measure the resistance according to the value(s) in the table below. А Wire Harness Side : Hybrid Vehicle Converter (DC/DC Converter) **Battery Pack Wire** В A HBC A side D B side Е IGCT IGCT JMCIA0163GE F Hybrid vehicle converter Battery pack wire (DC/DC converter) Resistance Harness connector Terminal Harness connector Terminal 1 (IGCT) 1 (IGCT) B130 n4 Below 1Ω Battery pack wire Н Ground Resistance Harness connector Terminal B130 1 (IGCT) Ground 10 k Ω or higher Hybrid vehicle converter (DC/DC converter) Ground Resistance Harness connector Terminal n4 1 (IGCT) Ground 10kΩ or higher OK or NG Κ OK >> Replace hybrid vehicle converter (See <u>HBB-103</u>, "Removal and Installation"). NG >> Repair or replace harness or connector. **31.**CHECK AUXILIARY BATTERY L 1. Check the connection of the auxiliary battery negative terminal. Μ The terminal is connected securely and there is no contact problem. 2. Check for arc marks on the auxiliary battery negative terminal. Ν There are no arc marks. Measure the resistance according to the value(s) in the table below. 3. Auxiliary battery Ground Resistance Harness connector Terminal Ρ negative Ground Below 1Ω

OK or NG

OK >> Repair or replace frame wire.

NG >> Repair or replace harness or connector.

P0AE7-224

Description

INFOID:000000004212074

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.

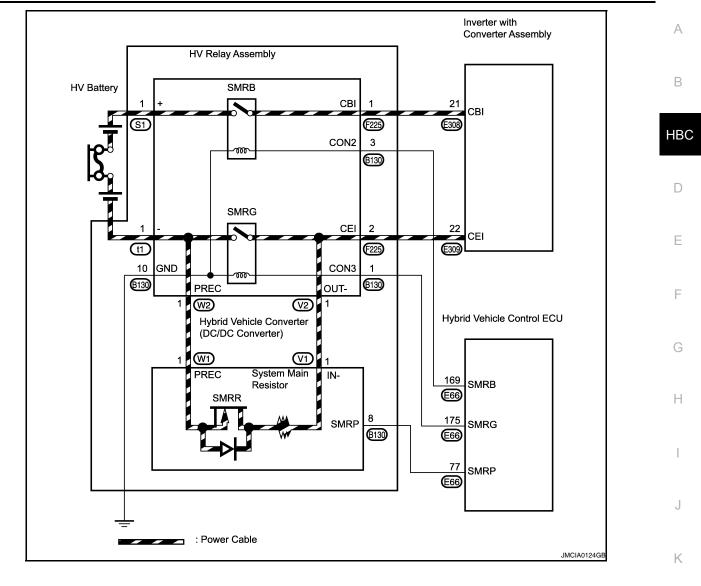
When there is an open in the AMD line or IGCT line, the following DTCs are output:

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.

P0AE7-224

< COMPONENT DIAGNOSIS >



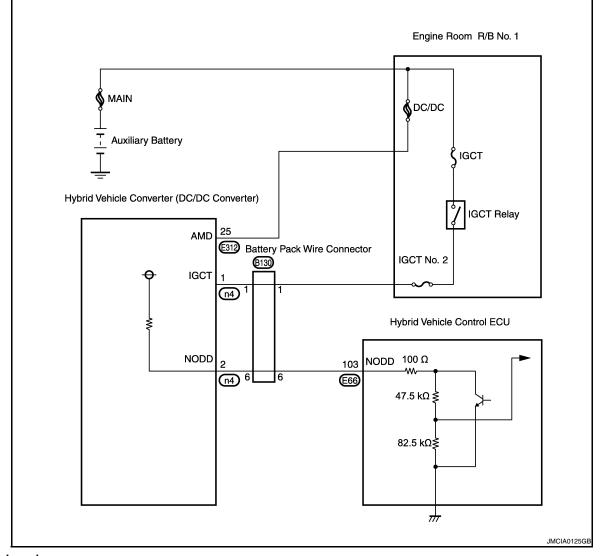
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DTC Logic

INFOID:000000004212075

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 con- tactor 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:000000004212076

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.

P0AE7-224

< COMPONENT DIAGNOSIS >

 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

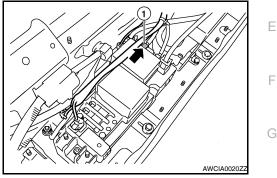
CAUTION:

- Be sure to wear insulated gloves.
- Turn ignition switch OFF and remove the service plug grip (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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 <u>HBB-97</u>, <u>"Removal and Installation"</u>).
- 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	Ground	voltage
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

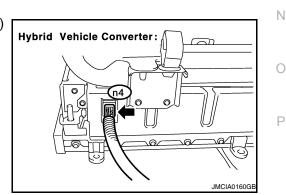
OK >> GO TO 3. NG >> GO TO 5.

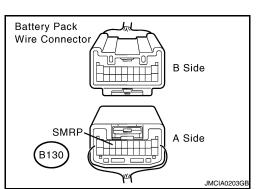
 $\mathbf{3}$. CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

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.





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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 k Ω 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 pa	ack wire	Ground	Resistance
Harness connector Terminal		Ground	Resistance
B130	8 (SMRP)	Ground	370 to 430 k Ω

<u>OK or NG</u>

- OK >> Replace hybrid vehicle converter. (See <u>HBB-103</u>, <u>"Removal and Installation"</u>)
- NG >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, <u>"Removal and Installation"</u>).

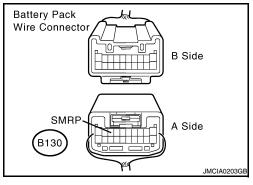
5. CHECK HARNESS AND CONNECTOR

- 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 p	ack wire	Ground	Voltage
Harness connector Terminal		Cround	voltage
B130	8 (SMRP)	Ground	Below 1V

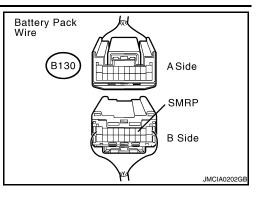
NOTE:

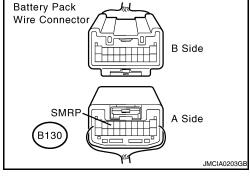
Turn ignition switch ON with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.





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





P0AEE-276, P0AEE-277

Description

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 sen-HBC sor. 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:000000004212078

INFOID:000000004212077

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	
	276	Motor inverter temperature	Sudden change or hunting in the motor inverter temperature sensor	 Inverter cooling system Water pump with motor & bracket assembly 	F
POAEE	277	sensor "A" circuit range/perfor- mance	Motor inverter temperature sen- sor output deviation	 Inverter with converter assembly Cooling fan system Hybrid vehicle control ECU Wire harness or connector 	0

Diagnosis Procedure

Н INFOID:000000004212079

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)

Turn ignition switch ON. 1

Check DTC.

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

 $\mathbf{3}.$ 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.

HBC-479

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4.CHECK QUANTITY OF INVERTER COOLANT

See <u>HBC-362, "Diagnosis Procedure"</u>.

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 <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 6.

NG >> Correct the problem.

6.CHECK FUSE (NO. 67)

See <u>HBC-362</u>, "Diagnosis Procedure".

OK or NG

OK >> GO TO 7.

NG >> Replace fuse.

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

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 8.

NG >> Connect securely.

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

See <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Connect securely.

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

See <u>HBC-362, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 10.

NG >> GO TO 12.

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

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 11.

NG >> Connect securely.

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

See <u>HBC-362, "Diagnosis Procedure"</u>.

OK or NG

- OK >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "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".

<u>OK or NG</u>

OK >> Add coolant.

NG >> GO TO 13.

< COMPONENT DIAGNOSIS >	
13. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY	А
See <u>HBC-362</u> , "Diagnosis Procedure".	/ \
<u>OK or NG</u>	
OK >> GO TO 14. NG >> GO TO 16.	В
14. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HY-	HBC
BRID VEHICLE CONTROL ECU)	TIDO
See <u>HBC-362, "Diagnosis Procedure"</u> . <u>OK or NG</u>	
OK >> GO TO 15.	D
NG >> Repair or replace harness or connectors.	
15. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LIMK BOX	Е
See HBC-362, "Diagnosis Procedure".	
OK or NG	
OK >> Replace hybrid vehicle control ECU.	F
NG >> Repair or replace high voltage fuse and fusible link box.	
16. CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT)	G
See <u>HBC-362</u> , "Diagnosis Procedure".	0
<u>OK or NG</u>	
OK >> Replace water pump with motor & bracket assembly.	Н
NG >> Repair or replace harness or connector.	
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P0AEF-275, P0AF0-274

Description

INFOID:000000004212080

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:000000004212081

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P0AEF	275	Drive motor inverter tempera- ture sensor "A" circuit low	Open or short to GND in the mo- tor inverter temperature sensor circuit	Inverter with converter assembly
P0AF0	274	Drive motor inverter tempera- ture sensor "A" circuit high	Short to +B in motor inverter tem- perature sensor circuit	

Diagnosis Procedure

INFOID:000000004212082

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

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 <u>HBC-66</u>, "System Description" for the ASCD function.

DTC Logic

INFOID:000000004212084 HBC

INFOID:000000004212083

INFOID:000000004212085

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 	E

Component Function Check

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	Со	Condition		
ASCD CANSEL SW	Brake pedal	Slightly depressed	ON	
ASCD CANSEL SW	Brake pedar	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					
Harness connector	Terminal	Ground	Condition		Voltage
E66	118 (ASCD brake switch signal)	Ground	Brake pedal	Slightly depressed	Approx. 0V
LUU	TTO (AGED brake Switch Signal)	Ground	Blake pedal	Fully released	Battery voltage

Is the inspection result normal?

YES >> INSPECTION END

NO >> Go to HBC-483, "Diagnosis Procedure".

Diagnosis Procedure

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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.

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>> 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.
- Check the voltage between ASCD brake switch harness connector and ground.

ASCD brake	e switch (A)		
Harness connector	Terminal	Ground	Voltage
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.
- Check the continuity between ASCD brake switch harness connector and hybrid vehicle control ECU harness connector.

ASCD brake switch		Hybrid vehicle control ECU		
Harness connector	Terminal	Harness connector Terminal		Continuity
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)".

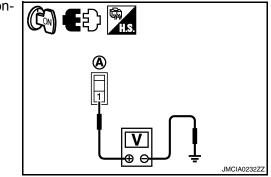
Is the inspection result normal?

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)

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)	Con	Continuity	
Terminals			
1 and 2	Brake nedal	Fully released	Existed
	Brake pedal Slightly depressed		Not existed

Is the inspection result normal?

YES >> INSPECTION END

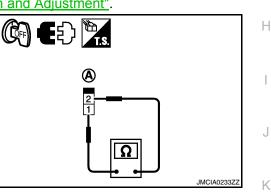
NO >> GO TO 2.

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	1 and 2 Broke nodel		Existed	
i anu z	Brake pedal	Slightly depressed	Not existed	



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Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace ASCD brake switch.

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P1606-308

Description

INFOID:000000004212088

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:000000004212089

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.	ACUHybrid 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:000000004212090

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.	В

<u>A or B</u>

A >> Go to inspection procedure relevant to output DTC. (P0A1D)

B >> GO TO 3.

	ECK SUPPLEMENTAL RESTRAINT SYSTEM	Α
Troubl	eshoot the air bag system.	
	Result: There is a malfunction.	В
YES o		
YES NO	>> Repair or replace malfunctioning parts, component and area. >> Replace ACU.	HBC
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P1805-902

Description

INFOID:000000004212091

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:000000004212092

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:000000004212093

1.CHECK FOR STOP LAMP SWITCH FUNCTION

(B) 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	C	Indication	
BRAKE SWITCH	Brake pedal	Slightly depressed	ON
BIARE SWITCH		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					
Harness connector	Terminal	Ground	Condition		Voltage
E66	148 (Stop lamp switch signal)	Ground Brake pedal		Slightly depressed	Battery voltage
200	140 (Stop lamp Switch Signal)	Ground	Diake pedal	Fully released	Approx. 0V

Is the inspection result normal?

YES >> INSPECTION END

NO >> Go to <u>HBC-488, "Diagnosis Procedure"</u>.

Diagnosis Procedure

INFOID:000000004212094

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.

2. CHECK STOP LAMP SWITCH CIRCUIT

1. Turn ignition switch OFF.

Check the stop lamp when depressing and releasing the brake pedal. 2.

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.
- Disconnect stop lamp switch harness connector. 2.
- 3. Check the voltage between stop lamp switch harness connector and ground.

Stop lamp switch (A)					
Harness connector	Terminal	Ground	Voltage		
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		
Harness connector	Terminal	Harness connector	Terminal	Continuity
E66	148 (STP)	E38	2	Existed

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.

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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".

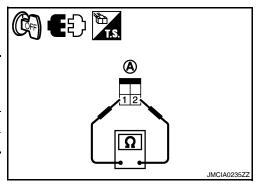
>> INSPECTION END

Component Inspection (Stop Lamp Switch)

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	Prako podal	Fully released	Not existed
T anu z	1 and 2 Brake pedal	Slightly depressed	Existed



Is the inspection result normal?

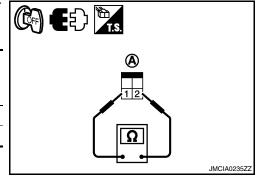
YES >> INSPECTION END

NO >> GO TO 2.

2.CHECK STOP LAMP SWITCH-II

- 1. Adjust stop lamp switch installation. Refer to <u>BR-12, "Inspection and Adjustment"</u>.
- 2. Check the continuity between stop lamp switch terminals under the following conditions.

Stop lamp switch (A)	Condition		Continuity	
Terminals				
1 and 2	Brake pedal	Fully released	Not existed	
T and 2	Diake pedal	Slightly depressed	Existed	



Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace stop lamp switch.

INFOID:000000004212095

INFUID:0000000042120

P1805-903, P1805-923

Description

The brake switch signal is applied to the hybrid vehicle control ECU through the stop lamp switch when the В 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:000000004212097

INFOID:000000004212096

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.
- Fully depress the brake pedal for at least 5 seconds. 2.
- Fully release the brake pedal for at least 5 seconds. 3.
- 4. Check DTC.

Is DTC detected?

YES >> Go to HBC-491, "Diagnosis Procedure".

NO >> INSPECTION END

Diagnosis Procedure

1.PRECONDITIONING

- Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with Μ 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. Ν
- 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.

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m 3.}$ CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT TO HYBRID VEHICLE CONTROL ECU FOR

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INFOID:000000004212098

OPEN AND SHORT

(I) 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
	Brake pedai	Fully released	OFF

(a) With GST

Turn ignition switch ON.

2. Check the voltage between hybrid vehicle control ECU harness connector and ground.

Hybrid vehicle control ECU					
Harness connector	Terminal	Ground	Condition		Voltage
E66	148 (Stop lamp switch signal)	Ground	Brake pedal	Slightly depressed	Battery voltage
L00		Ground	Blake pedal	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		
Harness connector	Terminal	Harness connector	Terminal	Continuity
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.
- Check the continuity between brake ECU harness connector and stop lamp switch harness connector for open and short.

Refer to <u>BRC-148</u>, "Wiring Diagram - BRAKE CONTROL SYSTEM -".

Is the inspection result normal?

- YES >> Replace brake ECU.
- NG >> Repair or replace harness or connectors.

P1805-903, P1805-923

< COMPONENT DIAGNOSIS >

Component Inspection (Stop Lamp Switch)

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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)	Con	Continuity	
Terminals			
1 and 2	Brake pedal	Fully released	Not existed
i anu z	Blake pedal	Slightly depressed	Existed

Is the inspection result normal?

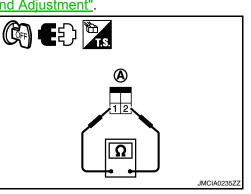
YES >> INSPECTION END

NO >> GO TO 2.

2.CHECK STOP LAMP SWITCH-II

- 1. Adjust stop lamp switch installation. Refer to <u>BR-12, "Inspection and Adjustment"</u>.
- 2. Check the continuity between stop lamp switch terminals under the following conditions.

Stop lamp switch (A)	Con	dition	Continuity	
Terminals				
1 and 2	Brake pedal	Fully released	Not existed	
T and 2	Blake pedal	Slightly depressed	Existed	



(A)

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Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace stop lamp switch.

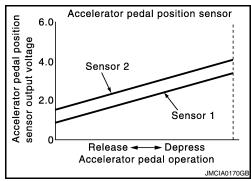
< COMPONENT DIAGNOSIS >

P2120-152, P2121-106, P2122-104, P2123-105, 2125-153

Description

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:000000004212101

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		
P2121	106	Throttle/pedal position sensor/ switch "D" circuit range/perfor- mance	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 mal- function or level is not stable	Wire harness or connector	
P2126	109	Throttle/pedal position sensor/ switch "E" circuit range/perfor- mance	Internal error of the sub sensor	 Accelerator pedal assembly Hybrid vehicle control ECU 	
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 cir- cuit		
P2138	110	Throttle/pedal position sensor/ switch "D"/"E" voltage correla- tion	Difference between the main sensor value and sub sensor val- ue is large or small.		
P2138	154	Throttle/pedal position sensor/ switch "D"/"E" voltage correla- tion	Main or sub sensor circuit wiring malfunction		

Diagnosis Procedure

INFOID:000000004212102

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

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< COMPONENT DIAGNOSIS >

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 \rightarrow Fully depressed \rightarrow 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".

<u>OK or NG</u>

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.

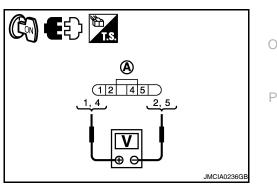
2. Turn ignition switch ON.

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

Accelerator pedal position sen- sor (A)		Accelerator pedal position sen- sor (A)		Voltage
Harness connector	Terminal	Harness connector		voltage
E40	4 (VC1)	E40	5 (GND1)	4.5 to 5.5V
240	1 (VC2)	240	2 (GND2)	4.5 10 5.5 V

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.



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OK or NG

OK >> GO TO 6.

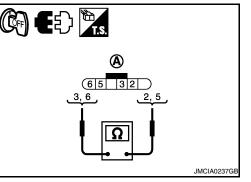
NG >> GO TO 8.

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 sen- sor (A)		Accelerator pedal position sen- sor (A)		Resistance
Harness connector	Terminal	Harness connector Terminal		Resistance
E40	6 (VPA1)	E40	5 (GND1)	37 to 41 kΩ
L40	3 (VPA2)	L+0	2 (GND2)	57 10 4 1 KS2



OK or NG

- OK >> Replace accelerator pedal position sensor. (See <u>ACC-3, "Removal and Installation"</u>).
- 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 ve	ehicle control ECU			
Harness connector	lerminal		Voltage	
	147 (VPA)		Below 1V	
E66	130 (EP1)	Ground		
LUU	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	Resistance
	147 (VPA)		6 (VPA1)	
	113 (VCP1)	E40	4 (VC1)	Below 1Ω
E66	130 (EP1)		5 (GND1)	
E00	146 (VPA2)		3 (VPA2)	Delow 122
	112 (VCP2)		1 (VC2)	
	129 (EP2)		2 (GND2)	

< COMPONENT DIAGNOSIS >

Hybrid vehicle control ECU			0	und				
Harness connecto	- Termina	I	Gro	una		Resistance		
	147 (VP	4)					-	
	113 (VCP	1)						
E66	130 (EP	1)	Gro	und	10	k0 or bighor		
E00	146 (VPA	2)	GIO	unu	10	$k\Omega$ or higher		H
	112 (VCP	2)						
	129 (EP2	2)						
							•	
Accelerator peda	position sensor	Ground		Resista	200			
Harness connector	Terminal	Ground		Resista	IIICE			
	6 (VPA1)							
	4 (VC1)							
E40	5 (GND1)	Ground	Ground 10 kΩ	10 10				
L40	3 (VPA2)	Giounu		10 132				
	1 (VC2)							
	2 (GND2)	1						
NG >> Repa		ness or conne	ector				J - ACCELERATOR PEDAL	
DSITION SENS Turn ignition Disconnect c Turn ignition	witch OFF. onnector E66 fro witch ON.	-						
OSITION SENS . Turn ignition : . Disconnect c . Turn ignition :	witch OFF. onnector E66 fro	-						
OSITION SENS . Turn ignition : . Disconnect co . Turn ignition : . Measure the	witch OFF. onnector E66 fro witch ON.	-	e(s) i	n the table		v.		
OSITION SENS . Turn ignition : . Disconnect co . Turn ignition : . Measure the	witch OFF. onnector E66 fro witch ON. voltage accordin	g to the value		n the table				
OSITION SENS Turn ignition Disconnect of Turn ignition Measure the Hybrid ve	witch OFF. onnector E66 fro switch ON. voltage accordin nicle control ECU Termina 147 (VP/	g to the value	e(s) i	n the table		v.		
OSITION SENS Turn ignition Disconnect co Turn ignition Measure the Hybrid ve Harness connecto	witch OFF. onnector E66 fro switch ON. voltage accordin	g to the value	e(s) i Gro	n the table		v. Voltage		
POSITION SENS Turn ignition Turn ignition Turn ignition Measure the Hybrid ve	witch OFF. onnector E66 fro switch ON. voltage accordin nicle control ECU Termina 147 (VP/	g to the value	e(s) i	n the table		v.		

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

Hybrid vehicle control ECU		Accelerator ped	Resistance	
Harness connector	Terminal	Harness connector	Terminal	Resistance
	113 (VCP1)	- E40	4 (VC1)	Below 1Ω
E66	130 (EP1)		5 (GND1)	
E00	112 (VCP2)		1 (VC2)	
	129 (EP2)		2 (GND2)	

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Hybrid vehic	e control ECU	Ground	Resistance
Harness connector Terminal		Ground	Resistance
	113 (VCP1)		
E66	130 (EP1)	Ground	10 k Ω or higher
E00	112 (VCP2)	Ground	TO KS2 OF Higher
	129 (EP2)		

Accelerator peda	al position sensor	Ground	Resistance	
Harness connector Terminal		Giouna	Tresistance	
	4 (VC1)		10 kΩ	
E40	5 (GND1)	Ground		
E40	1 (VC2)	Giouna		
	2 (GND2)	1		

OK or NG

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

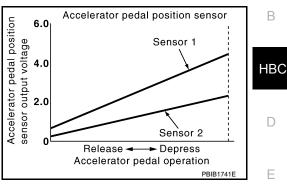
NG

< COMPONENT DIAGNOSIS >

P2126-109, P2127-107, P2128-108, P2138-110, P2138-154

Description

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:000000004212104

INFOID:000000004212103

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		-
P2121	106	Throttle/pedal position sensor/ switch "D" circuit range/perfor- mance	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 mal- function or level is not stable	Wire harness or connector	
P2126	109	Throttle/pedal position sensor/ switch "E" circuit range/perfor- mance	Internal error of the sub sensor	 Accelerator pedal assembly Hybrid vehicle control ECU 	
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 cir- cuit		
P2138	110	Throttle/pedal position sensor/ switch "D"/"E" voltage correla- tion	Difference between the main sensor value and sub sensor value ue is large or small.		
P2138	154	Throttle/pedal position sensor/ switch "D"/"E" voltage correla- tion	Main or sub sensor circuit wiring malfunction		

Diagnosis Procedure

INFOID:000000004212105

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

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< COMPONENT DIAGNOSIS >

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 \rightarrow Fully depressed \rightarrow 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.

 $\mathbf{3}$.check connector connection condition (hybrid vehicle control ecu connector)

Refer to HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

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 sen- sor (A)		Accelerator peo	Voltage	
Harness connector	Terminal	Harness connector	lerminal	
E40	4 (VC1)	E40	5 (GND1)	4.5 to 5.5V
L40	1 (VC2)	L40	2 (GND2)	4.0 10 0.0 V

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.



< COMPONENT DIAGNOSIS >

<u>OK or NG</u> OK >> G	6. TO 6.						A
NG >> G	60 TO 8.						
6. CHECK H	YBRID VEHIC	CLE CONTRO	DL ECU				D
	ion switch OF the resistanc		to the value(s)) in the ta	ble		- B HBC
	dal position sen- (A)		dal position sen- or (A)	Resistanc		(6)5 32	D
Harness connector	Terminal	Harness connector	Terminal	Resistance		<u>3,6</u> <u>2,5</u>	D
E40	6 (VPA1)	E40	5 (GND1)	37 to 41 k	Ω	<u>Ω</u>	Е
	3 (VPA2)		2 (GND2)			JMCIA0237GE	
_NG >> G	60 TO 7.					nd Installation").	F
POSITION SE	ENSOR)		OR (HYBRID	VEHICLE	CONTROL EC	U - ACCELERATOR PEDAL	G
 Disconne Turn ignit 	ion switch ON	brid vehicle co I.	ontrol ECU cor e value(s) in th		OW.		Н
Hybrid	vehicle control E	CU					
Harness connector	Term	ninal	Ground Volta		je		
	147 (VPA)					J
E66	130 (Ground	Below	1V		
	146 (\						K
	129 (EP2)					
tors disco 5. Turn ignit	onnected caus ion switch OF	es other DTC F.		. Clear the	DTCs after per	vehicle control ECU connector forming this inspection.	- L M
Hybr	id vehicle control	ECU	Accelerat	tor pedal pos	ition sensor	Desistance	
Harness conr	nector	Terminal	Harness conne	ector	Terminal	Resistance	Ν
	· · · · · · · · · · · · · · · · · · ·	147 (VPA)			6 (VPA1)		
	1	13 (VCP1)			4 (VC1)		0
E66		130 (EP1)	E40		5 (GND1)	Below 1Ω	0
200	1	46 (VPA2)	LIV		3 (VPA2)	20.011 122	
		. ,	-		. ,		
		12 (VCP2) 129 (EP2)	-		1 (VC2) 2 (GND2)	_	Р

< COMPONENT DIAGNOSIS >

Hybrid vehicle	control ECU	Ground	Resistance	
Harness connector Terminal		Giouna	Resistance	
	147 (VPA)		10 kΩ or higher	
	113 (VCP1)			
E66	130 (EP1)	Ground		
E00	146 (VPA2)	Giouna		
	112 (VCP2)			
-	129 (EP2)			

Accelerator peda	al position sensor	Ground	Resistance	
Harness connector Terminal		Ground	Resistance	
	6 (VPA1)			
	4 (VC1)			
E40	5 (GND1)	5 (GND1) Ground		
E40	3 (VPA2)	Giouna	10 kΩ	
	1 (VC2)			
	2 (GND2)			

OK or NG

- OK >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, "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 vehicl	e control ECU	Ground	Valtaga	
Harness connector Terminal		Giouna	Voltage	
	147 (VPA)			
E66	130 (EP1)	Ground	Below 1V	
LOO	146 (VPA2)	Ground		
	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 vehicl	e control ECU	Accelerator peda	Resistance	
Harness connector	Terminal	Harness connector	Terminal	Resistance
	113 (VCP1)		4 (VC1)	
E66	130 (EP1)	E40	5 (GND1)	Below 1Ω
E00	112 (VCP2)	L40	1 (VC2)	Delow 122
	129 (EP2)		2 (GND2)	

< COMPONENT DIAGNOSIS >

Hybrid vehicle control ECU Harness connector Terminal			round	Resistance	
		Ground		Resistance	
	113 (VCP1)			
E66	130 (EP1)		Ground	10 k Ω or higher	
LUU	112 (VCP2)	nouna		
	129 (EP2)				
Accelerator pedal p	osition sensor	Cround	Desist	2222	
Harness connector	Terminal	Ground	Resist	ance	
	4 (VC1)		Ground 10 kΩ		
	5 (GND1)				
E40	1 (VC2)	Ground		<Ω	
	2 (GND2)				
K or NG	. ,		1		
	e hybrid vehicle	control ECU.	(See HBC-	644, "Removal and	Installation")
NG >> Repair	or replace harne	ess or connect	or.		,

P2511-149

Description

The hybrid vehicle control ECU monitors the power resource VB voltage to detect an instantaneous interruption.

DTC Logic

INFOID:000000004212107

INFOID:000000004212106

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 con- trol ECU is reset.	Wire harness or connectorHybrid vehicle control ECU

Diagnosis Procedure

INFOID:000000004212108

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.

<u>OK or NG</u>

OK >> GO TO 3.

NG >> Connect securely.

3. check connector connection condition (hybrid vehicle control ecu connector)

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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 vehicl	e control ECU	High voltage fus b	Resistance	
Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	174 (VB)	V-1	5 (IGCT relay)	Below 1 Ω
	168 (VB2)	V-1	5 (IGCT Teldy)	

OK >> GO TO 5.	
NG >> Repair or replace harness or connector.	А
5. CHECK FOR INTERMITTENT INCIDENT	
 Check for intermittent incident. (See <u>GI-42. "Intermittent Incident"</u>) 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 	В
control ECU and the high voltage fuse and fusible link box.	HBC
OK or NG	
 OK >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, "<u>Removal and Installation</u>"). NG >> Repair malfunctioning parts, component and area. 	D
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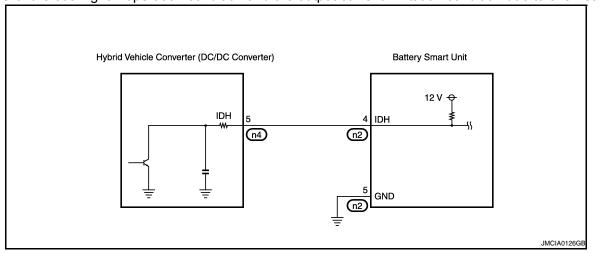
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P2519-766

Description

INFOID:000000004212109

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:000000004212110

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 op- eration condition signal circuit	 Battery smart unit Hybrid vehicle converter (DC/DC converter) Wire harness or connector

Diagnosis Procedure

INFOID:000000004212111

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

Be sure to wear insulated gloves.

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

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.

Battery Smart Unit

IDH

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 <u>HBB-101</u>, <u>"Removal and Installation"</u>).
- 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 <u>HBB-101. "Removal</u> and Installation")

NG >> GO TO 4.

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

See <u>HBC-140, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 5.

NG >> Connect securely.

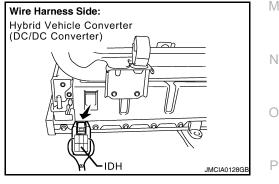
${f b.}$ CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER)

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 <u>HBB-103</u>, "Removal and Installation").
- 4. Turn ignition switch ON.
- 5. Measure the voltage according to the value(s) in the table below.

Hybrid Vehic	cle Converter		
Harness Terminal		Ground	Voltage
n4	5 (IDH)	Ground	9 to 14V



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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.

<u>OK or NG</u>

OK >> Replace hybrid vehicle converter. (See <u>HBB-103</u>, "Removal and Installation").

NG >> GO TO 6.

P2519-766

< COMPONENT DIAGNOSIS >

$6. {\sf CHECK \ CONNECTOR \ CONNECTION \ CONDITION \ (BATTERY \ SMART \ UNIT \ CONNECTOR)}$

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.

<u>OK or NG</u>

OK >> GO TO 7.

NG >> Connect securely.

 $7. {\sf CHECK} {\sf HARNESS} {\sf AND} {\sf CONNECTOR} {\sf (BATTERY} {\sf SMART} {\sf UNIT} {\sf -} {\sf HYBRID} {\sf VEHICLE} {\sf CONVERTER})$

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 S	Battery Smart Unit		Hybrid Vehicle Converter (DC/DC Converter)	
Harness connector	Terminal	ninal Harness Connector Terminal		Resistance
n2	4 (IDH)	n4	5 (IDH)	Below 1Ω

Battery S	mart Unit	Ground	Resistance
Harness connector	Terminal	Ground	Resistance
n2	4 (IDH)	Ground	10 k Ω or higher

Hybrid Vehicle Converter (DC/DC Converter)		Ground	Resistance
Harness connector Terminal			
n4 5 (IDH)		Ground	10 k Ω or higher

OK or NG

OK >> Replace battery smart unit. (See <u>HBB-101</u>, "Removal and Installation")

NG >> Repair or replace harness or connector.

P3000-388

Description

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:000000004212113

INFOID:000000004212112

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	
P3000	388	HV battery malfunction	Dischage inhibition control mal- function	Fuel levelHV battery	E

Diagnosis Procedure

INFOID:000000004212114

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
 H 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)

Turn ignition switch ON. Check DTC.

- 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.
 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.

${f 4}$. CHECK AMOUNT OF GASOLINE

See HBC-303, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 5.

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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 <u>HBB-97. "Removal and Installation"</u>).

P3000-389

< COMPONENT DIAGNOSIS >

P3000-389

Description

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

This DTC is set if the HV battery is discharged excessively or the HV control system malfunctions. NOTE:

HBC 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. D

DTC Logic

INFOID:000000004212116

INFOID:000000004212117

INFOID:000000004212115

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 assemblyHybrid transaxleHV battery	· -

Diagnosis Procedure

1.PRECONDITIONING	Н
 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. 	I
 Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly. 	J
 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. 	K
>> GO TO 2.	L
2.CHECK DTC OUTPUT (HYBRID SYSTEM)	
 Turn ignition switch ON. Check DTC. 	Μ
Result: DTCs other than P3000-388 or P3000-389 are output.	Ν
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?	0
YES >> Go to Diagnosis Procedure relevant to output DTC. NO >> GO TO 3.	Ρ
3. CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)	
1. Turn ignition switch ON.	

Check DTC. Ζ.

Result: Engine control system DTCs are output.

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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 <u>HBC-303</u>, "Diagnosis Procedure".

OK or NG

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

O.CHECK CRANKSHAFT PULLEY REVOLUTION (N POSITION)

See <u>HBC-303</u>, "Diagnosis Procedure".

<u>OK or NG</u>

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.

< COMPONENT DIAGNOSIS > P3000-603

Description

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

DTC Logic

INFOID:000000004212119

INFOID:000000004212120

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 ECUHV battery assembly	D
<u> </u>	_				E

Diagnosis Procedure

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 H 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.

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Is DTC detected?

- >> Replace HV battery assembly. (See <u>HBB-105, "Removal and Installation"</u>).
 >> COMPLETED YES
- NO

P3004-131

Description

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 NODD, short to GND	P0A09-265	Occurs	
Open in IGCT line	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.

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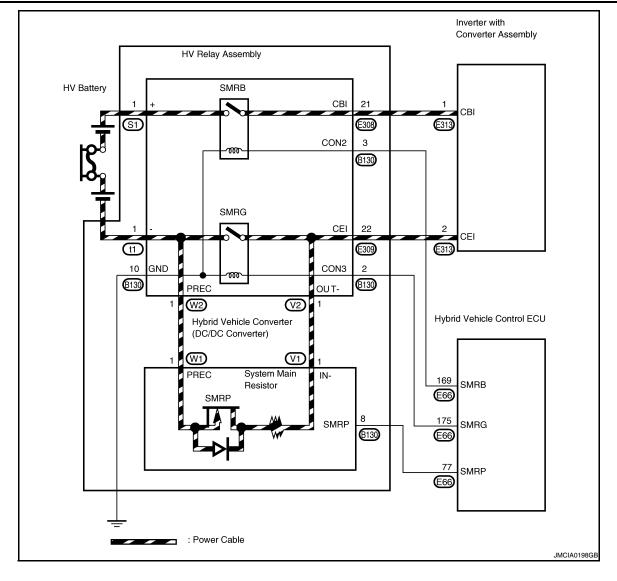
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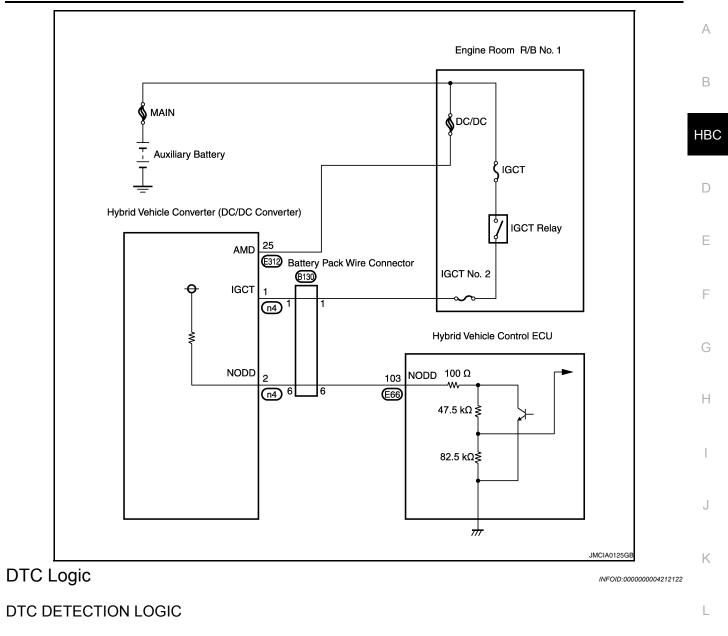
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P3004-131

< COMPONENT DIAGNOSIS >





DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	N
P3004	131	Power cable malfunction	The inverter voltage is not boost- ed 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) 	N

Diagnosis Procedure

INFOID:000000004212123

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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.

P3004-131

< COMPONENT DIAGNOSIS >

• 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.

Related Part
Electric vehicle fuse circuit
SMRP control line circuit
SMRB control line circuit
Battery smart unit, VB sensor circuit
IB sensor circuit
High-voltage power source line circuit
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	В

<u>A or B</u>

А

>> 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 <u>HBC-109, "Diagnosis Procedure"</u>.

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.

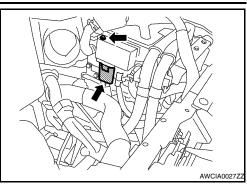
1. Turn ignition switch OFF and remove the service plug grip. (See <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>)

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.
- 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 <u>HBB-105</u>, "<u>Removal and</u> <u>Installation</u>").

Torque: 9.0 N*m (92 kgf*cm, 81 in.*lbf)

- 1: Frame wire connector h3 (-)
- 2: Frame wire connector h4 (+)

<u>OK or NG</u>

OK >> GO TO 7.

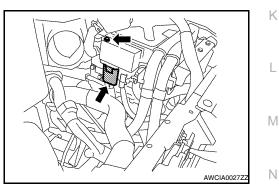
NG >> Connect securely.

7.CHECK FRAME WIRE

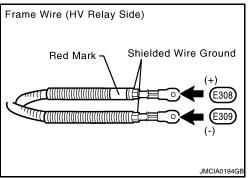
CAUTION:

Be sure to wear insulated gloves.

- 1. Check that the service plug grip is not installed.
- Disconnect the frame wire from the inverter with converter assembly (See <u>HBC-638</u>, "<u>Removal and Installation</u>").
- 3. Disconnect the frame wire from the HV relay assembly (See <u>HBB-105, "Removal and Installation"</u>).



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



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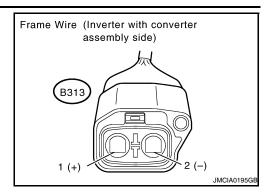
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Frame Wire (Inverter with Converter Assembly Side)		Frame (HV Relay As		Resistance	
Harness connector	Terminal	Harness connector Terminal			
E313	1 (High voltage +)	E308	21 (High voltage +)	Below 1Ω	
E313	2 (High voltage –)	E309	22 (High voltage –)	Below 1Ω	

OK or NG

OK >> GO TO 8.

NG >> Replace frame wire.

 $\mathbf{8}$. CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

See <u>HBC-140, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Connect securely.

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

NOTE:

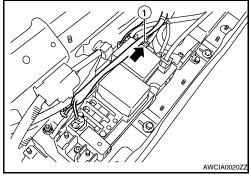
Be sure to wear insulated groves.

- 1. Check that the service plug grip is not installed.
- 2. Disconnect the E66 hybrid vehicle control ECU connector.
- Disconnect the B130 battery pack wire connector (See <u>HBB-97</u>, <u>"Removal and Installation"</u>).

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.

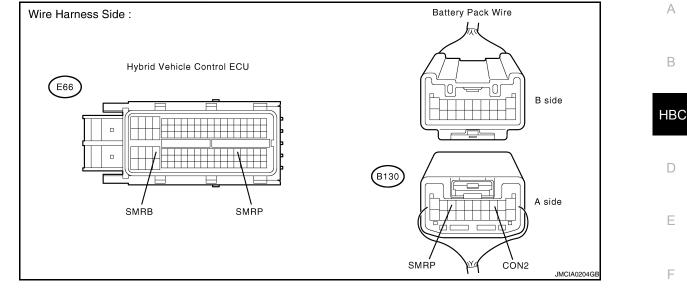
- Battery pack wire connector B130 (1)



P3004-131

< COMPONENT DIAGNOSIS >

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



Hybrid Vehicle Control ECU		Battery Pack Wire			
Harness connector	Terminal	Harness Terminal		Resistance	
E66	169 (SMRB)	P120	3 (CON2)	Below 1Ω	
EUU	77 (SMRP)	B130	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.	А
The connectors are not connected securely.	В
The HV relay assembly connector is damaged.	С
The main battery cable is damaged.	D

NOTE:

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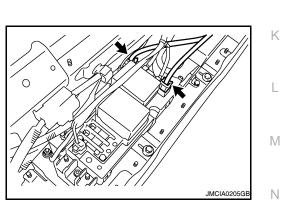
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nam battery cable and HV battery are supplied as one unit.
<u>· D</u>
>> GO TO 11.
>> Connect securely.
>> Replace HV relay assembly. (See <u>HBB-105, "Removal and Installation"</u>).
>> Replace HV battery assembly. (See <u>HBB-97, "Removal and Installation")</u> .

.CHECK HV BATTERY ASSEMBLY

CAUTION:

- Be sure to wear insulated gloves.
- 1. Check that the service plug grip is not installed.



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- Disconnect the main battery cable from the HV relay assembly (See <u>HBB-105, "Removal and Installation"</u>).
- 3. Measure the voltage according to the value(s) in the table below.

-	Harness	connector	Service	plug grip		
-	Harness connector	Terminal	Component connector	Terminal	Voltage	
-	s1	1	—	1	114 to 190V	
-	t1	1		2	90 to 190V	

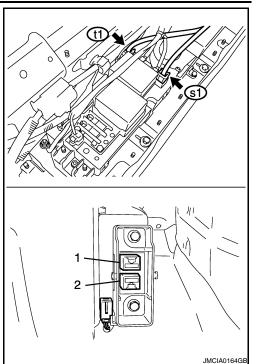
CAUTION:

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 <u>HBB-97, "Removal</u> <u>and Installation"</u>).



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 <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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 <u>HBB-105</u>, "<u>Removal and Installa-</u> tion").

OK or NG

OK >> GO TO 13.

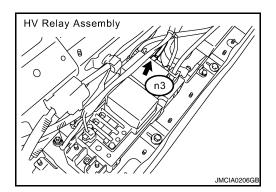
NG >> Connect securely.

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.



P3004-131

< COMPONENT DIAGNOSIS >

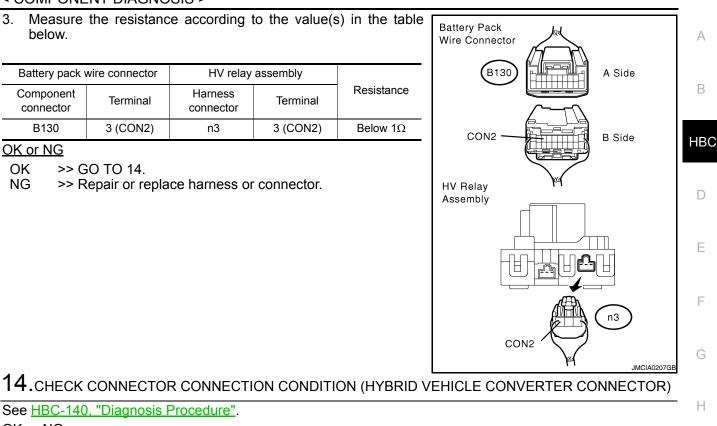
3. Measure the resistance according to the value(s) in the table below.

Battery pack	wire connector	HV relay		
Component connector	Terminal	Harness connector	Terminal	Resistance
B130	3 (CON2)	n3	3 (CON2)	Below 1Ω

OK or NG

OK >> GO TO 14.

NG >> Repair or replace harness or connector.



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See HBC-140, "Diagnosis Procedure".

OK or NG

OK >> GO TO 15.

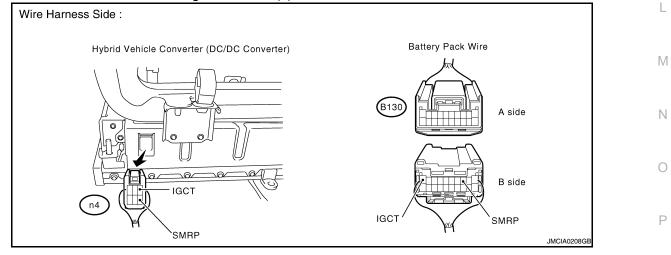
NG >> Connect securely.

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.
- Κ Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See HBB-103, "Removal and 2. Installation").
- 3. Measure the resistance according to the value(s) in the table below.



Battery pack wire		Hybrid vehi (DC/DC	Resistance	
Component connector	Terminal	Harness connector	Terminal	resistance
B130	8 (SMRP)	n4	4 (SMRP)	Below 1Ω

OK or NG

OK >> GO TO 16.

NG >> Repair or replace harness or connector.

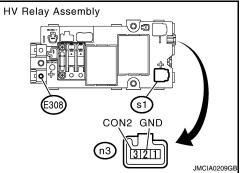
16.INSPECT HV RELAY ASSEMBLY (SMRB)

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 <u>HBB-105</u>, "Removal and Installation").
- 3. Measure the resistance according to the value(s) in the table HV Relay Assorbelow.

HV relay	HV relay assembly		assembly	
Component connector		Component connector	Terminal	Resistance
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		
Component connector Terminal		Component connector	Terminal	Resistance
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 <u>HBB-105</u>, "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 <u>HBB-103</u>, "Removal and Installation").
- NO >> Replace hv relay assembly. (See <u>HBB-105, "Removal and Installation"</u>).

P3004-132

Description

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in В 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 HBC 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	
	DC/DC converter malfunction	P0A08-264	May not occur	_
	Open in VLO, short to GND	P0A09-591	May not occur	
Open in AMD line	IDH frequency error	P2519-766	Occurs	
	Open in SMRP, short to GND	P0AE6-225	Occurs	_
	Open in NODD, short to GND	P0A09-265	Occurs	
	Open in VLO, short to GND	P0A09-591	Occurs	_
Open in IGCT line	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.

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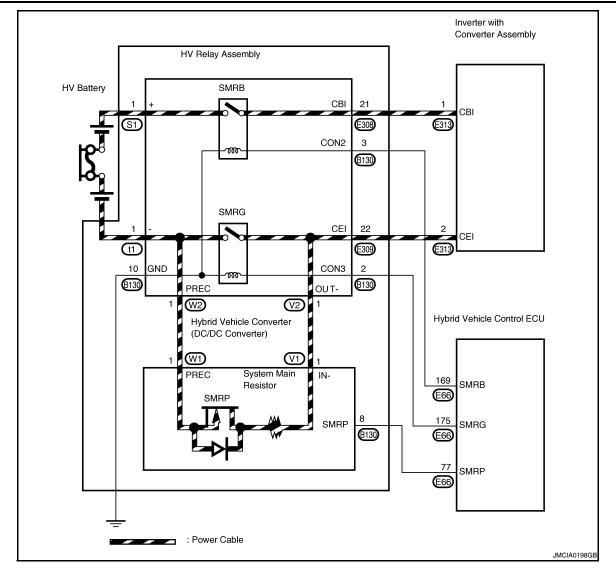
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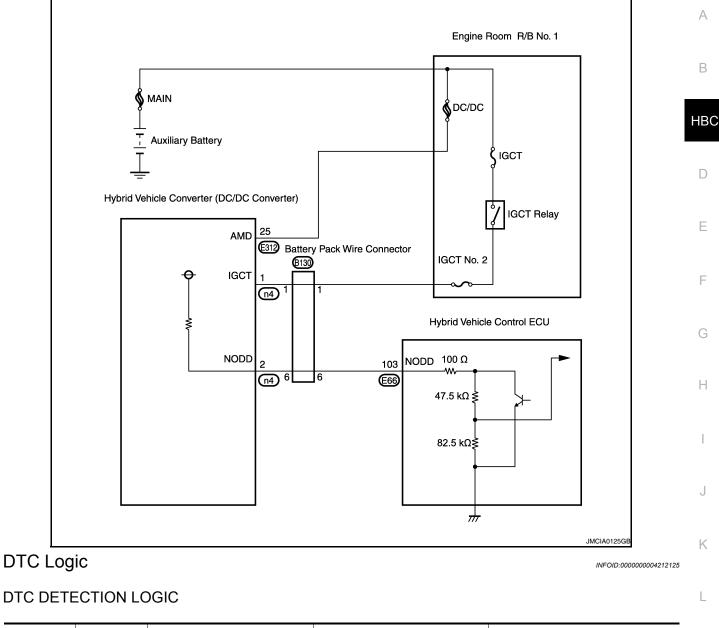
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DTC No.	INF Code	Trouble diagnosis name	DTC detecting condition	Possible cause	
P3004	132	Power cable malfunction	The inverter is not precharged	 HV relay assembly Frame wire Inverter with converter assembly HV battery Wire harness or connector 	M

Diagnosis Procedure

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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.	В
Other than above	С

<u>A. B or C</u>

A >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "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".

<u>OK or NG</u>

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 <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

NOTE:

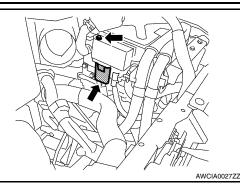
After removing the service plug grip, do not turn ignition switch ON (READY), unless instructed by the service manual because this may cause a malfunction.

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 <u>HBB-105</u>, <u>"Removal and Installation"</u>).

- 1: Frame wire connector h3 (–)
- 2: Frame wire connector h4 (+)

Torque: 9.0 N*m (92 kgf*cm, 81 in.*lbf)

<u>OK or NG</u>

OK >> GO TO 7.

NG >> Connect securely.

1.CHECK FRAME WIRE

See <u>HBC-517, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK	>> GO TO 8.
----	-------------

NG >> Replace frame wire.

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

See <u>HBC-140, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 9.

NG >> Connect securely.

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

See <u>HBC-517, "Diagnosis Procedure"</u>.

OK or NG

OK >> GO TO 10.

NG >> Repair or replace harness or connector.

10.CHECK CONDITION OF MAIN BATTERY CABLE CONNECTION(S)

See <u>HBC-517, "Diagnosis Procedure"</u>.

<u>A, B, C or D</u>

- A >> GO TO 11.
- B >> Connect securely.

C >> Replace HV relay assembly. (See <u>HBB-105, "Removal and Installation"</u>).

D >> Replace HV battery assembly. (See <u>HBB-97</u>, "Removal and Installation").

11.CHECK HV BATTERY ASSEMBLY

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See <u>HBC-517, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 12.

NG >> Replace HV battery assembly. (See <u>HBB-97</u>, "Removal and Installation").

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

See <u>HBC-517, "Diagnosis Procedure"</u>

OK or NG

OK >> GO TO 13.

NG >> Connect securely.

13. CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR)

See <u>HBC-517, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 14.

NG >> Repair or replace harness or connector.

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

See <u>HBC-140, "Diagnosis Procedure"</u>.

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".

<u>OK or NG</u>

- OK >> GO TO 16.
- NG >> Repair or replace harness or connector.

16.INSPECT HV RELAY ASSEMBLY (SMRB)

See <u>HBC-517</u>, "Diagnosis Procedure".

<u>OK or NG</u>

OK >> GO TO 17.

- NG >> Replace hv relay assembly. (See <u>HBB-105</u>, "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.	В
No DTC is output.	С

<u>A, B or C</u>

A >> Go to Diagnosis Procedure relevant to output DTC. (P3004-131)

B >> Replace inverter with converter assembly. (See <u>HBC-638, "Removal and Installation"</u>).

P3004-132

< COMPONENT DIAGNOSIS >

C >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "Removal and Installation").

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Description

INFOID:000000004212127

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.

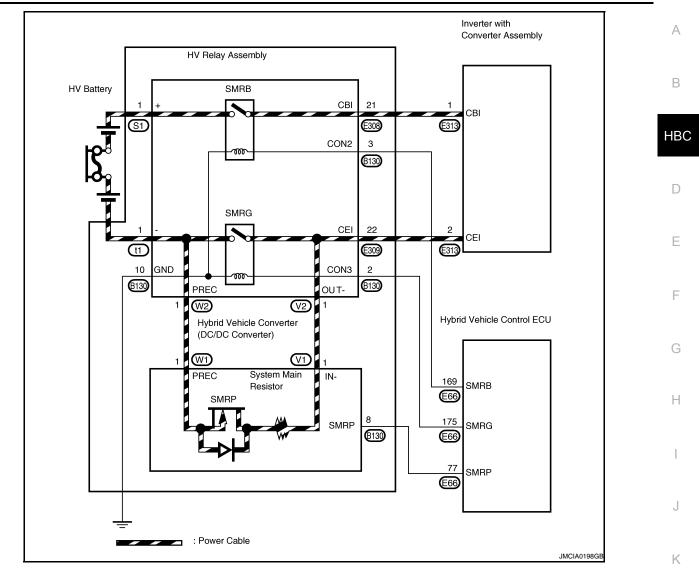
To connect to the high voltage power system, the vehicle will first turn on SMRP and SMRB to charge the vehicle through the system main resistor. Then, SMRP will be turned off after the SMRG is turned on. To shut off the high voltage power system, SMRB and SMRG are turned off.

When there is an open in the AMD line or IGCT line, the following DTCs are output:

Trouble area	Malfunction	DTC	Occurrence condition
	DC/DC converter malfunction	P0A08-264	May not occur
Onen in AMD line	Open in VLO, short to GND	P0A09-591	May not occur
Open in AMD line	IDH frequency error	P2519-766	Occurs
	Open in SMRP, short to GND	P0AE6-225	Occurs
	Open in NODD, short to GND	P0A09-265	Occurs
	Open in VLO, short to GND	P0A09-591	Occurs
Open in IGCT line	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.

< COMPONENT DIAGNOSIS >



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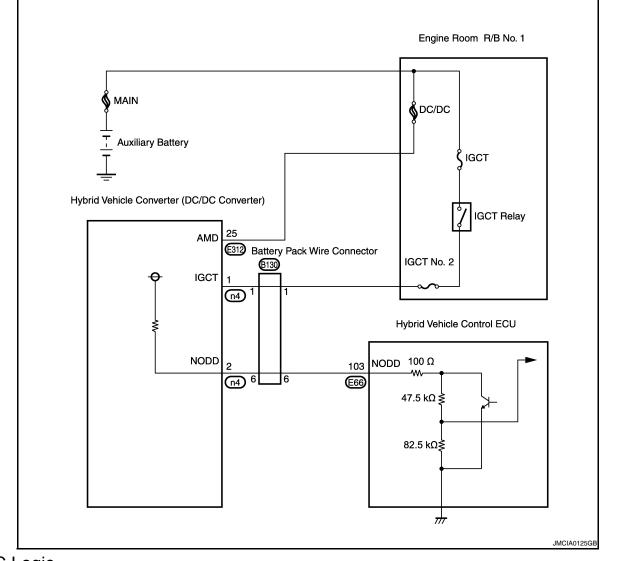
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< COMPONENT DIAGNOSIS >



DTC Logic

INFOID:000000004212128

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
	800		during precharge (time from when SMRP turns on until when SMRG turns on).• Air conditioning harness a • Compressor with motor as • Inverter with converter ass	 Wire harness or connector Air conditioning harness assembly Compressor with motor assembly Inverter with converter assembly
P3004	801	Power cable malfunction	Minimal overcurrent occurs dur- ing precharge (time from when SMRP turns on until when SMRG turns on).	 HV relay assembly Floor wire Hybrid vehicle converter (DC/DC converter) Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:000000004212129

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.

< COMPONENT DIAGNOSIS >

· 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	Г
P0AFA, P0A1F, P3105	VB sensor circuit, battery smart unit circuit	
P0ABF, P0AC0, P0AC1, P0AC2	IB sensor circuit	
Is DTC detected?		E

Is DTC detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.

NO >> GO TO 3.

 $\mathbf{3}$.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

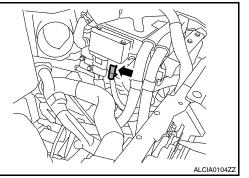
CAUTION:

Be sure to wear insulated gloves.

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



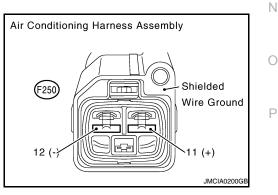
3. Measure the resistance according to the value(s) in the table below.

Air conditioning harness assembly		Air conditioning harness assembly		Resistance	
Harness connector	Terminal	Harness connector	Terminal	Resistance	
F250	11	F250	12	100 k Ω or higher	

NOTE:

Do not use a megohmmeter.

 Make sure that the tester probes are connected to the correct terminals.



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OK or NG

OK >> GO TO 6. NG >> GO TO 5.

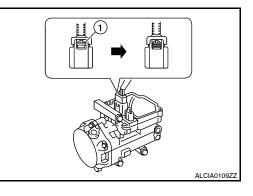
NG >> GO TO 5.

5. CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:

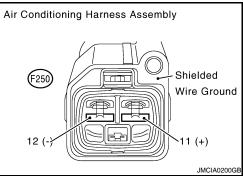
Be sure to wear insulated gloves.

- 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		rness Air conditioning harness assembly		Resistance
Harness connector	Terminal	Harness connector	Terminal	Resistance
F250	11	F250	12	10 M Ω or higher



OK or NG

OK >> Replace electric compressor.

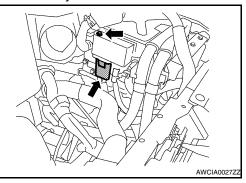
NG >> Replace air conditioning harness assembly.

6.CHECK FRAME WIRE

CAUTION:

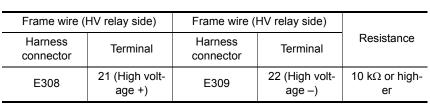
Be sure to wear insulated gloves.

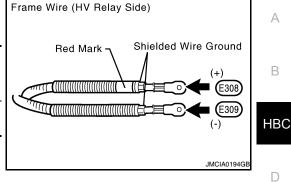
- 1. Check that the service plug grip is not installed.
- 2. Remove the compressor fuse cover from the inverter with converter assembly.
- Disconnect the frame wire from the inverter with converter assembly (See <u>HBC-638</u>, "Removal and Installation").
- 4. Disconnect the frame wire from the HV relay assembly (See <u>HBB-105, "Removal and Installation"</u>).



< COMPONENT DIAGNOSIS >

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





<u>OK or NG</u>

OK >> GO TO 7.

NG >> Replace frame wire.

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

See HBC-140, "Diagnosis Procedure".

OK or NG

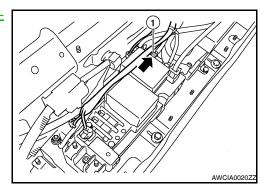
OK >> GO TO 8.

NG >> Connect securely.

8.CHECK HARNESS AND CONNECTOR

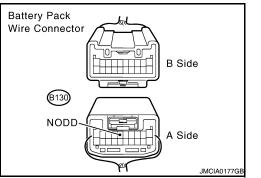
1. Turn ignition switch OFF.

 Disconnect the B130 battery pack wire connector (1) (See <u>HBB-</u> <u>97, "Removal and Installation"</u>).



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

Battery pack w	ire connector	Ground	Resistance	
Harness connector Terminal		Ground	Resistance	
B130	6 (NODD)	Ground	120 to 140 kΩ	
OK or NG				



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

See <u>HBC-140, "Diagnosis Procedure"</u>.

OK or NG

OK

NG

OK >> GO TO 10.

NG >> Connect securely.

>> GO TO 9.

>> GO TO 13.

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.
- Disconnect the n4 hybrid vehicle converter (DC/DC converter) connector (See <u>HBB-103</u>, "<u>Removal and</u> <u>Installation</u>").

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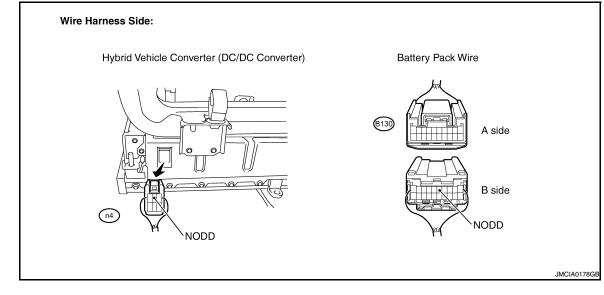
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3. Measure the resistance according to the value(s) in the table below.



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

Battery pack wire				
Component connector	Terminal	Ground	Resistance	
B130	6 (NODD)	Ground	10 k Ω or higher	

Hybrid vehic (DC/DC c		Ground	Resistance
Harness connector	Harness connector Terminal		
n4 2 (NODD)		Ground	10 k Ω or higher

OK or NG

OK >> GO TO 11.

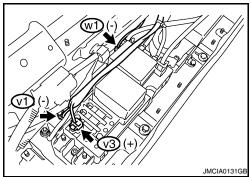
NG >> Repair or replace harness or connector.

11. CHECK HYBRID VEHICLE CONVERTER

CAUTION:

Be sure to wear insulated gloves.

- 1. Check that the service plug grip is not installed.
- Disconnect the hybrid vehicle converter (DC/DC converter) connectors from the HV relay assembly (See <u>HBB-103</u>, "Removal and Installation").
- 3. Measure the resistance according to the value(s) in the table below.



< COMPONENT DIAGNOSIS >

Frame	e Wire	Fram	ne Wire	
Component connector	Terminal	Component connector	Terminal	Resistance
v1	1 (High volt- age –)	v3	1 (High volt- age +)	100 k Ω or higher
v3	1 (High volt- age +)	w1	1 (High volt- age pre- charge)	1 M Ω 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.

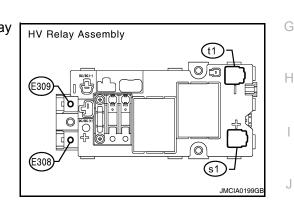
NG >> Replace hybrid vehicle converter. (See <u>HBB-103</u>, "Removal and Installation")

12. CHECK HV RELAY ASSEMBLY

CAUTION:

Be sure to wear insulated gloves.

- 1. Check that the service plug grip is not installed.
- Disconnect the high voltage connectors from the HV relay assembly (See <u>HBB-105</u>, "<u>Removal and Installation</u>").



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

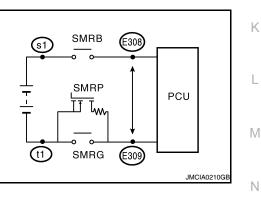
HV relay assembly		HV relay		
Component connector	Terminal	Component connector	Terminal	Resistance
E308	21	E309	22	10 k Ω or higher

OK or NG

- OK >> Replace inverter with converter assembly. (See <u>HBC-638</u>. "Removal and Installation").
- NG >> Replace HV relay assembly. (See <u>HBB-105</u>, "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.



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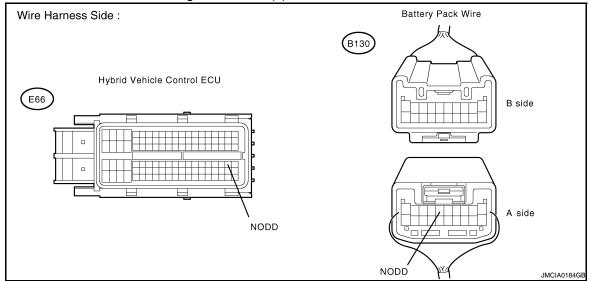
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3. Measure the resistance according to the value(s) in the table below.



Check for open

Hybrid vehicle control ECU		Battery pack wire			
Harness connector	Terminal	Harness connector	Terminal	Resistance	
E66	6 (NODD)	B130	103 (NODD)	Below 1Ω	
Check for short					
Battery pack wire					
Harness connector	Terminal	Ground	Resistance		
B130	6 (NODD)	Ground	10kΩ or high	er	

Hybrid vehi	cle converter		Resistance
Harness connector	Terminal	Ground	
n4	2 (NODD)	Ground	$10k\Omega$ or higher

OK or NG

OK >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, "Removal and Installation").

NG >> Repair or replace harness or connector.

P3004-803

Description

The SMRs (System Main Relay) are the relays that connect or disconnect the high voltage power system in В 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	
	DC/DC converter malfunction	P0A08-264	May not occur	_
	Open in VLO, short to GND	P0A09-591	May not occur	
Open in AMD line	IDH frequency error	P2519-766	Occurs	
	Open in SMRP, short to GND	P0AE6-225	Occurs	
	Open in NODD, short to GND	P0A09-265	Occurs	
Onen in ICCT line	Open in VLO, short to GND	P0A09-591	Occurs	
Open in IGCT line	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.

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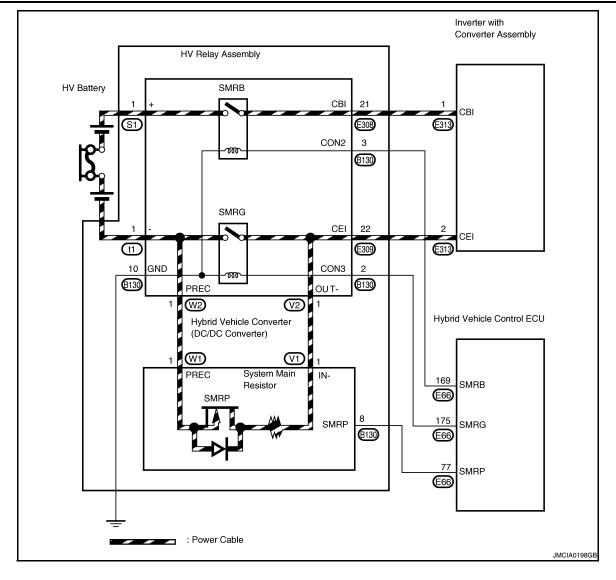
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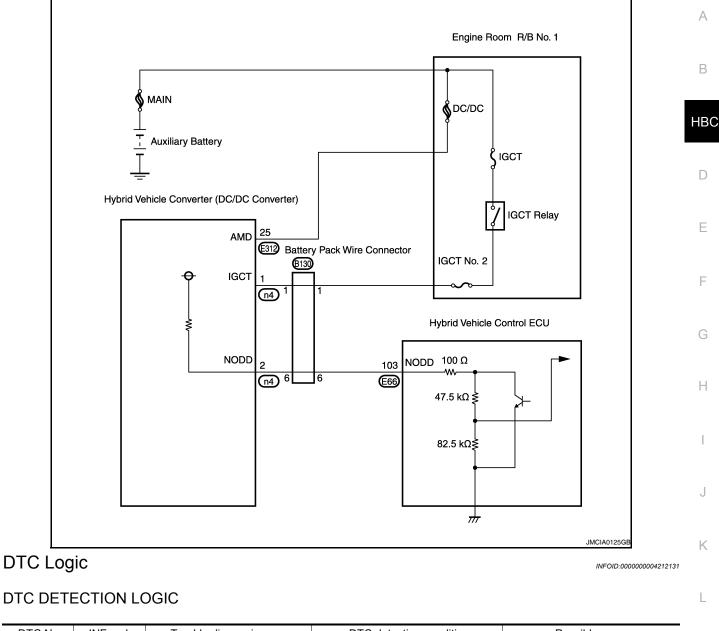
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P3004 803 Power cable malfunction While the ignition switch ON (READY), the voltage in the inverter with converter assembly (VL, VH) decreases. • Wire harness or connector • HV relay assembly	DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	
	P3004	803	Power cable malfunction	(READY), the voltage in the inverter with converter assembly (VL, VH)		M

Diagnosis Procedure

INFOID:000000004212132

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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.

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.	В

<u>A or B</u>

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 <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 6.

NG >> Connect securely.

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

See <u>HBC-140, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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.

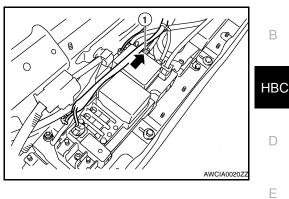
P3004-803

< COMPONENT DIAGNOSIS >

- 1. Turn ignition switch OFF and remove the service plug grip. (See <u>HBC-633</u>, "Precautions for the Hybrid <u>Control System Activation"</u>)
- 2. Disconnect the E66 hybrid vehicle control ECU connector.
- Disconnect the B130 battery pack wire connector (1) (See <u>HBB-</u> <u>97, "Removal and Installation"</u>).

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.



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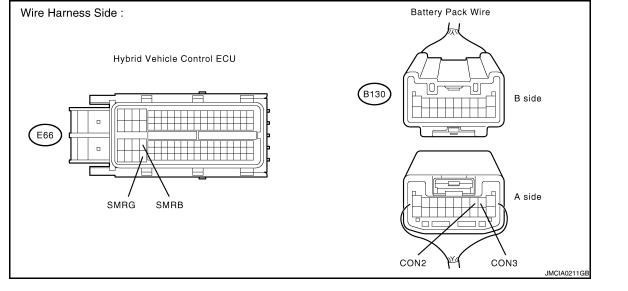
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4. Measure the resistance according to the value(s) in the table below.



Hybrid vehicle control ECU		Battery pack wire		
 Harness connector	Terminal	Harness connector	Terminal	Resistance
 E66	169 (SMRB)	B130	3 (CON2)	Below 1Ω
 LUU	175 (SMRG)	B130	2 (CON3)	Delow 122

<u>OK or NG</u>

OK >> GO TO 8.

NG >> Repair or replace harness or connector.

8 . CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR)	
---	--

See <u>HBC-517</u>, "Diagnosis Procedure".

OK or NG

OK >> GO TO 9.

NG >> Connect securely.

9. CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR) P

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

lation").

 Disconnect the n3 HV relay assembly connector. NOTE: For the removal and installation procedures related to the HV relay assembly connector, (See <u>HBB-105</u>, "Removal and Instal-

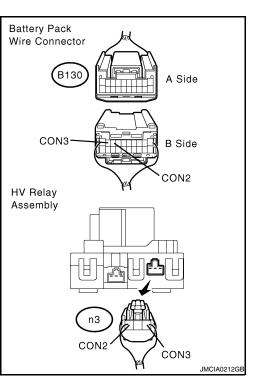
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3. Measure the resistance according to the value(s) in the table below.

Battery pack wire connector		HV relay assembly		
Component connector	Terminal	Harness connector	Terminal	Resistance
B130	3 (CON2)	n3	3 (CON2)	Below 1Ω
B130	2 (CON3)	113	1 (CON3)	Below 122

<u>OK or NG</u>

- OK >> Replace hv relay assembly. (See <u>HBB-105</u>, "<u>Removal</u> and <u>Installation</u>").
- NG >> Repair or replace harness or connector.



P3108-535, P3108-536, P3108-538

Description

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

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DTC DETECTION LOGIC

	DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	D
-	P3108	535		Serial communication malfunction	Wire harness or connector	
-	P3108	536	circuit malfunction	Compressor inverter malfunction	Electric compressor	
	P3108	538		Open in STB signal circuit	Hybrid vehicle control ECU	

NOTE:

DTC P3108-535 may be stored due to an open circuit in the SMRB circuit or SMRG circuit.

Diagnosis Procedure

INFOID:000000004212135

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	L
P0ADB-227, P0ADC-226	SMRB circuit	
P0ADF-229, P0AE0-228	SMRG circuit	B. 4
		IVI.

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.

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P3108-535, P3108-536, P3108-538

< COMPONENT DIAGNOSIS >

Hybrid vehicle	e control ECU	Ground	Voltage	
Harness connector Terminal		Ground	voltage	
	55 (CLK)			
E65	54 (ITE)	Ground	Below 1V	
205	53 (ETI)	Ground	Delow IV	
	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 vehic	le control ECU	Compressor with motor assembly		
Harness connector	Terminal	Harness connector	Terminal	Resistance
	55 (CLK)		1 (CLK)	
E65	54 (ITE)	F85	2 (DIN)	Below 1Ω
	53 (ETI)	105	3 (DOUT)	Delow 122
	56 (STB)		4 (STBI)	

Hybrid vehicle	e control ECU	Ground	Resistance	
Harness connector Terminal		Ground	Tresistance	
	55 (CLK)			
E65	54 (ITE)	Ground	10 kO ar histor	
E05	53 (ETI)	Ground	10 k Ω or higher	
	56 (STB)			

Compressor with motor assembly		Ground	Resistance
Harness connector	Terminal	Ground	Resistance
	1 (CLK)		10 kΩ or higher
F85	2 (DIN)	Ground	
F65	3 (DOUT)	Ground	
	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.

P3108-535, P3108-536, P3108-538

< COMPONENT DIAGNOSIS >

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

Compressor with motor assembly (A)		Ground	Resistance	
Harness connector	Terminal	Ground	Resistance	
F85	3 (DOUT)	Ground	10 kO or higher	
F05	4 (STBI)	Giodila	10 k Ω or higher	

Turn ignition switch ON. 4.

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

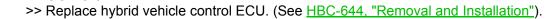
Compressor with motor assembly (A)		Ground	Voltago	
Harness connector	Terminal	Giouna	Voltage	
F85	1 (CLK)	Ground	10 to 14V	
100	2 (DIN)	Glound	10 (0 14 v	

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.

OK or NG

OK >> GO TO 5. NG



5.CHECK ELECTRIC COMPRESSOR

- 1. Turn ignition switch OFF.
- 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	Ground	Resistance	
E65	55 (CLK)	Ground	10 k Ω or higher	
LUJ	54 (ITE)	Sibulu	10 Ks2 OF Higher	

5. Turn ignition switch ON.

Measure the voltage according to the value(s) in the table below. 6.

Hybrid vehicle of	control ECU (A)	Ground	Voltage	
Harness connector	Terminal	Ground	voltage	
E65	53 (ETI)	Ground	10 to 14 V	
E03	56 (STB)	Ground	101014 0	

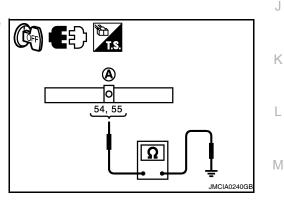
NOTE:

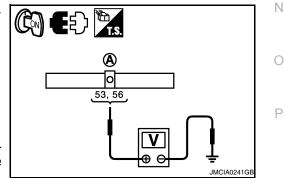
Turn ignition switch ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

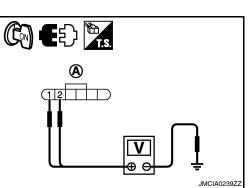
OK or NG

OK >> GO TO 6.

NG >> Replace electric compressor.







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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)

- Turn ignition switch ON.
 Check DTC. 1.

Result: DTC P3108-535 or 538 is output.

Is DTC detected?

- YES >> Replace electric compressor.
- >> COMPLETED NO

P3110-139, P3110-223

Description

The hybrid vehicle control ECU monitors the IGCT relay and detects malfunctions.

DTC Logic

INFOID:000000004212137

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 connectorIGCT relay
	223		The IGCT relay remains stuck closed.	Hybrid vehicle control ECU

Diagnosis Procedure

INFOID:000000004212138

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				
Component connector	Terminal	Component connector	Terminal	Conditions	Resistance	
				No current supply	10 k Ω or higher	
V - 1	3	V - 1	5	Apply battery voltage between 1 and 2	Below 1Ω	

<u>OK or NG</u>

OK >> GO TO 3.

NG >> Replace IGCT relay.

 $\mathbf{3}$. 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.

HBC-551

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INFOID:000000004212136

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P3110-139, P3110-223

< COMPONENT DIAGNOSIS >

Hybrid vehicl	Hybrid vehicle control ECU		Valtaga
Connector	Terminal	Ground	Voltage
	166 (MREL)		Below 1V
E66	174 (VBR1)	Ground	
	168 (VBR2)		

OK or NG

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

NG

P3136-914, P3136-915, P3136-916

Description

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:000000004212140

INFOID:000000004212139

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	D
	914	ACU communication circuit	The pulse signal sent from ACU is not in the normal pattern.	 ACU communication line ACU Hybrid vehicle control ECU 	E
P3136	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 	F
	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 <u>HBC-553</u>, "Diagnosis Procedure".

NO >> INSPECTION END

Diagnosis Procedure

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
 N
- 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.
- Check DTC for ACU. Refer to <u>SRC-14</u>, "CONSULT-III Function (AIR BAG)".

Is DTC detected?

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

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INFOID:000000004212141

P3136-914, P3136-915, P3136-916

< COMPONENT DIAGNOSIS >

$\overline{\mathbf{3}}$. 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 vehicl	e control ECU	A	CU	
Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	138 (IVCS)	M35	19 (IVCS)	Below 1Ω
Check for short				

Hybrid vehicle control ECU		Ground	Resistance	
Harness connector	Terminal	Ground	Resistance	
E66	138 (IVCS)	Ground	$10k\Omega$ or higher	

ACU		Ground	Resistance	
Harness connector	Terminal	Ground	Resistance	
M35 138 (IVCS)		Ground	$10k\Omega$ 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 <u>HBC-644, "Removal and Installation"</u>).
- NO >> Repair or replace harness or connectors.

P3147-239. P3147-241

Description

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 HBC 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

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DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	F
P3147	239		Hybrid transaxle input malfunc- tion (shaft damaged)	Engine assemblyHybrid transaxle (shaft, gear)	-
P3147	241	Transmission malfunction	Hybrid transaxle input malfunc- tion (input damper system)	 Transmission input damper Wire harness or connector Inverter with converter assembly 	G

Diagnosis Procedure

Н INFOID:000000004212144

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 Κ converter assembly.

>> GO TO 2.

2. CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

Turn ignition switch ON. 1.

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)

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

Result	Proceed to
DTC P3147-240 or P3147-242 is output.	A
DTC P0A1D is output.	В
DTCs other than P3147-239 or P3147-241 are not output.	C

P3147-239, P3147-241

< COMPONENT DIAGNOSIS >

- A >> Replace hybrid transaxle. (See <u>TM-36</u>, "<u>Removal and Installation</u>").
- 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".

<u>OK or NG</u>

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 <u>TM-36</u>, "Removal and Installation").

9. CHECK ENGINE RACING

1. Turn ignition switch ON.

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.

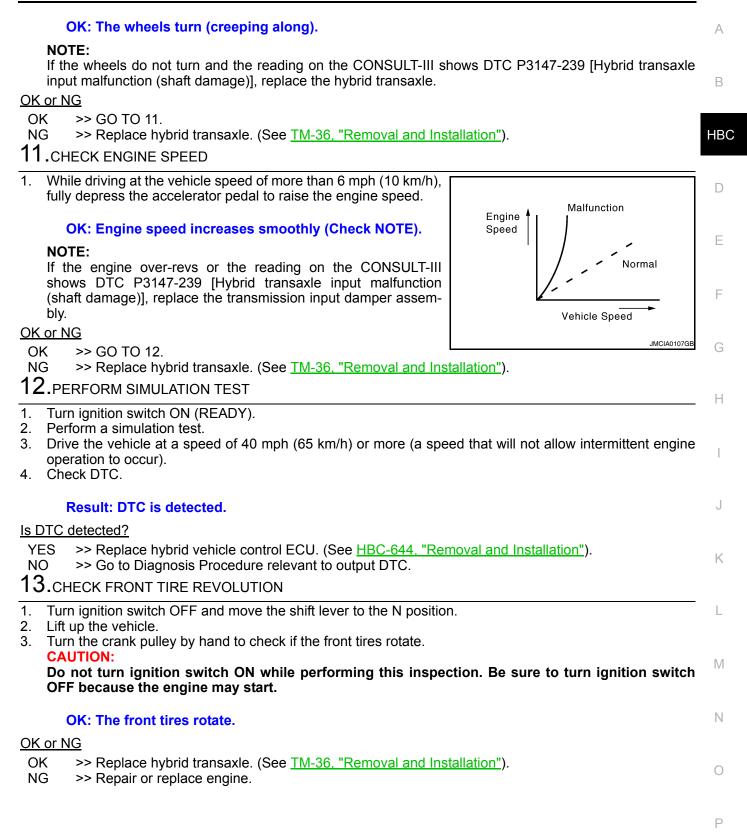
OK or NG

OK >> GO TO 10.

NG >> Replace hybrid transaxle. (See <u>TM-36</u>, "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.



P3147-240, P3147-242

Description

INFOID:000000004212145

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:000000004212146

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3147	240	Transmission malfunction	Generator lock	Hvbrid Transaxle
1 3147	242		Planetary gear lock	

Diagnosis Procedure

INFOID:000000004212147

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 <u>TM-36</u>, "Removal and Installation").

P3216-181, P3217-182

Description

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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.

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:000000004212149

DTC DETECTION LOGIC

-	DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause	F
-	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)	inventer with conventer assembly	G

Diagnosis Procedure

INFOID:000000004212150

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	Ν

Is DTC detected?

YES >> Go to Diagnosis Procedure relevant to output DTC.

NO >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "Removal and Installation").

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P3221-314, P3221-315

Description

INFOID:000000004212151

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:000000004212152

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3221	314	Generator inverter temperature - sensor circuit range/perfor- mance	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:000000004212153

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.

 $\overline{\mathbf{3}}$. CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-А NECTOR) See HBC-109, "Diagnosis Procedure". OK or NG В OK >> GO TO 4. NG >> Connect securely. 4.CHECK QUANTITY OF INVERTER COOLANT HBC See HBC-362, "Diagnosis Procedure". A or B or C D А >> GO TO 5. В >> Add coolant. С >> Check for coolant leaks and add coolant. Ε 5. CHECK COOLANT HOSE See HBC-362, "Diagnosis Procedure". OK or NG F OK >> GO TO 6. NG >> Correct the problem. **6.**CHECK FUSE (NO. 67) See HBC-362, "Diagnosis Procedure". OK or NG Н 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. ${f S}$. CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEM-Κ BLY CONNECTOR) SeeHBC-109, "Diagnosis Procedure". OK or NG L OK >> GO TO 9. NG >> Connect securely. **9.** PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP) Μ See HBC-109, "Diagnosis Procedure". OK or NG Ν 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 Ρ 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 <u>HBC-638</u>, "<u>Removal and Installation</u>").

P3221-314, P3221-315

< COMPONENT DIAGNOSIS >

NG >> Check cooling fan system. (See EC-382. "Component Function Check").

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

See <u>HBC-109</u>, "Diagnosis Procedure".

OK or NG

OK >> GO TO 13.

NG >> Add coolant.

13. CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

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".

<u>OK or NG</u>

OK >> GO TO 15.

NG >> Repair or replace harness or connector.

15.CHECK HIGH VOLTAGE FUSE AND FUSIBLE LIMK BOX

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

- OK >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, "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 <u>HBC-362</u>, "Diagnosis Procedure".

<u>OK or NG</u>

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

P3222-313, P3223-312

Description

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

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INFOID:000000004212155

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	inverter with converter assembly	G

Diagnosis Procedure

INFOID:000000004212156

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

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P3226-562, P3226-563

Description

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

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INFOID:000000004212157

DTC DETECTION LOGIC

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
P3226	562	DC/DC Boost Converter Tem- perature Sensor	Sudden change in boost convert- er 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:000000004212159

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)

- Turn ignition switch ON. 1.
- 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.

 ${f 3.}$ CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-NECTOR)

See HBC-109, "Diagnosis Procedure".

< COMPONENT DIAGNOSIS >	
OK or NG	
OK >> GO TO 4. NG >> Connect securely.	А
4. CHECK QUANTITY OF INVERTER COOLANT	
See <u>HBC-362, "Diagnosis Procedure"</u> .	В
A or B or C	
A >> GO TO 5.	HBC
 B >> Add coolant. C >> Check for coolant leaks and add coolant. 	
5. CHECK COOLANT HOSE	D
See HBC-362. "Diagnosis Procedure".	
OK or NG	_
OK >> GO TO 6.	E
NG >> Correct the problem.	
6. CHECK FUSE (NO. 67)	F
See <u>HBC-362</u> , "Diagnosis Procedure".	
<u>OK or NG</u>	
OK >> GO TO 7. NG >> Replace fuse.	G
7. CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)	
	Н
See <u>HBC-109, "Diagnosis Procedure"</u> . <u>OK or NG</u>	
OK >> GO TO 8.	
NG >> Connect securely.	I
8.CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEM-	
BLY CONNECTOR)	J
See HBC-362, "Diagnosis Procedure".	
<u>OK or NG</u>	1Z
OK >> GO TO 9. NG >> Connect securely.	K
9. PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)	
See HBC-362, "Diagnosis Procedure".	L
<u>OK or NG</u>	
OK >> GO TO 10.	M
NG >> GO TO 12.	
10. CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)	
See HBC-362, "Diagnosis Procedure".	Ν
<u>OK or NG</u>	
OK >> GO TO 11. NG >> Connect securely.	0
11.PERFORM ACTIVE TEST BY CONSULT-III (COOLING FAN SPD)	
See <u>HBC-362</u> , "Diagnosis Procedure".	Р
<u>OK or NG</u>	
OK >> Replace inverter with converter assembly. (See <u>HBC-638</u> , "Removal and Installation").	
NG >> Check cooling fan system. (See <u>EC-382. "Component Function Check"</u>).	
12.PERFORM ACTIVE TEST BY CONSULT-III (INV WATER PUMP)	
See <u>HBC-362, "Diagnosis Procedure"</u> .	

OK >> GO TO 13.

NG >> Add coolant.

13.check water pump with motor & bracket assembly $\mathbf{13}$

See HBC-362, "Diagnosis Procedure".

<u>OK or NG</u>

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".

<u>OK or NG</u>

OK >> GO TO 15.

NG >> Repair or replace harness or connector.

15. CHECK HIGH VOLTAGE FUSE AND FUSIBLE LINK BOX

See <u>HBC-362, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, "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 <u>HBC-362</u>, "Diagnosis Procedure".

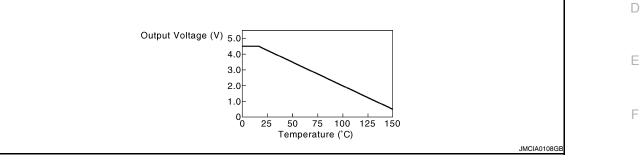
<u>OK or NG</u>

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

P3227-583, P3228-584

Description

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 HBC 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

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 con- verter temperature sensor circuit	
P3228	584	Converter temperature sensor circuit high	Short to +B in boost converter temperature sensor circuit	

Diagnosis Procedure

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.
- Μ 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

HBC-567

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INFOID:000000004212160

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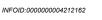
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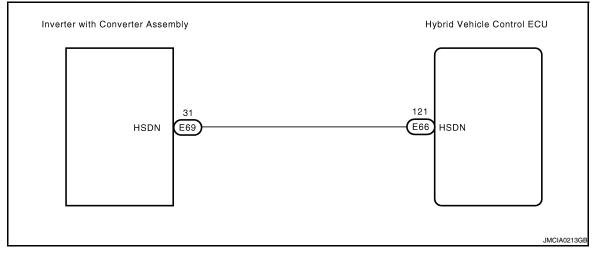


P3232-749

Description

INFOID:000000004212163

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:000000004212164

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:000000004212165

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 <u>HBC-633</u>, "Precautions for the Hybrid <u>Control System Activation"</u>).

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.

P3232-749

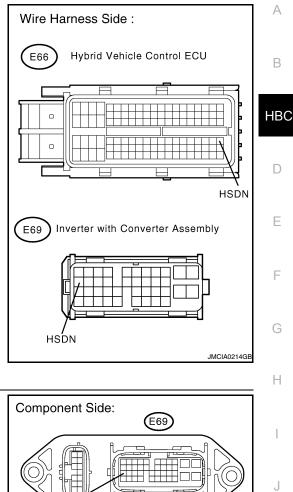
< COMPONENT DIAGNOSIS >

- 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		
Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	121 (HSDN)	E69	31 (HSDN)	10 k Ω or higher

<u>OK or NG</u>

- OK >> GO TO 3.
- NG >> Repair or replace harness or connector.



Inverter with Converter Assembly

HSND

3.CHECK INVERTER WITH CONVERTER ASSEMBLY

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

Inverter with co	nverter assembly		
Component connector	Terminal	Ground	Resistance
E69	31 (HSDN)	Ground	2.65 to 3.55 kΩ
OK or NG			

- OK >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>. <u>"Removal and Installation"</u>).
- NG >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "Removal and Installation").

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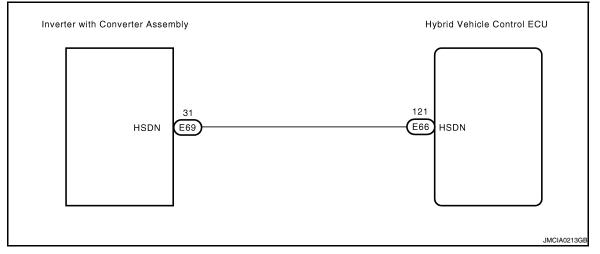


P3233-750

Description

INFOID:000000004212166

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:000000004212167

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 emer- gency shutdown signal line when the gate is driving	 Wire harness or connector Hybrid vehicle control ECU Inverter with converter assembly

Diagnosis Procedure

INFOID:000000004212168

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 <u>HBC-633</u>, "Precautions for the Hybrid <u>Control System Activation"</u>).

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 cor	verter assembly	Ground	Voltage
Harness connector Terminal		Ground	voltage
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		
Harness connector	Terminal	Harness connector	Terminal	Resistance
			174 (VB)	
E66	121 (HSDN)	E66	168 (VB2)	10 k Ω or higher
			165 (BATT)	

(E69) Inverter with Converter Assembly HSDN

Hybrid Vehicle Control ECU

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Wire Harness Side :

E66

NOTE:

To check for a short to VB, ignition switch ON. However, the bat-

tery 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		
 Harness connector	Terminal	Harness connector	Terminal	Resistance
E66	121 (HSDN)	E69	31 (HSDN)	Below 1Ω

<u>OK or NG</u>

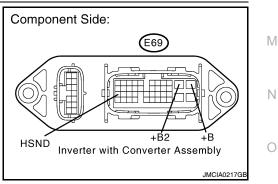
OK >> GO TO 3.

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 as- sembly		Inverter with converter assembly		
Component connector	Terminal	Compo- nent connector	Terminal	Resistance
E69	31 (HSDN)	E69	1 (+B)	10 k Ω or higher
L09		209	2 (+B2)	TO KS2 OF HIGHEI



Inverter with conve	rter assembly	Ground	Resistance	
Component connector	Terminal		Resistance	
E69	31 (HSDN)	Ground	2.65 to 3.55 kΩ	

OK or NG

OK >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, "<u>Removal and Installation</u>")

NG >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "<u>Removal and Installation</u>").

U0100-211, U0100-212, U0100-530

Description

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

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		Problem with CAN communication be- tween the ECM and hybrid vehicle con- trol ECU (communication error between ECUs)	
U0100	212	Lost communication with ECM/ PCM "A"	Problem with CAN communication be- tween the ECM and hybrid vehicle con- trol ECU (signal transmission error)	CAN communication system
U0100	530		Problem with CAN communication be- tween the ECM and hybrid vehicle con- trol 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 <u>HBC-572</u>, "Diagnosis Procedure". NO >> INSPECTION END

Diagnosis Procedure

INFOID:000000004212171

Go to LAN-53. "Trouble Diagnosis Flow Chart".

INFOID:000000004212169

INFOID:000000004212170

< COMPONENT DIAGNOSIS >

U0110-159, U0110-160, U0110-656, U0110-657

Description

INFOID:000000004212172

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.

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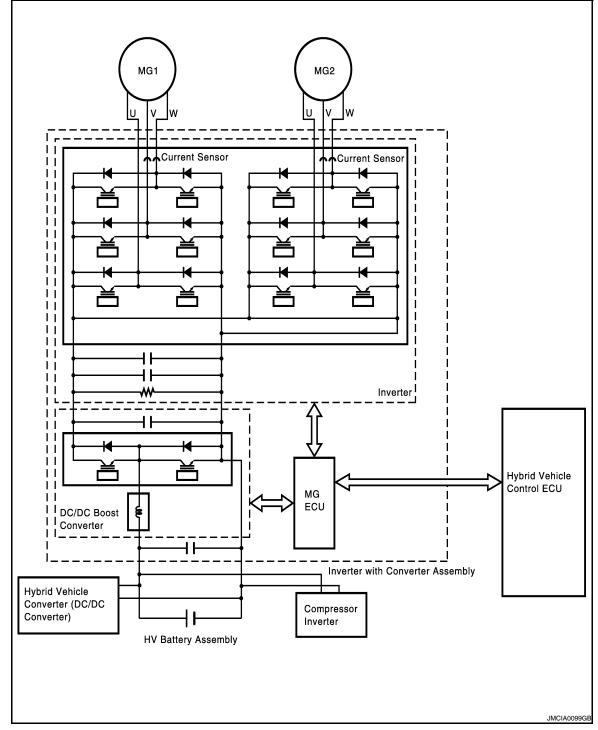
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< COMPONENT DIAGNOSIS >

The MG ECU monitors the inverter voltage and detects malfunctions.



DTC Logic

INFOID:000000004212173

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.

< COMPONENT DIAGNOSIS >

DTC No.	INF code	Trouble diagnosis name	DTC detecting condition	Possible cause
	159		Error in reception from the invert- er 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
U0110	160	Lost communication with driver	Error in signal transmission to the inverter with converter as- sembly (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	 motor control module 	Error in reception from the invert- er 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 invert- er with converter assembly (MG ECU) via serial communication (no reception)	 Wire harness or connector Inverter with converter assembly (MG ECU) Hybrid vehicle control ECU
TC CON	FIRMATIO	N PROCEDURE		
.PRECO	NDITIONIN	G		
			sly conducted, always turn ig	gnition switch OFF and wait at
east 10 se	conds befor	e conducting the next test.		
>>	GO TO 2.			
-		ONFIRMATION PROCEDU	RE	
		h ON and wait at least 3 sec		
2. Check				
s DTC dete				
YES >> NO >>	• Go to <u>HBC</u> • INSPECTI	C-575, "Diagnosis Procedure ON END	<u>e"</u> .	
	s Proced			
4				INFOID:00000004212174
1.PRECO	NDITIONIN	G		
converter	assembly,	take safety precautions su	ich as wearing insulated glo	connector of the inverter with wes and removing the service
other tech	nnicians from	m accidentally reconnecting	it while you are working on t	
	onnecting ti rs or termin		r at least 10 minutes before to	ouching any of the high-voltage

 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.

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• 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)

< COMPONENT DIAGNOSIS >

- 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 <u>GI-42, "Intermittent Incident"</u>)

4.CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CON-NECTOR)

See HBC-109, "Diagnosis Procedure".

<u>OK or NG</u>

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 <u>HBC-632</u>, "Precautions for Inspecting the <u>Hybrid Control System"</u>).

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 cor	nverter assembly	Ground	Resistance	
Harness connector Terminal		Ground	Resistance	
E69	3 (GND1)	Ground	Below 1Ω	
203	4 (GND2)	Ground	Delow 122	

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	Ground	voltage
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.

<u>OK or NG</u>

OK >> GO TO 6.

NG >> Repair or replace power source circuit.

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

See <u>HBC-109, "Diagnosis Procedure"</u>.

<u>OK or NG</u>

OK >> GO TO 7.

NG >> Connect securely.

/.CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - INVERTER WITH CONVERTER ASSEM-BLY)

1. Turn ignition switch OFF.

2. Disconnect the E66 hybrid vehicle control ECU connector.

3. Turn ignition switch ON.

U0110-159, U0110-160, U0110-656, U0110-657

< COMPONENT DIAGNOSIS >

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

Hybrid vehicle	Hybrid vehicle control ECU		Voltage
Harness connector	Terminal	Ground	voltage
	184 (CLK+)		d Below 1V
	178 (CLK-)		
	185 (REQ+)	Ground	
E66	179 (REQ-)		
200	182 (HTM+)		
	176 (HTM-)		
	183 (MTH+)		
	177 (MTH -)		

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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.

Hybrid vehic	Hybrid vehicle control ECU		Inverter with converter assembly	
Harness connector	Terminal	Harness connector Terminal		Resistance
	184 (CLK+)		15 (CLK+)	Below 1Ω
	178 (CLK-)		24 (CLK-)	
	185 (REQ+)	E69	18 (REQ+)	
E66	179 (REQ-)		27 (REQ-)	
LUU	182 (HTM+)		17 (HTM+)	DEIOM 175
	176 (HTM-)		26 (HTM-)	
	183 (MTH+)		19 (MTH+)	
	177 (MTH -)		28 (MTH -)	

Check for short

Hybrid vehicle control ECU		Cround	
Harness connector	Terminal	Ground	Resistance
	184 (CLK+)		
	178 (CLK-)		
	185 (REQ+)		
E66	179 (REQ-)	Ground	10 k Ω or higher
200	182 (HTM+)		
	176 (HTM-)		
	183 (MTH+)		
	177 (MTH -)		

U0110-159, U0110-160, U0110-656, U0110-657

< COMPONENT DIAGNOSIS >

Check for short				
Inverter with cor	overter assembly	Ground	Resistance	
Harness connector	Terminal	Giouna		
	15 (CLK+)			
	24 (CLK-)	Ground		
	18 (REQ+)			
E69	27 (REQ-)		10 k Ω or higher	
E09	17 (HTM+)	Ground	TO KS2 OF HIGHE	
	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			
Harness connector	Terminal	Harness connector	Terminal	Resistance	
	15 (CLK+)		24 (CLK-)	- 109 to 139 Ω	
EGO	18 (REQ+)	E69	27 (REQ-)		
E69	17 (HTM+)	E09	26 (HTM-)		
	19 (MTH+)		28 (MTH -)		

<u>OK or NG</u>

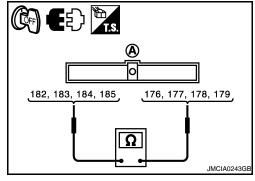
OK >> GO TO 9.

NG >> Replace hybrid vehicle control ECU. (See <u>HBC-644</u>, "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)		
Harness connector	Terminal	Harness connector	Terminal	Resistance
	184 (CLK+)	E66	178 (CLK-)	
F66	185 (REQ+)		179 (REQ-)	109 to 139Ω
E66	182 (HTM+)		176 (HTM-)	109 10 13922
	183 (MTH+)		177(MTH-)	



OK or NG

OK >> GO TO 10.

NG >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "Removal and Installation").

10.CHECK NOISE SOURCE

NOTE:

Using non-genuine parts may cause electrical noise to be introduced.

HBC-578

U0110-159, U0110-160, U0110-656, U0110-657

< COMPONENT DIAGNOSIS >	
Electrical noise is introduced	_
YES >> Repair or replace noise source. NO >> GO TO 11.	A
11.REPLACE HYBRID VEHICLE CONTROL ECU	_
See HBC-644, "Removal and Installation".	- B
>> GO TO 12. 12. CLEAR DTC	HBC
 Turn ignition switch ON. Check DTC. 	D
DTC P0A09-591 is output	
>> GO TO 13.	Е
13.RECONFIRM DTC OUTPUT (HYBRID SYSTEM)	_
 Turn ignition switch ON. Check DTC. 	F
DTC U0110-159, 160, 656 or 657 is output	I
 YES >> Replace inverter with converter assembly. (See <u>HBC-638</u>, "<u>Removal and Installation</u>"). NO >> Completed. 	G
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U0115-901

Description

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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:000000004212176

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:000000004212177

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?

HBC-580

U0115-901

< COMPONENT DIAGNOSIS >	
YES >> Go to Diagnosis Procedure relevant to output DTC. NO >> GO TO 4.	А
4. CHECK DTC OUTPUT (HYBRID SYSTEM)	
 Turn ignition switch OFF, wait at least 10 seconds and then turn ON. Check DTC for hybrid vehicle control system. 	В
Is DTC P0A1D-924 or P0A1D-925 detected?	
YES >> GO TO 5. NO >> INSPECTION END	HBC
5.REPLACE HYBRID VEHICLE CONTROL ECU	
	D
See <u>HBC-644</u> , "Removal and Installation".	D
>> Go to <u>HBC-12</u> , "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair <u>Requirement</u> ".	Е
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U0129-220, U0129-222, U0129-528

Description

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

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 be- tween the brake ECU and hybrid vehicle control ECU (no signal reception)		
U0129	222		Problem with CAN communication be- tween the brake ECU and hybrid vehicle control ECU (signal transmission error)	CAN communication system	
U0129	528		Problem with CAN communication be- tween the brake ECU and hybrid vehicle control ECU (CAN communication sys- tem 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

Go to LAN-53, "Trouble Diagnosis Flow Chart".

INFOID:000000004212180

INFOID:000000004212178

INFOID:000000004212179

U0129-529

Description

The hybrid vehicle control ECU transmits and receives signals to and from the ECM, the brake ECU, the EPS ontrol unit and network gateway ECU via CAN communication.

DTC Logic

INFOID:000000004212182

INFOID:000000004212181

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 ECUHybrid vehicle control ECU
DTC CON	FIRMATIO	N PROCEDURE		
1.PRECO		G		
		ocedure has been previous e conducting the next test.	sly conducted, always turn i	gnition switch OFF and wait at
-	GO TO 2.	ONFIRMATION PROCEDUI		
		n ON and wait at least 3 sec		
2. Check		TON and wait at least 3 set	Johus.	
Is DTC dete				
	Go to <u>HBC</u> GO TO 3.	-583, "Diagnosis Procedure	<u>e"</u> .	
3.PERFOR		RIVE		
			to freeze frame data for a ce	rtain time.
CAUTI Always		vehicle in safe manner a	according to traffic conditi	ons and obey all traffic laws
when c	lriving.			···· ···· ···· · ···· · ···· · ···· · ····
2. Check				
YES >>	Go to HBC	-583, "Diagnosis Procedure	<u>e"</u> .	
NO >>	INSPECTI	ON END		
Diagnosis	s Proced	ure		INFOID:000000004212183
1.PRECO		G		
				connector of the inverter with
converter	assembly,	take safety precautions su	ich as wearing insulated glo	oves and removing the service put it in your pocket to prevent
other tech	inicians fror	n accidentally reconnecting	it while you are working on t	the high-voltage system.
	onnecting the solution of the second s		at least 10 minutes before t	ouching any of the high-voltage
Waiting for	or at least 1		ischarge the high-voltage ca	pacitor inside the inverter with
converter	assembly.			

>> GO TO 2.

2. CHECK HARNESS CONTINUITY BETWEEN HYBRID VEHICLE CONTROL ECU AND BRAKE ECU

Refer to <u>LAN-4, "Description"</u>. <u>OK or NG</u>

HBC-583

А

HBC

OK >> GO TO 3.

NG >> Repair or replace harness or connectors.

 $3. {\sf CHECK \ DTC \ OUTPUT \ (BRAKE)}$

Turn ignition switch ON.
 Check DTC for brake system.

Is DTC detected?

>> Go to Diagnosis Procedure relevant to output DTC. YES

>> GO TO 4. NO

4.REPLACE HYBRID VEHICLE CONTROL ECU

See HBC-644, "Removal and Installation".

>> INSPECTION END

U0131-433, U0131-434

Description

The hybrid vehicle control ECU transmits and receives signals to and from the ECM, the brake ECU, the EPS on the control unit and network gateway ECU via CAN communication.

DTC Logic

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 be- tween the EPS control unit and hybrid vehicle control ECU (communication er- ror between ECUs)		E
U0131	434		Problem with CAN communication be- tween the EPS control unit and hybrid vehicle control ECU (signal transmission error)	CAN communication system	F
	FIRMATIO NDITIONIN	N PROCEDURE G			Н

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	

2. Check DTC.

Is DTC detected?

YES >> Go to HBC-585, "Diagnosis Procedure".

NO >> INSPECTION END

Diagnosis Procedure

Go to LAN-53, "Trouble Diagnosis Flow Chart".

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INFOID:000000004212186

INFOID:000000004212184

INFOID:000000004212185

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U0424-537

Description

If there is a malfunction in the Auto Amp. (Automatic air conditioner system), DTC U0424-537 will be output.

DTC Logic

INFOID:000000004212188

INFOID:000000004212187

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:000000004212189

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 < COMPONENT DIAGNOSIS >

U1001-146, U1001-435U1001-594, U1001-827 U1001-919, U1001-920

Description

CAN (Controller Area Network) is a serial communication line for real time application. It is an on-vehicle mul-В tiplex 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:000000004212191

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 receiv- ing 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 receiv- ing 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 receiv- ing 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 receiv- ing CAN communication signal with IPDM E/R for 2 seconds or more.	CAN communication system
U1001	594	Lost communication with con- troller (Auto AMP.)	When the hybrid vehicle control ECU is not transmitting or receiv- ing 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 receiv- ing 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

- Turn ignition switch ON and wait at least 3 seconds. 1.
- Check DTC. 2.
- Is DTC detected?
- YES >> Go to HBC-588, "Diagnosis Procedure".
- NO >> INSPECTION END

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U1001-146, U1001-435U1001-594, U1001-827 U1001-919, U1001-920

< COMPONENT DIAGNOSIS >

Diagnosis Procedure

INFOID:000000004212192

Go to LAN-16. "Trouble Diagnosis Flow Chart".

ASCD INDICATOR

< COMPONENT DIAGNOSIS >

ASCD INDICATOR

Description

ASCD indicator lamp illuminates to indicate ASCD operation status. Lamp has two indicators, CRUISE and BET, 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

1.ASCD INDICATOR FUNCTION

Check ASCD indicator under the following conditions.

ASCD INDICATOR	CON	DITION	SPECIFICATION
CRUISE LAMP	Ignition switch: ON	 MAIN switch: Pressed at the 1st time →at the 2nd time 	$ON \rightarrow OFF$
	MAIN switch: ON	ASCD: Operating	ON
SET LAMP	When vehicle speed: Be- tween 40 km/h (25 MPH) and 144 km/h (89 MPH)	ASCD: Not operating	OFF
Is the inspection result norr	nal?		
YES >> INSPECTION NO >> Go to <u>HBC-589</u>	END 9 <u>, "Diagnosis Procedure"</u> .		
Diagnosis Procedure			INFOID:00000004212195
1.снеск отс			
Check that DTC U1000 or	U1001 is not displayed.		
Is the inspection result norr	<u>nal?</u>		
YES >> GO TO 2.			
^	-	U1001. Refer to <u>EC-119, "Di</u>	agnosis Procedure".
2.CHECK COMBINATION			
	LT-III Function (METER/M&	<u>A)"</u> .	
Is the inspection result norr	<u>nal?</u>		
YES >> GO TO 3. NO >> Check combina	ation motor circuit. Pofor to	MWI-5, "METER SYSTEM :	System Diagram"
•		WWW-5, WETERSTSTEW.	System Diagram.
3.CHECK INTERMITTEN			
Refer to GI-42, "Intermitten	<u>t Incident"</u> .		
>> INSPECTION	END		

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INFOID:000000004212193

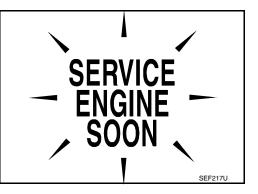
INFOID:000000004212194

MALFUNCTION INDICATOR LAMP

Description

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

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 <u>HBC-590</u>, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:000000004212198

INFOID:000000004212197

1. СНЕСК 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.

INFOID:000000004212196

< ECU DIAGNOSIS > ECU DIAGNOSIS

HV ECU

Reference Value

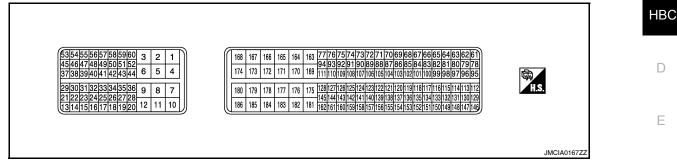
INFOID:000000004212199 B

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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.

Term	inal No.	Wire	Description			Value
+	-	color	Signal name	Input/ Output	Condition	(Approx.)
10	Ground	В	hybrid vehicle control ECU ground	_	[Ignition switch: READY]	0V
11	Ground	В	hybrid vehicle control ECU ground	_	[Ignition switch: READY]	0V
12	Ground	В	hybrid vehicle control ECU ground	_	[Ignition switch: READY]	0V
13	Ground	L/R	Generator temperature sensor ground	_	[Ignition switch: READY]	0V
14	Ground	C/P	G/R Generator temperature sensor	lan d	[Ignition switch: ON] • Ambient temperature: 25°C (77°F)	3.4 - 4.9V
14	Ground	G/K		Input	[Ignition switch: ON] • Ambient temperature: 60°C (140°F)	2.2 - 3.3V
15	Ground	LG/R	Motor temperature sen- sor ground	_	[Ignition switch: READY]	0V
16	Ground	BR/R Motor temperature sen- sor	Motor temperature sen-		[Ignition switch: ON] • Ambient temperature: 25°C (77°F)	3.4 - 4.9V
10	Ground		sor [Ignition • Ambier	[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)

HBC-591

HV ECU

< ECU DIAGNOSIS >

Term	inal No.	Wire	Description			Value						
+	-	color	Signal name	Input/ Output	Condition	(Approx.)						
37	Ground	R/B	BCM communication	Output	[Ignition switch: ON] • Shift position: P or N	BATTERY VOLTAGE (11 - 14V)						
57	Ground		(PNP switch signal)	Output	[Ignition switch: ON] • Shift position: Except above	0 - 1.5V						
45	45 0	V	PNP switch	Input	[Ignition switch: ON] • Shift position: P	BATTERY VOLTAGE (11 - 14V)						
40	Ground	v	(P position signal)	input	[Ignition switch: ON] • Shift position: Except above	0 - 1.5V						
46	Ground	Y/B	PNP switch	Input	[Ignition switch: ON] • Shift position: R	BATTERY VOLTAGE (11 - 14V)						
40	Ground	T/D	(R position signal)	Input	[Ignition switch: ON] • Shift position: Except above	0 - 1.5V						
47	Ground	G/B	G/B	C/P	PNP switch		[Ignition switch: ON] • Shift position: N	BATTERY VOLTAGE (11 - 14V)				
47	47 Ground C				[Ignition switch: ON]Shift position: Except above	0 - 1.5V						
48	Cround	ound L/B	L/B	L/B	PNP switch	loout	[Ignition switch: ON] • Shift position: D	BATTERY VOLTAGE (11 - 14V)				
48	Ground				L/D	L/D	L/D	L/D	L/D	L/D	L/D	(D position signal)
					[Ignition switch: ON] • Shift position: B	BATTERY VOLTAGE (11 - 14V)						
49	Ground	LG/B	PNP switch (B position signal)	Input	[Ignition switch: ON]Engine stoppedShift position: Except above	0 - 1.5V						
	Orregal		PNP switch	land	[Ignition switch: ON] • Shift position: R	BATTERY VOLTAGE (11 - 14V)						
50	Ground	GR/B	GR/B	GR/B	GR/B	(RV position signal) [Ignition switch: ON]	[Ignition switch: ON] • Shift position: Except above	0 - 1.5V				
			PNP switch		[Ignition switch: ON] • Shift position: D or B	BATTERY VOLTAGE (11 - 14V)						
51	Ground	P/B	(FD position signal)	Input	[Ignition switch: ON]Engine stoppedShift position: Except above	0 - 1.5V						
F 0	Crowned	W/R	PNP switch	Input	[Ignition switch: ON] • Shift position: P, R, N, D or B	BATTERY VOLTAGE (11 - 14V)						
52	Ground	vv/K	(MJ position signal)		[Ignition switch: ON] • Shift position: Except above	0 - 1.5V						



Term	inal No.	Wire	Description			Value	0
+	_	color	Signal name	Input/ Output	Condition	(Approx.)	A
	Ground	R	Compressor inverter		[Ignition switch: READY] • A/C system: Not operating	100mSec/div 100mSec/div 5V/div JMCIA0001GB The wave form will vary depend- ing on the content of the digital communication (digital signal).	B HBC D
53	Ground		communication		[Ignition switch: READY] • A/C system: Operating	100mSec/div 100mSec/div 5V/div JMCIA0002GB The wave form will vary depend- ing on the content of the digital communication (digital signal).	F G
54	Ground	Y I	Compressor inverter		[Ignition switch: READY] • A/C system: Not operating	100mSec/div 100mSec/div JMCIA0001GB 5V/div JMCIA0001GB The wave form will vary depend- ing on the content of the digital communication (digital signal).	J
			' communication		[Ignition switch: READY] • A/C system: Operating	100mSec/div 100mSec/div 5V/div JMCIA0002GB The wave form will vary depend- ing on the content of the digital communication (digital signal).	L M N
55	Ground	L	Compressor inverter communication	_	[Ignition switch: READY]	20mSec/div 20mSec/div 5V/div 3MCIA0005GB The wave form will vary depend- ing on the content of the digital communication (digital signal).	O

HBC-593



Term	inal No.	Wire	Description			Value
+	-	color	Signal name	Input/ Output	Condition	(Approx.)
56	Ground	w	Compressor inverter communication		[Ignition switch: READY]	100mSec/div
60	Ground	Ρ	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]	500mSec/div
82	Ground	G/B	Back up lamp relay	Output	[Ignition switch: ON] • Shift position: R	0 - 1.5V
	Ground	C,D	Duck up lamp relay	Output	[Ignition switch: ON] Shift position: Except above 	BATTERY VOLTAGE (11 - 14V)
94	Ground	GR/R	MG ECU communication	Input	[Ignition switch: ON] • Service plug grip: Connect	0 - 1.5V
			(Interlock switch signal)		[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 de- pending on rpm at idle.	50mSec/div 50mSec/div 50mSec/div JMCIA0008GB The pulse cycle becomes short- er as the engine speed in- creased.
101	Ground	Ρ	ECM (POS signal)	Input	[Engine is running] • Idle speed	2mSec/div 2mSec/div 5V/div 5V/div The pulse cycle becomes short- er as the engine speed in- creased.



Term	inal No.	\\/ire	Description			Value
+	_	Wire color	Signal name	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) 	2mSec/div 2mSec/div 5V/div JMCIA0009GB The higher the vehicle speed, the shorter the cycle.
			HV battery assembly		[Ignition switch: ON]	0.1 - 0.5V
103	Ground	GR	(DC/DC converter opera- tion signal)	Input	[Ignition switch: READY]	5 - 7V
104	Ground	G/R	HV battery assembly (DC/DC converter opera- tion signal)	Input	[Ignition switch: ON]	100mSec/div 100mSec/div JMCIA0011GB 5V/div JMCIA0011GB The cycle will vary depending on the specified voltage of the hy- brid vehicle converter.
105	Ground	Y/R	HV battery blower fan motor	_	[Ignition switch: ON] • During ACTIVE TEST	1mSec/div 2V/div JMCIA0122GB
109	Ground	R	Inverter water pump	_	[Ignition switch: READY]	100mSec/div 5V/div JMCIA0012GB
112	Ground	0	Sensor power supply (Accelerator pedal posi- tion sensor 2)	_	[Ignition switch: ON]	5V
113	Ground	O/L	Sensor power supply (Accelerator pedal posi- tion sensor 1)		[Ignition switch: ON]	5V
118	Ground	G/B	ASCD brake switch	Input	 [Ignition switch: OFF] Brake pedal: Fully released [Ignition switch: OFF] Brake pedal: Slightly depressed 	BATTERY VOLTAGE (11 - 14V) 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 posi- tion sensor 2)	_	[Ignition switch: READY]	OV

HBC-595



Term	inal No.	14/100	Description) (cluc							
+	_	Wire color	Signal name	Input/ Output	Condition	Value (Approx.)							
130	Ground	L/G	Sensor ground (Accelerator pedal posi- tion sensor 1)	_	[Ignition switch: READY]	0V							
133	Ground	L/R	HV battery assembly (Battery smart unit com- munication signal)	Input	[Ignition switch: ON]	500µSec/div 500µSec/div 500µSec/div JMCIA0013GB The wave form will vary depend- ing 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]	1Sec/div							
		w				10/	14/	Accelerator pedal posi-		 [Ignition switch: ON] Engine stopped Shift position: P Accelerator pedal: Fully released 	1.0 - 2.2V		
146	Ground		tion sensor 2	Input	 [Ignition switch: ON] Engine stopped Shift position: P Accelerator pedal: Fully depressed 	3.4 - 5.3V							
			Accelerator pedal posi-		 [Ignition switch: ON] Engine stopped Shift position: P Accelerator pedal: Fully released 	0.4 - 1.4V							
147	Ground	L/Y	L/Y	L/Y	L/Y	L/Y	L/Y	L/Y	L/Y	tion sensor 1	Input	 [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							
1-10	Croand			mput	[Ignition switch: ON] • Brake pedal: Slightly depressed	BATTERY VOLTAGE (11 - 14V)							
150	Ground	L/G	HV battery assembly (Battery smart unit com- munication signal)	Input	[Ignition switch: ON]	500µSec/div 500µSec/div 500µSec/div 500µSec/div 500µSec/div JMCIA0015GB The wave form will vary depend- ing on the content of the digital communication (digital signal).							

HBC-596



Term	inal No.		Description				
+	-	Wire color	Signal name	Input/ Output	Condition	Value (Approx.)	A
163	Ground	В	hybrid vehicle control ECU ground	_	[Ignition switch: READY]	OV	В
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)	HBC
167	Ground	R	BCM communication (Start signal)	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14V)	D
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]	500mSec/div 500mSe	E F G
170	Ground	Ρ	CAN communication line (TOYOTA)	Input/ Output	_	_	
171	Ground	L	CAN communication line (TOYOTA)	Input/ Output	_	_	Н
172	Ground	Ρ	CAN communication line (NISSAN)	Input/ Output	_	-	I
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)	J
175	Ground	Y/B	HV battery assembly (SMRG operation signal)		[Ignition switch: ON to READY]	500mSec/div 500mSec/div 5V/div JMCIA0017GB	K L M
176	Ground	LG	MG ECU communication		[Ignition switch: READY]	5mSec/div 5mSec/div 1V/div 1V/div 5mSec/div JMCIA0018GB The wave form will vary depend- ing on the content of the digital communication (digital signal).	N O P



Term	inal No.	Miro	Description			Value
+	-	Wire color	Signal name	Input/ Output	Condition	(Approx.)
177	Ground	Y/L	MG ECU communication	Input	[Ignition switch: READY]	5mSec/div 5mSec/div 1V/div 1V/div JMCIA0019GB The wave form will vary depend- ing 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]	2mSec/div 2mSec/div 1V/div JMCIA0020GB
180	Ground	G/W	Ignition switch signal	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14V)
181	Ground	В	hybrid vehicle control ECU ground	_	[Ignition switch: READY]	0V
182	Ground	V	MG ECU communication		[Ignition switch: READY]	5mSec/div
183	Ground	Y/G	MG ECU communication	Input	[Ignition switch: READY]	5mSec/div
184	Ground	W/L	MG ECU communication	Input/ Output	[Ignition switch: READY]	3V



 Termi	inal No.	Wire	Description			Value	^
 +	_	color	Signal name	Input/ Output	Condition	(Approx.)	A
185	Ground	Y	MG ECU communication	Input/ Output	[Ignition switch: READY]	2mSec/div 2mSec/div 2mSec/div 1V/div JMCIA0023GB	B HBC
 186	Ground	GR/R	HV battery blower fan re-	Input	[Ignition switch: OFF]	BATTERY VOLTAGE (11 - 14V)	D
			lay		[Ignition switch: ON]	0V	Е

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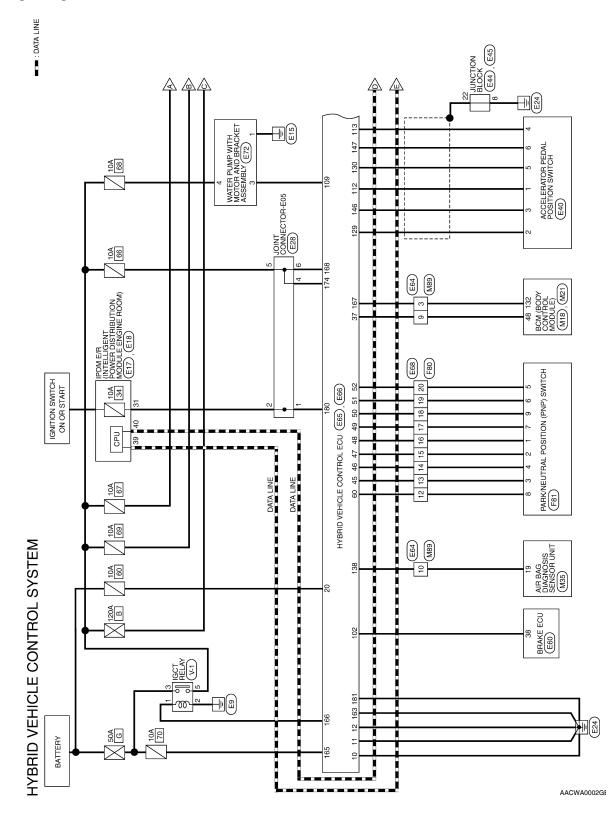
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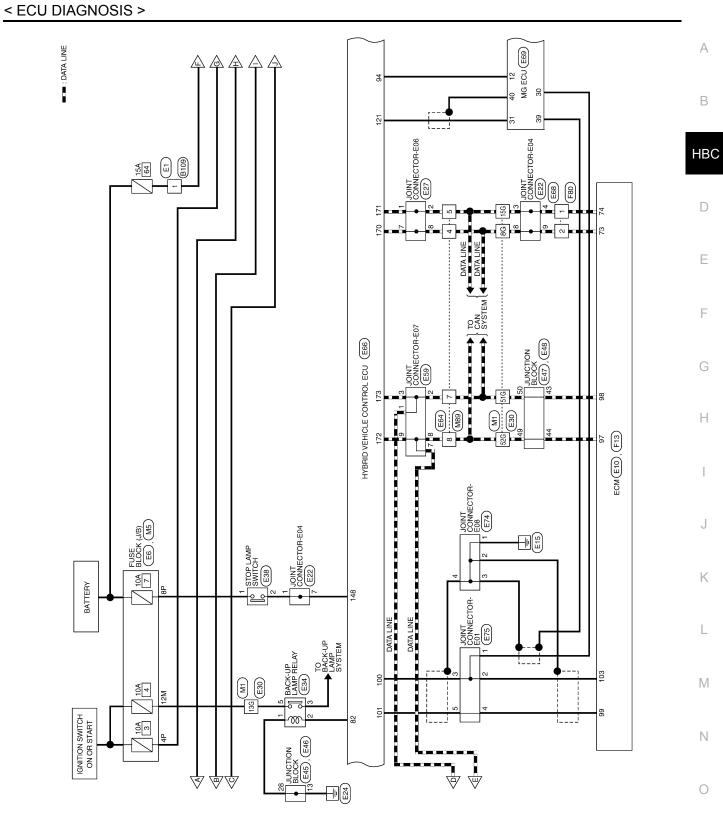
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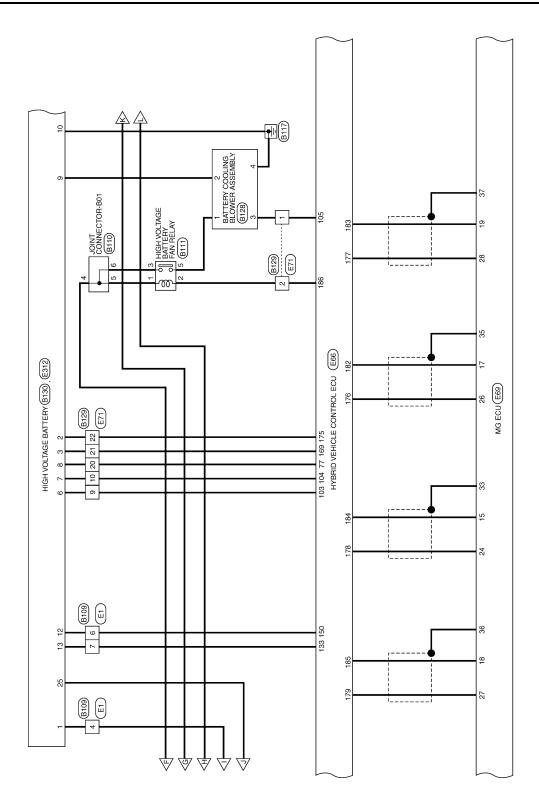
Wiring Diagram

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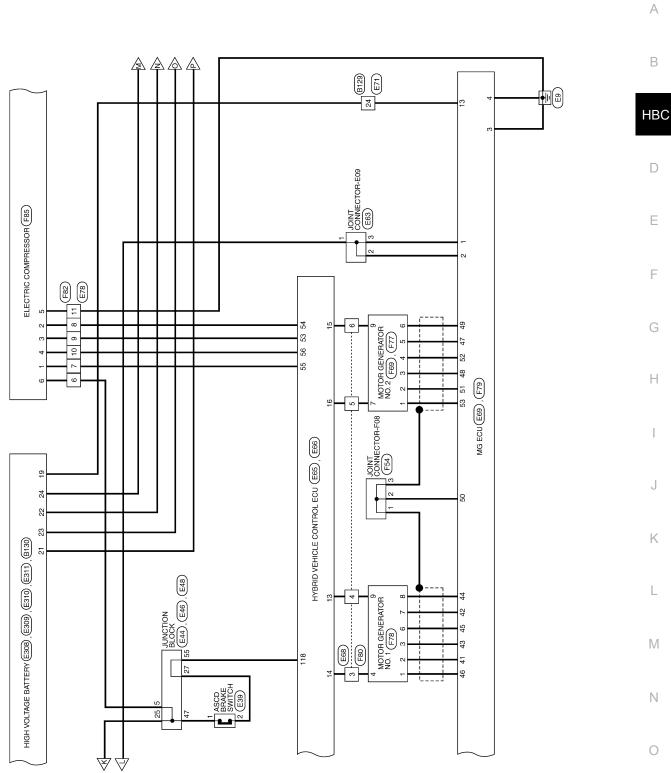




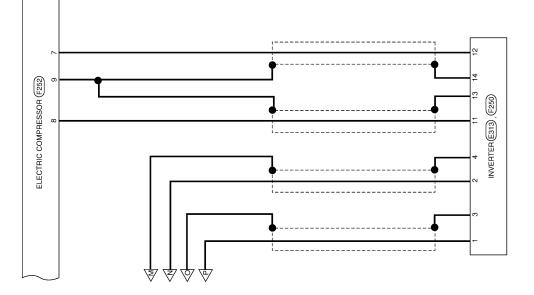
HV ECU



AWCWA0003G

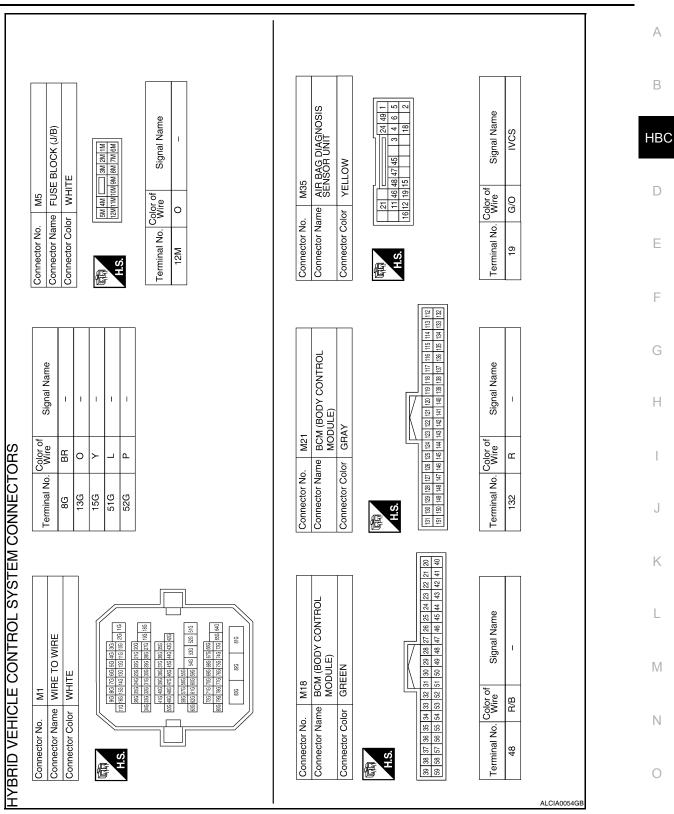


HV ECU



HBC-604

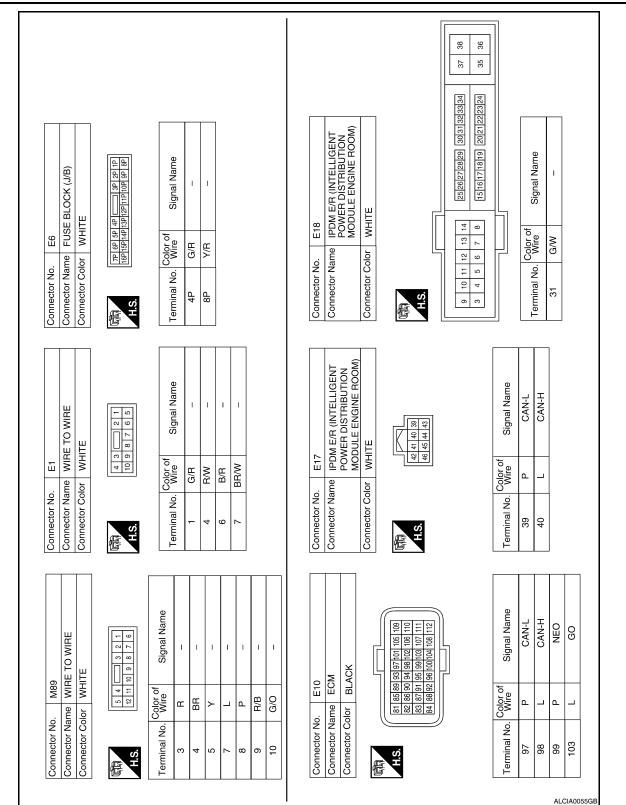
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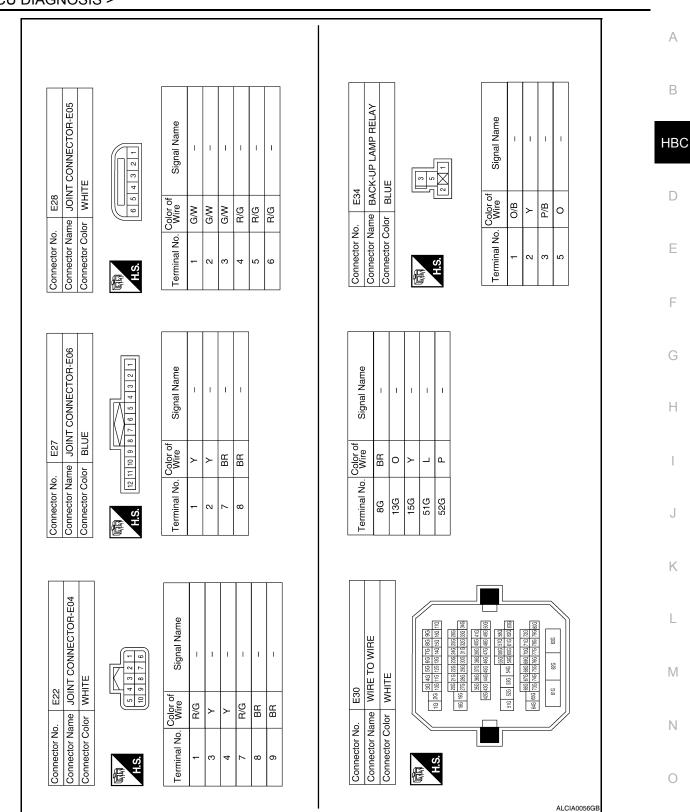
HBC-605

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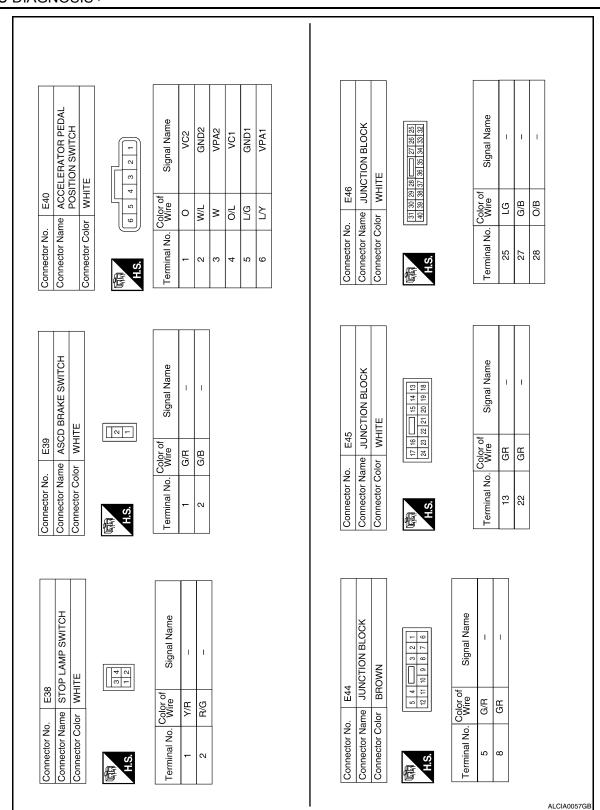


HV ECU

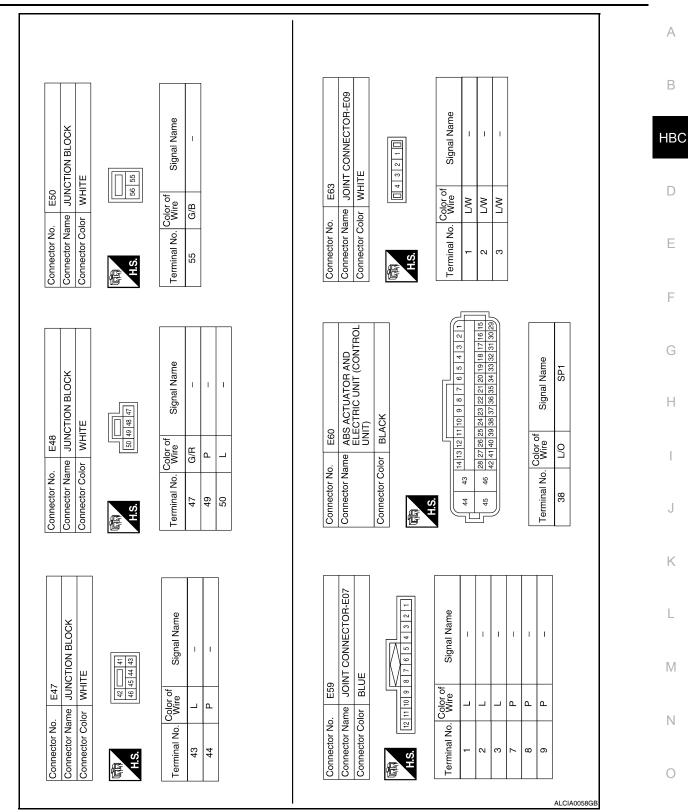


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mector No. E65 nector Name HYBRID VEHLCLE nector Name HYBRID VEHLCLE nector Name HYBRID VEHLCLE nector Color BLACK 1 CONTROL ECU 1 1 1<	Connector No. E65 Connector Name HYBRID VEHLCLE Connector Name HYBRID VEHLCLE Connector Name HYBRID VEHLCLE Connector Color BLACK Signal Maine 37 Terminal No. 73 Vire 37 47 Terminal No. 73 37 Vire 314151427312 312 37 37 Terminal No. 71 43 47 47 47 Terminal No. $71313233335333533533533533535353535353535$	nector No. E65 nector Name HYBRID VEHLCLE nector Name HYBRID VEHLCLE nector Name HYBRID VEHLCLE nector Color BLACK 37 37 38 38 39 31 31 35 31 36 31 37 37 37 38 38 39 <th>Signal Name</th> <th>MMT</th> <th>S</th> <th>SHNP</th> <th>۰</th> <th>н</th> <th>z</th> <th>D</th> <th>В</th> <th>RV</th> <th>FD</th> <th>ſW</th> <th>ETI</th> <th>ITE</th> <th>CLK</th> <th>STB</th> <th>+BS</th> <th></th> <th></th>	Signal Name	MMT	S	SHNP	۰	н	z	D	В	RV	FD	ſW	ETI	ITE	CLK	STB	+BS		
mector No. E65 nector Name HYBRID VEHLCLE nector Name HYBRID VEHLCLE nector Name HYBRID VEHLCLE nector Color BLACK 37 37 37 37 37 37 37 37 37 37 37 37 37 37 37 37 37 37 37 37 37 46 37 47 37 47 48 47 49 7 31 115 10 B EO1 12 B EO1 13 L/R GMTG 14 G/R MTG 15 LG/R MTG	Connector No. E65 Connector Name HYBRID VEHLCLE Connector Color BLACK Mame Statistical St	Connector No. E65 Connector Name HYBRID VEHLCLE Connector Color BLACK Mame Statistical St	Color of Wire	BR/R	N	R/B	>	Y/B	G/B	L/B	LG/B	GR/B	P/B	W/R	н	٢	_	N	٩		
mector No. E65 nector Name HYBRID VEHLCLE CONTROL ECU BLACK nector Color BLACK 37 39 37 39 31 24 31 31 11 B 12 B 13 L/R 14 G/R 13 L/R 14 G/R 15 L/R 15 LG/R	Connector No. E65 Connector Name HYBRID VEHLCLE Connector Name HYBRID VEHLCLE Connector Name HYBRID VEHLCLE Connector Color BLACK Mame 37 38 39 4041 42 43 46 50 51 28 26 27 28 24 65 56 57 58 56 78 58 56 78 58 58 58 58 58 58 58 58 58 58 58 58 58	Connector No. E65 Connector Name HYBRID VEHLCLE Connector Name HYBRID VEHLCLE Connector Name HYBRID VEHLCLE Connector Color BLACK Mame 37 38 39 4041 42 43 46 50 51 28 26 27 28 24 65 56 57 58 56 78 58 56 78 58 58 58 58 58 58 58 58 58 58 58 58 58	Terminal No.	16	20	37	45	46	47	48	49	50	51	52	53	54	55	56	60		
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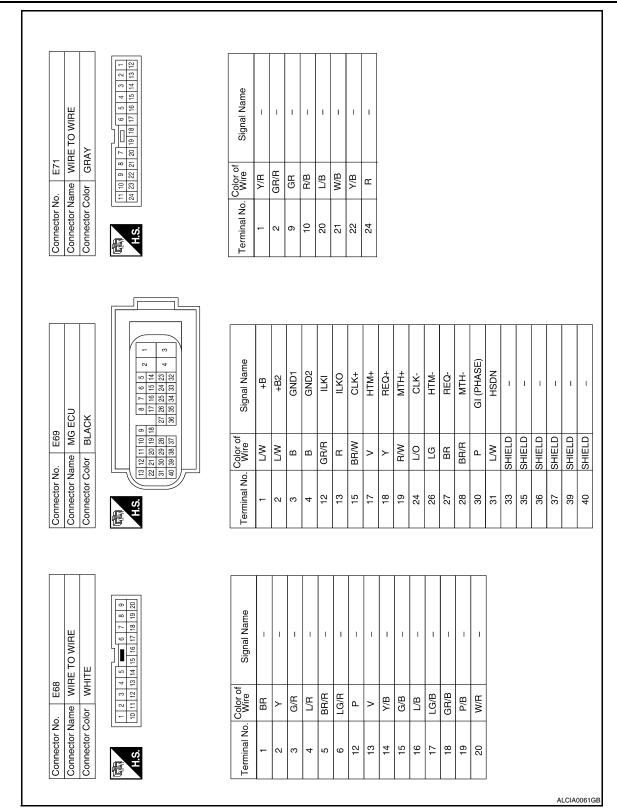
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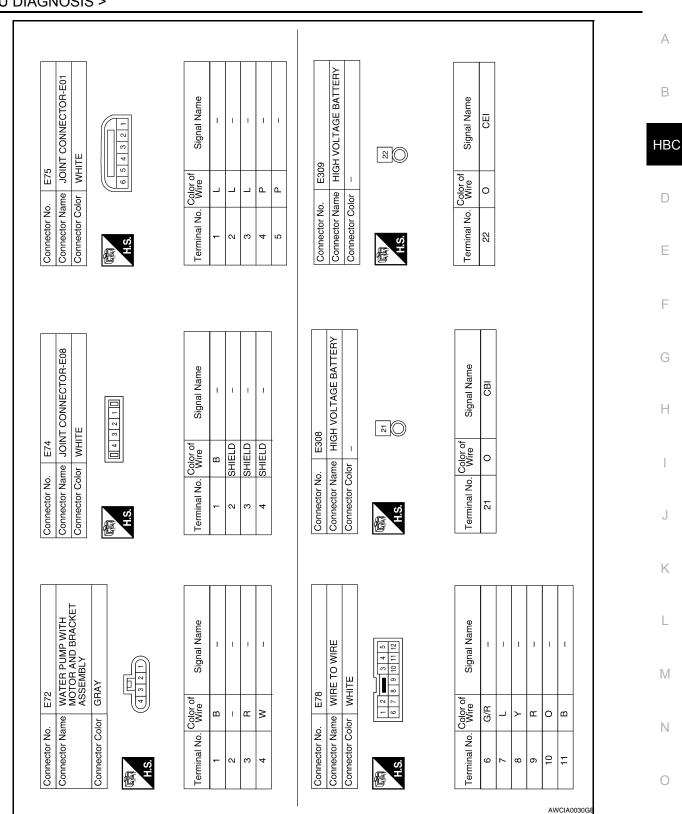
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Connector Name HIGH VOLTAGE BATTERY

E310

Connector No.

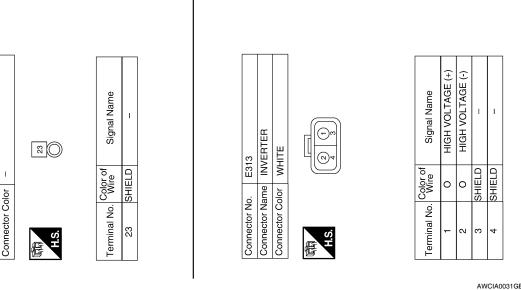
Connector Name HIGH VOLTAGE BATTERY Connector Name JOINT CONNECTOR-F08 Signal Name Signal Name Т I I ī 5 Connector Color WHITE Connector No. E312 F54 Color of Wire Color of Wire SHIELD SHIELD ī SHIELD ≥ Connector Color Connector No. Terminal No. Terminal No. 25 -N ო H.S. H.S. E E Connector Name HIGH VOLTAGE BATTERY
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 Signal Name Signal Name CAN-L CAN-H T BROWN 7 ECM E311 F13 Color of Wire Color of Wire SHIELD I. ВВ ≻ Connector Name Connector Color Connector Color Connector No. Connector No. Terminal No. Terminal No. 24 73 74 ALS. H.S. fe 佢



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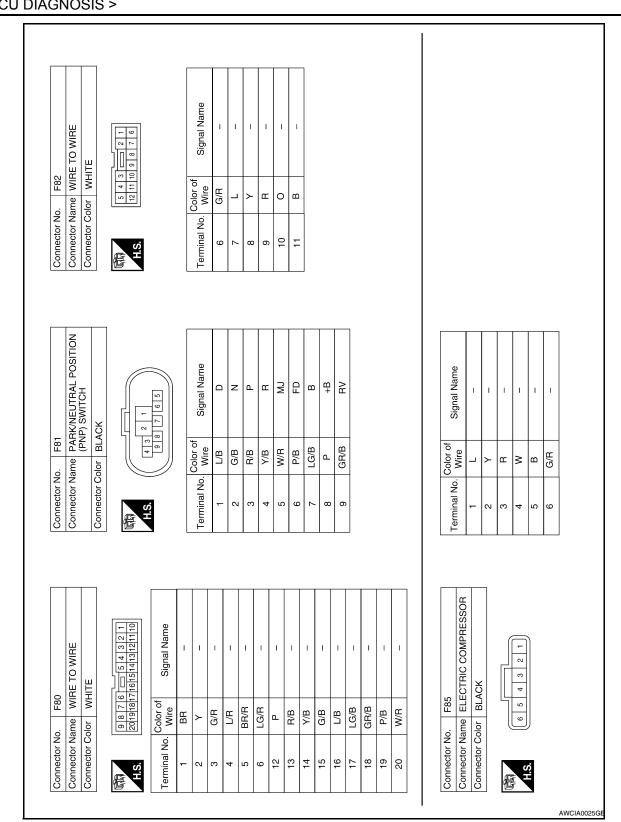
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Connector No. F78 Connector Name MOTOR GENERATOR NO. 1			Signal Name	CRF	GSN	GCS	GMT	GRFG	GSNG	GCSG	5																	
). F78 ame MOTOR	olor BLACK	10 10 10 10 10 10 10 10 10 10	Color of Wire	M/L	0	ΓΛ	G/R	×	L/G	O/L																		
Connector No. Connector Nan	Connector Color BLACK	成词 H.S.	Terminal No.	÷	2	3	4	9	7	8																		
										1		[T												1	1		
Connector No. F77 Connector Name MOTOR GENERATOR NO. 2	~		Signal Name	MRF	MSN	MCS	MRFG	MSNG	MCSG			Signal Name	GSN	GSNG	GCS	GCSG	GRFG	GRF	MSNG	MCS	MCSG	I	MSN	MRFG	MRF			
o. F77 ame MOTC	olor BLACK	0 3	Color of Wire	M/L	0	۲۸	M	D/J	O/L			Color of Wire	0	L/G	۲V	0/L	M	M/L	L/G	Γ	0/L	SHIELD	0	M	M/L			
Connector No. Connector Nam	Connector Color	后 H.S.	Terminal No.	-	N	m	4	5	9			Terminal No.	41	42	43	44	45	46	47	48	49	50	51	52	53			
2.2]																						
Connector No. F69 Connector Name MOTOR GENERATOR NO.			Signal Name	MMT	MMTG								2			46 45 44 43 42 41	50 49 48 47											
lo. F69 lame MOTO	olor BLACK		Color of Wire	BR/R	LG/R	-						0. F79		_		46 45 44	53 52 51											
Connector No.	Connector Color	H.S.	Terminal No.	7	6							Connector No.	Connector Color			¢	Ó											

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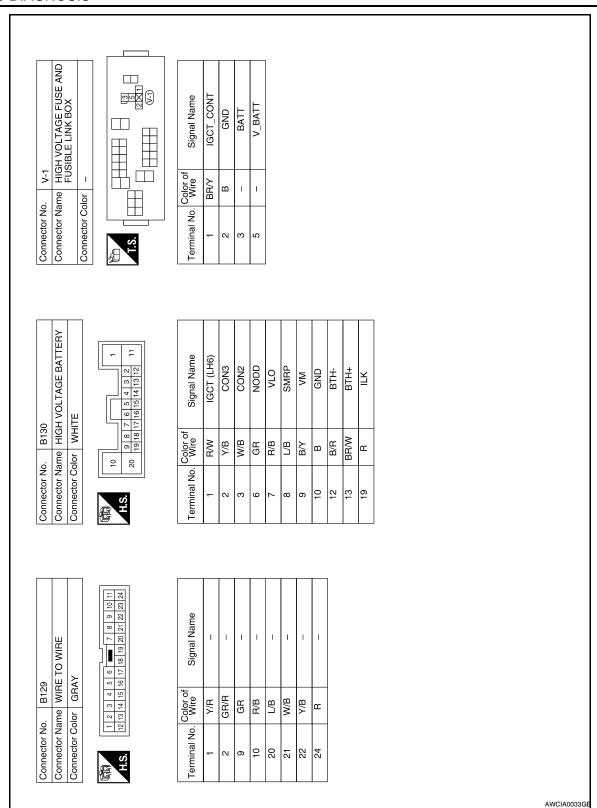


< ECU DIAGNOSIS >

TO WIRE 8 9 10 10	Signal Name	B128 BATTERY COOLING BLOWER ASSEMBLY WHITE	Signal Name	
Connector No. B109 Connector Name WIRE TO WIRE Connector Color WHITE	lo. Color of Wire BR/W BR/W		No. Color of Wire Wire B/Y	
Connector No. Connector Nam Connector Colo	Terminal No. 1 6 6	Connector No. Connector Name Connector Color	Terminal No.	
F252 ELECTRIC COMPRESSOR ORANGE	Signal Name	B111 HIGH VOLTAGE BATTERY FAN RELAY BLUE	Signal Name	
	40. Color of Wire O O SHIELD		Vo. Color of G/R G/R Y/R	
Connector No. Connector Name Connector Color	Terminal No. 7 8 9	Connector No. Connector Name Connector Color	Terminal No.	
	Signal Name ACPB (+) ACPE (-) -	Connector No. B110 Connector Name JOINT CONNECTOR-B01 Connector Color WHITE	Signal Name	
Connector No. F250 Connector Name INVERTER Connector Color WHITE	Color of Wire SMire SMire SMIRED SHIELD	B110 JOINT CO WHITE 6 5 4 3	Color of Wire of G/R G/R G/R G/R	
Connector No. Connector Name Connector Color	Terminal No. Col 11 0 12 1 13 SHI 14 SHI	Connector No. Connector Name Connector Color	Terminal No. Colo 4 4 0 5 6 0	
Conne Conne H.S.		Conne Conne H.S.		

HV ECU

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< ECU DIAGNOSIS >

< ECU DIAGNOSIS > DTC Index

INFOID:000000004212201

×:Applicable —: Not applicable

							×. <i>F</i>	ppiicai	ue —.	Not applicable	
DTC	INF code	CONSULT-III display	GST display	FRZF Informa- tion data	Hybrid system warning light	High volt- age bat- tery warning	Charge warning light	MIL	Trip	Reference page	В
					iigin	light					HBC
P0335* ²	524	CKP SENSOR	_	х	x	—		—	1	<u>EC-251</u>	
P0338	885	CKP SENSOR CIRCUIT		—	х	—	—	—	1	<u>HBC-107</u>	_
P0340* ²	525	CMP SENSOR	_	x	x	_	—	_	1	<u>EC-126</u> and <u>EC-</u> 255	D
P0343	747	CMP SENSOR CIRCUIT	—	х	х	—	_	—	1	HBC-109	Е
P0343	886	CMP SENSOR CIRCUIT	—	х	х	_	_	—	1	HBC-112	
P0560	117	HV ECU POWER SUPLY	×	_	х	_		х	1	HBC-114	
P0616	142	START SIGNAL/CIRC	—	_	х	—	-	—	1	HBC-116	F
P062F	143	EEPROM(HV ECU)	_	_	х	_	_	_	1	HBC-118	
P0705	757	SHIFT POS SWITCH	—	х	х	_		—	1	HBC-119	G
P0705	758	SHIFT POS SWITCH	_	х	х	_		—	1	HBC-119	0
P0851	775	N SIGNAL LINE	—	х	х	_		—	1	HBC-119	
P0A01	725	INV COOL SENSOR		х	х	_		_	1	HBC-125	Н
P0A01	726	INV COOL SENSOR	_	х	х	_			1	HBC-125	
P0A02	719	INV COOL SEN(GND)			x	_		_	1	HBC-128	
P0A03	720	INV COOL SEN(OPEN)			x	_		_	1	HBC-128	I
P0A08	101	DC/DC CONVERTER	_	x	_	_	х	_	1	HBC-129	
P0A08	264	DC/DC CONVERTER	_	x	_	_	х	_	1	HBC-132	J
P0A09	265	DC/DC STAT CIRC LO	_	_	_	_	х	_	1	HBC-138	
P0A09	591	DC/DC STAT CIRC LO	_	_	_	_	х		1	HBC-140	
P0A0D	350	ILK SWITCH CIRCUIT	_	_	x	_		_	1	HBC-144	K
P0A0D	351	ILK SWITCH CIRCUIT	_	_	x	_		_	1	HBC-144	
P0A0F*2	204	ENGINE STOP		x	x	_	_	_	1	EC-328	L
P0A0F* ²	205	ENGINE STOP		х	x	_		_	1	EC-325	
P0A0F	238	ENGINE STOP		х	x	_			1	HBC-151	M
P0A0F*2	533	ENGINE STOP	_	x	x	_	_	_	1	EC-331	IVI
P0A0F* ²	534	ENGINE STOP	_	x	x	_	_		1	EC-331	
P0A10	263	DC/DC STAT CIRC HI				_	x	_	1	HBC-156	Ν
P0A10	592	DC/DC STAT CIRC HI				_	x		1	HBC-159	
P0A1A	151	MG ECU(MG1)	x	x	x	_		x	1	HBC-163	\sim
P0A1A	155	MG ECU(MG1)	x	x	x	_		x	1	HBC-163	0
P0A1A	156	MG ECU(MG1)	x	x	x	_		x	1	HBC-163	
P0A1A	158	MG ECU(MG1)	x	x	x			x	1	HBC-163	Ρ
P0A1A	166	MG ECU(MG1)	x	x	x			x		HBC-163	
P0A1A	200	MG ECU(MG1)	x	x	x			x	1	<u>HBC-164</u>	
P0A1A	658	MG ECU(MG1)	x	x	x			x	1	HBC-169	
P0A1A	659	MG ECU(MG1)	x	x	x			x	1	<u>HBC-169</u>	
P0A1A	791	MG ECU(MG1)	x		x			x	1	<u>HBC-169</u>	
	191		^		^			^	I	100-103	

< ECU DIAGNOSIS >

		CONSULT-III display			Hybrid	High volt-				
DTC	INF code	ltem	GST display	FRZF Informa- tion data	system warning light	age bat- tery warning light	Charge warning light	MIL	Trip	Reference page
P0A1A	792	MG ECU(MG1)	х	_	х	_	_	х	1	HBC-164
P0A1A	793	MG ECU(MG1)	х	_	х	_		х	1	HBC-164
P0A1B	163	MG ECU(MG2)	х	х	х	_	-	х	1	HBC-170
P0A1B	164	MG ECU(MG2)	х	х	х	_	_	х	1	HBC-170
P0A1B	168	MG ECU(MG2)	х	х	х	_		х	1	HBC-171
P0A1B	192	MG ECU(MG2)	х	х	х	—	-	х	1	HBC-170
P0A1B	193	MG ECU(MG2)	х	х	х	_		х	1	HBC-170
P0A1B	195	MG ECU(MG2)	х	х	х	_	-	х	1	HBC-170
P0A1B	198	MG ECU(MG2)	х	х	х	_	_	х	1	HBC-170
P0A1B	511	MG ECU(MG2)	х	х	х	_		х	1	HBC-176
P0A1B	512	MG ECU(MG2)	х	х	х	_		х	1	HBC-176
P0A1B	661	MG ECU(MG2)	х	х	х	_		х	1	HBC-176
P0A1B	786	MG ECU(MG2)	х	х	х	_		х	1	HBC-176
P0A1B	788	MG ECU(MG2)	х	х	х	_		х	1	HBC-177
P0A1B	794	MG ECU(MG2)	х	_	х	_	_	х	1	HBC-176
P0A1B	795	MG ECU(MG2)	х	_	х	_		х	1	HBC-171
P0A1B	796	MG ECU(MG2)	х	—	х	—	-	х	1	HBC-171
P0A1D	134	HV ECU	х	х	х	_	_	х	1	HBC-182
P0A1D	135	HV ECU	х	х	х	_		х	1	HBC-182
P0A1D	140	HV ECU	х	х	х	_	_	х	1	HBC-183
P0A1D	141	HV ECU	х		х	_		х	1	HBC-184
P0A1D	144	HV ECU	х	х	х	—	-	х	1	HBC-185
P0A1D	145	HV ECU	х	х	х	_	_	х	1	HBC-185
P0A1D	148	HV ECU	х	—	х	_	_	х	1	HBC-186
P0A1D	162	HV ECU	х	х	х	—	-	х	1	HBC-187
P0A1D	179	HV ECU	х	х	х	_		х	1	HBC-188
P0A1D	187	HV ECU	х	—	х	—	-	х	1	HBC-189
P0A1D	390	HV ECU	х	_	х	_	_	х	1	HBC-190
P0A1D	393	HV ECU	х	х	х	_		х	1	HBC-191
P0A1D	570	HV ECU	х	х	х	_	_	х	1	HBC-182
P0A1D	721	HV ECU	х	х	х	_	_	х	1	HBC-192
P0A1D	722	HV ECU	х	х	х	_	_	х	1	HBC-192
P0A1D	723	HV ECU	х	х	х	—	-	х	1	HBC-192
P0A1D	765	HV ECU	х	х	х	_	_	х	1	HBC-192
P0A1D	787	HV ECU	х	х	х	_	_	х	1	HBC-192
P0A1D	821	HV ECU	x	х	х	—	_	х	1	<u>HBC-187</u>
P0A1D	822	HV ECU	x	х	х	—	_	х	1	HBC-187
P0A1D	823	HV ECU	х	х	х	_	_	х	1	HBC-187
P0A1D	924	HV ECU	x		х		_	x	1	HBC-193
P0A1D	925	HV ECU	x		х			x	1	HBC-193
P0A1F	129	HV BATT SMART UNIT	x	x	х	—	_	х	1	HBC-194
P0A1F	150	HV BATT SMART UNIT	х	х	х	—	_	х	1	HBC-196

< ECU DIAGNOSIS >

		CONSULT-III display			Hybrid	High volt-					_
DTC	INF code	Item	GST display	FRZF Informa- tion data	system warning light	age bat- tery warning light	Charge warning light	MIL	Trip	Reference page	A
P0A1F	157	HV BATT SMART UNIT	x	x	x	_	_	х	1	HBC-198	B
P0A2B	248	MG2 TEMP SENSOR	_	x	х	_	_	_	1	HBC-198	
P0A2B	250	MG2 TEMP SENSOR	_	x	х	_	_	_	1	HBC-198	HBC
P0A2C	247	MG2 TEMP SEN(GND)		_	х		_		1	HBC-199	
P0A2D	249	MG2 TEMP SEN(OPEN)			х		_		1	HBC-199	
P0A37	258	MG1 TEMP SENSOR		х	х		_		1	HBC-203	D
P0A37	260	MG1 TEMP SENSOR		х	х		_		1	HBC-203	
P0A38	257	MG1 TEMP SEN(GND)			х		_		1	HBC-205	E
P0A39	259	MG1 TEMP SEN(OPEN)			х		_		1	HBC-205	
P0A3F	243	MG2 RSLVR INT/SHRT	х	х	х		_	x	1	HBC-209	
P0A40	500	MG2 RSLVR RANGEout	х	х	х		_	x	1	HBC-209	F
P0A41	245	MG2 RESOLVER CIRCT	x	x	x	_	_	х	1	HBC-209	
P0A4B	253	MG1 RSLVR INT/SHRT	x	x	х	_	_	x	1	HBC-212	G
P0A4C	513	MG1 RSLVR RANGEout	x	x	х	_	_	x	1	HBC-212	0
P0A4D	255	MG1 RESOLVER CIRCT	x	х	х	_	_	x	1	HBC-212	
P0A51	174	MG2 ECU INTERNAL		x	x	_	_		1	HBC-214	Н
P0A60	288	MG2 CRNT SENSOR(V)	x	х	x		_	х	1	HBC-216	
P0A60	290	MG2 CRNT SENSOR(V)	x	x	x		_	х	1	HBC-216	1
P0A60	294	MG2 CRNT SENSOR(V)	х	х	х		_	х	1	HBC-216	I
P0A60	501	MG2 CRNT SENSOR(V)	х	х	х			х	1	HBC-216	
P0A63	296	MG2 CRNT SENSOR(W)	x	х	х	_	_	х	1	HBC-218	J
P0A63	298	MG2 CRNT SENSOR(W)	x	x	x		_	х	1	HBC-218	
P0A63	302	MG2 CRNT SENSOR(W)	х	х	х		_	х	1	HBC-218	
P0A63	502	MG2 CRNT SENSOR(W)	х	х	х			х	1	HBC-218	K
P0A72	326	MG1 CRNT SENSOR(V)	x	x	x		_	х	1	HBC-220	
P0A72	328	MG1 CRNT SENSOR(V)	х	х	х	_	_	х	1	HBC-220	L
P0A72	333	MG1 CRNT SENSOR(V)	х	х	х	_	_	х	1	HBC-220	
P0A72	515	MG1 CRNT SENSOR(V)	х	х	х	_	_	х	1	HBC-220	
P0A75	334	MG1 CRNT SENSOR(W)	х	х	х	—	—	х	1	HBC-222	M
P0A75	336	MG1 CRNT SENSOR(W)	х	х	х	—	—	х	1	HBC-222	
P0A75	341	MG1 CRNT SENSOR(W)	х	х	х	—	—	х	1	HBC-222	Ν
P0A75	516	MG1 CRNT SENSOR(W)	х	х	х	_	_	х	1	HBC-222	
P0A78	113	MG2 INV PERFORM	х	х	х	—	—	х	1	HBC-225	
P0A78	121	MG2 INV PERFORM	х	х	х	—	—	х	1	HBC-230	0
P0A78	128	MG2 INV PERFORM	х	х	х	_	_	х	1	HBC-238	
P0A78	266	MG2 INV PERFORM	х	_	х	—	—	х	1	HBC-243	Р
P0A78	267	MG2 INV PERFORM	х	—	х	—	—	х	1	HBC-243	
P0A78	279	MG2 INV PERFORM	х	х	х	—	—	х	1	HBC-246	
P0A78	282	MG2 INV PERFORM	х	х	х	—	—	х	1	HBC-250	
P0A78	284	MG2 INV PERFORM	х	x	x			х	1	HBC-253	
P0A78	286	MG2 INV PERFORM	х	x	х		_	х	1	HBC-260	
P0A78	287	MG2 INV PERFORM	х	х	х	—	—	х	1	HBC-267	
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< ECU DIAGNOSIS >

		CONSULT-III display				High volt-				
DTC	INF code	Item	GST display	FRZF Informa- tion data	Hybrid system warning light	age bat- tery warning light	Charge warning light	MIL	Trip	Reference page
P0A78	306	MG2 INV PERFORM	х	х	х	—	—	х	1	<u>HBC-271</u>
P0A78	503	MG2 INV PERFORM	х	х	х	_		х	1	HBC-275
P0A78	504	MG2 INV PERFORM	х	х	х	—	_	х	1	HBC-275
P0A78	505	MG2 INV PERFORM	x	х	х	—	_	х	1	HBC-280
P0A78	506	MG2 INV PERFORM	x	х	х	—	-	х	1	HBC-280
P0A78	510	MG2 INV PERFORM	х	х	x* ¹	—	_	х	1	HBC-285
P0A78	523	MG2 INV PERFORM	x	х	x	_	_	х	1	HBC-288
P0A78	586	MG2 INV PERFORM	х	х	х	_		х	1	HBC-291
P0A78	806	MG2 INV PERFORM	х	х	х	_	_	х	1	HBC-294
P0A78	807	MG2 INV PERFORM	х	х	х	_		х	1	HBC-299
P0A78	808	MG2 INV PERFORM	х	х	х	_	_	х	1	HBC-294
P0A7A	122	MG1 INV PERFORM	х	х	х	—		х	1	HBC-302
P0A7A	130	MG1 INV PERFORM	х	х	х	—		х	1	HBC-308
P0A7A	322	MG1 INV PERFORM	х	х	х	_	_	х	1	HBC-313
P0A7A	324	MG1 INV PERFORM	х	х	х	—		х	1	HBC-320
P0A7A	325	MG1 INV PERFORM	х	х	х	—	_	х	1	HBC-327
P0A7A	344	MG1 INV PERFORM	х	х	х	—	_	х	1	HBC-331
P0A7A	517	MG1 INV PERFORM	х	х	х	—	_	х	1	HBC-335
P0A7A	518	MG1 INV PERFORM	x	х	х	—	_	х	1	HBC-335
P0A7A	522	MG1 INV PERFORM	х	х	x* ¹	_	_	х	1	HBC-340
P0A7A	809	MG1 INV PERFORM	x	х	x	_		х	1	HBC-343
P0A7A	810	MG1 INV PERFORM	x	х	x	_		х	1	HBC-348
P0A7A	811	MG1 INV PERFORM	х	х	х	_		х	1	HBC-343
P0A90	251	MG2 PERFORMANCE	x	х	x	_	_	х	1	HBC-350
P0A90	509	MG2 PERFORMANCE	х	х	х	_		х	1	HBC-353
P0A92	261	MG1 PERFORMANCE	х	х	х	_	-	х	1	HBC-356
P0A92	521	MG1 PERFORMANCE	х	х	х	_	_	х	1	HBC-359
P0A93	346	MG COOLING SYSTEM	х	х	х	_		х	1	HBC-362
P0A94	127	BOOST CONVERTER	х	х	х	—		х	1	HBC-367
P0A94	172	BOOST CONVERTER	х	х	х	—	_	х	1	HBC-372
P0A94	442	BOOST CONVERTER	x	х	х	—	_	х	1	HBC-376
P0A94	547	BOOST CONVERTER	х	х	х	_	_	х	1	HBC-378
P0A94	548	BOOST CONVERTER	x	х	х	—	_	х	1	HBC-382
P0A94	549	BOOST CONVERTER	x	х	х	—	-	х	1	HBC-378
P0A94	550	BOOST CONVERTER	x	х	х	_	_	х	1	HBC-384
P0A94	553	BOOST CONVERTER	x	х	х			х	1	HBC-386
P0A94	554	BOOST CONVERTER	x	х	х			х	1	HBC-392
P0A94	555	BOOST CONVERTER	x	х	х			х	1	HBC-396
P0A94	556	BOOST CONVERTER	x	х	х			х	1	HBC-392
P0A94	557	BOOST CONVERTER	х	х	х			х	1	HBC-398
P0A94	585	BOOST CONVERTER	х	х	х	—		х	1	<u>HBC-403</u>

HBC-622

< ECU DIAGNOSIS >

DTC INF Item GST F/ZF United as marring warring wa			CONSULT-III display			Hybrid	High volt-					
PDAA4 567 BOOST CONVERTER x - - - x 1 HBC-402 PDA44 568 BOOST CONVERTER x - x - - x 1 HBC-402 PDA41 231 SMR B/G - x x'1 - - 1 HBC-412 PDAA1 232 SMR B/G - x x'1 - - 1 HBC-412 PDAA4 232 SMR B/G - x x'1 - - 1 HBC-412 PDAA6 561 INSULATION RESIST - x x'1 - - 1 HBC-420 PDAA6 614 INSULATION RESIST - x x'1 - - 1 HBC-420 PDAA6 614 INSULATION RESIST - x x'1 - - 1 HBC-420 PDAA7 727 ISOLATION SENSOR - x -	DTC		Item		Informa-	system warning	tery warning	warning	MIL	Trip		
P0A94 500 BOOST CONVERTER x x 1 HBC-402 HBC P0AA1 231 SMR B/G x x*1 - 1 HBC-412 P0AA1 232 SMR B/G x x*1 - 1 HBC-412 D P0AA4 232 SMR G x x*1 - 1 HBC-412 P0AA6 611 INSULATION RESIST - x x*1 - 1 HBC-420 F P0AA6 611 INSULATION RESIST - x x*1 - 1 HBC-420 F P0AA6 614 INSULATION RESIST - x x*1 - 1 HBC-420 F P0AA7 1 INDC-420 8/7 ISULATION RESIST - x - - 1 HBC-433 P0AC0 287 SMR B(OPEN)	P0A94	587	BOOST CONVERTER	х	х	х	—	—	х	1	<u>HBC-404</u>	D
P0AA1 231 SMR B/G x x ⁺¹ 1 HBC-410 P0AA4 232 SMR B/G x x ⁺¹ 1 HBC-412 P P0AA6 526 INSULATION RESIST x x ⁺¹ 1 HBC-412 P P0AA6 612 INSULATION RESIST x x ⁺¹ 1 HBC-420 P P0AA6 613 INSULATION RESIST x x ⁺¹ 1 HBC-420 P P0AA6 613 INSULATION RESIST x x ⁻¹ 1 HBC-430 P P0AA7 727 ISOLATION SENSOR x x ⁻¹ - 1 HBC-433 P0AD0 227 SMR B(GND) x - 1 HBC-433 P0AD2 <td>P0A94</td> <td>589</td> <td>BOOST CONVERTER</td> <td>х</td> <td>_</td> <td>х</td> <td></td> <td>_</td> <td>х</td> <td>1</td> <td><u>HBC-407</u></td> <td></td>	P0A94	589	BOOST CONVERTER	х	_	х		_	х	1	<u>HBC-407</u>	
P0AA1 233 SMR B/G - x x ⁻¹ - - 1 HBC413 D P0AA4 232 SMR G - x x ⁻¹ - - 1 HBC413 D P0AA6 526 INSULATION RESIST - X x ⁻¹ - - 1 HBC420 E P0AA6 611 INSULATION RESIST - X x ⁻¹ - - 1 HBC420 F P0AA6 614 INSULATION RESIST - X x ⁻¹ - - 1 HBC420 F P0AA6 614 INSULATION RESIST - X x ⁻¹ - - 1 HBC420 F P0AA7 727 ISOLATION SENSOR - X X - - 1 HBC423 G P0AC2 SMR B(GND) - - X - - 1 HBC433 H P0AC2	P0A94	590	BOOST CONVERTER	х	_	х	_	_	х	1	HBC-407	HBC
P0AA4 232 SMR G x x*1 1 HBC417 P0AA6 526 INSULATION RESIST x x*1 1 HBC420 P0AA6 611 INSULATION RESIST x x*1 1 HBC420 P0AA6 612 INSULATION RESIST x x*1 1 HBC420 F P0AA6 614 INSULATION RESIST x x*1 1 HBC420 F P0AA7 727 ISOLATION RESIST x x*1 1 HBC433 G P0AD2 226 SMR B(OPEN) x 1 HBC433 P0AD2 228 SMR G(OPEN) x 1 HBC444 I P0AE2 265 SM	P0AA1	231	SMR B/G	—	х	x* ¹	_	_	_	1	<u>HBC-410</u>	
P0AA6 520 INSULATION RESIST - x x*1 - - - 1 HBC-420 F P0AA6 611 INSULATION RESIST - x x*1 - - 1 HBC-420 F P0AA6 613 INSULATION RESIST - x x*1 - - 1 HBC-420 F P0AA6 613 INSULATION RESIST - x x*1 - - 1 HBC-420 P0AA7 727 ISOLATION SENSOR - x x - - 1 HBC-433 P0AD8 227 SMR B(GND) - - x - - 1 HBC-433 P0AD6 228 SMR G(OPEN) - - x - - 1 HBC-433 P0AD7 229 SMR G(OPEN) - - x - 1 HBC-433 P0AE1 SMR P(OPEN) - x	P0AA1	233	SMR B/G		х	x* ¹	_	_	_	1	HBC-413	D
P0AA6 611 INSULATION RESIST - x x*1 - - - 1 HBC.420 F P0AA6 612 INSULATION RESIST - x x*1 - - 1 HBC.420 F P0AA6 613 INSULATION RESIST - x x*1 - - 1 HBC.420 F P0AA6 614 INSULATION RESIST - x x*1 - - 1 HBC.433 G P0AA7 727 ISOLATION SENSOR - x - - 1 HBC.433 H P0AD1 226 SMR G(RD0) - - x - - 1 HBC.433 H P0AD2 228 SMR G(OPEN) - - x - - 1 HBC.434 P0AE2 15 SMR P - x x - - 1 HBC.442 P0AE2 245	P0AA4	232	SMR G	—	х	x* ¹	_	_	_	1	<u>HBC-417</u>	
P0AA6 611 INSULATION RESIST - x x^{*1} - - - 1 HBC-220 P0AA6 612 INSULATION RESIST - x x^{*1} - - - 1 HBC-420 P0AA6 614 INSULATION RESIST - x x^{*1} - - - 1 HBC-420 P0AA6 614 INSULATION RESIST - x x^{*1} - - 1 HBC-420 P0AC0 817 HVBAT CUR/SEN FRE x - x - - 1 HBC-433 G P0AD6 226 SMR B(OPEN) - - x - - 1 HBC-433 P0AD7 228 SMR G(OPEN) - - x - - 1 HBC-433 P0AE2 228 SMR P(GND) - - x - - 1 HBC-433 P0AE2 228 SMR P(OPEN) x - x - - 1 HBC-450 J	P0AA6	526	INSULATION RESIST	—	х	x* ¹	_	_	_	1	<u>HBC-420</u>	
P0AA6 613 INSULATION RESIST - x x*1 - - - 1 HBC-420 F P0AA6 614 INSULATION RESIST - x x*1 - - 1 HBC-420 G P0AA7 727 ISOLATION SENSOR - x x - - 1 HBC-433 G P0AC0 817 HVBAT CUR/SEN FRE x - x - - 1 HBC-433 P0AD6 220 SMR B(GND) - - x - - 1 HBC-434 P0AD7 228 SMR G(OND) - - x - - 1 HBC-444 P0AE2 181 SMR P - x - - 1 HBC-442 P0AE2 181 SMR P - x - - 1 HBC-442 P0AE6 225 SMR P(rEb) x - x	P0AA6	611	INSULATION RESIST	—	х	x* ¹	—	—	_	1	HBC-420	
POARA OIS INSULATION RESIST Imsolution Imsolutis Imsolution <td>P0AA6</td> <td>612</td> <td>INSULATION RESIST</td> <td>—</td> <td>х</td> <td>x*¹</td> <td>_</td> <td>—</td> <td>—</td> <td>1</td> <td>HBC-420</td> <td></td>	P0AA6	612	INSULATION RESIST	—	х	x* ¹	_	—	—	1	HBC-420	
P0AA7 727 ISOLATION SENSOR - x x - - 1 HBC-433 G 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-434 P0ADC 228 SMR G(OPEN) - - x - - 1 HBC-434 P0AE2 11 SMR P - x - - 1 HBC-432 P0AE2 773 SMR P - x x - - 1 HBC-452 P0AE2 773 SMR P(OPEN) x - - 1 HBC-452 P0AE2 77 MG2 INV TMP SENSOR x x x - - 1 HBC-	P0AA6	613	INSULATION RESIST		х	x* ¹	_		_	1	HBC-420	F
P0AC0 817 HVBAT CUR/SEN FRE x - x - - - 1 HBC-432 P0ADB 227 SMR B(GND) - - - - - 1 HBC-432 P0ADC 226 SMR B(OPEN) - - - - 1 HBC-432 P0ADC 228 SMR G(OPEN) - - x - - 1 HBC-432 P0AE2 161 SMR P - - x - - 1 HBC-450 P0AE2 773 SMR P - x - - - 1 HBC-452 P0AE2 275 SMR P(OPEN) x - x - - - 1 HBC-452 P0AE2 276 MG2 INV TMP SENSOR x x x - - 1 HBC-422 P0AE4 276 MG2 INV TMP/SENSOR x x x -	P0AA6	614	INSULATION RESIST		x	x* ¹	_			1	HBC-420	
P0ADB 227 SMR B(GND) - - x - - 1 HBC-438 H P0ADC 226 SMR B(OPEN) - - x - - 1 HBC-438 P0ADF 229 SMR G(GND) - - x - - 1 HBC-438 P0ADF 228 SMR G(OPEN) - - x - - 1 HBC-444 P0AE2 161 SMR P - x x - - 1 HBC-442 P0AE2 773 SMR P - x x - - 2 HBC-452 P0AE2 255 SMR P(PEN) x - x - - x 1 HBC-452 P0AE2 276 MG2 INV TMP SENSOR x x x - - 1 HBC-452 L P0AE5 275 MG2 INV TMP SENSOR x x x	P0AA7	727	ISOLATION SENSOR		х	x	_	—		1	HBC-433	G
P0ADC 226 SMR B(OPEN) - - x - - 1 HBC.438 H P0ADF 229 SMR G(GND) - - x - - 1 HBC.438 H P0ADF 228 SMR G(OPEN) - - x - - 1 HBC.444 P0AE2 161 SMR P - x x - - 1 HBC.442 P0AE2 773 SMR P - x x - - 2 HBC.458 P0AE6 225 SMR P(PE) x - x - - 1 HBC.476 P0AE7 224 SMR P(PE) x - x x - - 1 HBC.476 P0AEF 275 MG2 INV TMP SENSOR x x x - - 1 HBC.483 P1616 308 COLISION SIGNAL - - -	P0AC0	817	HVBAT CUR/SEN FRE	х	—	х	_	—		1	HBC-434	
POADC 22b SMR B(OPEN) - - x - - - 1 HBC.438 POADF 229 SMR G(GND) - - x - - 1 HBC.444 POAED 228 SMR G(OPEN) - - x - - 1 HBC.444 POAED 228 SMR G(OPEN) - - x - - 1 HBC.450 POAE2 773 SMR P - x x - - 2 HBC.450 POAE2 773 SMR P(PEN) x - x - - 1 HBC.450 POAEE 275 MG2 INV TMP SENSOR x x x - - 1 HBC.479 POAEE 276 MG2 INV TMP SENSOR x x x - - 1 HBC.482 POAEE 276 MG2 INV TMP/S(OPN) x - x - - 1 HBC.482 L P1572 904 ASCD BRAKE SW	P0ADB	227	SMR B(GND)	_	—	х	—	—		1	HBC-438	
POAE0 228 SMR G(OPEN) x 1 HBC-444 POAE2 161 SMR P x x 1 HBC-450 POAE2 773 SMR P x x 1 HBC-450 POAE2 773 SMR P x x 2 HBC-450 POAE6 225 SMR P(PEN) x x x 1 HBC-452 POAE6 225 SMR P(PB) x x 1 HBC-472 POAE6 276 MG2 INV TMP SENSOR x x x 1 HBC-472 POAE7 274 MG2 INV TMP/S(OPN) x x 1 HBC-482 P1572 904 ASCD BRAKE SW 1 HBC-483 P1606 308 COLLISION SIGNAL <	P0ADC	226	SMR B(OPEN)		_	х	—	—	—	1	HBC-438	Η
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:458 P0AE7 224 SMR P(+B) x x x 1 HBC:452 P0AEE 276 MG2 INV TMP SENSOR x x x 1 HBC:479 P0AEE 277 MG2 INV TMP/S(OPN) x x 1 HBC:482 P0AF0 274 MG2 INV TMP/S(OPN) x x 1 HBC:483 P1606 308 COLLISION SIGNAL 1 HBC:483 M P1611 908 ID DISCORD IMM-HV - <	P0ADF	229	SMR G(GND)	_	—	х	—	—		1	HBC-444	
P0AE2 773 SMR P - x x - - 2 HBC-458 P0AE6 225 SMR P(OPEN) x - x - x 1 HBC-458 P0AE7 224 SMR P(+B) x - x - - x 1 HBC-452 P0AE7 224 SMR P(+B) x - x - - x 1 HBC-452 P0AE7 224 SMR P(+B) x - x - - - 1 HBC-452 P0AE5 276 MG2 INV TMP SENSOR x x x - - - - 1 HBC-479 P0AE6 274 MG2 INV TMP/S(OPN) x - x - - - 1 HBC-482 L P1572 904 ASCD BRAKE SW - - - - 1 1 BEC-433 M P1610	P0AE0	228	SMR G(OPEN)	—	—	х	_	—		1	HBC-444	1
P0AE6 225 SMR P(OPEN) x - x - x 1 HBC-462 J P0AE7 224 SMR P(+B) x - x - x 1 HBC-462 P0AE7 224 SMR P(+B) x - x - - x 1 HBC-462 P0AE6 276 MG2 INV TMP SENSOR x x x - - - 1 HBC-479 P0AE6 277 MG2 INV TMP SENSOR x - x - - - 1 HBC-479 P0AE7 274 MG2 INV TMP/S(OPN) x - x - - - - 1 HBC-482 L P1672 904 ASCD BRAKE SW - - x-1 - - 1 HBC-483 M P1610 909 LOCK MODE - - - - 1 SEC-43 N P1611	P0AE2	161	SMR P	—	х	х	—	—		1	<u>HBC-450</u>	
POALD 223 Simin F(OF Lity) x - x - x 1 HBC-476 POAE7 224 SMR P(+B) x - x - x - x 1 HBC-476 POAEE 276 MG2 INV TMP SENSOR x x x - - - 1 HBC-479 K POAEE 277 MG2 INV TMP SENSOR x x x - - - 1 HBC-479 K POAEE 277 MG2 INV TMP SENSOR x x x - - - - 1 HBC-482 L POAE 274 MG2 INV TMP/S(OPN) x - x - - - - - 1 HBC-482 L P167 904 ASCD BRAKE SW - - x - - - - 1 HBC-483 P1606 308 COLLISION SIGNAL - - - - - 1 SEC-40 SEC-43 N <t< td=""><td>P0AE2</td><td>773</td><td>SMR P</td><td>—</td><td>х</td><td>х</td><td>_</td><td>—</td><td></td><td>2</td><td>HBC-458</td><td></td></t<>	P0AE2	773	SMR P	—	х	х	_	—		2	HBC-458	
POAEE 276 MG2 INV TMP SENSOR x </td <td>P0AE6</td> <td>225</td> <td>SMR P(OPEN)</td> <td>х</td> <td>—</td> <td>х</td> <td>_</td> <td>—</td> <td>х</td> <td>1</td> <td>HBC-462</td> <td>J</td>	P0AE6	225	SMR P(OPEN)	х	—	х	_	—	х	1	HBC-462	J
P0AEE 277 MG2 INV TMP SENSOR x <td>P0AE7</td> <td>224</td> <td>SMR P(+B)</td> <td>х</td> <td>—</td> <td>х</td> <td>_</td> <td>—</td> <td>х</td> <td>1</td> <td>HBC-476</td> <td></td>	P0AE7	224	SMR P(+B)	х	—	х	_	—	х	1	HBC-476	
P0AEE 277 MG2 INV TMP SENSOR x <td>P0AEE</td> <td>276</td> <td>MG2 INV TMP SENSOR</td> <td>х</td> <td>х</td> <td>х</td> <td>_</td> <td>—</td> <td></td> <td>1</td> <td><u>HBC-479</u></td> <td>K</td>	P0AEE	276	MG2 INV TMP SENSOR	х	х	х	_	—		1	<u>HBC-479</u>	K
P0AF0 274 MG2 INV TMP/S(+B) x - x - - - - 1 HBC-482 L P1572 904 ASCD BRAKE SW - - - - - 1 HBC-483 P1606 308 COLLISION SIGNAL - - x*1 - - 1 HBC-483 P1610 909 LOCK MODE - - - - - 1 HBC-486 M P1610 909 LOCK MODE - - - - - 1 HBC-486 M P1611 908 ID DISCORD IMM-HV - - - - 1 SEC-40 N P1612 926 CHAIN OF HV-IMMU - - - - 1 SEC-43 N P1615 906 DIFFERENCE OF KEY - - - - 1 HBC-488 O P1805 903 BRAKE SW ITCH CIRC - - - - 1 HBC-491 P <t< td=""><td>P0AEE</td><td>277</td><td>MG2 INV TMP SENSOR</td><td>х</td><td>х</td><td>х</td><td>_</td><td>_</td><td></td><td>1</td><td><u>HBC-479</u></td><td></td></t<>	P0AEE	277	MG2 INV TMP SENSOR	х	х	х	_	_		1	<u>HBC-479</u>	
P1572 904 ASCD BRAKE SW - - - - - - 1 HBC-483 P1606 308 COLLISION SIGNAL - - x*1 - - 1 HBC-483 P1610 909 LOCK MODE - - x*1 - - 1 HBC-483 P1610 909 LOCK MODE - - - - 1 SEC-40 P1611 908 ID DISCORD IMM-HV - - - - 1 SEC-43 P1612 926 CHAIN OF HV-IMMU - - - - 1 SEC-43 N P1615 906 DIFFERENCE OF KEY - - - - 1 SEC-43 N P1805 902 BRAKE SWITCH CIRC - - - - 1 HBC-484 O P1805 903 BRAKE SW ITCH CIRC - - - - 1 HBC-491 P P2120 152 APP SENSOR(CIRCUIT) - x	P0AEF	275	MG2 INV TMP/S(OPN)	х	—	х	_	—		1	HBC-482	
P1606 308 COLLISION SIGNAL - - x*1 - - 1 HBC-486 P1610 909 LOCK MODE - - - - 1 SEC-40 P1611 908 ID DISCORD IMM-HV - - - - 1 SEC-40 P1612 926 CHAIN OF HV-IMMU - - - - 1 SEC-43 N P1615 906 DIFFERENCE OF KEY - - - - 1 SEC-43 N P1805 902 BRAKE SWITCH CIRC - - - - 1 HBC-488 O P1805 903 BRAKE SW ITCH CIRC - - - - 1 HBC-491 P P2120 152 APP SENSOR(RANGE) - x x - - 1 HBC-494 P2121 106 APP SENSOR(OPEN) - - x - - 1 HBC-494 P2122 104 APP SENSOR(CIRCUIT) - - <td< td=""><td>P0AF0</td><td>274</td><td>MG2 INV TMP/S(+B)</td><td>х</td><td>_</td><td>х</td><td>_</td><td>—</td><td></td><td>1</td><td>HBC-482</td><td>L</td></td<>	P0AF0	274	MG2 INV TMP/S(+B)	х	_	х	_	—		1	HBC-482	L
P1610 909 LOCK MODE — — — — — — — — 1 SEC-40 P1611 908 ID DISCORD IMM-HV — — — — — — 1 SEC-40 P1612 926 CHAIN OF HV-IMMU — — — — — — 1 SEC-43 N P1612 926 CHAIN OF HV-IMMU — — — — — — 1 SEC-43 N P1615 906 DIFFERENCE OF KEY — — — — — — 1 HBC-438 P1805 902 BRAKE SWITCH CIRC — — — — 1 HBC-434 P1805 903 BRAKE SW ITCH CIRC — — — — 1 HBC-491 P1805 923 BRAKE SW ITCH CIRC — — X — — 1 HBC-494 P2120 152 APP SENSOR(RANGE) — X X — — 1 <	P1572	904	ASCD BRAKE SW			_	_	_		1	HBC-483	
P1611 908 ID DISCORD IMM-HV — — — — — — — — — I SEC-43 N P1612 926 CHAIN OF HV-IMMU — — — — — — — 1 SEC-43 N P1612 926 CHAIN OF HV-IMMU — — — — — — 1 SEC-43 N P1615 906 DIFFERENCE OF KEY — — — — — 1 Isec-43 P1805 902 BRAKE SWITCH CIRC — — — — — 1 HBC-488 P1805 903 BRAKE SW ITCH CIRC — — — — 1 HBC-491 P P1805 923 BRAKE SW ITCH CIRC — — — — 1 HBC-491 P P2120 152 APP SENSOR(RANGE) — X X — — 1 HBC-494 P P2121 106 APP SENSOR(OPEN) — X	P1606	308	COLLISION SIGNAL	—	—	x* ¹	—	—		1	<u>HBC-486</u>	Μ
P1612 926 CHAIN OF HV-IMMU — — — — — — — 1 SEC-45 N P1612 906 DIFFERENCE OF KEY — — — — — — 1 SEC-43 N P1615 906 DIFFERENCE OF KEY — — — — — — 1 SEC-43 N P1805 902 BRAKE SWITCH CIRC — — — — — — 1 HBC-488 O P1805 903 BRAKE SW ITCH CIRC — — — — — — 1 HBC-491 P P1805 923 BRAKE SW ITCH CIRC — — — — — 1 HBC-491 P P2120 152 APP SENSOR(CIRCUIT) — — x — — 1 HBC-494 P P2121 106 APP SENSOR(CANGE) — x x — — 1 HBC-494 P2122 104 APP SENSOR((CIRCUI	P1610	909	LOCK MODE	—	—	—	—	—		1	<u>SEC-40</u>	
P1615 906 DIFFERENCE OF KEY — — — — — — — I SEC-43 P1805 902 BRAKE SWITCH CIRC — — — — — — 1 HBC-488 P1805 903 BRAKE SW ITCH 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 P P2121 106 APP SENSOR(RANGE) — X X — — 1 HBC-494 P P2122 104 APP SENSOR(OPEN) — X X — — 1 HBC-494 P2123 105 APP SENSOR(CIRCUIT) — — X — —	P1611	908	ID DISCORD IMM-HV	—	—	—	—	—		1	<u>SEC-43</u>	
P1805 902 BRAKE SWITCH CIRC - - - - 1 HBC-488 O P1805 903 BRAKE SW ITCH CIRC - - - - 1 HBC-491 P P1805 923 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 x - - 1 HBC-494 P2123 105 APP SENSOR(CIRCUIT) - x - - 1 HBC-494 P2125 153 APP SENSOR(CIRCUIT) - - x - - 1 HBC-494	P1612	926	CHAIN OF HV-IMMU	—	—	—	—	—		1	<u>SEC-45</u>	Ν
P1805 903 BRAKE SW ITCH CIRC — — — — — — — Image: Marcon and the system of the system o	P1615	906	DIFFERENCE OF KEY		_	_	_	_		1	<u>SEC-43</u>	
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 X - - 1 HBC-494 P2123 105 APP SENSOR(OPEN) - X - - 1 HBC-494 P2123 105 APP SENSOR(CIRCUIT) - - X - - 1 HBC-494 P2125 153 APP SENSOR(CIRCUIT) - - X - - 1 HBC-494	P1805	902	BRAKE SWITCH CIRC	—	—	_	_	—	—	1	HBC-488	\cap
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 X 1 HBC-494 P2123 105 APP SENSOR(+B) X 1 HBC-494 P2125 153 APP SENSOR(CIRCUIT) X 1 HBC-494	P1805	903	BRAKE SW ITCH CIRC	_	_	_	_	_		1	HBC-491	0
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	P1805	923	BRAKE SW ITCH CIRC	—	—	—	_	—		1	HBC-491	
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	P2120	152	APP SEN(CIRCUIT)	—	_	х	_	—		1	HBC-494	Ρ
P2123 105 APP SENSOR(+B) x 1 HBC-494 P2125 153 APP SENSOR(CIRCUIT) x 1 HBC-494	P2121	106	APP SENSOR(RANGE)	—	х	х	—	—		1	HBC-494	
P2125 153 APP SENSOR(CIRCUIT) — — x — — 1 HBC-494	P2122	104	APP SENSOR(OPEN)	—	—	х	-	—		1	HBC-494	
	P2123	105	APP SENSOR(+B)	—	—	х	—	—	_	1	HBC-494	
P2126 109 APP SENSOR(RANGE) — x x — — 1 HBC-499	P2125	153	APP SENSOR(CIRCUIT)	—		x	_	—		1	HBC-494	
	P2126	109	APP SENSOR(RANGE)		х	x			_	1	HBC-499	

HBC-623

< ECU DIAGNOSIS >

DTC	INF code	CONSULT-III display	GST display	FRZF Informa- tion data	Hybrid system warning light	High volt- age bat- tery warning	Charge warning light	MIL	Trip	Reference page
					5	light				
P2127	107	APP SENSOR(OPEN)	—	—	х	_		_	1	<u>HBC-499</u>
P2128	108	APP SENSOR(+B)	—	—	х	_		_	1	HBC-499
P2138	110	APP SENSOR		х	х	_			1	<u>HBC-499</u>
P2138	154	APP SENSOR		_	Х				1	<u>HBC-499</u>
P2511	149	POWER SUPLY(RESET)			Х	_	_	—	1	<u>HBC-504</u>
P2519	766	HV BAT IDH CIRCUIT	—	Х	—	_	х	—	1	<u>HBC-506</u>
P3000	388	HV BAT MALFUNCTION	_	_	_	х		—	1	<u>HBC-509</u>
P3000	389	HV BAT MALFUNCTION			х			—	1	<u>HBC-511</u>
P3000	603	HV BAT MALFUNCTION		_	х			—	1	<u>HBC-513</u>
P3004	131	POWER CABLE MALFUN	—	х	х	—	—		2	<u>HBC-517</u>
P3004	132	POWER CABLE MALFUN	_	х	х	_	_	—	1	<u>HBC-527</u>
P3004	133	POWER CABLE MALFUN	—	_	х	—	—	_	1	<u>HBC-190</u>
P3004	800	POWER CABLE MALFUN	_	х	х	_	—	_	1	HBC-534
P3004	801	POWER CABLE MALFUN	_	х	х	_		_	1	HBC-534
P3004	803	POWER CABLE MALFUN	_	х	х	_	_	_	1	HBC-543
P3108	535	A/C COMM CIRCUIT	_	х	_	_	_	_	1	HBC-547
P3108	536	A/C COMM CIRCUIT	_	х		_		—	1	HBC-547
P3108	538	A/C COMM CIRCUIT	_	х	_	_			1	HBC-547
P3110	139	IGCT RELAY	_	_	х			_	1	HBC-551
P3110	223	IGCT RELAY	_	_	х			_	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	<u>HBC-559</u>
P3221	314	MG1 INV TMP SENSOR	x	х	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	<u>HBC-563</u>
P3223	312	MG1 INV TMP/S(+B)	x		× ×				1	<u>HBC-563</u>
	562								1	
P3226		BOOST CONV TMP SEN	x	x	x	—	—	<u> </u>	-	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)	Х	_	X				1	HBC-567
P3232	749	HV GATE CONN(GND)			x				1	HBC-568
P3233	750	HV GATE CONN(+B)	_	—	X			-	1	<u>HBC-570</u>
U0100	211	LOST COMM (ECM)			х			х	1	HBC-572
U0100	212	LOST COMM (ECM)			X			х	1	<u>HBC-572</u>
U0100	530	LOST COMM (ECM)	_	—	Х	—	—	х	1	<u>HBC-572</u>

< ECU DIAGNOSIS >

		CONSULT-III display		FRZF	Hybrid	High volt- age bat-	Charge			Reference	А
DTC	INF code	Item	GST display	Informa- tion data	system warning light	tery warning light	warning light	MIL	Trip	page	B
U0110	159	LOST COMM (MG ECM)	_	х	х		_	_	1	<u>HBC-574</u>	D
U0110	160	LOST COMM (MG ECM)	—	х	х	—	—		1	HBC-574	
U0110	656	LOST COMM (MG ECM)	—	х	х	—	—		1	HBC-574	HBC
U0110	657	LOST COMM (MG ECM)	_	х	х	_	_	_	1	HBC-574	
U0115	901	LOST COMM (COUNT)	—	—	_	—	—		1	HBC-580	
U0129	220	LOST COMM (BRAKE)	—	—	_	—	—		1	HBC-582	D
U0129	222	LOST COMM (BRAKE)	_	_	_	_	_	_	1	HBC-582	
U0129	528	LOST COMM (BRAKE)	—	—	—	—	—		1	HBC-582	E
U0129	529	LOST COMM (BRAKE)	—	—	х	—	—		1	HBC-583	
U0131	433	LOST COMM (EPS)	—	_	—	—	—		1	HBC-585	
U0131	434	LOST COMM (EPS)	_	_	_	_	_	_	1	HBC-585	F
U0424	537	HVAC COTROL UNIT	_	х	_	_	—	_	1	HBC-586	
U1001	146	CAN COMM CIRCUIT	_	_	х	_	—	_	1	HBC-587	G
U1001	435	CAN COMM CIRCUIT	_	_	х	_	_	_	1	HBC-587	0
U1001	594	CAN COMM CIRCUIT	—	—	—	—	—		1	HBC-587	
U1001	827	CAN COMM CIRCUIT	—	—	—	_	—		1	HBC-587	Н
U1001	919	CAN COMM CIRCUIT	—	—	х	—	—		1	HBC-587	
U1001	920	CAN COMM CIRCUIT	_	_	х	_	_	_	1	<u>HBC-587</u>	1

*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.

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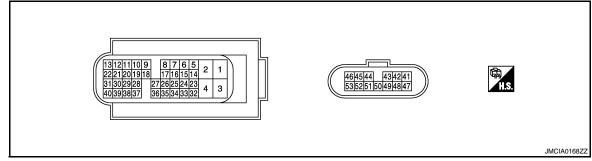
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MG ECU

Reference Value

INFOID:000000004212202

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.

Termi	nal No.		Descriptio	on		Value
+	-	Wire color	Signal name	Input/ Output	Condition	(Approx.)
41	42	0 - L/G	Generator re- solver 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. CH1 CH2 CH2 CH3 A A JMCIA0028GB
43	44	L/Y - O/L	Generator re- solver 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. CH1 CH2 CH2 CH3 CH3 A CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3

Termi	nal No.		Descriptio	on		Value
+	_	Wire color	Signal name	Input/ Output	Condition	Value (Approx.)
46	45	W/L - W	Generator re- solver 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. CH1 CH2 CH2 CH3 A A JMCIA0028GB
48	49	L/Y - 0/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. CH1 CH2 CH2 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3
51	47	0 - 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. CH1 CH2 CH2 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3

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Termi	nal No.		Descriptio	n		
+	-	Wire color	Signal name	Input/ Output	Condition	Value (Approx.)
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. CH1 CH2 CH2 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3 CH3
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).

Termir	nal No.		Description			Value	
+	_	Wire color	Signal name	Input/ Output	Condition	Value (Approx.)	A
27	3	BR - B	Communication request signal	Input/ Output	[Ignition switch: ON]	Refer to CH2 signal.	B HBC D
26	3	LG - B	Communication signal from hy- brid vehicle con- trol 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).	F G H
24	3	L/O - B	Communication clock signal	Input/ Output	[Ignition switch: ON]	10 - 14V	J
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).	K L M
18	3	Y - B	Communication request signal	Input/ Output	[Ignition switch: ON]	Refer to CH1 signal.	O

HBC-629

Termi	nal No.		Description			Velue	
+	-	Wire color	Signal name	Input/ Output	Condition	Value (Approx.)	
17	3	V - B	Communication signal from hy- brid vehicle con- trol 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). CH1 CH1 CH2 GND JMCIA0029GB	
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 > PRECAUTION

PRECAUTIONS

General Precautions

- 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.

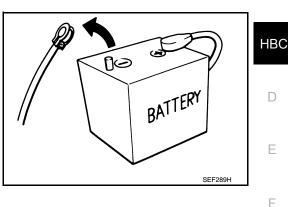
• Securely connect the hybrid vehicle control ECU harness connectors.

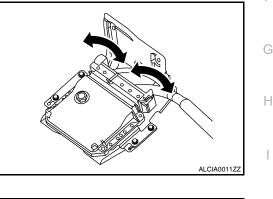
A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.

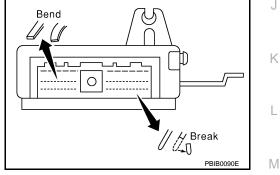
- Keep hybrid vehicle control system harness at least 10 cm (4 in) away from adjacent harness, to prevent hybrid vehicle control system malfunctions due to receiving external noise, degraded operation of ICs, etc.
- Keep hybrid vehicle control system parts and harness dry.

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- 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.

< PRECAUTION >

the two tester probes to contact.

damage the ECU power transistor.

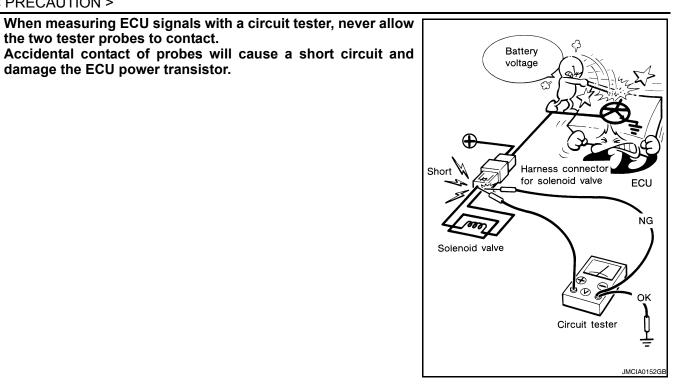
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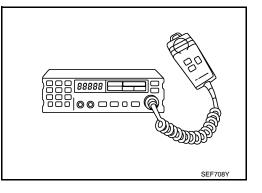
Precautions For High-Voltage System

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

Precautions for Inspecting the Hybrid Control System

· 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





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PRECAUTIONS

< PRECAUTION >

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.

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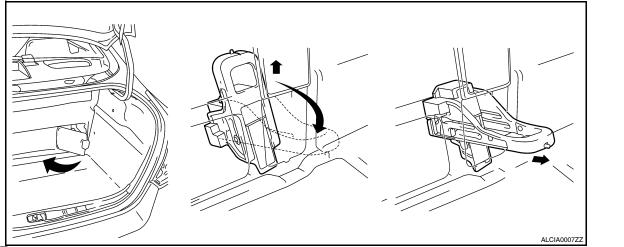
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NOTE:

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

 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"

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.

PRECAUTIONS

Precaution for replacing hybrid vehicle control ECU

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

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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 12volt 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

Connect both 12-volt battery cables.
 NOTE:
 Supply power using jumper cables if 12 yelt battery is discharded.

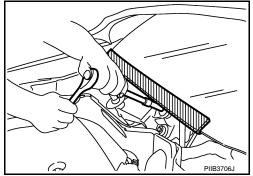
Supply power using jumper cables if 12-volt battery is discharged.

- 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

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



< PREPARATION >

PREPARATION

PREPARATION

Commercial Service Tools

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Tool name (Kent-Moore No.)	Description	HBC
Insulation gloves	Guaranteed insulation performance	for 1000V/300A
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HBC-635

<u>< ON-VEHICLE MAINTENANCE ></u> ON-VEHICLE MAINTENANCE > COOLANT(FOR INVERTER)

Inspection

INFOID:000000004212212

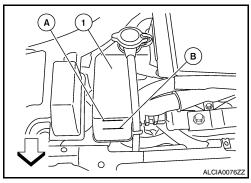
WARNING:

- 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)

- 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 <u>HBC-636.</u> <u>"Replacement"</u>.

Replacement

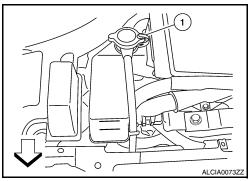
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DRAINING COOLANT

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.
- Remove the inverter cooling reservoir tank cap (1).

 ←: Front

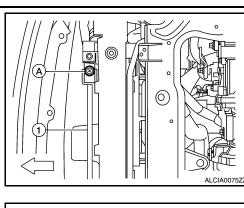


2. Remove the engine under cover. Refer to EXT-12. "Removal and Installation".

COOLANT(FOR INVERTER)

< ON-VEHICLE MAINTENANCE >

- 3. Loosen the drain plug (A) on the sub radiator (1) and drain the coolant.
 - ⇐: Front



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- 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.

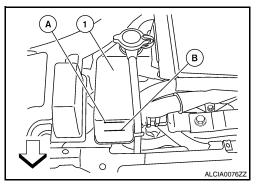
Drain plug : 0.78 - 1.56 N·m (0.08 - 0.15 kg-m, 7 - 13 in-lb)

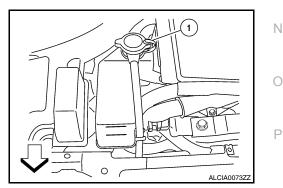
FILLING COOLANT

- 1. Slowly pour coolant into the inverter cooling reservoir tank (1) until the coolant level reaches MAX (A).
 - ⇐: Front
- 2. Turn ignition switch ON.
- Select "INV WATER PUMP" in "ACTIVE TEST" mode with CON-SULT-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





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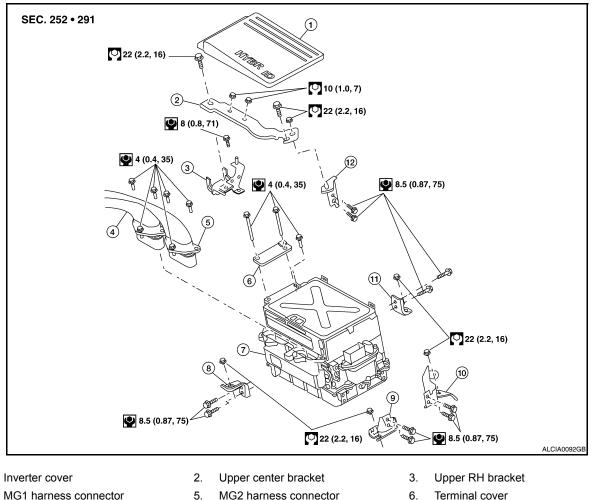
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< REMOVAL AND INSTALLATION >

REMOVAL AND INSTALLATION INVERTER WITH CONVERTER ASSEMBLY

Exploded View

INFOID:000000004212214



- MG1 harness connector 4.
- 7. Inverter

10. Rear LH bracket

1.

- 5. MG2 harness connector
- Lower RH bracket 8.
- 11. Rear RH bracket

INFOID:000000004212215

Lower LH bracket

12. Upper LH bracket

9.

Removal and Installation

REMOVAL

- 1. Drain the coolant from the inverter cooling system. Refer to HBC-636, "Replacement".
- 2. Remove the inverter cover.
- 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.

HBC-638

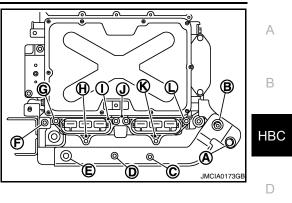
INVERTER WITH CONVERTER ASSEMBLY

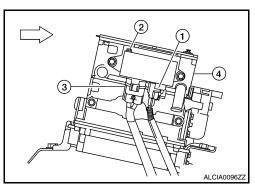
< REMOVAL AND INSTALLATION >

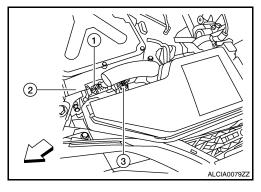
- 8. Disconnect the MG1 and MG2 connectors from the inverter as follows.
 - 1. Remove bolts G, I, J and L as shown.
 - 2. Remove bolts H and K as shown.
 - 3. Disconnect the MG1 and MG2 connectors from the inverter.
- 9. Remove the MG1 and MG2 harness clips from the bracket and set the MG1 and MG2 harness 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).
 - \Leftarrow : Front
- 14. Remove the frame wire inverter connector bolt (2) and disconnect the frame wire inverter connector (3) from the inverter (4).

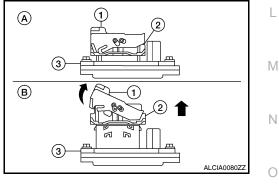
- 15. Disconnect the engine room harness connector (1) from the inverter (2).
 - EGI harness connector (3)
 - \Leftarrow : Front

- 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.

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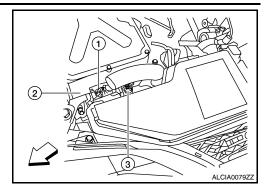
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INVERTER WITH CONVERTER ASSEMBLY

< REMOVAL AND INSTALLATION >

- 17. Disconnect the EGI harness connector (3) from the inverter (2).
 - Engine room harness connector (1)
 - \Leftarrow : Front

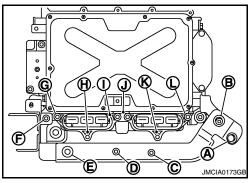


- 18. Remove the inverter nuts.
- 19. Remove the inverter from the vehicle.
- 20. Remove any necessary brackets from the inverter.

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

< REMOVAL AND INSTALLATION >

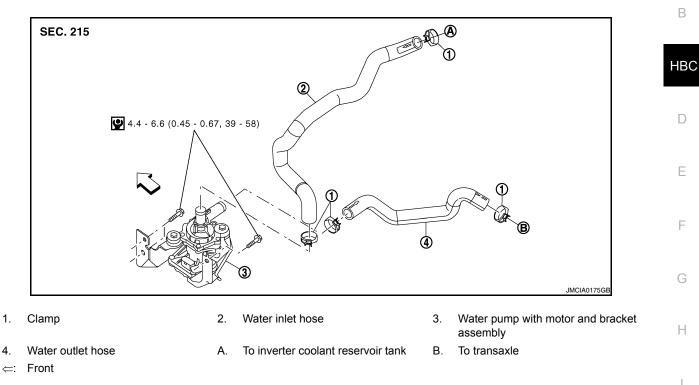
WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

Exploded View

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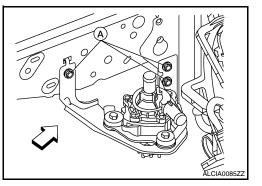


Removal and Installation

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. J

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ACCELERATOR PEDAL POSITION SENSOR

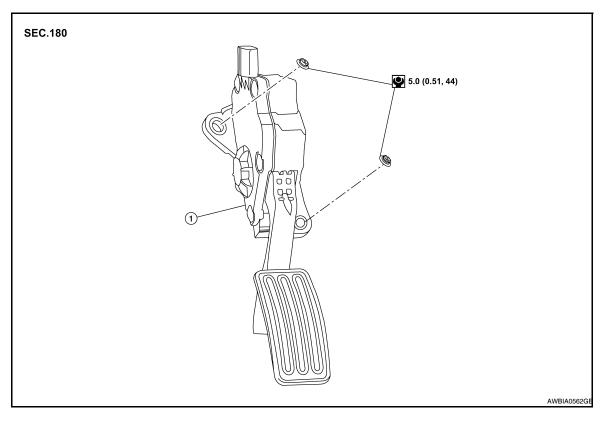
< REMOVAL AND INSTALLATION >

ACCELERATOR PEDAL POSITION SENSOR

Exploded View

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1. Accelerator pedal assembly

Removal and Installation

REMOVAL

- 1. Disconnect the 12-volt battery negative terminal.
- 2. Disconnect the accelerator position sensor electrical connector.
- 3. Remove the accelerator pedal nuts.
- Remove the accelerator pedal assembly.
 For electrical inspection of the accelerator pedal position sensor. Refer to <u>HBC-499</u>, "<u>Description</u>".
 CAUTION:
 - Do not disassemble the pedal assembly.
 - Avoid impact from dropping during handling.
 - Keep the pedal assembly away from water.

INSTALLATION

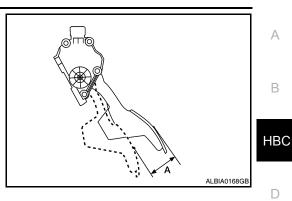
Installation is in the reverse order of removal.

• Check the accelerator pedal for smooth operation. There should be no binding or sticking when applying or releasing the accelerator pedal.

ACCELERATOR PEDAL POSITION SENSOR

- < REMOVAL AND INSTALLATION >
- 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 <u>HBC-12</u>, "<u>ADDITIONAL SERVICE WHEN</u> <u>REPLACING CONTROL UNIT : Special Repair Requirement"</u>.



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< REMOVAL AND INSTALLATION >

HV ECU

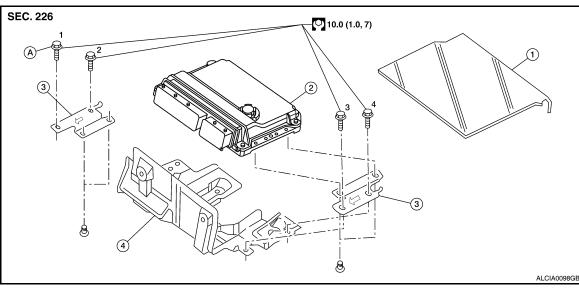
Precaution for replacing hybrid vehicle control ECU

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:000000004212221



- 1. Waterproof sheet
 - Mounting bracket
- 2. HV ECU A. Bolt

- 3. HV ECU bracket
- ⇐: Front

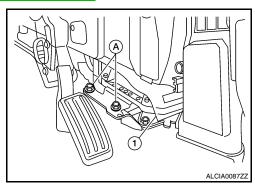
Removal and Installation

INFOID:000000004212222

REMOVAL

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- 1. Remove the console side finisher LH. Refer to IP-12, "Removal and Installation".
- 2. Remove the bolts (A) from the HV ECU (1).

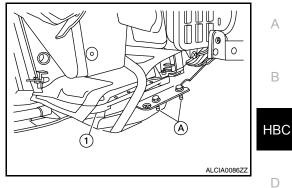


3. Remove the instrument side panel RH. Refer to <u>IP-12, "Removal and Installation"</u>.

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< REMOVAL AND INSTALLATION >

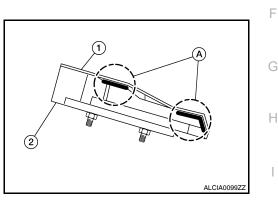
- 4. Remove the bolts (A) from the HV ECU (1).
- 5. Disconnect the drain hose from the heater and cooling unit assembly.
- 6. Pull out the HV ECU to RH side.
- 7. Disconnect the HV ECU harness connector from the HV ECU, and remove the HV ECU from the vehicle.
- 8. If necessary, remove the screws and 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 <u>HBC-644, "Exploded View"</u>.
- 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.



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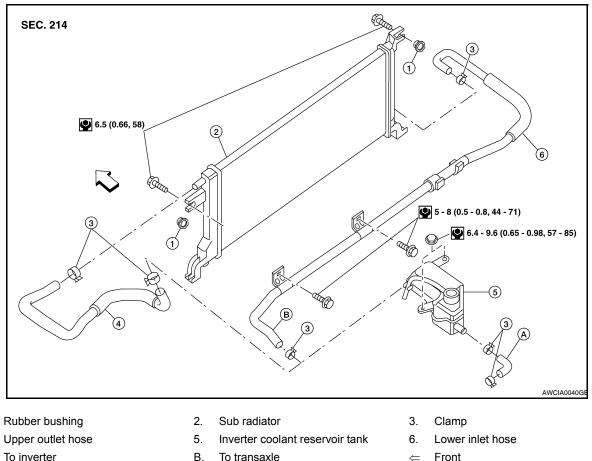
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< REMOVAL AND INSTALLATION >

SUB RADIATOR

Exploded View

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- A. To inverter

В. To transaxle

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Removal and Installation

REMOVAL **CAUTION:**

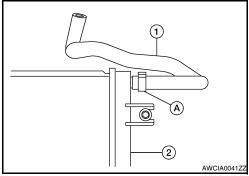
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Do not damage or scratch the radiator and condenser assembly and sub radiator core when removing.

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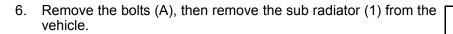
- 1. Drain the coolant from the inverter cooling system. Refer to HBC-636, "Replacement".
- 2. Remove the air duct. Refer to EM-24, "Removal and Installation".
- 3. Remove the front grille. Refer to EXT-16, "Removal and Installation".
- 4. Disconnect the clamp (A) and the upper outlet hose (1) from the sub radiator (2).

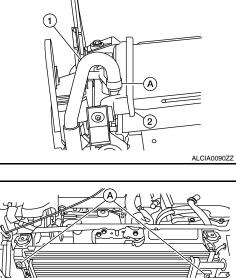


SUB RADIATOR

< REMOVAL AND INSTALLATION >

5. Disconnect the clamp (A) and the lower inlet hose (1) from the sub radiator (2).





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INSTALLATION Installation is in the reverse order of removal. А

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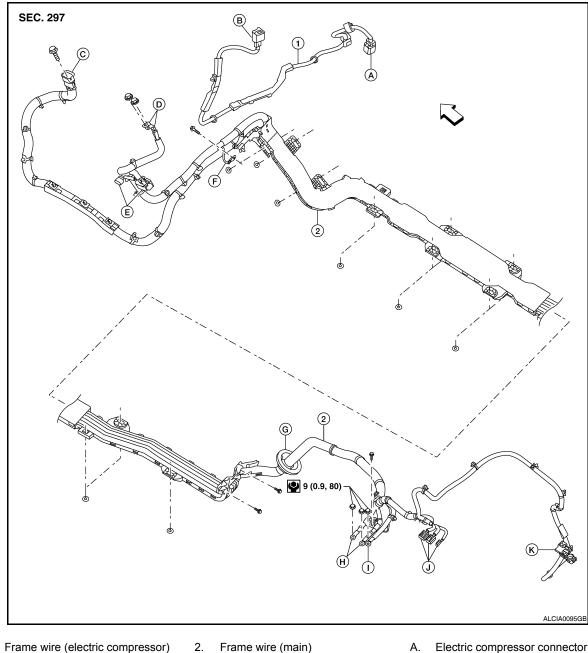
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< REMOVAL AND INSTALLATION >

FRAME WIRE

Exploded View

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- 1. Frame wire (electric compressor) 2. В. Electric compressor inverter connec- C.
- tor E. **EPS ECU connectors**
- H. Frame wire terminals to HV battery
- K. 12 volt terminal to 12 volt battery
- Frame wire (main)
- Frame wire inverter connector
- F. EPS ECU bonding wire

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- 12 volt terminal to HV battery ⇐: Front
- D. HV fuse box terminals
- G. Grommet
- DC/DC converter connectors J.

INFOID:000000004212226

Removal and Installation

FRAME WIRE (MAIN)

Removal

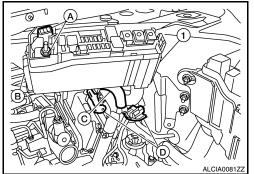
Disconnect the positive 12 volt terminal from the 12 volt battery. Refer to PG-69, "Removal and Installa-1. tion".

HBC-648

FRAME WIRE

< 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 <u>HBB-97</u>. <u>HBC</u> "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 <u>HBC-638</u>, "<u>Removal and Installa-</u><u>tion</u>".
- 12. Remove the frame wire inverter connector bolt and disconnect the frame wire inverter connector from the inverter. Refer to <u>HBC-638</u>, "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 <u>STC-58,</u> <u>"Removal and Installation"</u>.
- 17. Remove the EPS ECU harness retaining clips from the engine room.



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- 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".
- Remove the front terminal cover bolt from the inverter cover and disconnect the electric compressor inverter connector from the inverter. Refer to <u>HBC-638</u>, "<u>Removal and Installation</u>".
- Disconnect the electric compressor connector from the electric compressor. Refer to <u>HA-31, "Removal</u> <u>N</u> and <u>Installation"</u>.
- 4. Remove the front engine mounting insulator and bracket bolts. Refer to <u>EM-71, "Removal and Installa-</u> tion".
- 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

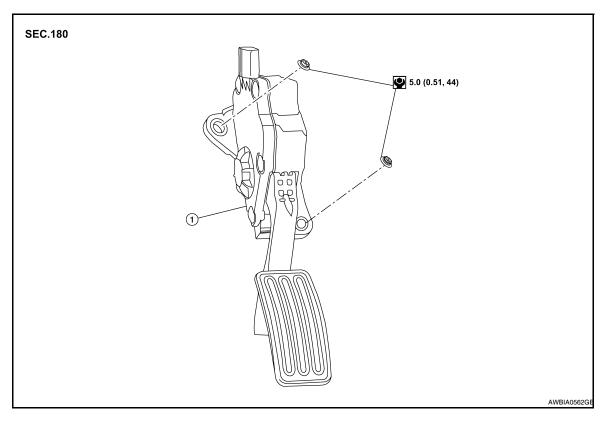
< REMOVAL AND INSTALLATION >

ACCELERATOR PEDAL ROD

Exploded View

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INFOID:000000004513182



1. Accelerator pedal assembly

Removal and Installation

REMOVAL

- 1. Disconnect the 12-volt battery negative terminal.
- 2. Disconnect the accelerator position sensor electrical connector.
- 3. Remove the accelerator pedal nuts.
- Remove the accelerator pedal assembly.
 For electrical inspection of the accelerator pedal position sensor. Refer to <u>HBC-499</u>, "<u>Description</u>".
 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.

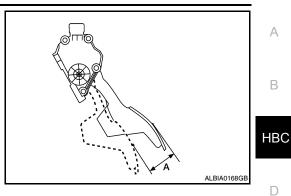
HBC-650

ACCELERATOR PEDAL ROD

< REMOVAL AND INSTALLATION >

· 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 <u>HBC-12</u>, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement"

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