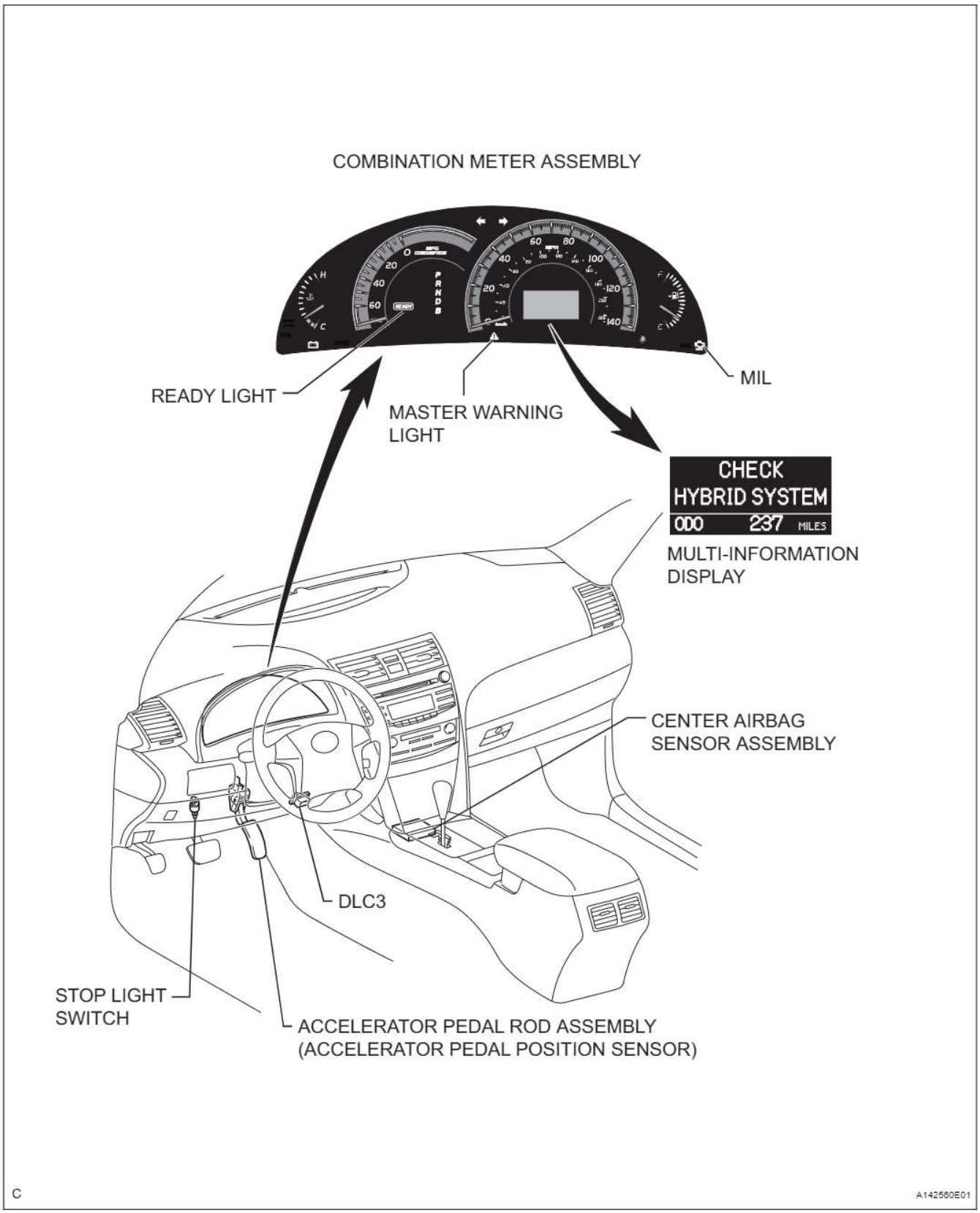
DEFINITION OF TERMS

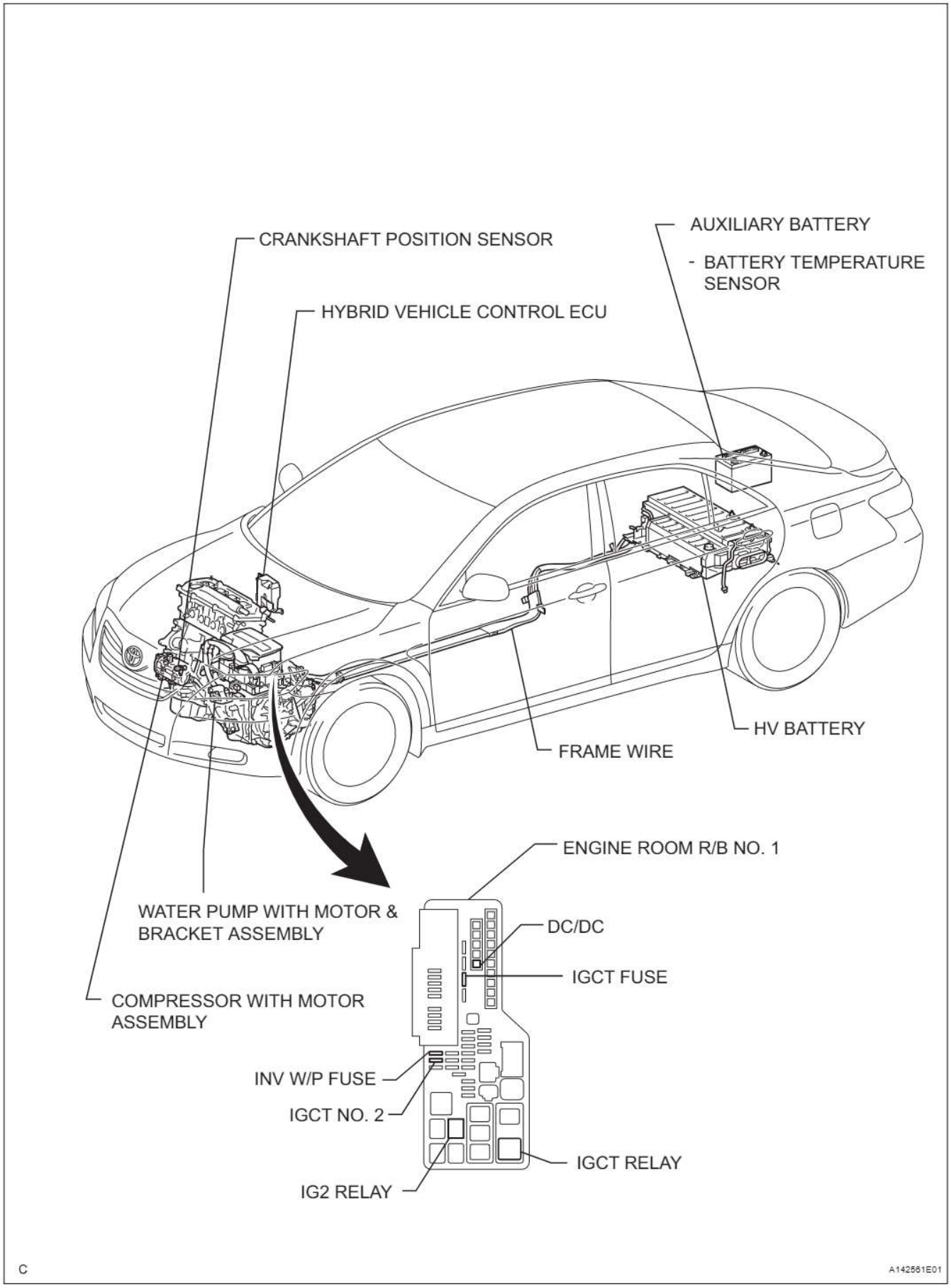
Terms	Definitions
Monitor description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).
Related DTCs	A group of diagnostic trouble codes that are output by the ECM based on the same malfunction detection logic.
Typical enabling condition	Preconditions that allow the ECM to detect malfunctions. With all preconditions satisfied, the ECM sets DTCs when the monitored value(s) exceeds malfunction threshold(s).
Sequence of operation	Order of monitor priority, applied if multiple sensors and components are involved in a single malfunction detection process. Each sensor and component are monitored in turn and subsequent items are not monitored until the previous detection operation completes.
Required sensors/components	Sensors and components used by the ECM to detect each malfunction.
Frequency of operation	Number of times the ECM checks for each malfunction during each driving cycle. "Once per driving cycle" means the ECM only performs checks for that malfunction once during single driving cycle. "Continuous" means that the ECM performs checks for that malfunction whenever enabling conditions are met.
Duration	Minimum time for which the ECM must detect continuous deviation in monitored value(s) in order to set a DTC. Timing begins when Typical Enabling Conditions are met.
Malfunction thresholds	Value beyond which the ECM determines malfunctions exist and sets DTCs.
MIL operation	Timing of MIL illumination after a malfunction is detected. "Immediate" means that the ECM illuminates the MIL as soon as the malfunction is detected. "2 driving cycle" means that the ECM illuminates the MIL if the same malfunction is detected again during the next driving cycle.

HV

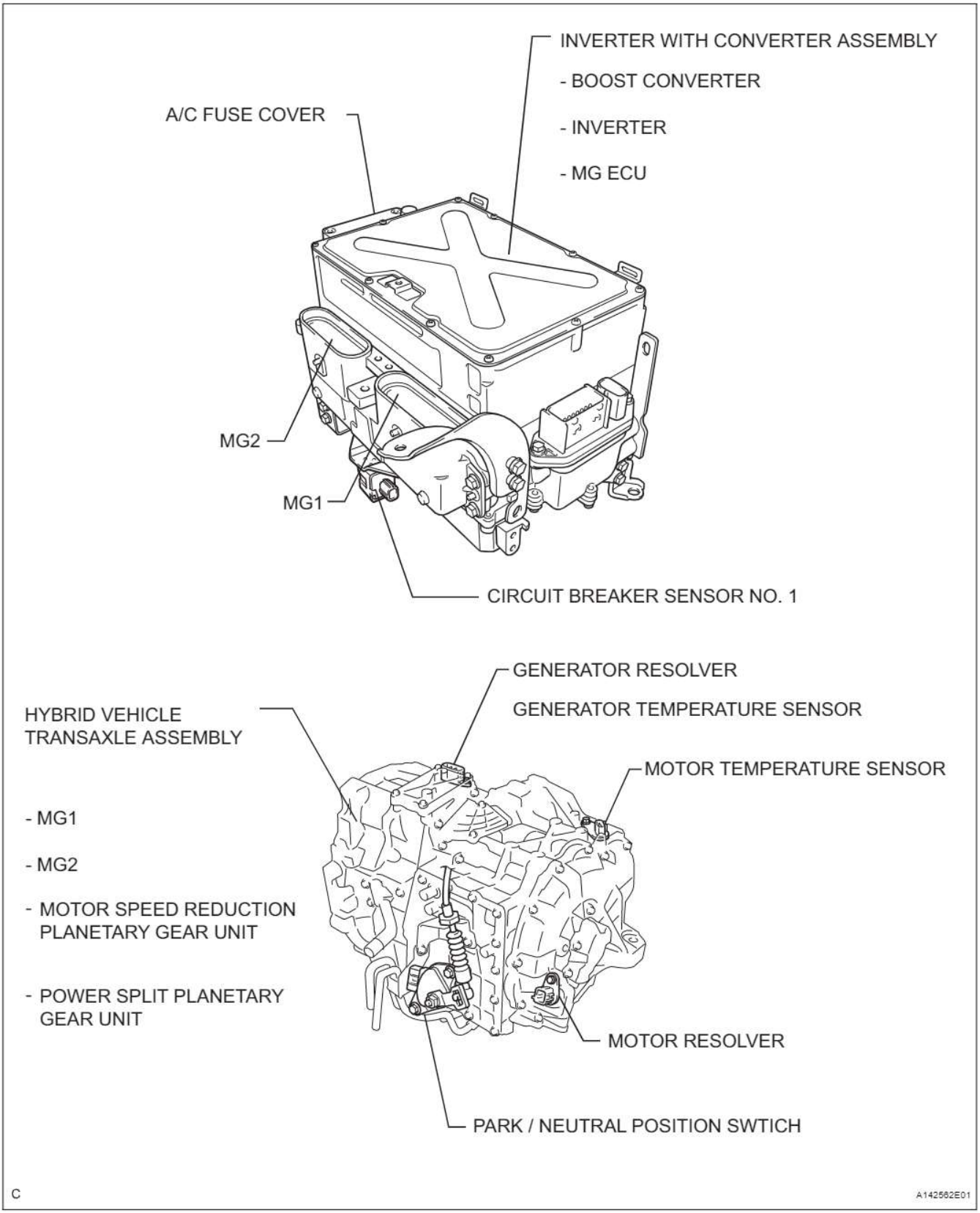
PARTS LOCATION

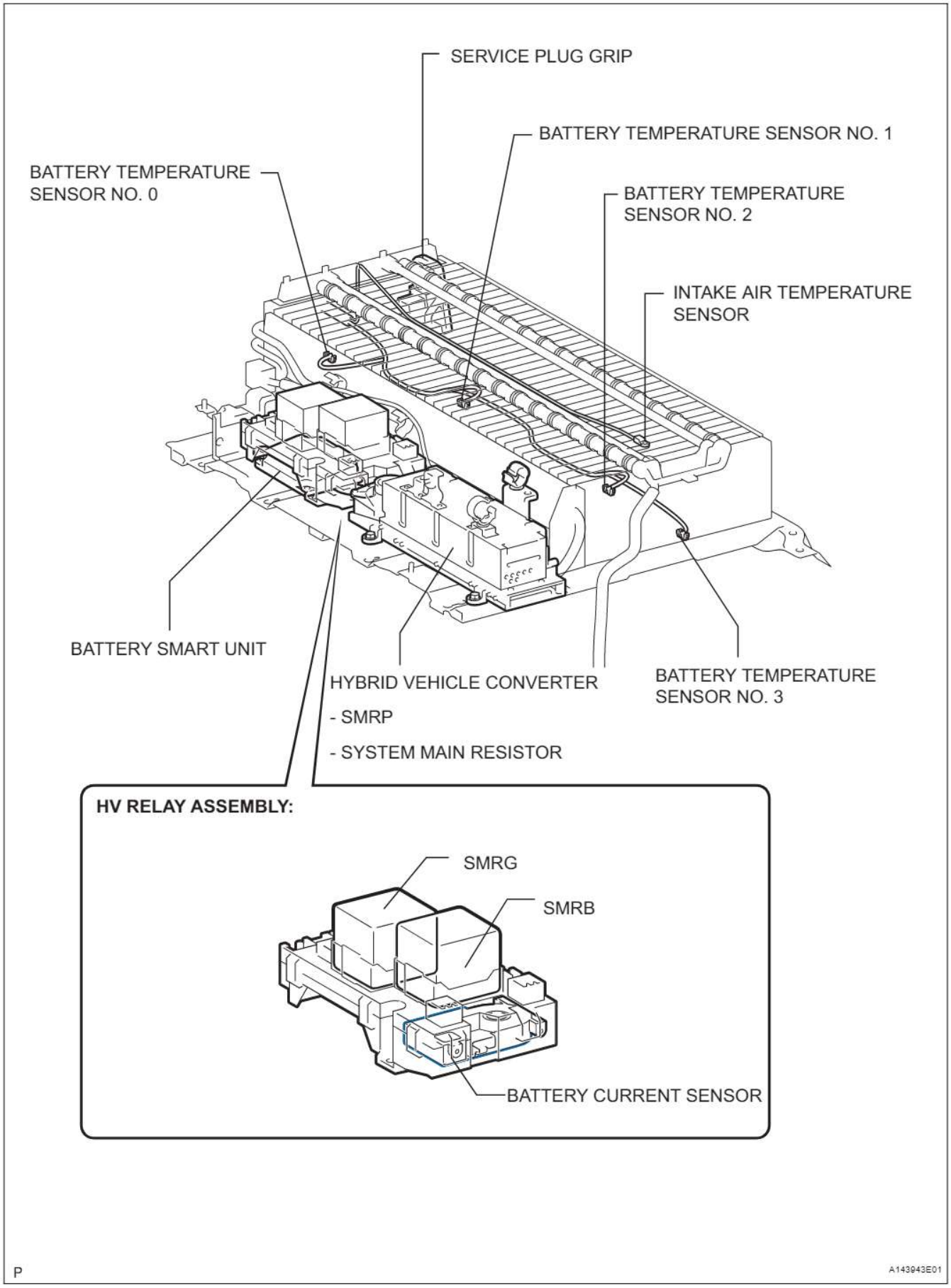


HV


CRANKSHAFT POSITION SENSOR
AUXILIARY BATTERY
- BATTERY TEMPERATURE SENSOR
HYBRID VEHICLE CONTROL ECU
HV BATTERY
FRAME WIRE
ENGINE ROOM R/B NO. 1
WATER PUMP WITH MOTOR & BRACKET ASSEMBLY
DC/DC
IGCT FUSE
COMPRESSOR WITH MOTOR ASSEMBLY
INV W/P FUSE
IGCT NO. 2
IGCT RELAY
IG2 RELAY
C
A142561E01

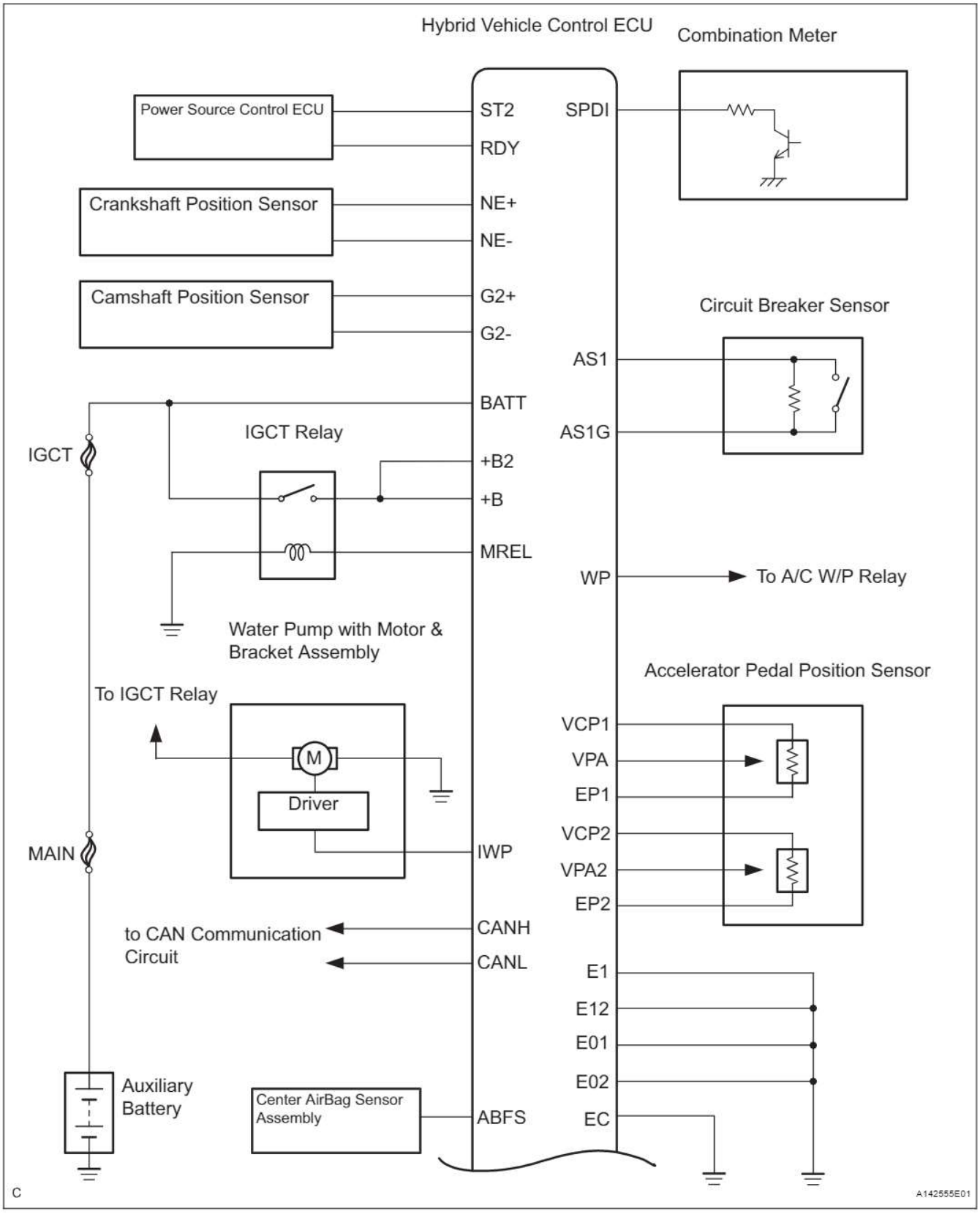
HV

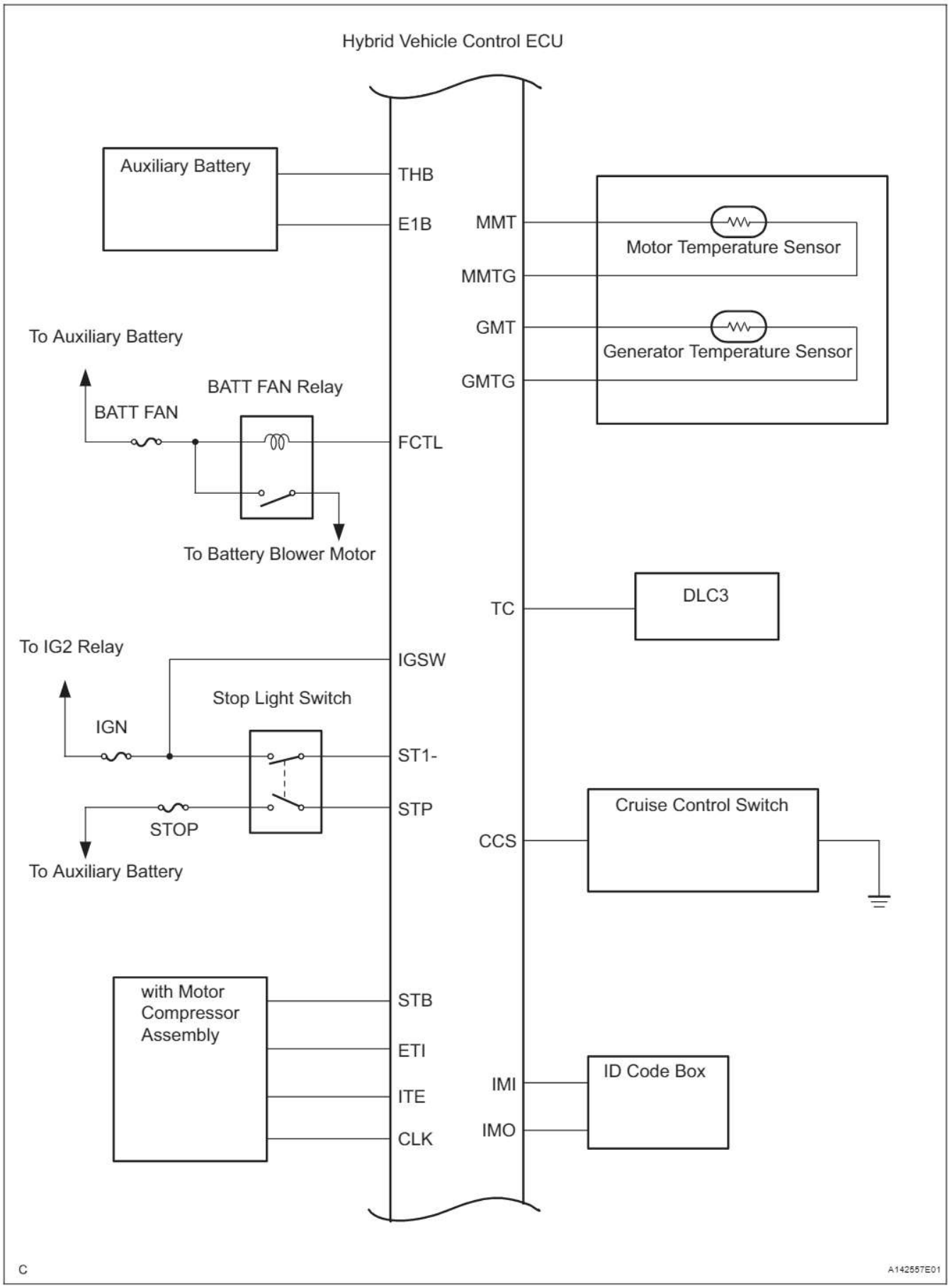

INVERTER WITH CONVERTER ASSEMBLY
- BOOST CONVERTER
- INVERTER
- MG ECU
A/C FUSE COVER
MG2
MG1
CIRCUIT BREAKER SENSOR NO. 1
GENERATOR RESOLVER
GENERATOR TEMPERATURE SENSOR
HYBRID VEHICLE TRANSAXLE ASSEMBLY
MOTOR TEMPERATURE SENSOR
- MG1
- MG2
- MOTOR SPEED REDUCTION PLANETARY GEAR UNIT
- POWER SPLIT PLANETARY GEAR UNIT
MOTOR RESOLVER
PARK / NEUTRAL POSITION SWTICH
C
A142562E01


SERVICE PLUG GRIP
BATTERY TEMPERATURE SENSOR NO. 1
BATTERY TEMPERATURE SENSOR NO. 0
BATTERY TEMPERATURE SENSOR NO. 2
INTAKE AIR TEMPERATURE SENSOR
BATTERY SMART UNIT
HYBRID VEHICLE CONVERTER
- SMRP
- SYSTEM MAIN RESISTOR
BATTERY TEMPERATURE SENSOR NO. 3
HV RELAY ASSEMBLY:
SMRG
SMRB
BATTERY CURRENT SENSOR
P
A143943E01

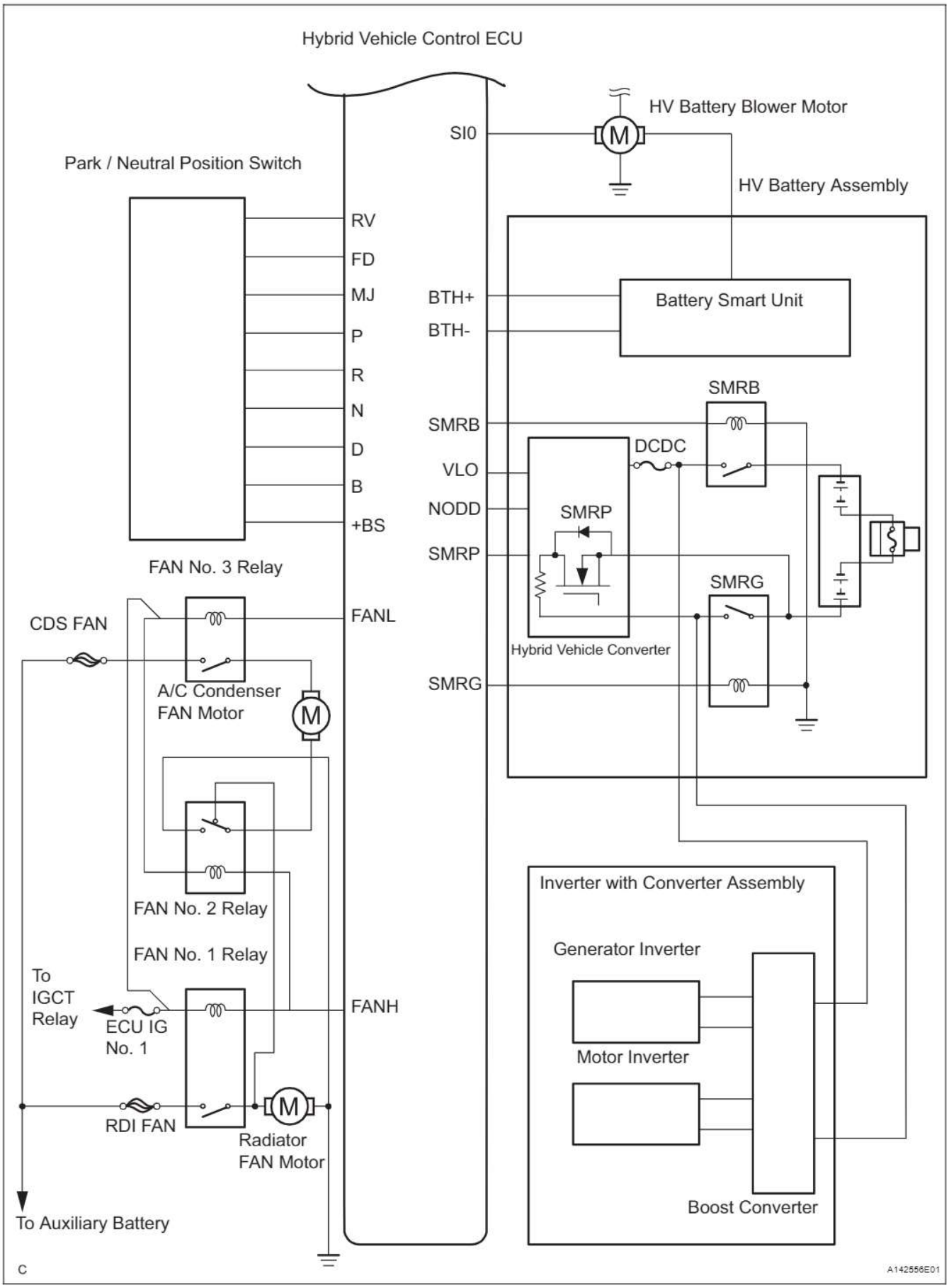
HV

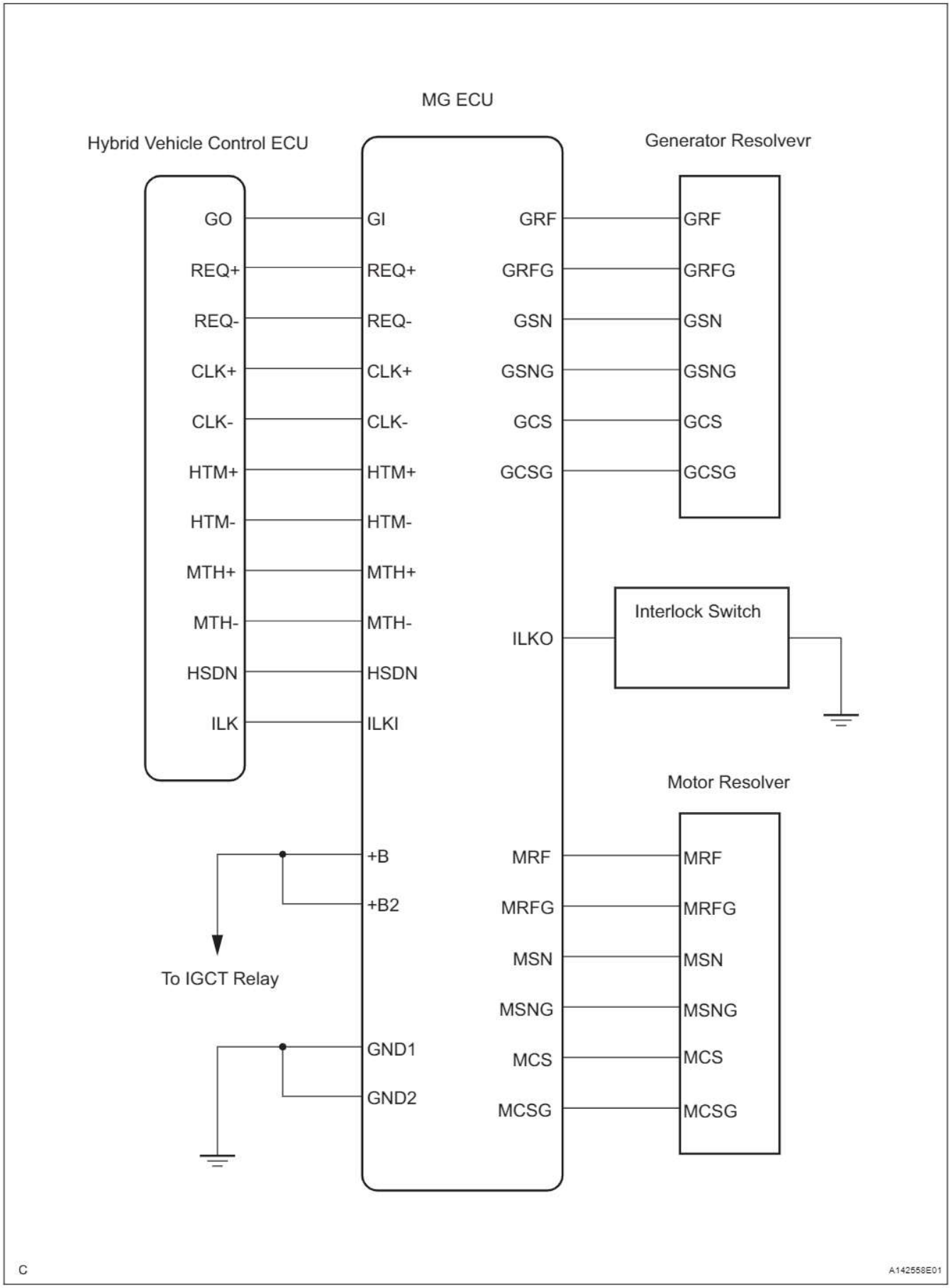
SYSTEM DIAGRAM




Hybrid Vehicle Control ECU
Auxiliary Battery
THB
E1B
MMT
MMTG
GMT
GMTG
Motor Temperature Sensor
Generator Temperature Sensor
To Auxiliary Battery
BATT FAN Relay
BATT FAN
FCTL
To Battery Blower Motor
TC
DLC3
To IG2 Relay
IGSW
Stop Light Switch
IGN
ST1-
STP
STOP
To Auxiliary Battery
CCS
Cruise Control Switch
with Motor Compressor Assembly
STB
ETI
ITE
CLK
IMI
IMO
ID Code Box
C
A142557E01

HV


Hybrid Vehicle Control ECU
SI0
HV Battery Blower Motor
M
Park / Neutral Position Switch
HV Battery Assembly
RV
FD
MJ
P
R
N
D
B
+BS
BTH+
BTH-
Battery Smart Unit
SMRB
SMRB
DCDC
VLO
NODD
SMRP
SMRP
SMRG
Hybrid Vehicle Converter
FAN No. 3 Relay
CDS FAN
FANL
A/C Condenser
FAN Motor
SMRG
Inverter with Converter Assembly
Generator Inverter
FAN No. 2 Relay
FAN No. 1 Relay
To
IGCT
Relay
ECU IG
No. 1
FANH
Motor Inverter
RDI FAN
Radiator
FAN Motor
Boost Converter
To Auxiliary Battery
C
A142556E01


MG ECU
Hybrid Vehicle Control ECU
Generator Resolvevr
GO
REQ+
REQ-
CLK+
CLK-
HTM+
HTM-
MTH+
MTH-
HSDN
ILK
GI
REQ+
REQ-
CLK+
CLK-
HTM+
HTM-
MTH+
MTH-
HSDN
ILKI
GRF
GRFG
GSN
GSNG
GCS
GCSG
GRF
GRFG
GSN
GSNG
GCS
GCSG
Interlock Switch
ILKO
Motor Resolver
+B
+B2
To IGCT Relay
GND1
GND2
MRF
MRFG
MSN
MSNG
MCS
MCSG
MRF
MRFG
MSN
MSNG
MCS
MCSG
C
A142558E01

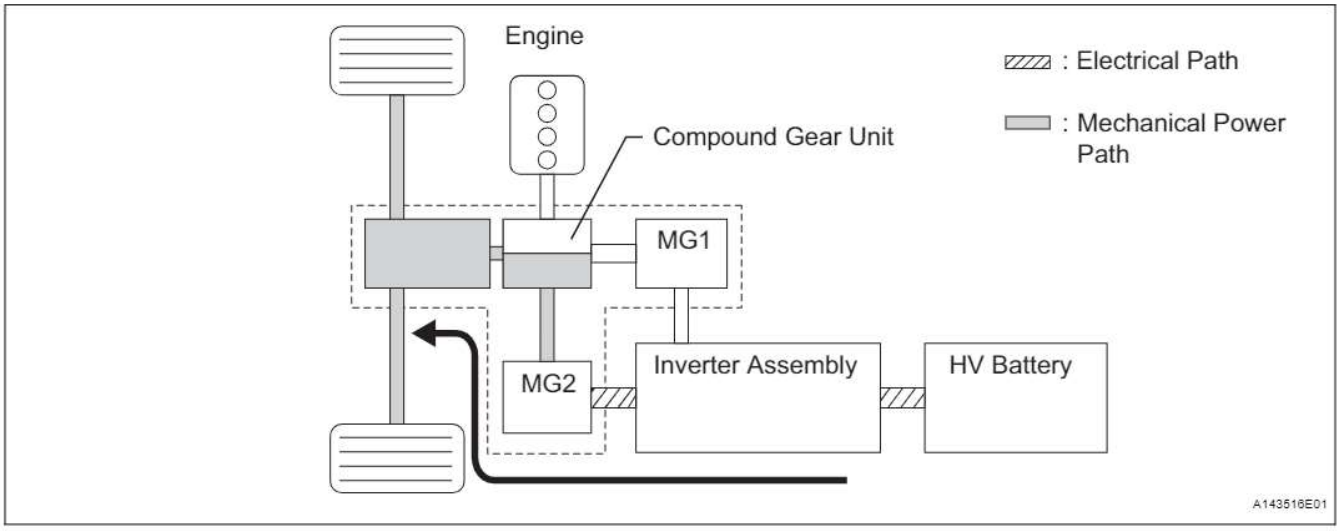
HV

SYSTEM DESCRIPTION

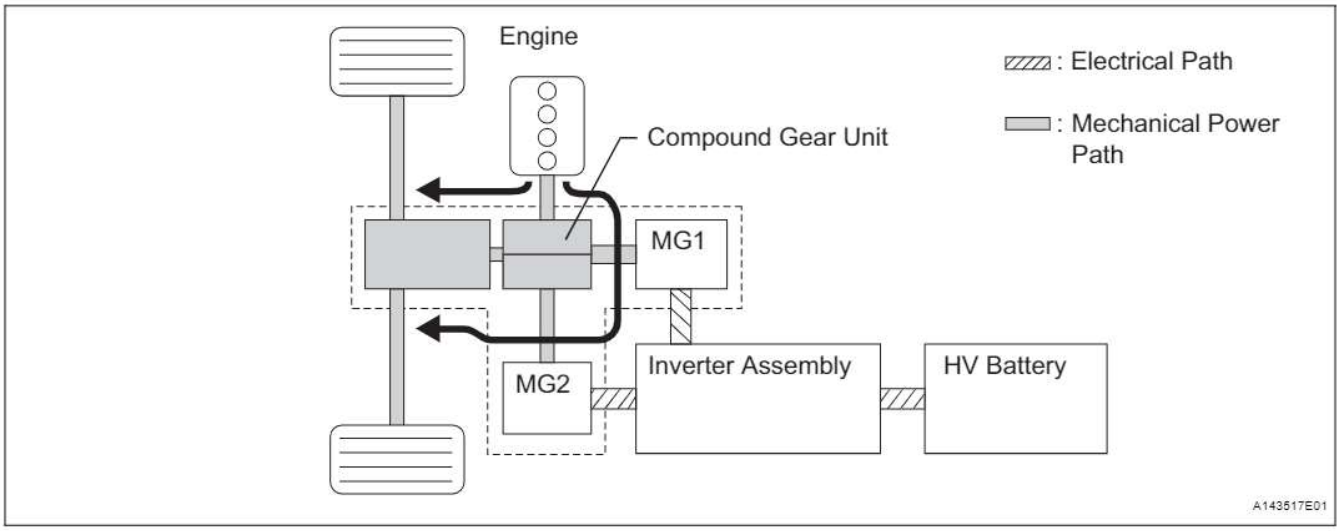
1. BASIC OPERATION

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

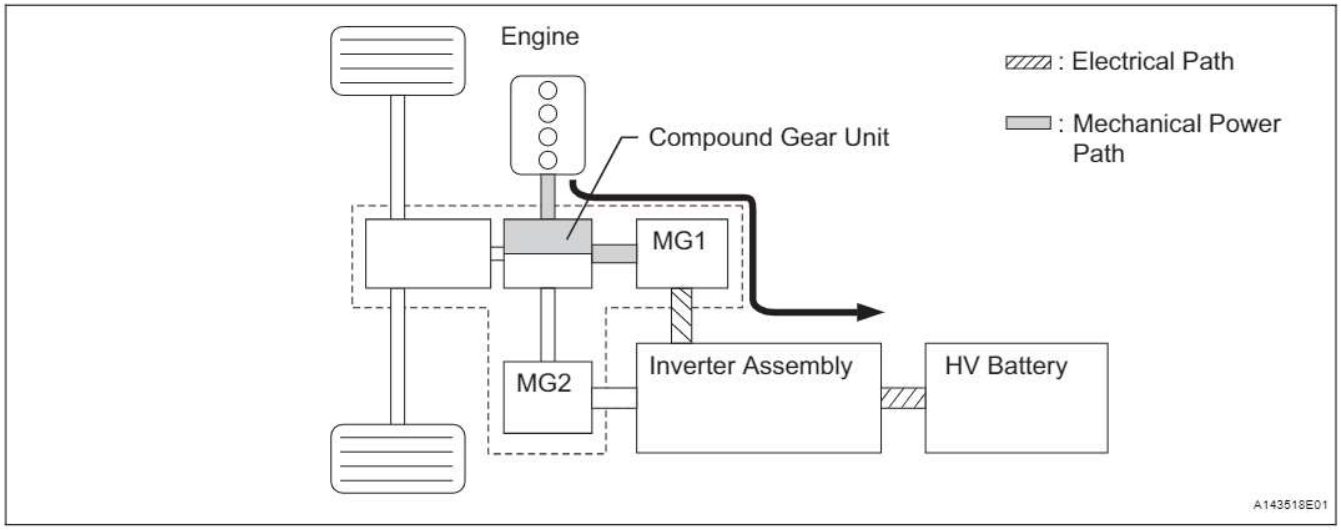
(a) Starting (Driven by MG2)
Supply of electrical power from the HV battery to MG2 provides force to drive the front wheels.



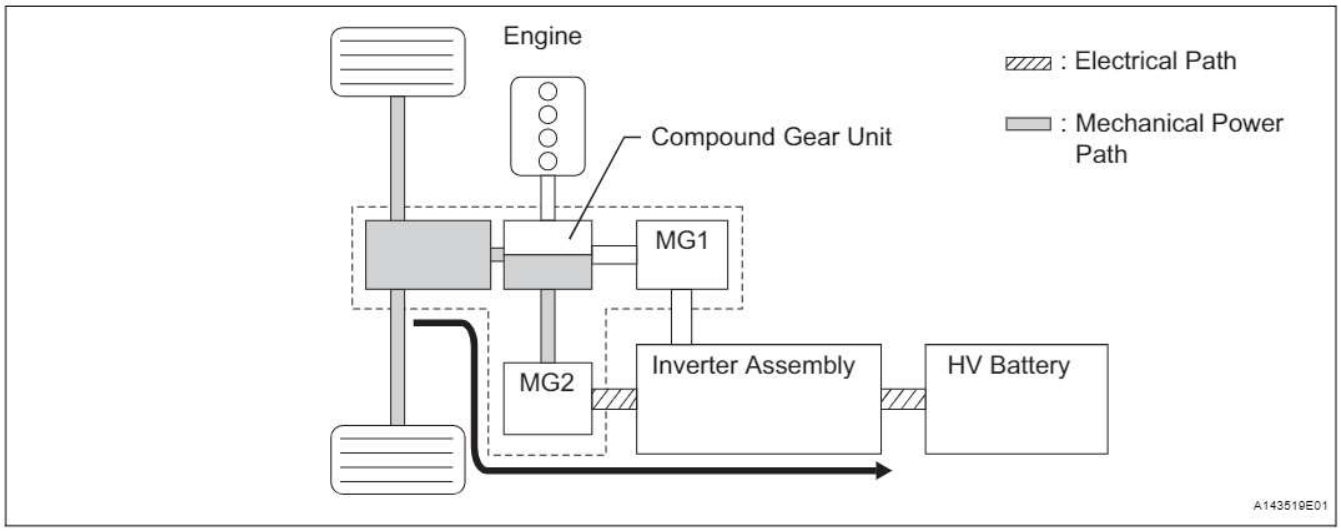
(b) During Acceleration with Engine
While the front wheels are being driven by the engine via the planetary gears, MG1 is also being driven by the engine via the planetary gears, in order to supply the electricity that MG1 generates to MG2.



(c) Charging the HV Battery
MG1 is rotated by the engine via the planetary gears, in order to charge the HV battery.

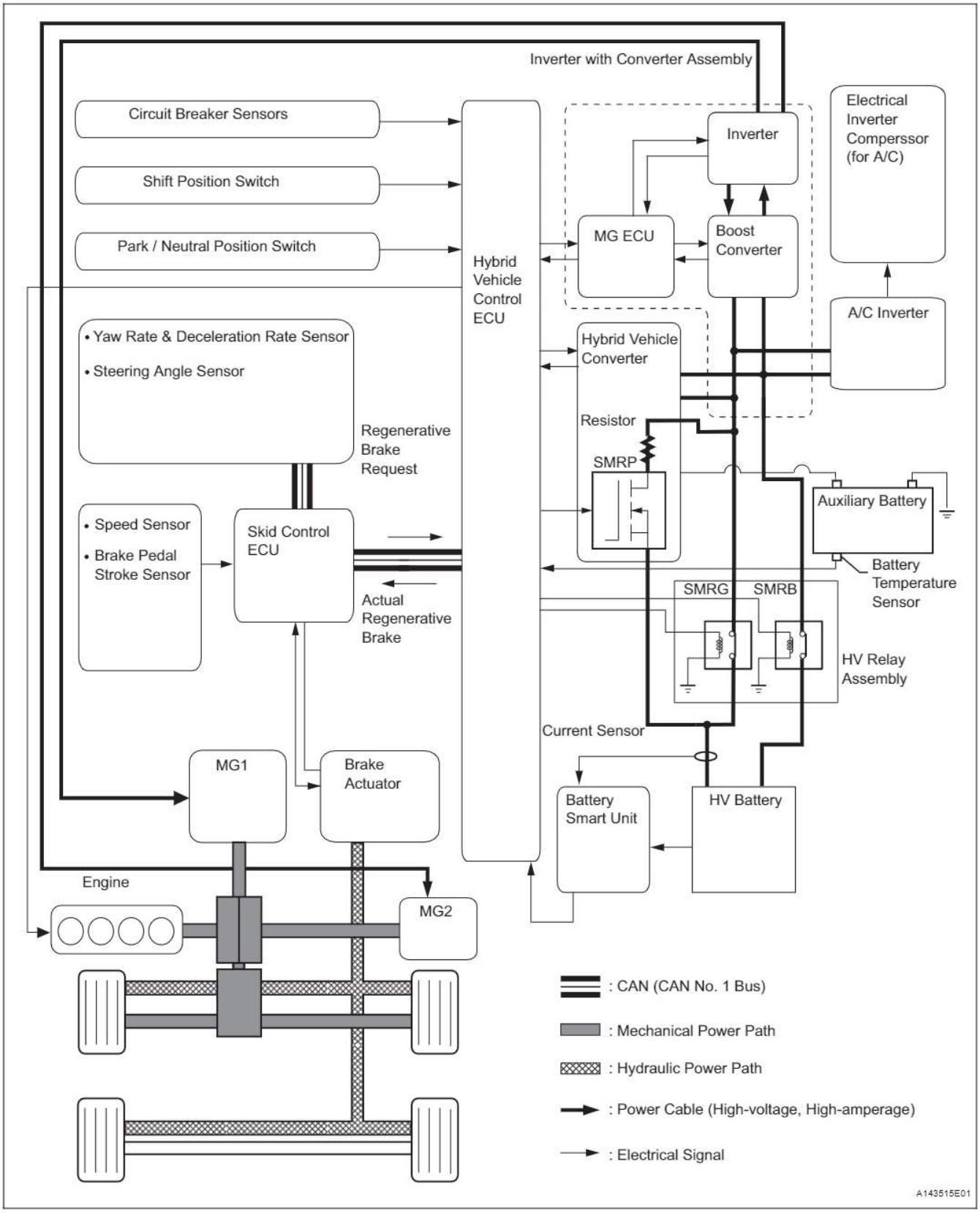


(d) During Deceleration Driving
When the vehicle is decelerating, kinetic energy from the front wheels is recovered and converted into electrical energy by means of MG2, and used to recharge the HV battery.



HV

2. SYSTEM DIAGRAM



HV

3. FUNCTION OF MAIN COMPONENTS

Item			Outline
Hybrid Vehicle Transaxle	MG1		• MG1, which is driven by the engine, generates high-voltage electricity in order to operate MG2 or charge the HV battery. Also, it functions as a starter to start the engine. • MG1 operates so that the gear ratio of the power split planetary gear unit will optimally suit the driving conditions of the vehicle.
	MG2		• Driven by electrical power from MG1 or the HV battery, and generates motive force for the front wheels. • During braking, or when the accelerator pedal is not depressed, it generates electricity to recharge the HV battery (Regenerative brake control).
	Compound Gear Unit	Power Split Planetary Gear	Distributes the engine's drive force as appropriate to directly drive the vehicle as well as drive MG1.
		Motor Speed Reduction Planetary Gear	Located between MG2 and the power split planetary gear, the motor speed reduction planetary gear reduces the rotational speed of MG2 in accordance with the characteristics of the planetary gear set, in order to increase torque.
HV Battery Unit	HV Battery		• Supplies electrical power to MG1 and MG2 in accordance with the driving conditions of the vehicle. • Recharged by MG1 and MG2 in accordance with the SOC and the driving conditions of the vehicle.
	Hybrid Vehicle Converter (DC/DC Converter)		Converts a voltage of DC 244.8 V into a DC voltage between 12 V and 14 V in order to supply electricity to body electrical components, as well as to recharge the auxiliary battery (DC 12 V). Contains SMRP.
	SMRP		Completes the initial connection of the high-voltage circuit through a resistor to allow a controlled precharge of the high-voltage system. SMRP is a semiconductor relay that is located in the hybrid vehicle converter (DC/DC converter.)
	Battery Smart Unit		Monitors the conditions of the HV battery and transmits this information to the hybrid vehicle control ECU.
	Service Plug Grip		Shuts off the high-voltage circuit of the HV battery when this plug grip is removed for vehicle inspection or maintenance.
Inverter with Converter Assembly	Inverter		A device that converts the high-voltage DC (HV battery) into AC (MG1 and MG2) and vice versa (converts AC into DC).
	Boost Converter		Boosts the maximum voltage of the HV battery from DC 244.8 to DC 650 V and vice versa (drops DC 650 V to DC 244.8 V).
	MG ECU		Controls the inverter and boost converter in accordance with the signals received from the hybrid vehicle control ECU, thus driving MG1 or MG2 causing them to generate electricity.
Hybrid Vehicle Control ECU			Effects comprehensive control of the THS II. • Information from each sensor as well as from the ECU (battery smart unit, skid control ECU, and EPS ECU) is received, and based on this information, the required torque and output power is calculated. The hybrid vehicle control ECU sends the calculated result to the inverter with converter assembly and skid control ECU. • Activates the ETCS-i (Electronic Throttle Control System-intelligent) in accordance with the target engine speed and required engine motive force. • Monitors the charging condition of the HV battery. • Controls the cooling fan of the HV battery. • Controls the hybrid vehicle converter.
Accelerator Pedal Position Sensor			Converts the accelerator pedal position into an electrical signal and outputs it to the hybrid vehicle control ECU.
Park / Neutral Position Switch			Converts the shift position into an electrical signal and outputs it to the hybrid vehicle control ECU.
HV Relay Assembly			Connects and disconnects the high-voltage power circuit between the HV battery and the inverter with converter assembly, through the use of a signal from the hybrid vehicle control ECU. Contains SMRB and SMRG.
Interlock Circuit (for A/C Fuse Cover and Service Plug Grip)			Verifies that the cover of both the inverter and the service plug grip have been installed.
Circuit Breaker Sensor			Detects the impact that is applied to the vehicle during a collision and transmits a signal to the hybrid vehicle control ECU. Upon receiving this signal, the hybrid vehicle control ECU operates the HV relay assembly to shut down the power supply.
Auxiliary Battery			Charged by the HV battery module power via the hybrid vehicle converter. Supplies power to the audio system, air conditioning system (except the electric inverter compressor) and the ECUs.

HV

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:
*: Use the intelligent tester.

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	CONNECT INTELLIGENT TESTER TO THE DLC3*

HINT:
If the display on the tester indicates a communication fault, inspect the DLC3.

NEXT

4	CHECK DTC AND SAVE FREEZE FRAME DATA* (See page HV-36), (See page HV-65)

HV

HINT:
Make sure to save freeze frame data because the data is necessary for a simulation test.

NEXT

5	CLEAR DTC* (See page HV-36)

NEXT

6	CONDUCT VISUAL INSPECTION

NEXT

7	CONFIRM PROBLEM SYMPTOMS

HINT:
If the engine does not start, perform steps 9 and 11 first.
Result

Result	Proceed to
Malfunction does not occur	A
Malfunction occurs	B

B → GO TO STEP 10

A

8	DUPLICATE CONDITIONS THAT PRODUCE SYMPTOMS

NEXT

9	CHECK FOR DTCS* (See page HV-36)

Result

Result	Proceed to
Trouble code	A
No code	B

B → GO TO STEP 11

A

10	REFER TO DTC CHART (See page HV-46)

NEXT

GO TO STEP 13

HV

11	CONDUCT BASIC INSPECTION

Result

Result	Proceed to
Malfunctioning parts not confirmed	A
Malfunctioning parts confirmed	B

B → GO TO STEP 15

A

12	CHECK ECU POWER SOURCE CIRCUIT

NEXT

13	CONDUCT CIRCUIT INSPECTION

Result

Result	Proceed to
Malfunction not confirmed	A

Result	Proceed to
Malfunction confirmed	B

B → GO TO STEP 16

A

14	CHECK FOR INTERMITTENT PROBLEMS (See page HV-17)

NEXT

GO TO STEP 16

15	CONDUCT PARTS INSPECTION

NEXT

16	IDENTIFY PROBLEM

NEXT

17	ADJUST AND/OR REPAIR

NEXT

18	CONDUCT CONFIRMATION TEST

NEXT

END

CHECK FOR INTERMITTENT PROBLEMS

1. CHECK FOR INTERMITTENT PROBLEMS

(a) Perform a simulation test (See page IN-72).

(1) For the simulation test, reproduce the driving conditions that were present when the trouble occurred. These conditions should be based on the customer's comments and freeze frame data that is recorded with DTCs, such as the opening angle of the accelerator pedal, SOC, engine coolant temperature, engine rpm, and MG1/MG2 rpm and torque.

(b) Check the connector(s) and terminal(s) (See page IN-67).

(c) Wiggle the harness and connector(s) (See page IN-72).

(d) Heat or cool suspected parts (See page IN-72).

NOTICE:

Do not directly heat or cool the MG ECU with the inverter cover removed.

HV

REGISTRATION

NOTICE:
The Vehicle Identification Number (VIN) must be input into the replacement HV control ECU.
HINT:
The VIN is a 17-digit alphanumeric vehicle identification number. The intelligent tester is required to register the VIN.

1. INPUT INSTRUCTIONS

(a) General VIN input instructions for use with the intelligent tester are as follows.
  (1) Intelligent Tester
  The arrow buttons (UP, DOWN, RIGHT, and LEFT) and number buttons (0 to 9) are used to input the VIN.
  (2) Cursor Operation
  To move the cursor around the tester screen, press the RIGHT and LEFT buttons.

(b) Input of Letters
  (1) Press the UP and DOWN buttons to select the desired letter.
  (2) After selection, the cursor should move.

(c) Input of Numbers
  (1) Press the number button that corresponds to the number that you want to input.
  (2) Select or input the correct character using the UP and DOWN buttons, or the number buttons.
  HINT:
  Numbers can be selected using the UP and DOWN buttons.

(d) Correction
  (1) After input, the cursor should move.
  (2) When correcting a character that has been input, put the cursor on the character using the RIGHT and LEFT buttons.

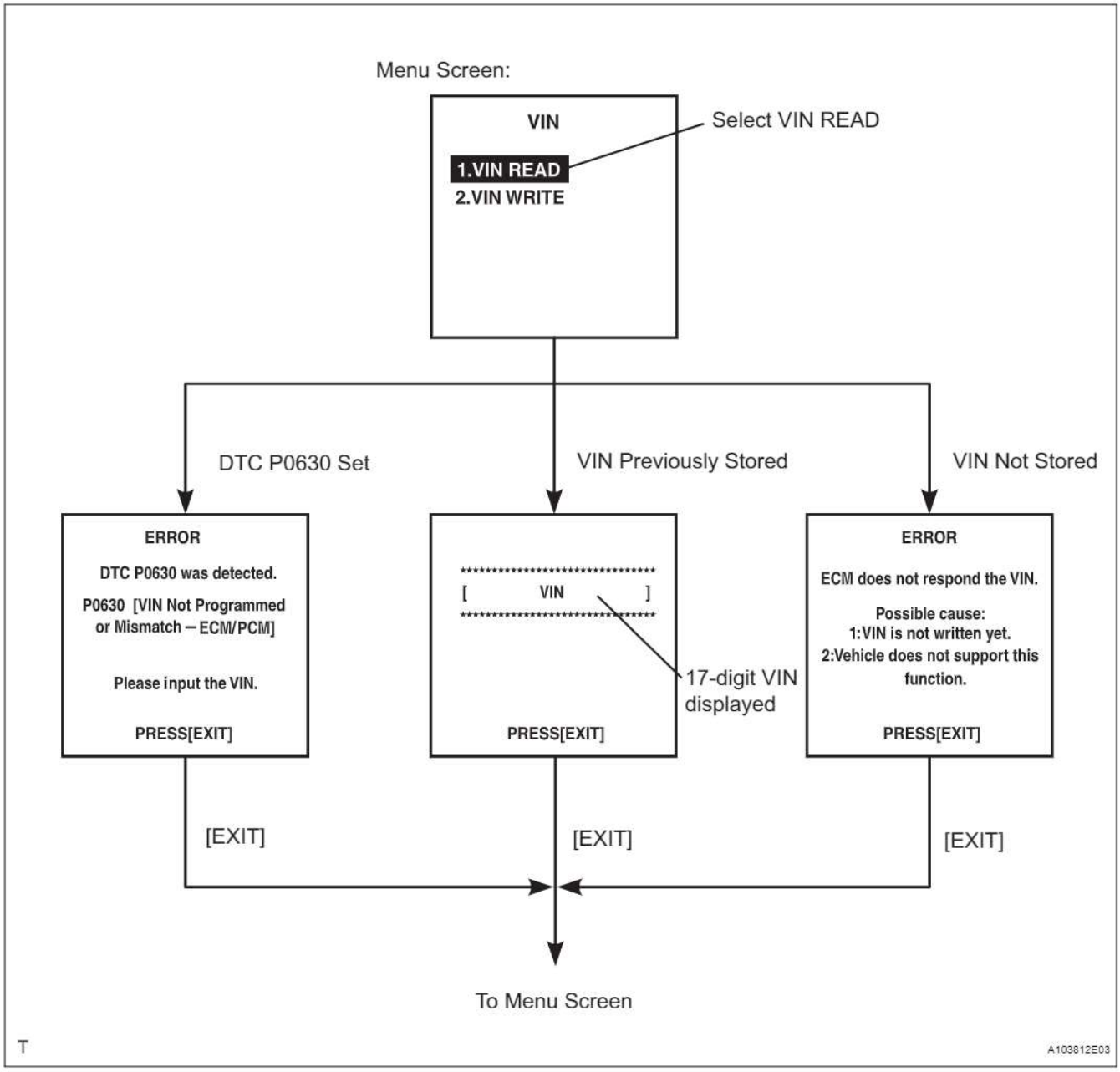
(e) Finishing Input Operation
  (1) Make sure that the VIN input using the tester matches the vehicle's VIN.
  (2) Press the ENTER button on the tester.

2. READ VIN (Vehicle Identification Number)

(a) The VIN reading process is explained using a flowchart as shown. Reading the VIN stored in the HV control ECU is necessary when comparing it to the VIN of the vehicle.
  (1) Read the VIN using the intelligent tester.
  (2) Check the vehicle's VIN.
  (3) Connect the intelligent tester to the DLC3.
  (4) Turn the power switch on (IG).
  (5) Turn the tester on.

HV

(6) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / VIN.



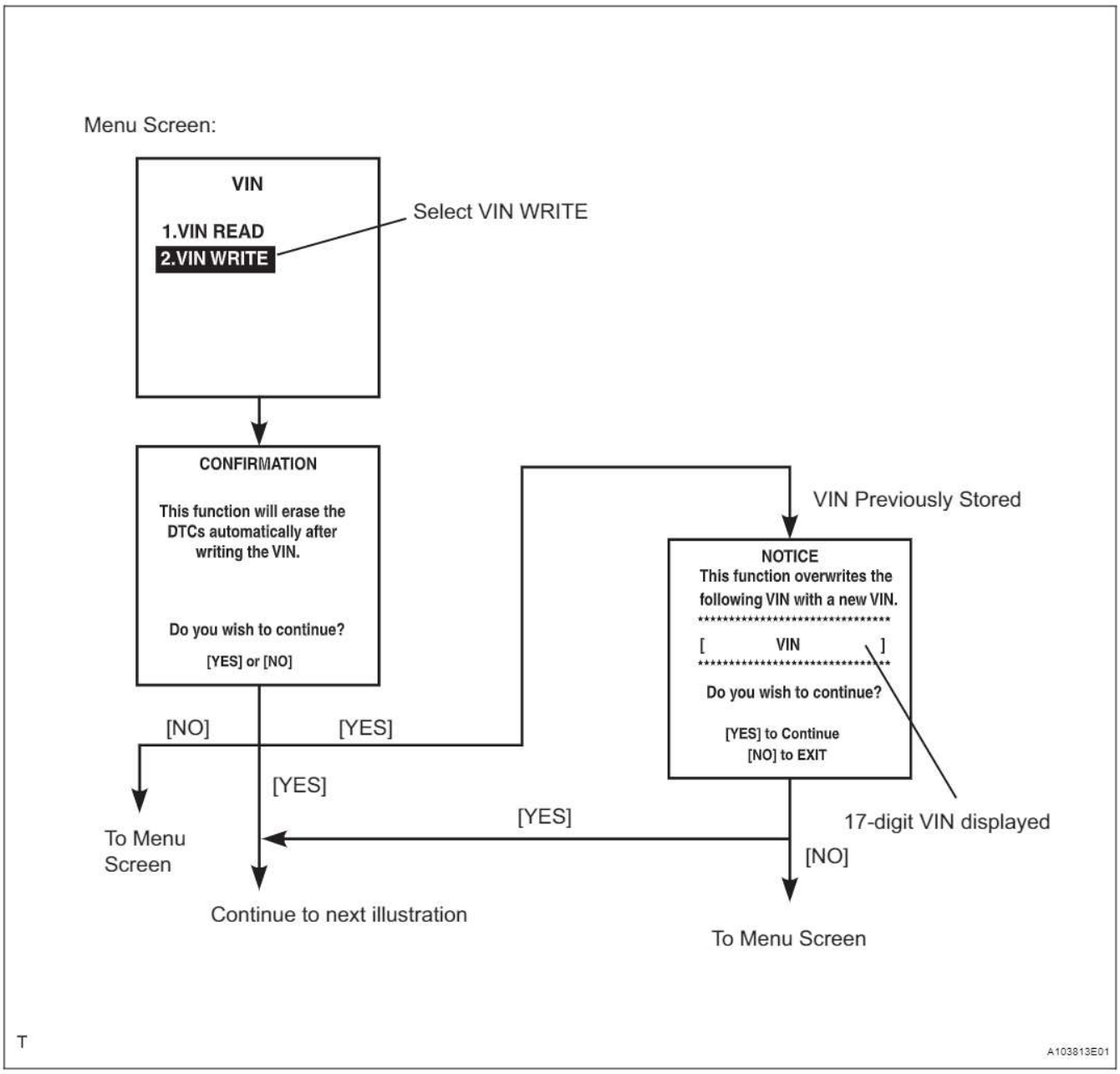
3. WRITE VIN

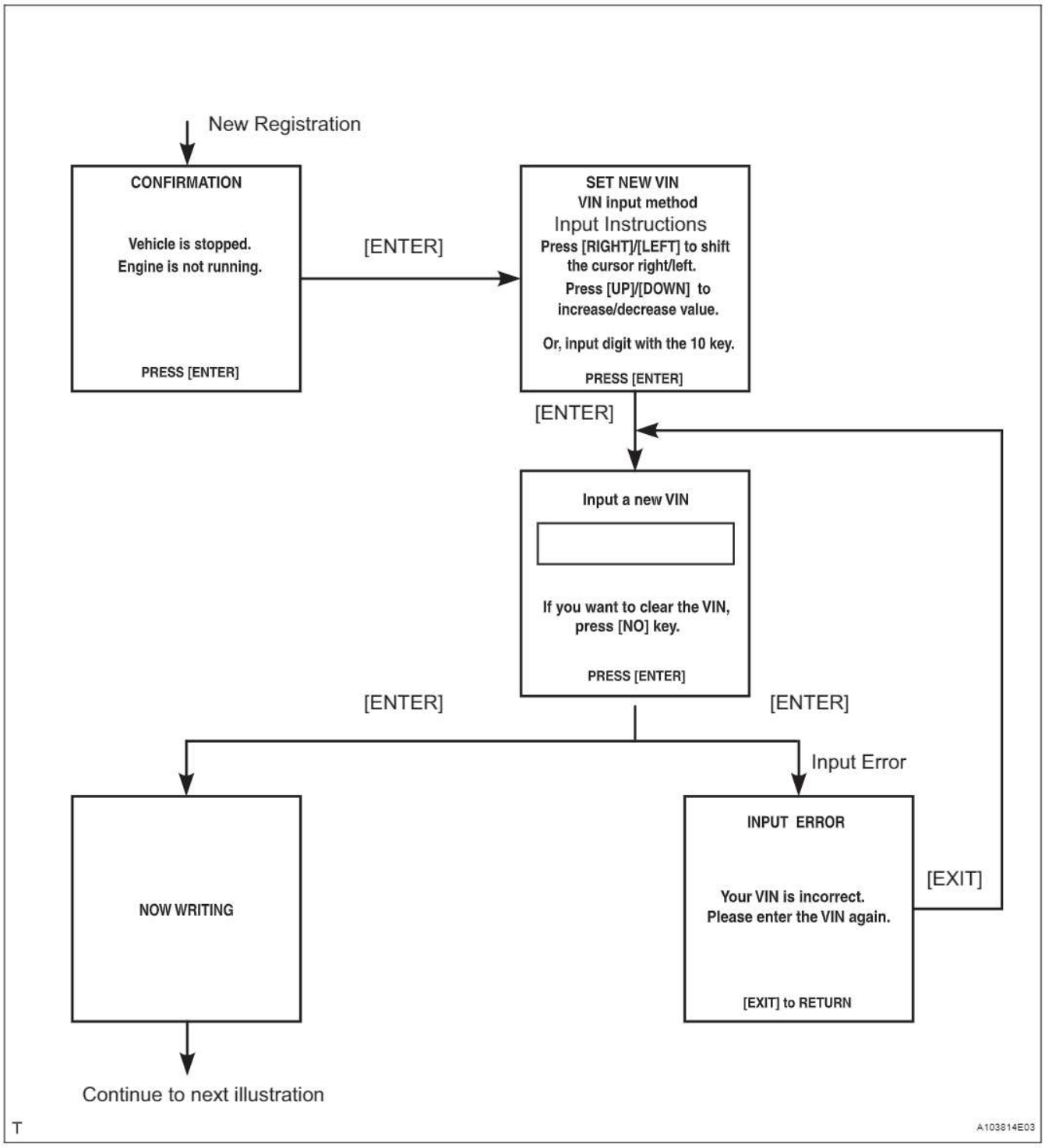
(a) The VIN writing process is explained using a flowchart as shown. This process allows the VIN to be input into the HV control ECU. If the HV control ECU is changed, or the HV control ECU VIN and the vehicles's VIN do not match, the VIN can be registered, or overwritten in the HV control ECU by following this procedure.

(1) Write VIN using the intelligent tester.
(2) Connect the intelligent tester to the DLC3.
(3) Turn the power switch on (IG).
(4) Turn the tester on.

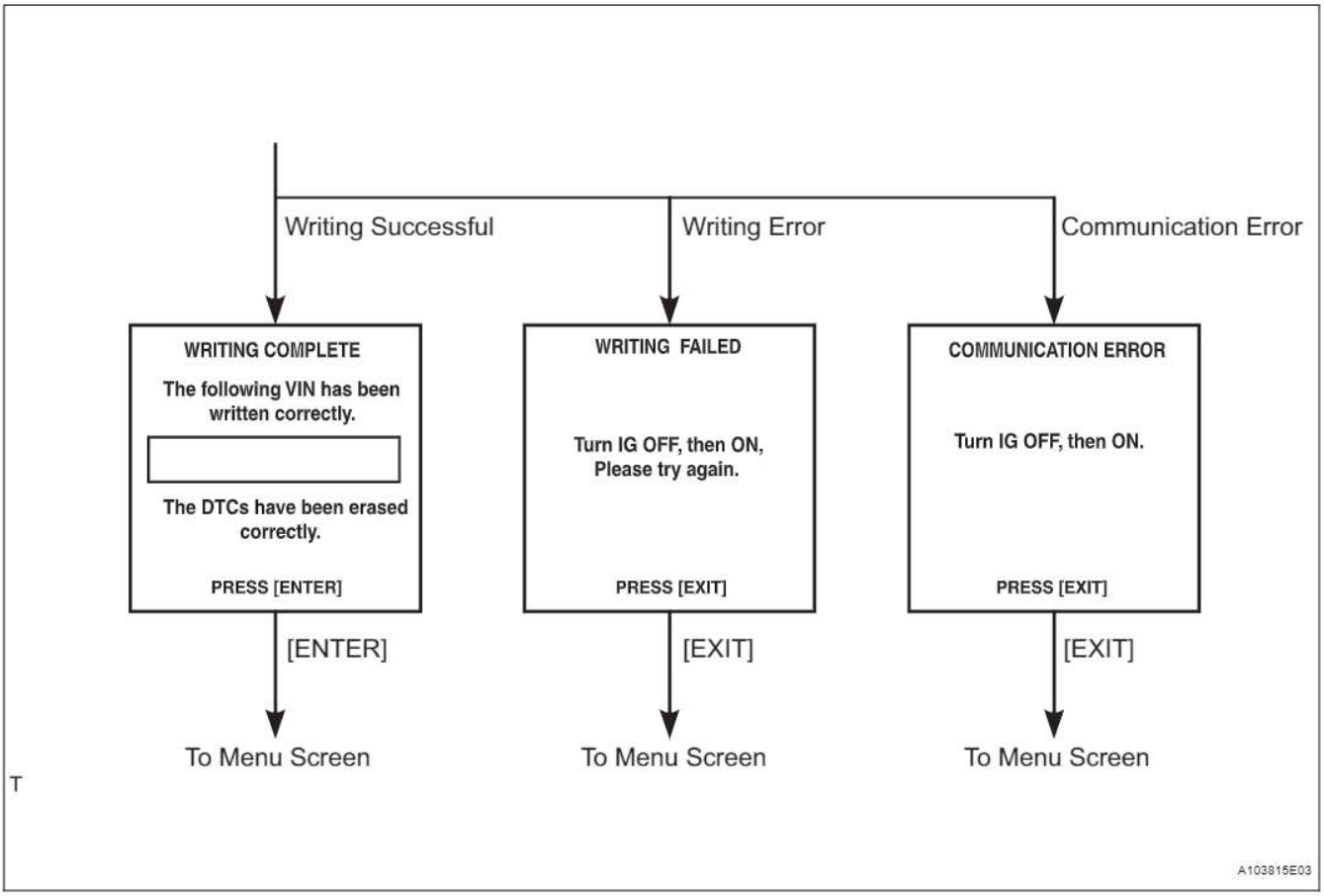
HV

(5) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / VIN.




New Registration
CONFIRMATION
Vehicle is stopped.
Engine is not running.
PRESS [ENTER]
[ENTER]
SET NEW VIN
VIN input method
Input Instructions
Press [RIGHT]/[LEFT] to shift the cursor right/left.
Press [UP]/[DOWN] to increase/decrease value.
Or, input digit with the 10 key.
PRESS [ENTER]
[ENTER]
Input a new VIN
If you want to clear the VIN, press [NO] key.
PRESS [ENTER]
[ENTER]
[ENTER]
Input Error
NOW WRITING
INPUT ERROR
Your VIN is incorrect.
Please enter the VIN again.
[EXIT] to RETURN
[EXIT]
Continue to next illustration
T
A103814E03

HV

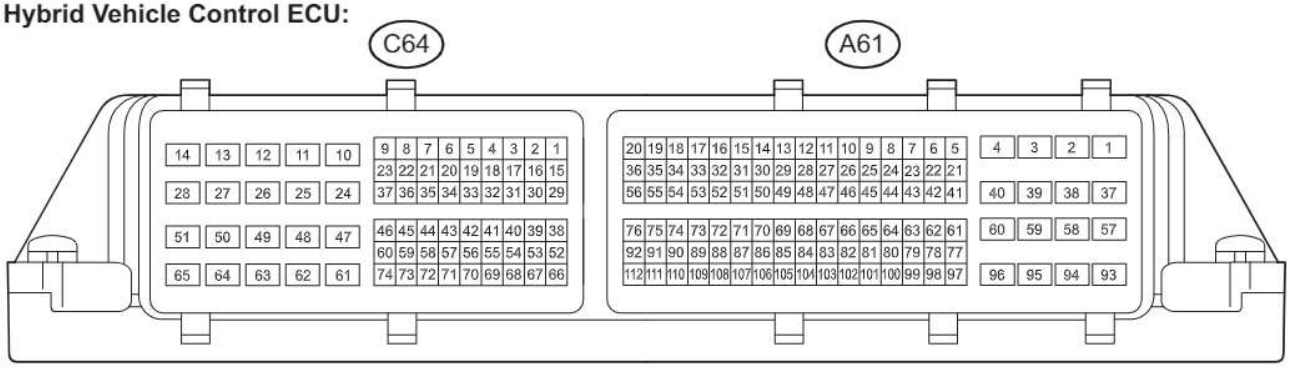

Writing Successful
Writing Error
Communication Error
WRITING COMPLETE
The following VIN has been written correctly.
The DTCs have been erased correctly.
PRESS [ENTER]
WRITING FAILED
Turn IG OFF, then ON, Please try again.
PRESS [EXIT]
COMMUNICATION ERROR
Turn IG OFF, then ON.
PRESS [EXIT]
[ENTER]
[EXIT]
[EXIT]
To Menu Screen
To Menu Screen
To Menu Screen
A103815E03

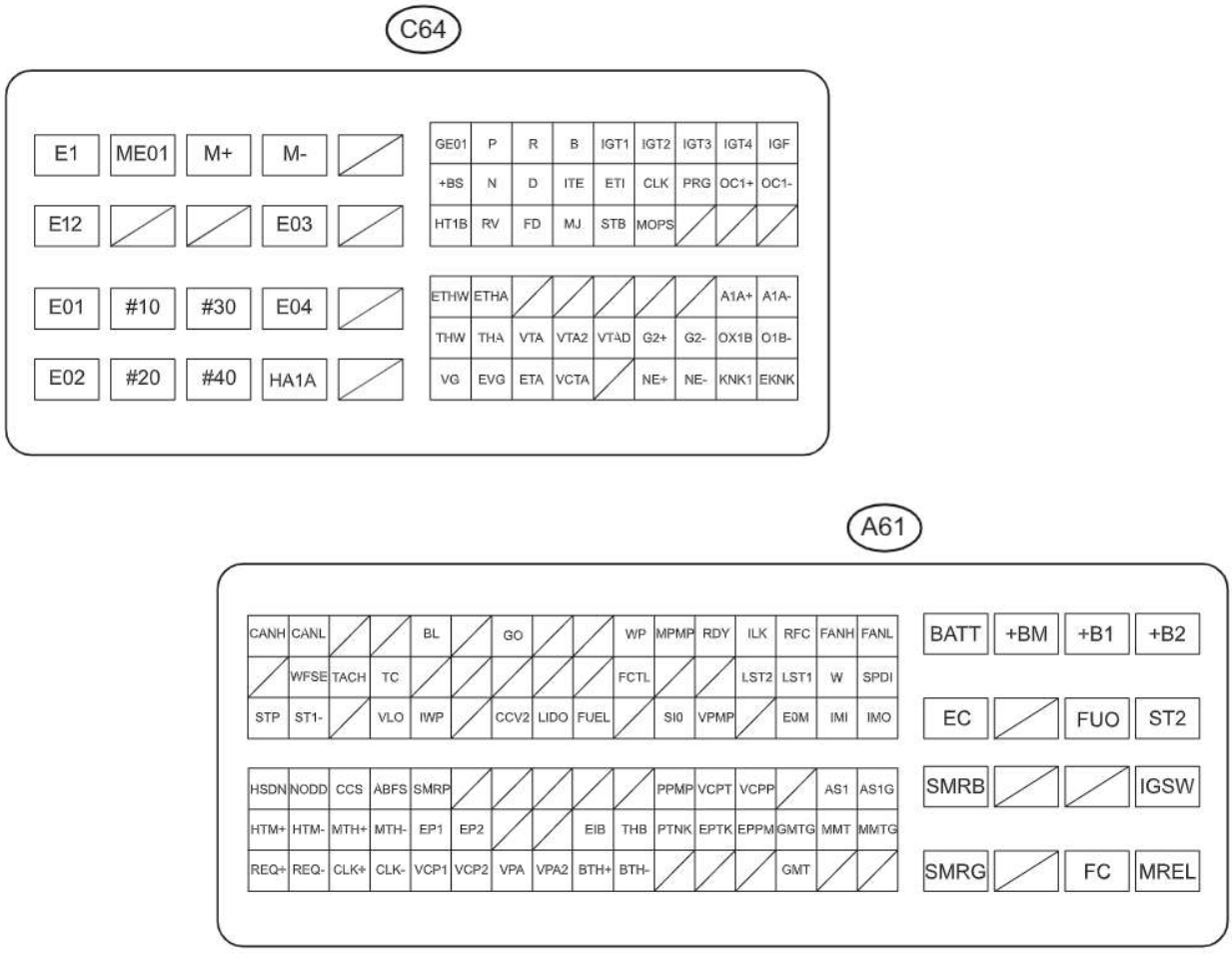
T

HV

TERMINALS OF ECU

Hybrid Vehicle Control ECU:





C A142563E01

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Standard Voltage
SMRP (A61-72) - E1 (C64-14)	BR - W-B	System main relay	Power switch on (IG) to on (READY)	Pulse generation (Waveform 1)
BATT (A61-4) - E1 (C64-14)	W - W-B	Constant power source	Always	10 to 14
MREL (A61-93) - E1 (C64-14)	B - W-B	Main relay	Power switch on (IG)	10 to 14
ST2 (A61-37) - E1 (C64-14)	R - W-B	Starter signal	Power switch on (IG)	0 to 1.5
IMI (A61-74) - E1 (C64-14)	W - W-B	Immobilizer communication	Immobilizer communicating	Pulse generation (Waveform 2)

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Standard Voltage
IMO (A61-41) - E1 (C64-14)	G - W-B	Immobilizer communication	Immobilizer communicating	Pulse generation (Waveform 2)
ILK (A61-8) - E1 (C64-14)	SB - W-B	Interlock switch	Power switch on (IG), A/C fuse cover and service plug grip installed correctly	0 to 1.5
ILK (A61-8) - E1 (C64-14)	SB - W-B	Interlock switch	Power switch on (IG), A/C fuse cover and service plug grip detached	10 to14
SMRB (A61-60) - E1 (C64-14)	G - W-B	System main relay	Power switch off to on (READY)	Pulse generation (Waveform 1)
CANL (A61-19) - E1 (C64-14)	W - W-B	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 3)
CANH (A61-20) - E1 (C64-14)	B - W-B	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 3)
+B1 (A61-2) - E1 (C64-14)	Y - W-B	Power source	Power switch on (IG)	10 to 14
SPDI (A61-21) - E1 (C64-14)	L - W-B	Vehicle speed signal	Approximately 20 km/h (12 mph)	Pulse generation (Waveform 4)
NODD (A61-75) - E1 (C64-14)	O - W-B	DC/DC operation	Converter operating normally	5 to 7
NODD (A61-75) - E1 (C64-14)	O - W-B	DC/DC operation	Converter not operating normally	2 to 4
NODD (A61-75) - E1 (C64-14)	O - W-B	DC/DC operation	Power switch on (IG)	0.1 to 0.5
VLO (A61-53) - E1 (C64-14)	V - W-B	DC/DC operation monitor / voltage change signal	Power switch on (IG)	Pulse generation (Waveform 5)
SIO (A61-46) - E1 (C64-14)	V - W-B	HV battery blower fan	Power switch on (IG), during active test	Pulse generation (Waveform 6)
IWP (A61-52) - E1 (C64-14)	O - W-B	HV water pump signal	Power switch on (READY)	Pulse generation (Waveform 7)
TC (A61-3) - E1 (C64-14)	P - W-B	Diagnosis terminal	Power switch on (IG)	10 to 14
VCP2 (A61-107) - E1 (C64-14)	W - W-B	Accelerator pedal position sensor power source (for VPA2)	Power switch on (IG)	4.5 to 5.5
VCP1 (A61-108) - E1 (C64-14)	BR - W-B	Accelerator pedal position sensor power source (for VPA1)	Power switch on (IG)	4.5 to 5.5
ST1- (A61-55) - E1 (C64-14)	GR - W-B	Brake cancel switch	Power switch on (IG), brake pedal depressed	0 to 1.5
ST1- (A61-55) - E1 (C64-14)	GR - W-B	Brake cancel switch	Power switch on (IG), brake pedal released	10 to 14
HSDN (A61-76) - E1 (C64-14)	L - W-B	MG shutdown signal	Power switch on (READY)	0 to 1.5
SMRG (A61-96) - E1 (C64-14)	P - W-B	System main relay	Power switch on (IG) to on (READY)	Pulse generation (Waveform 1)
HTM- (A61-91) - E1 (C64-14)	W - W-B	Communication signal from HV to MG	Power switch on (READY)	Pulse generation (Waveform 8)
MTH- (A61-89) - E1 (C64-14)	W - W-B	Communication signal from MG to HV	Power switch on (READY)	Pulse generation (Waveform 9)
CLK- (A61-109) - E1 (C64-14)	W - W-B	MG communication clock signal	Power switch on (READY)	Pulse generation (Waveform 10)
REQ- (A61-111) - E1 (C64-14)	W - W-B	MG communication request signal	Power switch on (READY)	Pulse generation (Waveform 11)
IGSW (A61-57) - E1 (C64-14)	Y - W-B	IG signal	Power switch on (IG)	10 to 14
BTH+ (A61-104) - E1 (C64-14)	R - W-B	Communication signal from battery to HV	Power switch on (IG)	Pulse generation (Waveform 12)
ABFS (A61-73)- E1 (C64-14)	Y - W-B	Airbag activation signal	Power switch on (READY) (2 seconds after ACC ON)	Pulse generation (Waveform 13)
HTM+ (A61-92) - E1 (C64-14)	B - W-B	Communication signal from HV to MG	Power switch on (READY)	Pulse generation (Waveform 8)

HV

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Standard Voltage
MTH+ (A61-90) - E1 (C64-14)	B - W-B	Communication signal from MG to HV	Power switch on (READY)	Pulse generation (Waveform 9)
CLK+ (A61-110) - E1 (C64-14)	B - W-B	MG communication clock signal	Power switch on (READY)	Pulse generation (Waveform 10)
REQ+ (A61-112) - E1 (C64-14)	B - W-B	MG communication request signal	Power switch on (READY)	Pulse generation (Waveform 11)
WP (A61-11) - E1 (C64-14)	O - W-B	A/C WP relay signal	Power switch on (READY)	Below 2
VPA2 (A61-105) - EP1 (A61-87)	L - W-B	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), accelerator pedal released	1.0 to 2.2
VPA2 (A61-105) - E1 (C64-14)	L - W-B	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), engine stopped, shift lever in P position, accelerator pedal fully depressed	3.4 to 5.3
VPA (A61-106) - EP2 (A61-88)	R -W-B	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), accelerator pedal released	0.4 to 1.4
VPA (A61-106) - E1 (C64-14)	R -W-B	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), engine stopped, shift lever in P position, accelerator pedal fully depressed	2.6 to 4.5
STP (A61-56) - E1 (C64-14)	W - W-B	Stop light switch	Brake pedal depressed	10 to 14
STP (A61-56) - E1 (C64-14)	W - W-B	Stop light switch	Brake pedal released	0 to 1.5
BTH- (A61-103) - E1 (C64-14)	W - W-B	Communication signal from battery to HV	Power switch on (IG)	Pulse generation (Waveform 12)
THB (A61-83) - EIB (A61-84)	LG - P	Auxiliary battery temperature sensor signal	Auxiliary battery temperature 25 °C (77°F)	1.8 to 2.5
THB (A61-83) - EIB (A61-84)	LG - P	Auxiliary battery temperature sensor signal	Auxiliary battery temperature 60 °C (140°F)	0.7 to 1.3
RDY (A61-117) - E1 (C64-14)	W-L - W-B	READY state	Power switch on (IG) Power switch on (READY)	Pulse generation (Waveform 14)
+BS (C64-23) - E1 (C64-14)	W-L - W-B	Park / neutral position switch power source	Power switch on (IG)	10 to 14
STB (C64-33) - E1 (C64-14)	R - W-B	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 15)
CLK (C64-18) - E1 (C64-14)	G - W-B	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 15)
ITE (C64-20) - E1 (C64-14)	W - W-B	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 15)
ETI (C64-19) - E1 (C64-14)	Y - W-B	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 15)
MJ (C64-34) - E1 (C64-14)	P - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever in P, R, N or D position	10 to 14
FD (C64-35) - E1 (C64-14)	W - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever in D position	10 to 14
FD (C64-35) - E1 (C64-14)	W - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever not in D position	0 to 1.5
RV (C64-36) - E1 (C64-14)	L - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever in R position	10 to 14
RV (C64-36) - E1 (C64-14)	L - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever not in R position	0 to 1.5
D (C64-21) - E1 (C64-14)	R - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever in D position	10 to 14

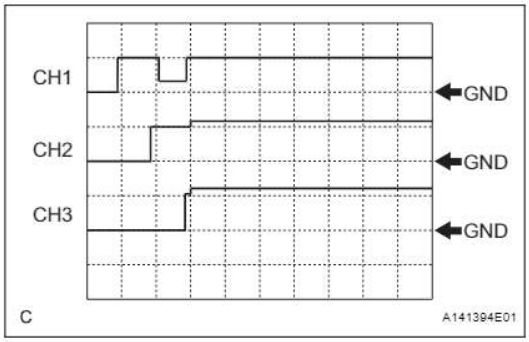
HV

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Standard Voltage
D (C64-21) - E1 (C64-14)	R - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever not in D position	0 to 1.5
N (C64-22) - E1 (C64-14)	Y - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever in N position	10 to 14
N (C64-22) - E1 (C64-14)	Y - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever not in N position	0 to 1.5
R (C64-7) - E1 (C64-14)	B - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever in R position	10 to 14
R (C64-7) - E1 (C64-14)	B - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever not in R position	0 to 1.5
P (C64-8) - E1 (C64-14)	G - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever in P position	10 to 14
P (C64-8) - E1 (C64-14)	G - W-B	Park / neutral position switch signal	Power switch on (IG), shift lever not in P position	0 to 1.5
FCTL (A61-27) - E1 (C64-14)	GR - W-B	Cooling fan relay	Power switch on (IG)	10 to 14
MMT (A61-78) - MMTG (A61-77)	G - SB	Motor temperature sensor	Power switch on (IG), ambient temperature 25°C (77°F)	1.9 to 2.8
MMT (A61-78) - MMTG (A61-77)	G - SB	Motor temperature sensor	Power switch on (IG), ambient temperature 60°C (140°F)	1.1 to 1.8
GMT (A61-99) - GMTG (A61-79)	L - V	Generator temperature sensor	Power switch on (IG), ambient temperature 25°C (77°F)	1.9 to 2.8
GMT (A61-99) - GMTG (A61-79)	L - V	Generator temperature sensor	Power switch on (IG), ambient temperature 60°C (140°F)	1.1 to 1.8
+B2 (A61-1) - E1 (C64-14)	Y - W-B	Power source	Power switch on (IG)	Power switch on (IG)
VCP2 (A61-1) - EP1 (A61-87)	W - Y	Power source of acceleration pedal position sensor	Power switch on (IG)	4.5 to 5.5
VCP1 (A61-108) - EP2 (A61-88)	BR - G	Power source of acceleration pedal position sensor	Power switch on (IG)	4.5 to 5.5
GO (A61-14) - E1 (C64-14)	B - W-B	GO signal	Engine running	Pulse generation (Waveform 16)

HV

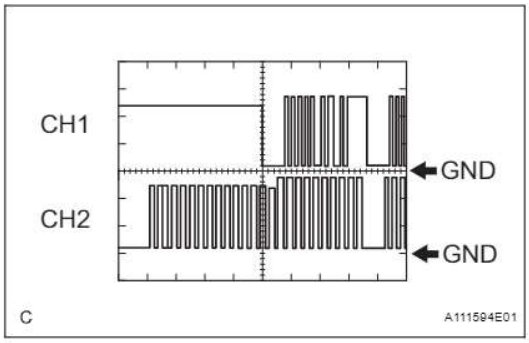
NOTICE:
Do not measure voltage or waveform directly at the sealed side of the hybrid vehicle control ECU connectors, Doing so may damage the connectors because these connectors are waterproof.

1. **Oscilloscope waveforms**
   HINT:
   Oscilloscope waveform samples are provided here for informational purposes. Noise and fluttering waveforms have been omitted.



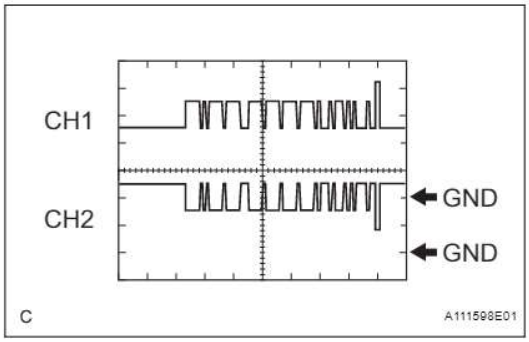
(a) Waveform 1 (System main relay operation signal)

Item	Contents
Terminal	CH1: SMRP - E1 CH2: SMRB - E1 CH3: SMRG - E1
Equipment Setting	10 V/DIV., 500 ms./DIV.
Condition	Power switch on (IG) → Power switch on (READY)



(b) Waveform 2 (Immobilizer communication signal)

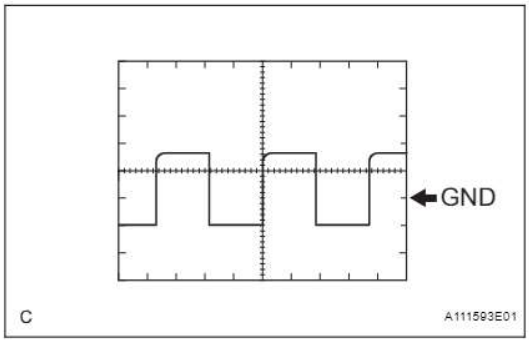
Item	Contents
Terminal	CH1: IMO - E1 CH2: IMI - E1
Equipment Setting	5 V/DIV., 200 ms./DIV.
Condition	Power switch off → Power switch on (IG) → Power switch on (READY)



(c) Waveform 3 (CAN communication signal)

Item	Contents
Terminal	CH1: CANH - E1 CH2: CANL - E1
Equipment Setting	1 V/DIV., 20 μs./DIV.
Condition	Power switch on (IG)

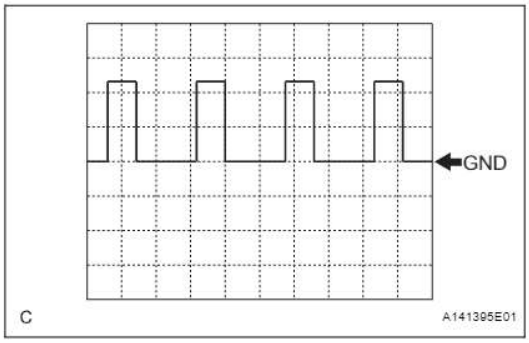
HINT:
The waveform will vary depending on the content of the digital communication (digital signal).



(d) Waveform 4 (Vehicle speed signal)

Item	Contents
Terminal	SPDI - E1
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Driving at approximately 20 km/h (12 mph) with power switch on (READY)

HINT:
The higher the vehicle speed, the shorter the cycle.

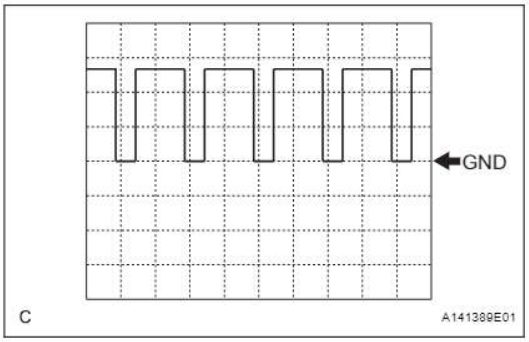


(e) Waveform 5 (VLO signal)

Item	Contents
Terminal	VLO - E1
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Power switch on (IG)

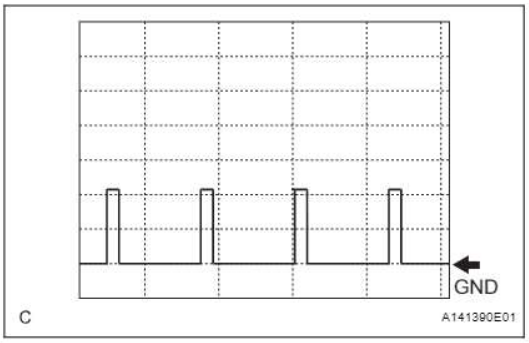
HINT:
The cycle will vary depending on the specified voltage of the hybrid vehicle converter.

HV



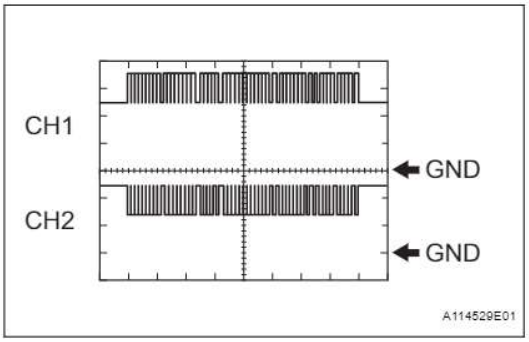
(f) Waveform 6 (HV battery blower fan operation signal)

Item	Contents
Terminal	SI0 - E1
Equipment Setting	5 V/DIV., 100 ms./DIV.
Condition	Power switch on (IG) during active test



(g) Waveform 7 (HV water pump signal)

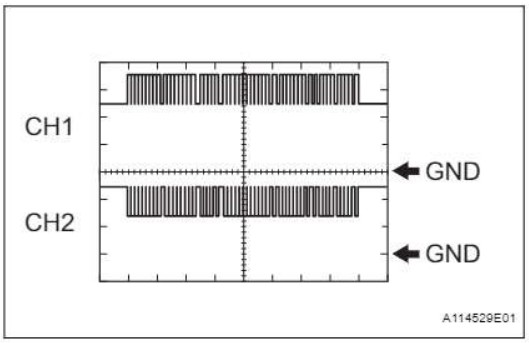
Item	Contents
Terminal	IWP - E1
Equipment Setting	5 V/DIV., 100 ms./DIV.
Condition	Power switch on (READY)



(h) Waveform 8 (Communication signal from HV control ECU to MG ECU)

Item	Contents
Terminal	CH1: HTM+ - E1 CH2: HTM- - E1
Equipment Setting	1 V/DIV., 200 μs./DIV.
Condition	Power switch on (READY)

HINT:
The waveform will vary depending on the content of the digital communication (digital signal).

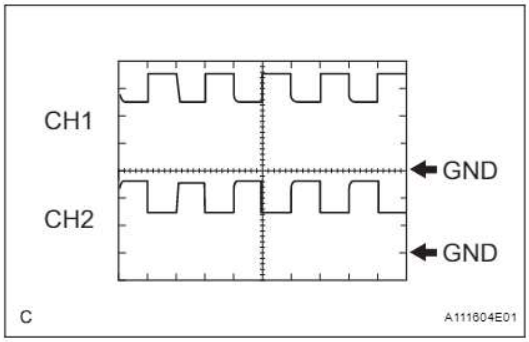


(i) Waveform 9 (Communication signal from MG ECU to HV control ECU)

Item	Contents
Terminal	CH1: HTM+ - E1 CH2: HTM- - E1
Equipment Setting	1 V/DIV., 200 μs./DIV.
Condition	Power switch on (READY)

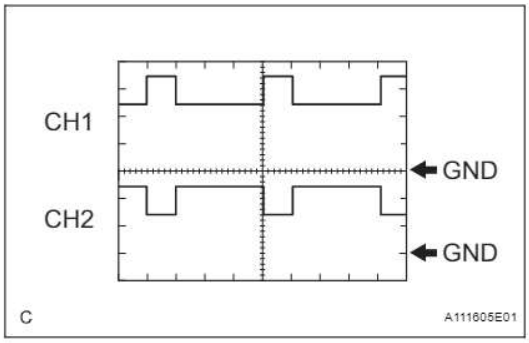
HINT:
The waveform will vary depending on the content of the digital communication.

HV



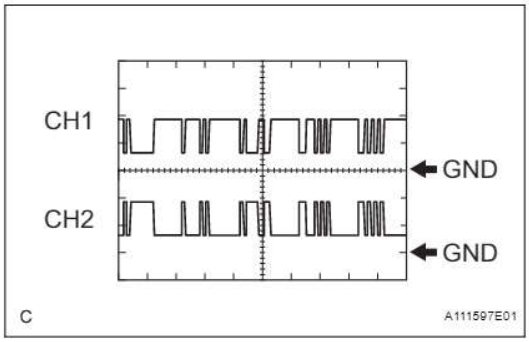
(j) Waveform 10 (MG communication clock signal)

Item	Contents
Terminal	CH1: CLK+ - E1 CH2: CLK- - E1
Equipment Setting	1 V/DIV., 1 μs./DIV.
Condition	Power switch on (READY)



(k) Waveform 11 (MG communication request signal)

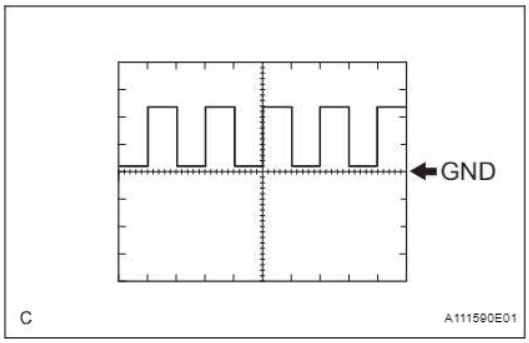
Item	Contents
Terminal	CH1: REQ+ - E1 CH2: REQ- - E1
Equipment Setting	1 V/DIV., 1 ms./DIV.
Condition	Power switch on (READY)



(l) Waveform 12 (Communication signal from battery smart unit to HV control ECU)

Item	Contents
Terminal	CH1: BTH+ - E1 CH2: BTH- - E1
Equipment Setting	2 V/DIV., 500 μs./DIV.
Condition	Power switch on (IG)

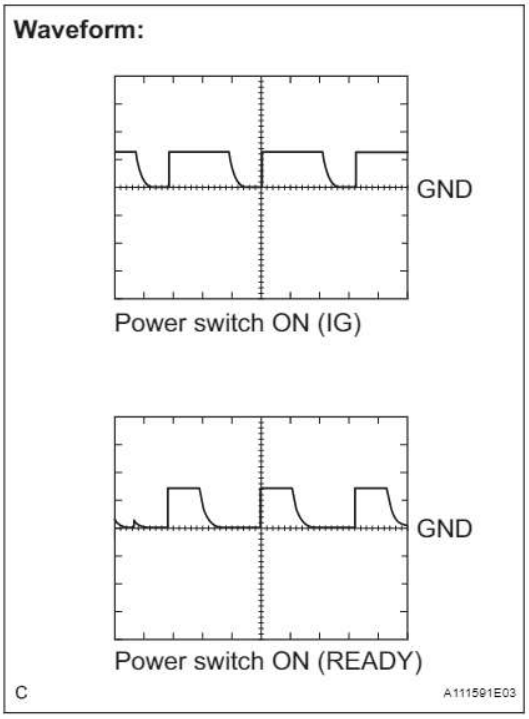
HINT:
The waveform will vary depending on the content of the digital communication (digital signal).



(m) Waveform 13 (Airbag deployment signal)

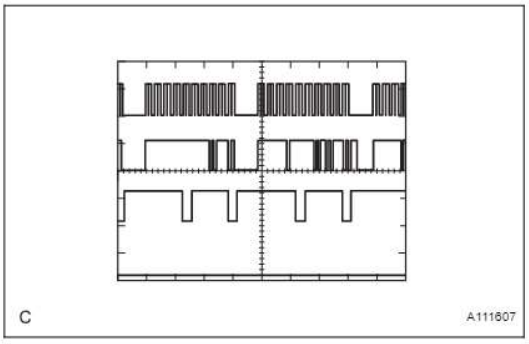
Item	Contents
Terminal	ABFS - E1
Equipment Setting	5 V/DIV., 500 ms./DIV.
Condition	Power switch on (READY)

HV



(n) Waveform 14 (READY signal)

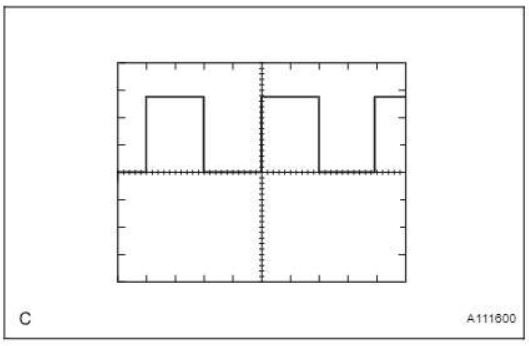
Item	Contents
Terminal	RDY - E1
Equipment Setting	10 V/DIV., 10 ms./DIV.
Condition	Power switch on (IG) / Power switch on (READY)



(o) Waveform 15 (A/C communication signal)

Item	Contents
Terminal	CH1: CLK - E1 CH2: ITE - E1 CH3: ETI - E1 CH4: STB - E1
Equipment Setting	10 V/DIV., 100 ms./DIV.
Condition	Power switch on (READY) with air conditioning system stopped

HINT:
The waveform will vary depending on the content of the digital communication (digital signal).



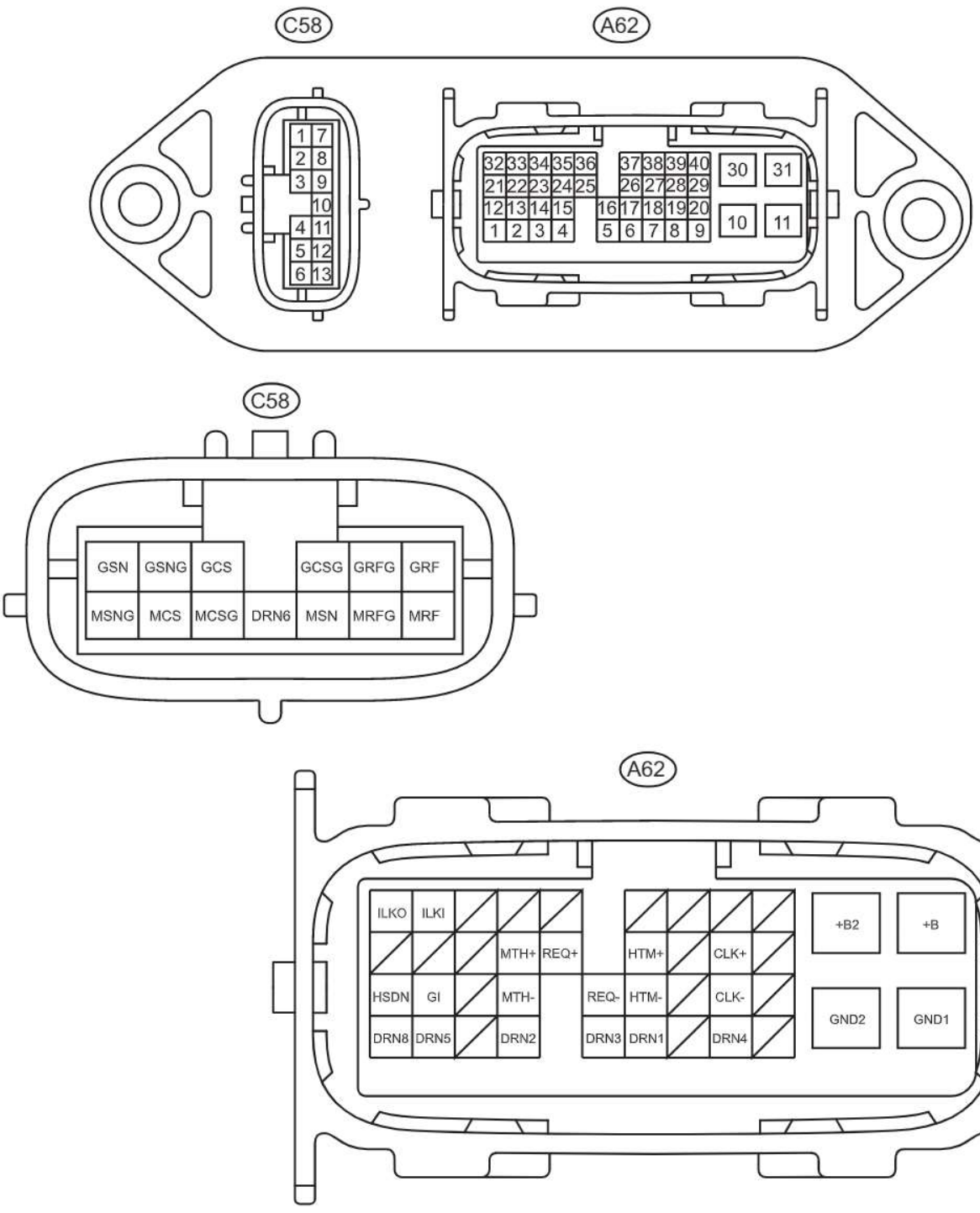
(p) Waveform 16 (GO signal)

Item	Contents
Terminal	GO - E1
Equipment Setting	5 V/DIV., 20 ms../DIV.
Condition	Power switch on (READY) with engine running

HINT:
The pulse cycle becomes shorter as the engine speed increases.

HV

Inverter with Converter Assembly (MG ECU):



A142541E01

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Standard Voltage (V)
+B (A62-31) - GND1 (A62-11)	Y - W	MG ECU power source	Power switch on (IG)	10 to 14
+B2 (A62-30) - GND1 (A62-11)	Y - W	MG ECU power source	Power switch on (IG)	10 to 14

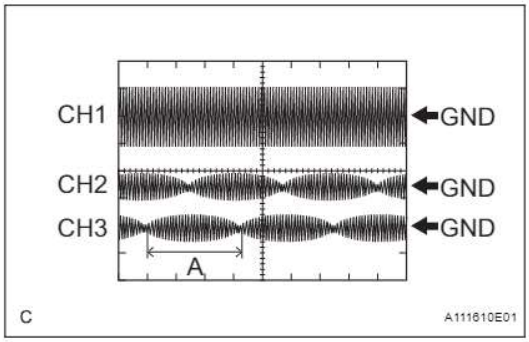
Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Standard Voltage (V)
CLK+ (A62-28) - GND1 (A62-11)	B - W	Communication clock signal	Power switch on (IG)	10 to 14
CLK- (A62-19) - GND1 (A62-11)	W - W	Communication clock signal	Power switch on (IG)	10 to 14
ILKO (A62-32) - GND1 (A62-11)	B - W	Interlock switch signal	Power switch on (IG), A/C fuse cover and service plug grip installed correctly	Below 1
ILKO (A62-32) - GND1 (A62-11)	B - W	Interlock switch signal	Power switch on (IG), A/C fuse cover and service plug grip detached	10 to 14
REQ+ (A62-25) - GND1 (A62-11)	B - W	Communication request signal	Power switch on (IG)	Pulse generation (Waveform 2)
MTH+ (A62-24) - GND1 (A62-11)	B - W	Communication signal from MG to HV	Power switch on (IG)	Pulse generation (Waveform 3)
MTH- (A62-15) - GND1 (A62-11)	W - W	Communication signal from MG to HV	Power switch on (IG)	Pulse generation (Waveform 3)
ILKI (A62-33) - GND1 (A62-11)	SB - W	Interlock switch signal	Power switch on (IG), A/C fuse cover and service plug grip installed correctly	Below 1
ILKI (A62-33) - GND1 (A62-11)	SB - W	Interlock switch signal	Power switch on (IG), A/C fuse cover and service plug grip detached	10 to 14
REQ- (A62-16) - GND1 (A62-11)	W - W	Communication request signal	Power switch on (IG)	Pulse generation (Waveform 2)
GI (A62-13) - GND1 (A62-11)	B - W	GI signal	Power switch on (READY), engine started	Pulse generation (Waveform 4)
HTM+ (A62-26) - GND1 (A62-11)	B - W	Communication signal from HV to MG	Generator resolver stopped or running	Pulse generation (Waveform 6
HTM- (A62-17) - GND1 (A62-11)	W - W	Communication signal from HV to MG	Generator resolver stopped or running	Pulse generation (Waveform 6)
HSDN (A62-12) - GND1 (A62-11)	L - W	MG shutdown signal	Generator resolver stopped or running	0 to 1
GRF (C58-6) - GRFG (C58-5)	BR - G	Generator resolver signal	Generator resolver stopped or running	Pulse generation (Waveform 5)
MRF (C58-13) - MRFG (C58-12)	BR - G	Motor resolver signal	Motor resolver stopped or running	Pulse generation (Waveform 1)
MCS (C58-8) - MCSG (C58-9)	W - Y	Motor resolver signal	Motor resolver stopped or running	Pulse generation (Waveform 1)
MSN (C58-11) - MSNG (C58-7)	L - R	Motor resolver signal	Motor resolver stopped or running	Pulse generation (Waveform 1)
GSN (C58-1) - GSNG (C58-2)	L - R	Generator resolver signal	Generator resolver stopped or running	Pulse generation (Waveform 5)
GCS (C58-3) - GCSG (C58-4)	W - Y	Generator resolver signal	Generator resolver stopped or running	Pulse generation (Waveform 5)

HV

NOTICE:
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.

2. Oscilloscope waveforms

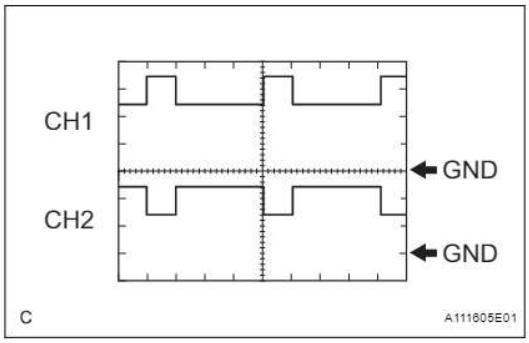
HINT:
Oscilloscope waveform samples are provided here for informational purposes. Noise and fluttering waveforms have been omitted.



(a) Waveform 1 (Motor resolver signal)

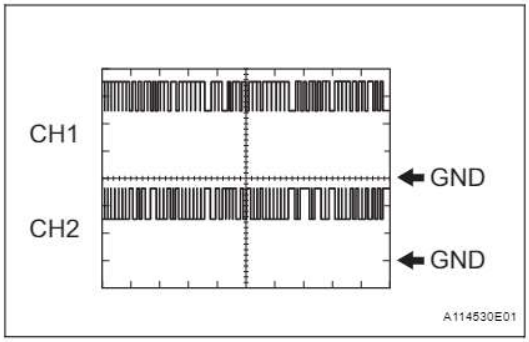
Item	Contents
Terminal	CH1: MRF - MRFG CH2: MSN - MSNG CH2: MCS - MCSG
Equipment Setting	CH1: 10 V/DIV., 1 ms./DIV. CH2, CH3: 5 V/DIV., 1 ms./DIV.
Condition	Resolver running

HINT:
Pulse cycle A becomes shorter as the rotor speed increases.



(b) Waveform 2 (MG ECU communication request signal)

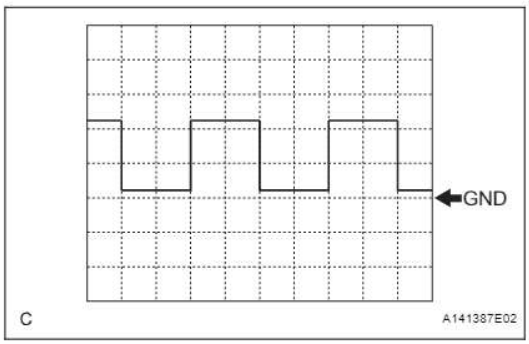
Item	Contents
Terminal	CH1: REQ+ - GND1 CH2: REQ- - GND11
Equipment Setting	1 V/DIV., 1 ms./DIV.
Condition	Power switch on (IG)



(c) Waveform 3 (Communication signal from MG ECU to HV control ECU)

Item	Contents
Terminal	CH1: MTH+ - GND1 CH2: MTH- - GND1
Equipment Setting	1 V/DIV., 200 µs./DIV.
Condition	Power switch on (IG)

HINT:
The waveform will vary depending on the content of the digital communication (digital signal).

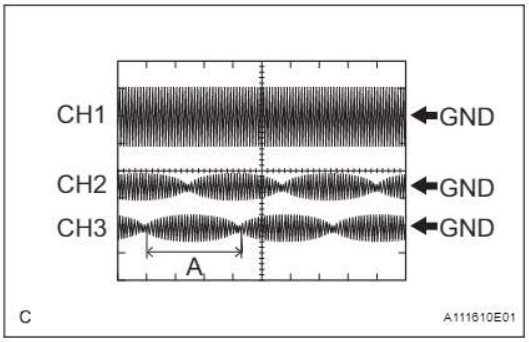


(d) Waveform 4 (GI signal)

Item	Contents
Terminal	CH1: GI - E1
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Power switch on (READY) with engine running

HINT:
The pulse cycle becomes shorter as the engine speed increases.

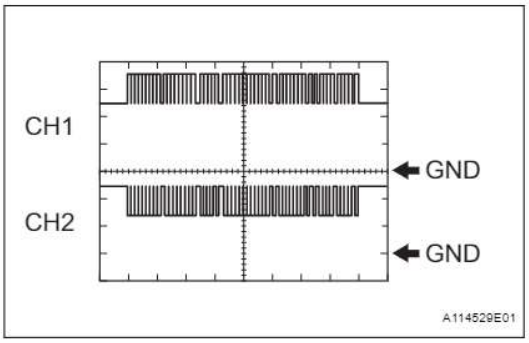
HV



(e) Waveform 5 (Generator resolver signal)

Item	Contents
Terminal	CH1: RRF - RRFG CH2: RSN - RSNG CH2: RCS - RCSG
Equipment Setting	CH1: 10 V/DIV., 1 ms./DIV. CH2, CH3: 5 V/DIV., 1 ms./DIV.
Condition	Resolver running

HINT:
Pulse cycle A becomes shorter as the rotor speed increases.



(f) Waveform 6 (Communication signal from HV control ECU to MG ECU)

Item	Contents
Terminal	CH1: HTM+ - GND1 CH2: HTM- - GND1
Equipment Setting	1 V/DIV., 200 ms./DIV.
Condition	Power switch on (IG)

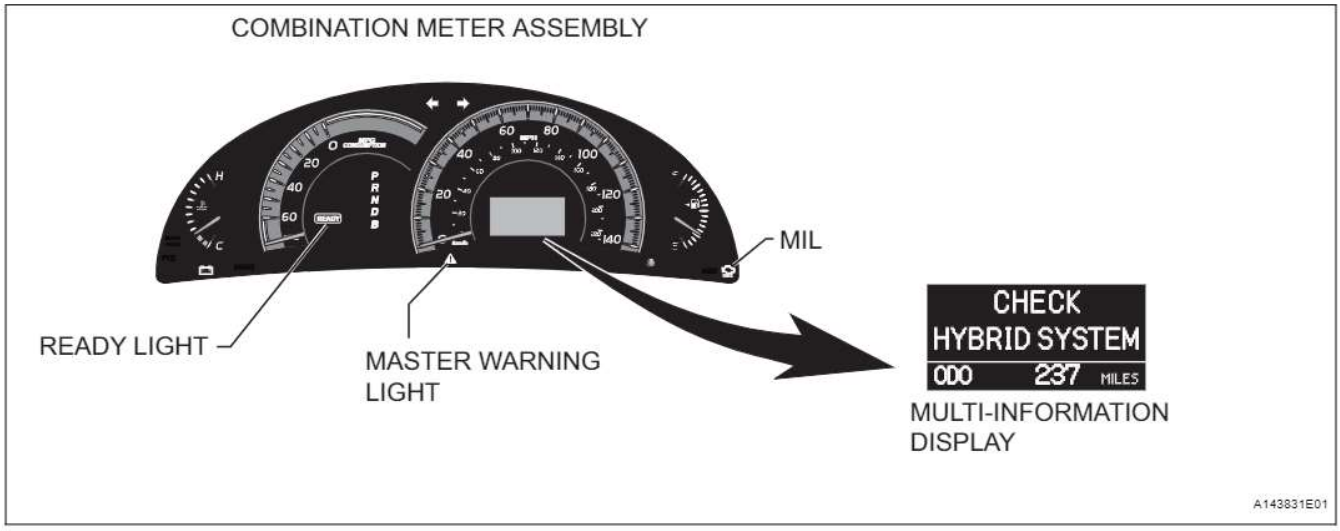
HINT:
The waveform will vary depending on the content of the digital communication (digital signal).

HV

DIAGNOSIS SYSTEM

1. DESCRIPTION

(a) The HV control ECU has a self-diagnosis system. If the computer, hybrid vehicle control system, or a component is not working properly, the ECU records the conditions that relate to the fault. The ECU also illuminates the master warning light and/or MIL in the combination meter and displays warning messages on the multi-information display.

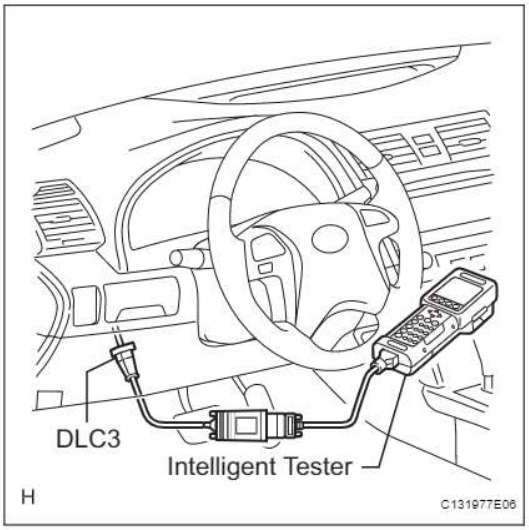


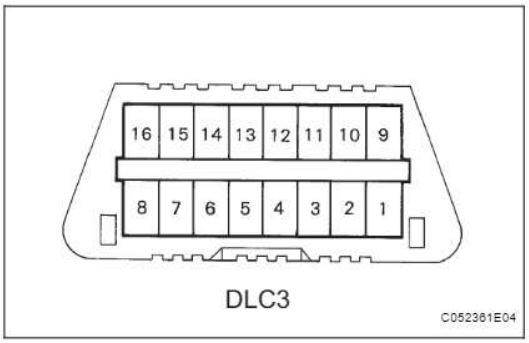
HINT:

The master warning light will illuminate when the THS II fails and the light will blink when in inspection mode.

- When troubleshooting OBD II vehicles, it is necessary to connect an OBD II scan tool that complies with SAE J1978 or connect an intelligent tester to the vehicle. Using one of these testers, it will be possible to read various data output from the vehicle's ECUs.
- OBD II regulations require that the vehicle's on-board computer illuminates the Malfunction Indicator light (MIL) in the instrument panel when the computer detects a malfunction in (1) the emission control system/ components, (2) the powertrain control components (which affect vehicle emissions), (3) the ECM and HV control ECU. In addition, applicable Diagnostic Trouble Codes (DTCs) prescribed by SAE J2012 are recorded in the HV control ECU memory (See page HV-46).

If a malfunction does not recur in 3 consecutive trips, the MIL will go off automatically. However the DTCs will remain recorded in the HV control ECU memory.





- To check for DTCs, connect the intelligent tester to the Data Link Connector 3 (DLC3) with the CAN vehicle interface module (CAN VIM). The intelligent tester also allows erasing of DTCs, viewing of freeze frame data, and viewing of various forms of THS II data (for operating instructions, refer to the tester's instruction manual). The DTCs include SAE controlled codes and manufacturer controlled codes. SAE controlled codes must be set as prescribed by the SAE, while manufacturer controlled codes can be set by the manufacturer within prescribed limits (See page HV-46).

2. CHECK DLC3

(a) The HV control ECU uses the ISO 9141-2 communication protocol. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 9141-2 format.

Symbol	Terminal No.	Name	Reference Terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	Always
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BATT	16	Battery positive	Body ground	11 to 14 V	Power switch off
CANH	6	HIGH-level CAN bus line	14 - LOW-level CAN bus line	54 to 69 Ω	Power switch off
CANH	6	HIGH-level CAN bus line	14 - Battery positive	1 MΩ or higher	Power switch off
CANH	6	HIGH-level CAN bus line	4 - Chassis ground	1 kΩ or higher	Power switch off
CANL	14	LOW-level CAN bus line	16 - Battery positive	1 MΩ or higher	Power switch off
CANL	14	LOW-level CAN bus line	4 - Chassis ground	1 kΩ or higher	Power switch off

HV

HINT:

Connect the cable of the intelligent tester to the DLC3, turn the power switch on (IG), and attempt to use the tester. If the display on the tester indicates that a communication error has occurred, there is a problem either with the vehicle or with the tester.

- If the tester is able to communicate when it is connected to another vehicle, inspect the DLC3 connector of the original vehicle.
- If communication is still not possible when the tester is connected to another vehicle, the problem is probably in the tester itself. Consult the tester's instruction manual for information on service or repair of the tester.

3. **INSPECT AUXILIARY BATTERY**
   (a) Measure the voltage of the auxiliary battery.
   Standard Voltage:
   10 to 14 V
   (b) Inspect the auxiliary battery, fuses, fusible links, wiring harness, connectors and ground.
4. **CHECK MIL**
   (a) The MIL will illuminate when the power switch is turned on (IG), before the "READY" light comes on. If the MIL does not illuminate, troubleshoot the MIL circuit (See page ES-373).
   (b) When the "READY" light turns on, the MIL should turn off. If the MIL remains on, the diagnosis system has detected a malfunction or abnormality in the system.

DTC CHECK / CLEAR

1. CHECK FOR DTCS (HV CONTROL ECU)

(a) Connect the intelligent tester to the DLC3.

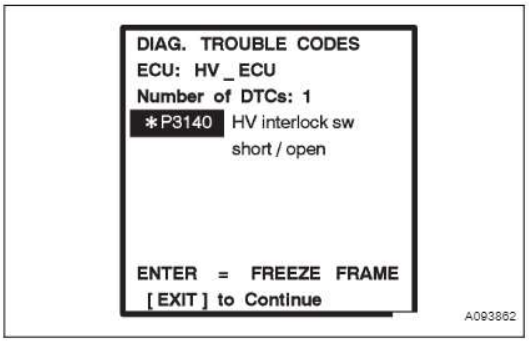
(b) Turn the power switch on (IG) and turn the intelligent tester on.

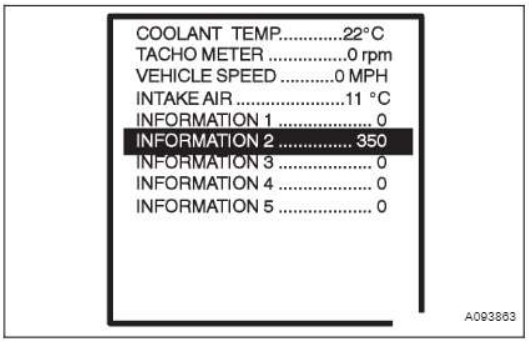
(c) Using the intelligent tester, check for DTCs and freeze frame data. If present, record or print the codes and the freeze frame data. Using the intelligent tester, enter the following menus: DIAGNOSIS / OBD/MOBD / HV ECU / DTC INFO / CURRENT CODES.

(d) Confirm the details of the DTCs. (See page HV-46)

2. CHECK FREEZE FRAME DATA AND INFORMATION

(a) If a DTC is present, select it in order to display its freeze frame data.





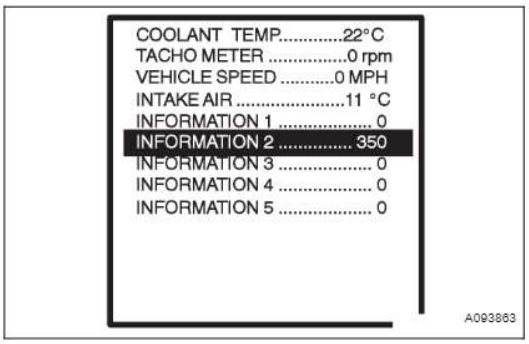
(b) Read the freeze frame data recorded when the DTC was set.

NOTICE:

An information code (INF code) will be displayed in one of the INFORMATION lines 1 to 5. Check the details by following the procedures in the following steps.

HINT:

In the case shown in the illustration, refer to troubleshooting for DTC P3140 and INF code 350.

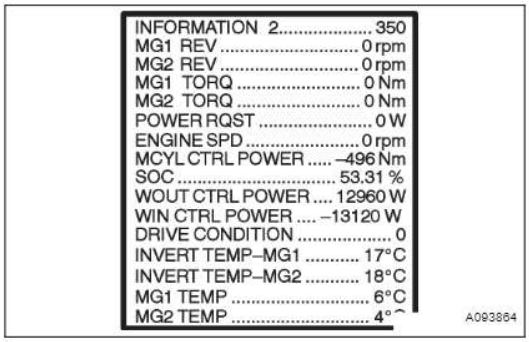


(c) Read the information.

(1) Select the item from among INFORMATION 1 to 5 that has an INF code on the freeze frame data screen.

(2) Press ENTER.

HV



(3) Additional information will be displayed as shown in the illustration.

3. CHECK FOR DTC (SYSTEMS OTHER THAN THE HV CONTROL ECU)

HINT:

The HV control ECU maintains communication with other computers, including the ECM, battery ECU, skid control ECU, and power steering ECU. Therefore, if the HV control ECU outputs a warning, it is necessary to check and record the DTCs of all the systems.

(a) Connect the intelligent tester to the DLC3.

(b) Turn the power switch on (IG) and turn the intelligent tester on.

(c) On the intelligent tester, enter the following menus: DIAGNOSIS / OBD/MOBD / CODES (All).

(d) If DTCs are present, check the relevant systems.

HINT:

If DTCs for the CAN communication system are present in addition to other DTCs, first troubleshoot and repair any malfunctions in the CAN communication system.

4. CLEAR DTCS

NOTICE:

Clearing the DTCs will also clear the freeze frame data, information (see page HV-65), and operation history data (see page HV-70).

(a) Connect the intelligent tester to the DLC3.

(b) Turn the power switch on (IG) and turn the intelligent tester on.

(c) Check that the P shift position has been selected.

(d) Clear DTCs and freeze frame data using the intelligent tester.

(1) Enter the following menus: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.

(2) Press YES.

HV

DATA LIST / ACTIVE TEST

1. DATA LIST

NOTICE:

- **Some data list 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 list.**

HINT:

Using the intelligent tester to read the data list 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 list information early in troubleshooting is one way to save diagnostic time.

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG) and turn the intelligent tester on.
(c) Select the following menu items: DIAGNOSIS / OBD/MOBD / HV ECU / DATA LIST.
(d) Check the results by referring to the following table.

HV

DATA LIST:

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
COOLANT TEMP (Engine coolant temperature)	Engine coolant temperature / Min.: -40°C, Max.: 140°C	After warming up: 80 to 100°C (176 to 212°F)	-
ENGINE REV (Engine revolution)	Min.: 0 rpm, Max.: 16383.75 rpm	Idling: 950 to 1,050 rpm	-
VEHICLE SPD (Vehicle SPD)	Vehicle speed / Min.: 0 km/h, Max.: 255 km/h	Vehicle stopped: 0 km/h (0 mph)	-
ENG RUN TIME (Engine run time)	Elapsed time after starting engine / Min.: 0 s, Max.: 65535 s	-	-
+B (+B)	Auxiliary battery voltage / Min.: 0 V, Max.: 65.535 V	Constant: Auxiliary battery voltage +-3 V	-
ACCEL POS #1 (Accelerator pedal position #1)	Accelerator pedal position sensor No. 1 / Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	-
ACCEL POS #2 (Accelerator pedal position #2)	Accelerator pedal position sensor No. 2 / Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	-
AMBIENT TEMP (Ambient Temperature)	Ambient air temperature / Min.: -40°C, Max.: 215°C	Power switch on (IG): Same as ambient air temperature	-
INTAKE AIR TEMP (Intake air temperature)	Intake air temperature / Min.: -40°C, Max.: 140°C	Constant: Same as ambient air temperature	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
DTC CLEAR WARM (DTC Clear Warm Up times)	The number of times engine is warmed up after clearing DTCs / Min.: 0, Max.: 255	MIL OFF, engine coolant temperature increases from below 22°C (71.6°F) before starting the engine to above 70°C (158°F) after starting the engine: Increases once	-
DTC CLEAR RUN (DTC Clear Run Distance)	Drive distance after clearing DTCs / Min.: 0 km, Max.: 65535 km	-	-
DTC CLEAR MIN (DTC Clear Min)	Elapsed time after clearing DTCs / Min.: 0 min, Max.: 65535 min	-	-
MIL ON RUN DIST (MIL ON RUN Distance)	Travel distance after a malfunction occurs / Min.: 0 km, Max.: 65535 km	-	-
MIL ON ENG TIME (MIL ON Engine Run Time)	Driving time after a malfunction occurs / Min.: 0 km, Max.: 65535 km	-	-
MIL status (MIL status)	MIL status / ON or OFF	MIL ON: ON	Constant ON: Repair in accordance with detected DTCs
MODEL CODE (MODEL CODE)	Model code	-	Identifying model code: AHV40L
ENGINE CODE (ENGINE CODE)	Engine code	-	Identifying engine code: AHV40L
ECU CODE (ECU CODE)	ECU code	-	Identifying ECU code: 33###
DESTINATION (DESTINATION)	Destination	-	Identifying destination: A (America)
Calc Load (Calculate Load)	Calculate load / Min.: 0%, Max.: 100%	• Idling (INSPECTION MODE): 11 to 22% • Driving (2,500 rpm): 12.1 to 18.2%	-
THROTTLE POS (Throttle POS)	Throttle position sensor / Min.: 0%, Max.: 100%	• Throttle valve fully closed: 10 to 24% • Throttle valve fully open: 64 to 96%	-
L-TEMP ST JUDGE (Times of low temperature start-judging)	Time of low temperature start judging / Min.: 0, Max.: 65535	-	-
L-TEMP ST TIME (Low temperature-starting accumulation time)	Low temperature starting accumulation / Min.: 0, Max.: 67107840	-	-
TAR BAT VOL (DC) (Target Battery Voltage (DCDC Converter))	Target auxiliary battery voltage / Min.: 0 V, Max.: 20 V	-	-
DCDC FAN MODE (DCDC Converter cooling fan mode)	Hybrid vehicle converter cooling fan mode / Min.: 0%, Max.: 255%	-	-
INV COOLANT TMP (Inverter Coolant Water Temperature)	Inverter coolant temperature / Min.: -128°C, Max.: 127°C	Cold start → Fully warmed up: Gradually rises	-
MG2 REV (Motor (MG2) Revolution)	Motor revolution / Min.: -16383 rpm, Max.: 16383 rpm	-	-
MG2 TORQ (Motor (MG2) Torq)	Motor torque / Min.: -500 N*m, Max.: 500 N*m	-	-
MG2 TRQ EXC VAL (Motor (MG2) Torque execute value)	MG2 torque execution value / Min.: -512 N*m, Max.: 508 N*m	After full-load acceleration with READY light ON and engine stopped: Within +-20% of MG2 TORQ	-

HV

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
MG1 REV (Generator (MG1) Revolution)	Generator revolution / Min.: -16383 rpm, Max.: 16383 rpm	-	-
MG1 TORQ (Generator (MG1) Torq)	Generator torque / Min.: -500 N*m, Max.: 500 N*m	-	-
MG1 TRQ EXC VAL (Generator (MG1) Torque execute value)	MG1 torque execution value / Min.: -512 N*m, Max.: 508 N*m	After full-load acceleration with READY light ON and engine stopped: Within +-20% of MG1 TORQ	-
REGEN EXEC TORQ (Regenrative Brake Torq)	Regenerative brake execution torque / Min.: 0 N*m, Max.: 186 N*m	-	-
REGEN RQST TORQ (Request Regenerative Brake Torq)	Regenerative brake request torque / Min.: 0 N*m, Max.: 186 N*m	Vehicle speed 30 km/h (19 mph) and master cylinder hydraulic pressure -200 N*m: Changes with brake pedal pressure	-
MG1 INVERT TEMP (Inverter temperature-(MG1))	Generator inverter temperature / Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MG2 INVERT TEMP (Inverter temperature-(MG2))	Motor inverter temperature / Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 80°C (77 to 176°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MOTOR2 TEMP (Motor Temperature No2)	Motor temperature / Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 90°C (77 to 194°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
MOTOR1 TEMP (Motor temperature No1)	Generator temperature / Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 100°C (77 to 212°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
CONVERTER TEMP (Converter Temperature)	Boost converter temperature / Min.: -50°C, Max.: 205°C	• Undisturbed for 1 day at 25°C (77°F): 25°C (77°F) • Street driving: 25 to 60°C (77 to 140°F)	• If the value is -50°C (-58°F): +B short in sensor circuit • If the value is 205°C (401°F): Open or GND short in sensor circuit
ACCEL DEG (the difference degree of an accelerator)	Accelerator pedal depressed angle / Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	-
POWER RQST (Request Power)	Request engine power / Min.: 0 W, Max.: 320000 W	-	-
TARGET ENG SPD (Target Engine Revolution)	Target engine speed / Min.: 0 rpm, Max.: 8000 rpm	-	-
ENGINE SPD (Engine SPD)	Engine speed / Min.: 0 rpm, Max.: 8000 rpm	Idling: 950 to 1,050 rpm	-
VEHICLE SPD (RSLVR) (Vehicle SPD (Resolver))	Resolver / Min.: -256 km/h, Max.: 254 km/h	Same as vehicle speed	-
MCYL CTRL POWOR (Master Cylinder Control Torq)	Braking torque that is equivalent to master cylinder hydraulic pressure / Min.: -2040 N*m, Max.: 0 N*m	Brake pedal depressed: Changes with brake pedal pressure	-
SOC (State Of Charge)	Battery state of charge / Min.: 0%, Max.: 100%	Constant: 0 to 100%	-
WOUT CTRL POWER (Wout Control Power)	Discharge control power value / Min.: 0 W, Max.: 81600 W	26,000 W or less	-
WIN CTRL POWER (Win Control Power)	Charge control power value / Min.: -40800 W, Max.: 0 W	-25,000 W or more	-

HV

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
PWR RESOURCE VB (Power Resource VB)	HV battery voltage / Min.: 0 V, Max.: 510 V	READY light ON: 200 to 340 V	-
PWR RESOURCE IB (Power Resource IB)	HV battery current / Min.: -256 A, Max.: 254 A	-	-
VL (VL-Voltage before boosting)	High voltage before boosting / Min.: 0 V, Max.: 510 V	READY ON: Practically the same as the HV battery voltage	• If the value is 0 V: Open or GND short in sensor circuit • If the value is 510 V: +B short in sensor circuit
VH (VH-Voltage past boosting)	High voltage past boosting / Min.: 0 V, Max.: 765 V	Engine revving up in P position: HV battery voltage to 650 V	• If the value is 0 V: Open or GND short in sensor circuit • If the value is 765 V: +B short in sensor circuit
BOOST RATIO (Boosting ratio)	Boost ratio / Min.: 0%, Max.: 100%	The pre-boost and the post boost voltages are equal: 0 to 10%	-
DRIVE CONDITION ID (Drive Condition ID)	Drive condition ID / Min.: 0, Max.: 6	• Engine stopped: 0 • Engine about to be stopped: 1 • Engine about to be started: 2 • Engine operated or operating: 3 • Generating or loading movement: 4 • Revving in P position: 6	-
SHIFT POSITION (Shift sensor shift position)	Shift lever position	P, R, N, D or B	-
CRANK POS (Crank position)	Crankshaft position / Min.: -90 deg, Max.: 90 deg	-	-
A/C CONSMPT PWR (Aircon consumption power)	A/C consumption power / Min.: 0 kW, Max.: 5 kW	-	-
Load Condition (Loading Condition)	Driving condition	• Generator load: MG1 • Motor load: MG2	-
DRIVING PATTEN 1 (Driving pattern 1)	Driving pattern / Min.: 0, Max.: 3	0: Driving at a low speed 1: Driving at a medium speed 2: Driving at a medium-high speed 3: Driving at a high speed	-
DRIVING PATTEN 2 (Driving pattern 2)	Driving pattern / Min.: 0, Max.: 3	0: Driving at a low speed 1: Driving at a medium speed 2: Driving at a medium-high speed 3: Driving at a high speed	-
DRIVING PATTEN 3 (Driving pattern 3)	Driving pattern / 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	-
SHORT WAVE HIGH (Short circuit wave highest value)	Waveform voltage in leak detection circuit in battery ECU / Min.: 0 V, Max.: 5 V	Left for 2 minutes in READY-on state, and pre-boost and post boost voltages are equal: 4 V or more	-
MG1 CTRL MODE (MG1 control model)	MG1 control mode	-	-
MG1 CARRIR FREQ (MG1 carrier frequency)	MG1 carrier frequency / 10 kHz / 5 kHz / 2.5 kHz / 1.25 kHz	-	-
MG2 CTRL MODE (MG2 control mode)	MG2 control mode	-	-
MG2 CARRIR FREQ (MG2 carrier frequency)	MG2 carrier frequency / 5 kHz / 2.5 kHz / 1.25 kHz	-	-
ECU TYPE (Type of ECU)	ECU TYPE	-	Identifying ECU type: HV ECU

HV

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
CURRENT DTC (The number of current code)	The number of current DTCs/ Min.: 0, Max.: 255	-	-
HISTORY DTC (The number of history DTC)	The number of history DTCs/ Min.: 0, Max.: 255	-	-
CHECK MODE (Check mode)	Check mode: ON or OFF	ON: Check mode ON	-
ENG STOP RQST (Engine Stop Request)	Engine stop request / NO or RQST	Requesting engine stop: RQST	-
IDLING REQUEST (Engine Idling Request)	Engine idling request / NO or RQST	Requesting idle: RQST	-
HV BATT CH RQST (Main Battery Charging Request)	HV battery charging request / NO or RQST	Requesting HV battery charging: RQST	-
SHIFT SW P (Shift Sensor SW-P)	Park / Neutral position switch / ON or OFF	P position: ON Except P position: OFF	-
SHIFT SW R (Shift Sensor SW-R)	Park / Neutral position switch / ON or OFF	R position: ON Except R position: OFF	-
SHIFT SW N (Shift Sensor SW-N)	Park / Neutral position switch / ON or OFF	N position: ON Except N position: OFF	-
SHIFT SW D (Shift Sensor SW-D)	Park / Neutral position switch / ON or OFF	D position: ON Except D position: OFF	-
SHIFT SW B (Shift Sensor SW-B)	Park / Neutral position switch / ON or OFF	B position: ON Except B position: OFF	-
SHIFT SW FD (Shift Sensor SW-FD)	Park / Neutral position switch / ON or OFF	D or B position: ON Except D or B position: OFF	-
SHIFT SW RV (Shift Sensor SW-RV)	Park / Neutral position switch / ON or OFF	R position: ON Except R position: OFF	-
SHIFT SW MJ (Shift Sensor SW-MJ)	Park / Neutral position switch / ON or OFF	P, R, N, D or B position: ON	-
AIRCON REQUEST (Aircon request)	Engine starting request from A/C amplifier / NO or RQST	Requesting engine start from A/C amplifier: RQST	-
ENG WARM UP RQT (Engine Warming up request)	Engine warm-up request / NO or RQST	Requesting engine warm-up: RQST	-
SMRP (System Precharge Relay Status-SMRP)	Operating condition of system precharge relay SMRP / ON or OFF	READY ON: OFF	-
SMRB (System Main Relay Status-SMRB)	Operating condition of system main relay SMRB / ON or OFF	READY ON: ON	-
SMRG (System Main Relay Status-SMRG)	Operating condition of system main relay SMRG / ON or OFF	READY ON: ON	-
MG1 GATE (MG1 gate status)	MG1 gate status / ON or OFF	Shutting down generator inverter: ON	-
MG2 GATE (MG2 gate status)	MG2 gate status / ON or OFF	Shutting down motor inverter: ON	-
CNV GATE (Converter gate status)	Boost converter gate status / ON or OFF	Shutting down boost converter: ON	-
A/C GATE (Aircon gate status)	A/C gate status / ON or OFF	While A/C inverter is being shut off: ON	-
CNV CARIER FREQ (Converter carrier frequency)	Converter signal carrier frequency / 5kHz/10kHz	5kHz/10kHz	-
COMP MON (Comprehensive Component Monitor)	Converter monitor / NOT AVL or AVAIL	-	-
CCM ENA (Comprehensive Component Monitor ENA)	Converter monitor enable / UNABLE or ENABLE	-	-

HV

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
CCM CMPL (Comprehensive Component Monitor CMPL)	Component monitor complete / COMPL or INCMPL	-	-
BATTERY SOC (Battery State of Charge)	Battery state of charge / Min.: 0%, Max.: 127.5%	-	-
DELTA SOC (Delta SOC)	Difference between maximum and minimum values of SOC / Min.: 0%, Max.: 100%	READY light ON, engine stopped and no electrical load: 0 to 60%	-
IB BATTERY (Current value of Battery Pack)	Current value of battery pack/ Min.: - 327.68 A, Max.: 327.67 A	-	-
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 VOLT 1 (VMF fan motor voltage 1)	Battery blower motor monitoring voltage / Min.: -25.6 V, Max.: 25.4 V	Fan mode 1 with READY light ON and P position: 0.9 to 1.1 V	-
AUX. BAT V (Auxiliary battery voltage)	Auxiliary battery voltage / Min.: -25.6 V, Max.: 25.4 V	Equivalent to auxiliary battery voltage	-
WIN (Charge control value)	Charge control wattage / Min.: -64 kW, Max.: 63.5 kW	-25 kW or more	-
WOUT (Discharge control value)	Discharge control wattage / Min.: 0 kW, Max.: 63.5 kW	26 kW or less	-
COOLING FAN1 (COOLING FANMODE1)	Battery blower motor actuation mode / Min.: 0, Max.: 40	Stopped: 0 Low to high speed actuation: 1 to 40	-
ECU CTRL MODE (ECU Control mode)	ECU control mode / Min.: 0, Max.: 4	-	-
SBLW RQST (Cooling fan stop control request (Standby Blower))	Battery blower motor stop control request (standby blower) / ON or OFF	While blower motor stop control is requested: ON	-
BATT TEMP 1 to 4 (Temperature of battery TB 1 to 4)	Temperature of HV battery / Min.: -327.68°C, Max.: 327.67°C	Undisturbed for 1 day: Same as ambient air temperature	-
NUM OF BATT (The number of Battery Block)	The number of battery blocks / Min.: 0, Max.: 255	Always: 17	-
BAT BLOCK MIN V (Battery Block Minimum Voltage)	Battery block minimum voltage / Min.: -327.68 V, Max.: 327.67 V	SOC 50 to 60%: 12 V or more	-
MIN BAT BLOCK # (Minimum Battery Block No)	Battery block number with minimum voltage / Min.: 1, Max.: 255	One of numbers 1 to 17	-
BAT BLOCK MAX V (Battery Block Max Voltage)	Battery block maximum voltage / Min.: -327.68 V, Max.: 327.67 V	SOC 55 to 60%: 18 V or less	-
MAX BAT BLOCK # (Max Battery Block No)	Battery block number with maximum voltage / Min.: 1, Max.: 255	One of numbers 1 to 17	-
V1 to V17 BATT BLOCK (Battery Block Voltage V01 to 17)	Battery block voltage / Min.: -327.68 V, Max.: 327.67 V	SOC 60% : 12 to 20 V	-
1 to 17 INTNL RESIST (Internal resistance R01 to 17)	Internal resistance of each battery block / Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1	-
BLOW TIME (Accumulated time of Battery LOW)	Battery low time / Min.: 0, Max.: 65535	-	-
DCIH TIME (Accumulated time of DC Inhibit)	DC inhibit time / Min.: 0, Max.: 65535	-	-
BHI TIME (Accumulated time of Battery too High)	Battery too high time / Min.: 0, Max.: 65535	-	-
HTMP TIME (Accumulated time of Hot Temperature)	Hot temperature time / Min.: 0, Max.: 65535	-	-

HV

2. ACTIVE TEST

HINT:

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

NOTICE:

It is necessary to use caution, because if the intelligent tester DLC3 connector becomes disconnected or if a communication error occurs during an active test, the vehicle could become inoperative (the READY light may go off).

(a) Connect the intelligent tester to the DLC3.

(b) Turn the power switch on (IG) and turn the intelligent tester on.

(c) On the system selection screen, enter the following menus: DIAGNOSIS / OBD/MOBD / HV ECU / ACTIVE TEST.

(d) According to the display on the tester, perform the appropriate active test.

ACTIVE TEST:

Tester Display	Test Part	Control Range	Test Details	Test Condition
INSPECTION MOD 1 (Inspection mode-2WD inspection)	• To check engine running operation • To release traction control while using a speedometer tester	ON or OFF	• Runs the engine continuously with the shift lever in the P position • Releases traction control that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P	Power switch on (IG), HV system normal, not in maintenance mode, and other active tests not being done
INSPECTION MOD 2 (Inspection mode-2WD chassis-dynamo)	To release traction control while using a speedometer tester	ON or OFF	Releases traction control that is initiated when the rotational difference between the front and rear wheels is excessive with the shift lever in any position other than P	Power switch on (IG), HV system normal, not in maintenance mode, and other active tests not being done
COMPRESS TEST (Compression Test) *1	To crank the engine continuously in order to measure the compression	ON or OFF	Allows the engine to continue cranking by activating the MG1 continuously	Power switch on (IG), HV system normal, not in cranking mode, and other active tests not being done
WATER PUMP (Activate the Water Pump)	To activate the HV water pump continuously	ON or OFF	Activates the HV water pump continuously	Power switch on (IG), HV 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)	-

Tester Display	Test Part	Control Range	Test Details	Test Condition
TC/TE1 (Connect the TC and TE1)	Batch display of warnings on combination meter	ON or OFF	TC terminal can be switched ON/OFF	Power switch on (IG), system is normal
BATTERY CHECK (Discharging battery to check weak battery cells)	-	ON or OFF	-	-

NOTICE:
For items marked with *1 in the chart, the intelligent tester will display a communication error and the vehicle's READY light will turn off when the active test is completed. If the tester will be used on the vehicle again, turn the power switch off and then on (READY) again to restart the tester.

HV

DIAGNOSTIC TROUBLE CODE CHART

HYBRID CONTROL SYSTEM:

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0343-747	Camshaft Position Sensor "A" Circuit High Input	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Inverter with converter assembly	Comes on	-	DTC stored	HV-72
P0516-769	Battery Temperature Sensor Circuit Low	1. Auxiliary battery (battery temperature sensor) 2. Wire harness or connector 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-77
P0517-770	Battery Temperature Sensor Circuit High	1. Auxiliary battery (battery temperature sensor) 2. Wire harness or connector 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-77
P0560-117	System Voltage	1. Wire harness or connector 2. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-80
P0617-142	Starter Relay Circuit High	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Main body ECU	Comes on	-	DTC stored	HV-84
P062F-143	EEPROM Malfunction	Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-87
P0630-804	VIN not Programmed or Mismatch-ECM / PCM	Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-88
P0705-757	Transmission Range Sensor Circuit	1. Wire harness or connector 2. Park / neutral position switch 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-90
P0705-758	Transmission Range Sensor Circuit	1. Wire harness or connector 2. Park / neutral position switch 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-90
P0851-775	Park / Neutral Switch Input Circuit Low	1. Wire harness or connector 2. Park / neutral position switch 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-90

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A01-725	Motor Electronics Coolant Temperature Sensor Circuit Range / Performance	1. Wire harness or connector 2. Inverter cooling system 3. Cooling fan system 4. Water pump with motor & bracket assembly 5. Inverter with converter assembly 6. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-96
P0A01-726	Motor Electronics Coolant Temperature Sensor Circuit Range / Performance	1. Wire harness or connector 2. Inverter cooling system 3. Cooling fan system 4. Water pump with motor & bracket assembly 5. Inverter with converter assembly 6. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-96
P0A02-719	Motor Electronics Coolant Temperature Sensor Circuit Low	Inverter with converter assembly	Comes on	-	DTC stored	HV-99
P0A03-720	Motor Electronics Coolant Temperature Sensor Circuit High	Inverter with converter assembly	Comes on	-	DTC stored	HV-99
P0A08-101	DC / DC Converter Status Circuit	1. Duct 2. Hybrid vehicle converter (DC/DC converter) 3. Auxiliary battery	Comes on	-	DTC stored	HV-100
P0A08-264	DC / DC Converter Status Circuit	1. Wire harness or connector 2. Fusible link or fuse 3. Frame wire 4. Hybrid vehicle converter (DC/DC converter) 5. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-102
P0A09-265	DC / DC Converter Status Circuit Low Input	1. Wire harness or connector 2. Hybrid vehicle converter (DC/DC converter) 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-109
P0A09-591	DC / DC Converter Status Circuit Low Input	1. Hybrid vehicle converter (DC/DC converter) 2. Hybrid vehicle control ECU 3. Wire harness or connector	Comes on	-	DTC stored	HV-112
P0A0D-350	High Voltage System Inter-Lock Circuit High	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Service plug grip 4. Inverter with converter assembly 5. Air conditioning harness assembly	Comes on	-	DTC stored	HV-119

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A0D-351	High Voltage System Inter-Lock Circuit High	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Service plug grip 4. Inverter with converter assembly 5. Air conditioning harness assembly	Comes on	-	DTC stored	HV-119
P0A0F-204	Engine Failed to Start	1. Hybrid vehicle control ECU 2. Engine control system	Comes on	-	DTC stored	HV-128
P0A0F-205	Engine Failed to Start	1. Hybrid vehicle control ECU 2. Engine control system	Comes on	-	DTC stored	HV-128
P0A0F-238	Engine Failed to Start	1. Engine 2. Hybrid vehicle transaxle assembly (shaft, gear) 3. Transmission input damper 4. Wire harness or connector 5. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-130
P0A0F-533	Engine Failed to Start	1. Hybrid vehicle control ECU 2. Engine control system	Comes on	-	DTC stored	HV-128
P0A0F-534	Engine Failed to Start	1. Hybrid vehicle control ECU 2. Engine control system	Comes on	-	DTC stored	HV-128
P0A10-263	DC / DC Converter Status Circuit High Input	1. Wire harness or connector 2. Hybrid vehicle converter (DC/DC converter) 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-136
P0A10-592	DC / DC Converter Status Circuit High Input	Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-139
P0A1A-151	Generator Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-143
P0A1A-155	Generator Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-143
P0A1A-156	Generator Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-143
P0A1A-166	Generator Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-143
P0A1A-200	Generator Control Module	1. Inverter with converter assembly (MG ECU) 2. Hybrid vehicle transaxle assembly (Generator resolver) 3. Wire harness or connector	Comes on	Comes on	DTC stored	HV-145
P0A1A-658	Generator Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-143
P0A1A-659	Generator Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-143
P0A1A-791	Generator Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-143

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A1A-792	Generator Control Module	1. Inverter with converter assembly (MG ECU) 2. Hybrid vehicle transaxle assembly (Generator resolver) 3. Wire harness or connector	Comes on	Comes on	DTC stored	HV-145
P0A1A-793	Generator Control Module	1. Inverter with converter assembly (MG ECU) 2. Hybrid vehicle transaxle assembly (Generator resolver) 3. Wire harness or connector	Comes on	Comes on	DTC stored	HV-145
P0A1B-163	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-164	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-168	Drive Motor "A" Control Module	1. Inverter with converter assembly (MG ECU) 2. Hybrid vehicle transaxle assembly (Motor resolver) 3. Wire harness or connector	Comes on	Comes on	DTC stored	HV-152
P0A1B-192	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-193	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-198	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-511	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-512	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-661	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-786	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-788	Drive Motor "A" Control Module	1. Wire harness or connector 2. Inverter with converter assembly (MG ECU) 3. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-157
P0A1B-794	Drive Motor "A" Control Module	Inverter with converter assembly (MG ECU)	Comes on	Comes on	DTC stored	HV-150
P0A1B-795	Drive Motor "A" Control Module	1. Inverter with converter assembly (MG ECU) 2. Hybrid vehicle transaxle assembly (Motor resolver) 3. Wire harness or connector	Comes on	Comes on	DTC stored	HV-152
P0A1B-796	Drive Motor "A" Control Module	1. Inverter with converter assembly (MG ECU) 2. Hybrid vehicle transaxle assembly (Motor resolver) 3. Wire harness or connector	Comes on	Comes on	DTC stored	HV-152
P0A1D-103	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-163

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A1D-134	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-165
P0A1D-135	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-165
P0A1D-140	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-167
P0A1D-141	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-169
P0A1D-144	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-171
P0A1D-145	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-171
P0A1D-148	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-173
P0A1D-162	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-175
P0A1D-179	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-177
P0A1D-187	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-179
P0A1D-390	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-181
P0A1D-393	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-183
P0A1D-570	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-165
P0A1D-721	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-185
P0A1D-722	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-185
P0A1D-723	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-185
P0A1D-765	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-185
P0A1D-787	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-185
P0A1D-821	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-175
P0A1D-822	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-175
P0A1D-823	Hybrid Powertrain Control Module	Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-175
P0A1F-129	Battery Energy Control Module	Battery smart unit	Comes on	Comes on	DTC stored	HV-187
P0A1F-150	Battery Energy Control Module	1. Battery smart unit 2. Wire harness or connector	Comes on	Comes on	DTC stored	HV-189
P0A1F-157	Battery Energy Control Module	1. Battery smart unit 2. Wire harness or connector	Comes on	Comes on	DTC stored	HV-189
P0A2B-248	Drive Motor "A" Temperature Sensor Circuit Range / Performance	Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	DTC stored	HV-193

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A2B-250	Drive Motor "A" Temperature Sensor Circuit Range / Performance	Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	DTC stored	HV-193
P0A2C-247	Drive Motor "A" Temperature Sensor Circuit Low	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	DTC stored	HV-194
P0A2D-249	Drive Motor "A" Temperature Sensor Circuit High	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	DTC stored	HV-194
P0A37-258	Generator Temperature Sensor Circuit Range / Performance	Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	DTC stored	HV-199
P0A37-260	Generator Temperature Sensor Circuit Range / Performance	Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	DTC stored	HV-199
P0A38-257	Generator Temperature Sensor Circuit Low	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	DTC stored	HV-200
P0A39-259	Generator Temperature Sensor Circuit High	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	DTC stored	HV-200
P0A3F-243	Drive Motor "A" Position Sensor Circuit	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly (Motor resolver) 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-205
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly (Motor resolver) 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-205
P0A41-245	Drive Motor "A" Position Sensor Circuit Low	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly (Motor resolver) 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-205
P0A4B-253	Generator Position Sensor Circuit	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly (Generator resolver) 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-209

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A4C-513	Generator Position Sensor Circuit Range / Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly (Generator resolver) 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-209
P0A4D-255	Generator Position Sensor Circuit Low	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly (Generator resolver) 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-209
P0A51-174	Drive Motor "A" Current Sensor Circuit	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-212
P0A60-288	Drive Motor "A" Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A60-290	Drive Motor "A" Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A60-294	Drive Motor "A" Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A60-501	Drive Motor "A" Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A63-296	Drive Motor "A" Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A63-298	Drive Motor "A" Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A63-302	Drive Motor "A" Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A63-502	Drive Motor "A" Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-213
P0A72-326	Generator Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216
P0A72-328	Generator Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216
P0A72-333	Generator Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216
P0A72-515	Generator Phase V Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216
P0A75-334	Generator Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216
P0A75-336	Generator Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A75-341	Generator Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216
P0A75-516	Generator Phase W Current	1. Inverter with converter assembly 2. Service plug grip	Comes on	Comes on	DTC stored	HV-216
P0A78-113	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-219
P0A78-121	Drive Motor "A" Inverter Performance	1. HV relay assembly 2. Inverter with converter assembly 3. Service plug grip 4. Frame wire 5. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-222
P0A78-128	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-229
P0A78-266	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-232
P0A78-267	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-232
P0A78-279	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-235
P0A78-282	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-237
P0A78-284	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Inverter cooling system 3. Cooling fan system 4. Water pump with motor & bracket assembly 5. Hybrid vehicle transaxle assembly 6. Inverter with converter assembly 7. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-239
P0A78-286	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Inverter cooling system 3. Cooling fan system 4. Water pump with motor & bracket assembly 5. Hybrid vehicle transaxle assembly 6. Inverter with converter assembly 7. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-244
P0A78-287	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-249

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A78-306	Drive Motor "A" Inverter Performance	1. Hybrid vehicle transaxle assembly 2. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-251
P0A78-503	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Inverter with converter assembly 3. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-254
P0A78-504	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Inverter with converter assembly 3. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-254
P0A78-505	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Inverter with converter assembly 3. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-258
P0A78-506	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Inverter with converter assembly 3. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-258
P0A78-510	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on until DTC is cleared	Comes on	DTC stored	HV-261
P0A78-523	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-263
P0A78-586	Drive Motor "A" Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-265
P0A78-806	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-267
P0A78-807	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-270
P0A78-808	Drive Motor "A" Inverter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-267
P0A7A-122	Generator Inverter Performance	1. Fuel level 2. Hybrid vehicle transaxle assembly 3. Engine assembly 4. Inverter with converter assembly 5. Wire harness or connector	Comes on	Comes on	DTC stored	HV-272

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A7A-130	Generator Inverter Performance	1. Fuel level 2. Hybrid vehicle transaxle assembly 3. Engine assembly 4. Inverter with converter assembly 5. Wire harness or connector	Comes on	Comes on	DTC stored	HV-276
P0A7A-322	Generator Inverter Performance	1. Inverter cooling system 2. Water pump with motor & bracket assembly 3. Hybrid vehicle transaxle assembly 4. Inverter with converter assembly 5. Engine assembly 6. Fuel level 7. Cooling fan system 8. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-280
P0A7A-324	Generator Inverter Performance	1. Inverter cooling system 2. Water pump with motor & bracket assembly 3. Hybrid vehicle transaxle assembly 4. Inverter with converter assembly 5. Engine assembly 6. Fuel level 7. Cooling fan system 8. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-286
P0A7A-325	Generator Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-292
P0A7A-344	Generator Inverter Performance	1. Hybrid vehicle transaxle assembly 2. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-294
P0A7A-517	Generator Inverter Performance	1. Hybrid vehicle transaxle assembly 2. Wire harness or connector 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-297
P0A7A-518	Generator Inverter Performance	1. Hybrid vehicle transaxle assembly 2. Wire harness or connector 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-297
P0A7A-522	Generator Inverter Performance	Inverter with converter assembly	Comes on until DTC is cleared	Comes on	DTC stored	HV-300
P0A7A-809	Generator Inverter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-302
P0A7A-810	Generator Inverter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-305

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A7A-811	Generator Inverter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-302
P0A90-251	Drive Motor "A" Performance	Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-307
P0A90-509	Drive Motor "A" Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-310
P0A92-261	Hybrid Generator Performance	Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-313
P0A92-521	Hybrid Generator Performance	1. Hybrid vehicle transaxle assembly 2. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-316
P0A93-346	Inverter Cooling System Performance	1. Wire harness or connector 2. Inverter cooling system 3. Water pump with motor & bracket assembly 4. Hybrid vehicle control ECU 5. Inverter with converter assembly 6. Cooling fan system	Comes on	Comes on	DTC stored	HV-319
P0A94-127	DC / DC Converter Performance	1. HV relay assembly 2. Inverter with converter assembly 3. Service plug grip 4. Frame wire 5. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-327
P0A94-172	DC / DC Converter Performance	1. Fuel level 2. Wire harness or connector 3. Hybrid vehicle transaxle assembly 4. Inverter with converter assembly 5. Engine assembly	Comes on	Comes on	DTC stored	HV-331
P0A94-442	DC / DC Converter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-336
P0A94-547	DC / DC Converter Performance	1. Wire harness or connector 2. Inverter with converter assembly 3. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-339
P0A94-548	DC / DC Converter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-343
P0A94-549	DC / DC Converter Performance	1. Wire harness or connector 2. Inverter with converter assembly 3. Hybrid vehicle transaxle assembly	Comes on	Comes on	DTC stored	HV-339

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0A94-550	DC / DC Converter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-345
P0A94-553	DC / DC Converter Performance	1. Wire harness or connector 2. Inverter cooling system 3. Water pump with motor & bracket assembly 4. Hybrid vehicle transaxle assembly 5. Inverter with converter assembly 6. Fuel level 7. Engine assembly 8. Cooling fan system	Comes on	Comes on	DTC stored	HV-347
P0A94-554	DC / DC Converter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-354
P0A94-555	DC / DC Converter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-358
P0A94-556	DC / DC Converter Performance	1. Wire harness or connector 2. Hybrid vehicle transaxle assembly 3. Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-354
P0A94-557	DC / DC Converter Performance	1. Wire harness or connector 2. Inverter cooling system 3. Water pump with motor & bracket assembly 4. Hybrid vehicle transaxle assembly 5. Inverter with converter assembly 6. Fuel level 7. Engine assembly 8. Cooling fan system	Comes on	Comes on	DTC stored	HV-360
P0A94-585	DC / DC Converter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-367
P0A94-587	DC / DC Converter Performance	1. Inverter with converter assembly 2. Battery smart unit	Comes on	Comes on	DTC stored	HV-369
P0A94-589	DC / DC Converter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-373
P0A94-590	DC / DC Converter Performance	Inverter with converter assembly	Comes on	Comes on	DTC stored	HV-373
P0AA1-231	Hybrid Battery Positive Contactor Circuit Stuck Closed	1. HV relay assembly 2. Inverter with converter assembly	Comes on until DTC is cleared	Comes on	DTC stored	HV-375
P0AA1-233	Hybrid Battery Positive Contactor Circuit Stuck Closed	HV relay assembly	Comes on until DTC is cleared	-	DTC stored	HV-377
P0AA4-232	Hybrid Battery Negative Contactor Circuit Stuck Closed	1. HV relay assembly 2. Inverter with converter assembly	Comes on until DTC is cleared	-	DTC stored	HV-379

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0AA6-526	Hybrid Battery Voltage System Isolation Fault	1. Hybrid vehicle transaxle assembly 2. Inverter with converter assembly 3. Frame wire 4. Air conditioning harness assembly 5. HV relay assembly 6. Compressor with motor assembly 7. HV battery 8. Battery smart unit 9. Hybrid vehicle converter (DC/DC converter)	Comes on until DTC is cleared	-	DTC stored	HV-381
P0AA6-611	Hybrid Battery Voltage System Isolation Fault	Compressor with motor assembly	Comes on until DTC is cleared	-	DTC stored	HV-381
P0AA6-612	Hybrid Battery Voltage System Isolation Fault	1. HV relay assembly 2. Battery smart unit 3. HV battery 4. Hybrid vehicle converter (DC/DC converter)	Comes on until DTC is cleared	-	DTC stored	HV-381
P0AA6-613	Hybrid Battery Voltage System Isolation Fault	1. Hybrid vehicle transaxle assembly 2. Inverter with converter assembly	Comes on until DTC is cleared	-	DTC stored	HV-381
P0AA6-614	Hybrid Battery Voltage System Isolation Fault	1. Inverter with converter assembly 2. Floor wire 3. Compressor with motor assembly 4. Air conditioning harness assembly 5. HV relay assembly 6. Hybrid vehicle converter (DC/DC converter)	Comes on until DTC is cleared	-	DTC stored	HV-381
P0AA7-727	Hybrid Battery Voltage Isolation Sensor Circuit	Battery smart unit	Comes on	-	DTC stored	HV-394
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low	1. Wire harness or connector 2. HV relay assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-395
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High	1. Wire harness or connector 2. HV relay assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-395
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low	1. Wire harness or connector 2. HV relay assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-399
P0AE0-228	Hybrid Battery Negative Contactor Control Circuit High	1. Wire harness or connector 2. HV relay assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-399

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P0AE2-161	Hybrid Battery Precharge Contactor Circuit Stuck Closed	1. Wire harness or connector 2. HV relay assembly 3. Hybrid vehicle control ECU 4. Hybrid vehicle converter (DC/DC converter)	Comes on	-	DTC stored	HV-403
P0AE2-773	Hybrid Battery Precharge Contactor Circuit Stuck Closed	1. Connector connection 2. Hybrid vehicle converter (DC/DC converter)	Comes on until DTC is cleared	-	DTC stored	HV-410
P0AE6-225	Hybrid Battery Precharge Contactor Control Circuit Low	1. Wire harness or connector 2. Frame wire 3. Hybrid vehicle converter (DC/DC converter) 4. Hybrid vehicle control ECU 5. Fuse 6. Fusible link	Comes on	Comes on	DTC stored	HV-412
P0AE7-224	Hybrid Battery Precharge Contactor Control Circuit High	1. Wire harness or connector 2. Hybrid vehicle converter (DC/DC converter) 3. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-433
P0AEE-276	Motor Inverter Temperature Sensor "A" Circuit Range / Performance	1. Inverter cooling system 2. Water pump with motor & bracket assembly 3. Inverter with converter assembly 4. Cooling fan system 5. Hybrid vehicle control ECU 6. Wire harness or connector	Comes on	-	DTC stored	HV-437
P0AEE-277	Motor Inverter Temperature Sensor "A" Circuit Range / Performance	1. Inverter cooling system 2. Water pump with motor & bracket assembly 3. Inverter with converter assembly 4. Cooling fan system 5. Hybrid vehicle control ECU 6. Wire harness or connector	Comes on	-	DTC stored	HV-437
P0AEF-275	Drive Motor Inverter Temperature Sensor "A" Circuit Low	Inverter with converter assembly	Comes on	-	DTC stored	HV-440
P0AF0-274	Drive Motor Inverter Temperature Sensor "A" Circuit High	Inverter with converter assembly	Comes on	-	DTC stored	HV-440
P1555-181	Reactor Temperature Sensor Circuit Low	Inverter with converter assembly	Comes on	-	DTC stored	HV-441
P1556-182	Reactor Temperature Sensor Circuit High	Inverter with converter assembly	Comes on	-	DTC stored	HV-441
P1606-138	Collision Detection	1. Center airbag sensor assembly 2. Hybrid vehicle control ECU 3. Vehicle has experienced a collision 4. Circuit breaker sensor No. 1	Comes on until DTC is cleared	-	DTC stored	HV-442

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P1606-308	Collision Detection	1. Center airbag sensor assembly 2. Hybrid vehicle control ECU 3. Vehicle has experienced a collision 4. Circuit breaker sensor No. 1	Comes on until DTC is cleared	-	DTC stored	HV-442
P1606-317	Collision Detection	1. Center airbag sensor assembly 2. Hybrid vehicle control ECU 3. Vehicle has experienced a collision 4. Circuit breaker sensor No. 1	Comes on until DTC is cleared	-	DTC stored	HV-442
P2120-152	Throttle / Pedal Position Sensor / Switch "D" Circuit	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2121-106	Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2122-104	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2123-105	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2125-153	Throttle / Pedal Position Sensor / Switch "E" Circuit	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2126-109	Throttle / Pedal Position Sensor / Switch "E" Circuit Range / Performance	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2127-107	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P2128-108	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2138-110	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2138-154	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation	1. Wire harness or connector 2. Accelerator link rod assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-445
P2511-149	ECM/PCM Power Relay Sense Circuit Intermittent	1. Wire harness or connector 2. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-452
P2519-766	A/C Request "A" Circuit	1. Battery smart unit 2. Hybrid vehicle converter 3. Wire harness or connector	Comes on	-	DTC stored	HV-454
P2532-772	Ignition Switch Run Position Circuit High	1. Wire harness or connector 2. Main body ECU 3. IG1 relay 4. IG2 relay 5. ECU IG No. 1 fuse 6. A/C No. 1 fuse 7. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-458
P3000-388	HV Battery Malfunction	1. Fuel level 2. HV battery	Comes on	-	DTC stored	HV-467
P3000-389	HV Battery Malfunction	1. Engine assembly 2. Hybrid vehicle transaxle assembly 3. HV battery	Comes on	-	DTC stored	HV-469
P3000-603	HV Battery Malfunction	1. Hybrid vehicle control ECU 2. HV battery assembly	Comes on	-	DTC stored	HV-472
P3004-131	Power Cable Malfunction	1. HV relay assembly 2. Frame wire 3. Inverter with converter assembly 4. HV battery 5. Wire harness or connector 6. Hybrid vehicle converter (DC/DC converter)	Comes on	-	DTC stored	HV-474
P3004-132	Power Cable Malfunction	1. HV relay assembly 2. Frame wire 3. Inverter with converter assembly 4. HV battery 5. Wire harness or connector	Comes on	-	DTC stored	HV-483
P3004-133	Power Cable Malfunction	Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-181

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P3004-800	Power Cable Malfunction	1. Wire harness or connector 2. Air conditioning harness assembly 3. Compressor with motor assembly 4. Inverter with converter assembly 5. HV relay assembly 6. Floor wire 7. Hybrid vehicle converter (DC/DC converter) 8. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-488
P3004-801	Power Cable Malfunction	1. Wire harness or connector 2. Air conditioning harness assembly 3. Compressor with motor assembly 4. Inverter with converter assembly 5. HV relay assembly 6. Floor wire 7. Hybrid vehicle converter (DC/DC converter) 8. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-488
P3004-803	Power Cable Malfunction	1. Wire harness or connector 2. HV relay assembly	Comes on	-	DTC stored	HV-496
P3107-213	Airbag ECU Communication Circuit Malfunction	1. Wire harness or connector 2. Center airbag sensor assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-500
P3107-214	Airbag ECU Communication Circuit Malfunction	1. Wire harness or connector 2. Center airbag sensor assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-504
P3107-215	Airbag ECU Communication Circuit Malfunction	1. Wire harness or connector 2. Center airbag sensor assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-507
P3108-535	A/C Amplifier Communication Circuit Malfunction	1. Wire harness or connector 2. Compressor with motor assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-510
P3108-536	A/C Amplifier Communication Circuit Malfunction	1. Wire harness or connector 2. Compressor with motor assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-510

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P3108-538	A/C Amplifier Communication Circuit Malfunction	1. Wire harness or connector 2. Compressor with motor assembly 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-510
P3110-139	IGCT Relay Malfunction	1. Wire harness or connector 2. IGCT relay 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-515
P3110-223	IGCT Relay Malfunction	1. Wire harness or connector 2. IGCT relay 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-515
P3137-348	Collision Sensor Low Input	1. Wire harness or connector 2. Circuit breaker sensor No. 1 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-519
P3138-349	Collision Sensor High Input	1. Wire harness or connector 2. Circuit breaker sensor No. 1 3. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-519
P3147-239	Transmission Malfunction	1. Engine assembly 2. Hybrid vehicle transaxle assembly (shaft, gear) 3. Transmission input damper 4. Wire harness or connector 5. Inverter with converter assembly	Comes on	-	DTC stored	HV-522
P3147-240	Transmission Malfunction	Hybrid vehicle transaxle assembly	Comes on	-	DTC stored	HV-527
P3147-241	Transmission Malfunction	1. Engine assembly 2. Hybrid vehicle transaxle assembly (shaft, gear) 3. Transmission input damper 4. Wire harness or connector 5. Inverter with converter assembly	Comes on	-	DTC stored	HV-522
P3147-242	Transmission Malfunction	Hybrid vehicle transaxle assembly	Comes on	-	DTC stored	HV-527
P3221-314	Generator Inverter Temperature Sensor Circuit Range / Performance	1. Wire harness or connector 2. Inverter cooling system 3. Water pump with motor & bracket assembly 4. Inverter with converter assembly 5. Cooling fan system 6. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-528

HV

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
P3221-315	Generator Inverter Temperature Sensor Circuit Range / Performance	1. Wire harness or connector 2. Inverter cooling system 3. Water pump with motor & bracket assembly 4. Inverter with converter assembly 5. Cooling fan system 6. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-528
P3222-313	Generator Inverter Temperature Sensor Circuit High / Low	Inverter with converter assembly	Comes on	-	DTC stored	HV-531
P3223-312	Generator Inverter Temperature Sensor Circuit High	Inverter with converter assembly	Comes on	-	DTC stored	HV-531
P3226-562	DC/DC Boost Converter Temperature Sensor	1. Wire harness or connector 2. Inverter cooling system 3. Water pump with motor & bracket assembly 4. Inverter with converter assembly 5. Cooling fan system 6. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-532
P3226-563	DC/DC Boost Converter Temperature Sensor	1. Wire harness or connector 2. Inverter cooling system 3. Water pump with motor & bracket assembly 4. Inverter with converter assembly 5. Cooling fan system 6. Hybrid vehicle control ECU	Comes on	-	DTC stored	HV-532
P3227-583	Converter Temperature Sensor Circuit Low	Inverter with converter assembly	Comes on	-	DTC stored	HV-535
P3228-584	Converter Temperature Sensor Circuit High	Inverter with converter assembly	Comes on	-	DTC stored	HV-535
P3232-749	Open or Short to B+ in Blocking of HV Gate Connection	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Inverter with converter assembly	Comes on	-	DTC stored	HV-536
P3233-750	Short to B+ in Blocking of HV Gate Connection	1. Wire harness or connector 2. Hybrid vehicle control ECU 3. Inverter with converter assembly	Comes on	-	DTC stored	HV-538
U0100-211	Lost Communication with ECM / PCM "A"	CAN communication system	Comes on	-	DTC stored	HV-541
U0100-212	Lost Communication with ECM / PCM "A"	CAN communication system	Comes on	-	DTC stored	HV-541
U0100-530	Lost Communication with ECM / PCM "A"	CAN communication system	Comes on	-	DTC stored	HV-541
U0100-774	Lost Communication with ECM / PCM "A"	CAN communication system	Comes on	-	DTC stored	HV-541
U0100-784	Lost Communication with ECM / PCM "A"	CAN communication system	Comes on	-	DTC stored	HV-541

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	Memory	See page
U0110-159	Lost Communication with Driver Motor Control Module	1. Wire harness or connector 2. Inverter with converter assembly (MG ECU) 3. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-544
U0110-160	Lost Communication with Driver Motor Control Module	1. Wire harness or connector 2. Inverter with converter assembly (MG ECU) 3. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-544
U0110-656	Lost Communication with Driver Motor Control Module	1. Wire harness or connector 2. Inverter with converter assembly (MG ECU) 3. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-544
U0110-657	Lost Communication with Driver Motor Control Module	1. Wire harness or connector 2. Inverter with converter assembly (MG ECU) 3. Hybrid vehicle control ECU	Comes on	Comes on	DTC stored	HV-544
U0129-220	Lost Communication with Brake System Control Module	CAN communication system	Comes on	-	DTC stored	HV-541
U0129-222	Lost Communication with Brake System Control Module	CAN communication system	Comes on	-	DTC stored	HV-541
U0129-528	Lost Communication with Brake System Control Module	CAN communication system	Comes on	-	DTC stored	HV-541
U0133-147	Lost Communication with Active Roll Control Module	CAN communication system	Comes on	-	DTC stored	HV-541
U0146-146	Lost Communication with Gateway "A"	CAN communication system	Comes on	-	DTC stored	HV-541
U0146-594	Lost Communication with Gateway "A"	CAN communication system	Comes on	-	DTC stored	HV-551
U0146-827	Lost Communication with Gateway "A"	CAN communication system	Comes on	-	DTC stored	HV-551
U0151-763	Lost Communication with Airbag ECU	1. CAN communication system 2. Multiplex communication system	Comes on	-	DTC stored	HV-553
U0424-537	Lost Communication with A/C ECU	Air conditioning amplifier assembly	-	-	DTC stored	HV-554

INFORMATION / FREEZE FRAME DATA

1. FREEZE FRAME DATA

HINT:

The HV control ECU records vehicle and driving condition information as freeze frame data the moment a DTC is stored. It can be used for estimating or duplicating the vehicle conditions that were present when the malfunction occurred. To confirm the details of the hybrid control system, check the detailed information for the DTC information code in the data list (INF code).

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG) and turn the intelligent tester on.
(c) Select the following menu items: DIAGNOSIS / OBD/MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Select a DTC in order to display its freeze frame data.
(e) Check the freeze frame data of the DTC that has been detected.
(f) Check the freeze frame information recorded with the DTC.

FREEZE FRAME DATA:

Intelligent Tester Display	Measurement Item / Range (Display)	Suspected Vehicle Status When Malfunction Occurs
FREEZE DTC (DTC with require freeze frame data storage)	DTC corresponding to displayed freeze frame data	-
INFORMATION 1 to 5 (DETAIL INFORMATION 1 to 5)	Information code	-
COOLANT TEMP (Engine coolant temperature)	Engine coolant temperature / Min.: -40°C, Max.: 140°C	Cold or warmed-up engine
ENGINE REV (Engine revolution)	Engine speed / Min.: 0 rpm, Max.: 16,383.75 rpm	Engine speed
VEHICLE SPD (Vehicle SPD)	Vehicle speed / Min.: 0 km/h, Max.: 255 km/h	Stopped, or driving (at low, medium, or high speeds)
ENG RUN TIME (Engine run time)	Elapsed time after engine start / Min.: 0 sec., Max.: 65535 sec.	Elapsed time after engine start
+B (+B)	Auxiliary battery voltage / Min.: 0 V, Max.: 65.535 V	Auxiliary battery condition
ACCEL POS #1 (Accelerator pedal position #1)	Accelerator pedal position sensor No. 1 / Min.: 0%, Max.: 100%	Idling, accelerating, or decelerating
ACCEL POS #2 (Accelerator pedal position #2)	Accelerator pedal position sensor No. 2 / Min.: 0%, Max.: 100%	Idling, accelerating, or decelerating
AMBIENT TEMP (Ambient Temperature)	Ambient air temperature / Min.: -40°C, Max.: 215°C	Hot or cold weather
INTAKE AIR TEMP (Intake air temperature)	Intake air temperature / Min.: -40°C, Max.: 140°C	Hot or cold weather
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.: 65535 km	Frequency of malfunction recurrence after clearing DTCs
DTC CLEAR MIN (DTC Clear Min)	Elapsed time after clearing DTCs / Min.: 0 min, Max.: 65535 min	Elapsed time after clearing DTCs
CALC LOAD (Calculate Load)	Calculate load / Min.: 0%, Max.: 100%	-

Intelligent Tester Display	Measurement Item / Range (Display)	Suspected Vehicle Status When Malfunction Occurs
THROTTLE POS (Throttle POS)	Throttle position sensor / Min.: 0%, Max.: 100%	Idling, accelerating, or decelerating
ECU TYPE (Type pf ECU)	ECU type	Identifying ECU type: HV ECU
BATTERY SOC (Battery State of Charge)	Battery state of charge / Min.: 0%, Max.: 100%	State of charge of HV battery
DELTA SOC (Delta SOC)	Difference between maximum and minimum value of SOC / Min.: 0%, Max.: 100%	SOC variance
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
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. BAT V (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
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
SBLW RQST (Cooling fan stop control request (Standby Blower))	Standby blower request	-
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
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

HV

2. INFORMATION

HINT:

Similar to freeze frame data, the HV control ECU also records vehicle and driving condition information as INFORMATION (INF code) at the moment a DTC is stored.

(a) Select the information item which has an INF code from among INFORMATION 1 to 5.

(b) Check the information for the DTC.

INFORMATION:

Intelligent Tester Display	Measurement Item / Range (Display)	Suspected Vehicle Status When Malfunction Occurs
INFORMATION n (INFORMATION n)	Information code	Indication of system with malfunction
MG1 REV (Generator (MG1) Revolution)	Generator revolution / Min.: -16,384 rpm, Max.: 16,256 rpm	Generator speed • Forward rotation appears as "+" • Backward rotation appears as "-"

Intelligent Tester Display	Measurement Item / Range (Display)	Suspected Vehicle Status When Malfunction Occurs
MG2 REV (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 TORQ (Generator (MG1) Torq)	Generator torque / Min.: -512 N*m, Max.: 508 N*m	When generator rotation in "+" direction: • Torque appears as "+" while generator discharges • Torque appears as "-" while generator charges When generator rotation in "-" direction: • Torque appears as "-" while generator discharges • Torque appears as "+" while generator charges
MG2 TORQ (Motor (MG2) Torq)	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
INVERT TEMP-MG1 (Inverter temperature (MG1))	Generator inverter temperature / Min.: -50°C, Max.: 205°C	Generator inverter temperature
INVERT TEMP-MG2 (Inverter temperature (MG2))	Generator inverter temperature / Min.: -50°C, Max.: 205°C	Motor inverter temperature
MG2 TEMP (No2) (Motor temperature MG2 (No2))	Generator inverter temperature / Min.: -50°C, Max.: 205°C	Generator temperature
MG2 TEMP (No1) (Motor temperature MG2 (No1)	Generator inverter temperature / Min.: -50°C, Max.: 205°C	Motor temperature
POWER RQST (Request Power)	Request engine power / Min.: 0 W, Max.: 255 W	Engine power output requested to ECM
ENGINE SPD (Engine SPD)	Engine speed / Min.: 0 rpm, Max.: 16320 rpm	Engine speed
MCYL CTRL POWER (Master Cylinder Control Torq)	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 CTRL POWER (Wout Control Power)	Power value discharge control / Min.: 0 W, Max.: 81600 W	Discharge amount of HV battery
WIN CTRL POWER (Win Control Power)	Power value charge control / Min.: -40800 W, Max.: 0 W	Charge amount of HV battery
DRIVE CONDITION 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 • Generating or loading movement: 4 • Revving in P position: 6	Engine operating condition
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 1. Amount of current during discharge is indicated with positive values 2. Amount of current during charge is indicated with negative values
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

Intelligent Tester Display	Measurement Item / Range (Display)	Suspected Vehicle Status When Malfunction Occurs
ACCEL SENSOR M (Accel sensor main)	Accelerator pedal position sensor main / Min.: 0%, Max.: 100%	Idling, accelerating, or decelerating
AUX. BATT V (Auxiliary Battery Voltage)	Auxiliary battery voltage / Min.: 0 V, Max.: 20 V	Auxiliary battery voltage
CONVERTER TEMP (Converter Temperature)	Boost converter temperature / Min.: -50°C, Max.: 205°C	Boost converter temperature
VL (VL-Voltage before raising pressure)	High voltage after it is boosted / Min.: 0 V, Max.: 510 V	High voltage level before it is boosted
VH (VH-Voltage after raising pressure)	High voltage after it is boosted Min.: 0 V, Max.: 765 V	High voltage level after it is boosted
IG ON TIME (The time of Ignition ON)	The time after power switch on (IG) / Min.: 0 min, Max.: 255 min	Time elapsed with power switch on (IG)
VEHICLE SPD-MAX (Vehicle Speed (Max))	Maximum vehicle speed / Min.: -256 km/h, Max.: 254 km/h	Over-discharging of HV battery
A/C COSMPT PWR (Aircon consumption power)	A/C consumption power / Min.: 0 kW, Max.: 5 kW	A/C load
ENG STOP RQST (Engine Stop Request)	Engine stop request / NO or YES	Engine stop request
IDLING REQUEST (Engine Idling Request)	Engine idling request / NO or YES	Idle stop request
ENGINE FUEL CUT (Engine Fuel Cut)	Engine fuel cut request / NO or YES	Fuel cut request
HV BATT CH RQST (Main Battery Charging Request)	HV battery charging request	HV battery charging request
ENG WARM UP RQT (Engine Warming up Request)	Engine warming up request / NO or YES	Engine warm-up request
STOP SW COND (Stop SW)	Stop light switch ON condition / NO or YES	Brake pedal depressed or released
CRUISE CONTROL (Cruise Control)	Cruise control active condition / NO or YES	Operation under cruise control ON or OFF
EXCLUSIVE INFO 1 to 7 (Exclusive Information 1 to 7)	Exclusive information (in numerical data)	Exclusive information linked to Information
OCCURRENCE ORDR (Occurrence order)	Occurrence sequence of information	Occurrence sequence of information
INVT TMP-MG1 IG (Inverter temperature (MG1) after IG-ON)	Generator inverter temperature after power switch on (IG) / Min.: -50°C, Max.: 205°C	Generator inverter temperature soon after power switch on (IG)
INVT TMP-MG2 IG (Inverter temperature (MG2) after IG-ON)	Motor inverter temperature after power switch on (IG) / Min.: -50°C, Max.: 205°C	Motor inverter temperature soon after power switch on (IG)
MG2 TEMP IG (Motor temperature (MG2) after IG-ON))	Motor temperature after power switch on (IG) / Min.: -50°C, Max.: 205°C	Motor temperature soon after power switch on (IG)
CONVRTR TEMP IG (Converter Temperature after IG-ON)	Boost converter temperature after power switch on (IG) / Min.: -50°C, Max.: 205°C	Boost converter temperature soon after power switch on (IG)
SOC IG (Status Of Charge after IG-ON))	Battery state of charge after power switch on (IG) / Min.: 0%, Max.: 100%	Battery state of charge soon after power switch on (IG)
INVT TMP-MG1MAX (Inverter temperature (MG1) MAX)	Generator inverter maximum temperature / Min.: -50°C, Max.: 205°C	Overheating state of Generator inverter
INVT TMP-MG2MAX (Inverter temperature (MG2) MAX)	Motor inverter maximum temperature / Min.: -50°C, Max.: 205°C	Overheating state of Motor inverter
MG2 TEMP MAX (Motor temperature (MG2) MAX)	Motor maximum temperature / Min.: -50°C, Max.: 205°C	Overheating state of Motor
CONVRTR TMP MAX (Converter Temperature MAX)	Boost converter maximum temperature / Min.: -50°C, Max.: 205°C	Overheating state of boost converter

HV

Intelligent Tester Display	Measurement Item / Range (Display)	Suspected Vehicle Status When Malfunction Occurs
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
HV COOLANT TEMP (HV Coolant Temperature)	HV coolant temperature / Min.: -40°C , Max.: 140°C	HV coolant temperature

OPERATION HISTORY DATA

1. OPERATION HISTORY DATA

HINT:

The HV 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.

(a) Connect the intelligent tester to the DLC3.

(b) Turn the power switch on (IG) and turn the intelligent tester on.

(c) Select the following menu items: DIAGNOSIS / OBD/MOBD / HV ECU / DATA LIST.

(d) Select the menu to view the number of special operations or controls that have been effected.

HINT:

- LATEST OPER: Among the past occurrences, the number of special operations or controls that have been effected during the most recent 1 trip detection.
- LATEST TRIP: The number of trips after the occurrence of LATEST OPER.
- BEF LATST OPER: The number of occurrences during the trip previous to the LATEST OPER.
- BEF LATST TRIP: The number of trips after the occurrence of BEF LATST OPER.

Special operation and history data:

Intelligent Tester Display	Count Condition
SHIFT BEF READY (Shift gear before READY)	Shift lever moved with READY light blinking
N RANGE CTRL 1 (N range control in half shift)	Shift position cannot be determined
N RANGE CTRL 2 (N range control by busy shift)	N position control effected due to frequent shifting operation
STEP ACCEL IN N (Step accelerator in N range)	Accelerator pedal depressed in N position
AUX. BATT LOW (Auxiliary Battery Low)	Auxiliary battery voltage below 9.5 V
HV INTERMITTENT (HV ECU Intermittent problems)	Instantaneous open circuit at IGSW terminal of HV control ECU
MG2 TEMP HI (MG2 (motor) temperature high)	Motor temperature rose above 168°C (334°F)
MG1 TEMP HI (MG1 (generator) temperature high)	Generator temperature rose above 168°C (334°F)
MG2 INV TEMP HI (MG2 (motor) Inverter temperature high)	Motor inverter temperature rose above 120°C (248°F)
MG1 INV TEMP HI (MG1 (generator) Inverter temperature high)	Generator inverter temperature rose above 120°C (248°F)
MAIN BATT LOW (Main Battery low voltage)	Battery state of charge dropped below 30%
RESIST OVR HEAT (Resister over heat)	System main resistor overheated
COOLANT HEAT (Coolant heating)	Inverter coolant forecast temperature rose above 65°C (149°F)
CONVERTER HEAT (Converter heating)	Boost converter temperature rose above 120°C (248°F)

HV

Intelligent Tester Display	Count Condition
BKWRD DIR SHIFT (Shift backward direction)	Shifted to R while moving forward or shifted to D or B while moving in reverse
PREVENT STAYING (Prevention control of staying)	Engine speed stays in resonance frequency band
ACCEL AND BRK (Accelerator and brake depressing)	Both accelerator and brake pedals depressed

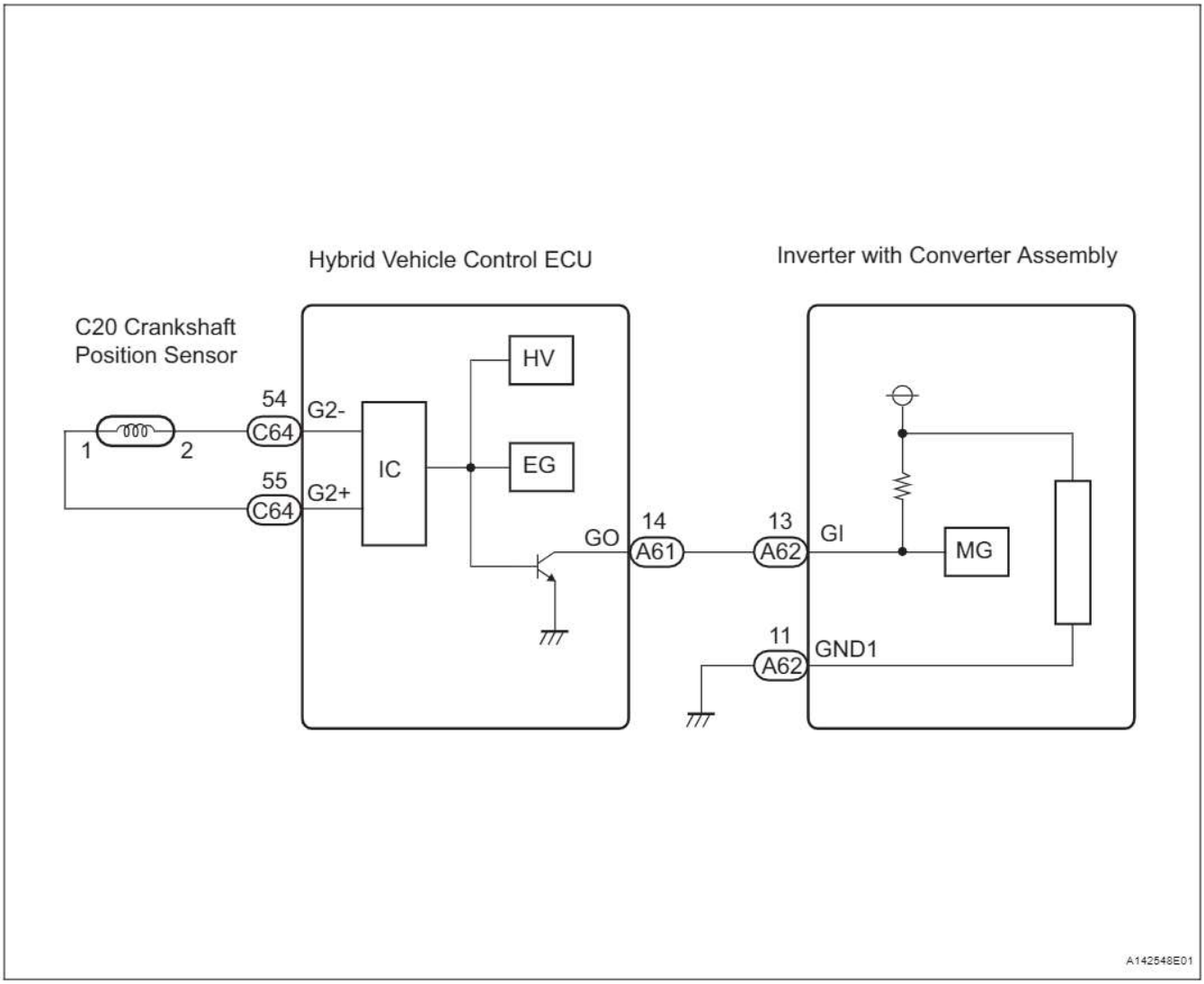
DTC	P0343-747	Camshaft Position Sensor "A" Circuit High Input

DESCRIPTION

The crankshaft position sensor sends the engine speed signal (NE) to the engine CPU and HV CPU of the hybrid vehicle control ECU. The hybrid vehicle control ECU compares the input engine speed signals (NE) in the engine CPU and HV CPU. If any abnormality is found, this DTC will be output.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0343	747	GI 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

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / ENGINE / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
Any two or more of the following DTCs are output simultaneously.

DTC No.	Relevant Diagnosis
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)

HV

YES → **GO TO DTC CHART (P0340) (See page ES-45)**

NO

2	CHECK ENGINE START

(a) Check if the engine can start.
(b) Connect the intelligent tester to the DLC3.
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / ENGINE / DTC INFO / CURRENT DTC.
(d) Read output DTCs.

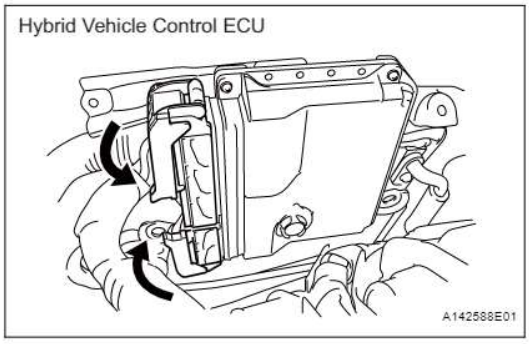
Result

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

B → **GO TO DTC CHART (P0340) (See page ES-45)**

A

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



(a) Check the connections of the hybrid vehicle control ECU connectors.

OK:

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

NG → **CONNECT SECURELY**

OK

4	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY)

CAUTION:

Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).

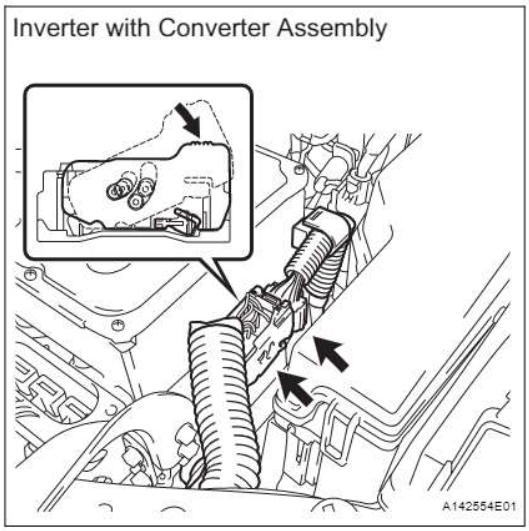
NOTICE:

Do not turn the power switch on (READY) with the service plug grip removed as this may cause a malfunction.

(b) Check the connections of the inverter with converter assembly connectors.

OK:

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



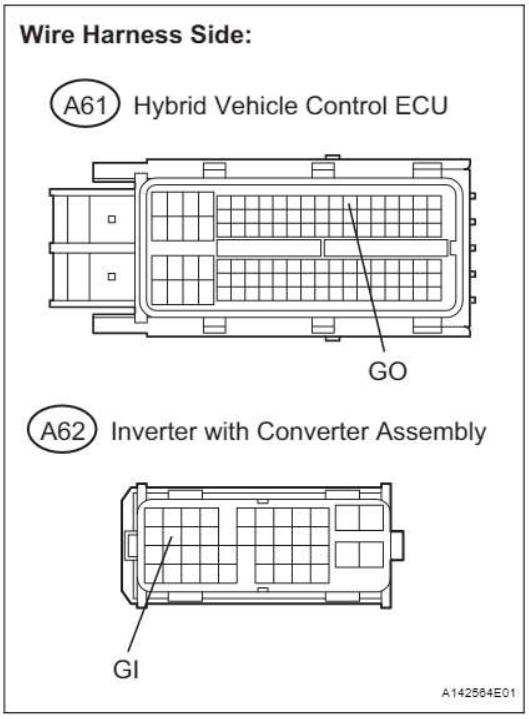
NG → **CONNECT SECURELY**

OK

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

(a) Disconnect the A61 hybrid vehicle control ECU connector.

(b) Disconnect the A62 inverter with converter assembly connector.



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

Standard resistance (Check for open)

Tester Connection	Specified Condition
GO (A61-14) - GI (A62-13)	Below 1 Ω

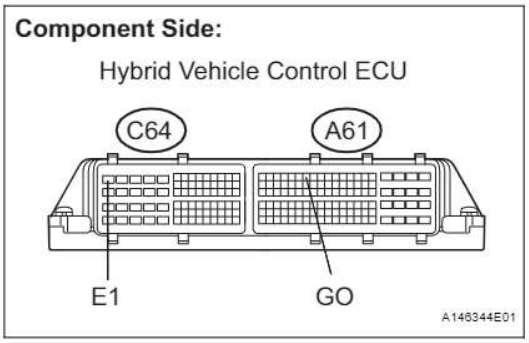
Standard resistance (Check for short)

Tester Connection	Specified Condition
GO (A61-14) or GI (A62-13) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

6 CHECK HYBRID VEHICLE CONTROL ECU



(a) Remove the hybrid vehicle control ECU (See page HV-569).

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

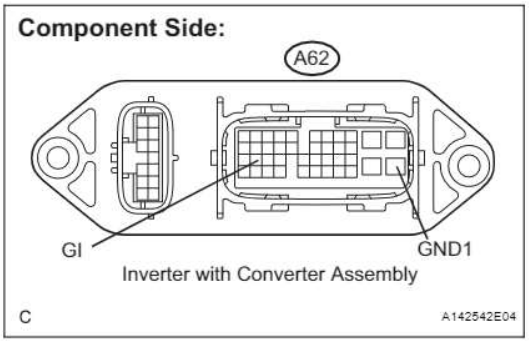
Standard resistance

Tester Connection	Specified Condition
GO (A61-14) - E1 (C64-14)	100 Ω or more

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

OK

7 CHECK INVERTER WITH CONVERTER ASSEMBLY



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

Standard resistance

Tester Connection	Specified Condition
GI (A62-13) - GND1 (A62-11)	10 kΩ or more

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

NG → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

OK

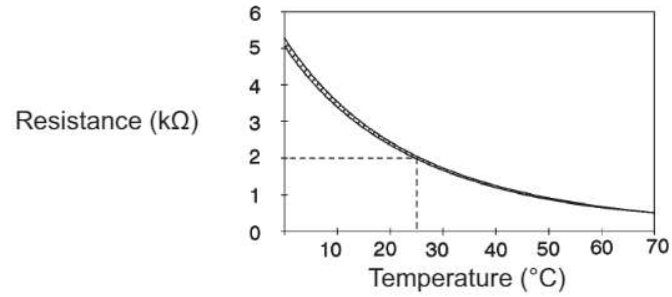
REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0516-769	Battery Temperature Sensor Circuit Low

DTC	P0517-770	Battery Temperature Sensor Circuit High

DESCRIPTION

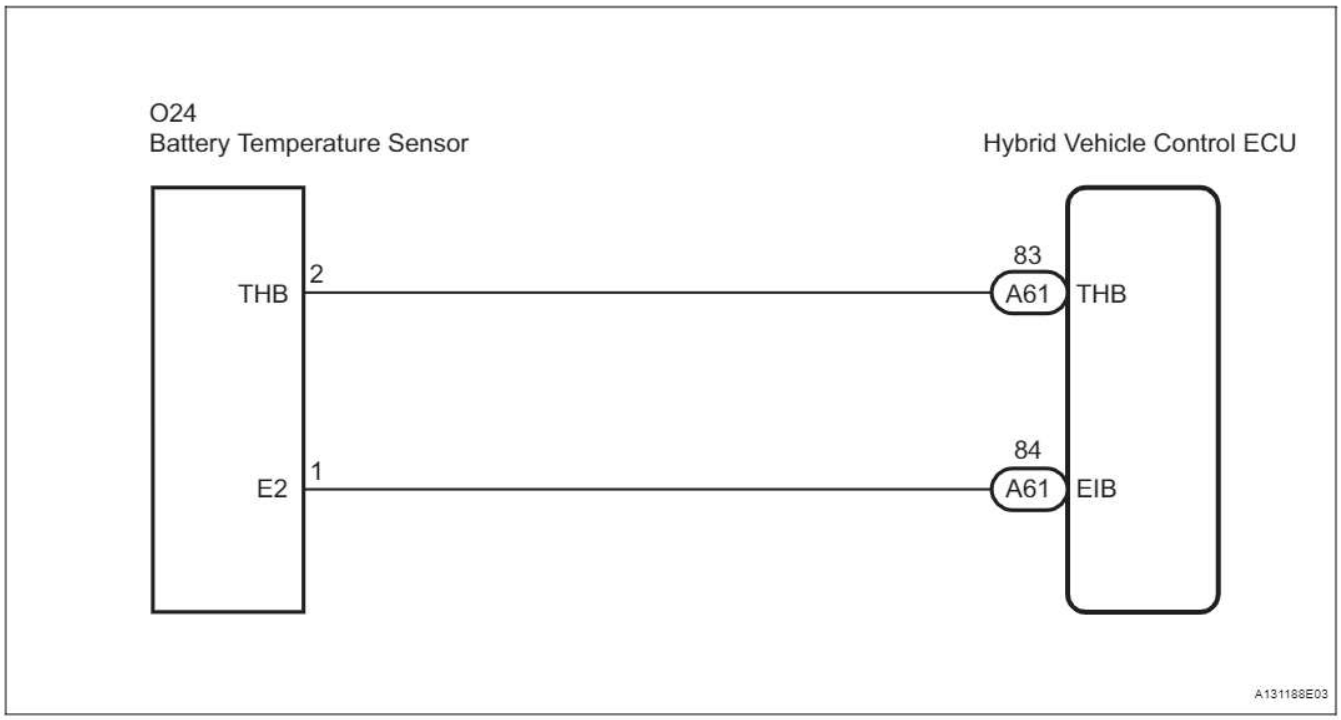
The auxiliary battery temperature sensor detects the auxiliary battery temperature. The resistance of the thermistor built into the auxiliary battery temperature sensor changes in accordance with changes in the auxiliary battery temperature. The lower the auxiliary battery temperature, the more the thermistor resistance. Conversely, the more the temperature, the lower the resistance. The auxiliary battery temperature sensor is connected to the hybrid vehicle control ECU. A voltage of 5 V is supplied to the auxiliary battery temperature sensor from the THB terminal of the hybrid vehicle control ECU through its internal resistor R. This means that resistor R and the auxiliary battery temperature sensor are connected in series. The voltage at the THB terminal and the resistance value change in accordance with changes in the auxiliary battery temperature. Based on this signal, the hybrid vehicle control ECU reduces the charging current when the auxiliary battery temperature is high to protect the auxiliary battery.



HV

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0516	769	Malfunction in the auxiliary battery temperature sensor circuit (short to GND)	• Auxiliary battery (battery temperature sensor) • Wire harness or connector • Hybrid vehicle control ECU
P0517	770	Malfunction in the auxiliary battery temperature sensor circuit (open or +B short circuit)	• Auxiliary battery (battery temperature sensor) • Wire harness or connector • Hybrid vehicle control ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

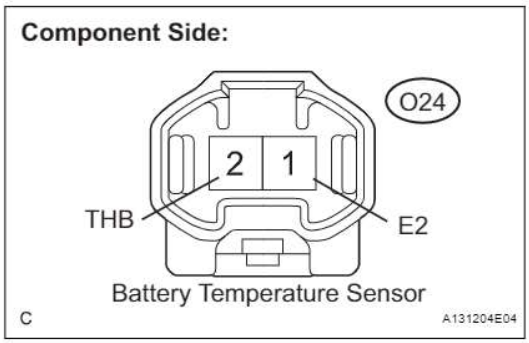
CAUTION:

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

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

HV

1	INSPECT BATTERY (AUXILIARY BATTERY TEMPERATURE SENSOR)



(a) Disconnect the O24 auxiliary battery temperature sensor connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

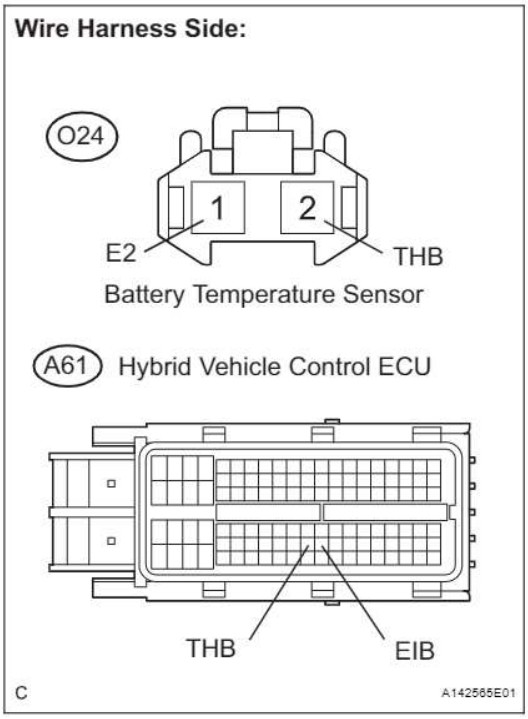
Tester Connection	Temperature	Specified Condition
THB (O24-2) - E2 (O24-1)	0°C (32°F)	5.0 to 5.3 kΩ
	20°C (68°F)	2.3 to 2.5 kΩ
	40°C (104°F)	1.1 to 1.3 kΩ

HINT:
The auxiliary battery temperature sensor is not available separately. If it requires replacement, replace the battery.

NG → REPLACE AUXILIARY BATTERY

OK

2 CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - BATTERY TEMPERATURE SENSOR)



(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
THB (A61-83) - THB (O24-2)	Below 1 Ω
EIB (A61-84) - E2 (O24-1)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
THB (A61-83) or THB (O24-2) - Body ground	10 kΩ or more
EIB (A61-84) or E2 (O24-1) - Body ground	10 kΩ or more

(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
THB (A61-83) or THB (O24-2) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3 CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems (See page HV-17).

NG → REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0560-117	System Voltage

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 power switch is turned off. The back-up power is supplied even when the power switch is off.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0560	117	Malfunction in the hybrid vehicle control ECU back-up power source circuit	• Wire harness or connector • Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0560 (INF 117): Battery signal malfunction
Required sensors / components	Main: Back-up power source circuit Sub: Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

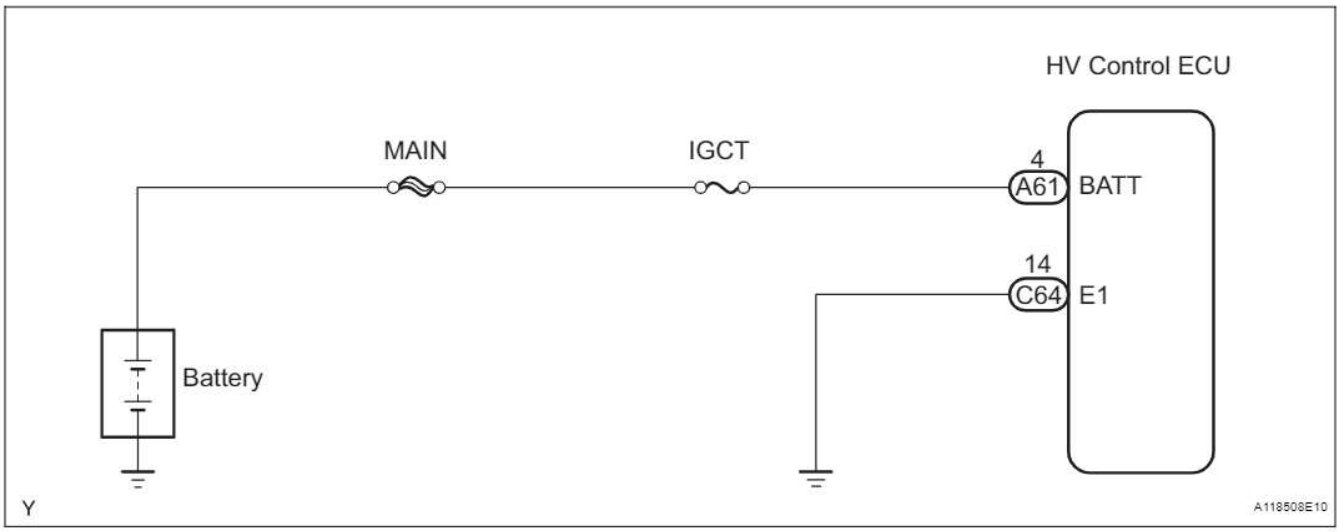
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Auxiliary battery voltage	Between 9 and 14 V

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	**CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)**

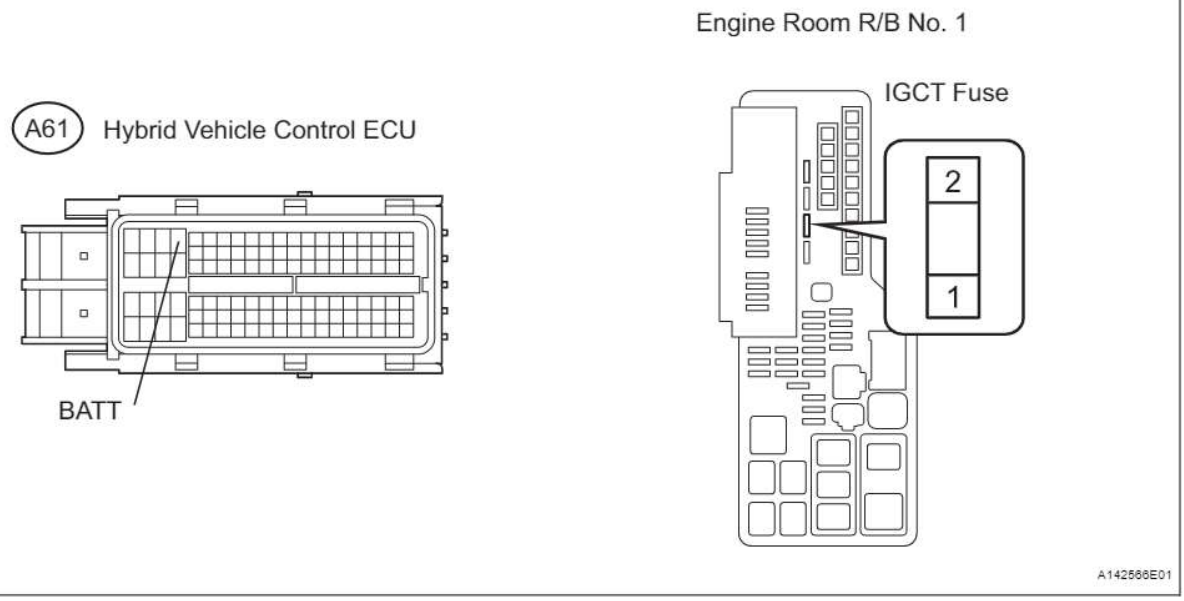
NG → **CONNECT SECURELY**

OK

2	**CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - IGCT FUSE)**

(a) Turn the power switch off.
(b) Remove the IGCT fuse from the engine room R/B No. 1.
(c) Disconnect the A61 hybrid vehicle control ECU connector.
(d) Measure the resistance according to the value(s) in the table below.

Wire Harness Side:



Standard Resistance (Check for open)

Tester Connection	Specified Condition
BATT (A61-4) - Engine room R/B No. 1 IGCT fuse terminal 2	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
BATT (A61-4) or Engine room R/B No. 1 IGCT fuse terminal 2 - Body ground	10 kΩ or more

HV

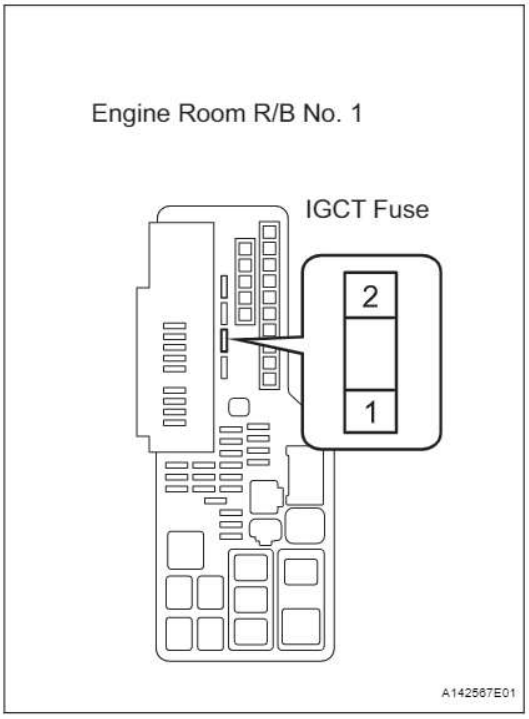
NOTICE:
When taking measurements with a tester, do not apply excessive force to the tester probes to avoid damaging the fuse holder or terminals.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	**CHECK HARNESS AND CONNECTOR (IGCT NO. 1 FUSE - BATTERY POSITIVE TERMINAL)**

(a) Disconnect the positive and negative terminals from the auxiliary battery.



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

Standard resistance (Check for open)

Tester Connection	Specified Condition
Engine room R/B No. 1 IGCT fuse terminal 1 - positive (+) battery terminal	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
Engine room R/B No. 1 IGCT fuse terminal 1 - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4	RECONFIRM DTC OUTPUT (HV)

HV

HINT:
If DTC P0560-117 is output after this inspection, replace the hybrid vehicle control ECU. If the DTC is not output, check for intermittent problems (See page HV-17) because there may be a malfunction in the wire harness or connector.

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Recheck for DTCs.

Result:

DTC P0560-117 is output again.

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page HV-17)**

YES

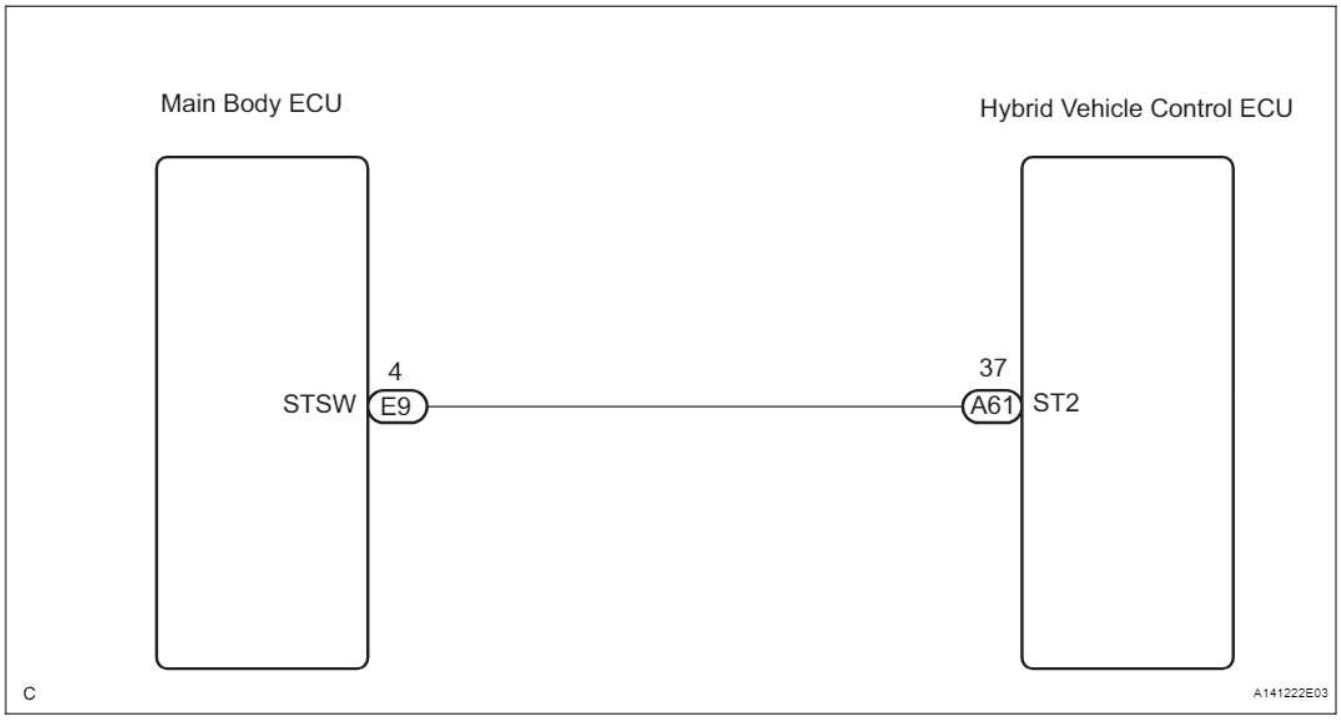
REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0617-142	Starter Relay Circuit High

DESCRIPTION

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0617	142	An ST signal from the hybrid vehicle control ECU is present when the power switch is off.	• Wire harness or connector • Hybrid vehicle control ECU • Main body ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

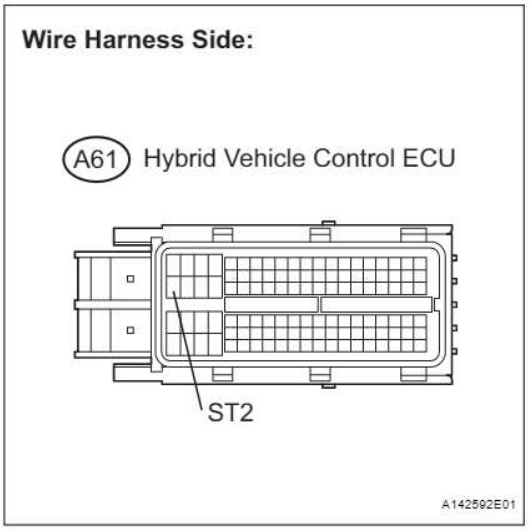
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HINT:

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

1	CHECK HARNESS AND CONNECTOR (ST2 TERMINAL VOLTAGE)

(a) Disconnect the A61 hybrid vehicle control ECU connector.



(b) Measure the voltage according to the value(s) in the table below when the power switch is off.

Standard voltage

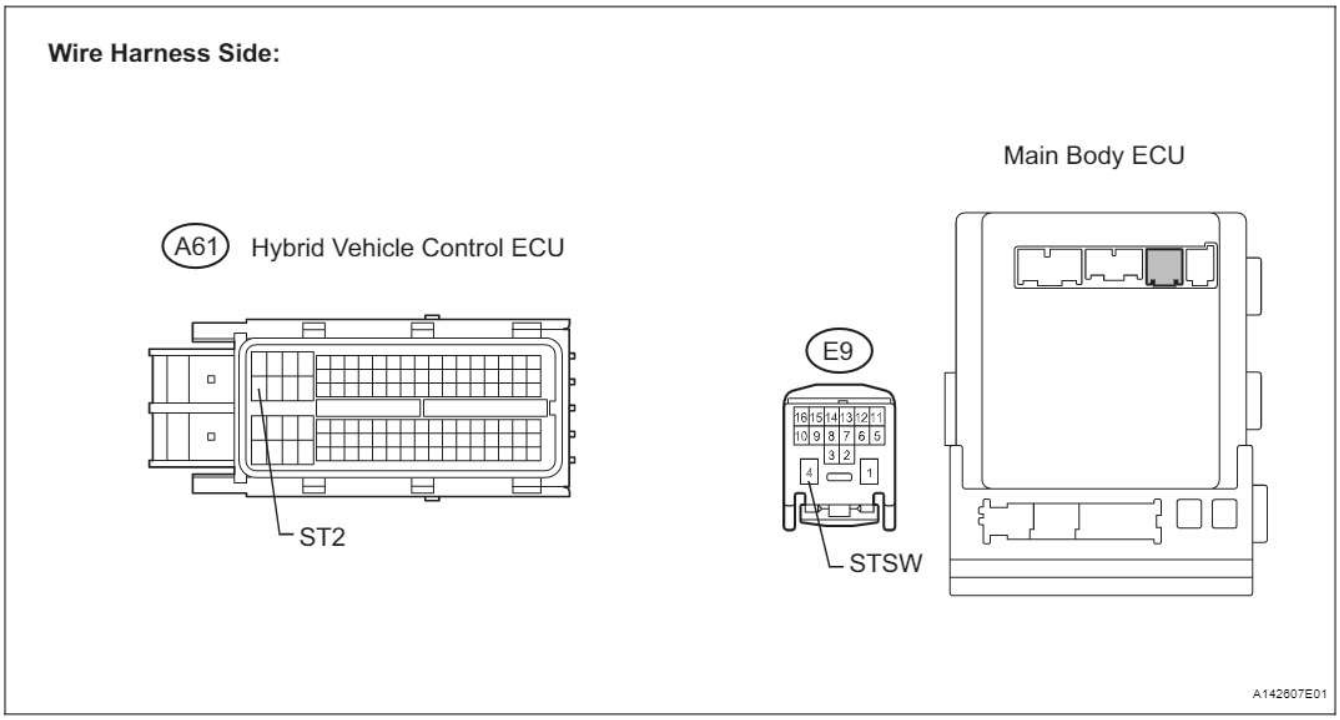
Tester Connection	Specified Condition
ST2 (A61-37) - Body ground	Below 1 V

OK → Go to step 3

NG

2	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - MAIN BODY ECU)

(a) Disconnect the E9 main body ECU connector .
(b) Measure the voltage according to the value(s) in the table below when the power switch is off.



Standard voltage

Tester Connection	Specified Condition
ST2 (A61-37) or STSW (E9-4) - Body ground	Below 1 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE MAIN BODY ECU

3	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

4	RECONFIRM DTC OUTPUT

(a) Turn the power switch off and leave the vehicle as it is for approximately 5 seconds.
(b) Turn the power switch on (IG) again.
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Recheck for DTCs.
Result:
DTC P0617-142 is output again.

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page HV-17)**

HV

YES

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P062F-143	EEPROM Malfunction

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P062F	143	ECU internal error	Hybrid vehicle control ECU

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:

See page HV-569

NEXT

HV

COMPLETED

DTC	P0630-804	VIN not Programmed or Mismatch-ECM / PCM

DESCRIPTION

DTC P0630 is set if the Vehicle Identification Number (VIN) is not stored in the hybrid vehicle control ECU or the input VIN is not accurate. Input the VIN with the intelligent tester (See page HV-18).

DTC No.	INF No.	DTC Detection Condition	Trouble Area
P0630	804	• VIN not stored in hybrid vehicle control ECU • Input VIN in hybrid vehicle control ECU not accurate	Hybrid vehicle control ECU

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

NOTICE:

If P0630 is set, the VIN must be input to the hybrid vehicle control ECU using the intelligent tester. However, all DTCs are cleared automatically by the tester when inputting the VIN. If DTCs other than P0630-804 are set, check them first.

HV

NEXT

2	INPUT VIN WITH INTELLIGENT TESTER

(a) Input the VIN with the intelligent tester (See page HV-18).

NOTICE:

Be sure to check the auxiliary battery voltage before performing VIN writing because VIN writing cannot be performed if the auxiliary battery voltage is below 10 V.

NEXT

3	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.

(b) Turn the power switch on (IG).

(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
OK:
DTC P0630-804 is not output.

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

OK

COMPLETED

HV

DTC	P0705-757	Transmission Range Sensor Circuit

DTC	P0705-758	Transmission Range Sensor Circuit

DTC	P0851-775	Park / Neutral Switch Input Circuit Low

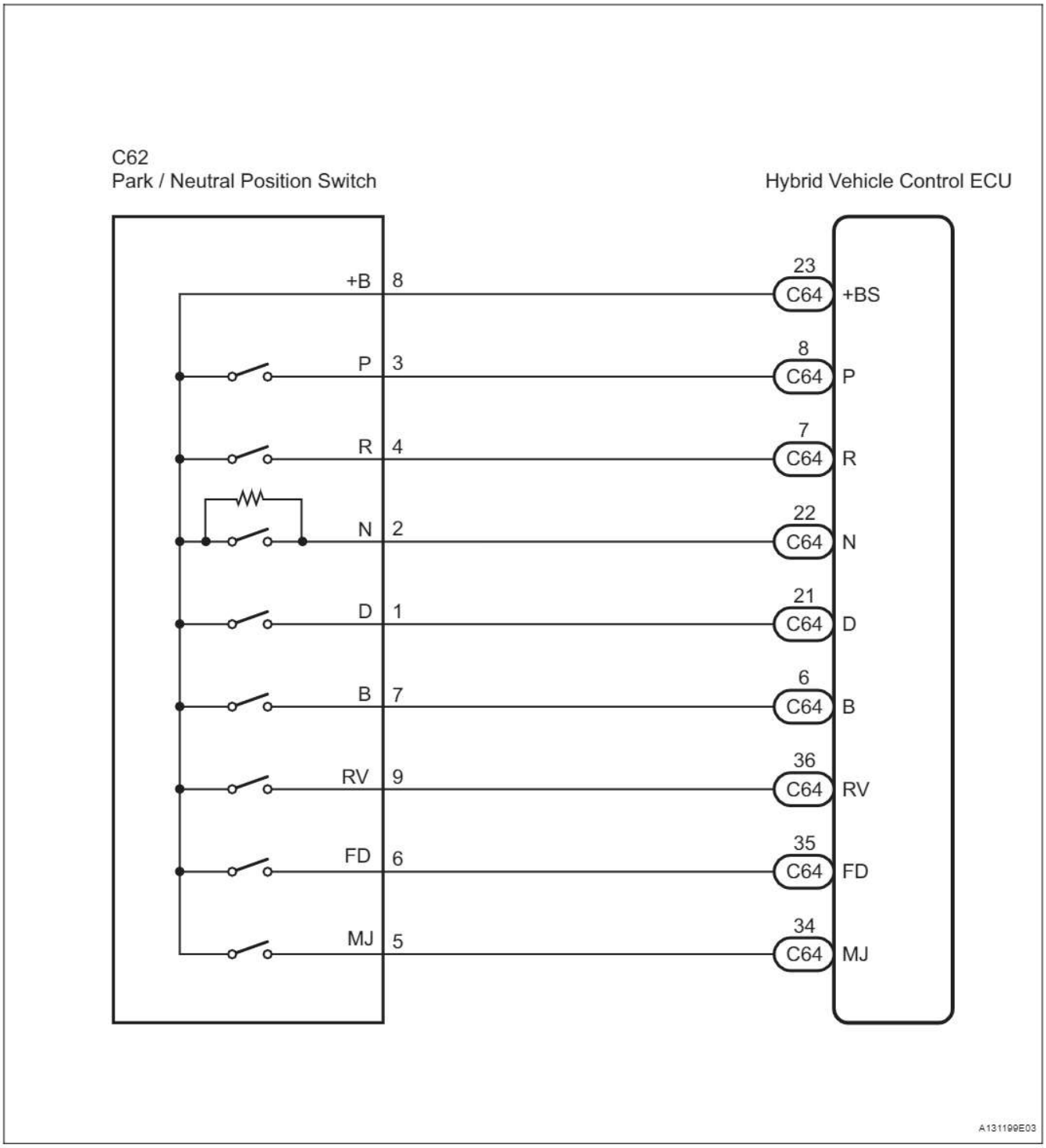
DESCRIPTION

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 No.	INF Code	DTC Detection Condition	Trouble Area
P0705	757	Park / neutral position switch pattern problem	• Wire harness or connector • Park / neutral position switch • Hybrid vehicle control ECU
P0705	758	Shifting malfunction (open circuit in MJ)	• Wire harness or connector • Park / neutral position switch • Hybrid vehicle control ECU
P0851	775	N signal line malfunction	• Wire harness or connector • Park / neutral position switch • Hybrid vehicle control ECU

HV

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.**

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

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

1	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

2	READ VALUE OF INTELLIGENT TESTER (SHIFT POSITION)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) While slowly moving the shift lever from P to B, and then back to the P position, read the data list (SHIFT POSITION) displayed on the intelligent tester.
HINT:
Make sure to move the shift lever slowly.

Result

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

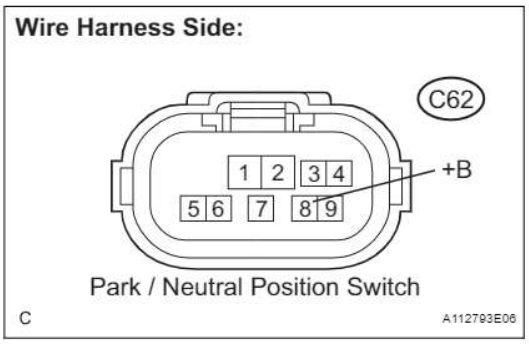
HV

(d) Check if DTCs are output.
Result:
DTCs P0705-757, P0705-758, and P0851-775 are not output.

OK → **Go to step 6**

NG

3	CHECK HARNESS AND CONNECTOR (POWER SOURCE CIRCUIT)



(a) Disconnect the C62 park / neutral position switch connector.
(b) Turn the power switch on (IG).
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

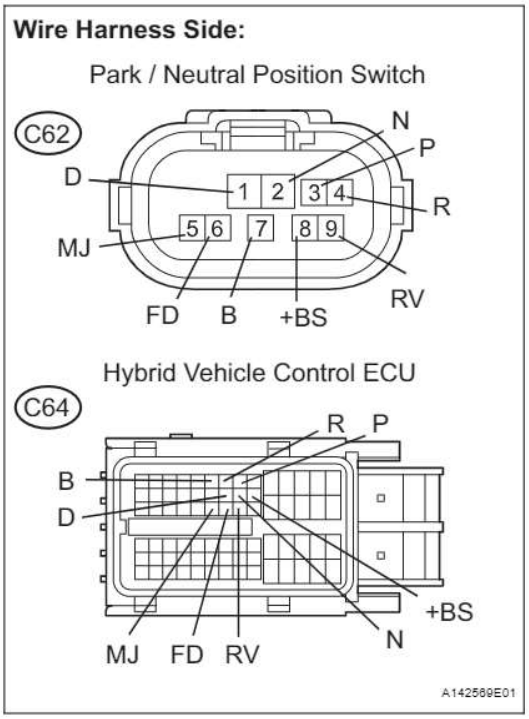
Tester Connection	Specified Condition
+B (C62-8) - Body ground	10 to 14 V

NOTICE:
Turning the power switch on (IG) with the park / neutral position switch connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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



(a) Disconnect the C64 hybrid vehicle control ECU connector.
(b) Disconnect the C62 park / neutral position switch connector .
(c) Measure the voltage according to the value(s) in the table below when the power switch is on (IG).

Standard voltage

Tester Connection	Specified Condition
+BS (C64-23) - Body ground	Below 1 V
P (C64-8) - Body ground	Below 1 V
R (C64-7) - Body ground	Below 1 V
N (C64-22) - Body ground	Below 1 V
D (C64-21) - Body ground	Below 1 V
B (C64-6) - Body ground	Below 1 V
MJ (C64-34) - Body ground	Below 1 V
FD (C64-35) - Body ground	Below 1 V
RV (C64-36) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the park / neutral position switch connector and hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(d) Turn the power switch off.
(e) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
+BS (C64-23) - +B (C62-8)	Below 1 Ω
P (C64-8) - P (C62-3)	Below 1 Ω
R (C64-7) - R (C62-4)	Below 1 Ω
N (C64-22) - N (C62-2)	Below 1 Ω
D (C64-21) - D (C62-1)	Below 1 Ω
B (C64-6) - B (C62-7)	Below 1 Ω
MJ (C64-34) - MJ (C62-5)	Below 1 Ω
FD (C64-35) - FD (C62-6)	Below 1 Ω
RV (C64-36) - RV (C62-9)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
+BS (C64-23) or +B (C62-8) - Body ground	10 kΩ or more
P (C64-8) or P (C62-3) - Body ground	10 kΩ or more
R (C64-7) or R (C62-4) - Body ground	10 kΩ or more
N (C64-22) or N (C62-2) - Body ground	10 kΩ or more
D (C64-21) or D (C62-1) - Body ground	10 kΩ or more
B (C64-6) or B (C62-7) - Body ground	10 kΩ or more
MJ (C64-34) or MJ (C62-5) - Body ground	10 kΩ or more
FD (C64-35) or FD (C62-6) - Body ground	10 kΩ or more
RV (C64-36) or RV (C62-9) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

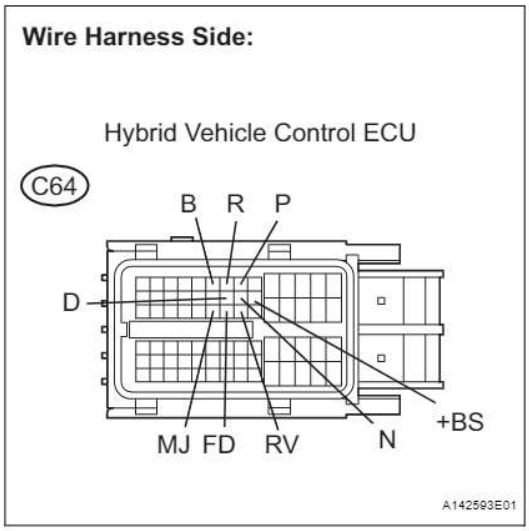
OK

HV

5 CHECK PARK / NEUTRAL POSITION SWITCH

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

Wire Harness Side:



Standard resistance (Check for open)

Shift Lever Position	Tester Connection	Specified Condition
P	+BS (C64-23) - P (C64-8) +BS (C64-23) - MJ (C64-34)	Below 1 Ω

Shift Lever Position	Tester Connection	Specified Condition
R	+BS (C64-23) - R (C64-7) +BS (C64-23) - MJ (C64-34) +BS (C64-23) - RV (C64-36)	Below 1 Ω
N	+BS (C64-23) - N (C64-22) +BS (C64-23) - MJ (C64-34)	Below 1 Ω
D	+BS (C64-23) - D (C64-21) +BS (C64-23) - MJ (C64-34) +BS (C64-23) - FD (C64-35)	Below 1 Ω
B	+BS (C64-23) - B (C64-6) +BS (C64-23) - MJ (C64-34)	Below 1 Ω

Standard resistance (Check for short)

Shift Lever Position	Tester Connection	Specified Condition
P	+BS (C64-23) or P (C64-8) - Body ground and other terminal +BS (C64-23) or MJ (C64-34) - Body ground and other terminal	10 kΩ or more
R	+BS (C64-23) or R (C64-7) - Body ground and other terminal +BS (C64-23) or MJ (C64-34) - Body ground and other terminal +BS (C64-23) or RV (C64-36) - Body ground and other terminal	10 kΩ or more
N	+BS (C64-23) or N (C64-22) - Body ground and other terminal +BS (C64-23) or MJ (C64-34) - Body ground and other terminal	10 kΩ or more
D	+BS (C64-23) or D (C64-21) - Body ground and other terminal +BS (C64-23) or MJ (C64-34) - Body ground and other terminal +BS (C64-23) or FD (C64-35) - Body ground and other terminal	10 kΩ or more
B	+BS (C64-23) or B (C64-6) - Body ground and other terminal +BS (C64-23) or MJ (C64-34) - Body ground and other terminal	10 kΩ or more

HINT:
The resistance between terminals +BS and N should be 4.2 to 5.2 kΩ.

NG → REPLACE PARK / NEUTRAL POSITION SWITCH

HV

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

6 CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems (See page HV-17).

NG → REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0A01-725	Motor Electronics Coolant Temperature Sensor Circuit Range / Performance

DTC	P0A01-726	Motor Electronics Coolant Temperature Sensor Circuit Range / Performance

DESCRIPTION

Refer to the description for DTC P0A02-719 (See page HV-99).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A01	725	Sudden change in HV coolant temperature sensor output	• Wire harness or connector • Inverter cooling system • Cooling fan system • Water pump with motor & bracket assembly • Inverter with converter assembly • Hybrid vehicle control ECU
P0A01	726	HV 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

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

4	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

5	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

HV

NG → CONNECT SECURELY

OK

6	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

7	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 10

OK

8	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

9	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-328)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

NG → ADD COOLANT

OK

11	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 13

OK

12	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

13	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

HV

DTC	P0A02-719	Motor Electronics Coolant Temperature Sensor Circuit Low

DTC	P0A03-720	Motor Electronics Coolant Temperature Sensor Circuit High

DESCRIPTION

The hybrid vehicle control ECU detects HV 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 HV coolant temperature sensor. The ECU also monitors cooling system operation and detects malfunctions in the HV coolant temperature sensor and the circuit.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A02	719	Short to GND in the HV coolant temperature sensor circuit	Inverter with converter assembly
P0A03	720	Open or short to +B in the HV coolant temperature sensor circuit	Inverter with converter assembly

INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

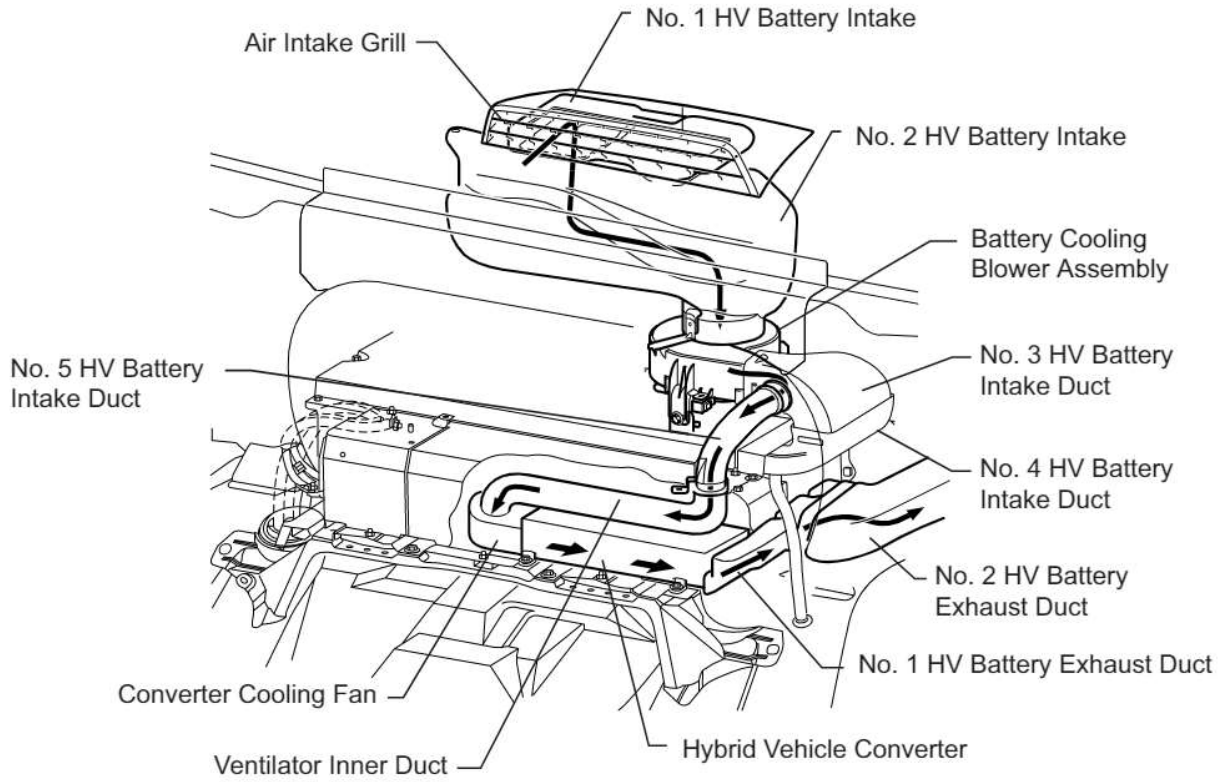
NEXT

COMPLETED

DTC	P0A08-101	DC / DC Converter Status Circuit

DESCRIPTION

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).



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A08	101	Overheating of the hybrid vehicle converter	• Duct • Hybrid vehicle converter • Auxiliary battery

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.**

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

HINT:
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.

1	CHECK PACKAGE TRAY TRIM PANEL ASSEMBLY

(a) Check that the air intake grill of the package tray trim panel assembly is not clogged.
OK:
The air intake grill is not clogged.

NG → **REMOVE FOREIGN OBJECT**

OK ↓

2	CHECK AIR DUCT (ALL)

(a) Check if the duct is installed correctly.
OK:
The duct is installed correctly.
(b) Check the duct for clogging.
OK:
The duct is not clogged.

NG → **REPAIR OR REPLACE AIR DUCT (ALL)**

OK ↓

3	REPLACE HYBRID VEHICLE CONVERTER

(a) Replace the hybrid vehicle converter (See page HB-123).

NEXT ↓

4	CHECK AUXILIARY BATTERY

(a) Turn the power switch on (READY).
(b) Leave the vehicle for 5 minutes.
(c) Measure the voltage of the auxiliary battery.
Standard voltage:
More than 10.5 V

NG → **CHECK AND REPLACE AUXILIARY BATTERY**

OK ↓

COMPLETED

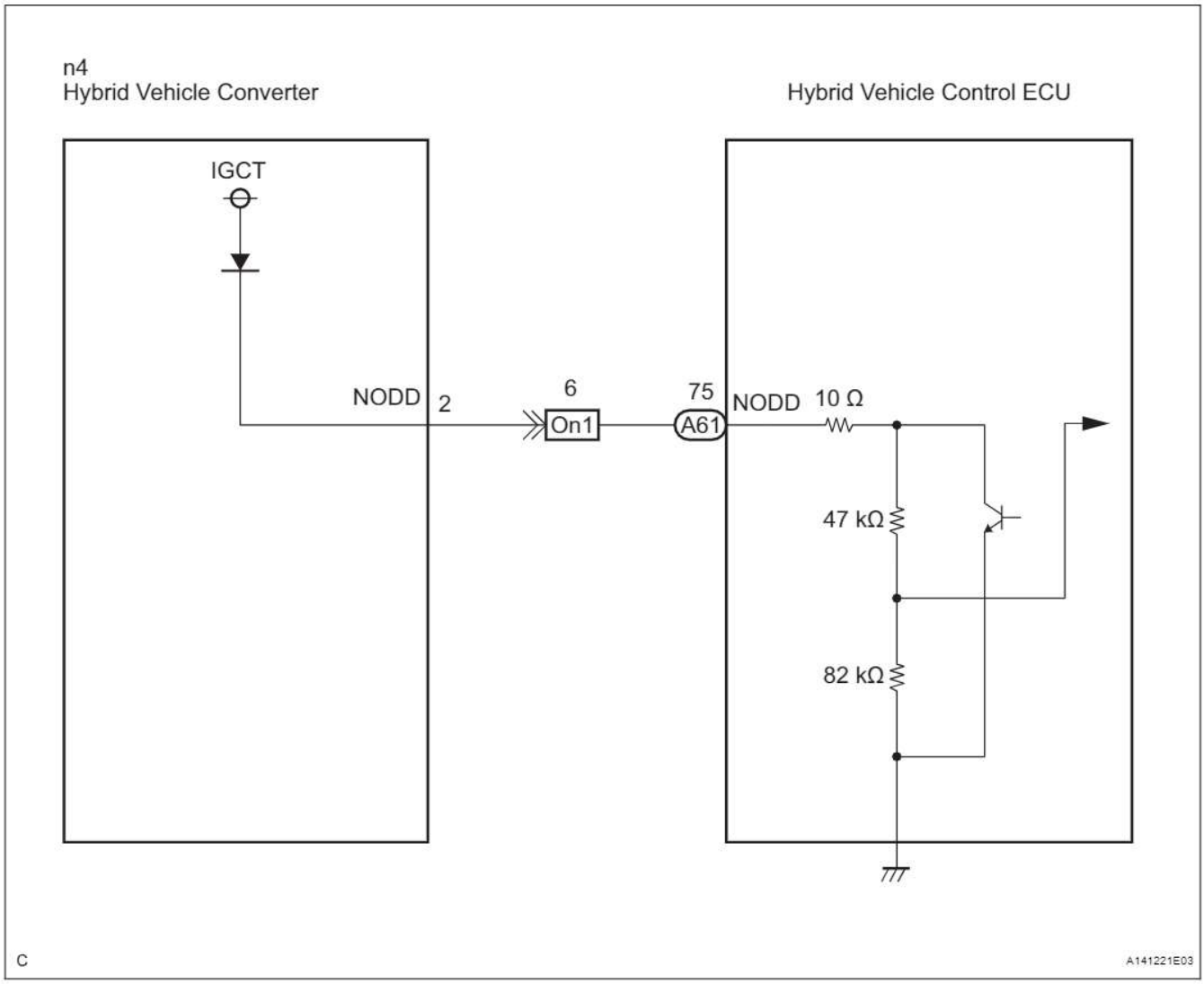
DTC	P0A08-264	DC / DC Converter Status Circuit

DESCRIPTION

For a description of the hybrid vehicle converter (DC/DC converter), (See page HV-109).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A08	264	Malfunction in the hybrid vehicle converter	• Wire harness or connector • Fusible link or fuse • Frame wire • Hybrid vehicle converter (DC/DC connector) • Hybrid vehicle control ECU

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

HV

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

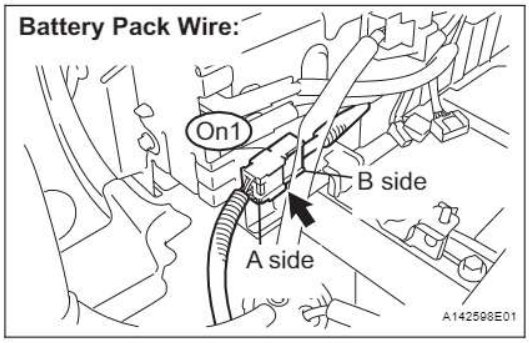
OK

3	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

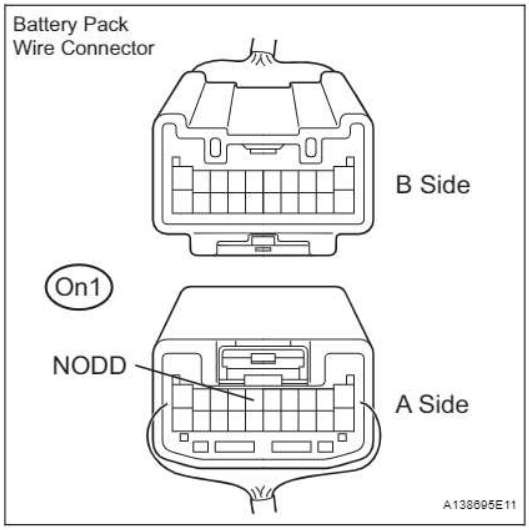
NG → CONNECT SECURELY

OK

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



(a) Disconnect the On1 battery pack wire connector (See page HB-81).



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

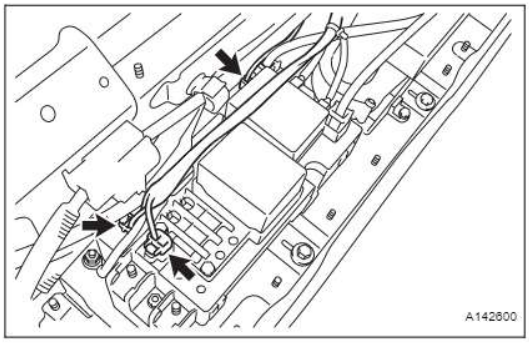
Standard resistance

Tester Connection	Specified Condition
NODD (On1-6) - Body ground	120 to 140 kΩ

NG → **Go to step 11**

OK

5	CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR)



CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).

NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Check the connections of the HV relay assembly connectors.

Result:

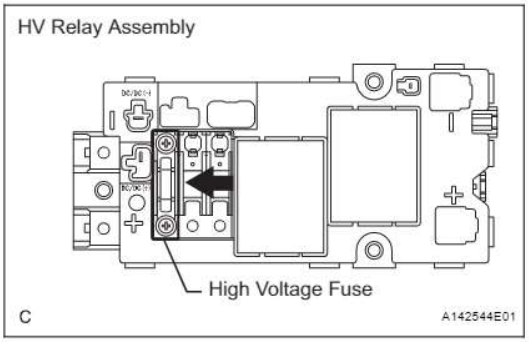
The connectors are connected securely and there are no contact problems.

HINT:
For the removal procedure of the HV relay assembly connector, (See page HB-104).

NG → CONNECT SECURELY

OK

6	CHECK HV RELAY ASSEMBLY (HIGH VOLTAGE FUSE)



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Remove the HV relay assembly (See page HB-104).
(c) Measure the resistance according the the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
High voltage fuse terminal	Below 1 Ω

NG → REPLACE HIGH VOLTAGE FUSE

OK

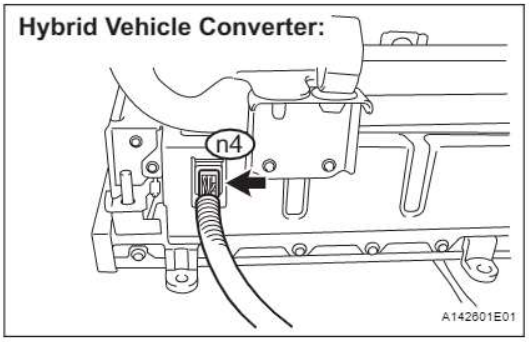
7	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → CONNECT SECURELY

OK

HV

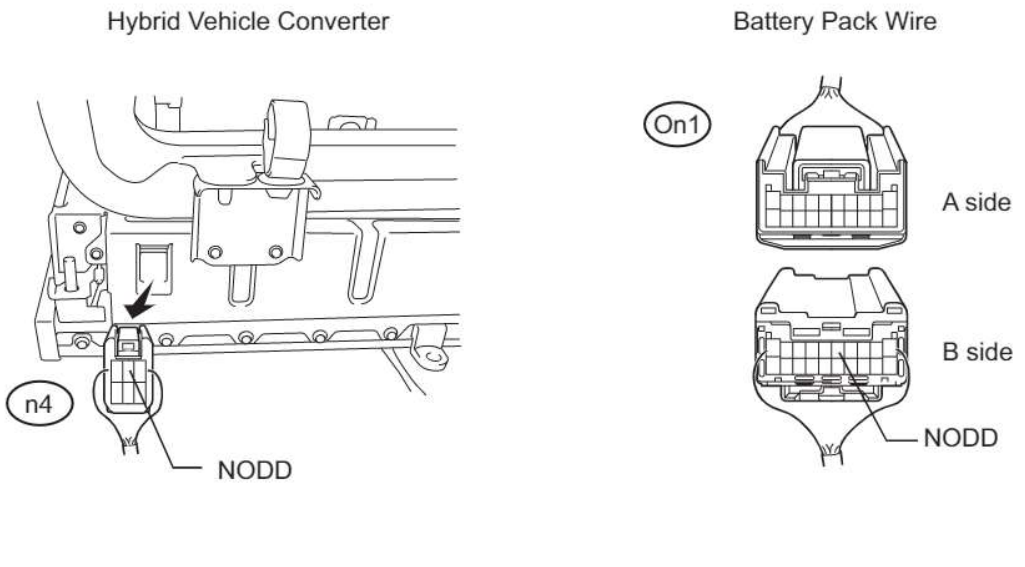
8	CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE - HYBRID VEHICLE CONVERTER)



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Measure the resistance according to the value(s) in the table below.

Wire Harness Side:



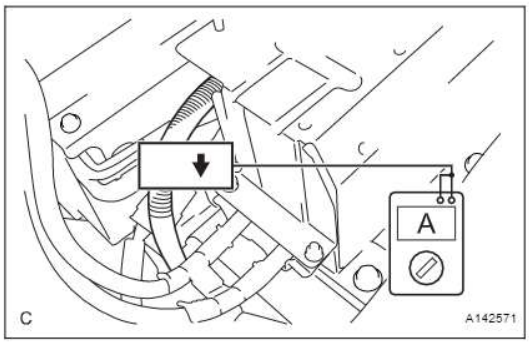
Standard resistance

Tester Connection	Specified Condition
NODD (On1-6) - NODD (n4-2)	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

9 INSPECT HYBRID VEHICLE CONVERTER



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

Result

Item	Specified Condition
Current flowing from the hybrid vehicle converter	60 to 140 A
Auxiliary battery voltage	13 to 15 V

NG → REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

OK

10	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems (See page HV-17).

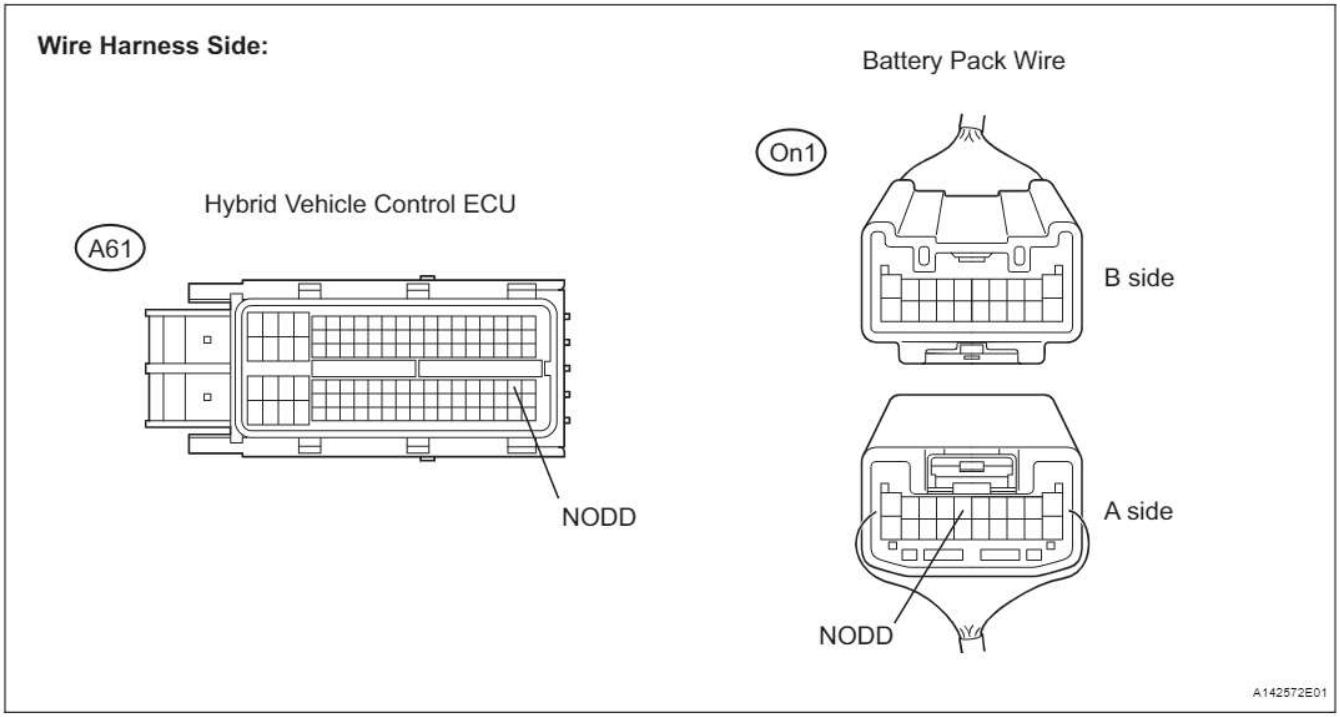
YES → REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

NO

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

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

(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Turn the power switch on (IG).
(c) Measure the voltage according to the value(s) in the table below.



Standard voltage

Tester Connection	Specified Condition
NODD (A61-75) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(d) Turn the power switch off.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
NODD (A61-75) - NODD (On1-6)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
NODD (A61-75) or NODD (On1-6) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

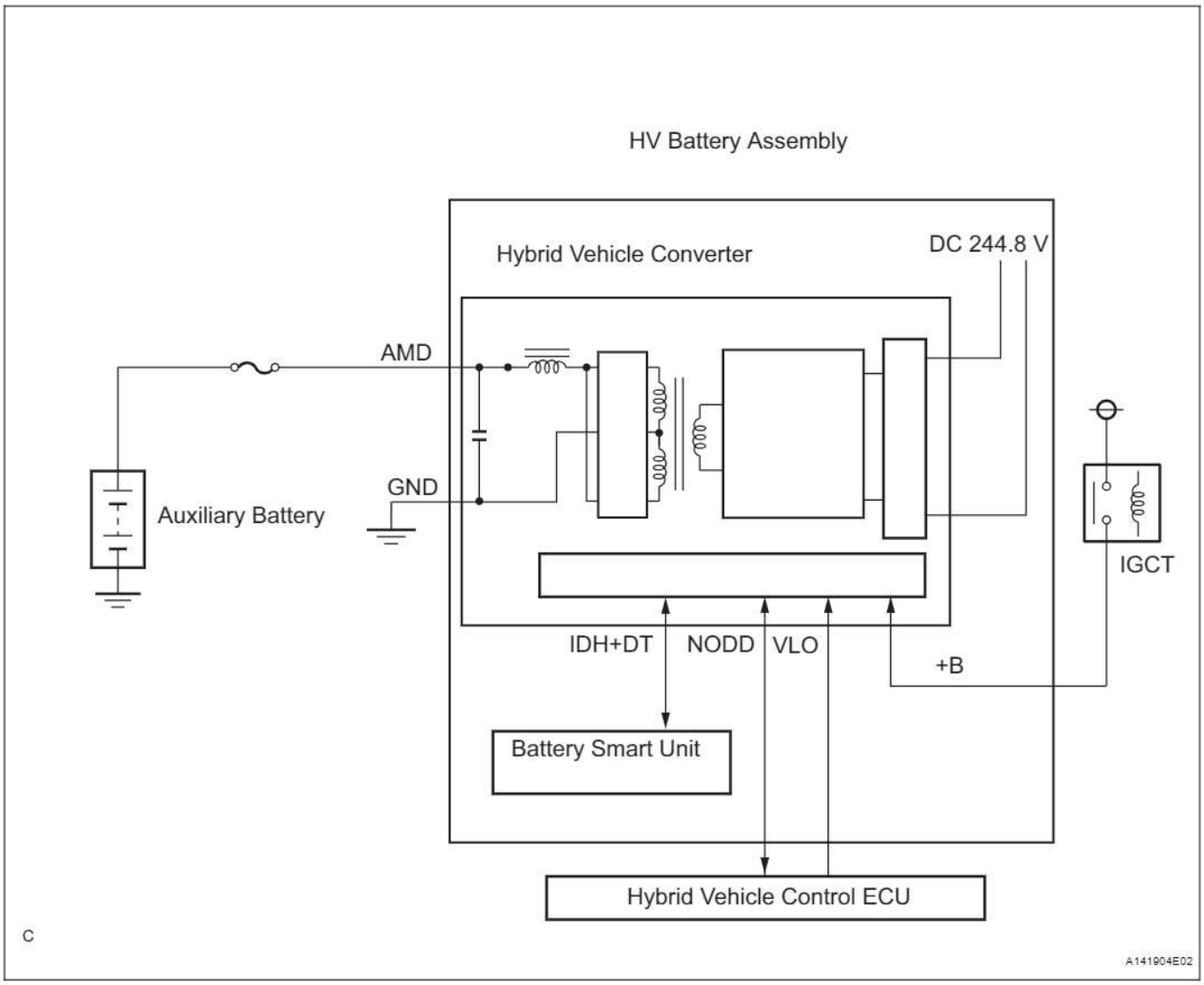
DTC	P0A09-265	DC / DC Converter Status Circuit Low Input

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 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 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, 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 and alerts the driver if it detects a malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A09	265	Open or short to GND in the hybrid vehicle converter (NODD) signal line	• Wire harness or connector • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU

WIRING DIAGRAM

Refer to the wiring diagram (See page HV-102).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1 CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTC P0AE6-225 is also output.

YES → **GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0AE6-225)**

NO

2 CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → **CONNECT SECURELY**

OK

3 CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-120)

NG → **CONNECT SECURELY**

HV

OK

4	CHECK HARNESS AND CONNECTOR (RESISTANCE VALUE OF NODD INSIDE HYBRID VEHICLE CONTROL ECU) (See page HV-109)

NG → Go to step 7

OK

5	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → CONNECT SECURELY

OK

6	CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HYBRID VEHICLE CONVERTER) (See page HV-110)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

HV

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

7	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR) (See page HV-112)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

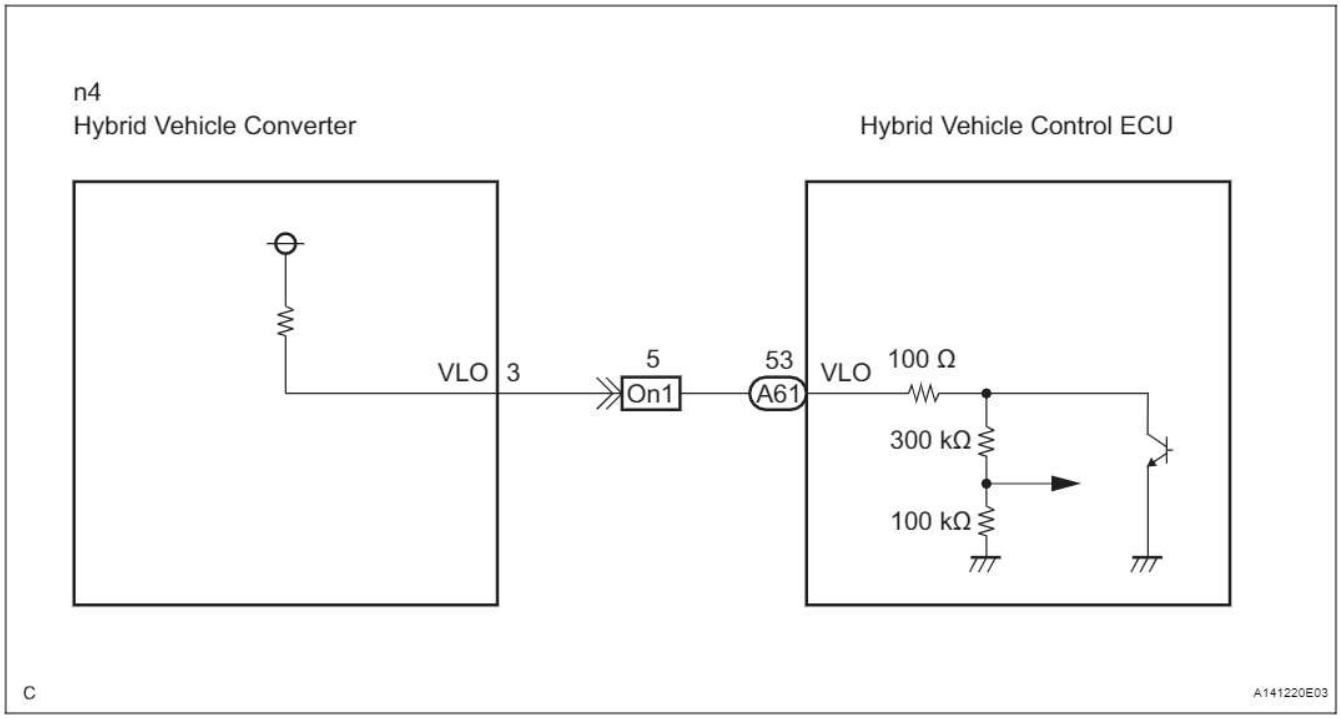
DTC	P0A09-591	DC / DC Converter Status Circuit Low Input

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A09	591	Hybrid vehicle 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

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).

(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTC P0AE6-225 is also output.

YES → **GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0AE6-225)**

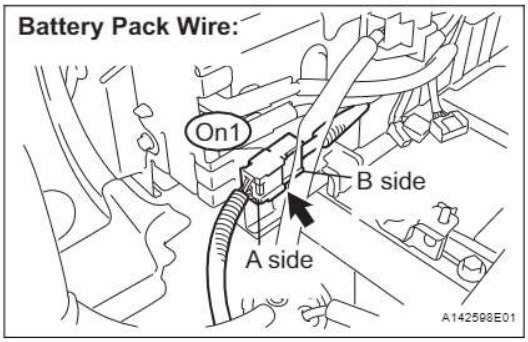
NO

2	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → **CONNECT SECURELY**

OK

3	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)



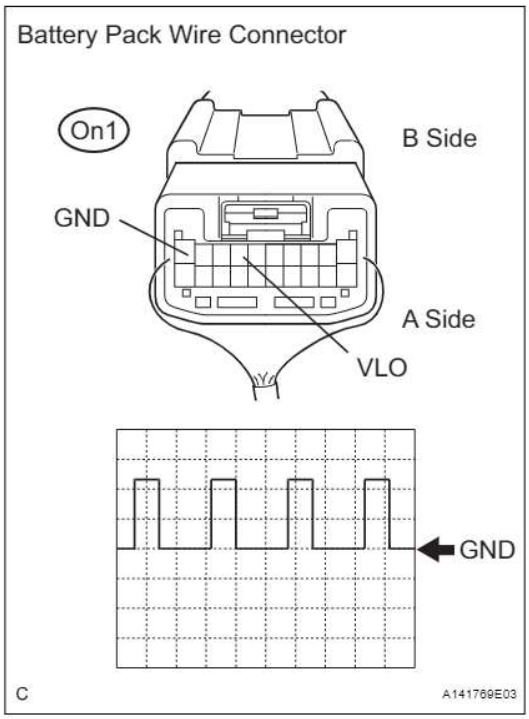
(a) Check the connection of the battery pack wire connector.
OK:
The connector is connected securely and there are no contact problems.
HINT:
For the removal and installation procedures related to inspection of the connection of the battery pack wire connector, (See page HB-81).

NG → **CONNECT SECURELY**

OK

HV

4	CHECK HYBRID VEHICLE CONTROL ECU



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

Item	Contents
Terminal	VLO (On1-7) - GND (On1-10)
Equipment Setting	5 V/DIV, 50 ms./DIV
Condition	Power switch on (IG)

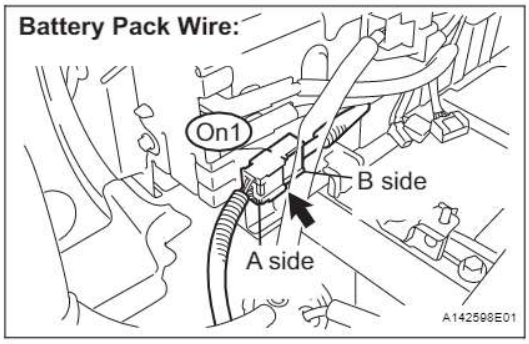
HINT:
Perform this inspection with the battery pack wire connected.

OK → Go to step 9

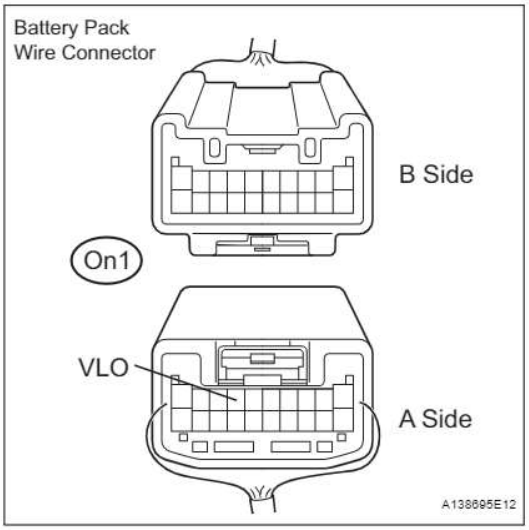
NG

5	CHECK HARNESS AND CONNECTOR (RESISTANCE VALUE INSIDE HV CONTROL ECU)

HV



(a) Disconnect the battery pack wire connector.



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

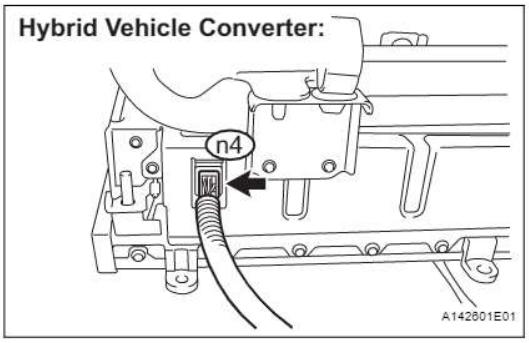
Standard resistance

Tester Connection	Specified Condition
VLO (On1-7) - Body ground	370 to 430 kΩ

NG → **Go to step 8**

OK

6	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Check the connection of the hybrid vehicle converter connector.

OK:

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

NG → **CONNECT SECURELY**

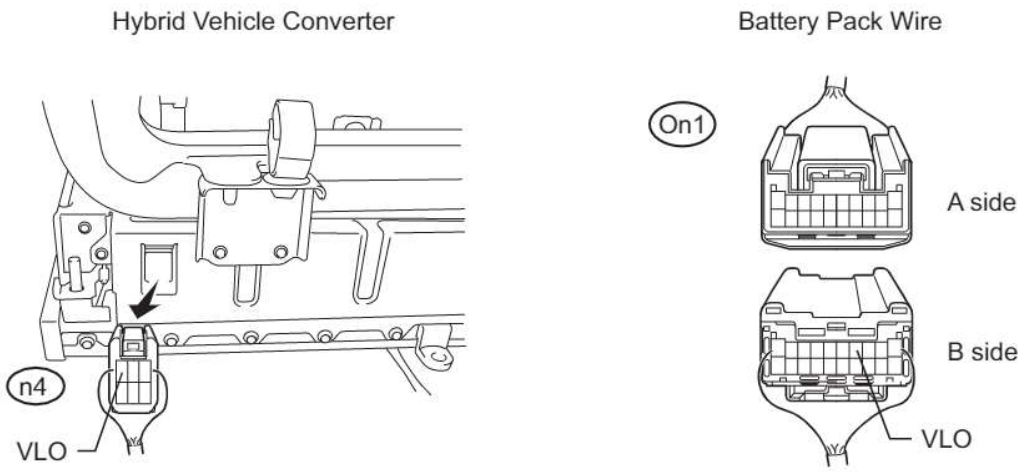
OK

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

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Measure the resistance according to the value(s) in the table below.

Wire Harness Side:



Standard resistance (Check for open)

Tester Connection	Specified Condition
VLO (On1-7) - VLO (n4-3)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
VLO (On1-7) or VLO (n4-3) - Body ground	10 kΩ or more

HV

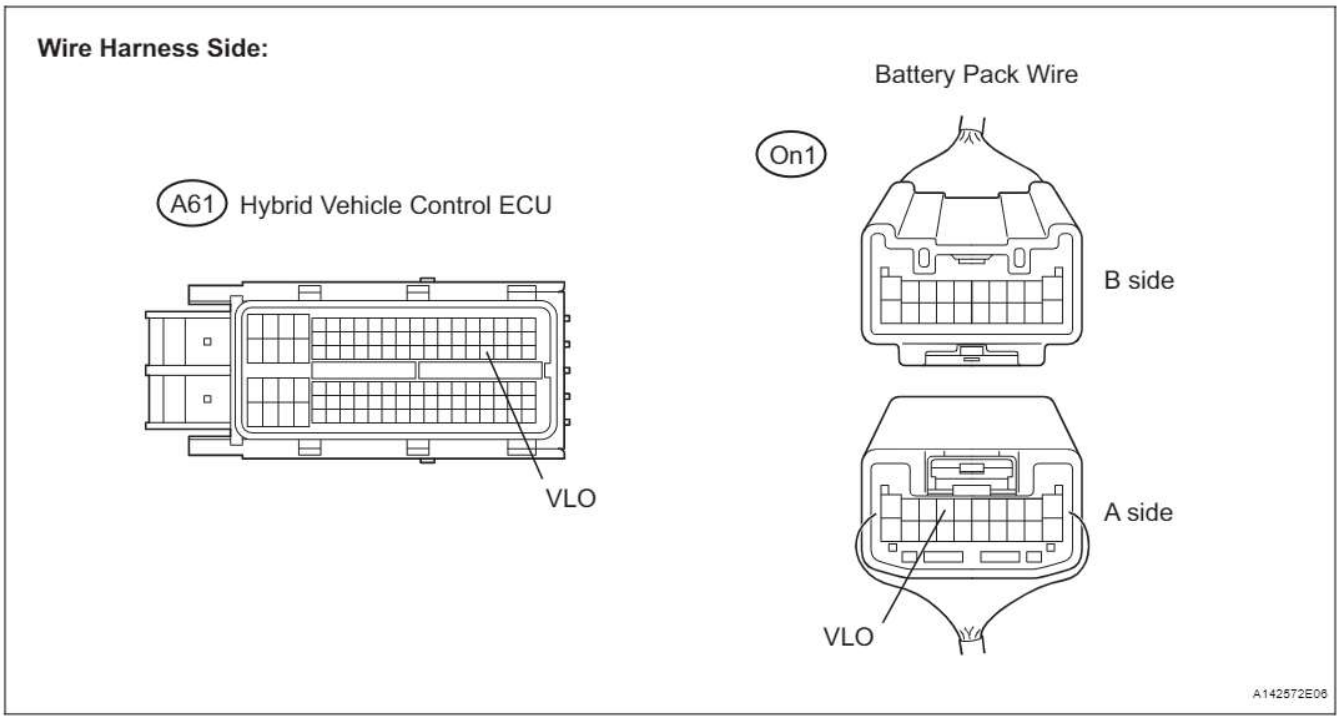
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

8	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Measure the resistance according to the value(s) in the table below.



Standard resistance (Check for open)

Tester Connection	Specified Condition
VLO (A61-53) - VLO (On1-7)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
VLO (A61-53) or VLO (On1-7) - Body ground	10 kΩ or more

HV

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

9	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

10	RECONFIRM DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).

(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTC P0A09-591 is output.
(e) Clear the DTCs.

YES → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

NO

11	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems (See page HV-17).

NG → **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0A0D-350	High Voltage System Inter-Lock Circuit High

DTC	P0A0D-351	High Voltage System Inter-Lock Circuit High

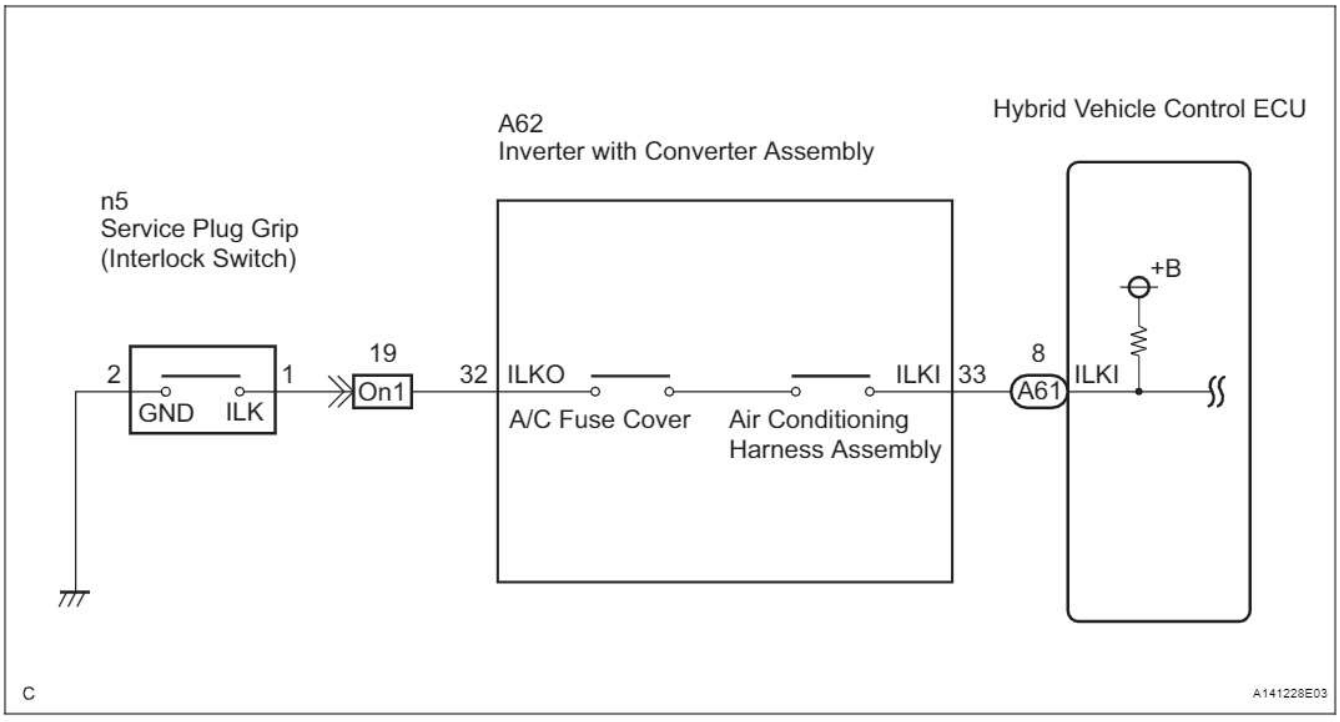
DESCRIPTION

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 A/C 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, A/C 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 power switch is turned on (IG).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0A0D	350	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	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

HV

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTC P0A1D is output.

YES → **GO TO DTC CHART**

NO

2	CLEAR DTC (HV)

(a) Turn the power switch on (IG).
(b) Read and record the DTCs and freeze frame data.
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(d) Clear the DTCs.

NEXT

3	RECONFIRM DTC OUTPUT (HV)

(a) Turn the power switch on (IG).
(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(c) Recheck for DTCs.
Result:
DTC P0A0D-350 or P0A0D-351 is output again.

NO → **Go to step 11**

YES

4	CHECK SERVICE PLUG GRIP

CAUTION:
Be sure to wear insulated gloves.

(a) Check if the service plug grip is installed correctly.
Result:
The service plug grip is installed correctly.
HINT:
For the removal and installation procedures, (See page HV-1).

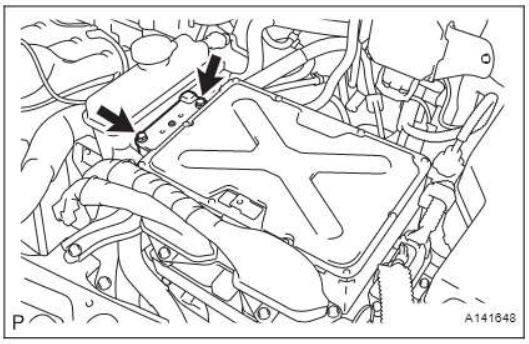
NO → **CONNECT SECURELY**

YES

5	CHECK INVERTER WITH CONVERTER (A/C FUSE COVER INSTALLATION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
(b) Check if the A/C fuse cover of the inverter with converter assembly is installed correctly.
Result:
The A/C fuse cover of the inverter with converter assembly is installed correctly.



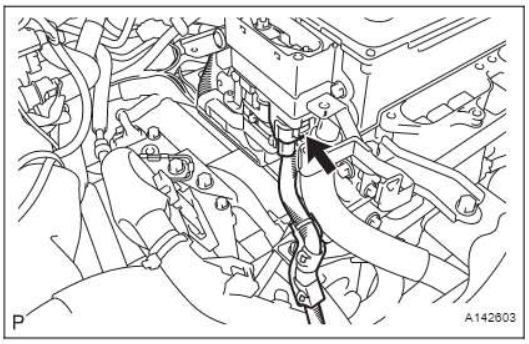
NO → **CONNECT SECURELY**

YES

6	CHECK AIR CONDITIONING HARNESS ASSEMBLY (AIR CONDITIONING HARNESS ASSEMBLY CONNECTION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Check if the air conditioning harness assembly connector is connected correctly.
Result:
The air conditioning harness assembly connector is connected correctly.



NO → **CONNECT SECURELY**

YES

7	CHECK HYBRID VEHICLE CONTROL ECU

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

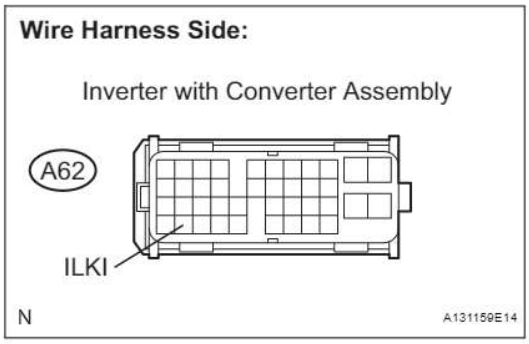
(b) Disconnect the A62 inverter with converter assembly connector.

(c) Turn the power switch on (IG).

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

Tester Connection	Specified Condition
ILKI (A62-33) - Body ground	9 to 14 V

NOTICE:
Turning the power switch on (IG) with the inverter with converter assembly connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.



NG → Go to step 17

OK

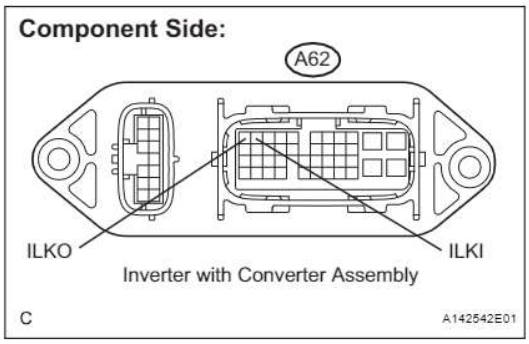
8	CHECK INVERTER WITH CONVERTER ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off.

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

Tester Connection	Specified Condition
ILKI (A62-33) - ILKO (A62-32)	1 Ω or less

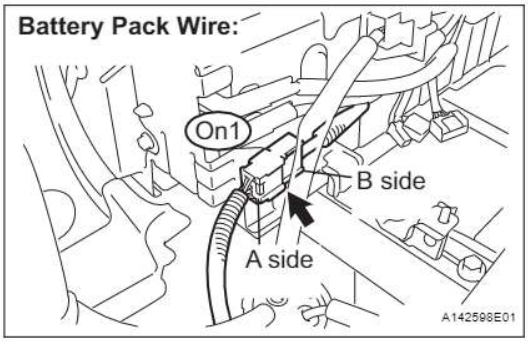


NG → Go to step 15

OK

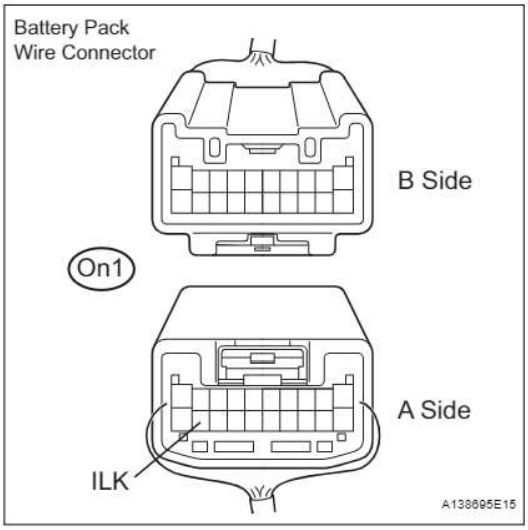
9	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - BATTERY PACK WIRE)

(a) Connect the inverter with converter assembly connector.



(b) Disconnect the On1 battery pack wire connector (See page HB-81).

(c) Turn the power switch on (IG).



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

Standard voltage

Tester Connection	Specified Condition
ILK (On1-19) - Body ground	9 to 14 V

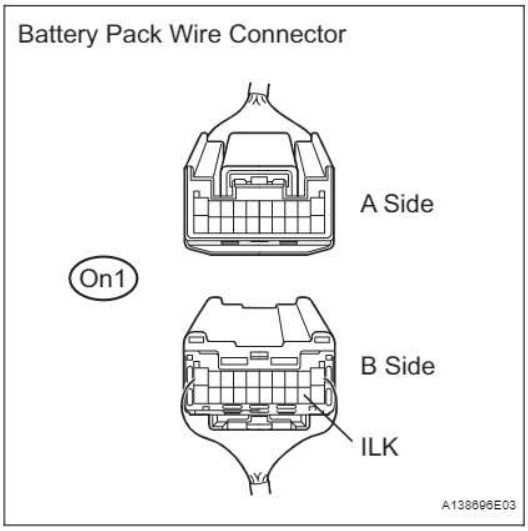
NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

HV

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



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

Standard resistance

Tester Connection	Specified Condition
ILK (On1-19) - Body ground	Below 1 Ω

NG → **Go to step 12**

OK

11 CHECK CONNECTOR CONNECTION CONDITION (INTERLOCK CIRCUIT)

(a) Check the connections of each connector.

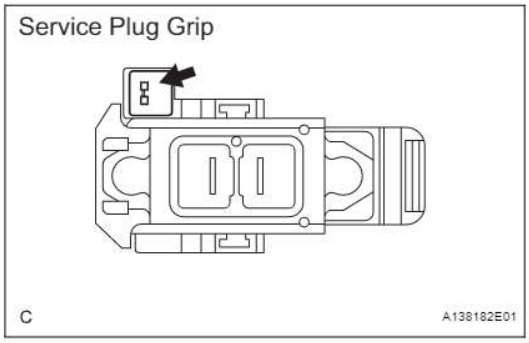
Result:
Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

NG → **REPAIR OR REPLACE CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

12 CHECK SERVICE PLUG GRIP



CAUTION:
Be sure to wear insulated gloves.

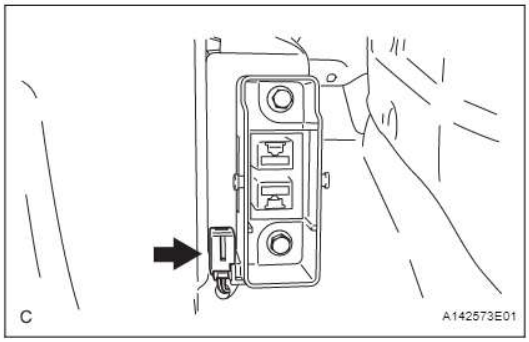
(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Check the condition of the service plug grip interlock.
Result:
Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

NG → **REPLACE SERVICE PLUG GRIP**

OK

13 CHECK HARNESS AND CONNECTOR (INTERLOCK CONNECTOR CONNECTION CONDITION)

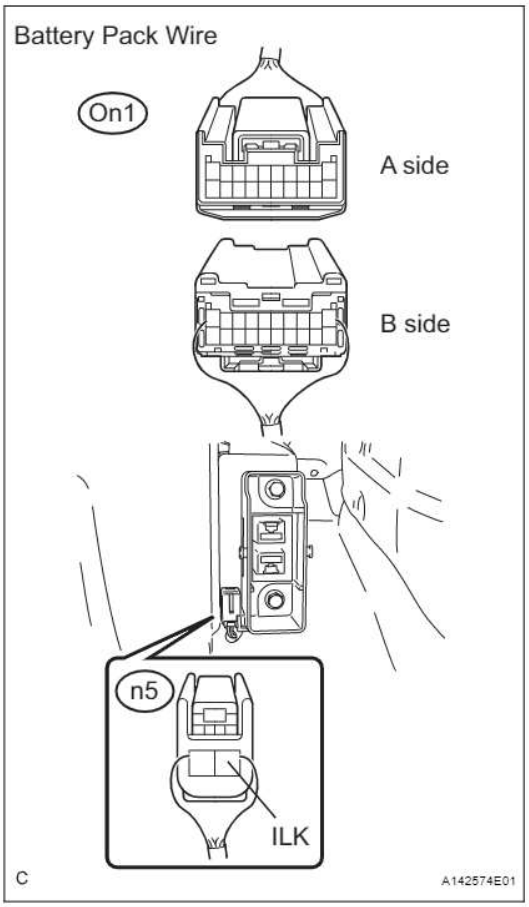


(a) Check that the interlock connector at the service plug grip installation socket is connected correctly.
Result:
The connector is connected correctly.

NG → **CONNECT SECURELY**

OK

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



CAUTION:
Be sure to wear insulated gloves.

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

Standard resistance

Tester Connection	Specified Condition
ILK (On1-19) - ILK (n5-1)	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (BATTERY PACK WIRE CONNECTOR - SERVICE PLUG GRIP)**

OK

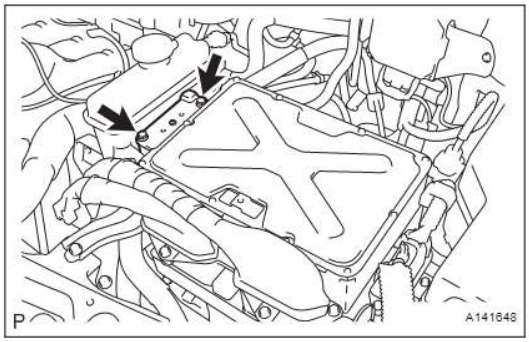
REPAIR OR REPLACE HARNESS OR CONNECTOR (SERVICE PLUG GRIP - BODY GROUND)

15	CHECK INVERTER WITH CONVERTER ASSEMBLY (A/C FUSE COVER OF INVERTER WITH CONVERTER)

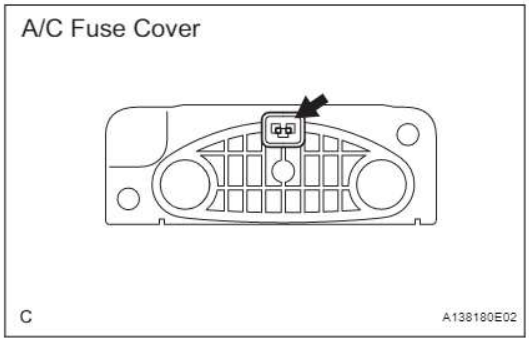
CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).

NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.



(b) Remove the A/C fuse cover from the inverter with converter assembly.



(c) Check the condition of the A/C fuse cover interlock.
Result:

Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

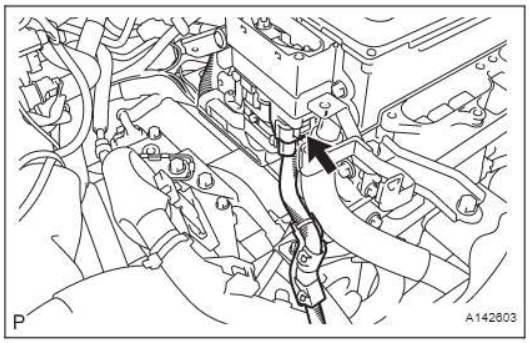
NG → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)**

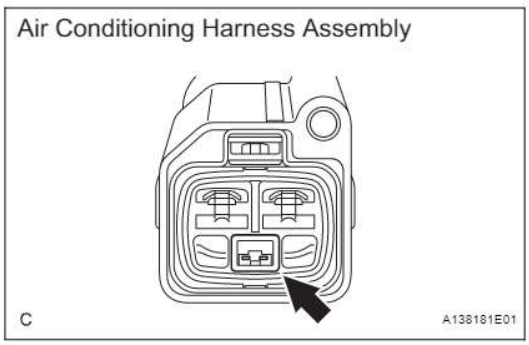
OK

16 CHECK AIR CONDITIONING HARNESS ASSEMBLY (INTERLOCK)

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Remove the air conditioning harness assembly from the inverter with converter assembly.





(c) Check the condition of the air conditioning harness assembly interlock.
Result:

Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

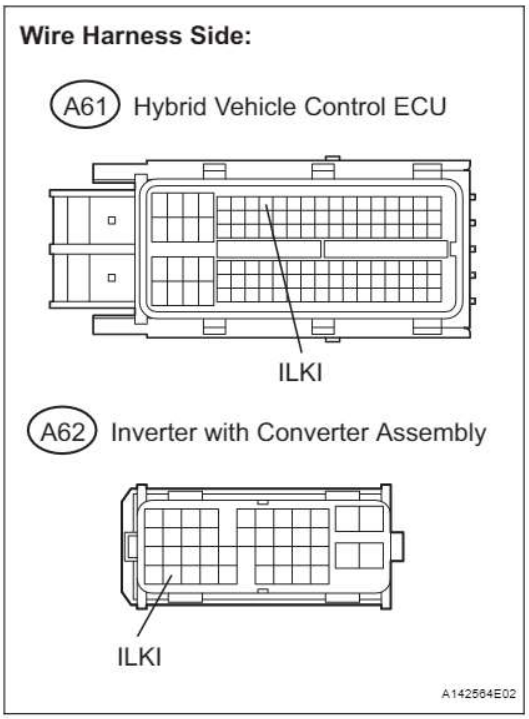
NG → **REPLACE AIR CONDITIONING HARNESS ASSEMBLY**

HV

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

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



(a) Turn the power switch off.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
ILKI (A61-8) - ILKI (A62-33)	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0A0F-204	Engine Failed to Start
DTC	P0A0F-205	Engine Failed to Start
DTC	P0A0F-533	Engine Failed to Start
DTC	P0A0F-534	Engine Failed to Start

DESCRIPTION

The hybrid vehicle control system performs the fail-safe control based on an abnormal signal from the EFI system.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A0F	204	Abnormal signal input from the ECM (abnormal engine output)	• Hybrid vehicle control ECU • Engine control system
P0A0F	205	Abnormal signal input from the ECM (engine is unable to start)	• Hybrid vehicle control ECU • Engine control system
P0A0F	533	Abnormal signal input from the ECM (abnormal engine output when running out of fuel)	• Hybrid vehicle control ECU • Engine control system
P0A0F	534	Abnormal signal input from the ECM (fuel level not sufficient to start the engine)	• Hybrid vehicle control ECU • Engine control system

HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / ENGINE / DTC INFO / CURRENT CODES.
(d) Read output DTC.

OK:

DTCs are output

YES → GO TO DTC CHART

NO

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0A0F-238	Engine Failed to Start

DESCRIPTION

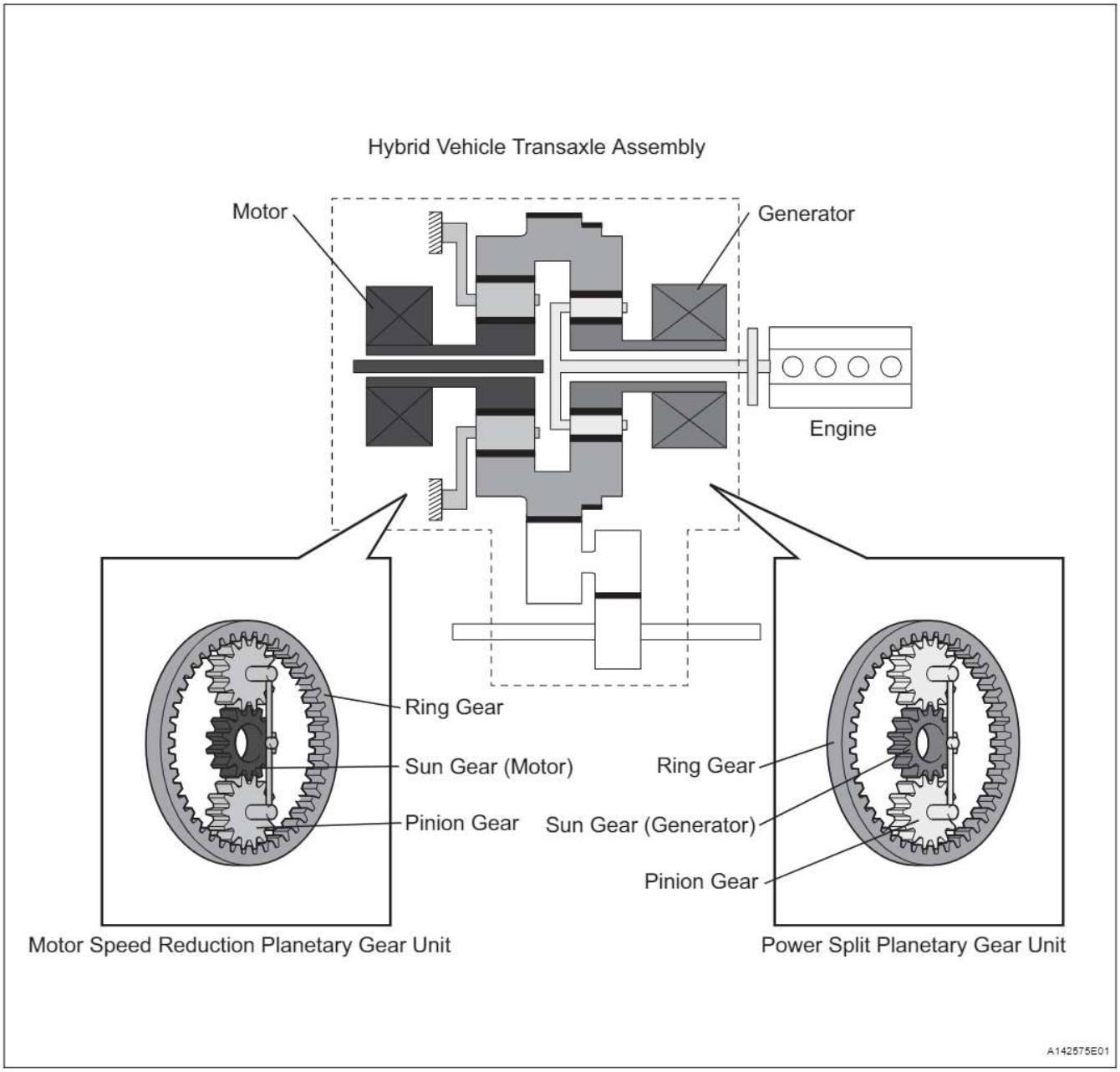
The hybrid vehicle control ECU detects this DTC and effects fail-safe control if the engine or transaxle gear has seized up, or foreign objects have been caught in either of them.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A0F	238	Engine does not start even though cranking it (transaxle input malfunction [engine system])	• Engine • Hybrid vehicle transaxle assembly (shaft, gear) • Transmission input damper • Wire harness or connector • Hybrid vehicle control ECU

HINT:

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

HV



INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / ENGINE / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTCs are output.

YES → **GO TO DTC CHART**

NO

2	CHECK CRANKSHAFT PULLEY REVOLUTION (P POSITION)

(a) Turn the power switch off, move the shift lever to the P position, and lift up the vehicle.
(b) Turn the crankshaft pulley by hand to check if the crankshaft rotates.
CAUTION:
Do not turn the power switch on (READY) while performing this inspection. Be sure to turn the power switch off before performing this inspection, to prevent the engine from starting.
OK:
The crankshaft rotates.

NG → **Go to step 11**

OK

3	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - CRANKSHAFT POSITION SENSOR) (See page ES-167)

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4	INSPECT CRANKSHAFT POSITION SENSOR (See page ES-166)

NG → **REPLACE CRANKSHAFT POSITION SENSOR**

OK

5	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.

(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(c) Check if DTCs are output.
(d) Confirm and record the DTCs, freeze frame data, and information for the HV system.

NEXT

6	CLEAR DTC

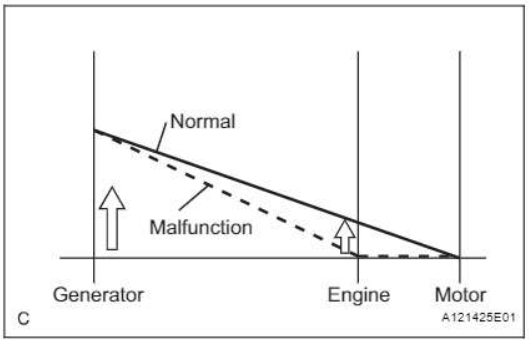
(a) Connect the intelligent tester to the DLC3.
(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(c) Clear the DTCs of the HV system.

NEXT

7	CHECK READY LIGHT ON

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MG1 REV and ENGINE SPD.
(d) Depress the brake pedal and turn the power switch on (READY).
OK:
The READY light comes on.
HINT:
- If the READY light does not come on and the reading on the intelligent tester shows DTC P0A90-239 (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 vehicle transaxle assembly.
- If this DTC (P0A0F-238) is output, the HV battery may be dead and DTC P3000-388 or P3000-389 may be output.

(e) Refer to the graph for data list confirmation of "MG1 REV" and "ENGINE SPD".



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

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

8	CHECK ENGINE RACING

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MG1 REV and ENGINE SPD.
(d) 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.
HINT:
If the engine does not rev up and the reading on the intelligent tester shows DTC P3147-239 (hybrid vehicle transaxle input malfunction [shaft damaged]), or the Generator turns but the engine does not crank, replace the hybrid vehicle transaxle assembly.

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

9	CHECK CREEP MOVEMENT

(a) Connect the intelligent tester to the DLC3.
(b) Depress the brake pedal, move the shift lever to the D position, and release the brake pedal.
OK:
The wheels turn (creeping along).
HINT:
If the wheels do not turn and the reading on the intelligent tester shows DTC P3147 (transaxle malfunction), replace the hybrid vehicle transaxle assembly.

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

10	ENGINE SPEED

(a) Connect the intelligent tester to the DLC3.
(b) While driving at the vehicle speed of more than 6 mph (10 km/h), fully depress the accelerator pedal to raise the engine speed.
OK:
Engine speed increases smoothly.

HV

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

NG → **REPLACE TRANSMISSION INPUT DAMPER ASSEMBLY**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

11	CHECK FRONT TIRE REVOLUTION

(a) Lift up the vehicle.
(b) Move the shift lever to the N position with the power switch off.
CAUTION:
Do not turn the power switch on (READY) while performing this inspection. Be sure to turn the power switch off before performing this inspection, to prevent the engine from starting.
(c) Turn the crank pulley by hand to check if the front tires rotate.
OK:
The front tires do not rotate.

HV

NG → **CHECK AND REPAIR ENGINE**

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A10-263	DC / DC Converter Status Circuit High Input

DESCRIPTION

Refer to the circuit description for DTC P0A08-264 (See page HV-109).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A10	263	+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

WIRING DIAGRAM

Refer to the wiring diagram for P0A08-264 (See page HV-102).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

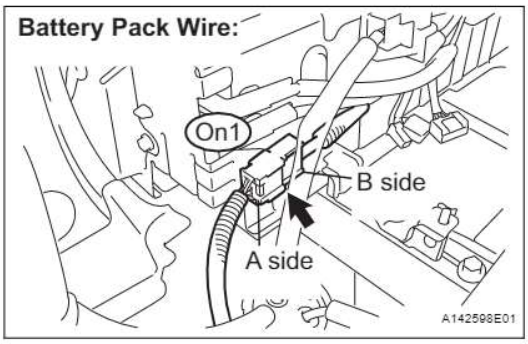
Result:

DTC P0A10-263 and other DTCs are output.

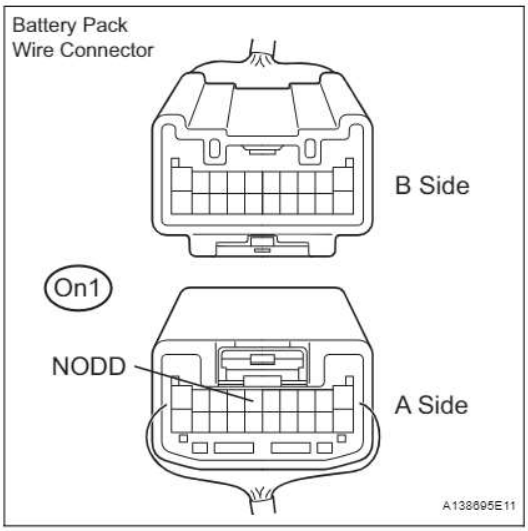
YES → **GO TO DTC CHART**

NO

2	CHECK HARNESS AND CONNECTOR



(a) Disconnect the On1 battery pack wire connector (See page HB-81).
(b) Turn the power switch on (IG).



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

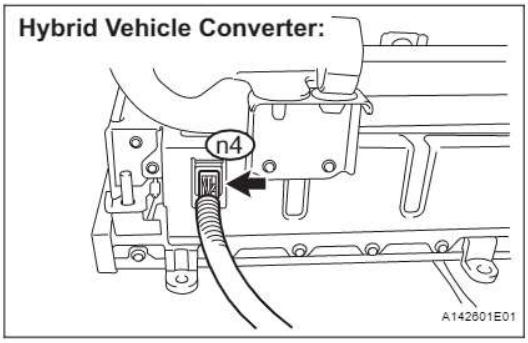
Tester Connection	Specified Condition
NODD (On1-6) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

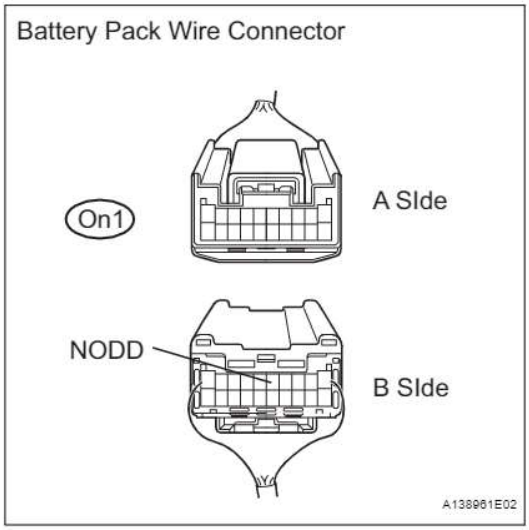
NG → **Go to step 4**

OK

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



CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Turn the power switch on (IG).



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

Standard voltage

Tester Connection	Specified Condition
NODD (On1-6) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.

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

Standard resistance

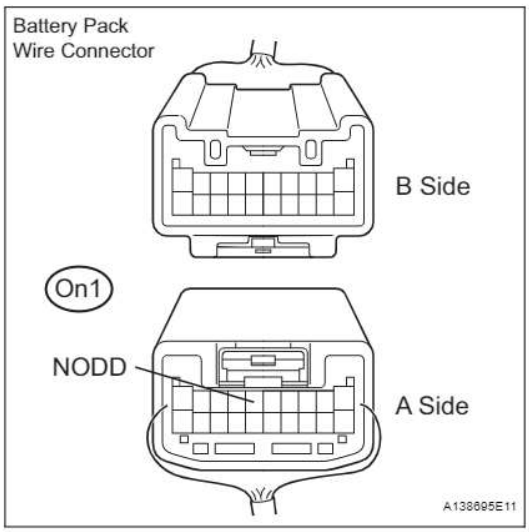
Tester Connection	Specified Condition
NODD (On1-6) - Each of the other terminals	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

4 CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - BATTERY PACK WIRE)



(a) Disconnect the A61 hybrid vehicle control ECU connector.

(b) Turn the power switch on (IG).

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

Standard voltage

Tester Connection	Specified Condition
NODD (On1-6) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0A10-592	DC / DC Converter Status Circuit High Input

DESCRIPTION

Refer to the circuit description for DTC P0A09-591 (See page HV-112).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A10	592	Hybrid vehicle converter (DC/DC converter) voltage switching (VLO) signal circuit malfunction (+B short)	Hybrid vehicle control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A09-591 (See page HV-112).

INSPECTION PROCEDURE

CAUTION:

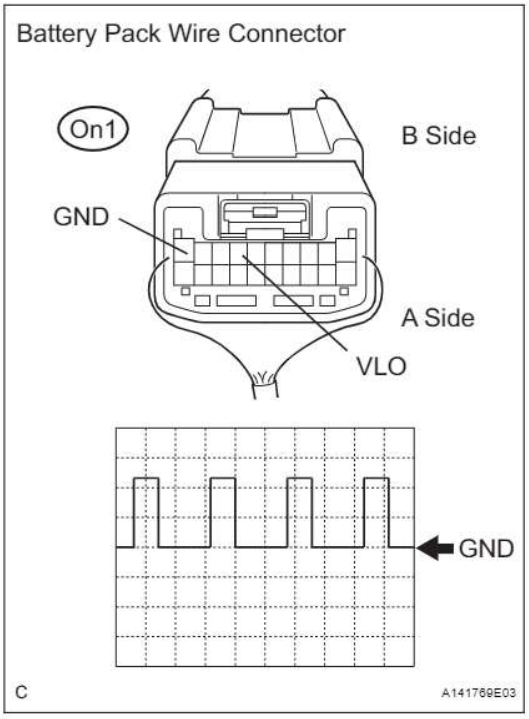
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HINT:

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

HV

1	CHECK HYBRID VEHICLE CONTROL ECU



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

Item	Contents
Terminal	VLO (On1-7) - GND (On1-10)
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Power switch on (IG)

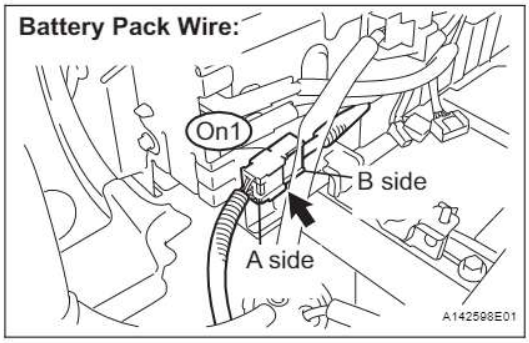
HINT:

Perform this inspection with the battery pack wire connected.

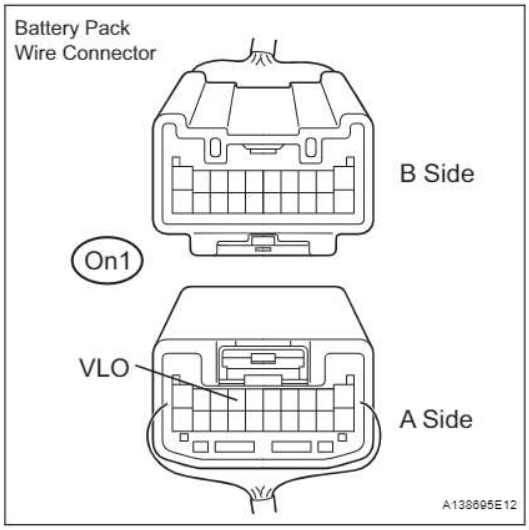
OK	Go to step 4

NG

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



(a) Disconnect the battery pack wire connector.
(b) Turn the power switch on (IG).



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

Standard voltage

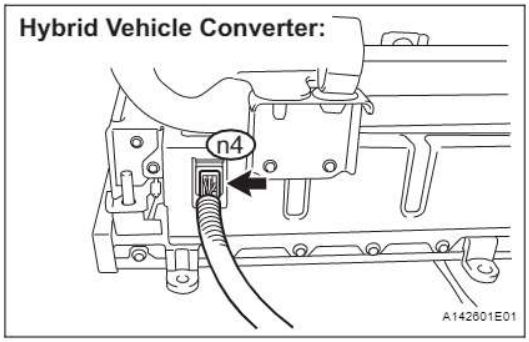
Tester Connection	Specified Condition
VLO (On1-7) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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



(a) Turn the power switch off.

CAUTION:
Be sure to wear insulated gloves.

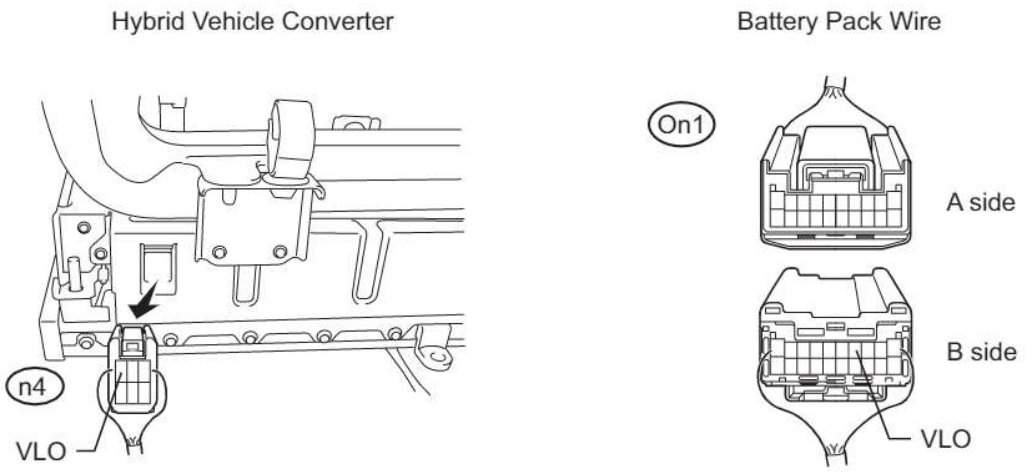
(b) Turn the power switch off and remove the service plug grip.

NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(c) Disconnect the n4 hybrid vehicle converter connector.
(d) Measure the voltage according to the value(s) in the table below.

HV

Wire Harness Side:



Standard voltage

Tester Connection	Specified Condition
VLO (On1-7) or VLO (n4-3) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

HV

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

4	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG)
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

5	RECONFIRM DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.

(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Read output DTCs.
Result:
DTC P0A10-592 is output.

YES → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

NO

6	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems (See page HV-17).

NG → **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0A1A-151	Generator Control Module
DTC	P0A1A-155	Generator Control Module
DTC	P0A1A-156	Generator Control Module
DTC	P0A1A-166	Generator Control Module
DTC	P0A1A-658	Generator Control Module
DTC	P0A1A-659	Generator Control Module
DTC	P0A1A-791	Generator Control Module

HV

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1A	151	Run pulse error	Inverter with converter assembly (MG ECU)
P0A1A	155	A/D error	Inverter with converter assembly (MG ECU)
P0A1A	156	ROM-RAM error	Inverter with converter assembly (MG ECU)
P0A1A	166	R/D converter NM stop error	Inverter with converter assembly (MG ECU)
P0A1A	658	ALU error	Inverter with converter assembly (MG ECU)
P0A1A	659	Communication error (from MG1 to MG2)	Inverter with converter assembly (MG ECU)
P0A1A	791	R/D converter communication error	Inverter with converter assembly (MG ECU)

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1A (INF 151): RUN pulse malfunction P0A1A (INF 155): A/D malfunction (1 MG CPU) P0A1A (INF 156): RAM and ROM destruction P0A1A (INF 166): RD converter NM signal stop abnormality P0A1A (INF 658): MG CPU ALU malfunction P0A1A (INF 659): MG CPU communication malfunction (1 MG CPU to 2 MG CPU) P0A1A (INF 791): RD converter communication malfunction

Required sensors / components	Inverter with converter (MG ECU)
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1A (INF 151/155/156/166/658/659/791) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

COMPLETED

DTC	P0A1A-200	Generator Control Module

DTC	P0A1A-792	Generator Control Module

DTC	P0A1A-793	Generator Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1A	200	Generator R/D resolver angle error	• Inverter with converter assembly (MG ECU) • Hybrid vehicle transaxle assembly (Generator resolver) • Wire harness or connector
P0A1A	792	REF frequency error	• Inverter with converter assembly (MG ECU) • Hybrid vehicle transaxle assembly (Generator resolver) • Wire harness or connector
P0A1A	793	REF signal open error	• Inverter with converter assembly (MG ECU) • Hybrid vehicle transaxle assembly (Generator resolver) • Wire harness or connector

MONITOR DESCRIPTION

HV

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.

MONITOR STRATEGY

Related DTCs	P0A1A (INF 200): RD converter resolver angle abnormality P0A1A (INF 792): REF malfunction (frequency abnormality) P0A1A (INF 793): REF malfunction (REF signal abnormality)
Required sensors / components	Inverter with converter (MG ECU)
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

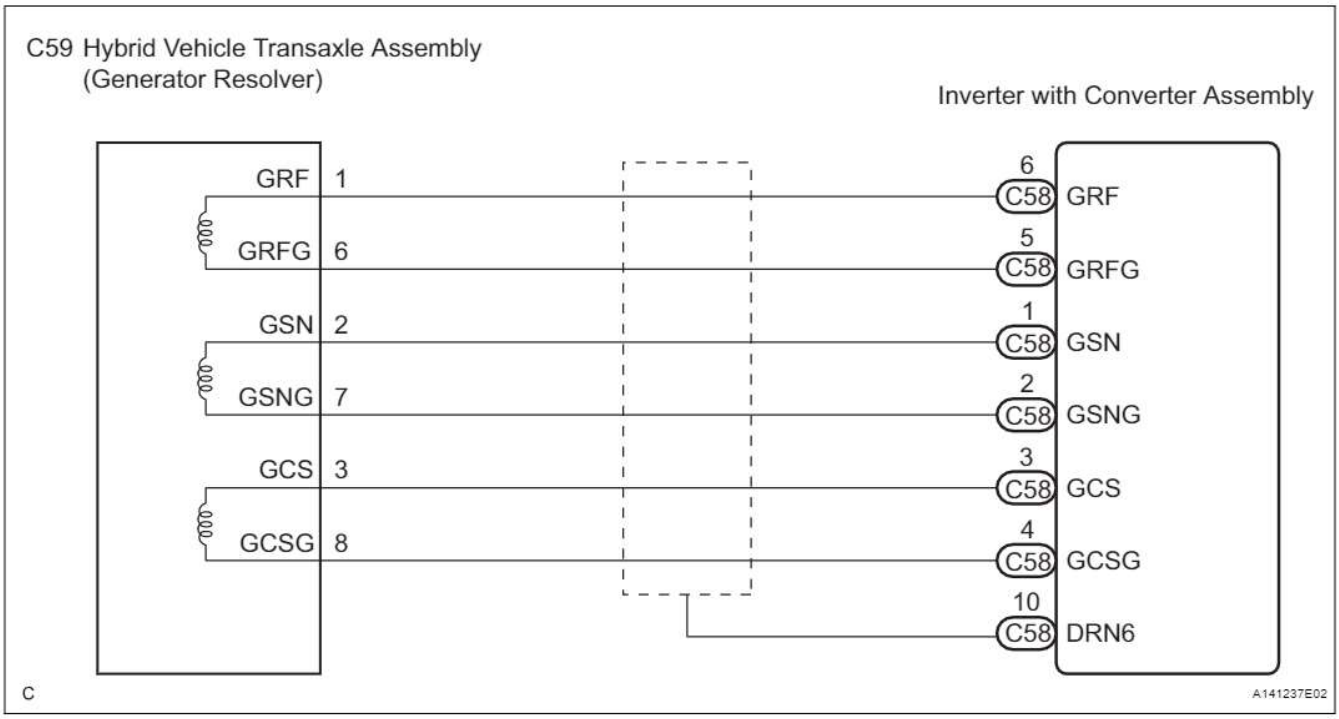
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1A (INF 200/792/793) is not detected

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

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

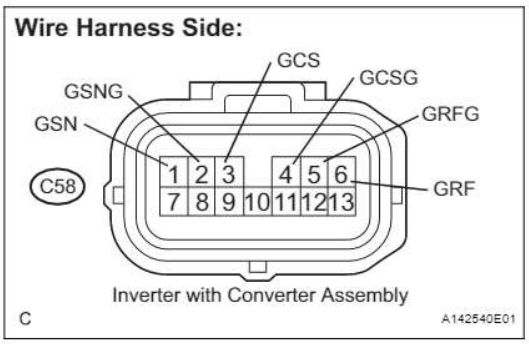
CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the C58 inverter with converter assembly connector.

(c) Turn the power switch on (IG).

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



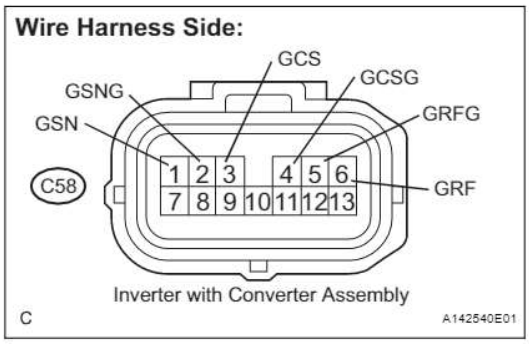
Tester Connection	Specified Condition
GRF (C58-6) - Body ground	Below 1 V
GRFG (C58-5) - Body ground	Below 1 V
GSN (C58-1) - Body ground	Below 1 V
GSNG (C58-2) - Body ground	Below 1 V
GCS (C58-3) - Body ground	Below 1 V
GCSG (C58-4) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the inverter with converter assembly connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	CHECK GENERATOR RESOLVER



(a) Turn the power switch off.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for open)

Tester Connection	Specified Condition
GRF (C58-6) - GRFG (C58-5)	5.8 to 11.8 Ω
GSN (C58-1) - GSNG (C58-2)	11.7 to 17.7 Ω
GCS (C58-3) - GCSG (C58-4)	11.7 to 17.7 Ω

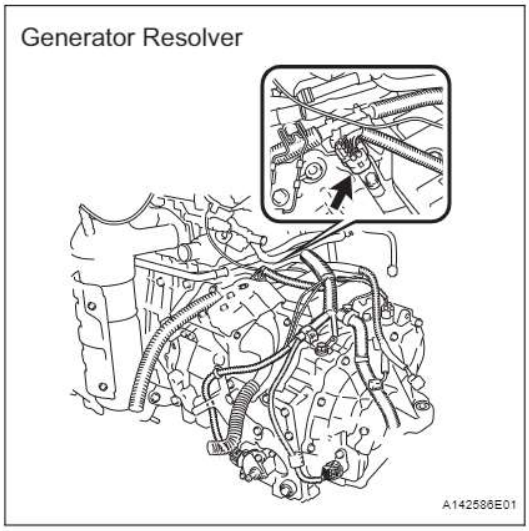
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for short)

Tester Connection	Specified Condition
GRF (C58-6) or GRFG (C58-5) - Body ground	10 kΩ or more
GSN (C58-1) or GSNG (C58-2) - Body ground	10 kΩ or more
GCS (C58-3) or GCSG (C58-4) - Body ground	10 kΩ or more

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG

5	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

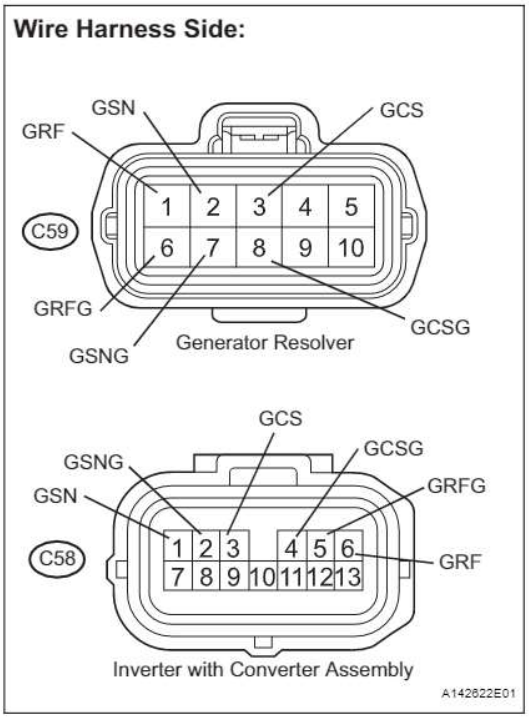


(a) Check the connection of the generator resolver connector.
OK:
The connector is connected securely and there are no contact problems.

NG → CONNECT SECURELY

OK

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



(a) Disconnect the C59 generator resolver connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
GRF (C58-6) - GRF (C59-1)	Below 1 Ω
GRFG (C58-5) - GRFG (C59-6)	Below 1 Ω
GSN (C58-1) - GSN (C59-2)	Below 1 Ω
GSNG (C58-2) - GSNG (C59-7)	Below 1 Ω
GCS (C58-3) - GCS (C59-3)	Below 1 Ω
GCSG (C58-4) - GCSG (C59-8)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
GRF (C58-6) or GRF (C59-1) - Body ground	10 kΩ or more
GRFG (C58-5) or GRFG (C59-6) - Body ground	10 kΩ or more
GSN (C58-1) or GSN (C59-2) - Body ground	10 kΩ or more
GSNG (C58-2) or GSNG (C59-7) - Body ground	10 kΩ or more
GCS (C58-3) or GCS (C59-3) - Body ground	10 kΩ or more
GCSG (C58-4) or GCSG (C59-8) - Body ground	10 kΩ or more

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

HV

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A1B-163	Drive Motor "A" Control Module
DTC	P0A1B-164	Drive Motor "A" Control Module
DTC	P0A1B-192	Drive Motor "A" Control Module
DTC	P0A1B-193	Drive Motor "A" Control Module
DTC	P0A1B-198	Drive Motor "A" Control Module
DTC	P0A1B-511	Drive Motor "A" Control Module
DTC	P0A1B-512	Drive Motor "A" Control Module
DTC	P0A1B-661	Drive Motor "A" Control Module
DTC	P0A1B-786	Drive Motor "A" Control Module
DTC	P0A1B-794	Drive Motor "A" Control Module

HV

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1B	163	IPM positive power source error	Inverter with converter assembly (MG ECU)
P0A1B	164	IPM negative power source error	Inverter with converter assembly (MG ECU)
P0A1B	192	A/D error	Inverter with converter assembly (MG ECU)
P0A1B	193	ROM-RAM error	Inverter with converter assembly (MG ECU)
P0A1B	198	R/D converter NM stop error	Inverter with converter assembly (MG ECU)
P0A1B	511	Standard voltage for analog signal offset	Inverter with converter assembly (MG ECU)
P0A1B	512	Standard voltage for analog signal	Inverter with converter assembly (MG ECU)
P0A1B	661	Communication error (from MG2 to MG1)	Inverter with converter assembly (MG ECU)
P0A1B	786	ALU error	Inverter with converter assembly (MG ECU)
P0A1B	794	R/D converter communication error	Inverter with converter assembly (MG ECU)

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

COMPLETED

HV

DTC	P0A1B-168	Drive Motor "A" Control Module

DTC	P0A1B-795	Drive Motor "A" Control Module

DTC	P0A1B-796	Drive Motor "A" Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1B	168	Motor R/D resolver angle error	• Inverter with converter assembly (MG ECU) • Hybrid vehicle transaxle assembly (Motor resolver) • Wire harness or connector
P0A1B	795	REF frequency error	• Inverter with converter assembly (MG ECU) • Hybrid vehicle transaxle assembly (Motor resolver) • Wire harness or connector
P0A1B	796	REF signal open error	• Inverter with converter assembly (MG ECU) • Hybrid vehicle transaxle assembly (Motor resolver) • Wire harness or connector

MONITOR DESCRIPTION

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.

HV

MONITOR STRATEGY

Related DTCs	P0A1B (INF 168): RD converter resolver angle abnormality P0A1B (INF 795): REF malfunction (frequency abnormality) P0A1B (INF 796): REF malfunction (REF signal abnormality)
Required sensors / components	Inverter with converter (MG ECU)
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

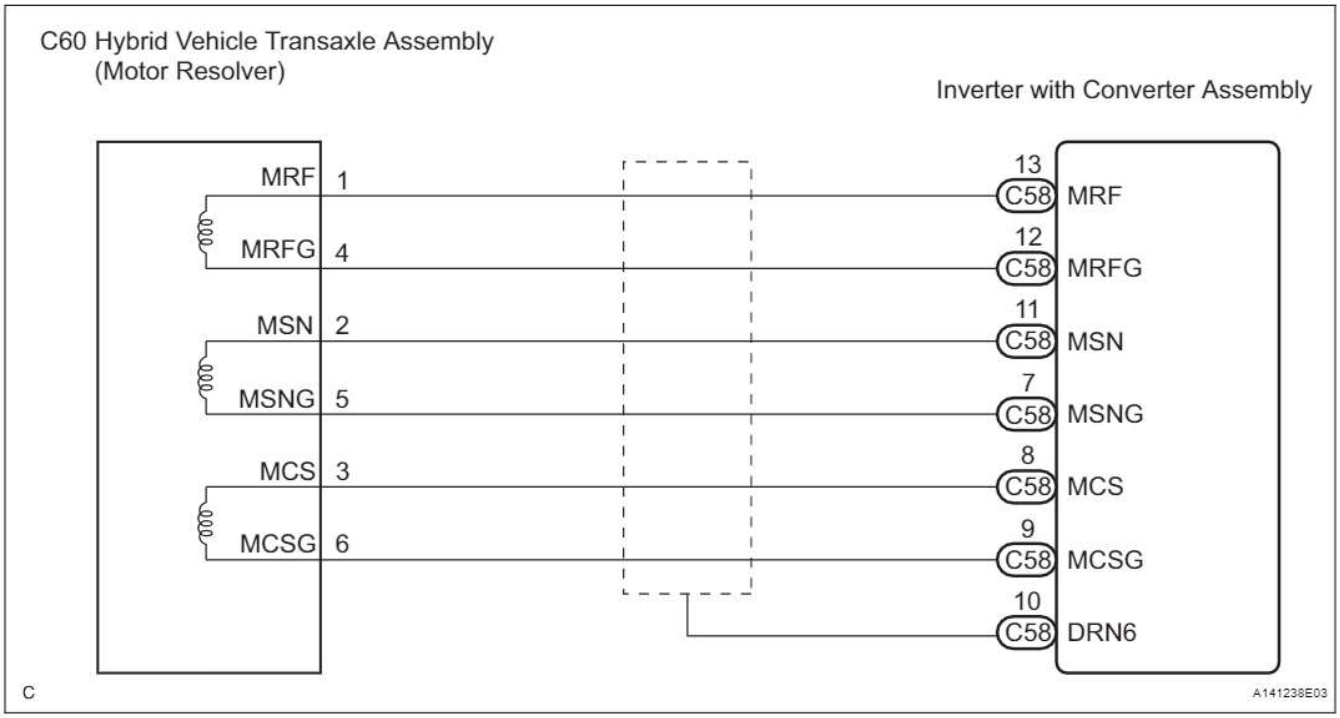
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1B (INF 168/795/796) is not detected

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

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

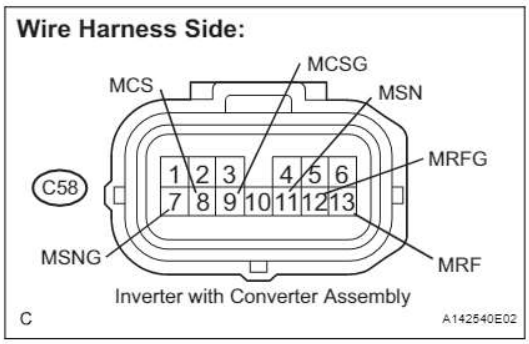
CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the C58 inverter with converter assembly connector.

(c) Turn the power switch on (IG).

(d) Measure the voltage according to the value(s) in the table below.
NOTICE:
Turning the power switch on (IG) 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.



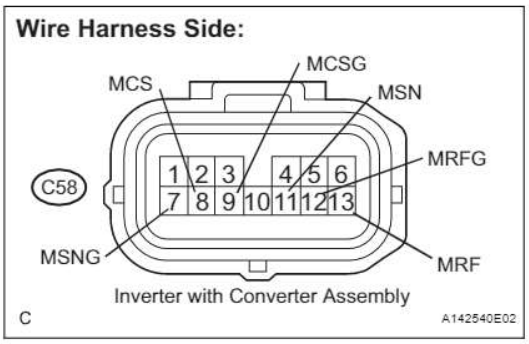
Standard voltage

Tester Connection	Specified Condition
MRF (C58-13) - Body ground	Below 1 V
MRFG (C58-12) - Body ground	Below 1 V
MSN (C58-11) - Body ground	Below 1 V
MSNG (C58-7) - Body ground	Below 1 V
MCS (C58-8) - Body ground	Below 1 V
MCSG (C58-9) - Body ground	Below 1 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4 CHECK MOTOR RESOLVER



(a) Turn the power switch off.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
MRF (C58-13) - MRFG (C58-12)	5.8 to 11.3 Ω
MSN (C58-11) - MSNG (C58-7)	11.7 to 17.7 Ω
MCS (C58-8) - MCSG (C58-9)	11.7 to 17.7 Ω

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

Standard resistance (Check for short)

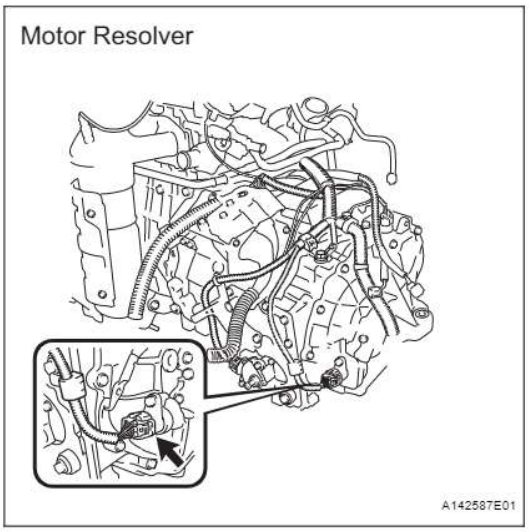
Tester Connection	Specified Condition
MRF (C58-13) or MRFG (C58-12) - Body ground	10 kΩ or more
MSN (C58-11) or MSNG (C58-7) - Body ground	10 kΩ or more
MCS (C58-8) or MCSG (C58-9) - Body ground	10 kΩ or more

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG

5 CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

HV



(a) Check the connection of the motor resolver connector.

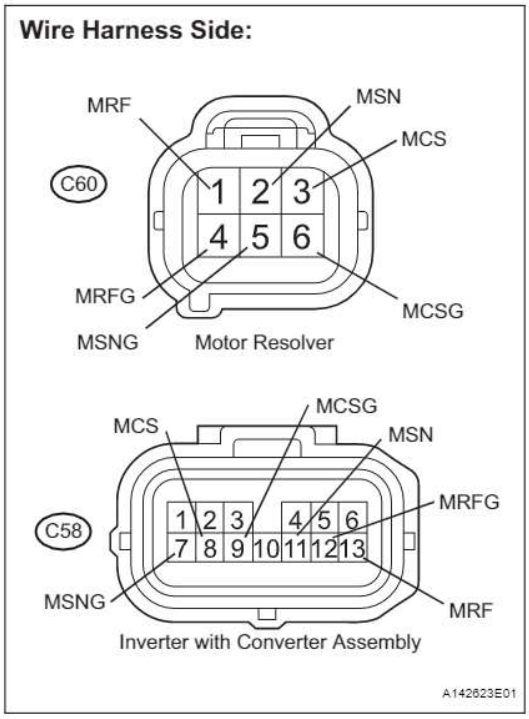
OK:

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

NG → CONNECT SECURELY

OK

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



(a) Disconnect the C60 motor resolver connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
MRF (C58-13) - MRF (C60-1)	Below 1 Ω
MRFG (C58-12) - MRFG (C60-4)	Below 1 Ω
MSN (C58-11) - MSN (C60-2)	Below 1 Ω
MSNG (C58-7) - MSNG (C60-5)	Below 1 Ω
MCS (C58-8) - MCS (C60-3)	Below 1 Ω
MCSG (C58-9) - MCSG (C60-6)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
MRF (C58-13) or MRF (C60-1) - Body ground	10 kΩ or more
MRFG (C58-12) or MRFG (C60-4) - Body ground	10 kΩ or more
MSN (C58-11) or MSN (C60-2) - Body ground	10 kΩ or more
MSNG (C58-7) or MSNG (C60-5) - Body ground	10 kΩ or more
MCS (C58-8) or MCS (C60-3) - Body ground	10 kΩ or more
MCSG (C58-9) or MCSG (C60-6) - Body ground	10 kΩ or more

HINT:
The motor resolver is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

HV

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A1B-788	Drive Motor "A" Control Module

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.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1B	788	Error in reset signal from power source IC	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle transaxle assembly

HINT:
Clearing the DTCs using the intelligent tester 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.

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1B (INF 788): Reset from power IC
Required sensors / components	Inverter with converter (MG ECU)
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	1 driving cycle
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

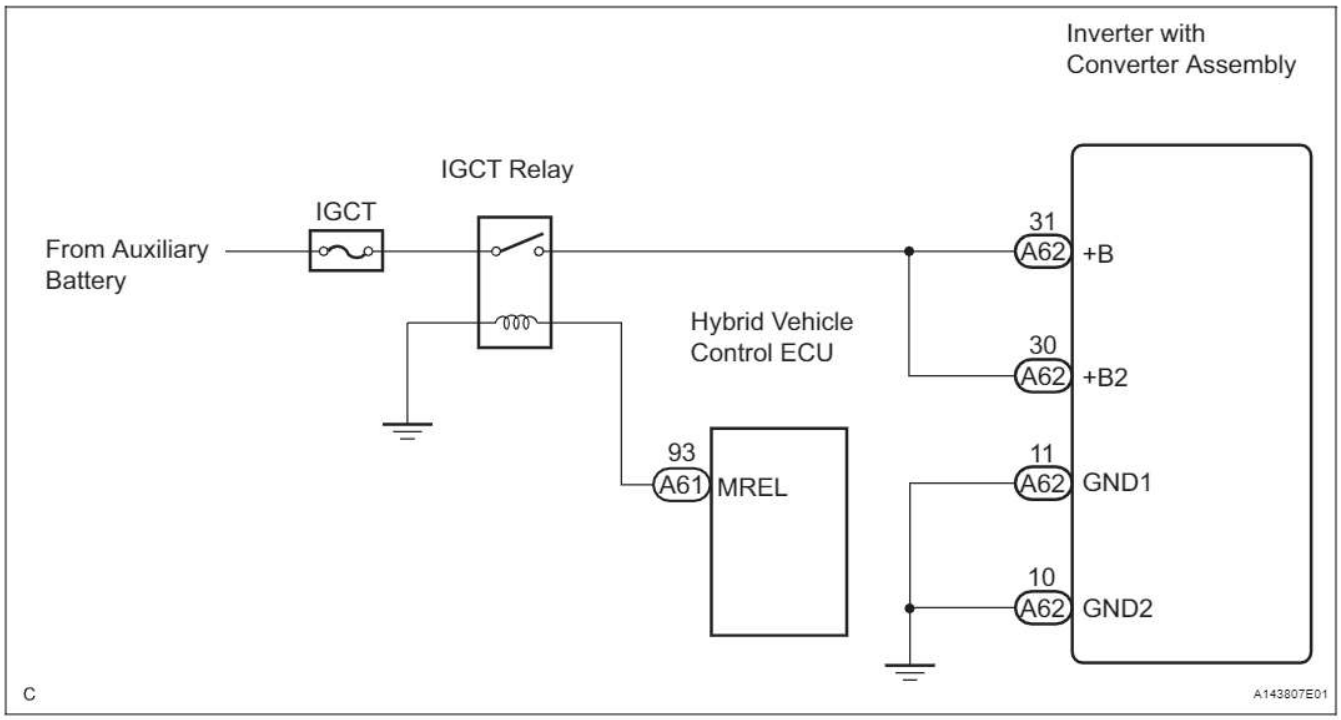
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1B (INF 788) is not detected

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	**CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)**

NG → **CONNECT SECURELY**

OK

2	**CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - ENGINE ROOM R/B NO. 1)**

CAUTION:

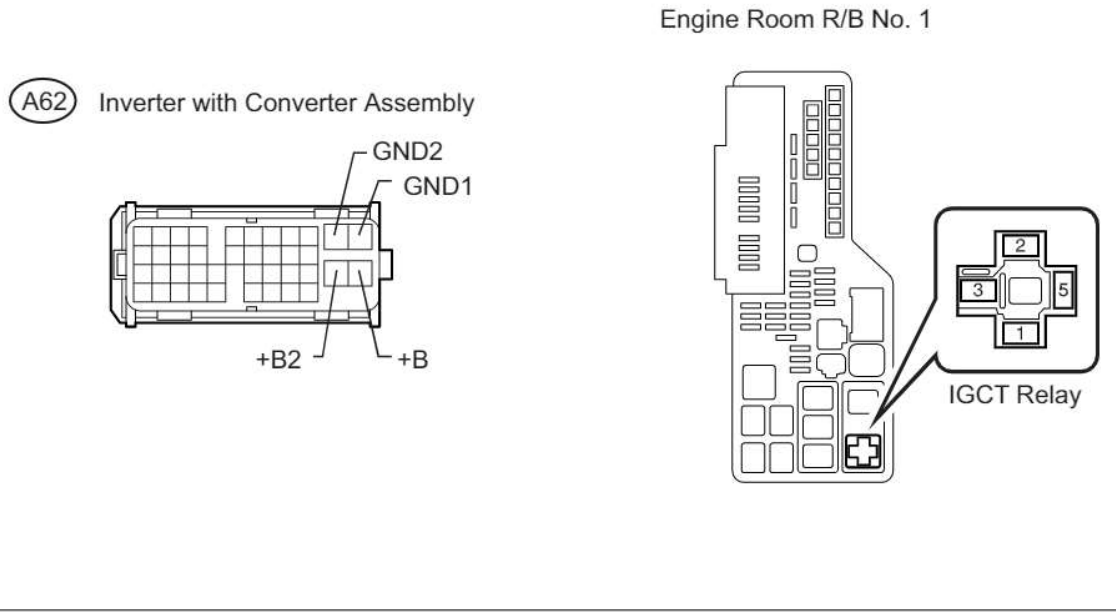
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).

NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Remove the IGCT relay from the engine room R/B No. 1.
(c) Disconnect the A62 inverter with converter assembly connector.
(d) Measure the resistance according to the value(s) in the table below.

Wire Harness Side:



HV

Standard resistance (Check for open)

Tester Connection	Specified Condition
+B (A62-31) - IGCT relay terminal 1	Below 1 Ω
+B2 (A62-30) - IGCT relay terminal 1	Below 1 Ω
GND1 (A62-11) - Body ground	Below 1 Ω
GND2 (A62-10) - Body ground	Below 1 Ω

Standard resistance (Check for short)

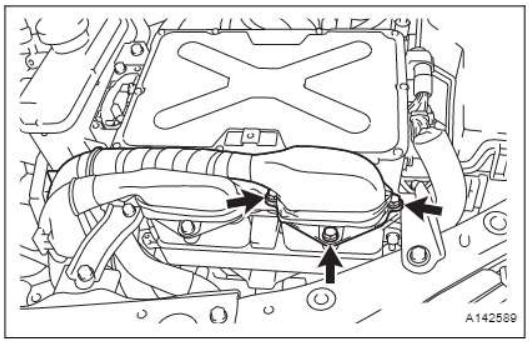
Tester Connection	Specified Condition
+B (A62-31) or +B2 (A62-30) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

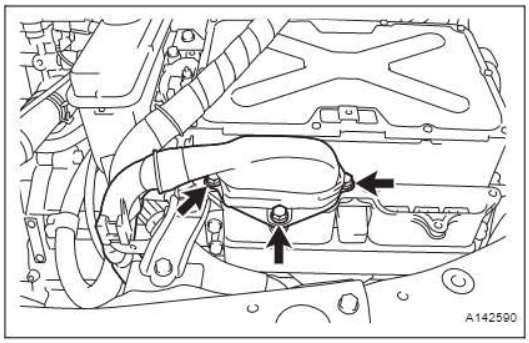


(a) Check that the service plug grip is not installed.
(b) Check that the bolts for the motor cable are tightened to the specified torque.
NOTICE:
Make sure that the tightening torque of the bolts is between 6.4 and 9.6 N*m (65 and 98 kgf*cm, 57 and 85 in.*lbf).
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

NG → **TIGHTEN TO SPECIFIED TORQUE**

OK

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



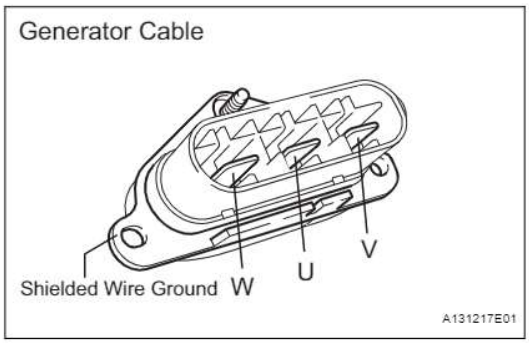
CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.
(b) Check that the bolts for the generator cable are tightened to the specified torque.
NOTICE:
Make sure that the tightening torque of the bolts is between 6.4 and 9.6 N*m (65 and 98 kgf*cm, 57 and 85 in.*lbf).
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

NG → **TIGHTEN TO SPECIFIED TORQUE**

HV

OK

5	INSPECT HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1)



CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.
(b) Disconnect the generator cable and motor cable from the inverter with converter assembly (See page HV-558).
(c) Using a milliohmmeter, measure the resistance according to the value(s) in the table below. (Check MG1 for an interphase short.)
HINT:
If the MG1 temperature is high, the resistance varies greatly. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.
Standard resistance

Tester Connection	Specified Condition
U - V	59 to 65 mΩ
V - W	56 to 62 mΩ
W - U	56 to 62 mΩ

HINT:
To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 20°C.
R20 = Rt / {1 + 0.00393 X (T - 20)}
The calculation is based on the following:
R20: Resistance at 20°C (mΩ)
Rt: Measured resistance (mΩ)
T: Temperature when the resistance is measured (°C)

(d) Using a megohmmeter (500 V range), measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
U - Body ground and shielded wire ground	10 MΩ or more
V - Body ground and shielded wire ground	10 MΩ or more
W - Body ground and shielded wire ground	10 MΩ or more

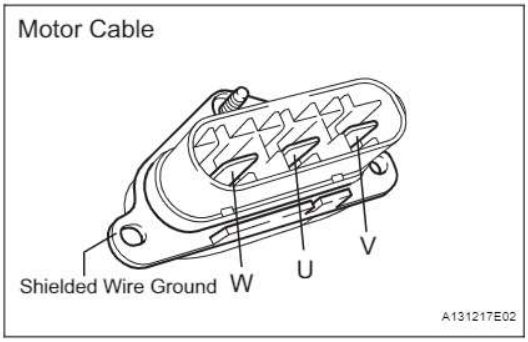
NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

6 INSPECT HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2)

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the generator cable and motor cable from the inverter with converter assembly (See page HV-558).
(c) Using a milliohmmeter, measure the resistance according to the value(s) in the table below. (Check MG2 for an interphase short.)
HINT:
If the MG2 temperature is high, the resistance varies greatly. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.



Standard resistance

Tester Connection	Specified Condition
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

HINT:
To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 20°C.
R20 = Rt / {1 + 0.00393 X (T - 20)}
The calculation is based on the following:
R20: Resistance at 20°C (mΩ)
Rt: Measured resistance (mΩ)
T: Temperature when the resistance is measured (°C)

(d) Using a megohmmeter (500 V range), measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
U - Body ground and shielded wire ground	10 MΩ or more
V - Body ground and shielded wire ground	10 MΩ or more
W - Body ground and shielded wire ground	10 MΩ or more

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

DTC	P0A1D-103	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	103	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

The hybrid vehicle control ECU performs diagnostic monitoring to verify proper operation of internal ECU systems. In this diagnostic 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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 103): Register value stuck
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 103) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-134	Hybrid Powertrain Control Module

DTC	P0A1D-135	Hybrid Powertrain Control Module

DTC	P0A1D-570	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	134	ECU internal error	Hybrid vehicle control ECU
P0A1D	135	ECU internal error	Hybrid vehicle control ECU
P0A1D	570	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

HV

Related DTCs	P0A1D (INF 134/135/570): Internal AD converter malfunction
Required sensors / components	HV control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 134/135/570) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:

See page HV-569

NEXT

COMPLETED

HV

DTC	P0A1D-140	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	140	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 140): Random Access Memory destruction
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 140) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-141	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	141	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 141): Read Only Memory destruction
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 141) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-144	Hybrid Powertrain Control Module

DTC	P0A1D-145	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	144	ECU internal error	Hybrid vehicle control ECU
P0A1D	145	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 144/145): Primary check malfunction
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 144/145) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-148	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	148	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 148): HV CPU malfunction
Required sensors / components	HV control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 148) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-162	Hybrid Powertrain Control Module
DTC	P0A1D-821	Hybrid Powertrain Control Module
DTC	P0A1D-822	Hybrid Powertrain Control Module
DTC	P0A1D-823	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	162	ECU internal error	Hybrid vehicle control ECU
P0A1D	821	ECU internal error	Hybrid vehicle control ECU
P0A1D	822	ECU internal error	Hybrid vehicle control ECU
P0A1D	823	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

HV

MONITOR STRATEGY

Related DTCs	P0A1D (INF 162/821/822/823): Lost communication with ECM/PCM
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 162/821/822/823) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

HV

DTC	P0A1D-179	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	179	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 179): HV CPU malfunction
Required sensors / components	HV control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 179) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-187	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	187	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 187): Specific random access memory destruction
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

HV

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 187) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-390	Hybrid Powertrain Control Module

DTC	P3004-133	Power Cable Malfunction

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	390	Charge control error	Hybrid vehicle control ECU
P3004	133	A high-voltage wiring system error signal is detected in the hybrid vehicle control ECU	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 390): HV CPU malfunction
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 390) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTCs other than P0A1D-390 and P3004-133 are output.

YES → **GO TO DTC CHART**

NO →

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0A1D-393	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	393	ECU internal error	Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 393): HV CPU operation malfunction
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 393) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE HYBRID VEHICLE CONTROL ECU

HINT:
See page HV-569

NEXT

COMPLETED

DTC	P0A1D-721	Hybrid Powertrain Control Module
DTC	P0A1D-722	Hybrid Powertrain Control Module
DTC	P0A1D-723	Hybrid Powertrain Control Module
DTC	P0A1D-765	Hybrid Powertrain Control Module
DTC	P0A1D-787	Hybrid Powertrain Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	721	ECU internal error	Hybrid vehicle control ECU
P0A1D	722	ECU internal error	Hybrid vehicle control ECU
P0A1D	723	ECU internal error	Hybrid vehicle control ECU
P0A1D	765	ECU internal error	Hybrid vehicle control ECU
P0A1D	787	ECU internal error	Hybrid vehicle control ECU

HV

MONITOR DESCRIPTION

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 checks the result of the ECM self-test. If the hybrid vehicle control ECU detects a "Fail" from the ECM self-test, it will conclude that there is an internal malfunction in the ECM. The hybrid vehicle control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 721/722/723/765/787): Monitor CPU malfunction
Required sensors / components	Hybrid vehicle control ECU
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A1D (INF 721/722/723/765/787) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	**REPLACE HYBRID VEHICLE CONTROL ECU**

HINT:
See page HV-569

NEXT

COMPLETED

HV

DTC	P0A1F-129	Battery Energy Control Module

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1F	129	HV battery voltage circuit malfunction	Battery smart unit

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1F (INF 129): Rationality
Required sensors / components	Battery smart unit
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

HV

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Battery smart unit	DTC P0A1F (INF 129) is not detected

INSPECTION PROCEDURE

NOTICE:

Performing the check procedures for a long time with the shift lever in the N position may cause DTC P3000-388 to be set.

HINT:

To determine if conditions are normal, turn the power switch on (READY), move the shift lever to the N position, and check HV battery voltage (PWR RESOURCE VB), pre-boost voltage (VL), and post-boost voltage (VH) in the data list. This check should be performed after the battery smart unit is replaced. When the system is normal, the PWR RESOURCE VB, VL, and VH values should be almost equal (voltage boosting will not occur when the shift lever is in neutral). If the difference between each voltage exceeds the values specified below, there is a malfunction in the battery smart unit.

Inspection voltage	Maximum voltage difference
Difference between HV battery voltage (PWR RESOURCE VB) and pre-boost voltage (VL)	50 V

Inspection voltage	Maximum voltage difference
Difference between HV battery voltage (PWR RESOURCE VB) and post-boost voltage (VH)	70 V
Difference between pre-boost voltage (VL) and post-boost voltage (VH)	90 V

CAUTION:

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

HINT:

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

1	REPLACE BATTERY SMART UNIT

NEXT

COMPLETED

HV

DTC	P0A1F-150	Battery Energy Control Module

DTC	P0A1F-157	Battery Energy Control Module

DESCRIPTION

Refer to description for DTC P0A1F-129 (See page HV-187).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1F	150	Power source voltage of the battery smart unit is insufficient during precharge.	• Battery smart unit • Wire harness or connector
P0A1F	157	Power source voltage of the battery smart unit is insufficient during precharge.	• Battery smart unit • Wire harness or connector

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A1F (INF 150): Rationality P0A1F (INF 157): Rationality
Required sensors / components	Battery smart unit
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Battery smart unit	DTC P0A1F (INF 150/157) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.**

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

HINT:

- 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 the power switch on (READY)) and recheck for DTCs (See page HV-36).

1	CHECK AUXILIARY BATTERY

(a) Measure the voltage between the terminals of the auxiliary battery.
Standard voltage:
11 to 14 V (Battery electrolyte temperature: 20°C (68°F))

NG → **CHARGE OR REPLACE AUXILIARY BATTERY**

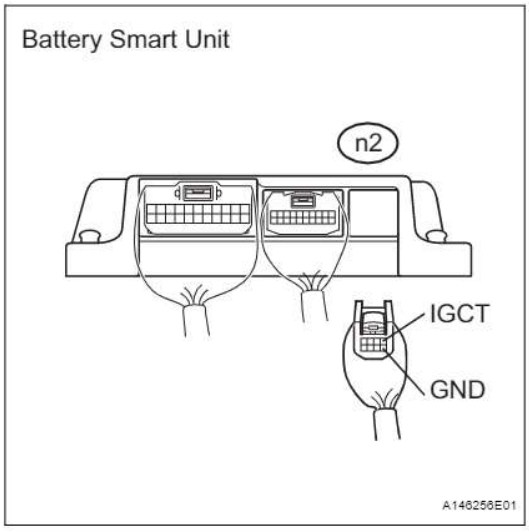
OK

2	CHECK HARNESS AND CONNECTOR (IGCT VOLTAGE)

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
(b) Remove the luggage compartment trim cover front (See page HB-81).
(c) Disconnect the frame wire (See page HV-579).
(d) Remove the battery bracket sub-assembly (See page HB-81).
(e) Connect the auxiliary battery positive terminal cable of the frame wire.
(f) Disconnect the n2 battery smart unit connector.
(g) Turn the power switch on (IG).
(h) Measure the voltage according to the value(s) in the table below.
Standard voltage

Tester Connection	Specified Condition
IGCT (n2-1) - GND (n2-5)	8.6 V or more

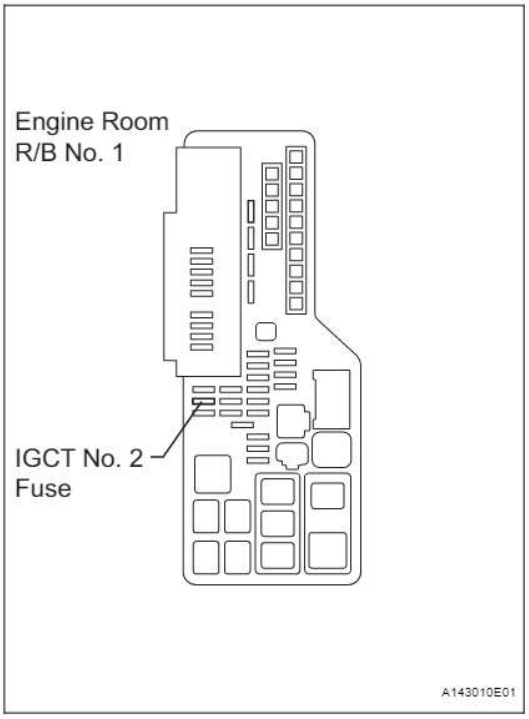


OK → **REPLACE BATTERY SMART UNIT (See page HB-99)**

HV

NG

3	CHECK FUSE (IGCT NO. 2)



(a) Remove the IGCT No. 2 fuse from the engine room R/B No. 1.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
IGCT No. 2 fuse terminal	Below 1 Ω

NG → REPLACE FUSE

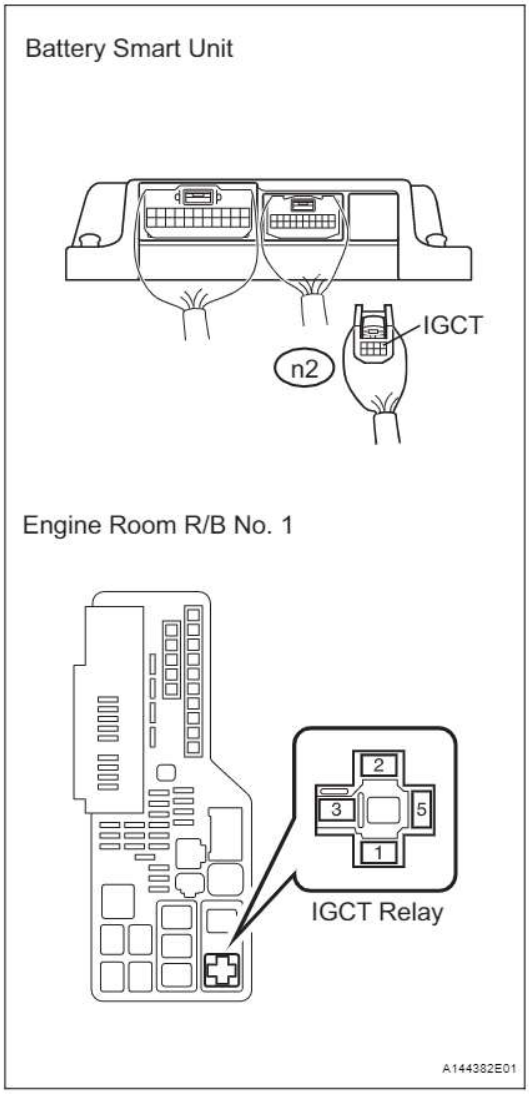
OK

HV

4	CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - ENGINE ROOM R/B NO. 1)

CAUTION:
Be sure to wear insulated gloves.

(a) Install the IGCT No. 2 fuse to the engine room R/B No. 1.
(b) Remove the IGCT relay from the engine room R/B No. 1.
(c) Disconnect connector N2 from the battery smart unit.



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

Standard resistance

Tester Connection	Specified Condition
IGCT (n2-1) - Engine room R/B No. 1 IGCT Relay terminal 3	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK AND REPAIR POWER SOURCE CIRCUIT

HV

DTC	P0A2B-248	Drive Motor "A" Temperature Sensor Circuit Range / Performance

DTC	P0A2B-250	Drive Motor "A" Temperature Sensor Circuit Range / Performance

DESCRIPTION

Refer to the circuit description for DTC P0A2C-247 (See page HV-194).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A2B	248	Motor temperature sensor malfunction	Hybrid vehicle transaxle assembly (Motor temperature sensor)
P0A2B	250	Motor temperature sensor performance problem	Hybrid vehicle transaxle assembly (Motor temperature sensor)

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

NEXT

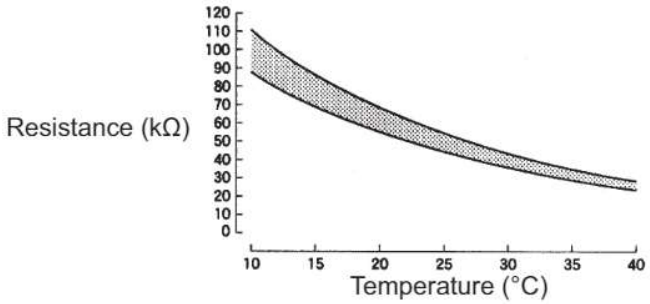
COMPLETED

DTC	P0A2C-247	Drive Motor "A" Temperature Sensor Circuit Low

DTC	P0A2D-249	Drive Motor "A" Temperature Sensor Circuit High

DESCRIPTION

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 No.	INF Code	DTC Detection Condition	Trouble Area
P0A2C	247	GND short in motor temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid vehicle transaxle assembly (Motor temperature sensor)
P0A2D	249	Open or +B short in motor temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid vehicle transaxle assembly (Motor temperature sensor)

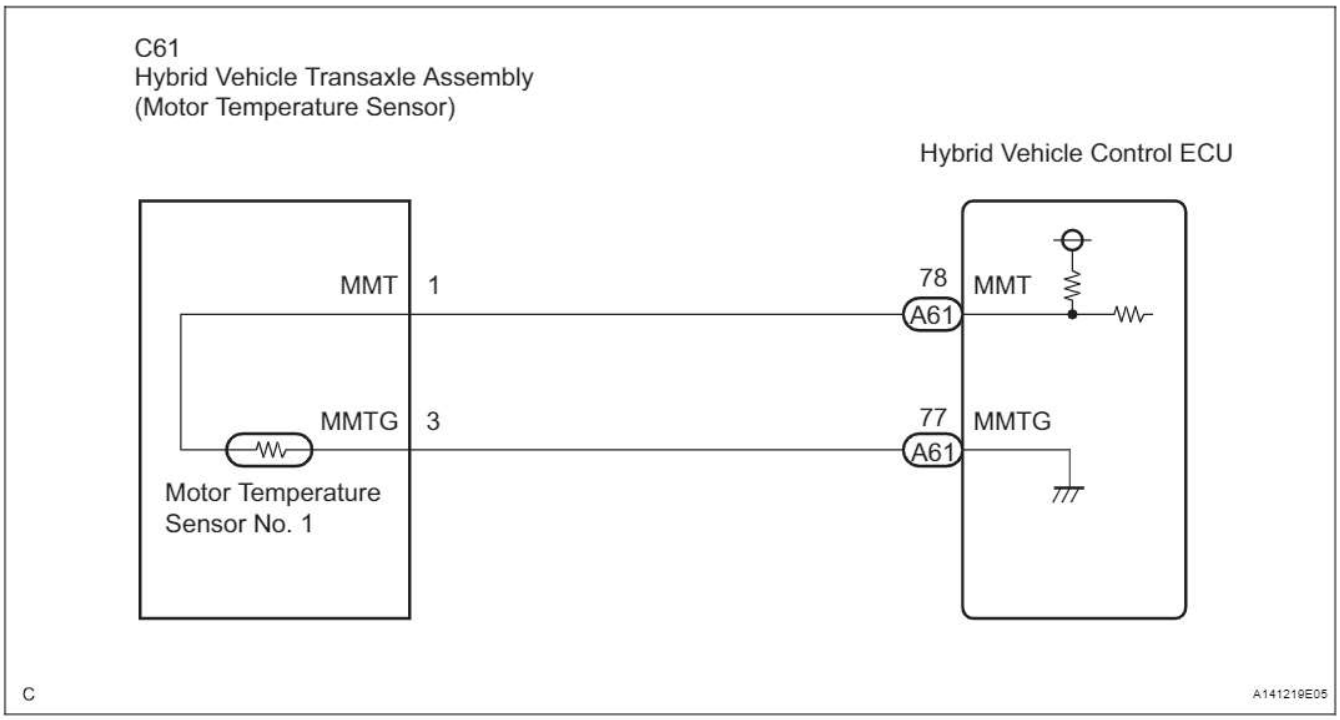
HV

HINT:

After confirming that DTC P0A2C-247 or P0A2D-249 is output, use the intelligent tester to check "MOTOR1 TEMP" in the HV ECU data list.

Displayed Temperature	Malfunction
-50°C (-58°F)	Open or +B short circuit
205°C (401°F)	GND short

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	**CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)**

NG → **CONNECT SECURELY**

OK

2	**CHECK CONNECTOR CONNECTION CONDITION (MOTOR TEMPERATURE SENSOR CONNECTOR)**

(a) Check the connections of the motor temperature sensor connectors.

OK:

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

NG → CONNECT SECURELY

OK

3 READ VALUE OF INTELLIGENT TESTER (MOTOR1 TEMP)

(a) Turn the power switch on (IG).
(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MOTOR1 TEMP.
(c) Read the data list.
Result

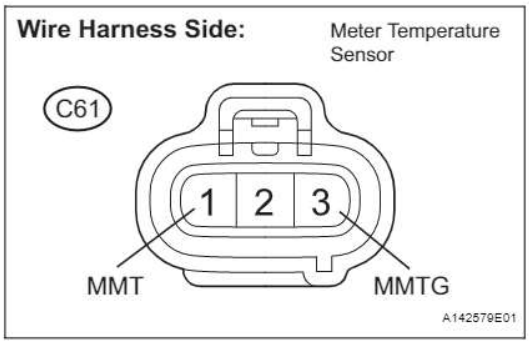
A	B	C
-50°C (-58°F)	205°C (401°F) or more	Same as actual temperature

B → Go to step 6

C → CHECK FOR INTERMITTENT PROBLEMS (See page HV-17)

A

4 READ VALUE OF INTELLIGENT TESTER (MOTOR1 TEMP)



(a) Disconnect the C61 motor temperature sensor connector.
(b) Connect terminals 1 and 3 of the motor temperature sensor vehicle side connector.
(c) Turn the power switch on (IG).
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MOTOR1 TEMP.
(e) Read the data list.
Displayed temperature:
205°C (401°F) or more

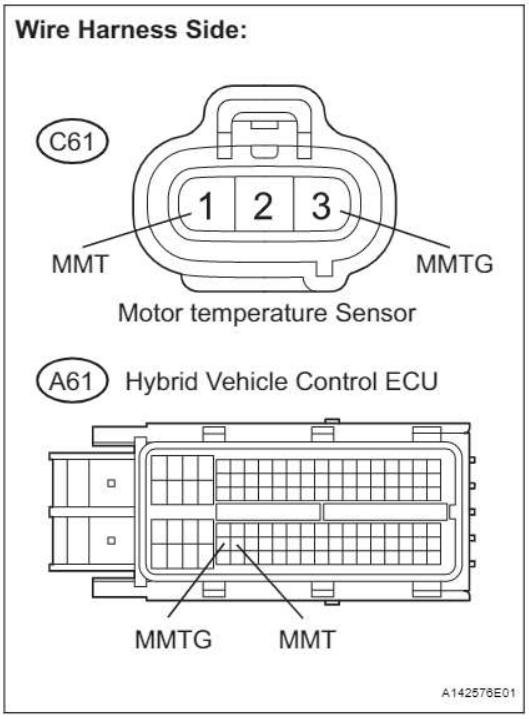
OK → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

NG

5 CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - MOTOR TEMPERATURE SENSOR)

(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Turn the power switch on (IG).

HV



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

Standard voltage

Tester Connection	Specified Condition
MMT (A61-78) - Body ground	Below 1 V
MMTG (A61-77) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(d) Turn the power switch off.

(e) Disconnect the C61 motor temperature sensor connector.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
MMT (A61-78) - MMT (C61-1)	Below 1 Ω
MMTG (A61-77) - MMTG (C61-3)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
MMT (A61-78) or MMT (C61-1) - Body ground	10 kΩ or more
MMTG (A61-77) or MMTG (C61-3) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

HV

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

6	READ VALUE OF INTELLIGENT TESTER (MOTOR1 TEMP)

(a) Disconnect the motor temperature sensor connector.

(b) Turn the power switch on (IG).

(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MOTOR1 TEMP.

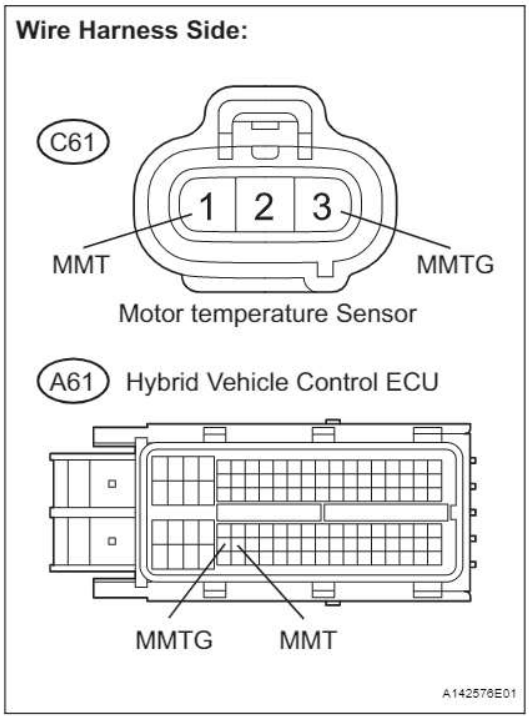
(d) Read the data list.

Displayed temperature:
-50°C (-50°F)

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

NG

7	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - MOTOR TEMPERATURE SENSOR)



(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Disconnect the motor temperature sensor connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
MMT (A61-78) - MMT (C61-1)	Below 1 Ω
MMTG (A61-77) - MMTG (C61-3)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
MMT (A61-78) or MMT (C61-1) - Body ground	10 kΩ or more
MMTG (A61-77) or MMTG (C61-3) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0A37-258	Generator Temperature Sensor Circuit Range / Performance

DTC	P0A37-260	Generator Temperature Sensor Circuit Range / Performance

DESCRIPTION

Refer to the circuit description for DTC P0A2C-247 (See page HV-194).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A37	258	Generator temperature sensor malfunction	Hybrid vehicle transaxle assembly (Generator temperature sensor)
P0A37	260	Generator temperature sensor performance problem	Hybrid vehicle transaxle assembly (Generator temperature sensor)

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

NEXT

COMPLETED

DTC	P0A38-257	Generator Temperature Sensor Circuit Low

DTC	P0A39-259	Generator Temperature Sensor Circuit High

DESCRIPTION

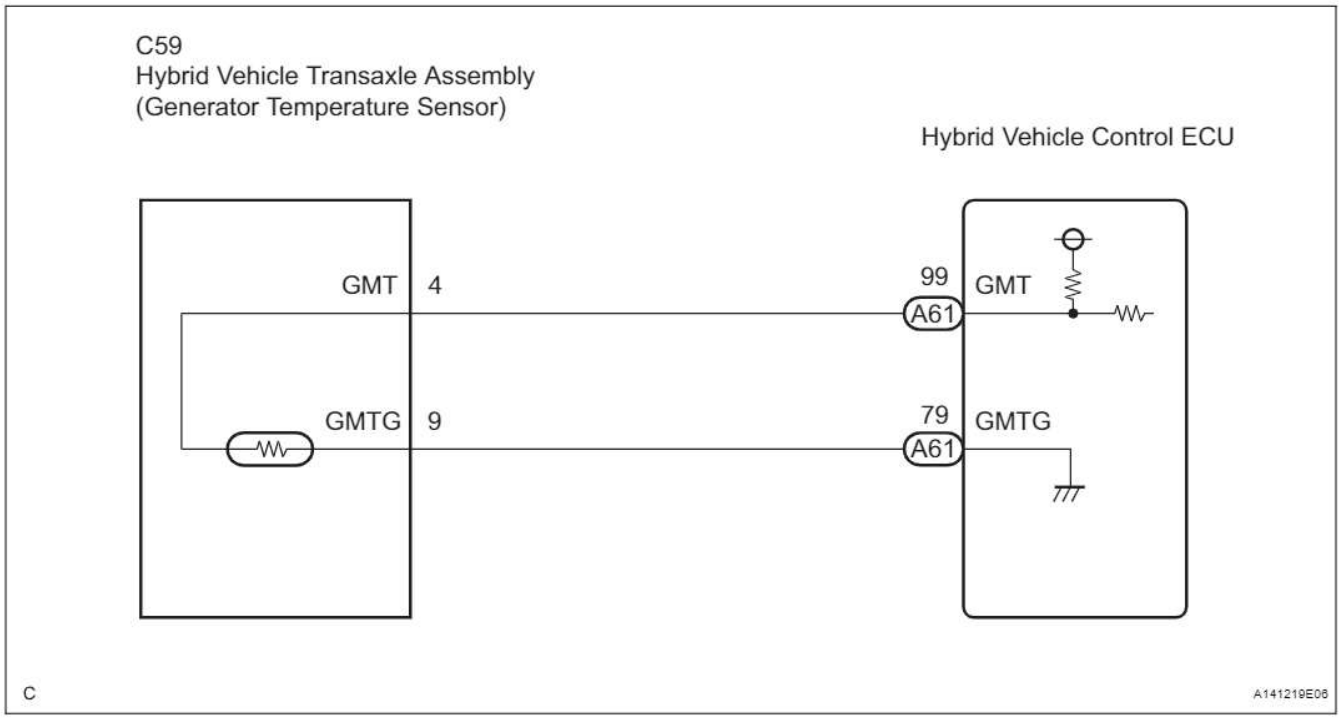
Refer to the circuit description for DTC P0A2C-247 (See page HV-194).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A38	257	GND short in generator temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid vehicle transaxle assembly (Generator temperature sensor)
P0A39	259	Open or +B short in generator temperature sensor circuit	• Wire harness or connector • Hybrid vehicle control ECU • Hybrid vehicle transaxle assembly (Generator temperature sensor)

HINT:
After confirming that DTC P0A38-257 or P0A39-259 is output, use the intelligent tester to check "MOTOR2 TEMP" in the HV ECU data list.

Displayed Temperature	Malfunction
-50°C (-58°F)	Open or +B short circuit
205°C (401°F)	GND short

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

2	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR TEMPERATURE SENSOR CONNECTOR)

(a) Check the connections of the generator temperature sensor connector.

OK:

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

NG → CONNECT SECURELY

OK ↓

3	READ VALUE OF INTELLIGENT TESTER (MOTOR2 TEMP)

(a) Turn the power switch on (IG).

(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MOTOR2 TEMP.

(c) Read the data list.

Result

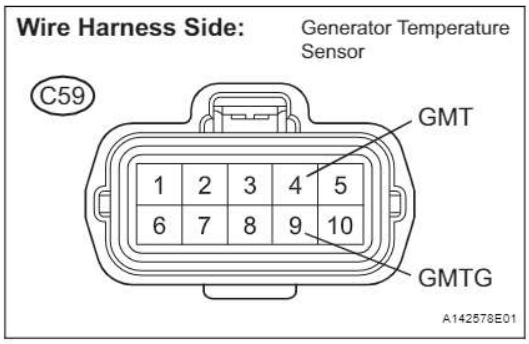
A	B	C
-50°C (-58°F)	205°C (401°F) or more	Same as actual temperature

B → Go to step 6

C → CHECK FOR INTERMITTENT PROBLEMS (See page HV-17)

A ↓

4	READ VALUE OF INTELLIGENT TESTER (MOTOR2 TEMP)

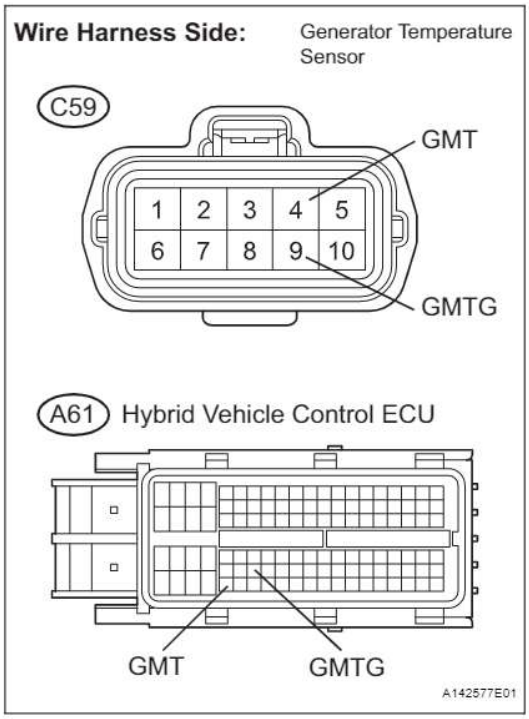


(a) Disconnect the C59 generator temperature sensor connector.
(b) Connect terminals 4 and 9 of the generator temperature sensor vehicle side connector.
(c) Turn the power switch on (IG).
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MOTOR2 TEMP.
(e) Read the data list.
Displayed temperature:
205°C (401°F) or more

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

NG

5	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - GENERATOR TEMPERATURE SENSOR)



(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Turn the power switch on (IG).
(c) Measure the voltage according to the value(s) in the table below.
Standard voltage

Tester Connection	Specified Condition
GMT (A61-99) - Body ground	Below 1 V
GMTG (A61-79) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.
(d) Turn the power switch off.
(e) Disconnect the generator temperature sensor connector.
(f) Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for open)

Tester Connection	Specified Condition
GMT (A61-99) - GMT (C59-4)	Below 1 Ω
GMTG (A61-79) - GMTG (C59-9)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
GMT (A61-99) or GMT (C59-4) - Body ground	10 kΩ or more
GMTG (A61-79) or GMTG (C59-9) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

HV

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

6	READ VALUE OF INTELLIGENT TESTER (MOTOR2 TEMP)

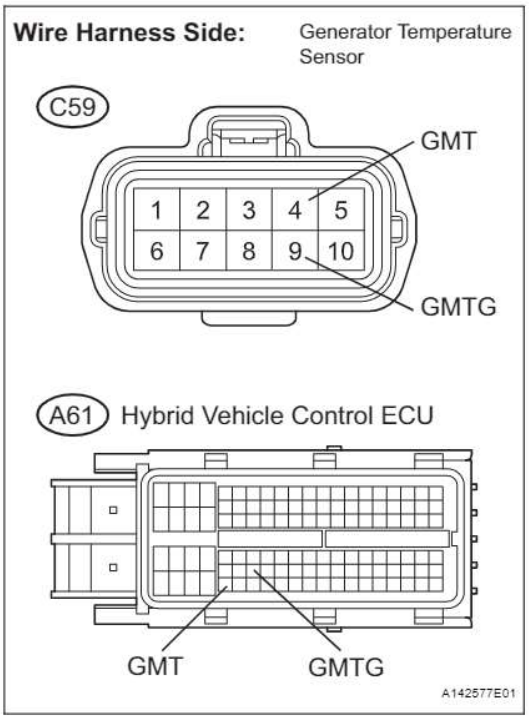
(a) Disconnect the generator temperature sensor connector.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MOTOR2 TEMP.
(d) Read the data list.
Displayed temperature:
-50°C (-58°F)

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

NG

7	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - GENERATOR TEMPERATURE SENSOR)

HV



(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Disconnect the C59 generator temperature sensor connector.
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for open)

Tester Connection	Specified Condition
GMT (A61-99) - GMT (C59-4)	Below 1 Ω
GMTG (A61-79) - GMTG (C59-9)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
GMT (A61-99) or GMT (C59-4) - Body ground	10 kΩ or more
GMTG (A61-79) or GMTG (C59-9) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

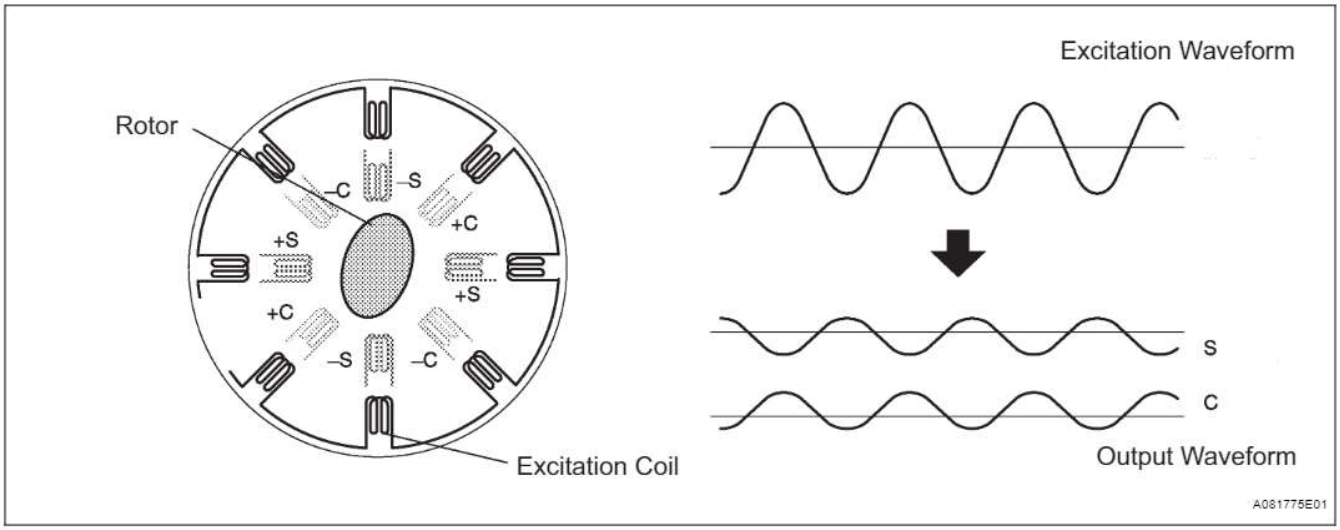
OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0A3F-243	Drive Motor "A" Position Sensor Circuit
DTC	P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
DTC	P0A41-245	Drive Motor "A" Position Sensor Circuit Low

DESCRIPTION

A resolver is a sensor that detects the position of the magnetic poles, which are indispensable for ensuring highly efficient control of MG2 and MG1.
The resolver stator contains an excitation coil and 2 detection coils. The gap between the stator and rotor changes as the rotor turns because the rotor is oval shaped. An alternating current with a predetermined frequency flows through the excitation coil, and detection coils S and C output alternating currents in accordance with the sensor rotor position.
The MG ECU detects the absolute position of the rotor according to the phases of detection coils S and C and the height of their waveforms. Furthermore, the CPU calculates the amount of change in the position within a predetermined length of time, in order to use the resolver as a speed sensor.
The MG ECU monitors signals output from the motor resolver and detects malfunctions.



HV

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A3F	243	Interphase short in motor resolver circuit	• Wire harness or connector • Hybrid vehicle transaxle assembly (Motor resolver) • Inverter with converter assembly
P0A40	500	Motor resolver output is out of normal range	• Wire harness or connector • Hybrid vehicle transaxle assembly (Motor resolver) • Inverter with converter assembly
P0A41	245	Open or short in motor resolver circuit	• Wire harness or connector • Hybrid vehicle transaxle assembly (Motor resolver) • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A3F (INF 243): Short circuit between phases P0A40 (INF 500): Range check P0A41 (INF245): Circuit discontinuity / short circuit
Required sensors / components	Motor resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

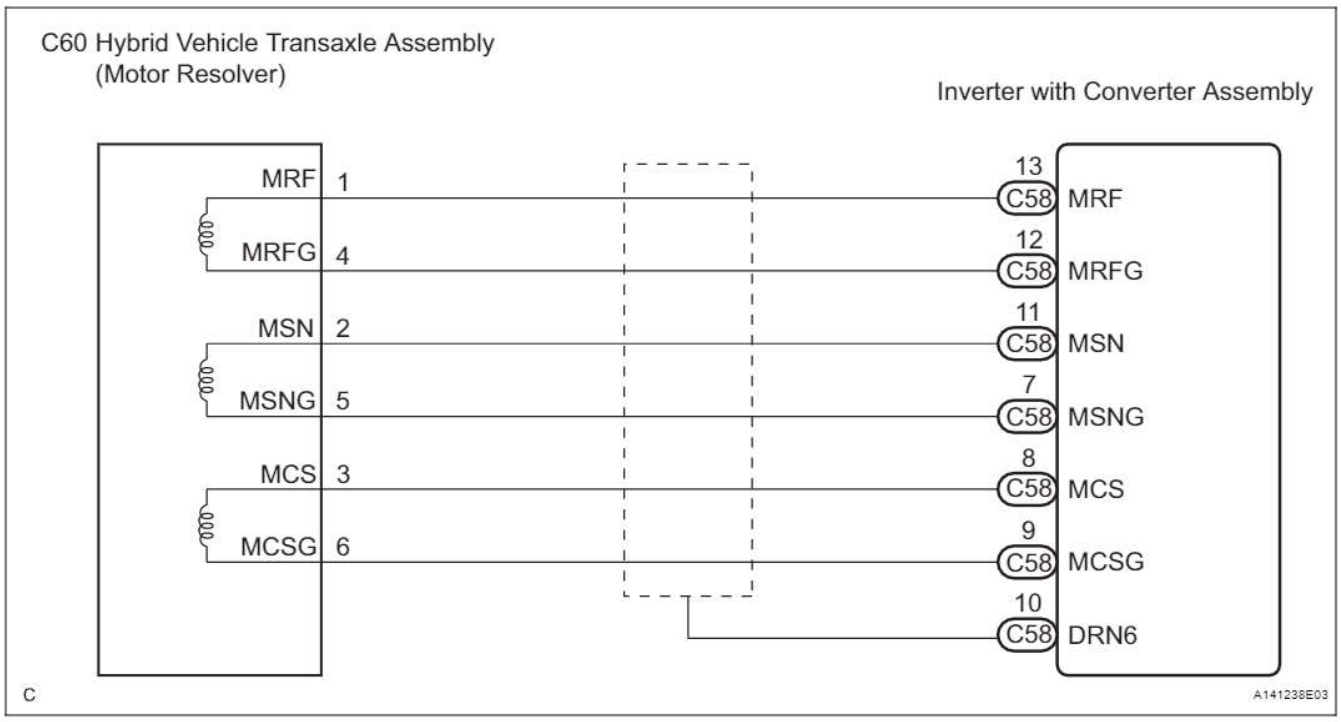
TMC's intellectual property	-

COMPONENT OPERATING RANGE

Motor resolver	DTC P0A3F (INF 243) is not detected DTC P0A40 (INF 500) is not detected DTC P0A41 (INF 245) is not detected

HV

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-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.)**

NOTICE:

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.

HINT:

- 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 vehicle transaxle assembly last.

1	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

HV

OK

2	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3	CHECK MOTOR RESOLVER (See page HV-160)

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG

4	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK

5	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A4B-253	Generator Position Sensor Circuit
DTC	P0A4C-513	Generator Position Sensor Circuit Range / Performance
DTC	P0A4D-255	Generator Position Sensor Circuit Low

DESCRIPTION

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 No.	INF Code	DTC Detection Condition	Trouble Area
P0A4B	253	Interphase short in the generator resolver circuit	• Wire harness or connector • Hybrid vehicle transaxle assembly (Generator resolver) • Inverter with converter assembly
P0A4C	513	Generator resolver output is out of the normal range	• Wire harness or connector • Hybrid vehicle transaxle assembly (Generator resolver) • Inverter with converter assembly
P0A4D	255	Open or short in the generator resolver circuit	• Wire harness or connector • Hybrid vehicle transaxle assembly (Generator resolver) • Inverter with converter assembly

HV

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A4B (INF 253): Short circuit between phases P0A4C (INF 513): Range check P0A4D (INF 255): Circuit discontinuity / short circuit
Required sensors / components	Generator resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

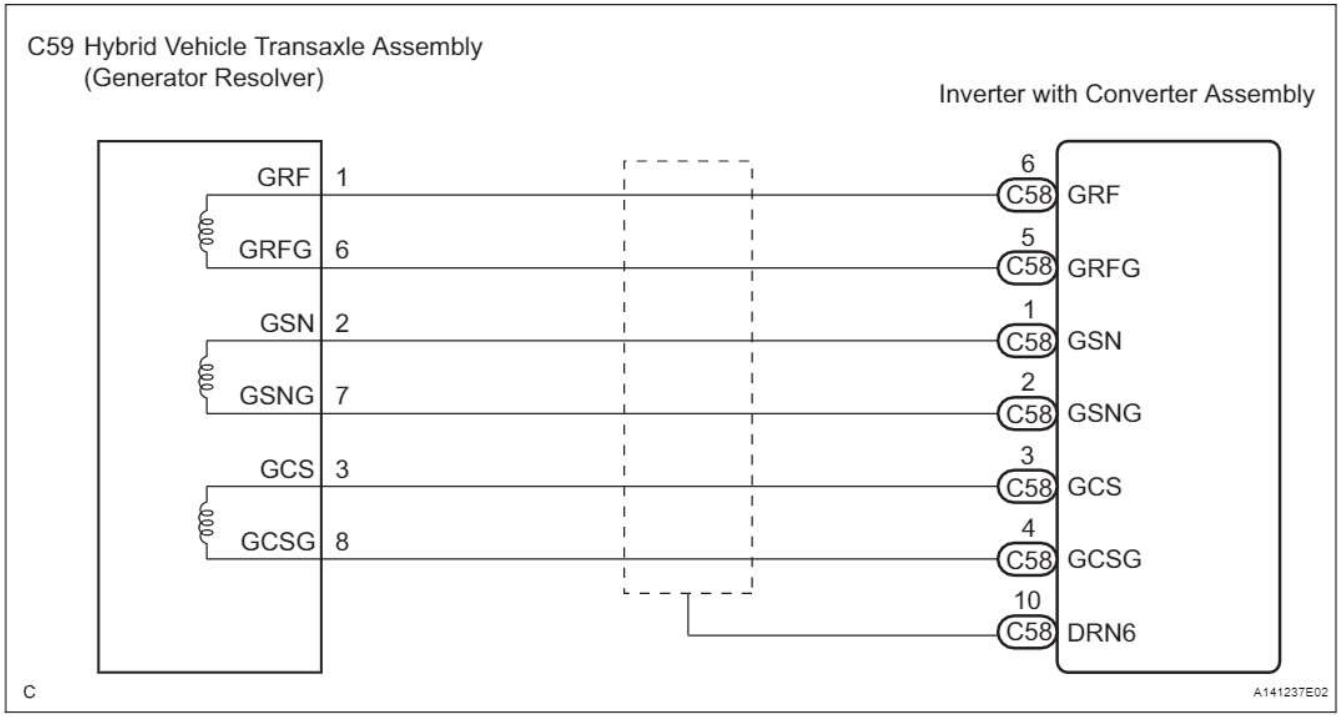
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Generator resolver	DTC P0A4B (INF 253) is not detected DTC P0A4C (INF 513) is not detected DTC P0A4D (INF 255) is not detected

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-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.)**

NOTICE:

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.

HINT:

- 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.

HV

- 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 vehicle transaxle assembly last.

1	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

2	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

3	CHECK GENERATOR RESOLVER (See page HV-153)

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG ↓

HV

4	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK ↓

5	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A51-174	Drive Motor "A" Current Sensor Circuit

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A51	174	Inverter with converter assembly (MG ECU) internal error	Inverter with converter assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

HV

COMPLETED

DTC	P0A60-288	Drive Motor "A" Phase V Current
DTC	P0A60-290	Drive Motor "A" Phase V Current
DTC	P0A60-294	Drive Motor "A" Phase V Current
DTC	P0A60-501	Drive Motor "A" Phase V Current
DTC	P0A63-296	Drive Motor "A" Phase W Current
DTC	P0A63-298	Drive Motor "A" Phase W Current
DTC	P0A63-302	Drive Motor "A" Phase W Current
DTC	P0A63-502	Drive Motor "A" Phase W Current

HV

DESCRIPTION

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 No.	INF Code	DTC Detection Condition	Trouble Area
P0A60	288	Malfunction in motor inverter current sensor (phase V sub sensor)	• Inverter with converter assembly • Service plug grip
P0A60	290	Malfunction in motor inverter current sensor (phase V main sensor)	• Inverter with converter assembly • Service plug grip
P0A60	294	Malfunction in motor inverter current sensor (Performance problem or open phase V)	• Inverter with converter assembly • Service plug grip
P0A60	501	Malfunction in motor inverter current sensor (phase V main and sub sensors offset)	• Inverter with converter assembly • Service plug grip
P0A63	296	Malfunction in motor inverter current sensor (phase W sub sensor)	• Inverter with converter assembly • Service plug grip
P0A63	298	Malfunction in motor inverter current sensor (phase W main sensor)	• Inverter with converter assembly • Service plug grip
P0A63	302	Malfunction in motor inverter current sensor (Performance problem or open phase W)	• Inverter with converter assembly • Service plug grip
P0A63	502	Malfunction in motor inverter current sensor (phase W main and sub sensors offset)	• Inverter with converter assembly • Service plug grip

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A60 (INF 288/290/294/501): Phase V, sub sensor P0A63 (INF 296/298/302/502): Phase W, sub sensor
Required sensors / components	Motor inverter current sensor, motor resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A60 (INF 288/290/294/501) is not detected DTC P0A63 (INF 296/298/302/502) is not detected

HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	**CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)**

NG → **Go to step 3**

OK

2	REPLACE INVERTER WITH CONVERTER ASSEMBLY

HINT:
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.

NEXT

REPLACE SERVICE PLUG GRIP

3	CONNECT SECURELY

HINT:
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.

NEXT

REPLACE SERVICE PLUG GRIP

HV

DTC	P0A72-326	Generator Phase V Current
DTC	P0A72-328	Generator Phase V Current
DTC	P0A72-333	Generator Phase V Current
DTC	P0A72-515	Generator Phase V Current
DTC	P0A75-334	Generator Phase W Current
DTC	P0A75-336	Generator Phase W Current
DTC	P0A75-341	Generator Phase W Current
DTC	P0A75-516	Generator Phase W Current

HV

DESCRIPTION

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 No.	INF Code	DTC Detection Condition	Trouble Area
P0A72	326	Malfunction in generator inverter current sensor (phase V sub sensor)	• Inverter with converter assembly • Service plug grip
P0A72	328	Malfunction in generator inverter current sensor (phase V main sensor)	• Inverter with converter assembly • Service plug grip
P0A72	333	Malfunction in generator inverter current sensor (Performance problem or open phase V)	• Inverter with converter assembly • Service plug grip
P0A72	515	Malfunction in generator inverter current sensor (phase V main and sub sensors offset)	• Inverter with converter assembly • Service plug grip
P0A75	334	Malfunction in generator inverter current sensor (phase W sub sensor)	• Inverter with converter assembly • Service plug grip
P0A75	336	Malfunction in generator inverter current sensor (phase W main sensor)	• Inverter with converter assembly • Service plug grip
P0A75	341	Malfunction in generator inverter current sensor (Performance problem or open phase W)	• Inverter with converter assembly • Service plug grip
P0A75	516	Malfunction in generator inverter current sensor (phase W main and sub sensors offset)	• Inverter with converter assembly • Service plug grip

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A72 (INF 326/328/333/515): Phase V, sub sensor P0A75 (INF 334/336/341/516): Phase W, sub sensor
Required sensors / components	Generator inverter current sensor, Generator resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A72 (INF 326/328/333/515) is not detected DTC P0A75 (INF 334/336/341/516) is not detected

HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	**CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)**

NG → **Go to step 3**

OK

2	REPLACE INVERTER WITH CONVERTER ASSEMBLY

HINT:
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.

NEXT

REPLACE SERVICE PLUG GRIP

3	CONNECT SECURELY

HINT:
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.

NEXT

REPLACE SERVICE PLUG GRIP

HV

DTC	P0A78-113	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	113	Motor inverter fail signal detection (overcurrent due to system malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

DTC No.	Relevant Diagnosis
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 7

OK

5	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

6	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

7	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK

8	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A78-121	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	121	Motor inverter overvoltage signal detection (overvoltage due to system malfunction)	• HV relay assembly • Inverter with converter assembly • Service plug grip • Frame wire • Hybrid vehicle transaxle assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

HV

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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

DTC No.	Relevant Diagnosis
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

HV

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 15

OK

5	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 13

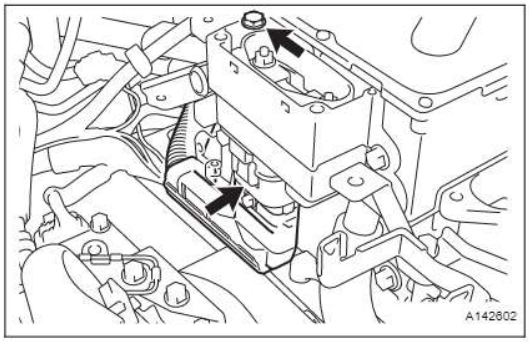
OK

7	CHECK INVERTER WITH CONVERTER ASSEMBLY (HIGH VOLTAGE CONNECTOR CONNECTION CONDITION)

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Check the connection of the high voltage connector of the inverter with converter assembly.
OK:
The connector is connected securely and there are no contact peoblems.



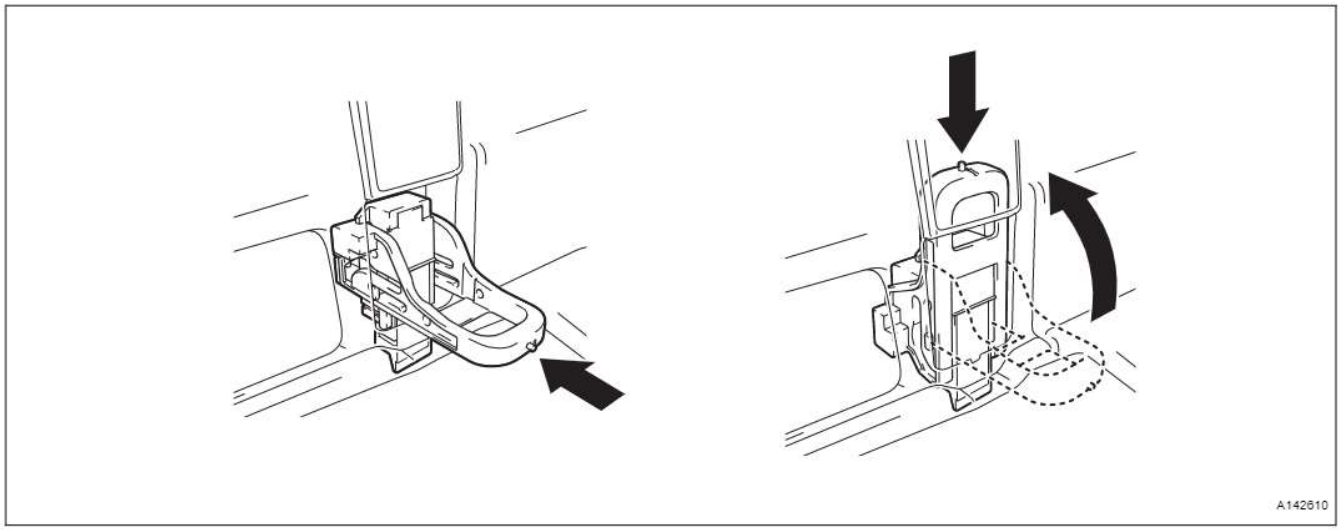
NG → CONNECT SECURELY

OK

8	CHECK SERVICE PLUG GRIP

CAUTION:
Be sure to wear insulated gloves.

(a) Check the connection of the service plug grip.

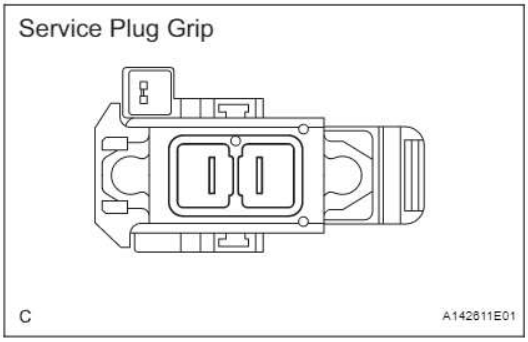


OK:
Dirt or foreign objects have not entered the connection, or there is no evidence of contamination.

NG → **REPLACE SERVICE PLUG GRIP**

OK

9 CHECK SERVICE PLUG GRIP



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

Tester Connection	Specified Condition
Service plug grip terminal	Below 1 Ω

NG → **REPLACE SERVICE PLUG GRIP**

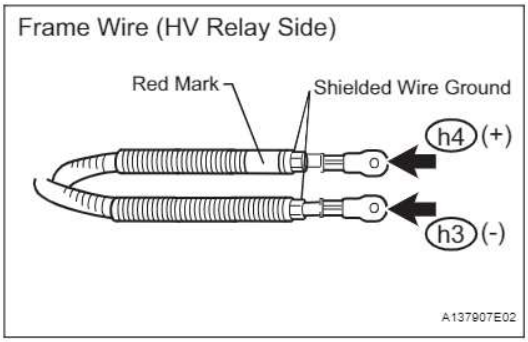
OK

10 CHECK FRAME WIRE

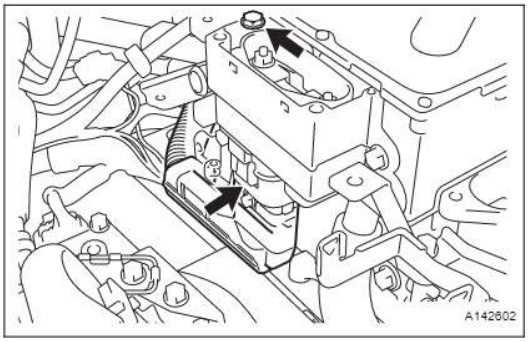
HV

CAUTION:
Be sure to wear insulated gloves and protective goggles.

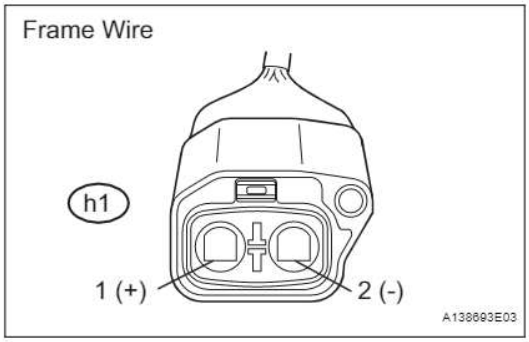
(a) Check that the service plug grip is not installed.
(b) Disconnect the frame wire from the HV relay.
(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
Standard resistance



Tester Connection	Specified Condition
h4-1 - Body ground and shielded wire ground	10 MΩ or more
h3-1 - Body ground and shielded wire ground	10 MΩ or more



(d) Disconnect the frame wire from the high voltage connector of the inverter with converter assembly.



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

Standard resistance

Tester Connection	Specified Condition
h4-1 (high voltage +) - h1-1 (high voltage +)	Below 1 Ω
h3-1 (high voltage -) - h1-2 (high voltage -)	Below 1 Ω

NG → **REPLACE FRAME WIRE**

OK

11 INSPECT HV RELAY ASSEMBLY (SMRB)

CAUTION:
Be sure to wear insulated gloves.

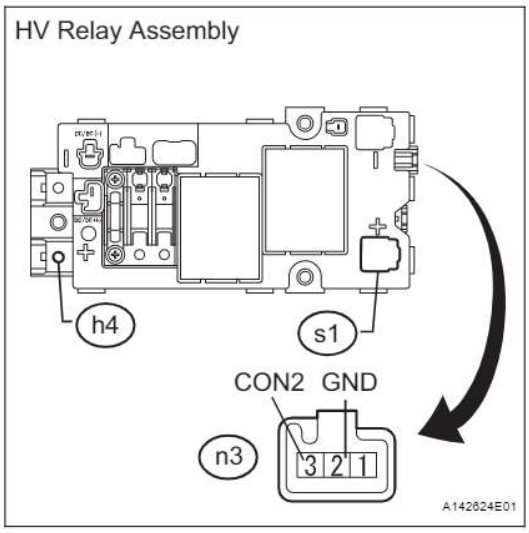
(a) Check that the service plug grip is not installed.

(b) Remove the HV relay assembly from the vehicle (See page HB-104).

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

Standard resistance

Tester Connection	Specified Condition
h4-1 - s1-1	Below 1 Ω (When battery voltage (12 V) applied to terminals n3-2 and n3-3)



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

Standard resistance

Tester Connection	Specified Condition
CON2 (n3-3) - GND (n3-2)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

NG → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

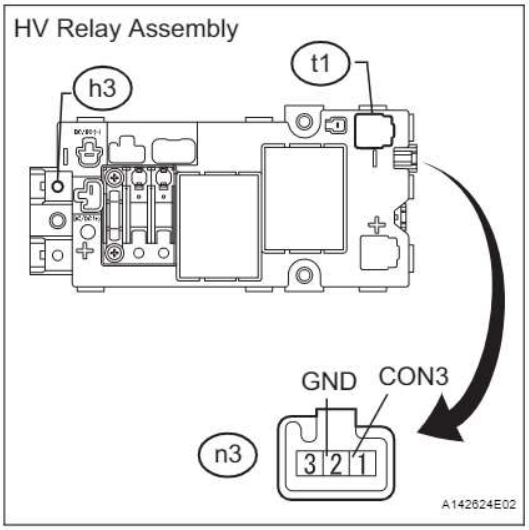
OK

12 INSPECT HV RELAY ASSEMBLY (SMRG)

CAUTION:
Be sure to wear insulated gloves and protective goggles.

(a) Check that the service plug grip is not installed.

HV



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

Standard resistance

Tester Connection	Specified Condition
h3-1 - t1-1	Below 1 Ω (When battery voltage applied to terminals n3-1 and n3-2)

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

Standard resistance

Tester Connection	Specified Condition
CON3 (n3-1) - GND (n3-2)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

NG → REPLACE HV RELAY ASSEMBLY (See page HB-104)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

13	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

HV

OK

14	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

15	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK

16	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A78-128	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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	DTC Detection Condition	Trouble Area
P0A78	128	Abnormal motor current value detection (System malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

DTC No.	Relevant Diagnosis
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

HV

OK

4	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 7

OK

5	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

6	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

7	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK

8	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

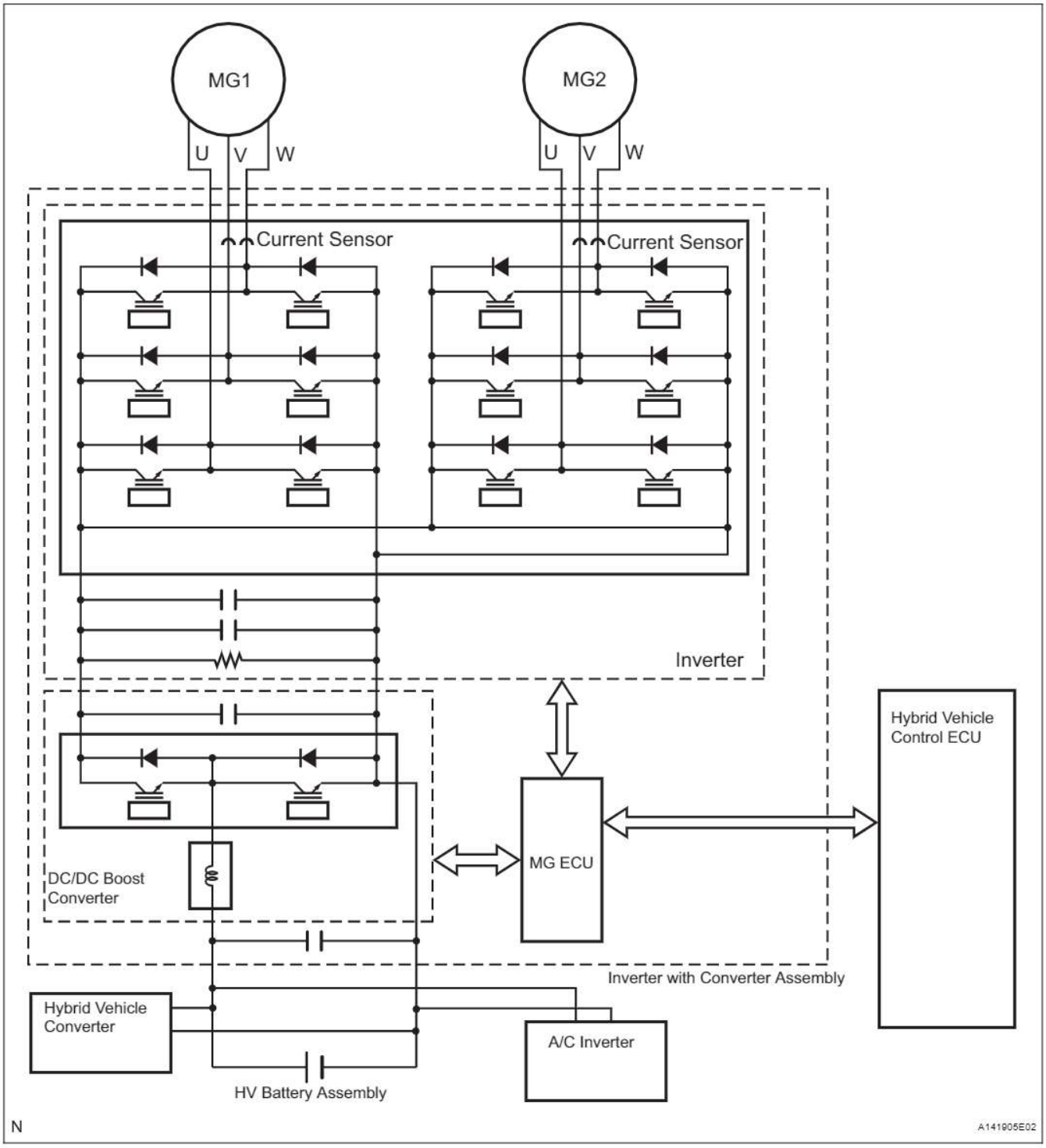
HV

DTC	P0A78-266	Drive Motor "A" Inverter Performance

DTC	P0A78-267	Drive Motor "A" Inverter Performance

DESCRIPTION

The inverter converts high-voltage direct current from the HV battery and alternating current for MG2 and MG1. The inverter contains a three-phase bridge circuit, which consists of six power transistors each for MG2 and MG1, that converts direct current to three-phase alternating current. The MG ECU controls the actuation of the power transistors. The inverter transmits information that is necessary for effecting control, such as the amperage and voltage, to the MG ECU.



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

The inverter voltage sensor outputs voltage that varies between 0 and 5 V in accordance with the changes in the high voltage. The higher the high voltage, the higher the output voltage, and the lower the high voltage, the lower the output voltage.

The MG ECU monitors the inverter voltage and detects malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	266	Open or short to GND in the inverter voltage (VH) signal line	Inverter with converter assembly
P0A78	267	Short to +B in the inverter voltage (VH) signal line	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 266): VH malfunction (GND short and disconnection) P0A78 (INF 267): VH malfunction (+B short)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 266/267) is not detected

HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

COMPLETED

DTC	P0A78-279	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	279	Motor inverter overvoltage signal detection (overvoltage due to inverter with converter assembly malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 279): OVH detection (Over high voltage malfunction)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 279) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

HV

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A78-282	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	282	Motor inverter overvoltage signal detection (circuit malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 282): OVH detection (Circuit malfunction)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 282) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A78-284	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	284	Motor inverter fail signal detection (overheat)	• Wire harness or connector • Inverter cooling system • Cooling fan system • Water pump with motor & bracket assembly • Hybrid vehicle transaxle assembly • Inverter with converter assembly • Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 284): MFIV detection (Over heat malfunction)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 284) is not detected

INSPECTION PROCEDURE

CAUTION:

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

NOTICE:
After inspection, be sure to replace the inverter with converter assembly
HINT:
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
DTC P0A78-284 may be set due to a malfunction which also causes DTCs in the table above to be set. First troubleshoot the output DTCs in the table above. After troubleshooting all output DTCs, be sure to replace the inverter with converter assembly.

YES → GO TO DTC CHART

NO

2	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

HV

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

3	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

4	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

5	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

HV

6	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 16

OK

7	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

8	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

9	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

10	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

11	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 14

OK ↓

12	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK ↓

13	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

14	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK ↓

HV

15	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

16	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG ↓

17	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 19

OK ↓

HV

18	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

19	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

DTC	P0A78-286	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	286	Motor inverter fail signal detection (circuit malfunction)	• Wire harness or connector • Inverter cooling system • Cooling fan system • Water pump with motor & bracket assembly • Hybrid vehicle transaxle assembly • Inverter with converter assembly • Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 286): MFIV detection (Circuit malfunction)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 286) is not detected

INSPECTION PROCEDURE

CAUTION:

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

NOTICE:
After inspection, be sure to replace the inverter with converter assembly.
HINT:
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
DTC P0A78-286 may be set due to a malfunction which also causes DTCs in the table above to be set. First troubleshoot the output DTCs in the table above. After troubleshooting all output DTCs, be sure to replace the inverter with converter assembly.

YES → GO TO DTC CHART

NO

2	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

3	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

4	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

5	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY) (See page HV-326)

NG → CONNECT SECURELY

OK

6	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 16

OK

7	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

8	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

9	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

10	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

11	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 14

OK ↓

12	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

HV

NG → TIGHTEN TO SPECIFIED TORQUE

OK ↓

13	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

14	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK ↓

15	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

16	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG ↓

17	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 19

OK ↓

18	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

19	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

DTC	P0A78-287	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	287	Motor inverter fail signal detection (overcurrent due to inverter assembly malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 287): MFIV detection (Load short circuit)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 287) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

HV

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A78-306	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).
The MG ECU controls motor torque according to driving conditions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	306	Motor torque execution monitoring malfunction	• Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 306): Discrepancy between motor monitored torque and commanded torque
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 306) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

HV

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

4	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A78-503	Drive Motor "A" Inverter Performance

DTC	P0A78-504	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	503	Motor inverter overvoltage signal detection (overvoltage due to MG ECU malfunction)	• Wire harness or connector • Inverter with converter assembly • Hybrid vehicle transaxle assembly
P0A78	504	Motor inverter overvoltage signal detection (overvoltage due to hybrid vehicle transaxle assembly malfunction)	• Wire harness or connector • Inverter with converter assembly • Hybrid vehicle transaxle assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 503/504): OVH detection (Over high voltage malfunction)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 503/504) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.**

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

4	CHECK MOTOR RESOLVER (See page HV-160)

OK → Go to step 7

NG ↓

5	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK ↓

6	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVRTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

7	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

HV

8	CHECK GENERATOR RESOLVER (See page HV-153)

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG

9	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK

10	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A78-505	Drive Motor "A" Inverter Performance

DTC	P0A78-506	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).
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	DTC Detection Condition	Trouble Area
P0A78	505	Motor inverter fail signal detection (overcurrent due to MG ECU malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly
P0A78	506	Motor inverter fail signal detection (overcurrent due to hybrid vehicle transaxle assembly malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 505/506): MFIV detection (Load short circuit)
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 505/506) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:

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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

4	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 5

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

5	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK ↓

6	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A78-510	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).
Upon receiving a motor gate shutdown signal from the MG ECU, the inverter forcibly stops MG2 by turning off all power transistors that are actuating MG2.
The MG ECU monitors the motor gate shutdown signal line and detects malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	510	Motor inverter gate malfunction	Inverter with converter assembly

HINT:
- 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.

MONITOR DESCRIPTION

The MG ECU monitors the current that flows in MG2. If the current flows in MG2 while the vehicle is stationary with the power switch on (IG) 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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 510): Malfunction of inverter gate shutdown circuit
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 510) is not detected

INSPECTION PROCEDURE

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

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

1	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

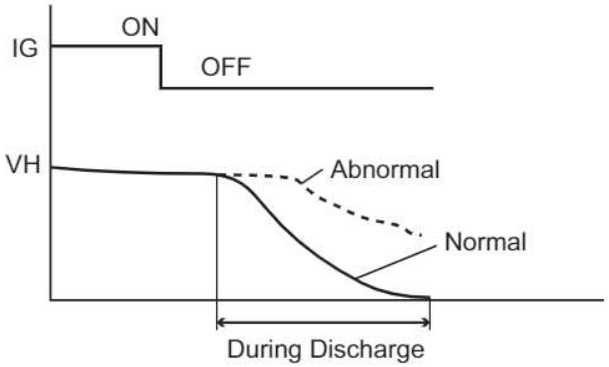
DTC	P0A78-523	Drive Motor "A" Inverter Performance

DESCRIPTION

Refer to the circuit description for DTC P0A78-266 (See page HV-232).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	523	Inverter voltage (VH) sensor offset malfunction	Inverter with converter assembly

HINT:
Turning the power 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.



HV

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 523): Voltage (VH) sensor deviation
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 523) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1 CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0AE2-773, 161	SMRP
P0AE0-228	SMRG
P0ADC-226	SMRB
P0A1A-156, 658, 151, 155, P0A1B-511, 164, 163, 512, 193, 786, 788, 659, 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

YES → GO TO DTC CHART

NO → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

DTC	P0A78-586	Drive Motor "A" Inverter Performance

DESCRIPTION

Refer to the circuit description for DTC P0A78-266 (See page HV-232).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	586	Inverter voltage (VH) sensor performance problem	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 586): Voltage (VH) sensor deviation
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A78 (INF 586) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1A, P0A1B	MG ECU circuit malfunction
P0A1D	Hybrid vehicle control ECU circuit malfunction

YES → GO TO DTC CHART

NO → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

DTC	P0A78-806	Drive Motor "A" Inverter Performance

DTC	P0A78-808	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).
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	DTC Detection Condition	Trouble Area
P0A78	806	Abnormal motor current value detection (MG ECU malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly
P0A78	808	Abnormal motor current value detection (Hybrid vehicle transaxle assembly malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 806/808): Motor inverter abnormal current
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 806/808) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

4	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 5

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

5	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK ↓

6	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A78-807	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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	DTC Detection Condition	Trouble Area
P0A78	807	Abnormal motor current value detection (Inverter malfunction)	• Wire harness or connector • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 807): Motor Inverter Abnormal Current
Required sensors / components	Motor inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A78 (INF 807) is not detected

INSPECTION PROCEDURE

CAUTION:

- **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.**

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HV

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A7A-122	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

If the generator inverter circuit is opened or shorted, or if the circuit overheats, the information is transmitted from the inverter to the GFIV terminal of the MG ECU via the generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	122	Generator inverter fail signal detection (overcurrent due to system malfunction)	• Fuel level • Hybrid vehicle transaxle assembly • Engine assembly • Inverter with converter assembly • Wire harness or connector

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance

DTC No.	Relevant Diagnosis
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

HINT:
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.

YES > GO TO DTC CHART

NO

2 CHECK AMOUNT OF GASOLINE

(a) Turn the power switch on (IG).
(b) Check the amount of fuel by referring to the fuel gauge in the meter.
OK:
Proper amount of fuel is in the tank.

NG > REFUEL VEHICLE

HV OK

3 CHECK ENGINE START

(a) Turn the power switch on (READY).
(b) Check if the engine starts.
HINT:
Depressing the accelerator pedal with the shift lever in the P position will cause the engine to start.
OK:
The engine starts.

OK > Go to step 6

NG

4 INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION)

(a) Turn the power switch off, move the shift lever to the P position, and lift up the vehicle.
(b) Turn the crankshaft pulley using hand tools to check if the crankshaft pulley can rotate.

CAUTION:
Do not turn the power switch on (READY) while performing this inspection. Be sure to turn the power switch off before performing this inspection, to prevent the engine from starting.
OK:
The crankshaft pulley rotates.

OK	Go to step 6

NG

5	INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION)

(a) Lower the vehicle.
(b) Turn the power switch off, move the shift lever to the N position, and lift up the vehicle.
(c) Turn the crankshaft pulley using hand tools to check if the crankshaft pulley can rotate.

CAUTION:
Do not turn the power switch on (READY) while performing this inspection. Be sure to turn the power switch off before performing this inspection, to prevent the engine from starting.
OK:
The crankshaft pulley rotates.

OK	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

NG

REPAIR OR REPLACE ENGINE ASSEMBLY

6	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG	CONNECT SECURELY

OK

7	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

HV

8	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 11

OK

9	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

10	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

11	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK

12	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A7A-130	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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	DTC Detection Condition	Trouble Area
P0A7A	130	Abnormal generator current value detection (System)	• Fuel level • Hybrid vehicle transaxle assembly • Engine assembly • Inverter with converter assembly • Wire harness or connector

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance

DTC No.	Relevant Diagnosis
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

HINT:
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.

YES → GO TO DTC CHART

NO

2 CHECK AMOUNT OF GASOLINE (See page HV-278)

NG → REFUEL VEHICLE

OK

3 CHECK ENGINE START (See page HV-278)

OK → Go to step 6

NG

4 INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

OK → Go to step 6

NG

5 INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION) (See page HV-279)

OK → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

NG

REPAIR OR REPLACE ENGINE ASSEMBLY

6	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

7	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

8	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 11

OK ↓

9	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK ↓

10	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

11	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK ↓

HV

12	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A7A-322	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

If the generator inverter circuit is opened or shorted, or if the circuit overheats, the information is transmitted from the inverter to the GFIV terminal of the MG ECU via the generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	322	Generator inverter fail signal detection (overheating)	• Inverter cooling system • Water pump with motor & bracket assembly • Hybrid vehicle transaxle assembly • Inverter with converter assembly • Engine assembly • Fuel level • Cooling fan system • Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 322): GFIV detection (Overheat malfunction)
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 322) is not detected

INSPECTION PROCEDURE

CAUTION:

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

NOTICE:
After inspection, be sure to replace the inverter with converter assembly.
HINT:
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK AMOUNT OF GASOLINE (See page HV-278)

NG → REFUEL VEHICLE

OK

3	CHECK ENGINE START (See page HV-278)

OK → Go to step 6

NG

4	INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

OK → Go to step 6

NG

5	INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION) (See page HV-279)

OK → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

NG

REPAIR OR REPLACE ENGINE ASSEMBLY

6	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

7	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

8	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

9	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 20

OK

11	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

12	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

13	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

14	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

15	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 18

OK

16	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

17	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

18	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK

19	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

20	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG

21	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 23

HV

OK

22	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

23	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

HV

DTC	P0A7A-324	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

If the generator inverter circuit is opened or shorted, or if the circuit overheats, the information is transmitted from the inverter to the GFIV terminal of the MG ECU via the generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	324	Generator inverter fail signal detection (circuit malfunction)	• Inverter cooling system • Water pump with motor & bracket assembly • Hybrid vehicle transaxle assembly • Inverter with converter assembly • Engine assembly • Fuel level • Cooling fan system • Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 324): GFIV detection (Circuit malfunction)
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 324) is not detected

INSPECTION PROCEDURE

CAUTION:

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

NOTICE:
After inspection, be sure to replace the inverter with converter assembly.
HINT:
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK AMOUNT OF GASOLINE (See page HV-278)

NG → REFUEL VEHICLE

OK

3	CHECK ENGINE START (See page HV-278)

OK → Go to step 6

NG

4	INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

OK → Go to step 6

NG

5	INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION) (See page HV-279)

OK → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

NG

REPAIR OR REPLACE ENGINE ASSEMBLY

6	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

7	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

8	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

9	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 20

OK

11	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

12	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

13	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

14	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

15	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 18

OK

16	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

17	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

18	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK

19	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

20	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG

21	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 23

HV

OK

22	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

23	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

HV

DTC	P0A7A-325	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

If the generator inverter circuit is opened or shorted, or if the circuit overheats, the information is transmitted from the inverter to the GFIV terminal of the MG ECU via the generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	325	Generator inverter fail signal detection (overcurrent due to inverter assembly malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 325): GFIV detection (Load short circuit)
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 325) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HV

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A7A-344	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).
The MG ECU controls generator torque according to driving conditions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	344	Generator torque execution monitoring malfunction	• Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 344): Discrepancy between generator monitored torque and commanded torque
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 344) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HV

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

4	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

DTC	P0A7A-517	Generator Inverter Performance

DTC	P0A7A-518	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).
If the generator inverter circuit is opened or shorted, or if the circuit overheats, the information is transmitted from the inverter to the GFIV terminal of the MG ECU via the generator inverter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	517	Generator inverter fail signal detection (overcurrent due to MG ECU malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly
P0A7A	518	Generator inverter fail signal detection (overcurrent due to hybrid vehicle transaxle assembly malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

HV

Related DTCs	P0A7A (INF 517/518): GFIV detection (Load short circuit)
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 517/518) is not detected

WIRING DIAGRAM

Refer to wiring diagram for P0A1A-200 (See page HV-146).

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

4	CHECK GENERATOR RESOLVER (See page HV-153)

NG → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

OK ↓

5	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK ↓

6	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A7A-522	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A7A	522	Generator inverter gate malfunction	Inverter with converter assembly

HINT:

- 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.

MONITOR DESCRIPTION

The MG ECU monitors the current that flows in MG1. If current flows in MG1 while the vehicle is stationary with the power switch on (IG) 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.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 522): Malfunction of Inverter gate shut down circuit
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 522) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK →

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A7A-809	Generator Inverter Performance

DTC	P0A7A-811	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).
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	DTC Detection Condition	Trouble Area
P0A7A	809	Abnormal generator current value detection (MG ECU malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly
P0A7A	811	Abnormal generator current value detection (hybrid vehicle transaxle assembly malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 809/811): Generator inverter abnormal current
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 809/811) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

4	CHECK GENERATOR RESOLVER (See page HV-153)

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG ↓

5	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK ↓

6	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A7A-810	Generator Inverter Performance

DESCRIPTION

For a description of the inverter, (See page HV-232).

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	DTC Detection Condition	Trouble Area
P0A7A	810	Abnormal generator current value detection (inverter malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A7A (INF 810): Generator inverter abnormal current
Required sensors / components	Generator inverter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

HV

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A7A (INF 810) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

HV

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

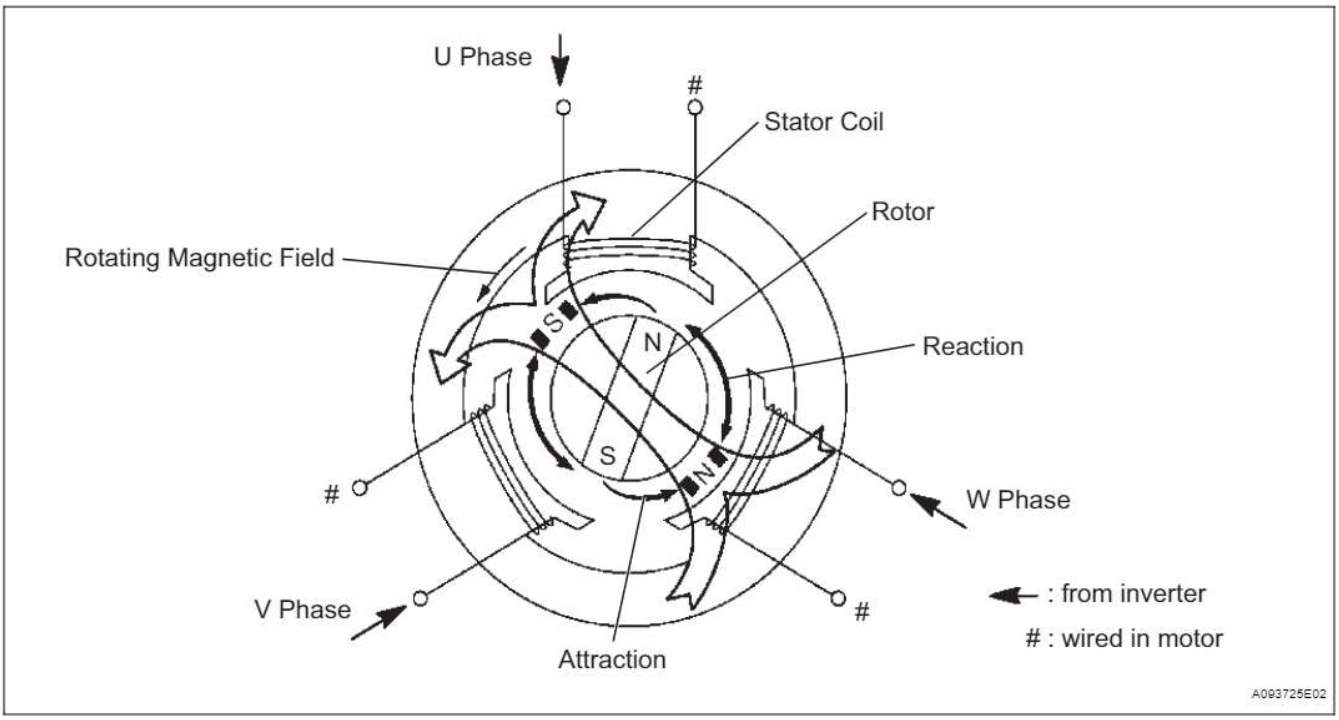
OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A90-251	Drive Motor "A" Performance

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 No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	251	Motor magnetic force deterioration or same phase short circuit	Hybrid vehicle transaxle assembly

SYSTEM DESCRIPTION

The MG ECU monitors MG2. If the MG ECU detects a reduction in the magnetic force of MG2 or an in-phase short, it interprets this as an MG2 failure. The hybrid vehicle control ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A90 (INF 251): Magnetic force deterioration / same phase short circuit
Required sensors / components	Hybrid vehicle motor, inverter, motor resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A90 (INF 251) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

HV

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1A (all INF codes), P0A1B (all INF codes)	MG ECU circuit malfunction
P0A1D (all INF codes)	HV ECU circuit malfunction
P0A3F-243, P0A40-500, P0A41-245	Motor resolver circuit
P0A4B-253, P0A4C-513, P0A4D-255	Generator resolver circuit
P0A51-174	MG ECU circuit malfunction
P0A60 (all INF codes), P0A63 (all INF codes)	Motor current sensor circuit
P0A72 (all INF codes), P0A75 (all INF codes)	Generator current sensor circuit
P0A78-306, 510, 586, 266, 267, 523	Motor inverter malfunction
P0A7A-344, 522	Generator inverter malfunction
P0A90-509	Motor system malfunction
P0A92-521	Generator system 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

HINT:
P0A90-251 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

YES → GO TO DTC CHART

NO

2 SIMULATION TEST

(a) Connect the intelligent tester to the DLC3.
(b) Test-drive the vehicle at a speed of 40 km/h for approximately 1 minute.
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result

DTC output	Proceed to
P0A78-306 or P0A90-509 is output	A
P0A90-251 is output or no DTC is output	B

A → GO TO DTC CHART

B

HV

3 CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

4 CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A90-509	Drive Motor "A" Performance

DESCRIPTION

For a description of MG2, (See page HV-307).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A90	509	Motor system malfunction	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A90 (INF 509): Motor system malfunction (No motor torque)
Required sensors / components	Hybrid vehicle motor, inverter, motor resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A90 (INF 509) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HV

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK ↓

4	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A92-261	Hybrid Generator Performance

DESCRIPTION

For a description of MG1, (See page HV-307).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A92	261	Generator magnetic force deterioration or same phase short circuit	Hybrid vehicle transaxle assembly

MONITOR DESCRIPTION

The MG ECU monitors MG1. If the MG ECU detects a reduction in the magnetic force of MG1 or an in-phase short, it interprets this as an MG1 failure. The hybrid vehicle control ECU will illuminate the MIL and set a DTC.

TYPICAL ENABLING CONDITIONS

Related DTCs	P0A92 (INF 261): Magnetic force deterioration / same phase short circuit
Required sensors / components	Hybrid vehicle generator, inverter, generator resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

HV

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A92 (INF 261) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1A (all INF codes), P0A1B (all INF codes)	MG ECU circuit malfunction
P0A1D (all INF codes)	HV ECU circuit malfunction
P0A3F-243, P0A40-500, P0A41-245	Motor resolver circuit malfunction
P0A4B-253, P0A4C-513, P0A4D-255	Generator resolver circuit malfunction
P0A51-174	MG ECU circuit malfunction
P0A60 (all INF codes), P0A63 (all INF codes)	Motor current sensor circuit
P0A72 (all INF codes), P0A75 (all INF codes)	Generator current sensor circuit
P0A78-306, 510, 586, 266, 267, 523	Motor inverter malfunction
P0A7A-344, 522	Generator inverter malfunction
P0A90-509	MG2 malfunction
P0A92-521	MG1 malfunction
P0A94-585, 587, 589, 590	Boost converter circuit
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3004-132	Power Cable Malfunction
P3233-750	HV gate shutdown wiring malfunction

HINT:
P0A92-261 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

HV

YES → GO TO DTC CHART

NO

2	SIMULATION TEST

(a) Connect the intelligent tester to the DLC3.
(b) Leave the vehicle for 1 minute with the engine on (with MG1 rotating)
HINT:
If the accelerator pedal is depressed with the shift lever in the P position, the engine will start.
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result

DTC output	Proceed to
P0A7A-344 or P0A92-521 is output	A
P0A92-261 is output or no DTC is output	B

A → GO TO DTC CHART

B

3	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A92-521	Hybrid Generator Performance

DESCRIPTION

For a description of MG1, (See page HV-307).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A92	521	Generator system malfunction	• Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A92 (INF 521): Discrepancy between commanded and actual voltage
Required sensors / components	Hybrid vehicle generator, inverter, generator resolver
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A92 (INF 521) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HV

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK ↓

4	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

OK → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

NG ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A93-346	Inverter Cooling System Performance

DESCRIPTION

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 cooling system is unavailable. Therefore, similar to MG2 and MG1, the inverter is cooled by a special cooling system consisting of an electric water pump, cooling fan, and radiator. This cooling system is independent of the engine cooling system. The hybrid vehicle control ECU monitors the electric water pump, cooling fan, and cooling system, and detects malfunctions.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0A93	346	Inverter cooling system malfunction (HV 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

MONITOR DESCRIPTION

If the hybrid vehicle control ECU detects a malfunction of the electric water pump, fan or radiator, the ECU will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A93 (INF 346): HV cooling water malfunction
Required sensors / components	Water pump, radiator fan, inverter, boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Inverter cooling system	DTC P0A93 (INF 346) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.**

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A02-719, P0A03-720	Inverter coolant temperature circuit

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

HV

3	CHECK QUANTITY OF HV COOLANT

(a) Check for coolant leaks.
(b) Check the coolant in the water reserve tank assembly is above the low level.

Result

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

HINT:
After repairing the coolant leaks and adding coolant, perform the WATER PUMP and COOLING FAN SPD active tests and make sure that there are no malfunctions.

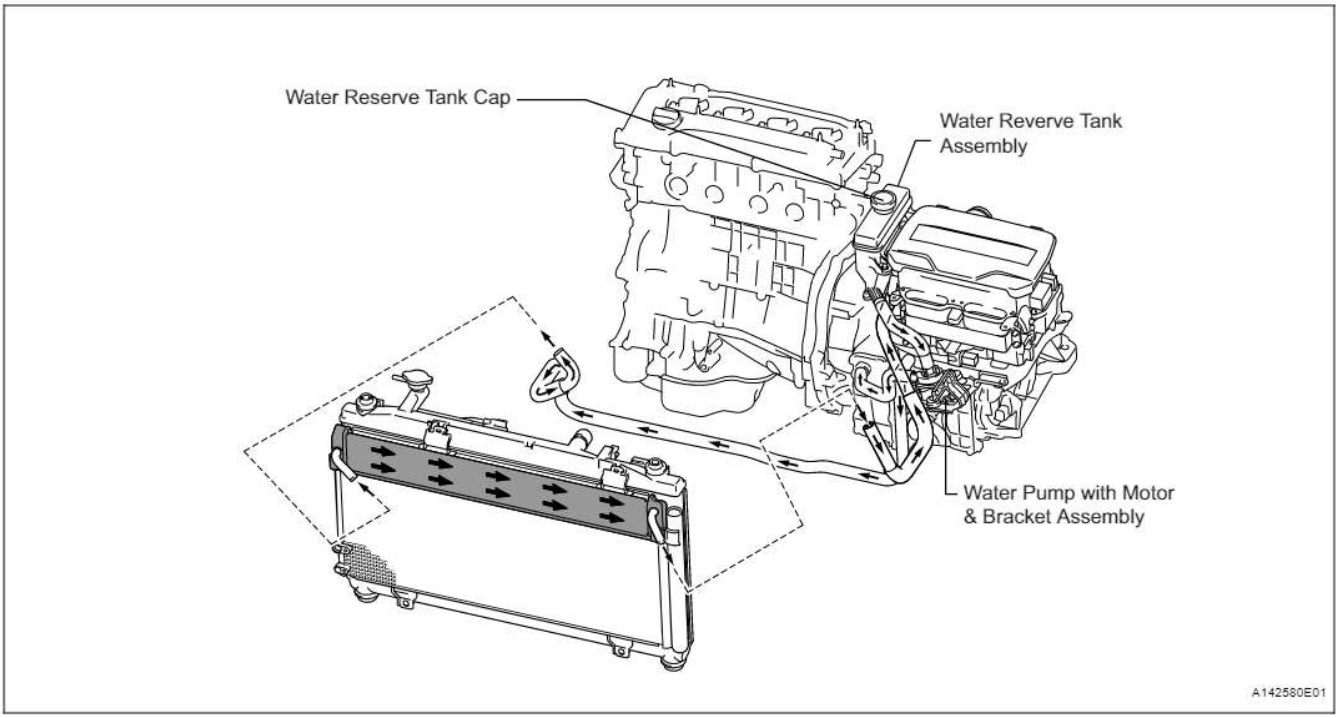
B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

4	CHECK COOLANT HOSE

(a) Check if the hoses of the cooling system are kinked or clogged.



NG → CORRECT THE PROBLEM

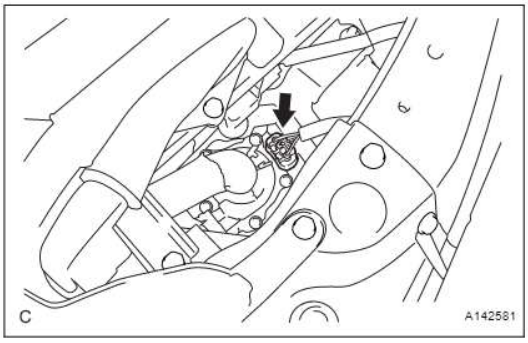
OK

5	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

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



(a) Check the connection of the water pump with motor & bracket assembly connector.

OK:

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

NG → CONNECT SECURELY

OK

7	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / ACTIVE TEST / WATER PUMP.
(d) Perform the WATER PUMP active test.
(e) During the WATER PUMP active test, open the water reserve tank cap and check that there are ripples in the coolant. Continue the active test for at least 1 minute.

Result:

There are ripples in the coolant in the water reserve tank assembly for 1 minute.

NOTICE:

Turning the power switch off or finishing the active test with the water reserve tank cap open will cause the coolant to overflow. Be sure to close the water reserve tank cap before turning the power switch off or finishing the active test.

HINT:

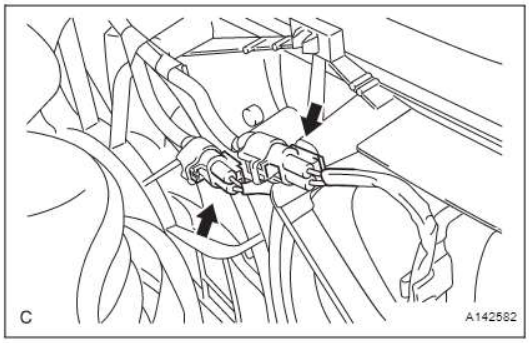
The water pump motor operates even in inspection mode.

NG → Go to step 11

OK

HV

8	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR)



(a) Check the connections of the cooling fan motor connectors.

OK:

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

NG → CONNECT SECURELY

OK

9	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / ACTIVE TEST / COOLING FAN SPD.
(d) Perform the COOLING FAN SPD active test.

OK:
The cooling fan rotates.

NG → **CHECK COOLING FAN SYSTEM (See page CO-3)**

OK ↓

10	READ VALUE OF INTELLIGENT TESTER

(a) Stop the engine and leave the vehicle for at least 1 hour.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the power switch on (IG).
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA TEST / INV COOLANT TMP, CONVERTER TEMP, MG1 INVERT TEMP, MG2 INVERT TEMP.
(e) Read the data list.
Result:
The displayed INV COOLANT TMP value is at least 20°C (68°F) higher than MG2 INVERT TEMP, CONVERTER TEMP, and MG 1 INVERT TEMP.
NOTICE:
The lower limit temperature that can be displayed for MG2 INVERT TEMP, CONVERTER TEMP, and MG1 INVERT 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 the intelligent tester may be lower than the others, but this is not a malfunction.

HV

NG → **REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY**

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

11	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP)

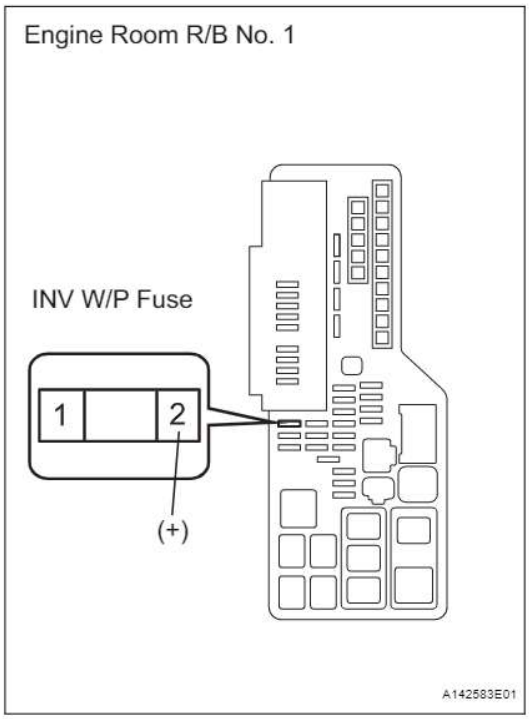
(a) Connect the intelligent tester to the DLC3.
(b) Compress the inlet hose for the water pump with motor & bracket assembly several times.
(c) Turn the power switch on (IG).
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / ACTIVE TEST / WATER PUMP.
(e) Perform the WATER PUMP active test.
(f) During the WATER PUMP active test, open the water reserve tank cap and check that there are ripples in the coolant. Continue the active test for at least 1 minute.
Result:
There are ripples in the coolant in the water reserve tank assembly for 1 minute.

NOTICE:
Turning the power switch off or finishing the active test with the water reserve tank cap open will cause the coolant to overflow. Be sure to close the water reserve tank cap before turning the power switch off or finishing the active test.
HINT:
- Keep compressing the water pump inlet hose until the coolant level in the water reserve tank assembly stops dropping.
- The water pump motor operates even in maintenance mode.
- After repairing the coolant leaks and adding coolant, perform the WATER PUMP and COOLING FAN SPD active tests and make sure that there are no malfunctions.

OK → **ADD COOLANT**

NG

12 CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY



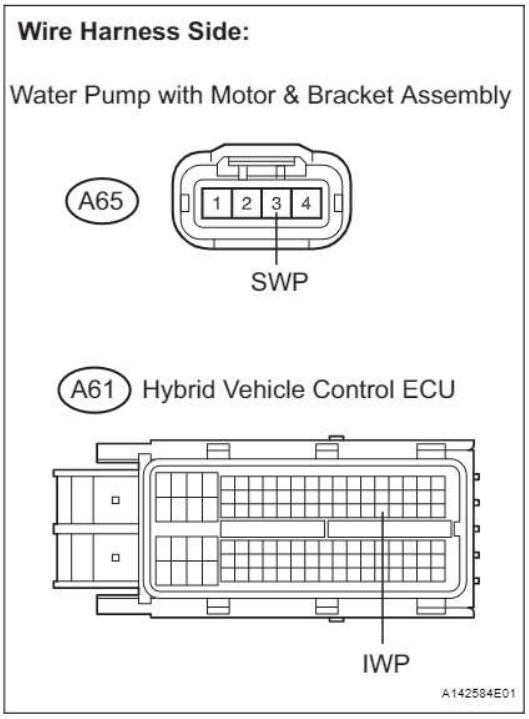
(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Remove the INV W/P fuse from the engine room R/B No. 1.
(c) Apply 12 V to terminal 2 of the socket for the fuse in the engine room R/B No. 1 and check that the water pump operates.
OK:
The water pump operates.
(d) Install the INV W/P fuse to the engine room R/B No. 1.

NG → **Go to step 14**

OK

HV

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



(a) Disconnect the A65 water pump with motor & bracket assembly connector.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
IWP (A61-52) - SWP (A65-3)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
IWP (A61-52) or SWP (A65-3) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

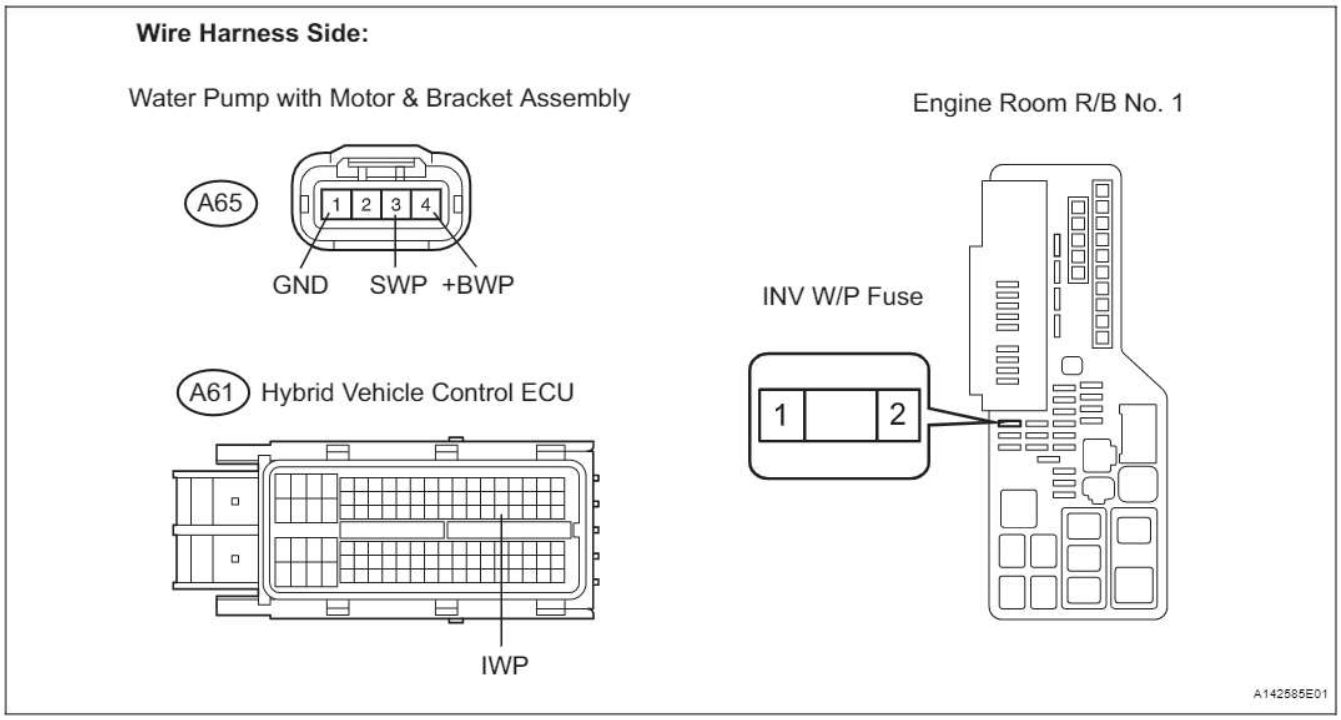
HV

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

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

(a) Remove the INV W/P fuse from the engine room R/B No. 1.

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



Standard resistance (Check for open)

Tester Connection	Specified Condition
IWP (A61-61) - SWP (A65-3)	Below 1 Ω
GND (A65-1) - Body ground	Below 1 Ω
Engine room R/B No. 1 INV W/P fuse terminal 2 - +BWP (A65-4)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
IWP (A61-52) or SWP (A65-3) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

HV

DTC	P0A94-127	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).
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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0A94	127	Boost converter overvoltage signal detection (overvoltage due to system malfunction)	• HV relay assembly • Inverter with converter assembly • Service plug grip • Frame wire • Hybrid vehicle transaxle assembly

INSPECTION PROCEDURE

CAUTION:

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

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance

DTC No.	Relevant Diagnosis
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

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 15

OK

5	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

HV

OK

6	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 13

OK

7	CHECK INVERTER WITH CONVERTER ASSEMBLY (HIGH VOLTAGE CONNECTOR CONNECTION CONDITION) (See page HV-229)

NG → CONNECT SECURELY

OK

8	CHECK SERVICE PLUG GRIP (See page HV-229)

NG → REPLACE SERVICE PLUG GRIP

OK

9	CHECK SERVICE PLUG GRIP (See page HV-230)

NG → REPLACE SERVICE PLUG GRIP

OK

10	CHECK FRAME WIRE (See page HV-230)

NG → REPLACE FRAME WIRE (See page HV-579)

OK

11	INSPECT HV RELAY ASSEMBLY (SMRB) (See page HV-231)

NG → REPLACE HV RELAY ASSEMBLY (See page HB-104)

OK

12	INSPECT HV RELAY ASSEMBLY (SMRG) (See page HV-231)

NG → REPLACE HV RELAY ASSEMBLY (See page HB-104)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

13	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK

14	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

15	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK

16	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A94-172	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0A94	172	Boost converter fail signal detection (overcurrent due to system malfunction)	• Fuel level • Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly • Engine assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

HV

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

DTC No.	Relevant Diagnosis
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

HINT:
P0A94-172 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

YES > GO TO DTC CHART

NO

2 CHECK AMOUNT OF GASOLINE (See page HV-278)

NG > REFUEL VEHICLE

OK

3 CHECK ENGINE START (See page HV-278)

OK > Go to step 6

NG

4 INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

OK > Go to step 6

NG

5 INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION) (See page HV-279)

NG > REPAIR OR REPLACE ENGINE ASSEMBLY

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

6	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

7	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

8	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 15

OK ↓

9	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

HV

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

10	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 17

OK ↓

11	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK ↓

12	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

13	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

14	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

15	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK

HV

16	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

17	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK

18	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

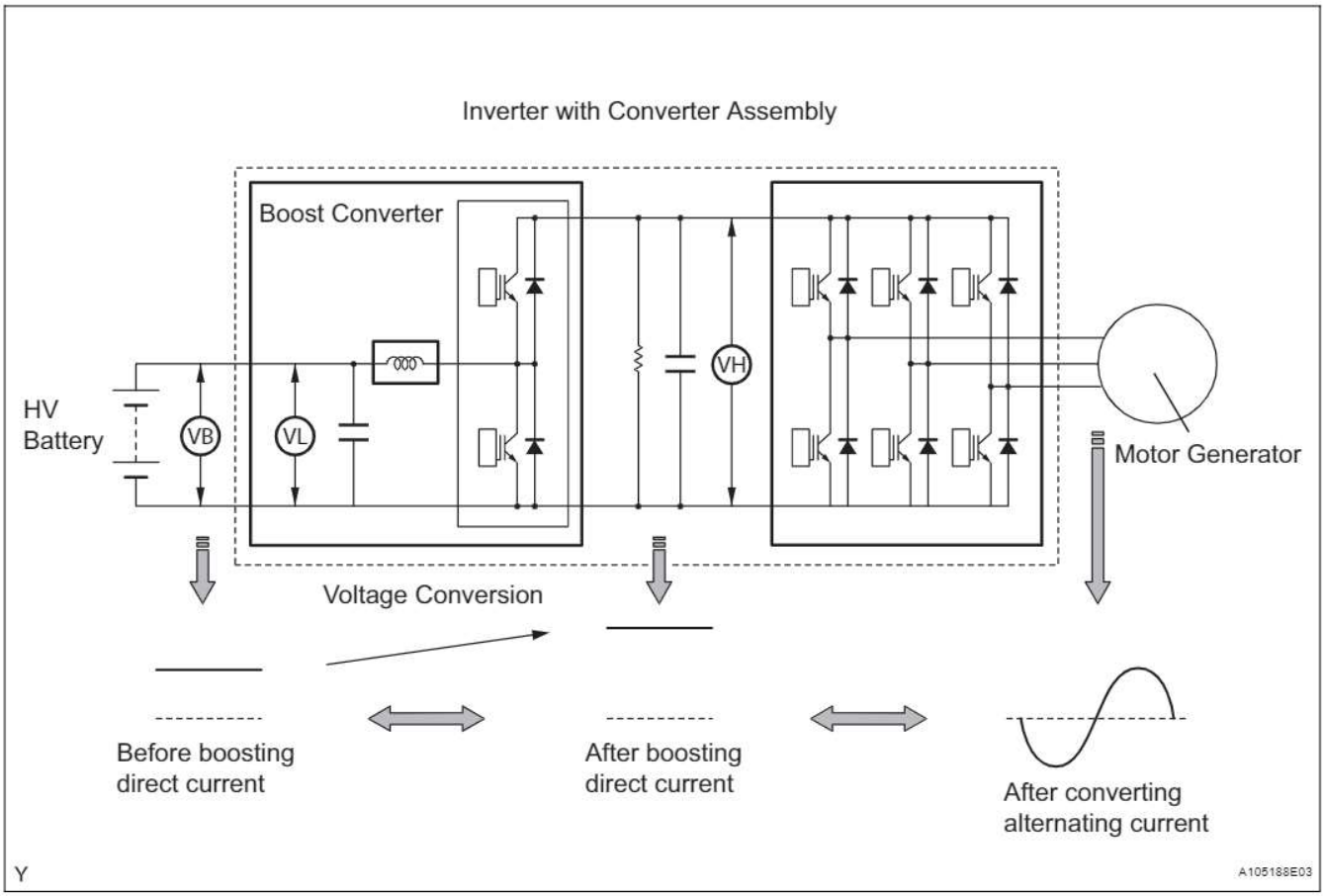
OK →

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A94-442	DC / DC Converter Performance

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 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 No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	442	Abnormal voltage execution value	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 442): Discrepancy between commanded and actual
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A94 (INF 442) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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

DTC No.	Relevant Diagnosis
P0A4B-253	Generator Position Sensor Circuit
P0A4D-255	Generator Position Sensor Circuit Low
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
P0A78-266, 267, 306, 510, 523, 586, 505, 287, 506, 503, 279, 504, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A94-585, 587, 589, 590, 554, 555, 556, 547, 548, 549	DC/DC Converter Performance
P0A7A-517, 325, 344, 518, 522, 809, 810, 811	Generator Inverter Performance
P0A92 (all INF codes)	Hybrid Generator Performance
P0A90 (all INF codes)	Hybrid Generator Performance
P0AA6 (all INF codes)	Hybrid Battery Voltage System Isolation Fault
P3000 (all INF codes)	HV Battery Malfunction

HINT:
P0A94-442 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

DTC	P0A94-547	DC / DC Converter Performance

DTC	P0A94-549	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).
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	DTC Detection Condition	Trouble Area
P0A94	547	Boost converter overvoltage signal detection (overvoltage due to MG ECU malfunction)	• Wire harness or connector • Inverter with converter assembly • Hybrid vehicle transaxle assembly
P0A94	549	Boost converter overvoltage signal detection (overvoltage due to hybrid vehicle transaxle assembly malfunction)	• Wire harness or connector • Inverter with converter assembly • Hybrid vehicle transaxle assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 547/549): OVL detection over voltage
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Motor generator ECU	DTC P0A94 (INF 547/549) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:

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.

YES → GO TO DTC CHART

HV

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 7

OK

5	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 8

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

7	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

OK → Go to step 9

NG

CONNECT SECURELY

8	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

OK → Go to step 10

NG

CONNECT SECURELY

9	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

10	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0A94-548	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).
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	DTC Detection Condition	Trouble Area
P0A94	548	Boost converter overvoltage signal detection (overvoltage due to inverter malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 548): OVL detection over voltage
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A94 (INF 548) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

HV

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A94-550	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	550	Boost converter overvoltage (OVL) signal detection (circuit malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 550): OVL detection circuit malfunction
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A94 (INF 550) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A94-553	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0A94	553	Boost converter fail signal detection (boost converter overheating)	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Hybrid vehicle transaxle assembly • Inverter with converter assembly • Fuel level • Engine assembly • Cooling fan system

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 553): FCV detection over heat
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A94 (INF 553) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
P0A94-553 may be set due to a malfunction which also causes DTCs in the table above to be set. In this case, first troubleshoot the output DTCs in the table above. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

YES → GO TO DTC CHART

NO

2	CHECK AMOUNT OF GASOLINE (See page HV-278)

NG → REFUEL VEHICLE

OK

3	CHECK ENGINE START (See page HV-278)

OK → Go to step 6

NG

4	INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

OK → Go to step 6

NG

5	INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION) (See page HV-279)

NG → REPAIR OR REPLACE ENGINE ASSEMBLY

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

6	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

7	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

8	CHECK CONNECTOR CONNECTION CONDITION (HV CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

9	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK ↓

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 26

OK ↓

11	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK ↓

12	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK ↓

13	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK ↓

14	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

15	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 22

HV

OK

16	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

17	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 24

OK

18	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

19	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

20	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

21	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

22	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK ↓

23	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

24	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK ↓

25	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

26	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG ↓

27	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 29

OK

28	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

29	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

HV

DTC	P0A94-554	DC / DC Converter Performance

DTC	P0A94-556	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	554	Boost converter inverter fail signal detection (overcurrent due to MG ECU malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly
P0A94	556	Boost converter inverter fail signal detection (overcurrent due to hybrid vehicle transaxle assembly malfunction)	• Wire harness or connector • Hybrid vehicle transaxle assembly • Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 554/556): FCV detection load short circuit
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A94 (INF 554/556) is not detected

INSPECTION PROCEDURE

CAUTION:

- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.**

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HINT:
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.

HV

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

4	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 7

OK ↓

5	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

6	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 8

OK ↓

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

7	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

OK → Go to step 9

NG ↓

CONNECT SECURELY

8	CHECK CONNECTOR CONNECTION CONDITION (See page HV-160)

OK → Go to step 10

HV

NG

CONNECT SECURELY

9	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

10	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P0A94-555	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	555	Boost converter inverter fail signal detection (overcurrent due to inverter assembly malfunction)	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 555): FCV detection load short circuit
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TOYOTA's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A94 (INF 555) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
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

HV

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P0A94-557	DC / DC Converter Performance

DESCRIPTION

For a description of the boost converter, (See page HV-336).

If the boost converter detects a circuit malfunction, overheat, or internal short, it transmits this information to the FCV terminal of the MG ECU via the boost converter fail signal line.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	557	Boost converter fail signal detection (circuit malfunction)	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Hybrid vehicle transaxle assembly • Inverter with converter assembly • Fuel level • Engine assembly • Cooling fan system

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 557): FCV detection circuit malfunction
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A94 (INF 557) is not detected

INSPECTION PROCEDURE

CAUTION:

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

NOTICE:
After inspection, be sure to replace the inverter with converter assembly.
HINT:
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1D (all INF codes)	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
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
P0A78-266, 267, 523, 586, 284, 505, 287, 506, 113, 286, 503, 279, 504, 306, 806, 807, 808, 128	Drive Motor "A" Inverter Performance
P0A94-585, 587, 589, 590, 553, 554, 555, 556, 172, 547, 548, 549, 442	DC/DC Converter Performance
P0A7A-322, 517, 325, 518, 122, 324, 344, 809, 810, 811, 130	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A90-509	Drive Motor "A" Performance

HINT:
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.

YES → GO TO DTC CHART

NO

2	CHECK AMOUNT OF GASOLINE (See page HV-278)

NG → REFUEL VEHICLE

OK

3	CHECK ENGINE START (See page HV-278)

OK → Go to step 6

NG

4	INSPECT CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

OK → Go to step 6

NG

5	INSPECT CRANKSHAFT PULLEY REVOLUTION (N POSITION) (See page HV-279)

NG → REPAIR OR REPLACE ENGINE ASSEMBLY

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

6	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

7	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

8	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

9	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 26

OK

11	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

12	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

13	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

14	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-152)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

15	CHECK GENERATOR RESOLVER (See page HV-153)

NG → Go to step 22

OK

16	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-159)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

17	CHECK MOTOR RESOLVER (See page HV-160)

NG → Go to step 24

OK

18	CHECK INVERTER WITH CONVERTER ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) (See page HV-165)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

19	CHECK INVERTER WITH CONVERTER ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) (See page HV-164)

NG → TIGHTEN TO SPECIFIED TORQUE

OK

20	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) (See page HV-165)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

21	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) (See page HV-166)

NG → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

22	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) (See page HV-153)

NG → CONNECT SECURELY

OK ↓

23	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - GENERATOR RESOLVER) (See page HV-154)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

24	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) (See page HV-160)

NG → CONNECT SECURELY

OK ↓

HV

25	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - MOTOR RESOLVER) (See page HV-161)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

26	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG ↓

27	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 29

OK

28	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

29	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

HV

DTC	P0A94-585	DC / DC Converter Performance

DESCRIPTION

Refer to the description for DTC P0A94-589 (See page HV-373).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	585	Boost converter voltage (VL) sensor performance problem	Inverter with converter assembly

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 585): Voltage (VL) sensor deviation
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

HV

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A94 (INF 585) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P0A1A, P0A1B	MG ECU malfunction
P0A1D	Hybrid vehicle control ECU malfunction

YES → GO TO DTC CHART

NO → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

HV

DTC	P0A94-587	DC / DC Converter Performance

DESCRIPTION

For a description for the boost converter, (See page HV-336).
The hybrid vehicle control 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).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	587	Voltages from HV battery voltage (VB) sensor and boost converter voltage (VL) sensor deviate	• Inverter with converter assembly • Battery smart unit

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 587): Voltage (VB or VL) sensor deviation
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately
Sequence of operation	None

HV

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P0A94 (INF 587) is not detected

INSPECTION PROCEDURE

CAUTION:

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

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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 → GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0A1F-129)

B → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

C → GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0A94-585)

D

HV

2	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs,

NEXT

3	CHECK DTC OUTPUT (HV)

(a) Turn the power switch on (READY) and move the shift lever to the N position. (*1)
(b) Turn the A/C switch to the MAX COOL position. (*2)
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / PWR RESOURCE IB.
(d) Confirm that PWR RESOURCE IB is more than 3 A. (*3)
(e) Leave the vehicle in the condition specified in steps (*2) and (*3) above for 15 seconds. (*4)

NOTICE:
If the low battery charge warning light comes on, move the shift lever to the P position and start the engine to charge the HV battery. After the engine stops, perform steps (*1) through (*5) again.

(f) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(g) Check if DTCs are output. (*5)

Result

DTC No.	Relevant Diagnosis	Proceed to
P0A1F-129	HV battery voltage circuit malfunction	A
P0A94-585	Boost converter voltage (VL) sensor performance problem	B
P3000-388	Discharge inhibition	C
P3004-132	Power Cable Malfunction	D
No DTC is output.	-	E

A → **REPLACE BATTERY SMART UNIT (See page HB-99)**

B → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)**

C → **LEAVE VEHICLE IN P POSITION, AND CHARGE HV BATTERY IN IDLE STATUS UNTIL IDLING STOPS (PERFORM STEPS (*1) THROUGH (*5))**

D → **REPLACE BATTERY SMART UNIT (See page HB-99)**

HV

E

4	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3. (*6)
(b) Perform a road test that repeats full acceleration to 60 km/h and then full braking to a complete stop several times. (*7)
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES. (*8)
(d) Check if DTCs are output. (*9)

Result

DTC No.	Relevant Diagnosis	Proceed to
P0A1F-129	HV battery voltage circuit malfunction	A
P0A94-585	Boost converter voltage (VL) sensor performance problem	B
P3000-388	Discharge inhibition	C
P3004-132	Power Cable Malfunciton	D
No DTC is output.	-	E

A → **REPLACE BATTERY SMART UNIT (See page HB-99)**

B → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

C → LEAVE VEHICLE IN P POSITION, AND CHARGE HV BATTERY IN IDLE STATUS UNTIL IDLING STOPS (PERFORM STEPS (*6) THROUGH (*9))

D → REPLACE BATTERY SMART UNIT (See page HB-99)

E

5 READ VALUE OF INTELLIGENT TESTER

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (READY).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / PWR RESOURCE VB, VL, VH.
(d) Read the data list when the shift lever is in the N position (the engine is off) and the vehicle is stationary.

Result

Voltage	Voltage Difference	Result
Difference between HV battery voltage (PWR RESOURCE VB) and pre-boost voltage (VL)	50 V or less	1
Difference between HV battery voltage (PWR RESOURCE VB) and post-boost voltage (VH)	70 V or less	2
Difference between pre-boost voltage (VL) and post-boost voltage (VH)	90 V or less	3

HV

Result

Result	Proceed to
Only 2 is satisfied.	A
Only 3 is satisfied.	B
1, 2, and 3 are all satisfied (normal condition)	C

A → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

B → REPLACE BATTERY SMART UNIT (See page HB-99)

C

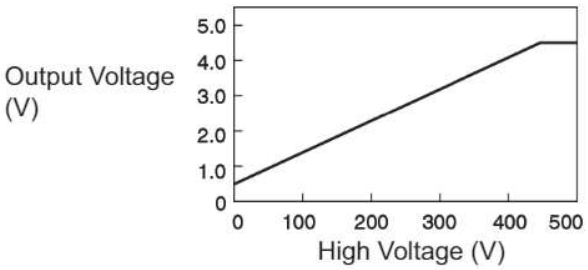
REPLACE BATTERY SMART UNIT (See page HB-99)

DTC	P0A94-589	DC / DC Converter Performance

DTC	P0A94-590	DC / DC Converter Performance

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.



A087696E01

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A94	589	Open or short to GND in the boost converter voltage (VL) sensor circuit	Inverter with converter assembly
P0A94	590	Short to +B in the boost converter voltage (VL) sensor circuit	Inverter with converter assembly

HV

MONITOR DESCRIPTION

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 illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A94 (INF 589): VL malfunction (Disconnection and GND short) P0A94 (INF 590): VL malfunction (+B short)
Required sensors / components	Boost converter
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

MG ECU	DTC P0A94 (INF 589/590) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

COMPLETED

HV

DTC	P0AA1-231	Hybrid Battery Positive Contactor Circuit Stuck Closed

DESCRIPTION

Refer to the description for DTC P0AE6-225 (See page HV-412).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0AA1	231	System main relay B on the HV battery positive side is stuck closed.	• HV relay assembly • Inverter with converter assembly

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

- 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.

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Part
P0AE2-773, 161	SMRP short
P0ADC-226	SMRB control line
P0A1A-156, 658, 151, 155, P0A1B-511, 164, 163, 512, 193, 786, 788, 659, 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

YES → GO TO DTC CHART

NO

2	CHECK FREEZE FRAME DATA

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).

(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Read output DTCs.
(e) Read the freeze frame data of P0AA1-231.

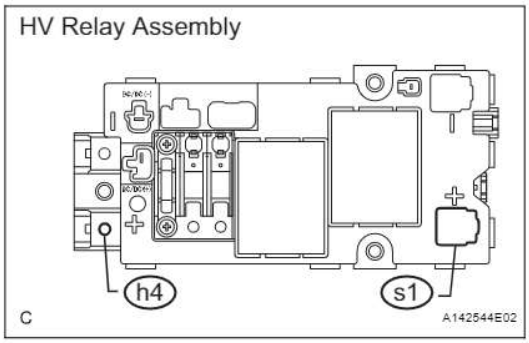
Result

Result	Proceed to
Pre-boost voltage (VL) is less than 60 V.	A
Pre-boost voltage (VL) is 60 V or more.	B

A → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)**

B

3 CHECK HV RELAY ASSEMBLY



CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.
HINT:
For the removal and installation procedures related to inspection of the HV relay assembly, (See page HB-104).

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

Tester Connection	Specified Condition
h4-1 - s1-1	10 kΩ or more

HINT:
- 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.

NG → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

OK

REPLACE HV RELAY ASSEMBLY (See page HB-104)

HV

DTC	P0AA1-233	Hybrid Battery Positive Contactor Circuit Stuck Closed

DESCRIPTION

Refer to the description for DTC P0AE6-225 (See page HV-412).

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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0AA1	233	System main relays B, and G on the HV battery positive and negative sides are stuck closed.	HV relay assembly

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

- 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.

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Part
P0AE2-773, 161	SMRP short
P0AE0-228	SMRG control line
P0ADC-226	SMRB control line
P0A1A-156, 658, 151, 155, P0A1B-511, 164, 163, 512, 193, 786, 788, 659, 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

YES → GO TO DTC CHART

NO

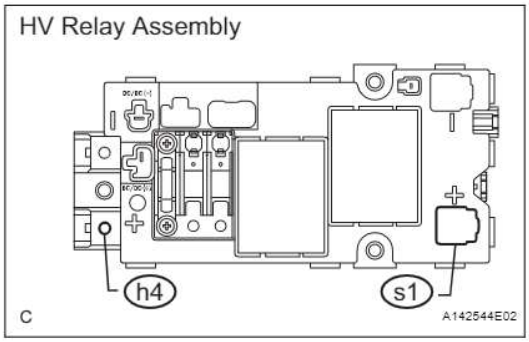
2	CHECK HV RELAY ASSEMBLY (SMRB, SMRG)

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the high voltage connector of the HV relay assembly (See page HB-104).

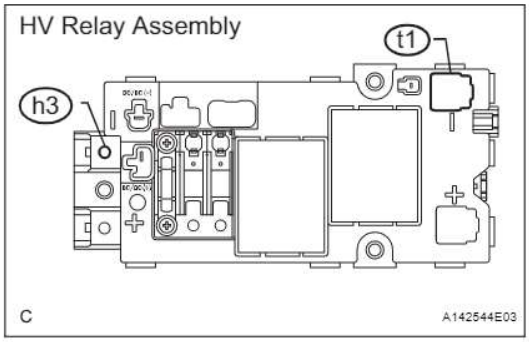
(c) Measure the resistance according to the value(s) in the table below. (SMRB inspection) (*1)
Standard resistance



Tester Connection	Specified Condition
h4-1 - s1-1	10 kΩ or more

HINT:
- 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

(d) Measure the resistance according to the value(s) in the table below. (SMRG inspection) (*2)
Standard resistance



Tester Connection	Specified Condition
h3-1 - t1-1	10 kΩ or more

HINT:
- 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

HV

Result

Result	Proceed to
There is conduction in either step (*1) or (*2).	A
There is conduction in both steps (*1) and (*2).	B

A → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

B

REPLACE HV RELAY ASSEMBLY (See page HB-104)

DTC	P0AA4-232	Hybrid Battery Negative Contactor Circuit Stuck Closed

DESCRIPTION

Refer to the description for DTC P0AE6-225 (See page HV-412).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0AA4	232	System main relay G on the HV battery negative side is stuck closed.	• HV relay assembly • Inverter with converter assembly

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

- 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.

HV

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Part
P0AE2-773, 161	SMRP short
P0AE0-228	SMRG control line
P0A1F, P3105	Battery smart unit circuit
P0A1A-156, 658, 151, 155, P0A1B-511, 164, 163, 512, 193, 786, 788, 659, 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

YES → GO TO DTC CHART

NO

2	CHECK FREEZE FRAME DATA

(a) Connect the intelligent tester to the DLC3.

(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Read output DTCs.
(e) Read the freeze frame data of P0AA4-232.

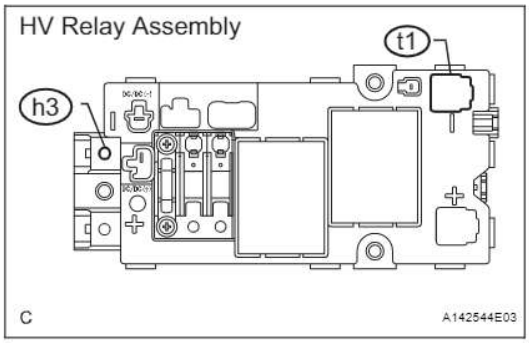
Result

Result	Proceed to
IB BATTERY (Current value of HV battery) is less than 3 A.	A
IB BATTERY (Current value of HV battery) is 3 A or more.	B

A → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)**

B

3 CHECK HV RELAY ASSEMBLY



CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition
h3-1 - t1-1	10 kΩ or more

HINT:
- For the removal and installation procedures related to inspection of the HV relay assembly, (See page HB-104).
- 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.

NG → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

OK

REPLACE HV RELAY ASSEMBLY (See page HB-104)

HV

DTC	P0AA6-526	Hybrid Battery Voltage System Isolation Fault
DTC	P0AA6-611	Hybrid Battery Voltage System Isolation Fault
DTC	P0AA6-612	Hybrid Battery Voltage System Isolation Fault
DTC	P0AA6-613	Hybrid Battery Voltage System Isolation Fault
DTC	P0AA6-614	Hybrid Battery Voltage System Isolation Fault

DESCRIPTION

The hybrid vehicle control ECU monitors the battery smart unit and detects insulation malfunctions in the high-voltage system.

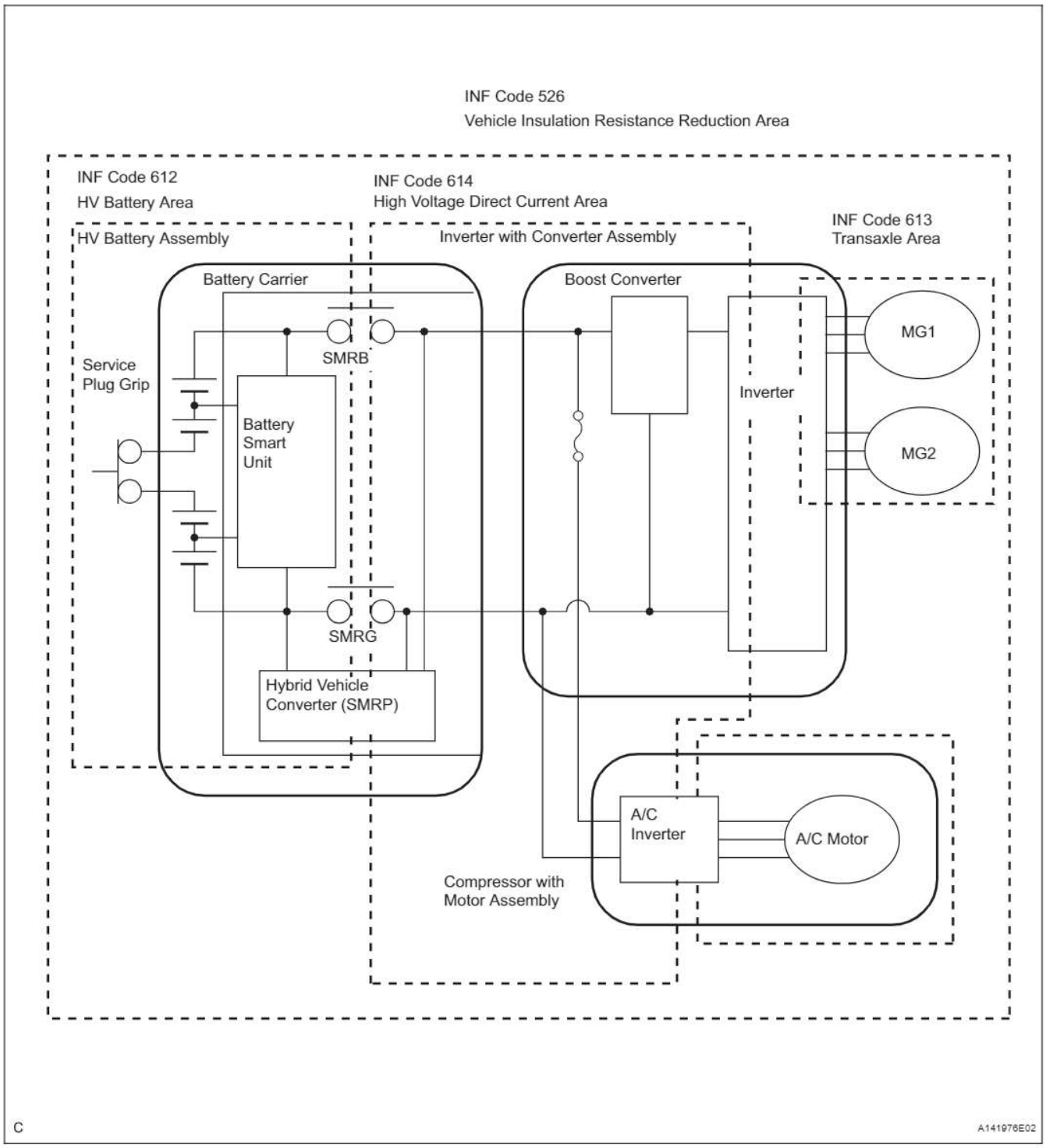
DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0AA6	526 (*1)	Insulation resistance between the high-voltage circuit and the body has decreased.	• Hybrid vehicle transaxle assembly • Inverter with converter assembly • Frame wire • Air conditioning harness assembly • HV relay assembly • Compressor with motor assembly • HV battery • Battery smart unit • Hybrid vehicle converter (DC/DC converter)
P0AA6	611 (*2)	Insulation resistance of the with motor compressor assembly has decreased.	Compressor with motor assembly
P0AA6	612 (*2)	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)	Insulation resistance of the transmission area has decreased.	• Hybrid vehicle transaxle assembly • Inverter with converter assembly
P0AA6	614 (*2)	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)

HV

HINT:

- *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 the intelligent tester.
- If P0AA6 is output while driving, the vehicle can drive for the remainder of that trip.

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- **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 the power 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.**

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

1 CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
HINT:
Do not remove the service plug grip.

Result

Output DTC	Proceed to
Only P0AA6 is output.	A
P0AA6 and P0A1D (HV ECU malfunction) are output.	B
P0AA6 and P0AA7-727 (Malfunction in the battery smart unit) are output.	C
P0AA6 and P0A1F (Battery smart unit malfunction) are output.	D

B → **GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0A1D)**

C → **GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0AA7-727)**

D → **REPLACE BATTERY SMART UNIT (See page HB-99)**

HV

A

2 CHECK INFORMATION CODE

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
(e) Access the freeze frame data of DTC P0AA6 and read the INF code.
NOTICE:
INF codes 611, 612, 613, and 614 are not stored at the same time with 526. If INF code 526 only is output, turn the power switch off and wait 30 seconds to determine the malfunctioning area. Then, read the INF code again.

Result

Output INF	Proceed to
526 (decrease in the insulation resistance of the high-voltage circuit) only is output.	A
526 and 611 (decrease in the insulation resistance of the air conditioner area) are output.	B

Output INF	Proceed to
526 and 612 (decrease in the insulation resistance of the HV battery area) are output.	C
526 and 613 (decrease in the insulation resistance of the transaxle area) are output.	D
526 and 614 (decrease in the insulation resistance of the high-voltage DC area) are output.	E

B → GO TO AIR CONDITIONING SYSTEM

C → Go to step 9

D → Go to step 17

E → Go to step 12

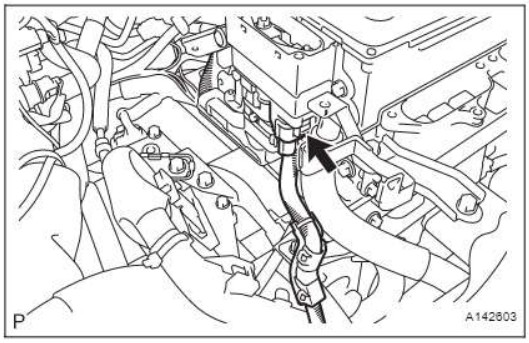
A

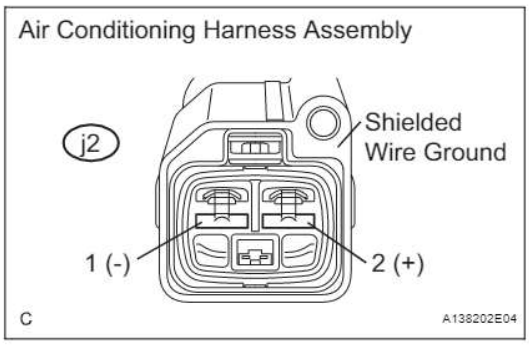
3 CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the air conditioning harness assembly from the inverter with converter assembly.





(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition
j2-1 - Body ground and shielded wire ground	3 MΩ or more
j2-2 - Body ground and shielded wire ground	3 MΩ or more

NG → Go to step 7

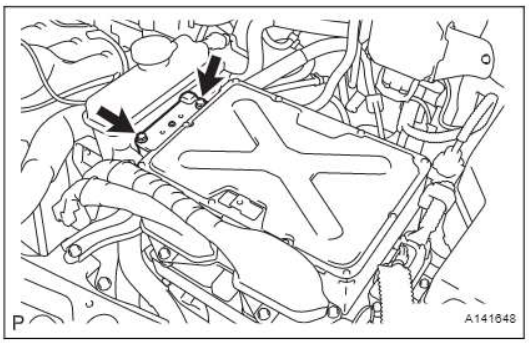
OK

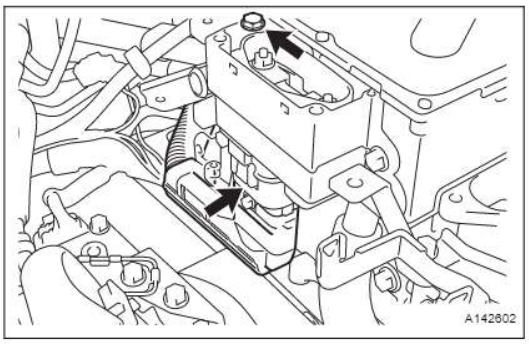
4	CHECK INVERTER WITH CONVERTER ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

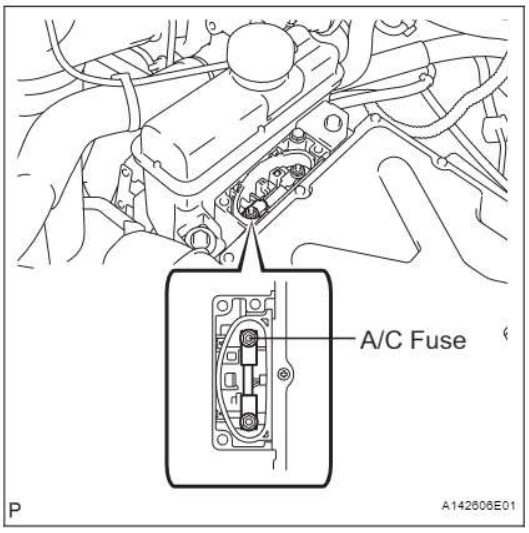
(a) Check that the service plug grip is not installed.

(b) Remove the A/C fuse cover from the inverter with converter assembly (See page HV-558).





(c) Disconnect the frame wire from the inverter with converter assembly.



(d) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
A/C fuse terminal - Body ground	1.0 MΩ or more

HINT:
Perform this inspection with the air conditioning harness assembly disconnected from the inverter with converter assembly.

OK	Go to step 8

NG

5	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2)

CAUTION:
Be sure to wear insulated gloves.

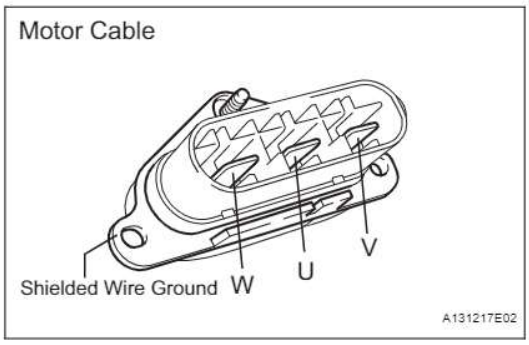
(a) Check that the service plug grip is not installed.

NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the motor cable and generator cable from the inverter with converter assembly (See page HV-558).

(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

Standard resistance



Tester Connection	Specified Condition
U - Body ground and shielded wire ground	10 MΩ or more
V - Body ground and shielded wire ground	10 MΩ or more
W - Body ground and shielded wire ground	10 MΩ or more

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

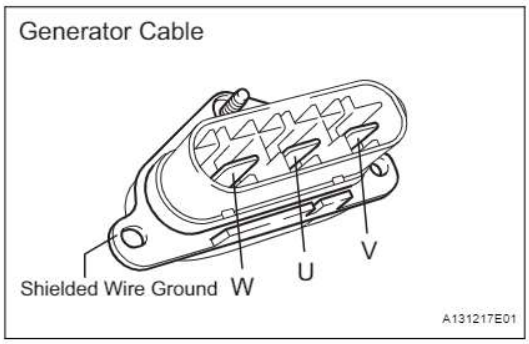
6	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1)

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

(b) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

Standard resistance



Tester Connection	Specified Condition
U - Body ground and shielded wire ground	10 MΩ or more
V - Body ground and shielded wire ground	10 MΩ or more
W - Body ground and shielded wire ground	10 MΩ or more

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

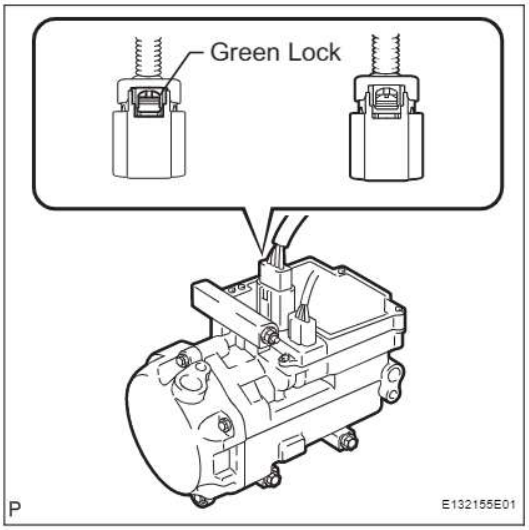
OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HX-10)

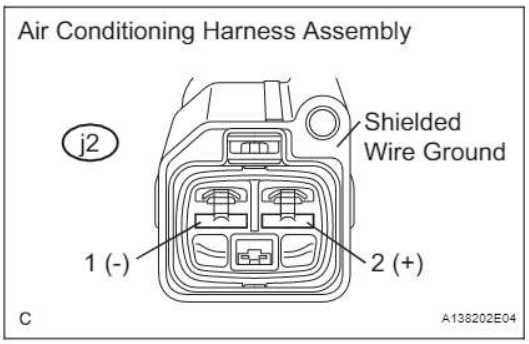
7	CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

HV



(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.
(b) Disconnect the air conditioning harness assembly from the compressor with motor assembly.



(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition
j2-1 - Body ground and shielded wire ground	3 MΩ or more
j2-2 - Body ground and shielded wire ground	3 MΩ or more

OK → GO TO AIR CONDITIONING SYSTEM

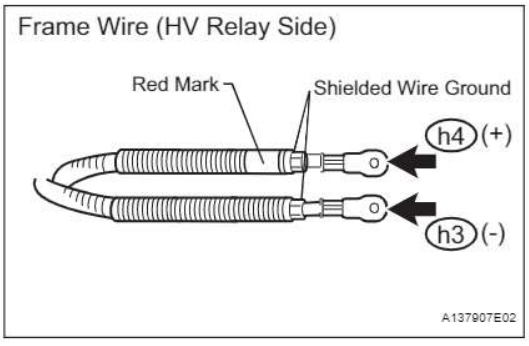
NG

HV

REPLACE AIR CONDITIONING HARNESS ASSEMBLY

8 CHECK FRAME WIRE

CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.
(b) Disconnect the frame wire from the HV relay assembly (See page HB-104).
(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
Standard resistance



Tester Connection	Specified Condition
h4-1 - Body ground and shielded wire ground	10 MΩ or more
h3-1 - Body ground and shielded wire ground	10 MΩ or more

NG → REPLACE FRAME WIRE

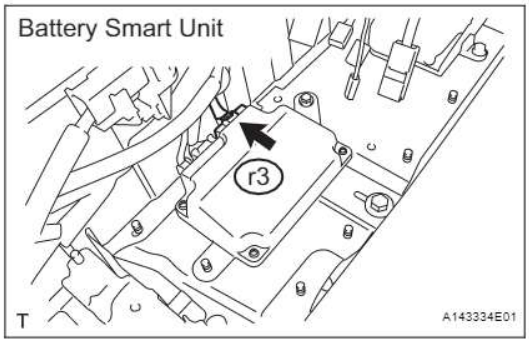
OK

9	CHECK HV BATTERY AREA

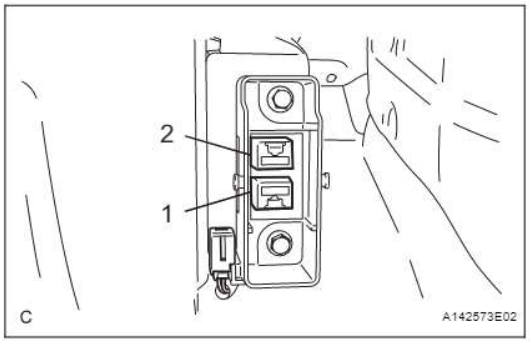
CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the r3 battery smart unit connector.



(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
OK



Tester Connection	Specified Condition
Service plug grip terminal 1 - Body ground	10 MΩ or more
Service plug grip terminal 2 - Body ground	10 MΩ or more

HV

OK → **REPLACE BATTERY SMART UNIT (See page HB-99)**

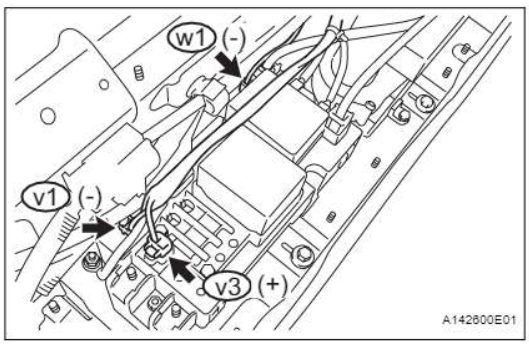
NG

10	CHECK HYBRID VEHICLE CONVERTER

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

(b) Disconnect the w1, v1 and v3 hybrid vehicle converter connectors from the HV relay assembly (See page HB-104).
Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
Standard resistance



Tester Connection	Specified Condition
w1-1 (High voltage precharge) - Body ground	10 MΩ or more
v3-1 (High voltage +) - Body ground	10 MΩ or more
v1-1 (High voltage -) - Body ground	10 MΩ or more

(c) Connect the hybrid vehicle converter connectors.

NG → **REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)**

OK

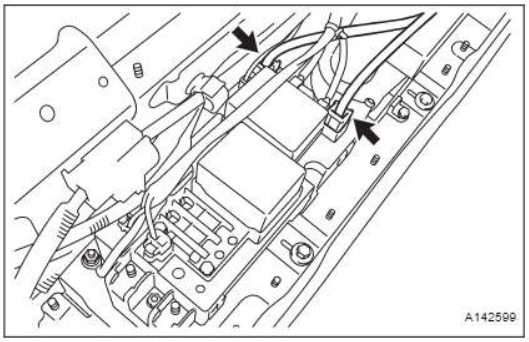
11	CHECK HV RELAY ASSEMBLY

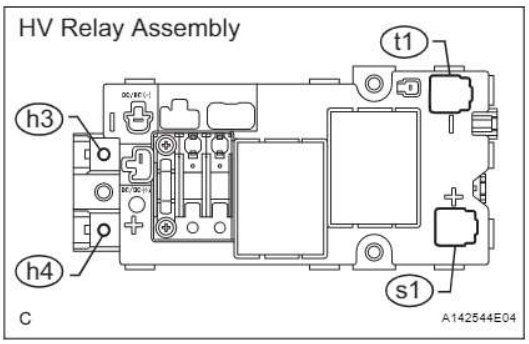
CAUTION:
Be sure to wear insulated gloves and protective goggles.

(a) Check that the service plug grip is not installed.

(b) Check that the high-voltage connectors (v1, v3, and w1) of the hybrid vehicle converter are connected securely.

(c) Disconnect the high voltage connectors of the HV battery from the HV relay assembly (See page HB-104).





(d) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
h4-1 (High voltage +) - Body ground	10 MΩ or more
h3-1 (High voltage -) - Body ground	10 MΩ or more
t1-1 (High voltage -) - Body ground	10 MΩ or more
s1-1 (High voltage +) - Body ground	10 MΩ or more

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

Standard voltage

Tester Connection	Specified Condition
h4-1 (High voltage +) - Body ground	Below 1 V
h3-1 (High voltage -) - Body ground	Below 1 V

HINT:
The voltage decreases to below 1 V after 10 seconds. If the voltage is 1 V or more, recheck the voltage after 10 seconds.

NG → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

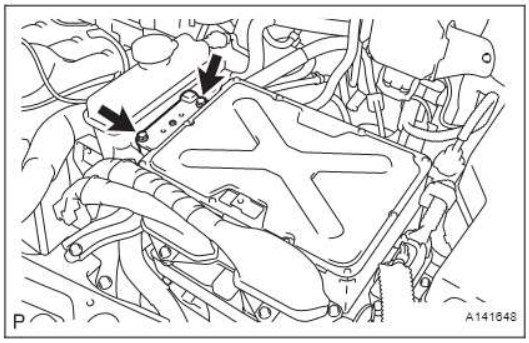
OK

REPLACE HV BATTERY (See page HB-81)

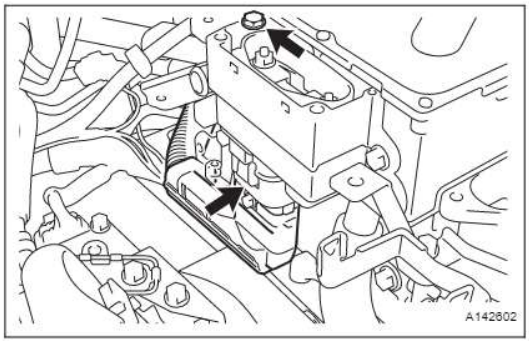
12 CHECK HIGH VOLTAGE DIRECT CURRENT AREA

CAUTION:
Be sure to wear insulated gloves.

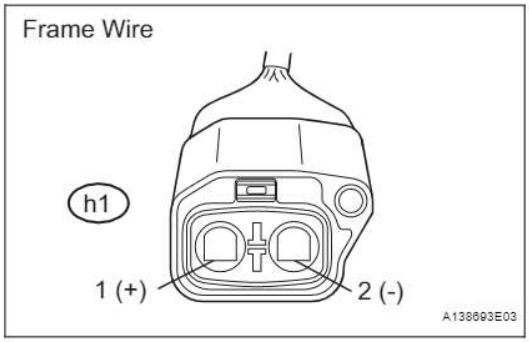
(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.



(b) Remove the A/C fuse cover from the inverter with converter assembly (See page HV-558).



(c) Disconnect the frame wire from the inverter with converter assembly.



(d) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition
h1-1 (High voltage +) - Body ground	10 MΩ or more
h1-2 (High voltage -) - Body ground	10 MΩ or more

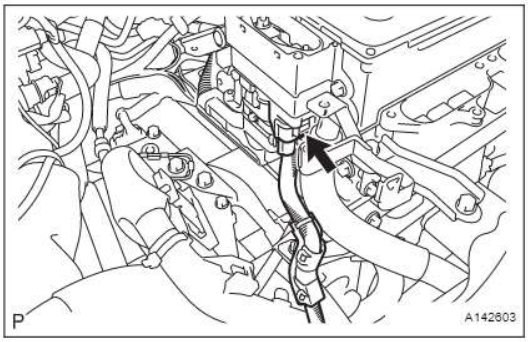
NG → **Go to step 15**

OK

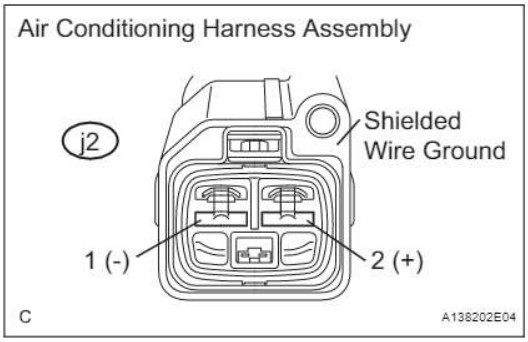
13 CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

HV



(a) Check that the service plug grip is not installed.
(b) Disconnect the air conditioning harness assembly from the inverter with converter assembly (See page HV-558).



(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

Standard resistance

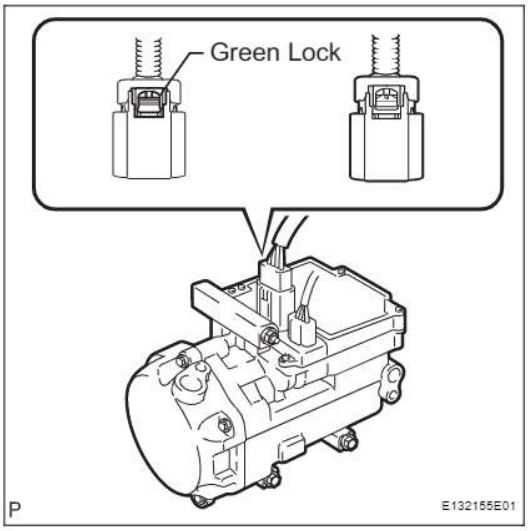
Tester Connection	Specified Condition
j2-1 - Body ground	3 MΩ or more
j2-2 - Body ground	3 MΩ or more

OK → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HX-10)**

NG

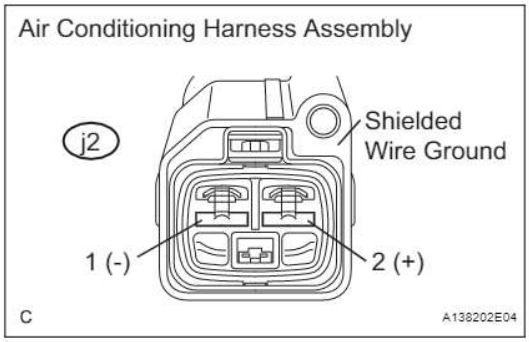
14	CHECK AIR CONDITIONING HARNESS ASSEMBLY

HV



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the air conditioning harness assembly from the compressor with motor assembly.



(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

Standard resistance

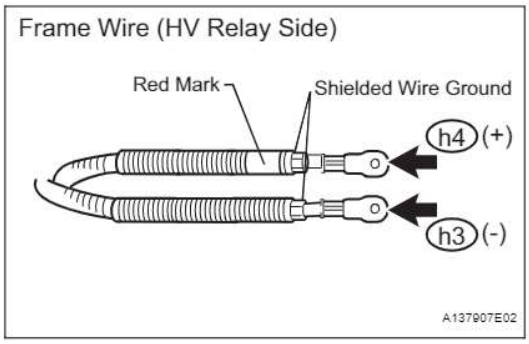
Tester Connection	Specified Condition
j2-1 - Body ground and shielded wire ground	10 MΩ or more
j2-2 - Body ground and shielded wire ground	10 MΩ or more

NG → **REPLACE AIR CONDITIONING HARNESS ASSEMBLY**

OK

GO TO AIR CONDITIONING SYSTEM

15 CHECK FRAME WIRE



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

(b) Disconnect the frame wire from the HV relay assembly (See page HB-104).

(c) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

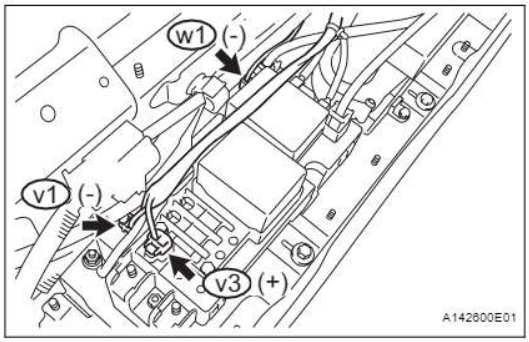
Standard resistance

Tester Connection	Specified Condition
h4-1 - Body ground and shielded wire ground	10 MΩ or more
h3-1 - Body ground and shielded wire ground	10 MΩ or more

NG → **REPLACE FRAME WIRE**

OK

16 CHECK HYBRID VEHICLE CONVERTER



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

(b) Disconnect the w1, v1 and v3 hybrid vehicle converter connectors from the HV relay assembly (See page HB-104).

Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
w1-1 (High voltage precharge) - Body ground	10 MΩ or more
v3-1 (High voltage +) - Body ground	10 MΩ or more

Tester Connection	Specified Condition
v1-1 (High voltage -) - Body ground	10 MΩ or more

(c) Connect the hybrid vehicle converter connectors.

NG → REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

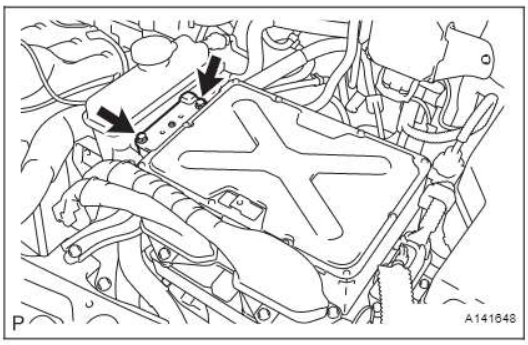
OK

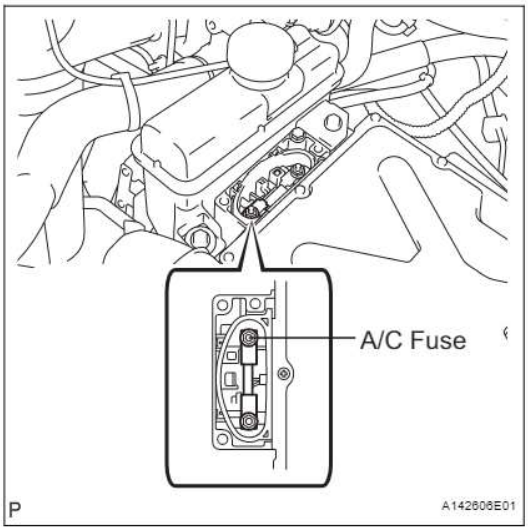
REPLACE HV RELAY ASSEMBLY (See page HB-104)

17 CHECK HYBRID VEHICLE TRANSAXLE AREA

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Remove the A/C fuse cover from the inverter with converter assembly (See page HV-558).
(c) Disconnect the generator cable and motor cable from the inverter with converter assembly.





(d) Using a megohmmeter (500 V range), measure the insulation resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition
A/C fuse terminal - Body ground	0.5 MΩ or more

NG → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HX-10)

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P0AA7-727	Hybrid Battery Voltage Isolation Sensor Circuit

DESCRIPTION

The hybrid vehicle control ECU monitors the insulation monitoring circuit located in the battery smart unit and detects a malfunction.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0AA7	727	Malfunction in the insulation monitoring circuit located in the battery smart unit	Battery smart unit

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE BATTERY SMART UNIT

NEXT

HV

COMPLETED

DTC	P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low

DTC	P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High

DESCRIPTION

Refer to the circuit description for DTC P0AE6-225 (See page HV-412).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0ADB	227	Short to GND in the SMRB circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU
P0ADC	226	Open or short to +B in the SMRB circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU

WIRING DIAGRAM

See the wiring diagram for P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

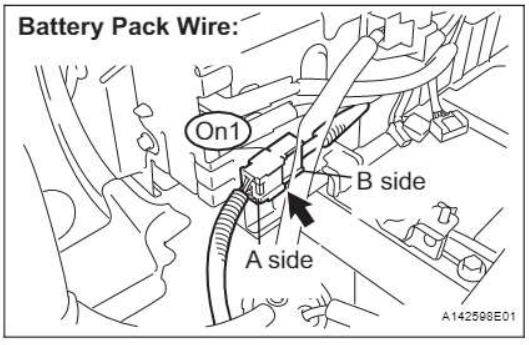
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HV

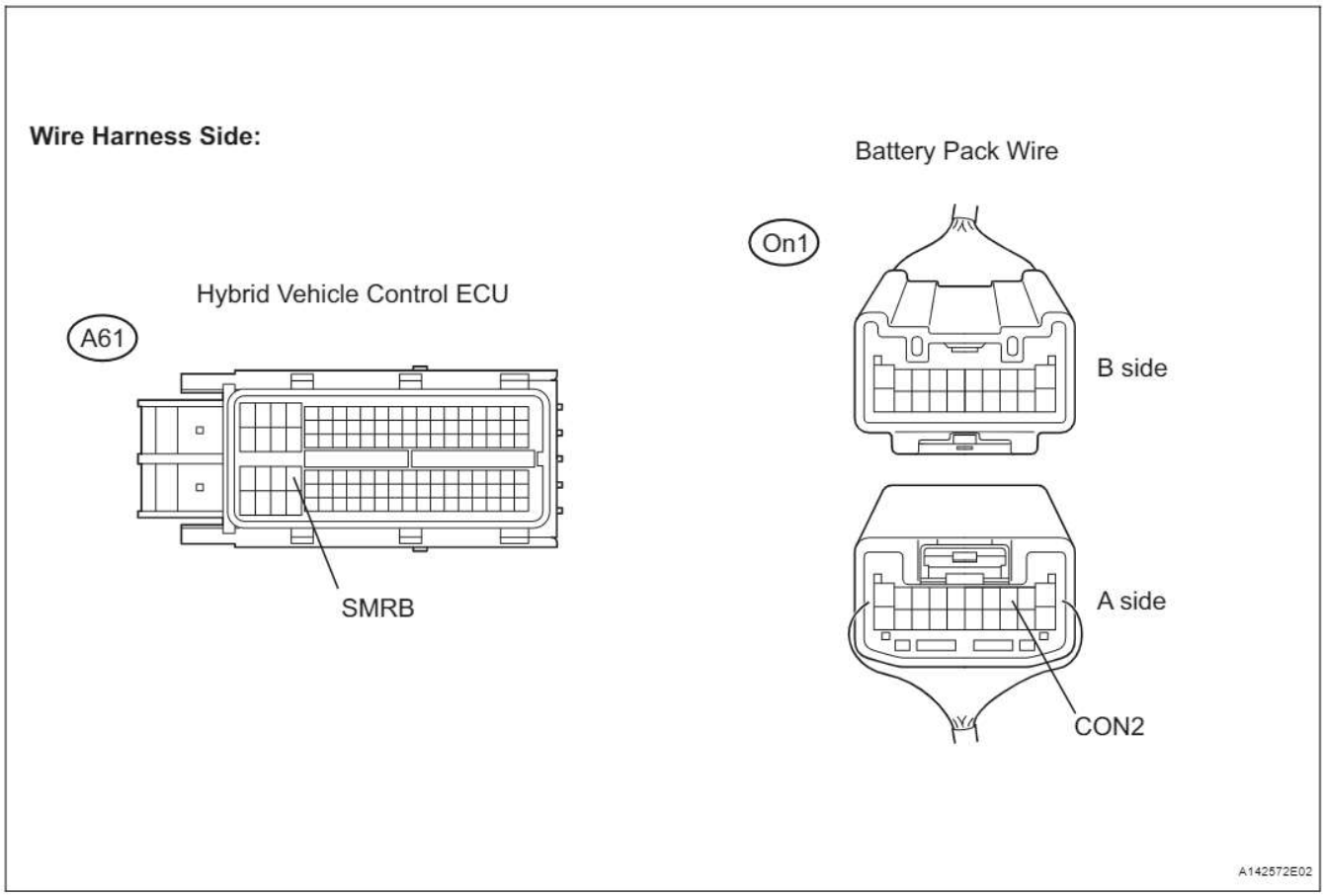
HINT:

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

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



(a) Turn the power switch off.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Disconnect the On1 battery pack wire connector (See page HB-81).
(d) Turn the power switch on (IG).
(e) Measure the voltage according to the value(s) in the table below.



Standard voltage

Tester Connection	Specified Condition
SMRB (A61-60) - Body ground	Below 1 V

HV

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(f) Turn the power switch off.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
SMRB (A61-60) - CON2 (On1-3)	Below 1 Ω

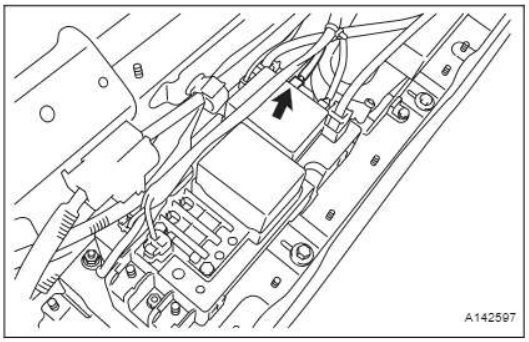
Standard resistance (Check for short)

Tester Connection	Specified Condition
SMRB (A61-60) or CON2 (On1-3) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

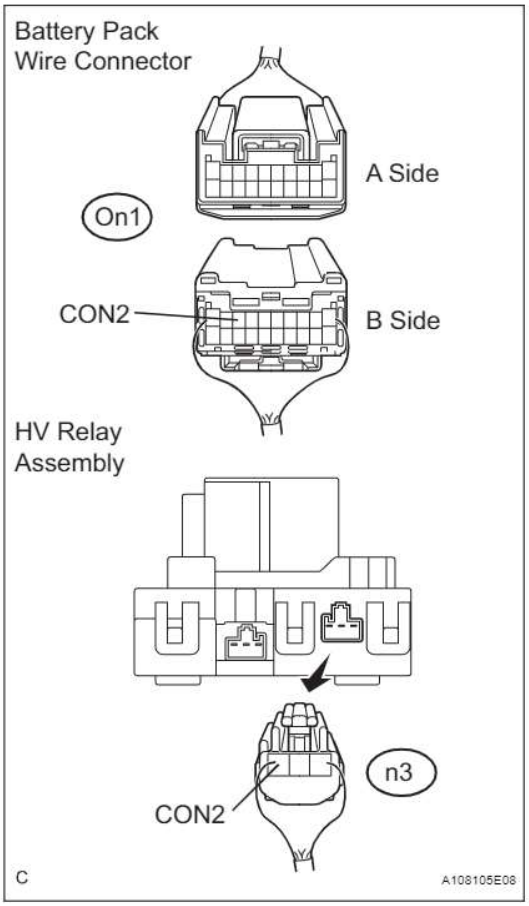
OK

2	CHECK HARNESS AND CONNECTOR (BATTERY PACK WIRE CONNECTOR - HV RELAY ASSEMBLY)



CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
(b) Disconnect the n3 HV relay assembly connector (See page HB-104).
(c) Turn the power switch on (IG).



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

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

Standard voltage

Tester Connection	Specified Condition
CON2 (On1-3) - Body ground	Below 1 V

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
CON2 (On1-3) - CON2 (n3-3)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
CON2 (On1-3) or CON2 (n3-3) - Body ground	10 kΩ or higher

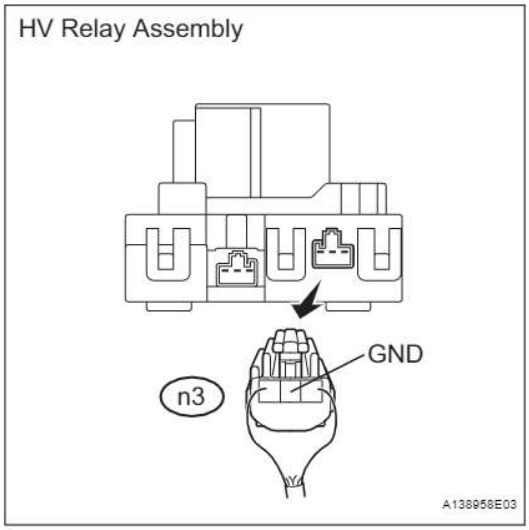
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK HARNESS AND CONNECTOR

CAUTION:
Be sure to wear insulated gloves.

(a) Connect the battery pack wire connector.



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

Standard resistance

Tester Connection	Specified Condition
GND (n3-2) - Body ground	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4 INSPECT HV RELAY ASSEMBLY (SMRB)

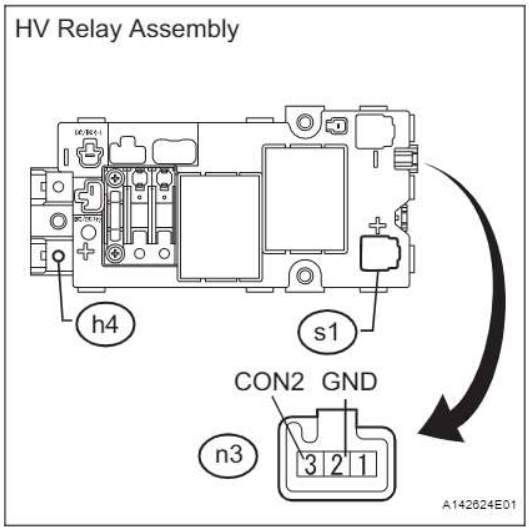
CAUTION:
Be sure to wear insulated gloves and protective goggles.

(a) Check that the service plug grip is not installed.

(b) Remove the HV relay assembly from the vehicle (See page HB-104).

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

Standard resistance



Tester Connection	Specified Condition
h4-1 - s1-1	Below 1 Ω (When battery voltage (12 V) applied to terminals n3-2 and n3-3)
h4-1 - s1-1	10 kΩ or more

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

Standard resistance

Tester Connection	Specified Condition
CON2 (n3-3) - GND (n3-2)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

NG → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low

DTC	P0AE0-228	Hybrid Battery Negative Contactor Control Circuit High

DESCRIPTION

Refer to the circuit description for DTC P0AE6-225 (See page HV-412).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0ADF	229	Short to GND in the SMRG circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU
P0AE0	228	Open or short to +B in the SMRG circuit	• Wire harness or connector • HV relay assembly • Hybrid vehicle control ECU

WIRING DIAGRAM

See the wiring diagram for P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

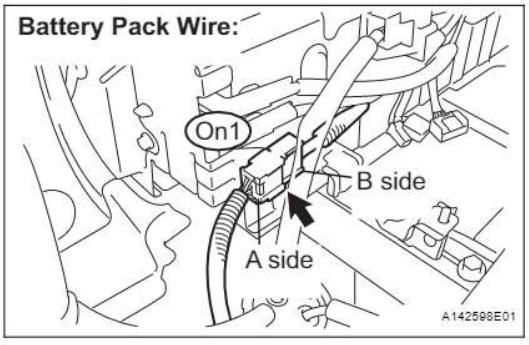
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HV

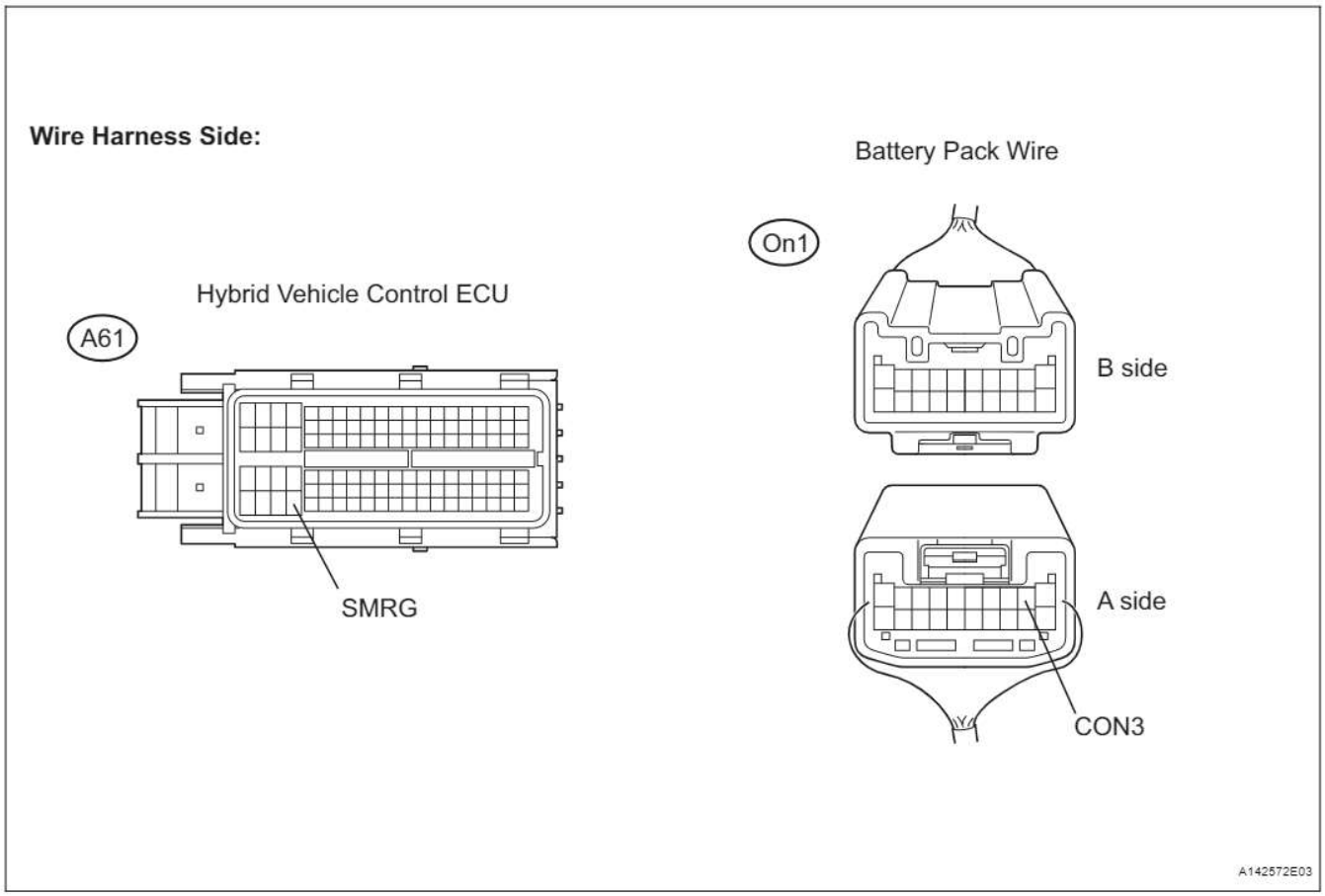
HINT:

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

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



(a) Turn the power switch off.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Disconnect the battery pack wire connector (See page HB-81).
(d) Turn the power switch on (IG).
(e) Measure the voltage according to the value(s) in the table below.



Standard voltage

Tester Connection	Specified Condition
SMRG (A61-96) - Body ground	Below 1 V

HV

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(f) Turn the power switch off.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
SMRG (A61-96) - CON3 (On1-2)	Below 1 Ω

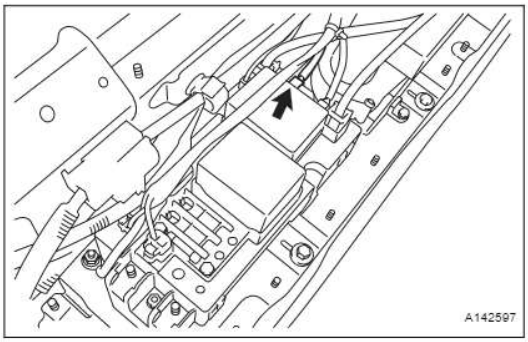
Standard resistance (Check for short)

Tester Connection	Specified Condition
SMRG (A61-96) or CON3 (On1-2) - Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

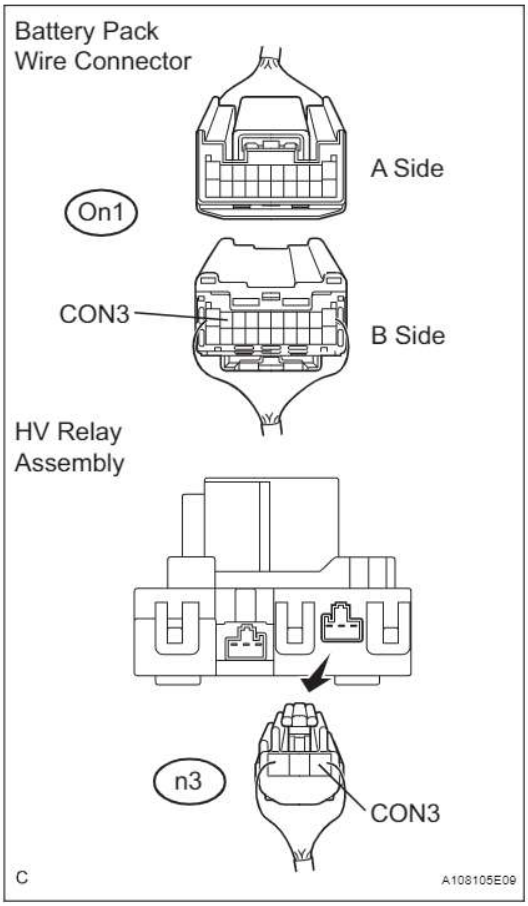
OK

2	CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR)



CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
(b) Disconnect the the n3 HV relay assembly connector (See page HB-104).
(c) Turn the power switch on (IG).



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

Standard voltage

Tester Connection	Specified Condition
CON3 (On1-2) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
CON3 (On1-2) - CON3 (n3-1)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
CON3 (On1-2) or CON3 (n3-1) - Body ground	10 kΩ or higher

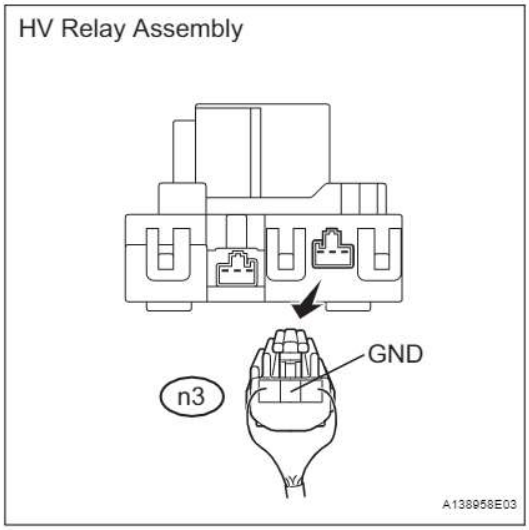
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK HARNESS AND CONNECTOR

CAUTION:
Be sure to wear insulated gloves.

(a) Connect the battery pack wire connector.



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

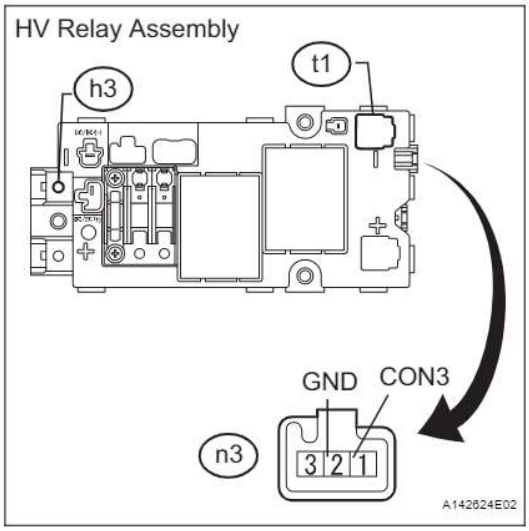
Standard resistance

Tester Connection	Specified Condition
GND (n3-2) - Body ground	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4 CHECK HV RELAY ASSEMBLY (SMRG)



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

(b) Remove the HV relay assembly from the vehicle (See page HB-104).

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

Standard resistance

Tester Connection	Specified Condition
h3-1 - t1-1	10 kΩ or more
h3-1 - t1-1	Below 1 Ω (When battery voltage (12 V) applied to terminals n3-1 and n3-2)

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

Standard resistance

Tester Connection	Specified Condition
CON3 (n3-1) - GND (n3-2)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

NG → REPLACE HV RELAY ASSEMBLY (See page HB-104)

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0AE2-161	Hybrid Battery Precharge Contactor Circuit Stuck Closed

DESCRIPTION

Refer to the circuit description for DTC P0AE6-225 (See page HV-412).
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	DTC Detection Condition	Trouble Area
P0AE2	161	When the power switch is 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)

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

HV

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

P0AE0-228 is output.

YES → **GO TO DTC CHART**

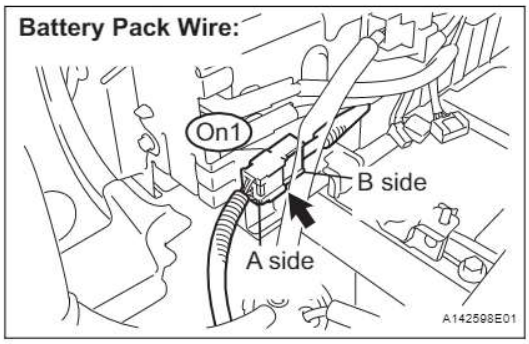
NO

2	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → **CONNECT SECURELY**

OK

3	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR)

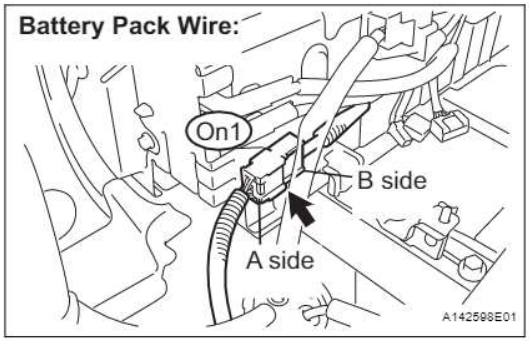


(a) Check the connection of the battery pack wire connector.
OK:
The connector is connected securely and there are no contact problems.
HINT:
For the removal and installation procedures related to inspection of the connection of the battery pack wire connector, (See page HB-81).

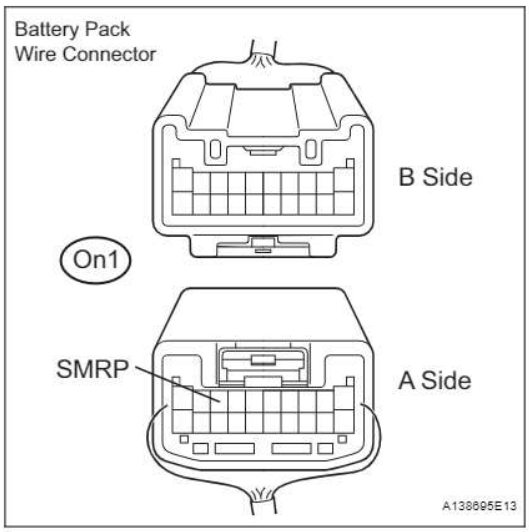
NG → **CONNECT SECURELY**

OK

4	CHECK HYBRID VEHICLE CONTROL ECU



(a) Disconnect the battery pack wire connector (See page HB-81).



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

Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	370 to 430 kΩ

NG → **Go to step 11**

OK

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

(a) Disconnect the A61 hybrid vehicle control ECU.
(b) Turn the power switch on (IG).

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

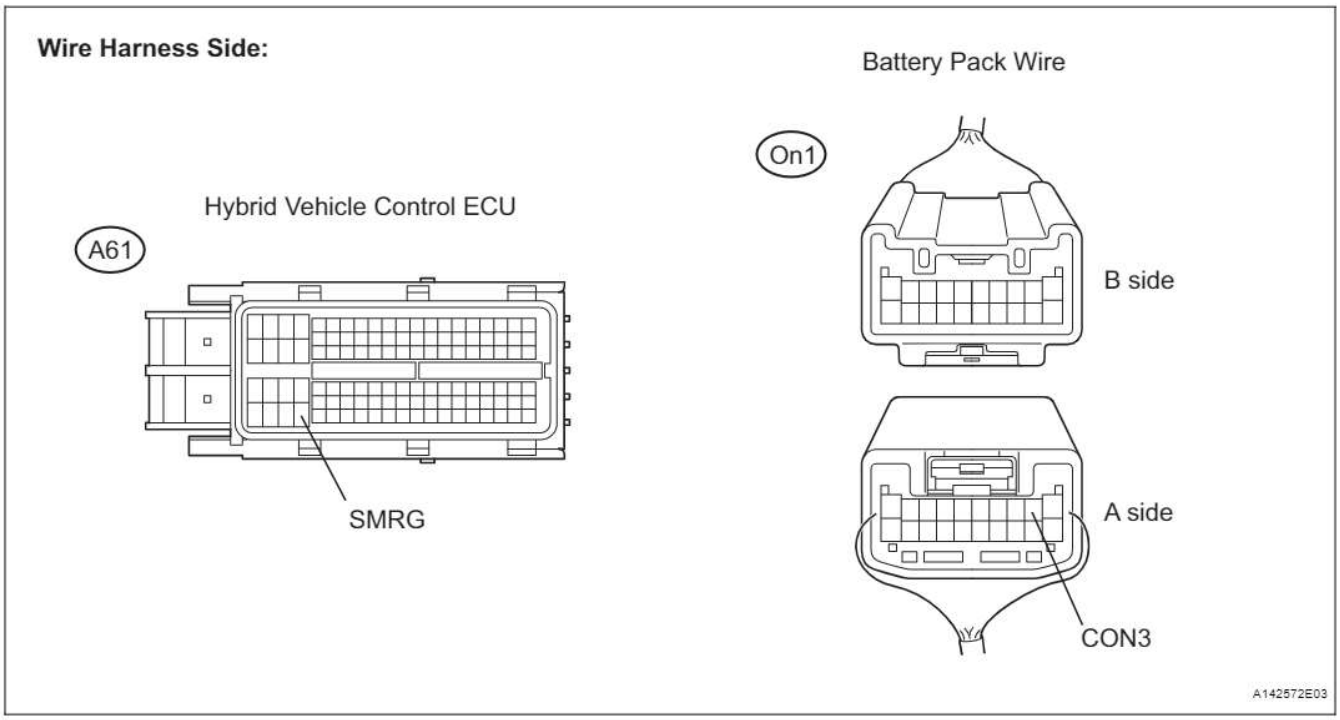
Standard voltage

Tester Connection	Specified Condition
SMRG (A61-96) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(d) Turn the power switch off.

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



Standard resistance (Check for open)

Tester Connection	Specified Condition
SMRG (A61-96) - CON3 (On1-2)	Below 1 Ω

Standard resistance (Check for short)

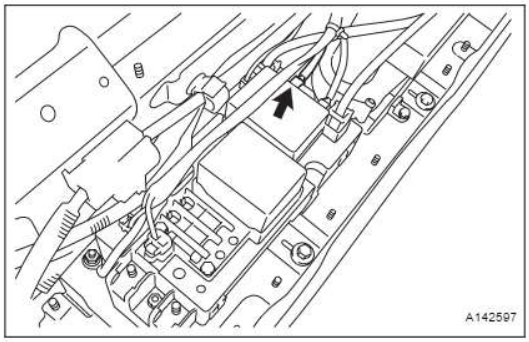
Tester Connection	Specified Condition
SMRG (A61-96) or CON3 (On1-2) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6	CHECK CONNECTOR CONNECTION CONDITION (HV RELAY CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

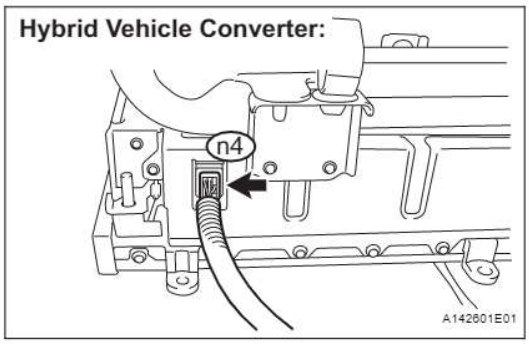


(a) Turn the power switch off and remove the service plug grip (See page HV-1).
(b) Check the connection of the low voltage connector that drives the HV relay assembly.
Result:
The connector is connected securely and there are no contact problems.
HINT:
For the removal and installation procedures related to inspection of the connection of the connector that drives the HV relay assembly, (See page HB-104).

NG → **CONNECT SECURELY**

OK

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



CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.
(b) Check the connection of the low voltage connector of the hybrid vehicle converter.
Result:
The connector is connected securely and there are no contact problems.

NG → **CONNECT SECURELY**

OK

8	CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR) (See page HV-406)

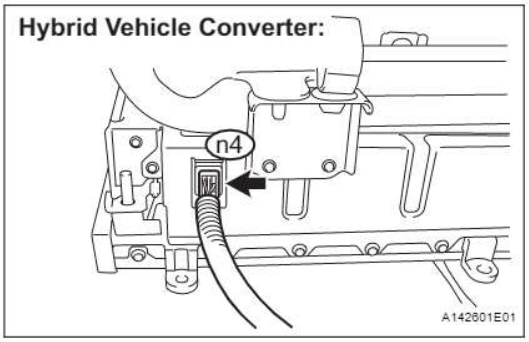
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

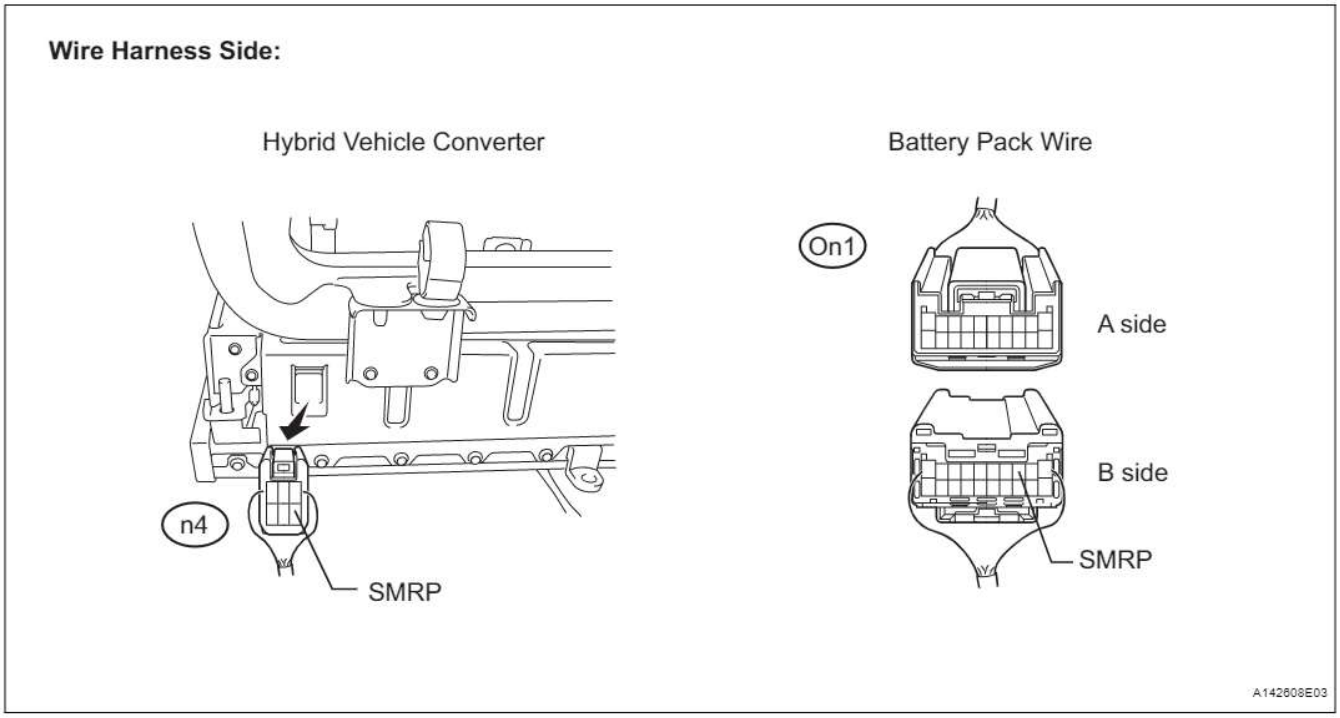
9	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.

HV



(b) Disconnect the n4 hybrid vehicle converter connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.



HV

Standard voltage

Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle converter connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
SMRP (On1-8) - SMRP (n4-4)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
SMRP (On1-8) or SMRP (n4-4) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

10	INSPECT HV RELAY ASSEMBLY (SMRG) (See page HV-407)

NG → REPLACE HV RELAY ASSEMBLY (See page HB-104)

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

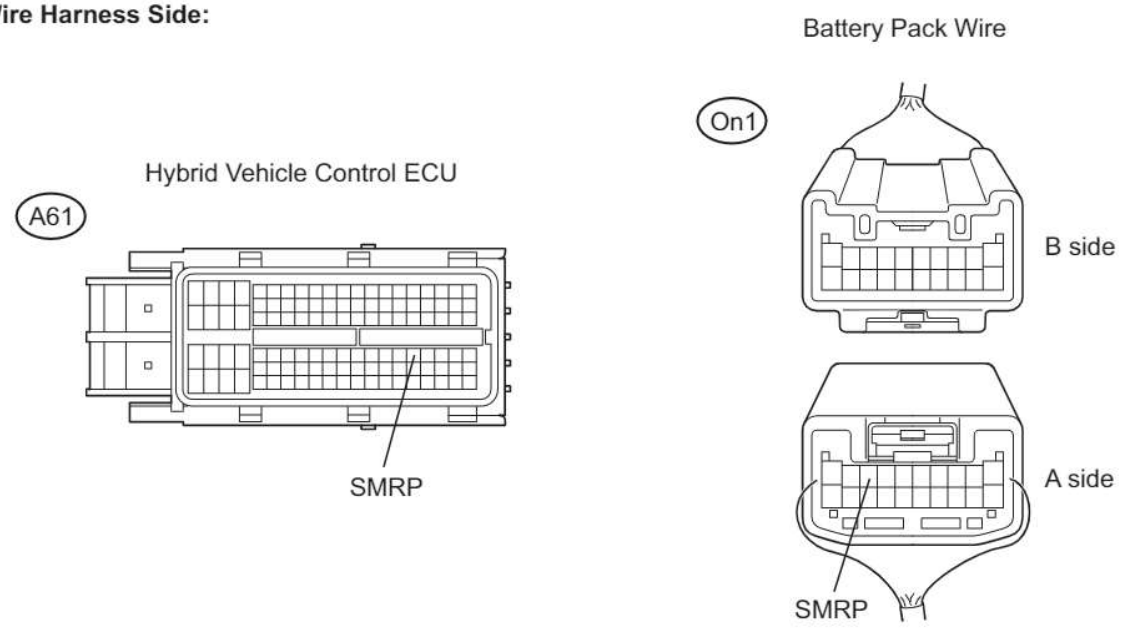
11	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

NOTICE:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

HV

Wire Harness Side:



Standard voltage

Tester Connection	Specified Condition
SMRP (A61-72) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
SMRP (A61-72) - SMRP (On1-8)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
SMRP (A61-72) or SMRP (On1-8) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P0AE2-773	Hybrid Battery Precharge Contactor Circuit Stuck Closed

DESCRIPTION

Refer to the circuit description for DTC P0AE6-225 (See page HV-412).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AE2	773	When only SMRB is ON, current is applied to SMRP (SMRP is stuck closed).	• Connector connection • Hybrid vehicle converter (DC/DC converter)

WIRING DIAGRAM

See the wiring diagram for P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

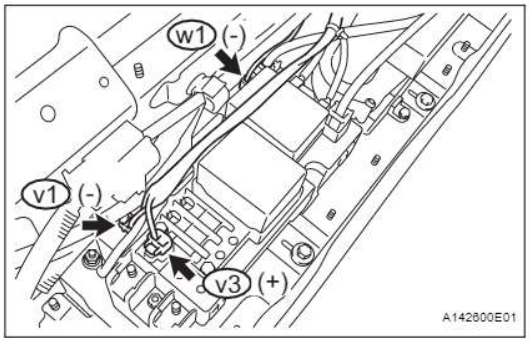
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HINT:

- 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.

HV

1	CHECK HYBRID VEHICLE CONVERTER



CAUTION:

Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).

NOTICE:

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

(b) Disconnect the w1, v1 and v3 hybrid vehicle converter connectors from the HV relay assembly.

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

Standard resistance

Tester Connection	Specified Condition
w1-1 (Precharge +) - v1-1 (High voltage -)	10 kΩ or more

HINT:

If the resistance is between 28.5 and 31.5 Ω, it can be determined that the SMRP is stuck closed.

NG	REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

OK

2	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → CONNECT SECURELY

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

HV

DTC	P0AE6-225	Hybrid Battery Precharge Contactor Control Circuit Low

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 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.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AE6	225	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

HV

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0AE6 (INF 225): Range check (Low input)
Required sensors / components	Hybrid vehicle converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTC is not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	-

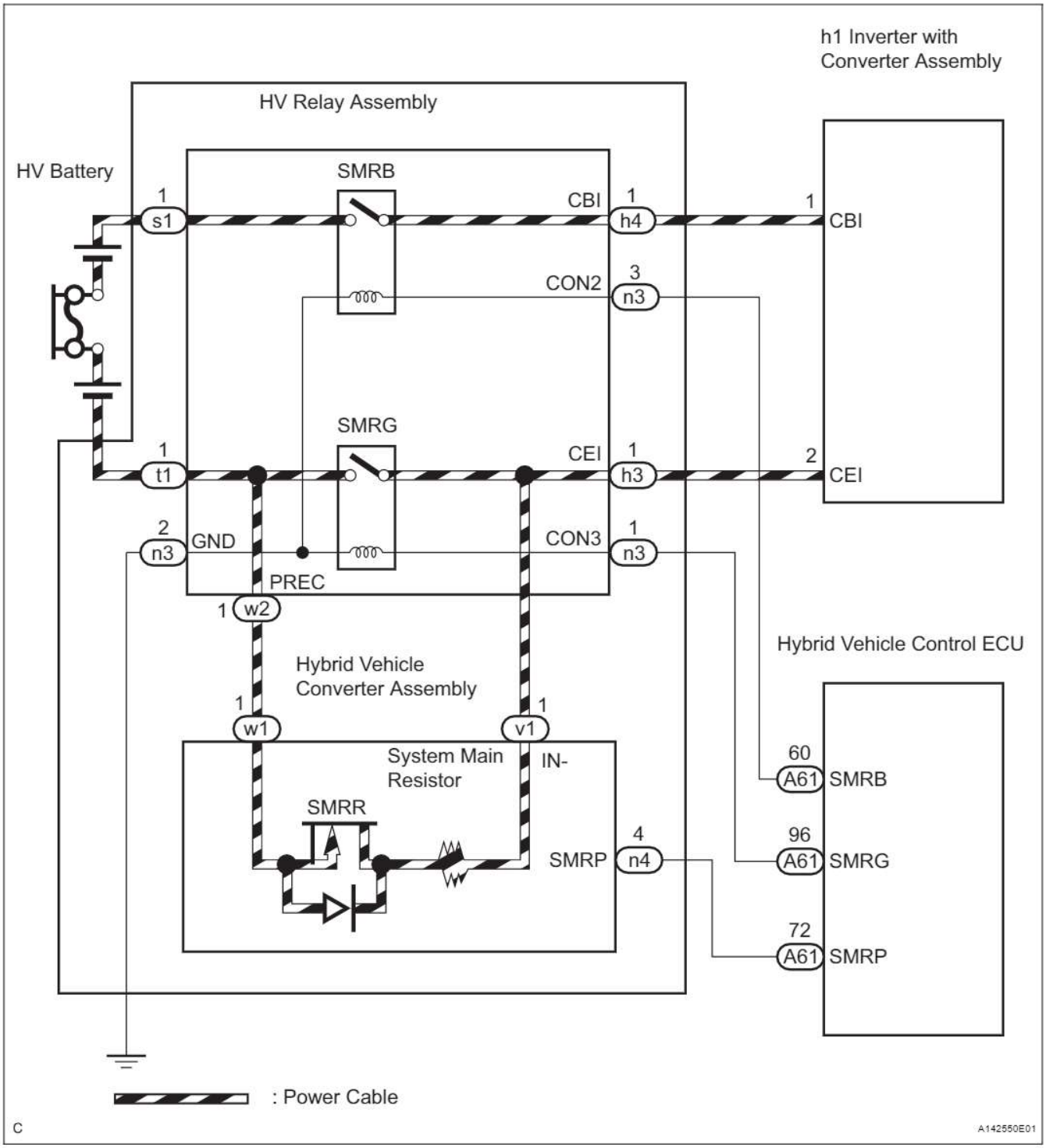
TYPICAL MALFUNCTION THRESHOLDS

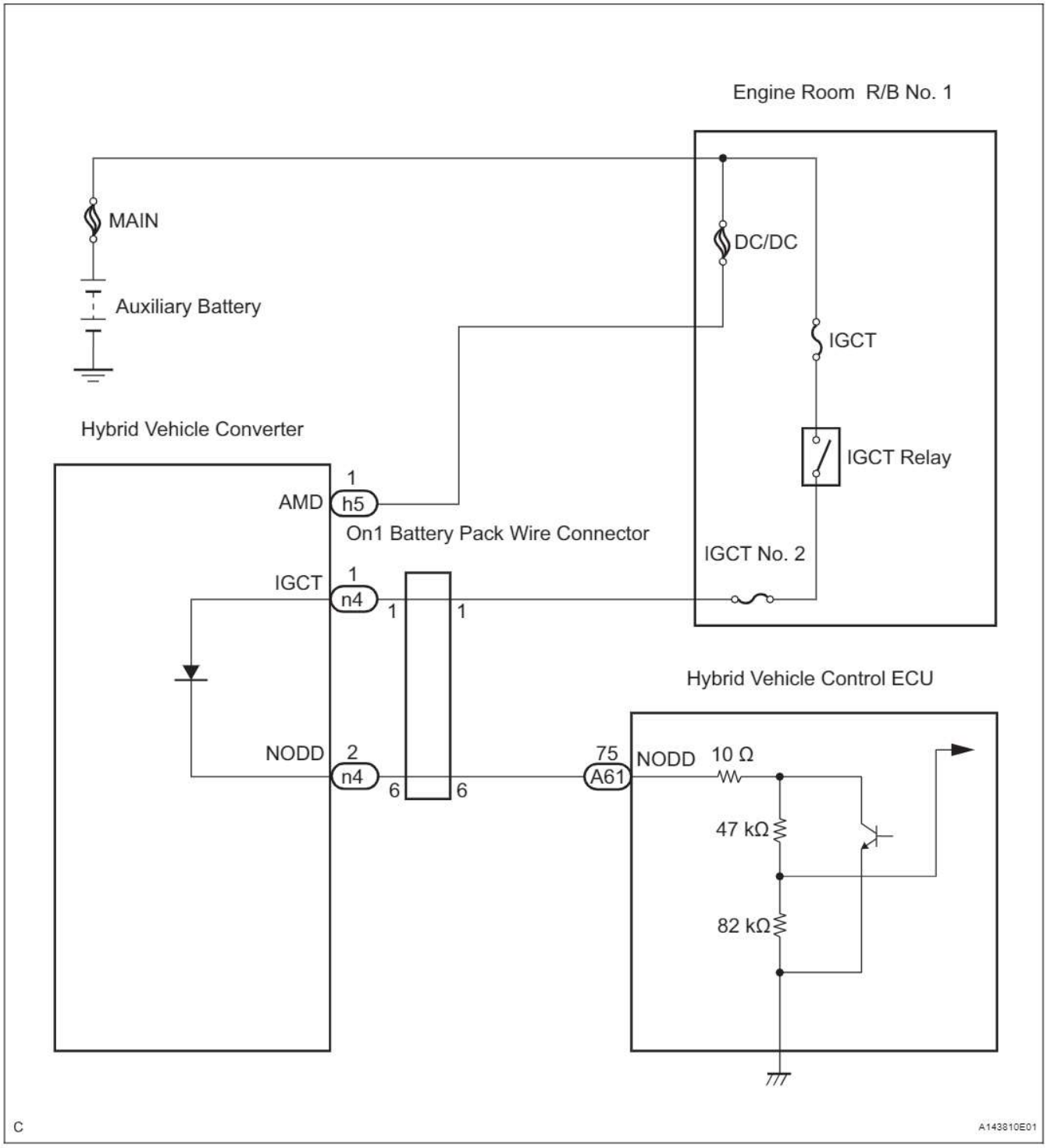
TOYOTA's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle converter	DTC P0AE6 (INF 225) is not detected

WIRING DIAGRAM





INSPECTION PROCEDURE

CAUTION:

- **Turn the power 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.**

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
(e) Refer to "Proceed to" in the table below to perform each inspection.

Result

Item to inspect	P0A08-264	P0A09-265	P0A09-591	P2519-766	P0AE6-225	Proceed to
Only AMD open circuit inspection	O	-	O	O	O	A
	O	-	-	O	O	
	O	-	-	-	O	
Only IGCT open circuit inspection	-	O	O	O	O	B
	-	O	-	-	O	
	-	O	-	O	O	
AMD and IGCT open circuit inspections	-	-	O	O	O	C
	-	-	-	O	O	
AMD and IGCT open circuit and SMRP system inspections	-	-	-	-	O	D

HINT:
- O : DTCs that are output
- - : DTCs that are not output

HV

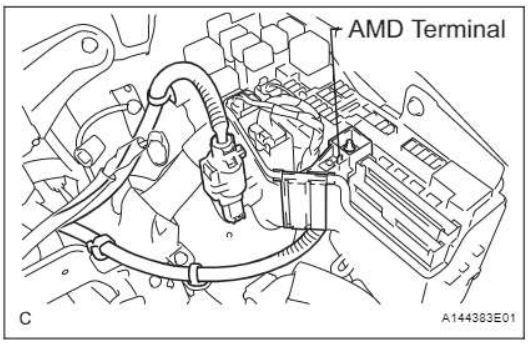
A → Go to step 13

B → Go to step 17

C → Go to step 22

D

2	CHECK FRAME WIRE (AUXILIARY BATTERY POSITION TERMINAL AND AMD TERMINAL VOLTAGE)



(a) Turn the power switch off.
(b) Measure the voltage according to the value(s) in the table below.

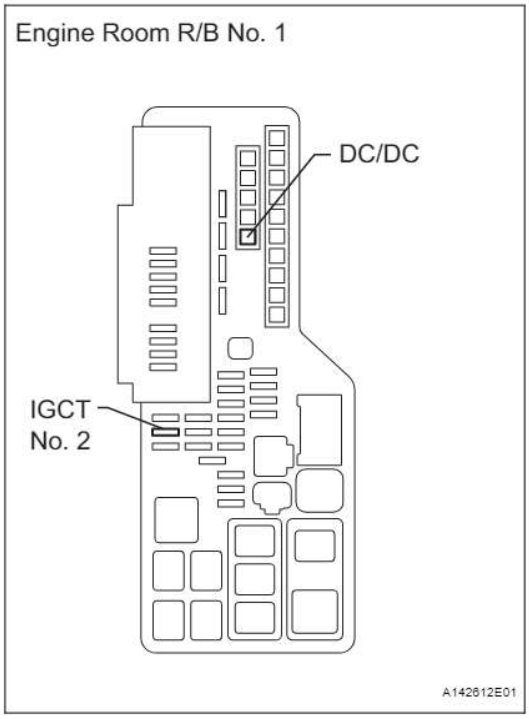
Standard voltage

Tester Connection	Specified Condition
Auxiliary battery positive (+) terminal and AMD terminal - Body ground	9 to 14 V

NG → Go to step 30

OK

3	CHECK ENGINE ROOM R/B NO. 1 (FUSIBLE LINK AND FUSE)



(a) Check the fusible link (DC/DC) and the fuse (IGCT No. 2) in the engine room R/B No. 1, and the fusible link (MAIN) that is installed at the auxiliary battery, for improper installation and for open circuits.

Result:

They are connected securely. There are no open circuits in the fusible links or fuse.

NG → **REPLACE FUSE**

OK

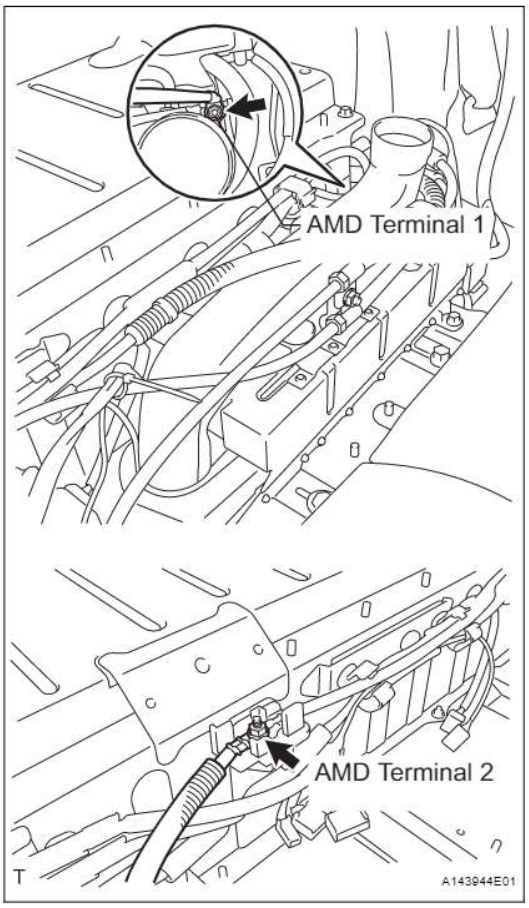
HV

4	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → **CONNECT SECURELY**

OK

5	CHECK HYBRID VEHICLE CONVERTER (AMD TERMINAL CONNECTION CONDITION)



(a) Check for DTCs and save freeze frame data.
(b) Disconnect the negative terminal from the auxiliary battery.
(c) 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, 81 in*lbf)
(d) Make sure to disconnect the terminals 1 and 2 to check for arc marks.
Result 2:
There are no arc marks.

HV

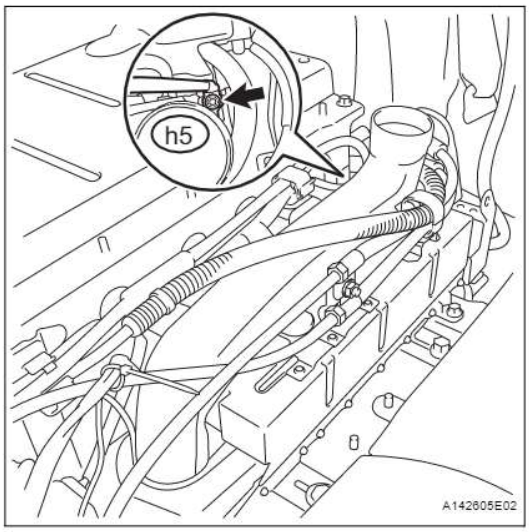
Result		Procedure	Procedure to
Result 1	Result 2		
No looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery, and go to step 6.	A
No looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter, terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	C
Looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter, terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B

B → REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

C → TIGHTEN TO SPECIFIED TORQUE

A

6	CHECK TERMINAL VOLTAGE (AMD TERMINAL)



(a) Turn the power switch off.
(b) Measure the voltage according to the value(s) in the table below when the power switch is off.

Standard voltage

Tester Connection	Specified Condition
h5-1 - Body ground	9 to 14 V

NG → REPAIR OR REPLACE FRAME WIRE

OK

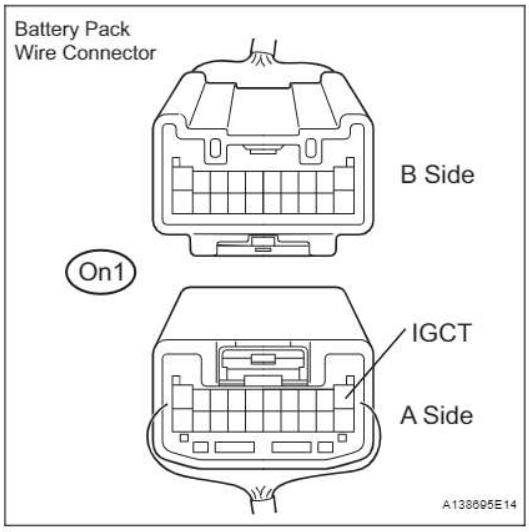
7	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

NG → CONNECT SECURELY

OK

HV

8	CHECK HARNESS AND CONNECTOR



(a) Disconnect the battery pack wire connector (See page HB-81).
(b) Turn the power switch on (IG).
(c) Measure the voltage according to the value(s) in the table below.

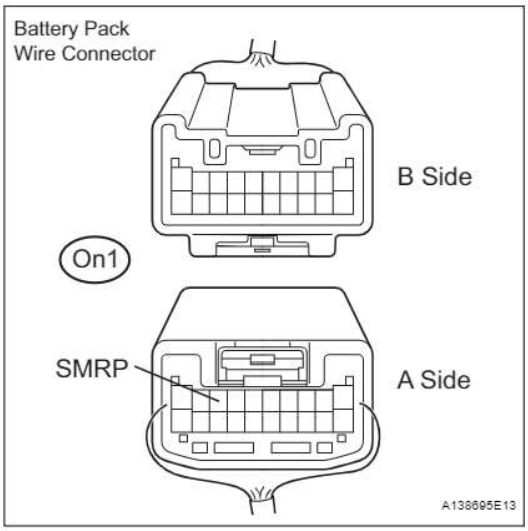
Standard voltage

Tester Connection	Specified Condition
IGCT (On1-1) - Body ground	9 to 14 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

9	CHECK HYBRID VEHICLE CONTROL ECU



(a) Turn the power switch off.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	370 to 430 kΩ

NG → Go to step 12

OK

10	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → CONNECT SECURELY

HV

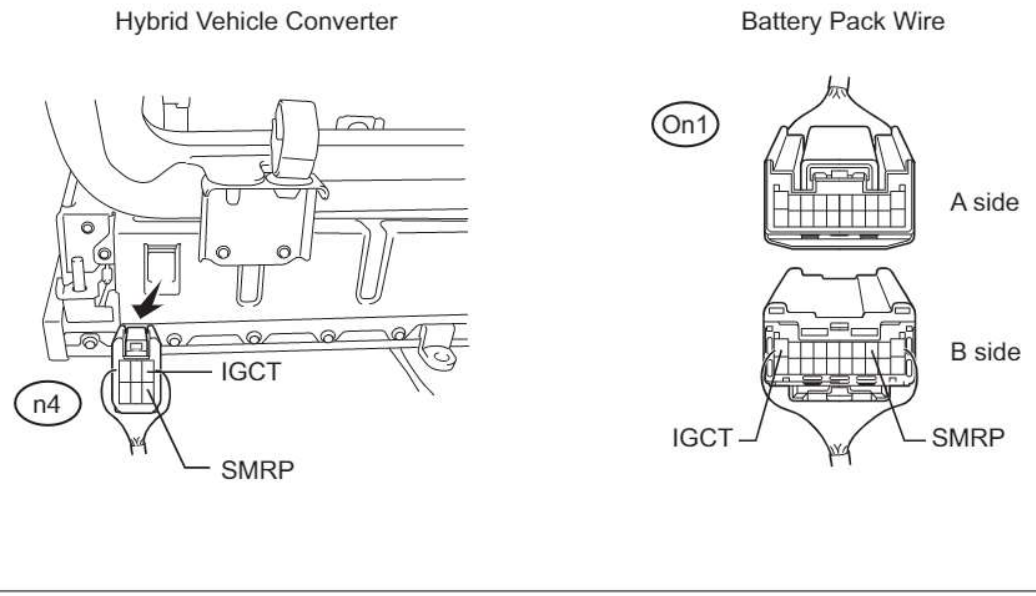
OK

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

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Measure the resistance according to the value(s) in the table below.

Wire Harness Side:



Standard resistance

Tester Connection	Specified Condition
IGCT (On1-1) - IGCT (n4-1)	Below 1 Ω
SMRP (On1-8) - SMRP (n4-4)	Below 1 Ω
SMRP (On1-8) or SMRP (n4-4) - Body ground	10 kΩ or more
IGCT (On1-1) or IGCT (n4-1) - Body ground	10 kΩ or more

HV

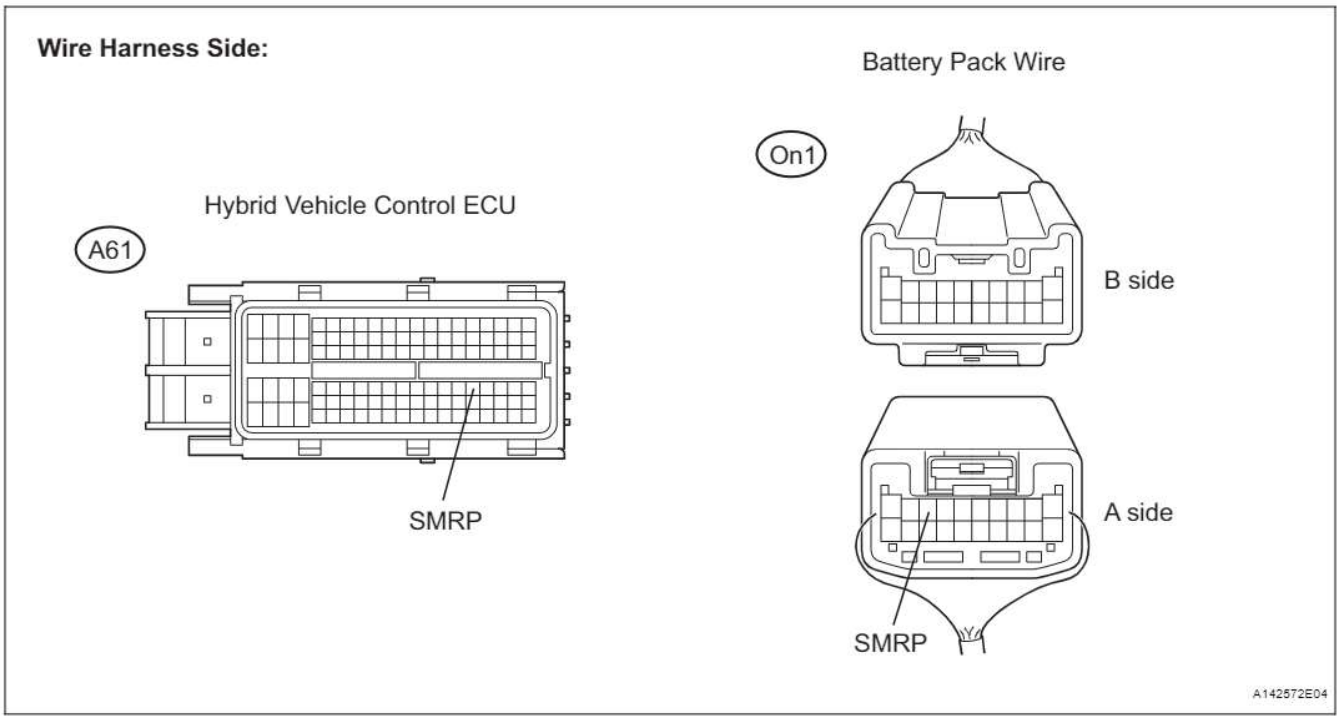
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

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

(a) Turn the power switch off.
(b) Disconnect the A61 hybrid vehicle control ECU connector.



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

Standard resistance (Check for open)

Tester Connection	Specified Condition
SMRP (A61-72) - SMRP (On1-8)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
SMRP (A61-72) or SMRP (On1-8) - Body ground	10 kΩ or higher

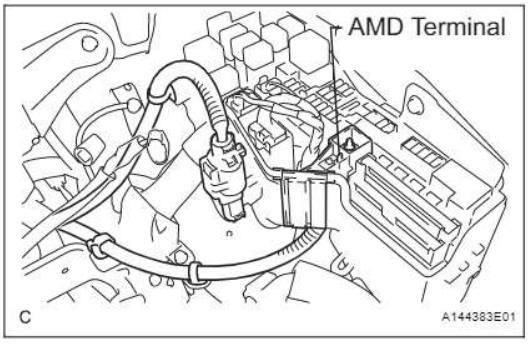
HV

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

13 CHECK FRAME WIRE (AUXILIARY BATTERY POSITIVE TERMINAL AND AMD TERMINAL)



(a) Turn the power switch off.
(b) Measure the voltage according to the value(s) in the table below.

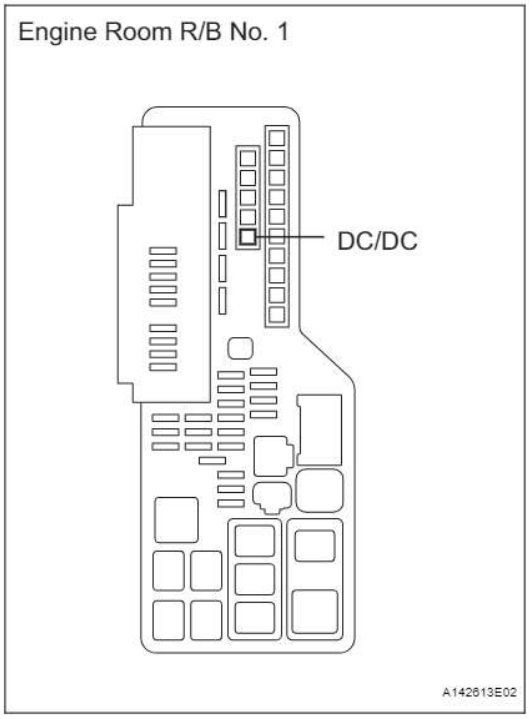
Standard voltage

Tester Connection	Specified Condition
AMD terminal - Body ground	9 to 14 V

NG → Go to step 30

OK

14	CHECK FUSIBLE LINK



(a) Check the fusible link (DC/DC) in the engine room R/B No. 1 and the fusible link (MAIN) that is installed at the auxiliary battery for improper installation and for open circuits.

Result:

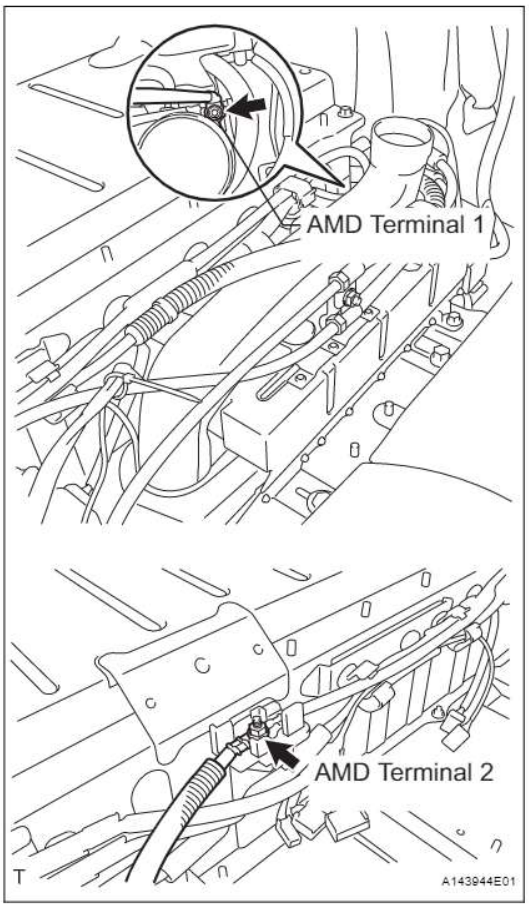
They are connected securely. There are no open circuits in the fusible links.

NG → **REPLACE FUSIBLE LINK**

OK

HV

15 CHECK HYBRID VEHICLE CONVERTER (AMD TERMINAL CONNECTION CONDITION)



(a) Check for DTCs and save freeze frame data.
(b) Disconnect the negative terminal from the auxiliary battery.
(c) 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, 81 in*lbf)
(d) Make sure to disconnect the terminals 1 and 2 to check for arc marks.
Result 2:
There are no arc marks.

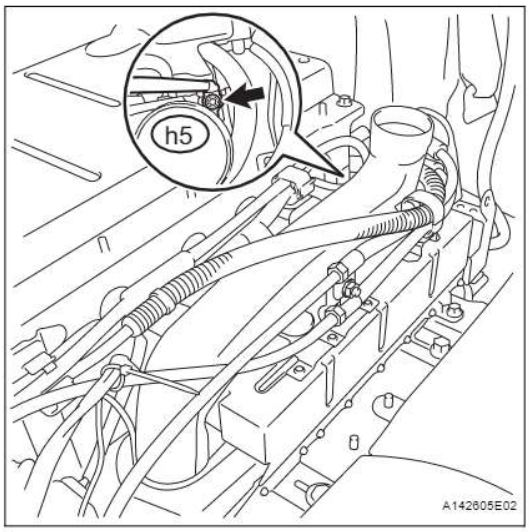
HV

Result		Procedure	Procedure to
Result 1	Result 2		
No looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery, and go to step 6.	A
No looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter, terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	C
Looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter, terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B

NG → REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

OK

16 CHECK TERMINAL VOLTAGE (AMD TERMINAL)



(a) Turn the power switch off.
(b) Measure the voltage according to the value(s) in the table below when the power switch is off.

Standard voltage

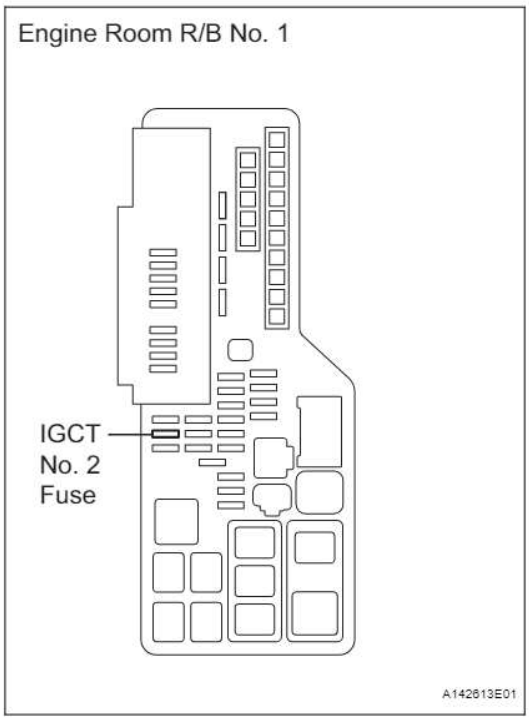
Tester Connection	Specified Condition
Auxiliary battery positive (+) terminal and h5-1 - Body ground	9 to 14 V

NG → **REPAIR OR REPLACE FRAME WIRE**

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

17 CHECK FUSE (IGCT NO. 2)



(a) Check the fuse (IGCT No. 2) in the engine room R/B No. 1 for improper installation and open circuit.

Result:

The fuse is installed securely. There is no open in the fuse.

NG → **REPLACE FUSE**

OK

HV

18	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

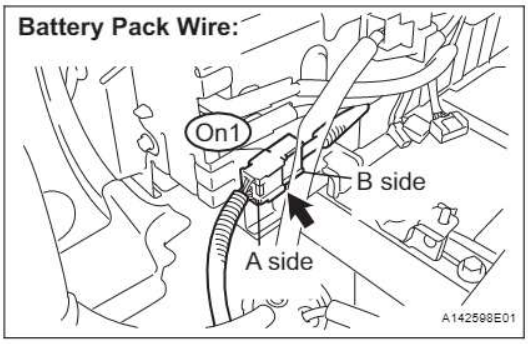
NG → CONNECT SECURELY

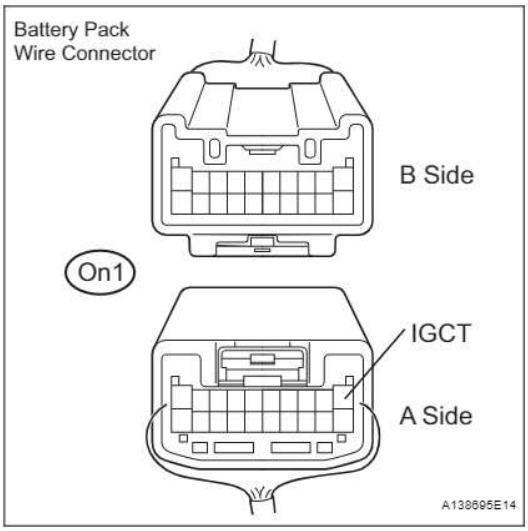
OK

19	CHECK HARNESS AND CONNECTOR

(a) Disconnect the battery pack wire connector (See page HB-81).

(b) Turn the power switch on (IG).





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

Standard voltage

Tester Connection	Specified Condition
IGCT (On1-1) - Body ground	9 to 14 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

20	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → CONNECT SECURELY

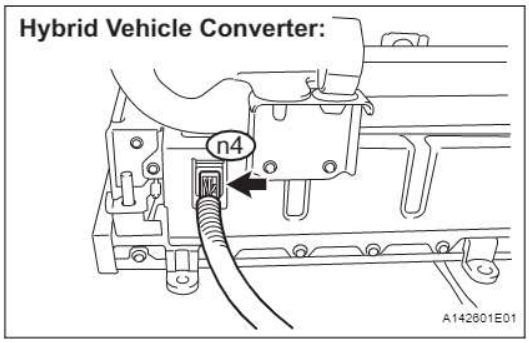
OK

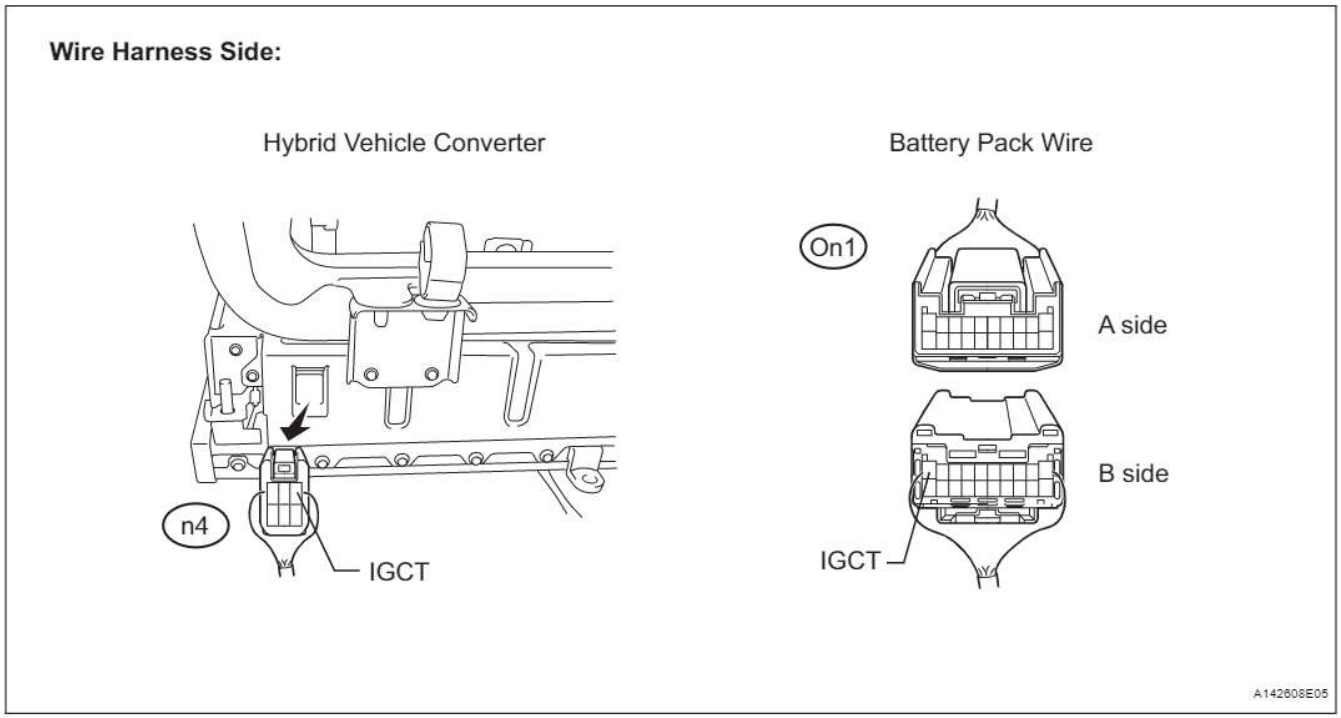
HV

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

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Measure the resistance according to the value(s) in the table below.





Standard resistance

Tester Connection	Specified Condition
IGCT (On1-1) - IGCT (n4-1)	Below 1 Ω
IGCT (On1-1) or IGCT (n4-1) - Body ground	10 kΩ or more

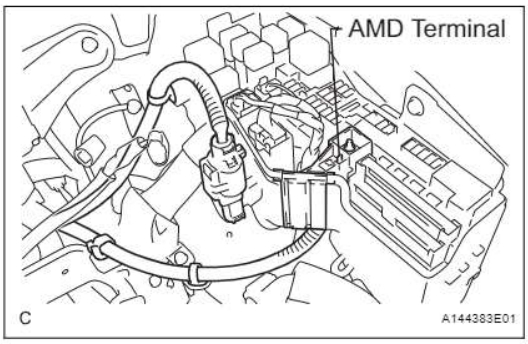
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

HV

22 CHECK FRAME WIRE (AUXILIARY BATTERY POSITIVE TERMINAL AND AMD TERMINAL)



(a) Turn the power switch off.
(b) Measure the voltage according to the value(s) in the table below.

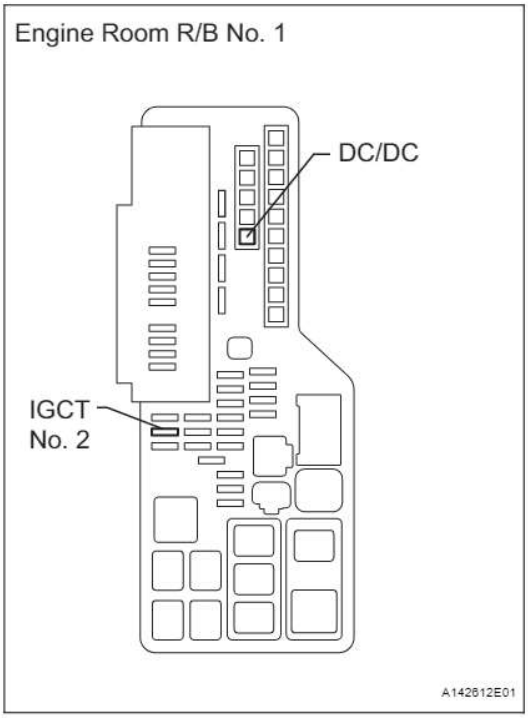
Standard voltage

Tester Connection	Specified Condition
AMD terminal - Body ground	9 to 14 V

NG → **Go to step 30**

OK

23 CHECK ENGINE ROOM R/B NO. 1 (FUSIBLE LINK AND FUSE)



(a) Check the fusible link (DC/DC) and the fuse (IGCT No. 2) in the engine room R/B No. 1 and the fusible link (MAIN) that is installed at the auxiliary battery for improper installation and for open circuits.

Result:

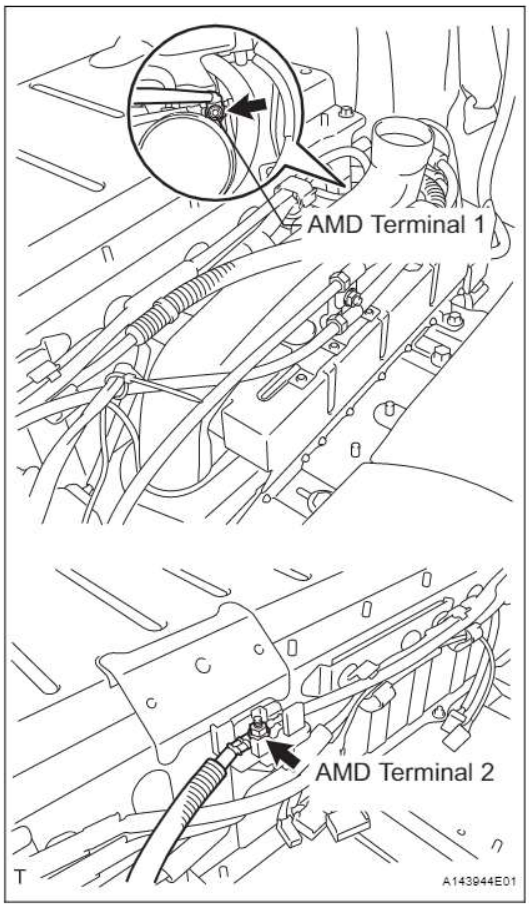
They are connected securely. There are no open circuits in the fusible links or fuse.

NG → **REPLACE FUSE**

HV

OK

24 CHECK HYBRID VEHICLE CONVERTER (AMD TERMINAL CONNECTION CONDITION)



(a) Check for DTCs and save freeze frame data.
(b) Disconnect the negative terminal from the auxiliary battery.
(c) 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, 81 in*lbf)
(d) Make sure to disconnect the terminals 1 and 2 to check for arc marks.
Result 2:
There are no arc marks.

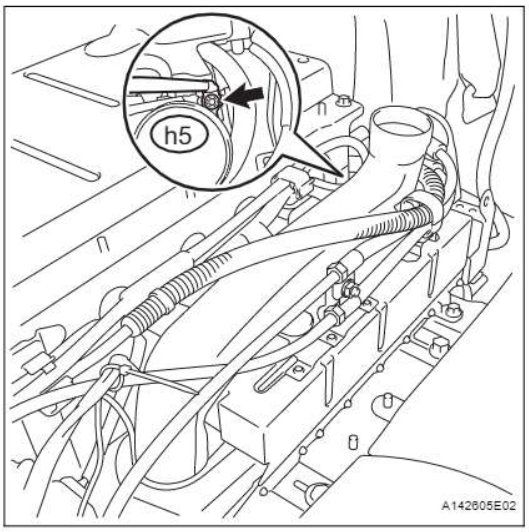
HV

Result		Procedure	Procedure to
Result 1	Result 2		
No looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery, and go to step 6.	A
No looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter, terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B
Looseness is present	No arc marks are present	Connect AMD terminals 1 and 2, connect the negative terminal to the auxiliary battery.	C
Looseness is present	Arc marks are present	Repair or replace the appropriate part (nut, round terminal, hybrid vehicle converter, terminal block for AMD terminal 2). After repair or replacement, connect the negative terminal to the auxiliary battery.	B

NG → REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

OK

25	CHECK TERMINAL VOLTAGE (AMD TERMINAL)



(a) Turn the power switch off.
(b) Measure the voltage according to the value(s) in the table below when the power switch is off.

Standard voltage

Tester Connection	Specified Condition
Auxiliary battery positive (+) terminal and h5-1 - Body ground	9 to 14 V

NG → CONNECT SECURELY

OK

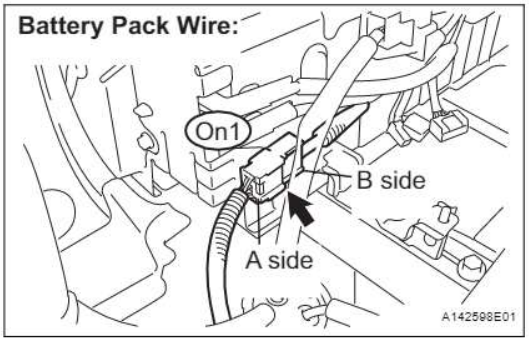
26	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

NG → CONNECT SECURELY

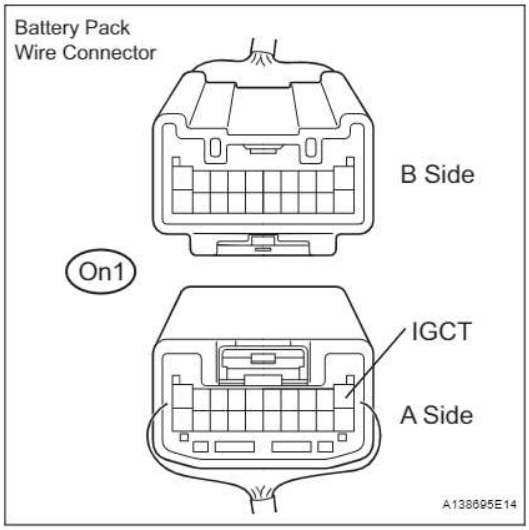
OK

HV

27	CHECK HARNESS AND CONNECTOR



(a) Disconnect the battery pack wire connector (See page HB-81).
(b) Turn the power switch on (IG).



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

Standard voltage

Tester Connection	Specified Condition
IGCT (On1-1) - Body ground	9 to 14 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

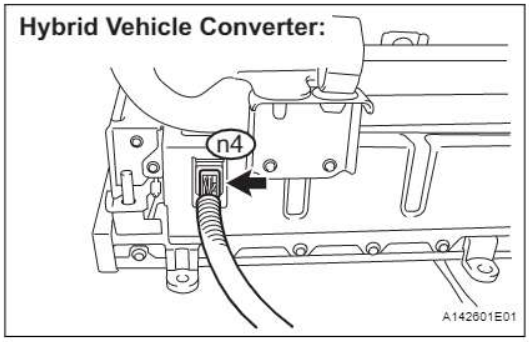
OK

28	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → CONNECT SECURELY

OK

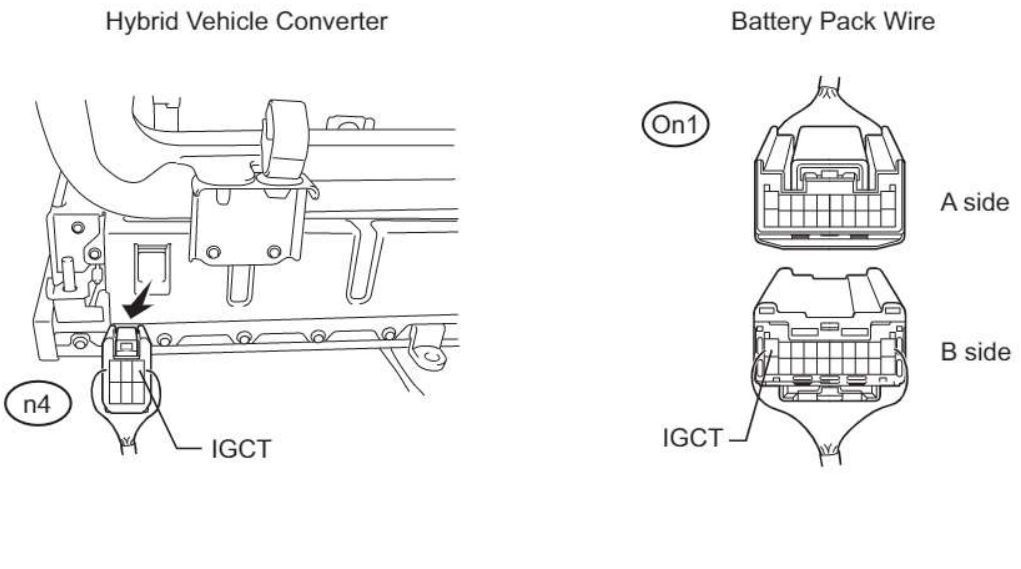
29	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Measure the resistance according to the value(s) in the table below.

Wire Harness Side:



Standard resistance

Tester Connection	Specified Condition
IGCT (On1-1) - IGCT (n4-1)	Below 1 Ω
IGCT (On1-1) or IGCT (n4-1) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

HV

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

30	CHECK AUXILIARY BATTERY

(a) Check the connection of the auxiliary battery negative terminal.
Result:
The terminal is connected securely and there is no contact problem.

(b) Check for arc marks on the auxiliary battery negative terminal.
Result:
There are no arc marks.

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

Tester Connection	Specified Condition
Auxiliary battery negative terminal - Body ground	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPAIR OR REPLACE FRAME WIRE

DTC	P0AE7-224	Hybrid Battery Precharge Contactor Control Circuit High

DESCRIPTION

Refer to the circuit description for DTC P0AE6-225 (See page HV-412).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0AE7	224	Short to +B in the SMRP circuit	• Wire harness or connector • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	P0AE7 (INF 224): Range check (High input)
Required sensors / components	Hybrid vehicle converter
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

HV

The monitor will run whenever the following DTC is not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TOYOTA's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle converter	DTC P0AE7 (INF 224) is not detected

WIRING DIAGRAM

See the wiring diagram for P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

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

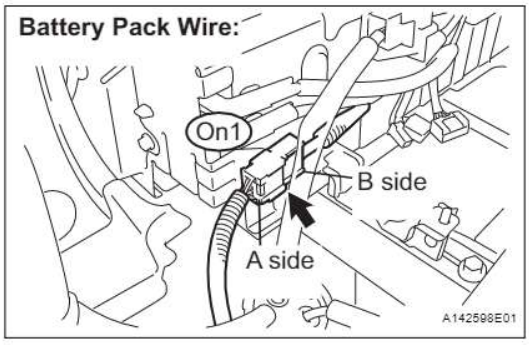
1	CHECK HARNESS AND CONNECTOR

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the battery pack wire connector (See page HB-81).

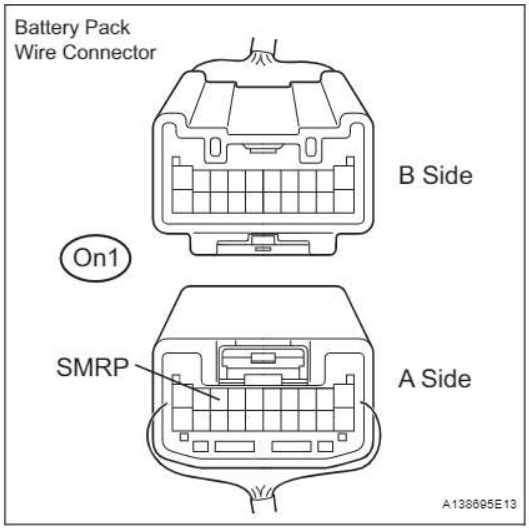
(c) Turn the power switch on (IG).



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

Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.



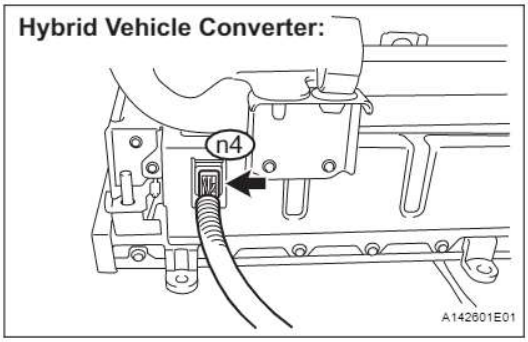
NG → Go to step 4

OK

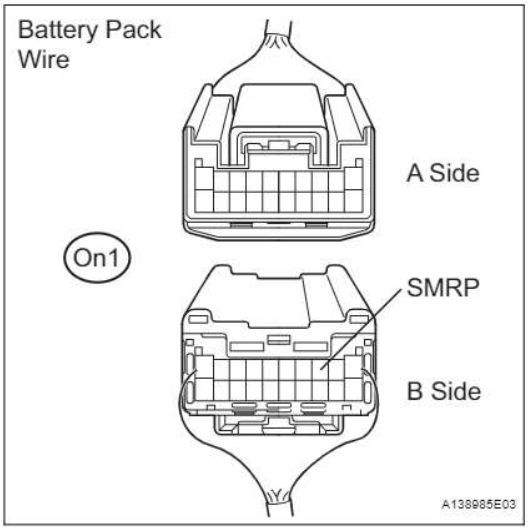
2	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

HV



(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector.
(c) Turn the power switch on (IG).



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

Standard voltage

Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance

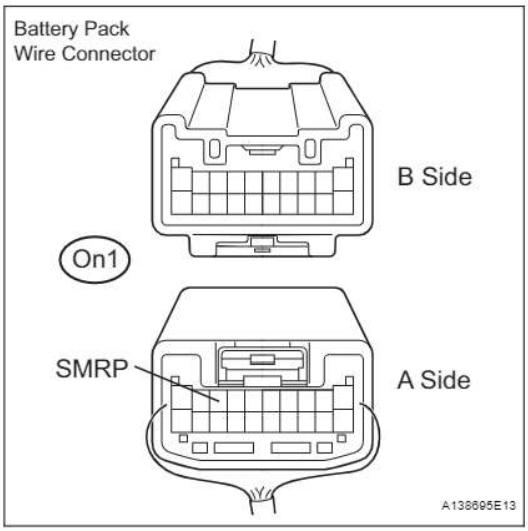
Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	10 kΩ or higher

HV

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3 CHECK HYBRID VEHICLE CONTROL ECU



(a) Turn the power switch off.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

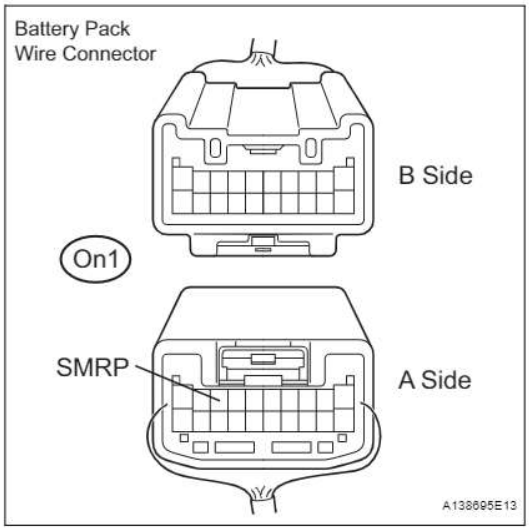
Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	370 to 430 kΩ

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

OK

REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)

4	CHECK HARNESS AND CONNECTOR



(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Turn the power switch on (IG).
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
SMRP (On1-8) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the battery pack wire connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

HV

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P0AEE-276	Motor Inverter Temperature Sensor "A" Circuit Range / Performance

DTC	P0AEE-277	Motor Inverter Temperature Sensor "A" Circuit Range / Performance

DESCRIPTION

Refer to the description for DTC P0AEF-275 (See page HV-440).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0AEE	276	Sudden change or hunting in the motor inverter temperature sensor	• Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU • Wire harness or connector
P0AEE	277	Motor inverter temperature sensor output deviation	• Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU • Wire harness or connector

INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

4	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

5	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

6	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

7	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 10

OK

8	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

HV

OK

9	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG

11	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 13

OK

HV

12	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY - HV CONTROL ECU) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

13	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

DTC	P0AEF-275	Drive Motor Inverter Temperature Sensor "A" Circuit Low

DTC	P0AF0-274	Drive Motor Inverter Temperature Sensor "A" Circuit High

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 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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P0AEF	275	Open or short to GND in the motor inverter temperature sensor circuit	Inverter with converter assembly
P0AF0	274	Short to +B in motor inverter temperature sensor circuit	Inverter with converter assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

COMPLETED

DTC	P1555-181	Reactor Temperature Sensor Circuit Low

DTC	P1556-182	Reactor Temperature Sensor Circuit High

DESCRIPTION

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.

HINT:

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 No.	INF Code	DTC Detection Condition	Trouble Area
P1555	181	Malfunction in the reactor temperature sensor wiring (short to GND)	Inverter with converter assembly
P1556	182	Malfunction in the reactor temperature sensor wiring (open or short to +B)	Inverter with converter assembly

INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Relevant Diagnosis
P3226-562, 563	Boost converter temperature sensor

YES → GO TO DTC CHART

NO

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

DTC	P1606-138	Collision Detection

DTC	P1606-308	Collision Detection

DTC	P1606-317	Collision Detection

DESCRIPTION

The hybrid vehicle control ECU receives a signal that indicates a collision from the center airbag sensor assembly to detect a collision. After detecting a collision, the hybrid vehicle control ECU shuts off the high-voltage systems for safety.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P1606	138	Shutoff signal from the circuit breaker sensor No. 1 is determined.	• Center airbag sensor assembly • Hybrid vehicle control ECU • Vehicle has experienced a collision • Circuit breaker sensor No. 1
P1606	308	Shutoff signal from the center airbag sensor assembly is determined.	• Center airbag sensor assembly • Hybrid vehicle control ECU • Vehicle has experienced a collision • Circuit breaker sensor No. 1
P1606	317	A collision is determined due to a wiring malfunction.	• Center airbag sensor assembly • Hybrid vehicle control ECU • Vehicle has experienced a collision • Circuit breaker sensor No. 1

HINT:
If P1608-138, 308 or 317 is output, the vehicle cannot start unless the DTCs are cleared using the intelligent tester.

INSPECTION PROCEDURE

HV

CAUTION:

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

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

1	CHECK VEHICLE FOR COLLISION DAMAGE

(a) Check the vehicle condition.
Result:
The vehicle is damaged.

YES → REPAIR VEHICLE

NO

2	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result

DTC No.	Proceed to
P1606 and PA01D are output.	A
P1606 only is output.	B

A → **GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0A1D)**

B

3	CHECK SUPPLEMENTAL RESTRAINT SYSTEM

(a) Troubleshoot the airbag system.
Result:
There is a malfunction.

YES → **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

HV NO

4	CHECK INFORMATION CODE

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
(e) Access the freeze frame data corresponding to DTC P1606 and select the information.
Result

INF Code	Proceed to
138	A
308	B
317	C

B → **REPLACE CENTER AIRBAG SENSOR ASSEMBLY**

C → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

A

REPLACE CIRCUIT BREAKER SENSOR NO. 1

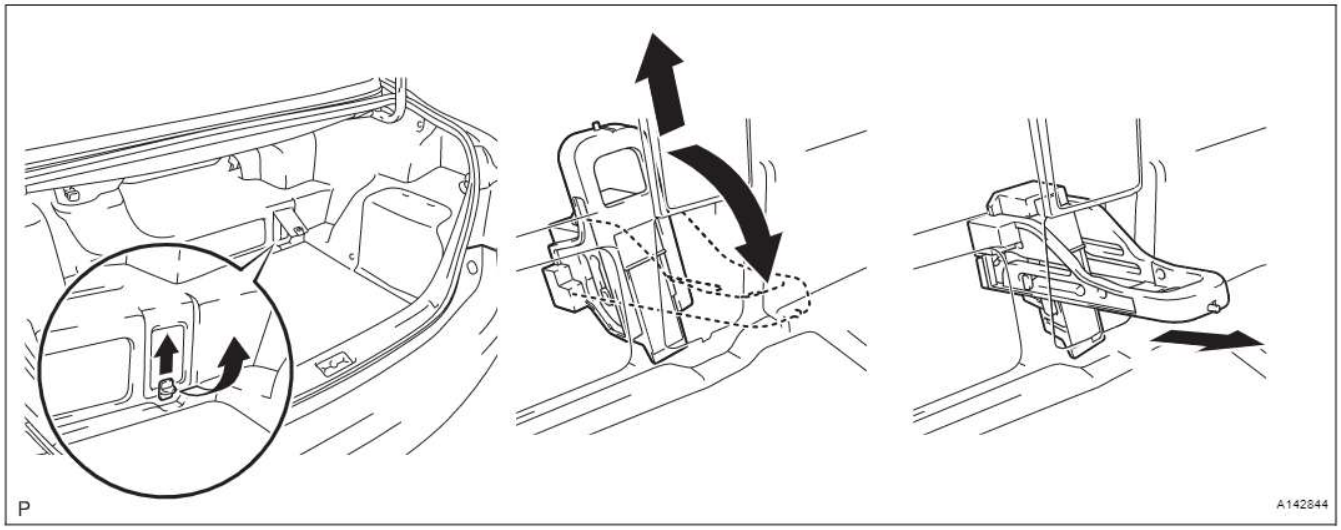
HYBRID CONTROL SYSTEM

PRECAUTION

NOTICE:
When the negative (-) battery terminal has been disconnected, initialize the following systems after the terminal is reconnected.

System	See Procedure
SFI System	IN-43

1. **PRECAUTIONS FOR INSPECTING THE HYBRID CONTROL SYSTEM**
   (a) Before inspecting the high-voltage system or disconnecting the low voltage connector 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 the power switch off before removing the service plug grip. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.
   NOTICE:
   Turning the power switch on (READY) with the service plug grip removed could cause a malfunction. Do not turn the power switch on (READY) unless instructed by the repair manual.
   (b) After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.



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

(c) Turn the power 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.
(d) Turn the power switch off before performing any resistance checks.
(e) Turn the power switch off before disconnecting or reconnecting any connectors.

2. PRECAUTIONS FOR HYBRID CONTROL SYSTEM ACTIVATION

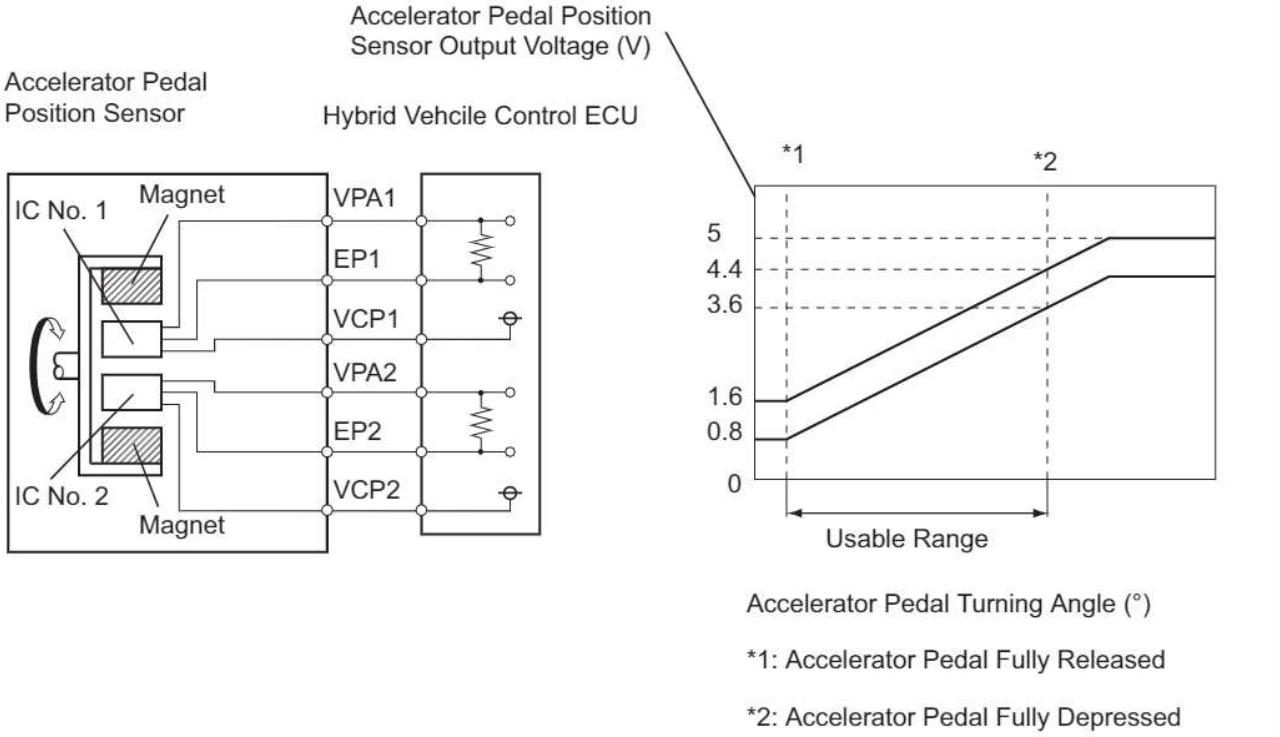
(a) When the auxiliary battery has been disconnected and reconnected, attempting to turn the power switch on (READY) may not start the system (the system may not enter the READY-on state) on the first attempt. If so, turn the power switch off and reattempt to turn the power switch on (READY).

DTC	P2120-152	Throttle / Pedal Position Sensor / Switch "D" Circuit
DTC	P2121-106	Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance
DTC	P2122-104	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input
DTC	P2123-105	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input
DTC	P2125-153	Throttle / Pedal Position Sensor / Switch "E" Circuit
DTC	P2126-109	Throttle / Pedal Position Sensor / Switch "E" Circuit Range / Performance
DTC	P2127-107	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input
DTC	P2128-108	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input
DTC	P2138-110	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation
DTC	P2138-154	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation

HV

DESCRIPTION

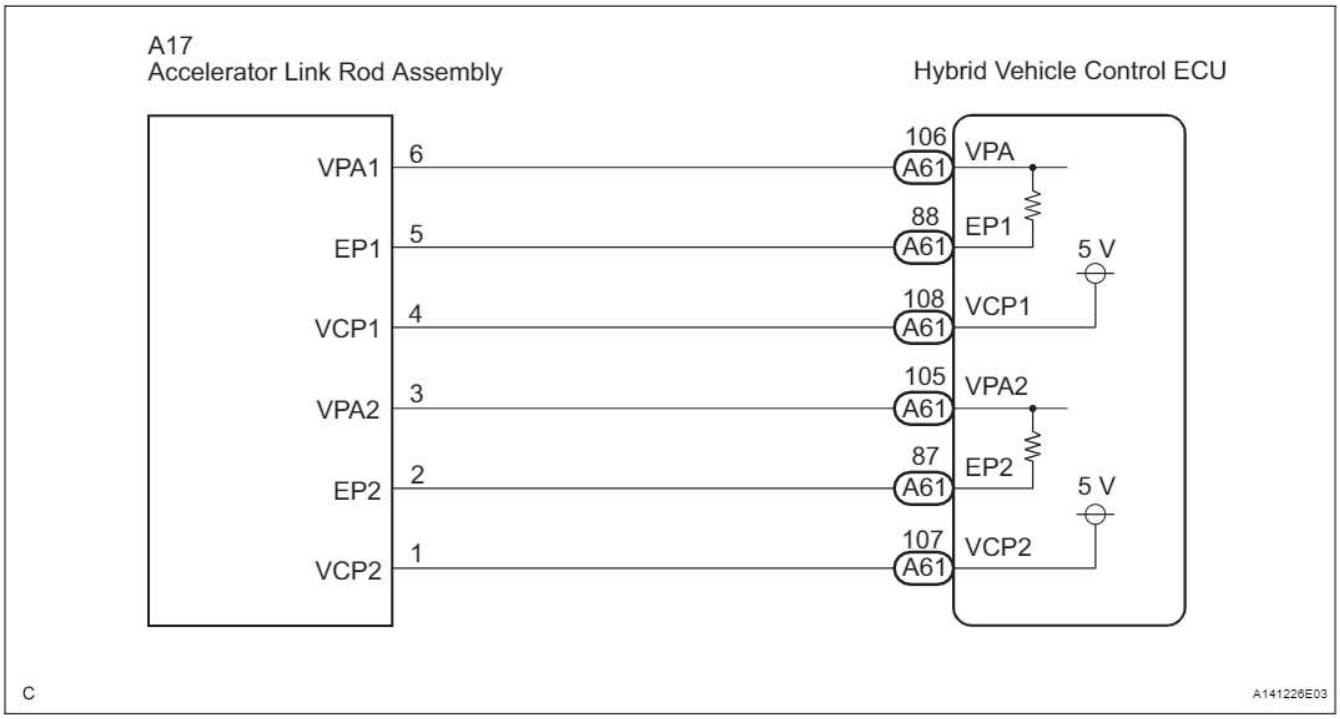
The accelerator pedal position sensor is mounted on the accelerator pedal to detect how much the pedal is depressed. This is a non-contact sensor with hall elements. It has 2 sensors per sensor unit. One is used to detect the accelerator pedal position and the other is used as a confirmation to allow the detection of a malfunction in the sensor itself. Voltage is output from the accelerator pedal position sensor to terminals VPA1 and VPA2 of the hybrid vehicle control ECU. This voltage varies from 0 to 5 V in accordance with the accelerator pedal position. Terminal VPA2 is primarily used to detect a malfunction in the sensor itself. The hybrid vehicle control ECU determines the current accelerator pedal position and controls the hybrid control system based on signals received by terminals VPA1 and VPA2.



DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P2120	152	Main sensor circuit malfunction or level is not stable	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2121	106	Internal error of the main sensor	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2122	104	Open or short to GND in the main sensor circuit	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2123	105	Short to +B in the main sensor circuit	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2125	153	Sub sensor circuit wiring malfunction or level is not stable	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2126	109	Internal error of the sub sensor	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2127	107	Open or short to GND in the sub sensor circuit	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P2128	108	Short to +B in the sub sensor circuit	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2138	110	Difference between the main sensor value and sub sensor value is large.	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU
P2138	154	Main or sub sensor circuit wiring malfunction	• Wire harness or connector • Accelerator link rod assembly • Hybrid vehicle control ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

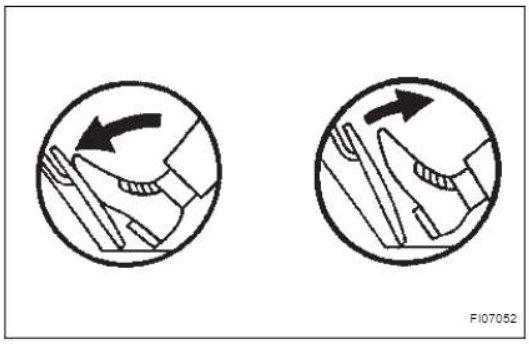
CAUTION:

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

HINT:

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

1 READ VALUE OF INTELLIGENT TESTER



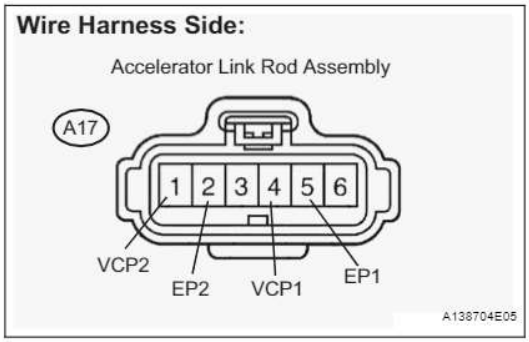
(a) Turn the power switch on (IG).
(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / ACCEL POS #1, ACCEL POS #2.
(c) Read the data list.
HINT:
5 V is described as 100% on the tester.
Result

Pedal Condition	ACCEL POS #1	ACCEL POS #2
Not depressed	(8 to 28%) 0.4 to 1.4 V	(20 to 44%) 1.0 to 2.2 V
Fully depressed	(62 to 92%) 3.1 to 4.6 V	(78 to 100%) 3.9 to 5.0 V
Not depressed → Fully depressed → Not depressed (Accelerator pedal should be operated slowly)	Value changes progressively	Value changes progressively

OK → CHECK FOR INTERMITTENT PROBLEMS

NG

2 CHECK HYBRID VEHICLE CONTROL ECU



(a) Disconnect the A17 accelerator link rod assembly connector.
(b) Turn the power switch on (IG).
(c) Measure the voltage according to the value(s) in the table below.
Standard voltage

Tester Connection	Specified Condition
VCP1 (A17-4) - EP1 (A17-5)	4.5 to 5.5 V
VCP2 (A17-1) - EP2 (A17-2)	4.5 to 5.5 V

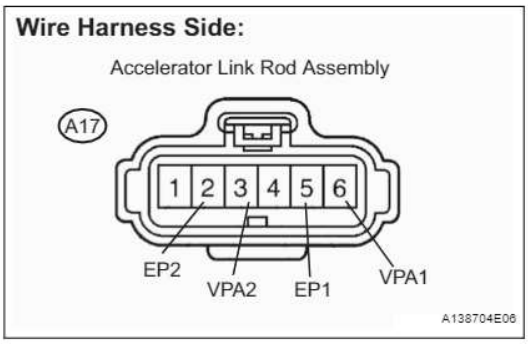
NOTICE:
Turning the power switch on (IG) with the accelerator link rod assembly connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → Go to step 5

OK

HV

3 CHECK HYBRID VEHICLE CONTROL ECU



(a) Turn the power switch off.
(b) Measure the resistance according to the value(s) in the table below.

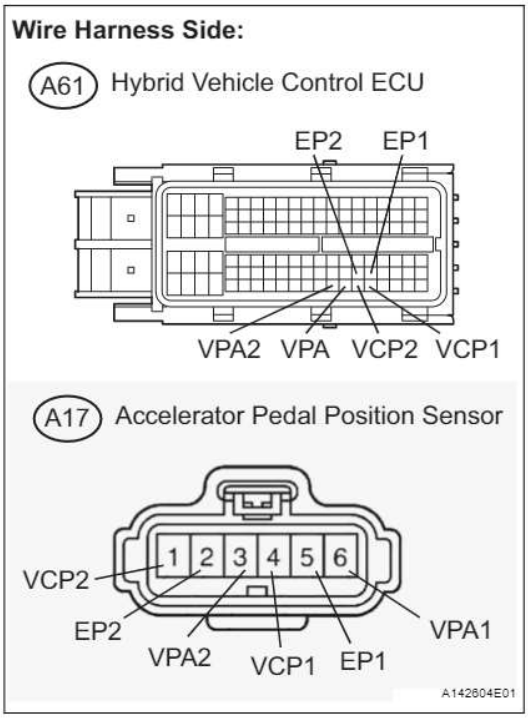
Standard resistance

Tester Connection	Specified Condition
VPA1 (A17-6) - EP1 (A17-5)	37 to 41 kΩ
VPA2 (A17-3) - EP2 (A17-2)	37 to 41 kΩ

OK → **REPLACE ACCELERATOR LINK ROD ASSEMBLY (See page HV-589)**

NG

4 CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR LINK ROD ASSEMBLY)



(a) Turn the power switch off.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
VPA (A61-106) - Body ground	Below 1 V
EP1 (A61-88) - Body ground	Below 1 V
VPA2 (A61-105) - Body ground	Below 1 V
EP2 (A61-87) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the accelerator link rod assembly and hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
VPA (A61-106) - VPA1 (A17-6)	Below 1 Ω
VCP1 (A61-107) - VCP1 (A17-4)	Below 1 Ω
EP1 (A61-88) - EP1 (A17-5)	Below 1 Ω
VPA2 (A61-105) - VPA2 (A17-3)	Below 1 Ω
VCP2 (A61-107) - VCP2 (A17-1)	Below 1 Ω
EP2 (A61-87) - EP2 (A17-2)	Below 1 Ω

Standard resistance (Check for short)

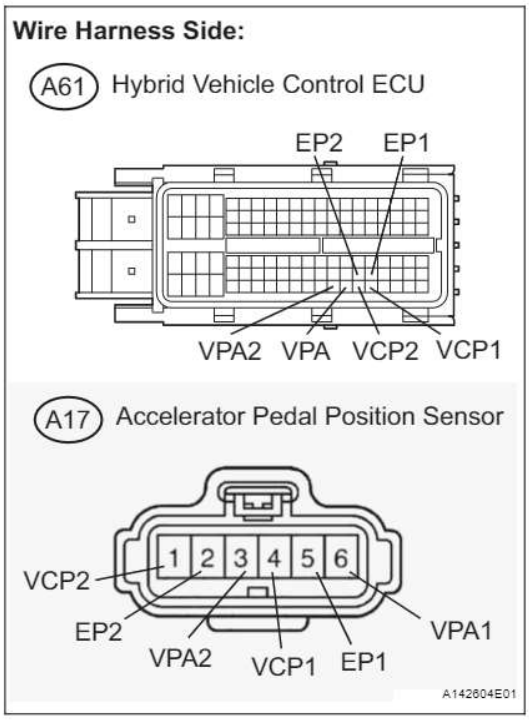
Tester Connection	Specified Condition
VPA (A61-106) or VPA1 (A17-6) - Body ground	10 kΩ or more
VCP1 (A61-107) or VCP1 (A17-4) - Body ground	10 kΩ or more
EP1 (A61-88) or EP1 (A17-5) - Body ground	10 kΩ or more
VPA2 (A61-105) or VPA2 (A17-3 - Body ground)	10 kΩ or more
VCP2 (A61-107) or VCP2 (A17-1) - Body ground	10 kΩ or more
EP2 (A61-87) or EP2 (A17-2) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

5 CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR LINK ROD ASSEMBLY)



(a) Turn the power switch off.
(b) Disconnect connector A61 from the hybrid vehicle control ECU.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
VCP1 (A61-65) - Body ground	Below 1 V
EP1 (A61-88) - Body ground	Below 1 V
VCP2 (A61-64) - Body ground	Below 1 V
EP2 (A61-87) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the accelerator link rod assembly and hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
VCP1 (A61-65) - VCP1 (A17-4)	Below 1 Ω
EP1 (A61-88) - EP1 (A17-5)	Below 1 Ω
VCP2 (A61-64) - VCP2 (A17-1)	Below 1 Ω
EP2 (A61-87) - EP2 (A17-2)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
VCP1 (A61-65) or VCP1 (A17-4) - Body ground	10 kΩ or more

HV

Tester Connection	Specified Condition
EP1 (A61-88) or EP1 (A17-5) - Body ground	10 kΩ or more
VCP2 (A61-64) or VCP2 (A17-1) - Body ground	10 kΩ or more
EP2 (A61-87) or EP2 (A17-2) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P2511-149	ECM/PCM Power Relay Sense Circuit Intermittent

DESCRIPTION

The hybrid vehicle control ECU monitors the +B power source voltage to detect an instantaneous interruption.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P2511	149	When the power switch is on (READY), the hybrid vehicle control ECU is reset.	• Wire harness or connector • Hybrid vehicle control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P3110-139 (See page HV-516).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK BATTERY TERMINAL

(a) Check the connection of the auxiliary battery terminal.

Result:

The terminal is connected securely and there is no contact problem.

NG → CONNECT SECURELY

OK

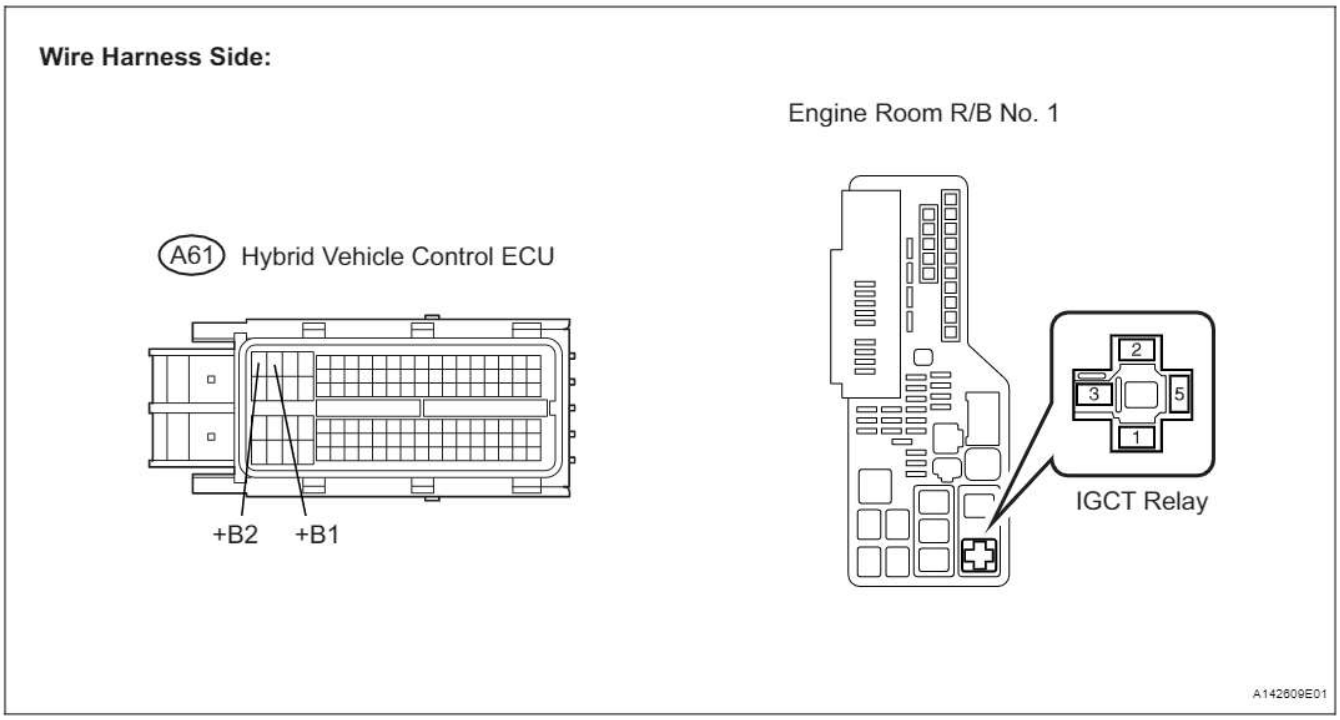
2	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - INTEGRATION RELAY)

(a) Remove the IGCT relay from the engine room R/B No. 1.



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

Standard resistance

Tester Connection	Specified Condition
+B1 (A61-2) - Engine room R/B No. 1 IGCT relay terminal 3	Below 1 Ω
+B2 (A61-1) - Engine room R/B No. 1 IGCT relay terminal 3	Below 1 Ω

HV

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4 CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems. (See page HV-17)
(1) Check the connection and terminal contact pressure of connectors and wire harness between the hybrid vehicle control ECU and the engine room R/B No. 1.
(2) When the power switch is on (READY), jiggle the connectors and wire harness between the hybrid vehicle control ECU and the engine room R/B No. 1.

NG → **REPAIR MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

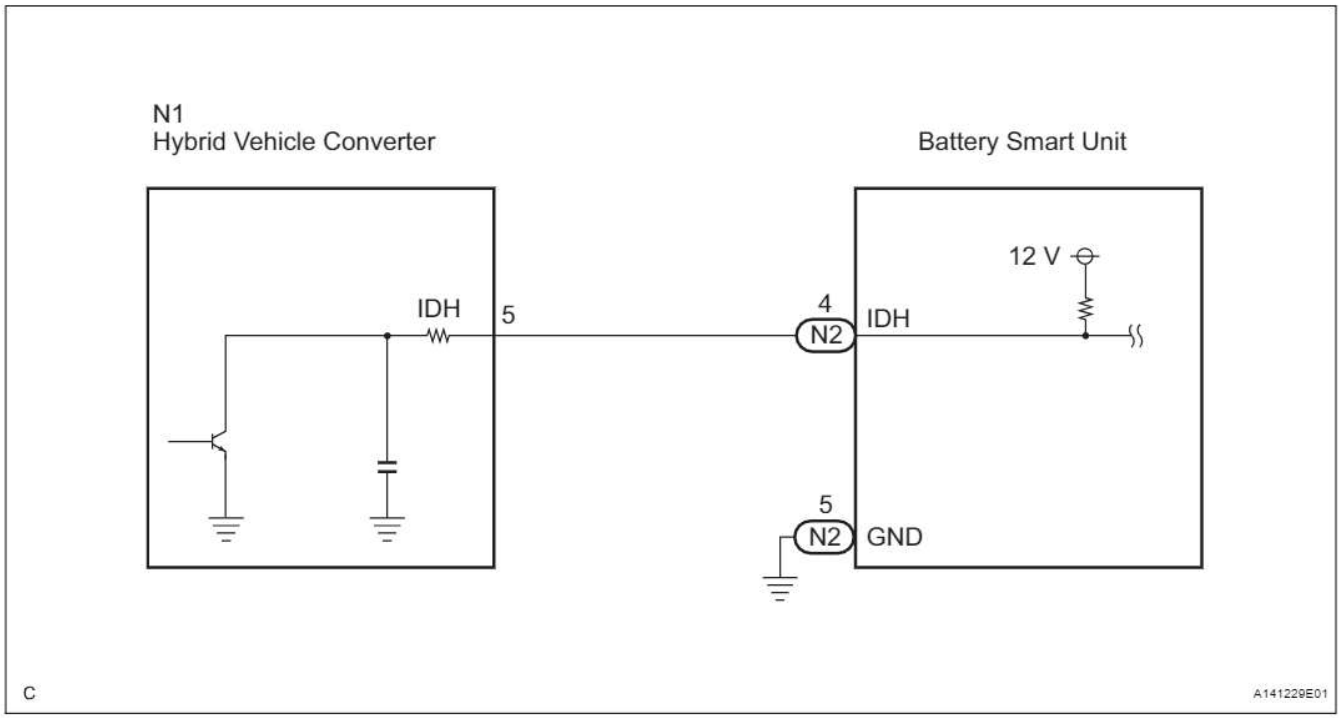
DTC	P2519-766	A/C Request "A" Circuit

DESCRIPTION

The hybrid vehicle 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 No.	INF Code	DTC Detection Condition	Trouble Area
P2519	766	Malfunction in the cooling fan operation condition signal circuit	• Battery smart unit • Hybrid vehicle converter (DC/DC converter) • Wire harness or connector

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

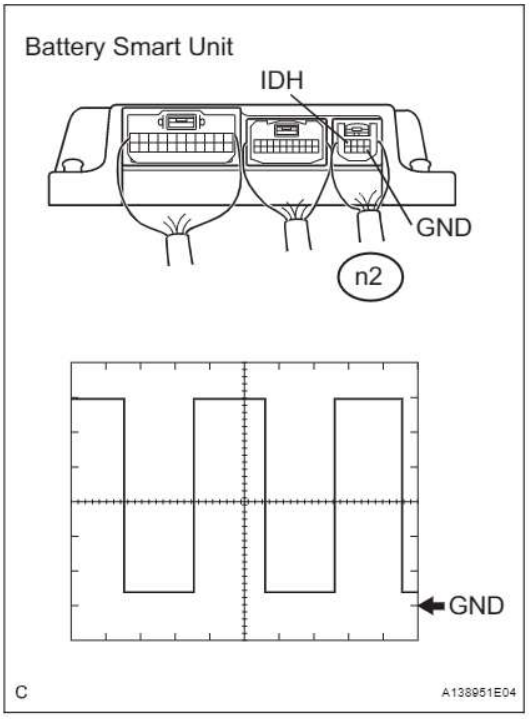
(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).

(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTC P0AE6-225 is also output.

YES	GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC

NO

2	CHECK BATTERY SMART UNIT



CAUTION:
Be sure to wear insulated gloves.
(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.
(b) 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	Power switch on (IG)

Result:
The waveform appears as shown in the illustration.
HINT:
- For the removal and installation procedures related to inspection of the waveform of the battery smart unit, (See page HB-99).
- 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.

OK	REPLACE BATTERY SMART UNIT (See page HB-99)

NG

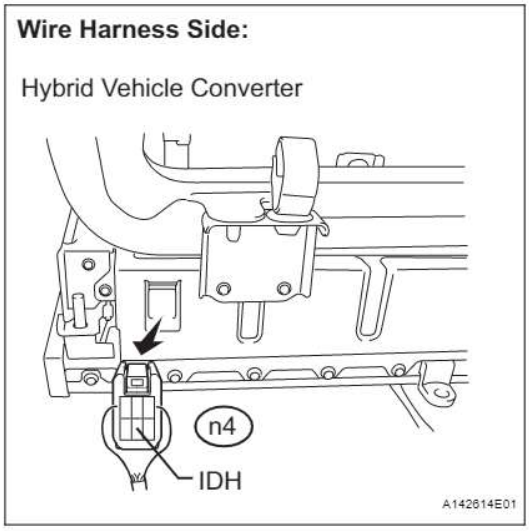
3	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG	CONNECT SECURELY

OK

HV

4	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER)



CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off.
(b) Check that the service plug grip is not installed.
(c) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(d) Turn the power switch on (IG).
(e) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
IDH (n4-5) - Body ground	9 to 14 V

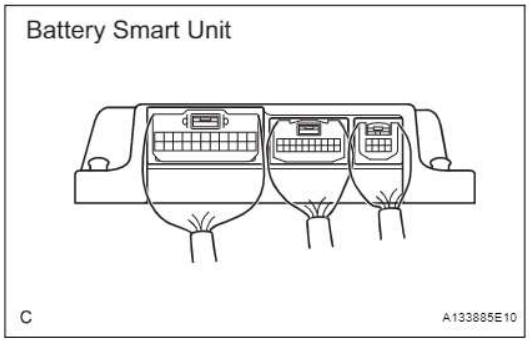
NOTICE:
Turning the power switch on (IG) with the hybrid vehicle converter connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

OK → **REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)**

NG

5	CHECK CONNECTOR CONNECTION CONDITION (BATTERY SMART UNIT CONNECTOR)

HV



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Check the connection of the battery smart unit connector.

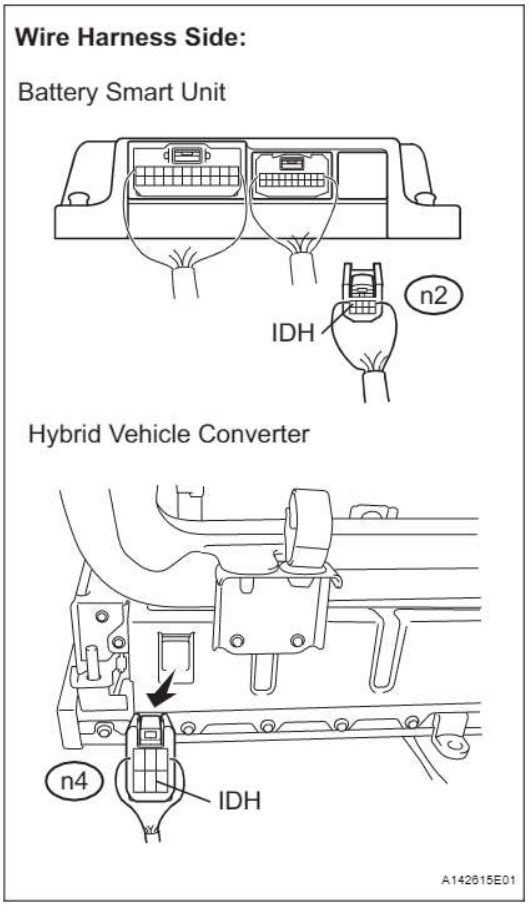
OK:
The connector is connected securely and there are no contact problems.

NG → **CONNECT SECURELY**

OK

6	CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HYBRID VEHICLE CONVERTER)

CAUTION:
Be sure to wear insulated gloves.



(a) Turn the power switch off.
(b) Check that the service plug grip is not installed.
(c) Disconnect the n2 battery smart unit connector (See page HB-99).
(d) Turn the power switch on (IG).
(e) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
IDH (n2-4) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle converter connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(f) Turn the power switch off.
(g) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
IDH (n2-4) - IDH (n4-5)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
IDH (n2-4) or IDH (n4-5) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

HV

OK

REPLACE BATTERY SMART UNIT (See page HB-99)

DTC	P2532-772	Ignition Switch Run Position Circuit High

DESCRIPTION

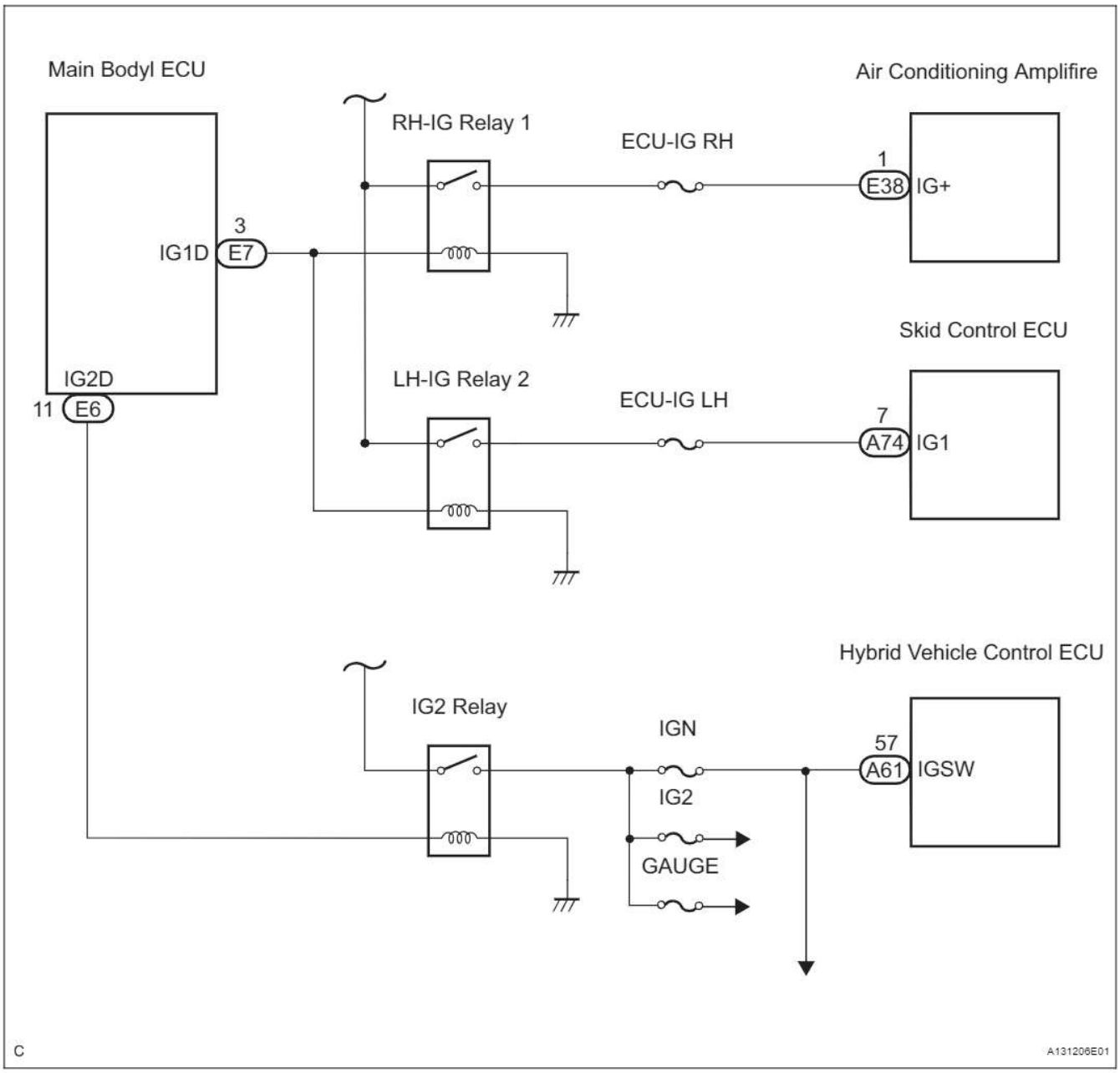
If a hybrid vehicle cannot be turned off, it will not be possible to determine this by listening or looking (high voltage cannot be shut off). In this case, checking for DTCs can help to determine the state of the vehicle. When the hybrid vehicle control ECU detects that the vehicle cannot be turned off, the ECU will set this DTC. This DTC is set based on communication between the hybrid vehicle control ECU and ECUs that are activated by the IG1 relay and IG2 relay.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P2532	772	When no signals are received from the ECUs (skid control ECU and A/C amplifier) that are activated by the IG1 relay, but the hybrid vehicle control ECU is operating.	• Wire harness or connector • Main body ECU • IG1 relay • IG2 relay • ECU IG No. 1 fuse • A/C No. 1 fuse • Hybrid vehicle control ECU

HINT:
If DTC P2532-772 is detected, it will not be possible to turn the vehicle off.

HV

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1 CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
The following DTC is output simultaneously.

DTC No.	Relevant Diagnosis
P2532-772	Ignition Switch Run Position Circuit High

NO → **Go to step 12**

YES

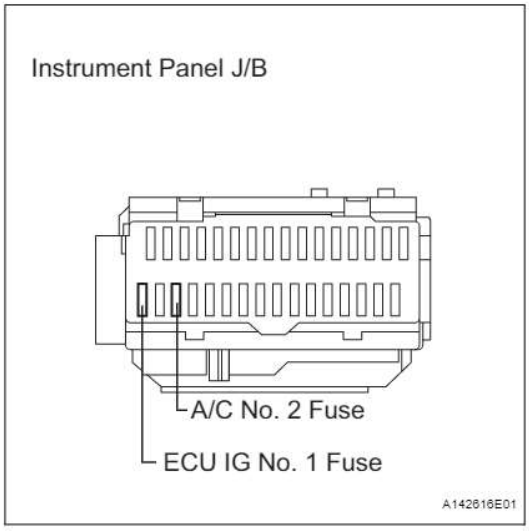
2 CHECK CAN COMMUNICATION SYSTEM (BUS CHECK)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Check BUS CHECK.
Result:
The screen displays the skid control ECU and A/C amplifier.

OK → **Go to step 7**

NG

3 CHECK FUSES (ECU IG NO. 1, A/C NO. 2)



(a) Remove the ECU IG No. 1 and A/C No. 2 fuses from the instrument panel J/B.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

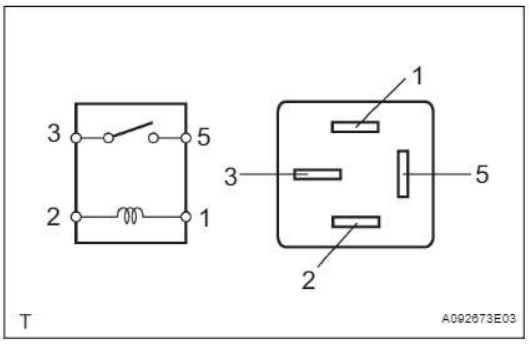
Fuse	Tester Connection	Specified Condition
ECU IG No. 1	1 - 2	Below 1 Ω
A/C No. 2	1 - 2	Below 1 Ω

(c) Install the fuses.

NG → **REPLACE FUSES**

OK

4 CHECK RELAY (IG1 RELAY)



(a) Remove the IG1 relay from the instrument panel J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

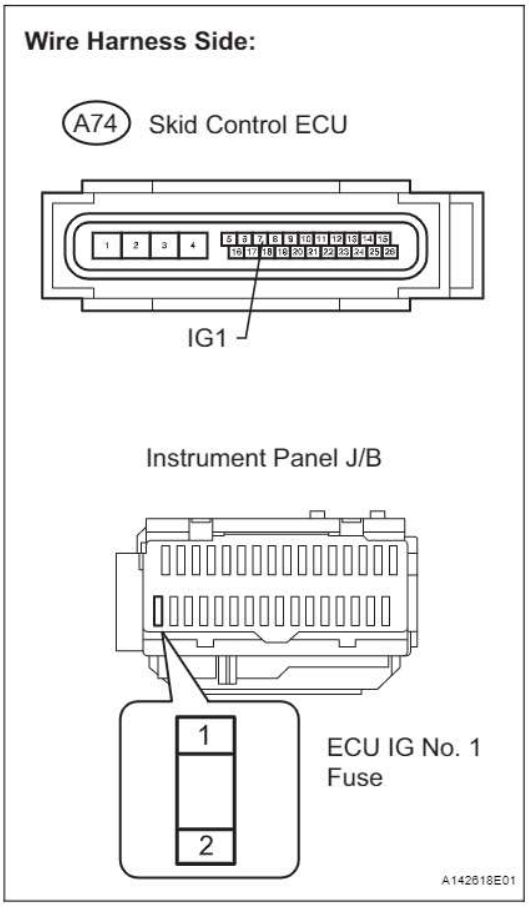
Tester Connection	Specified Condition
3 - 5	Below 1 Ω
3 - 5	10 kΩ or more (Apply battery voltage between terminals 1 and 2)

(c) Install the fuses.

NG → REPLACE RELAY

OK

5 CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - ECU IG NO. 1 FUSE)



(a) Disconnect the A74 skid control ECU connector.
(b) Remove the ECU IG No. 1 fuse from the instrument panel J/B.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

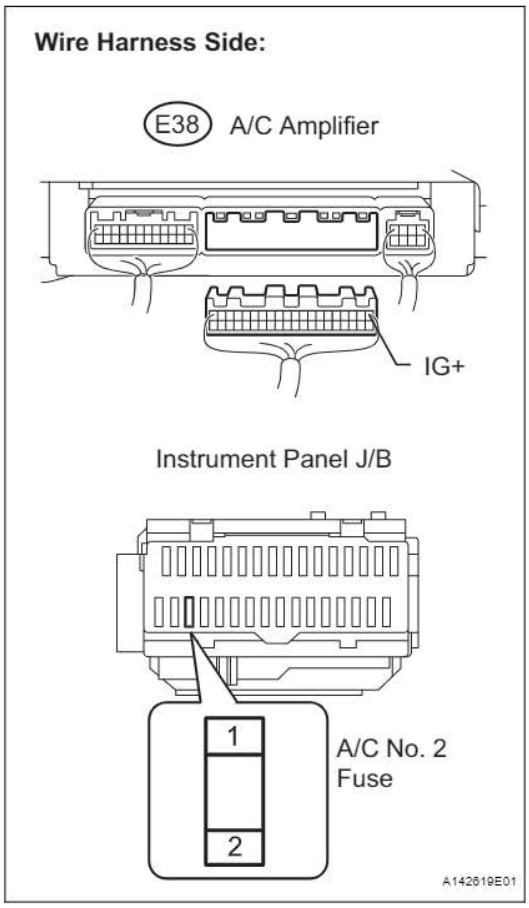
Tester Connection	Specified Condition
IG1 (A74-7) - Instrument panel J/B ECU IG No. 1 fuse terminal 2	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

HV

6	CHECK HARNESS AND CONNECTOR (A/C AMPLIFIER - A/C NO. 2 FUSE)



(a) Disconnect the E38 A/C amplifier connector.
(b) Remove the A/C No. 2 fuse from the instrument panel J/B.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
IG+ (E38-1) - Instrument panel J/B A/C No. 2 fuse terminal 2	Below 1 Ω

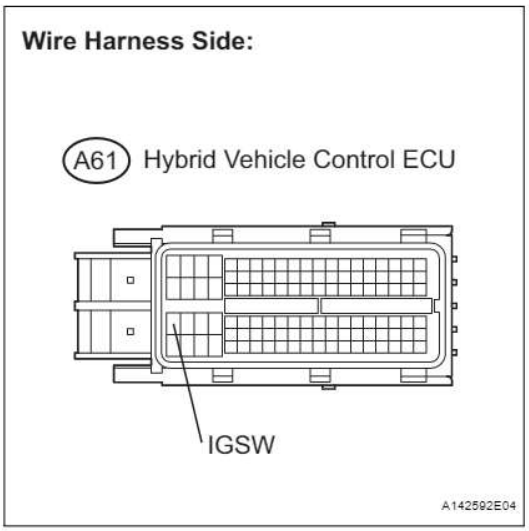
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

GO TO CAN COMMUNICATION SYSTEM

HV

7 CHECK HYBRID VEHICLE CONTROL ECU



(a) Turn the power switch off.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Measure the voltage according to the value(s) in the table below.

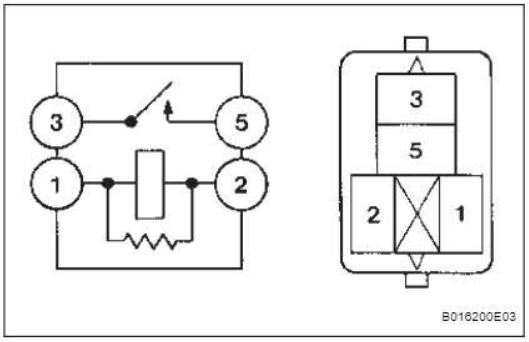
Standard voltage

Tester Connection	Specified Condition
IGSW (A61-57) - Body ground	Below 1 V

OK → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

NG

8 CHECK RELAY (IG2 RELAY)



(a) Disconnect the IG2 relay from the engine room R/B No. 1.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

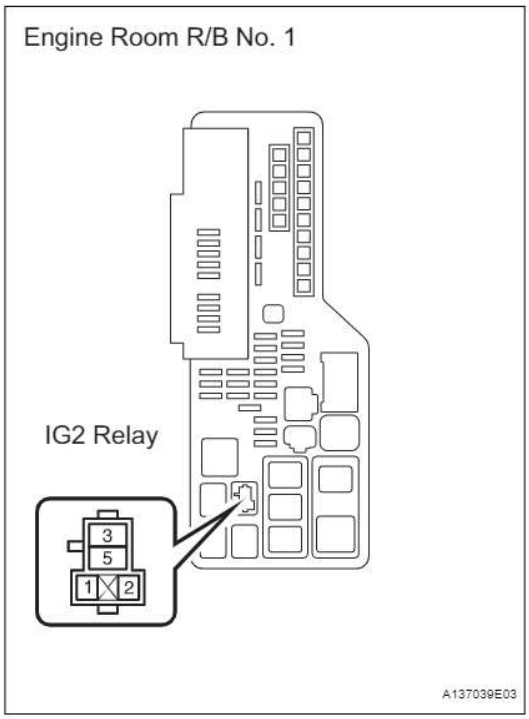
Tester Connection	Specified Condition
3 - 5	Below 1 Ω
3 - 5	10 kΩ or more (Apply battery voltage between terminals 1 and 2)

NG → **REPLACE RELAY**

OK

HV

9	CHECK MAIN BODY ECU



(a) Turn the power switch off.
(b) Connect the main body ECU connector.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
Engine room R/B No. 1 IG2 relay terminal 1 - Body ground	Below 1 V

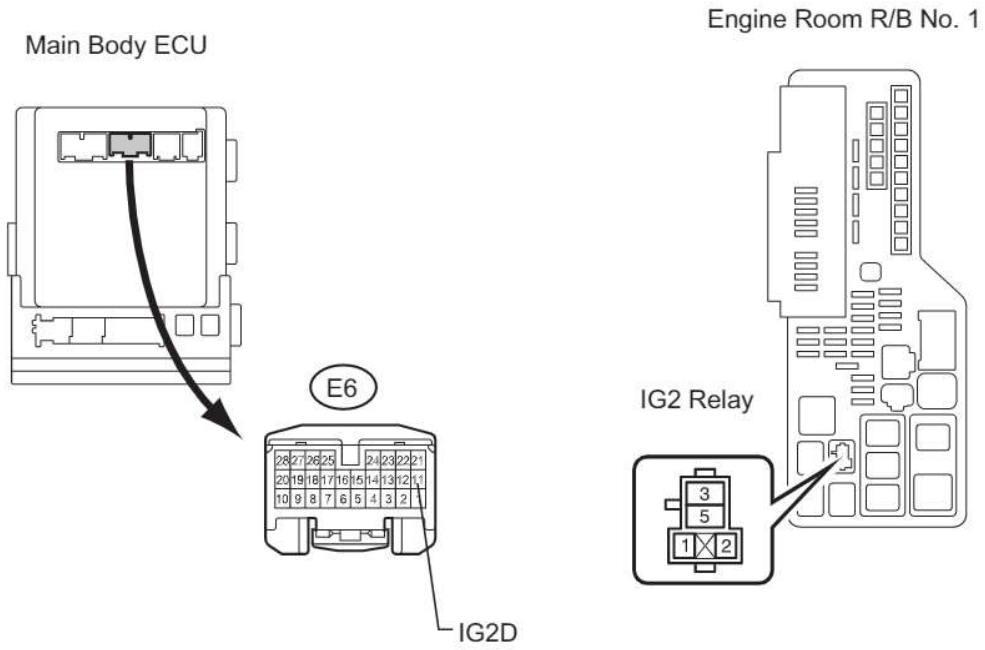
OK → Go to step 11

NG

10	CHECK HARNESS AND CONNECTOR (MAIN BODY ECU - IG2 RELAY)

(a) Disconnect the IG2 relay from the engine room R/B No. 1.

Wire Harness Side:



HV

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

Standard resistance

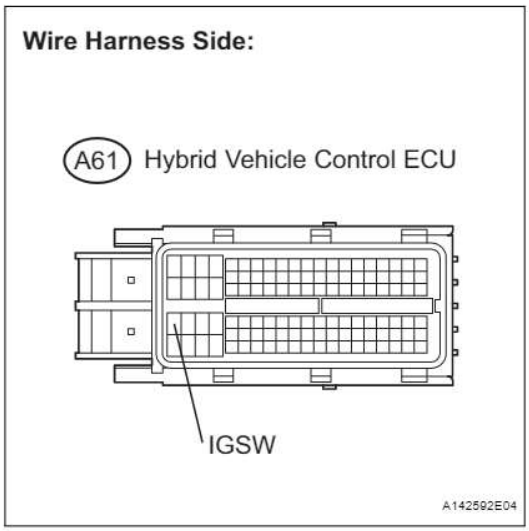
Tester Connection	Specified Condition
IG2D (E6-11) - Engine room R/B No. 1 IG2 relay terminal 1	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE MAIN BODY ECU

11	CHECK HARNESS AND CONNECTOR



(a) Turn the power switch off.
(b) Disconnect the F1 combination meter connector.
(c) Disconnect the A61 hybrid vehicle control ECU connector.
(d) Disconnect the E51 steering lock ECU connector.
(e) Disconnect the E58 certification ECU connector.
(f) Disconnect the A76 skid control ECU connector.
(g) Disconnect the E30 A/C amplifier connector.
(h) Disconnect the T10 or O4 occupant classification ECU connector.
(i) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
IGSW (A61-57) - Body ground	Below 1 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

12	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems (See page HV-17).

NG → REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P3000-388	HV Battery Malfunction

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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3000	388	Discharge inhibition control malfunction	• Fuel level • HV battery

INSPECTION PROCEDURE

CAUTION:

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

HINT:

- 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.

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTCs other than P3000-388 or P3000-389 are output.

YES → GO TO DTC CHART

NO

2	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

Engine control system DTCs are output.

YES → GO TO DTC CHART

NO

3	CHECK AMOUNT OF GASOLINE (See page HV-278)

NG → REFUEL VEHICLE

OK

4	CHECK ENGINE START

(a) Turn the power switch on (READY).
(b) Check if the engine starts.
HINT:
Depressing the accelerator pedal with the shift lever in the P position will cause the engine to start.
OK:
The engine starts.
HINT:
Do not turn the power switch on (READY) and off repeatedly because this may cause DTC P3000-389 to be set.

NO → REPLACE HV BATTERY ASSEMBLY (See page HB-104)

YES

LEAVE VEHICLE IN P POSITION, AND CHARGE HV BATTERY IN IDLE STATUS UNTIL IDLING STOPS

DTC	P3000-389	HV Battery Malfunction

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 if the HV battery is discharged excessively or the HV control system malfunctions.
HINT:
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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3000	389	HV battery voltage drops	• Engine assembly • Hybrid vehicle transaxle assembly • HV battery

INSPECTION PROCEDURE

CAUTION:

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

HINT:

- Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.
- If the vehicle is stopped or parked with the shift lever in the N position for a long time, DTC P3000-389 may be set because the HV battery cannot be charged.
- When the engine cannot be started, DTC P3000-389 may be set because the HV battery cannot be charged.

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTCs other than P3000-388 or P3000-389 are output.

HINT:
If the HV battery voltage has dropped due to a malfunction in other components (inverter with converter assembly, hybrid vehicle transaxle assembly), recharge or replace the HV battery and then repair the malfunctioning part.

YES → **GO TO DTC CHART**

NO

2	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
Engine control system DTCs are output.

YES → **GO TO DTC CHART**

NO

3	CHECK ENGINE START

(a) Turn the power switch on (READY).
(b) Check if the engine starts.
HINT:
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 the power 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 → **LEAVE VEHICLE IN P POSITION, AND CHARGE HV BATTERY IN IDLE STATUS UNTIL IDLING STOPS**

NO

4	CHECK CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

NG → **Go to step 5**

OK

5	CHECK CRANKSHAFT PULLEY REVOLUTION (N POSITION) (See page HV-279)

OK → **Go to step 7**

NG

HV

6	REPAIR OR REPLACE ENGINE ASSEMBLY

GO → Go to step 3

7	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

HX-10

GO → Go to step 3

HV

DTC	P3000-603	HV Battery Malfunction

DESCRIPTION

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

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3000	603	A HV battery cooling system error signal is detected in the hybrid vehicle control ECU.	• Hybrid vehicle control ECU • HV battery assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTCs other than P3000-603 are output.

YES → GO TO DTC CHART

NO

2	REPLACE HYBRID VEHICLE CONTROL ECU

(a) Replace the hybrid vehicle control ECU (See page HV-569).

NEXT

3	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTC P0A09-591 is output.

NEXT

4	RECONFIRM DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTCs other than P3000-603 are output.

YES → **REPLACE HV BATTERY ASSEMBLY (See page HB-81)**

NO

COMPLETED

HV

DTC	P3004-131	Power Cable Malfunction

DESCRIPTION

Refer to description for P0AE6-225 (See page HV-412).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3004	131	The inverter voltage is not boosted during precharge (time from when SMRP turns on until when SMRG turns on).	• HV relay assembly • Frame wire • Inverter with converter assembly • HV battery • Wire harness or connector • Hybrid vehicle converter (DC/DC converter)

WIRING DIAGRAM

Refer to the wiring diagram for P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Related Part
P0A95	Electric vehicle fuse circuit
P0AE7-224, P0AE6-225	SMRP control line circuit
P0ADC-226, P0ADB-227	SMRB control line circuit
P0A1F, P3105, P0AFA	Battery smart unit, VB sensor circuit
P0ABF, P0AC0, P0AC1, P0AC2	IB sensor circuit
P3004-800, 801	High-voltage power source line circuit
P0A1A-156, 658, 151, 155, 659 P0A1B-511, 164, 163, 512, 193, 786, 788, 661 P0A78-266, 267, 523, 586, P0A94-442	VH sensor circuit

YES → GO TO DTC CHART

NO

2	CHECK FREEZE FRAME DATA

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Read output DTCs.
(e) Read the freeze frame data for DTC P3004-131.

Result

Result	Proceed to
Post-boost voltage (VH) is below 50 V and difference between HV battery voltage (PWR RESOURCE VB) and pre-boost voltage (VL) is 50 V or less.	A
Other than above	B

A → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

B

3	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

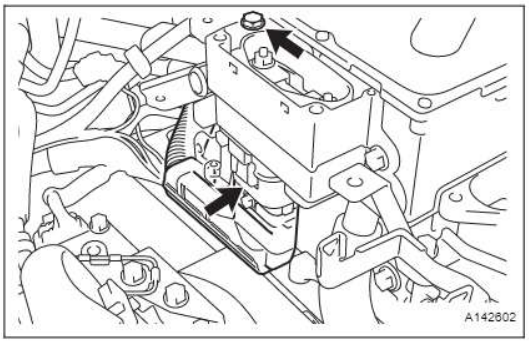
NG → CONNECT SECURELY

OK

HV

4	CHECK CONDITION OF FRAME WIRE CONNECTION(S) (INVERTER WITH CONVERTER ASSEMBLY SIDE)

CAUTION:
Be sure to wear insulated gloves.
(a) Turn the power switch off and remove the service plug grip. (See page HV-1)
(b) 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.

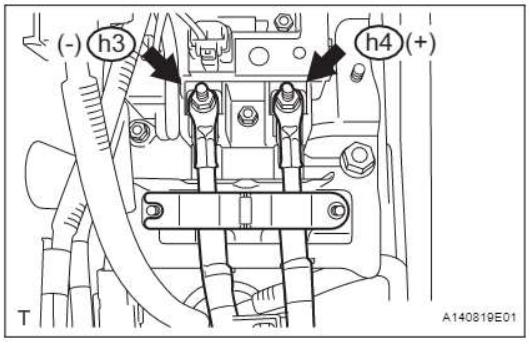


NG → CONNECT SECURELY

OK

5	CHECK CONDITION OF FRAME WIRE CONNECTION(S) (HV RELAY ASSEMBLY SIDE)

CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.



(b) Check the connections between the frame wire and the HV relay assembly.
HINT:
For the removal and installation procedures related to inspection of the frame wire connection, (See page HB-104).

Torque: 9.0 N*m (92 kgf*cm, 81 in.*lbf)

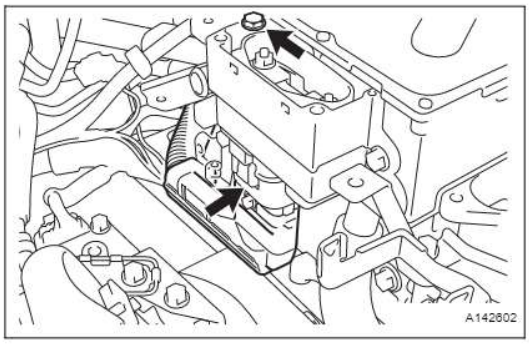
NG → **CONNECT SECURELY**

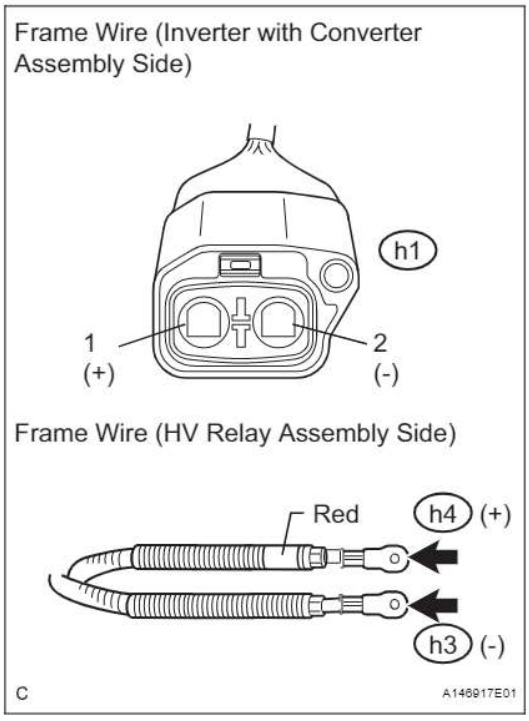
OK

6 CHECK FRAME WIRE

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the frame wire from the inverter with converter assembly (See page HV-558).
(c) Disconnect the frame wire from the HV relay assembly (See page HB-104).





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

Tester Connection	Specified Condition
h1-1 (High voltage +) - h4-1 (High voltage +)	Below 1 Ω
h1-2 (High voltage -) - h3-1 (High voltage -)	Below 1 Ω

NG → **REPLACE FRAME WIRE**

OK

HV

7	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

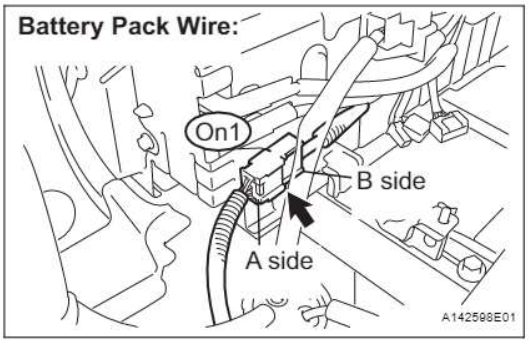
NG → CONNECT SECURELY

OK

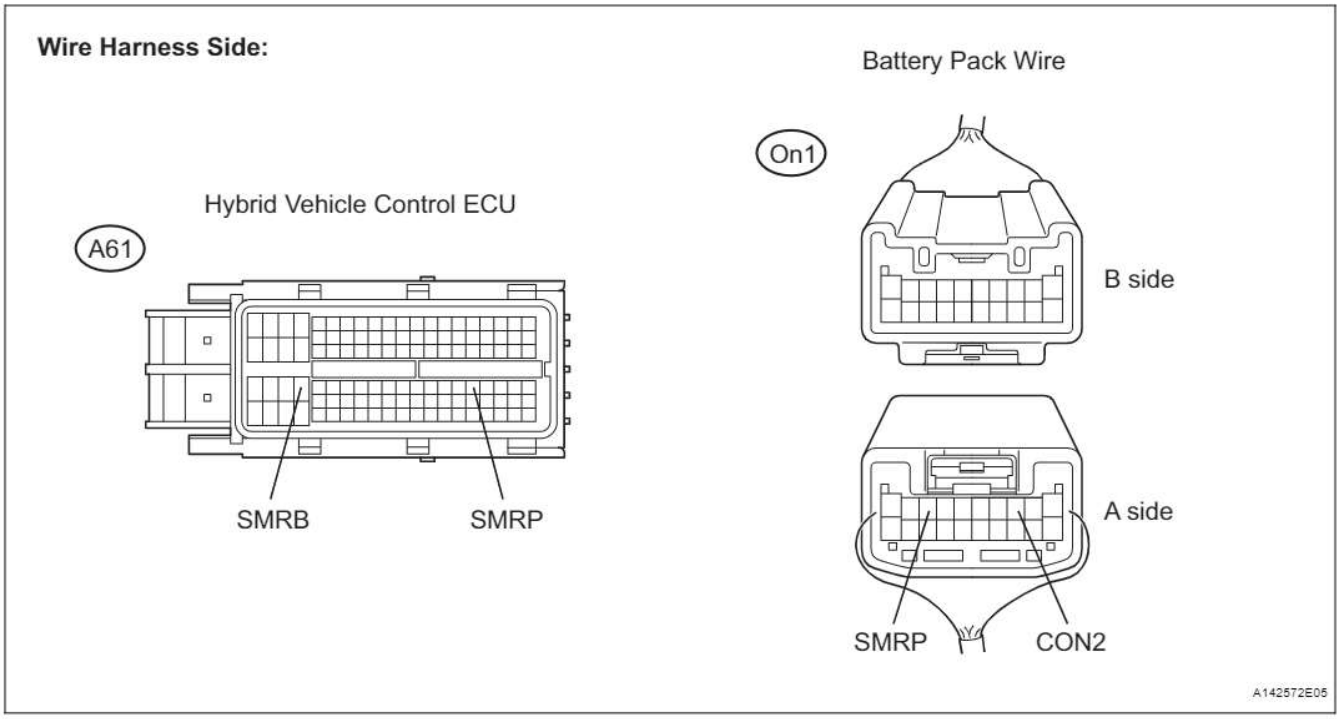
8	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR)

NOTICE:
Be sure to wear insulated groves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Disconnect the On1 battery pack wire connector (See page HB-81).
HINT:
Due to the time required to disconnect the HV relay assembly and hybrid vehicle converter connectors, the battery pack wire resistance check should be performed before these connectors are disconnected.
(d) Measure the resistance according to the value(s) in the table below.



HV



Standard resistance

Tester Connection	Specified Condition
SMRB (A61-60) - CON2 (On1-3)	Below 1 Ω
SMRP (A61-72) - SMRP (On1-8)	Below 1 Ω

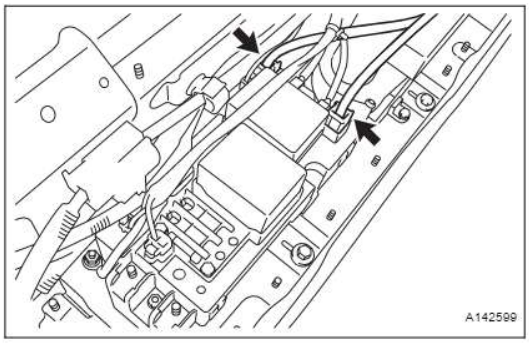
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

9	CHECK CONDITION OF MAIN BATTERY CABLE CONNECTION(S)

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Check the connections between the main battery cable and the HV relay assembly.



Result

Result	Proceed to
The connectors are connected securely and there are no contact problems.	A
The connectors are not connected securely.	B
The HV relay assembly connector is damaged.	C
The main battery cable is damaged.	D

HINT:
The main battery cable and HV battery are supplied as one unit.

B → CONNECT SECURELY

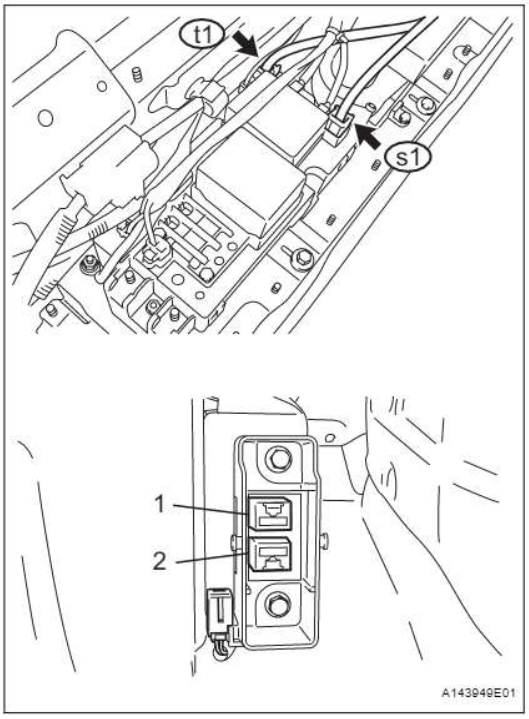
C → REPLACE HV RELAY ASSEMBLY (See page HB-104)

D → REPLACE HV BATTERY ASSEMBLY (See page HB-81)

A

10	CHECK HV BATTERY ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.



(a) Check that the service plug grip is not installed.
(b) Disconnect the main battery cable from the HV relay assembly (See page HB-104).
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
s1-1 - Service plug grip terminal 1	114 to 119 V
t1-1 - Service plug grip terminal 2	126 to 210 V

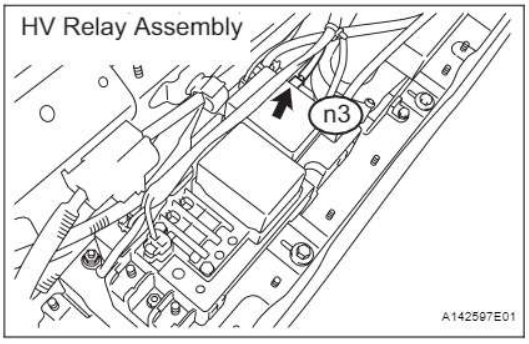
CAUTION:
Do not allow the probes of the electrical tester to contact each other during this inspection.

NG → **REPLACE HV BATTERY ASSEMBLY (See page HB-81)**

OK

11	CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR)

HV



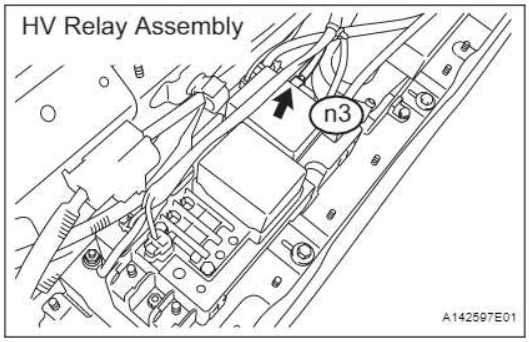
CAUTION:
Be sure to wear insulated gloves.
(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.
(b) Check the connections of the HV relay assembly connectors.
Result:
The connectors are connected securely and there are no contact problems.
HINT:
For the removal procedure of the HV relay assembly connector, (See page HB-104).

NG → **CONNECT SECURELY**

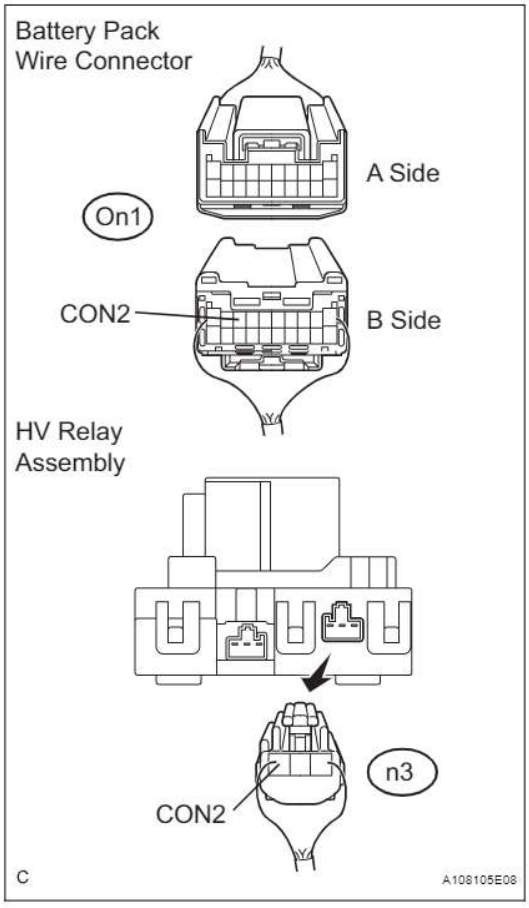
OK

12	CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.



(b) Disconnect the n3 HV relay assembly connector.



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

Standard resistance

Tester Connection	Specified Condition
CON2 (On1-3) - CON2 (n3-3)	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

13	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → **CONNECT SECURELY**

OK

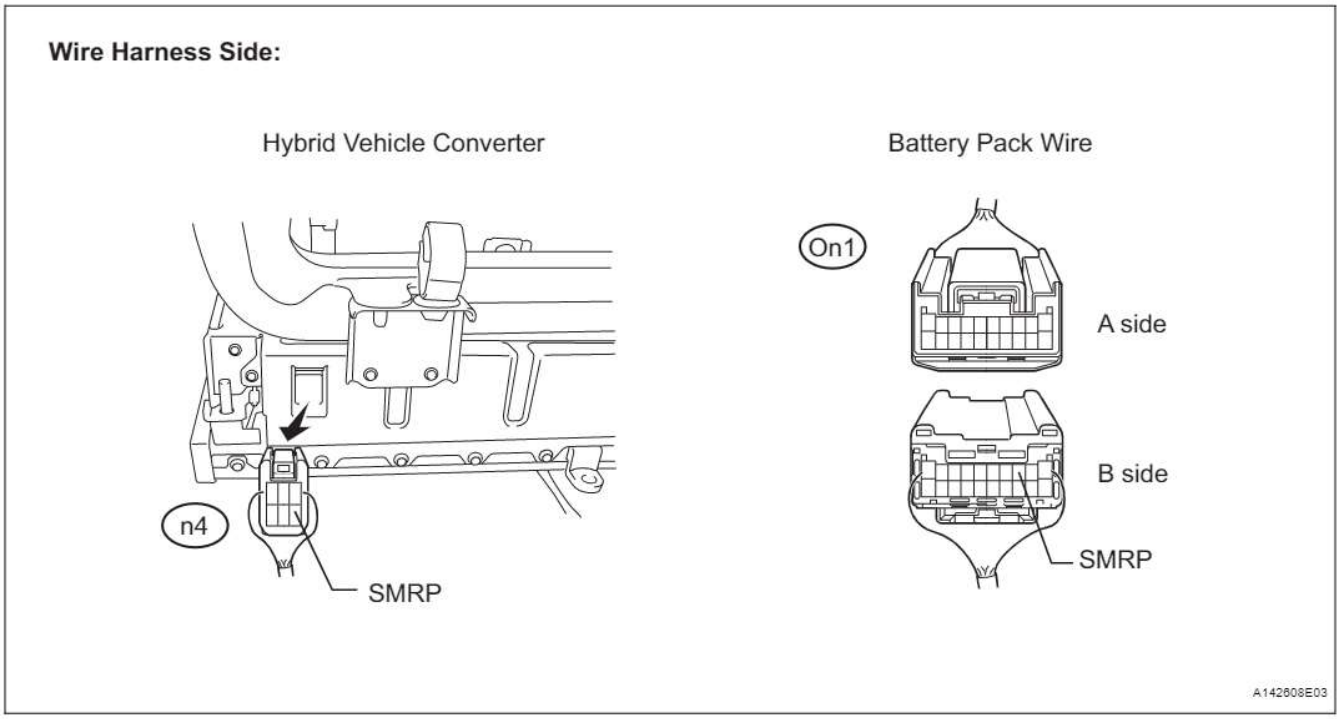
14	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR)

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

HV

(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Measure the resistance according to the value(s) in the table below.



Standard resistance

Tester Connection	Specified Condition
SMRP (On1-8) - SMRP (n4-4)	Below 1 Ω

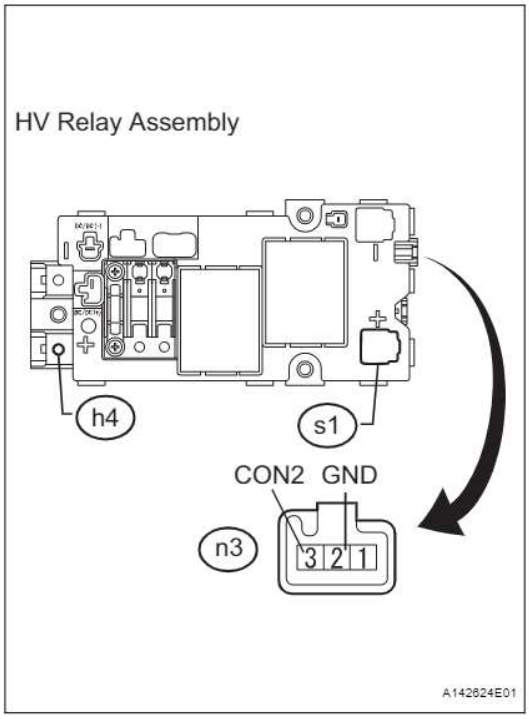
HV

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

15	INSPECT HV RELAY ASSEMBLY (SMRB)

CAUTION:
Be sure to wear insulated gloves and protective goggles.
(a) Check that the service plug grip is not installed.
(b) Remove the HV relay assembly from the vehicle (See page HB-104).



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

Standard resistance

Tester Connection	Specified Condition
h4-1 - s1-1	Below 1 Ω (When battery voltage (12 V) applied to terminals n3-2 and n3-3)

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

Standard resistance

Tester Connection	Specified Condition
CON2 (n3-3) - GND (n3-2)	18.8 to 32.1 Ω at -35 to 80°C (-31 to 176°F)

NG → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

OK

16	CHECK FOR INTERMITTENT PROBLEMS

HINT:
If DTC P3004-131 is output again after performing the inspection, replace the hybrid vehicle converter. If DTC P3004-131 is not output, replace the HV relay assembly.

YES → **REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)**

NO

REPLACE HV RELAY ASSEMBLY (See page HB-104)

HV

DTC	P3004-132	Power Cable Malfunction

DESCRIPTION

Refer to the description for P0AE6-225 (See page HV-412).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3004	132	The inverter is not precharged	• HV relay assembly • Frame wire • Inverter with converter assembly • HV battery • Wire harness or connector

WIRING DIAGRAM

Refer to the wiring diagram for P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

YES → GO TO DTC CHART

NO

2	CHECK FREEZE FRAME DATA

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Read output DTCs.
(e) Read the freeze frame data for DTC P3004-132.

Result

Result	Proceed to
Difference between HV battery voltage (PWR RESOURCE VB) and pre-boost voltage (VL) is 50 V or less, difference between HV battery voltage (PWR RESOURCE VB) and post-boost voltage (VH) is more than 70 V, and difference between pre-boost voltage (VL) and post-boost voltage (VH) is more than 90 V.	A
HV battery current (IB) is 3 A or more.	B
Other than above	C

A → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

B → GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P3004-800)

C

3	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

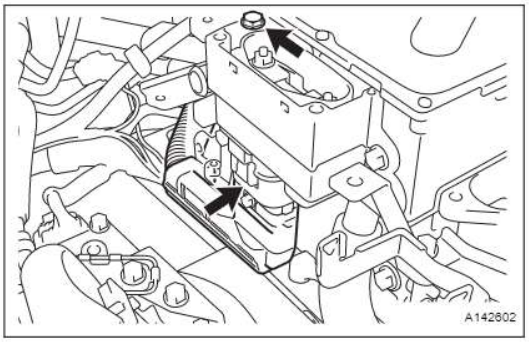
4	CHECK CONDITION OF FRAME WIRE CONNECTION(S) (INVERTER WITH CONVERTER ASSEMBLY SIDE)

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).

NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

HV

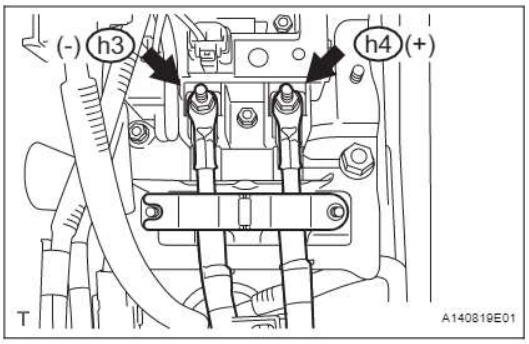


(b) Check the connections between the frame wire and the inverter with converter assembly.
OK:
The connectors are connected securely and there are no contact problems.

NG → **CONNECT SECURELY**

OK

5	CHECK CONDITION OF FRAME WIRE CONNECTION(S) (HV RELAY ASSEMBLY SIDE)



CAUTION:
Be sure to wear insulated gloves.
(a) Check that the service plug grip is not installed.
(b) Check the connections between the frame wire and the HV relay assembly.
HINT:
For the removal and installation procedures related to inspection of the frame wire connection, (See page HB-104).
Torque: 9.0 N*m (92 kgf*cm, 81 in.*lbf)

NG → **CONNECT SECURELY**

HV

OK

6	CHECK FRAME WIRE (See page HV-481)

NG → **REPLACE FRAME WIRE**

OK

7	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

NG → **CONNECT SECURELY**

OK

8	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - BATTERY PACK WIRE CONNECTOR) (See page HV-482)

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

9	CHECK CONDITION OF MAIN BATTERY CABLE CONNECTION(S) (See page HV-483)

B → CONNECT SECURELY

C → REPLACE HV RELAY ASSEMBLY (See page HB-104)

D → REPLACE HV BATTERY ASSEMBLY (See page HB-81)

A

10	CHECK HV BATTERY ASSEMBLY (See page HV-483)

NG → REPLACE HV BATTERY ASSEMBLY (See page HB-81)

OK

11	CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR) (See page HV-484)

NG → CONNECT SECURELY

OK

12	CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR) (See page HV-484)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

13	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR)

NG → CONNECT SECURELY

OK

14	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONVERTER - BATTERY PACK WIRE CONNECTOR) (See page HV-485)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

HV

OK

15	INSPECT HV RELAY ASSEMBLY (SMRB) (See page HV-486)

NG → REPLACE HV RELAY ASSEMBLY (See page HB-104)

OK

16	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

17	CHECK FOR INTERMITTENT PROBLEMS

(a) Connect the intelligent tester to the DLC3.
(b) Check for intermittent problems (See page HV-17).
(c) Turn the power switch on (READY).
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(e) Check if DTCs are output.

HV

Result

Result	Proceed to
DTC P3004-131 is output (SMRP may remain off).	A
DTC P3004-132 is output.	B
No DTC is output.	C

A → GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P3004-131)

B → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HB-123)

C

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HB-123)

DTC	P3004-800	Power Cable Malfunction

DTC	P3004-801	Power Cable Malfunction

DESCRIPTION

Refer to the description for P0AE6-225 (See page HV-412).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3004	800	Excessive overcurrent occurs during precharge (time from when SMRP turns on until when SMRG turns on).	• Wire harness or connector • Air conditioning harness assembly • Compressor with motor assembly • Inverter with converter assembly • HV relay assembly • Floor wire • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU
P3004	801	Minimal overcurrent occurs during precharge (time from when SMRP turns on until when SMRG turns on).	• Wire harness or connector • Air conditioning harness assembly • Compressor with motor assembly • Inverter with converter assembly • HV relay assembly • Floor wire • Hybrid vehicle converter (DC/DC converter) • Hybrid vehicle control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0AE6-225 (See page HV-413).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Related Part
P0A09-265, P0A10-263	Hybrid vehicle converter circuit
P0AFA, P0A1F, P3105	VB sensor circuit, battery smart unit circuit
P0ABF, P0AC0, P0AC1, P0AC2	IB sensor circuit

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

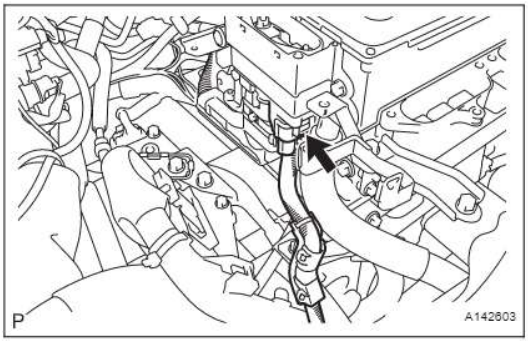
OK

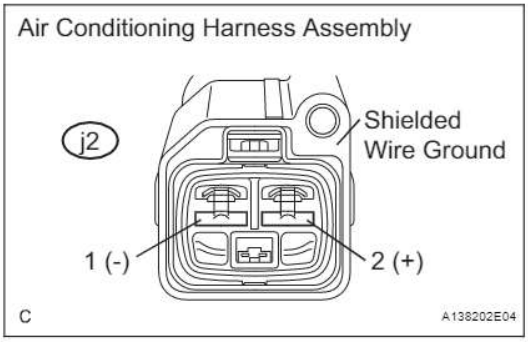
3	CHECK COMPRESSOR WITH MOTOR ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip. (See page HV-1)
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the air conditioning harness from the inverter with converter assembly (See page HV-558).





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

Tester Connection	Specified Condition
j2-1 - j2-2	100 kΩ or more

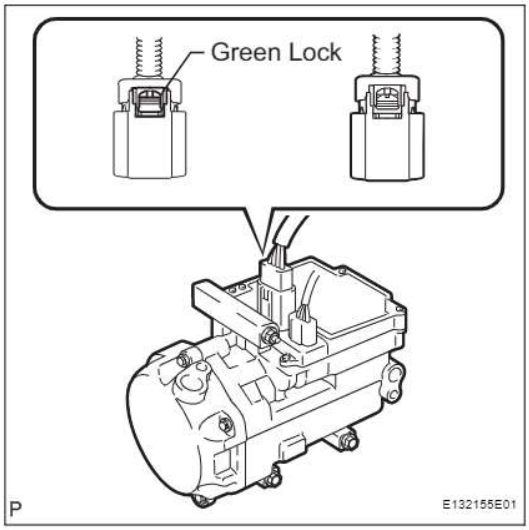
NOTICE:
- **Do not use a megohmeter.**
- **Make sure that the tester probes are connected to the correct terminals.**

OK → Go to step 5

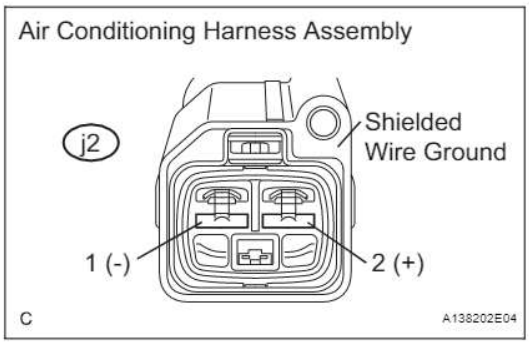
NG

4	CHECK AIR CONDITIONING HARNESS ASSEMBLY

CAUTION:
Be sure to wear insulated gloves.



(a) Check that the service plug grip is not installed.
(b) Disconnect the air conditioning harness from the compressor with motor assembly.



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

Standard resistance

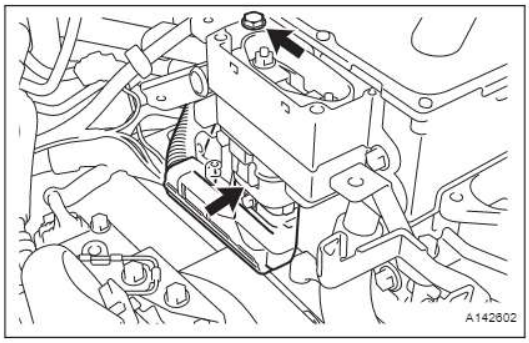
Tester Connection	Specified Condition
j2-1 - j2-2	10 MΩ or more

NG → **REPLACE AIR CONDITIONING HARNESS ASSEMBLY**

OK

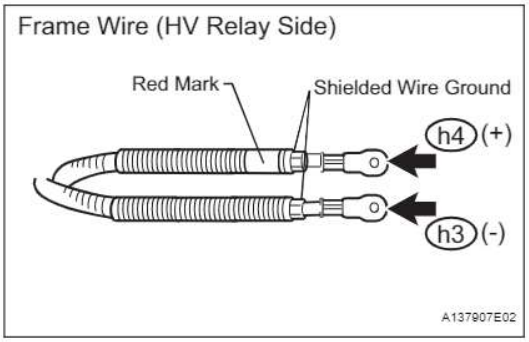
REPLACE COMPRESSOR WITH MOTOR ASSEMBLY

5	CHECK FRAME WIRE



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Remove the A/C fuse cover from the inverter with converter assembly.
(c) Disconnect the frame wire from the inverter with converter assembly (See page HV-558).
(d) Disconnect the frame wire from the HV relay assembly (See page HB-104).



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

Standard resistance

Tester Connection	Specified Condition
h4-1 (High voltage +) - h3-1 (High voltage -)	10 kΩ or more

NG → **REPLACE FRAME WIRE**

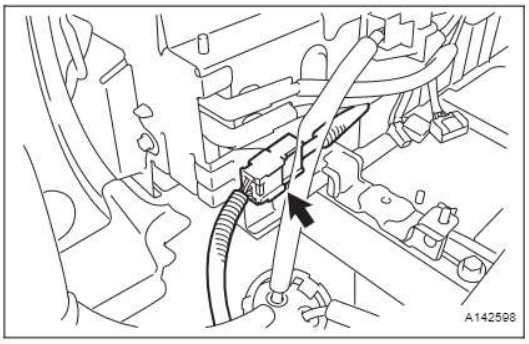
OK

6	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

NG → **CONNECT SECURELY**

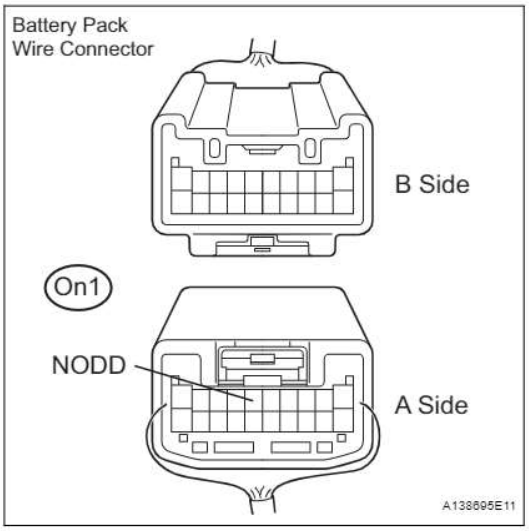
OK

7	CHECK HARNESS AND CONNECTOR



(a) Turn the power switch off.

(b) Disconnect the On1 battery pack wire connector (See page HB-81).



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

Standard resistance

Tester Connection	Specified Condition
NODD (On1-6) - Body ground	120 to 140 kΩ

NG → **Go to step 12**

OK

8	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONVERTER CONNECTOR) (See page HV-120)

NG → CONNECT SECURELY

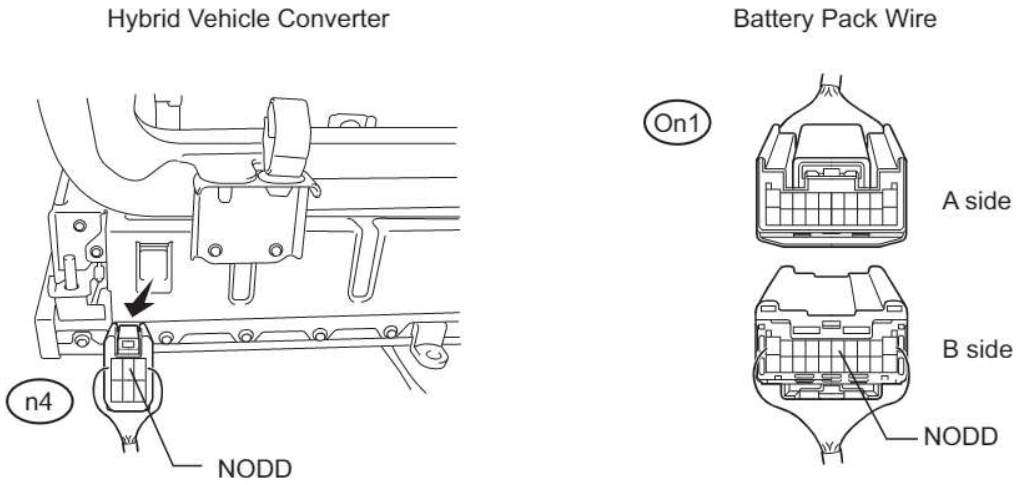
OK

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

CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the n4 hybrid vehicle converter connector (See page HB-123).
(c) Measure the resistance according to the value(s) in the table below.

Wire Harness Side:



Standard resistance (Check for open)

Tester Connection	Specified Condition
NODD (On1-6) - NODD (n4-2)	Below 1 Ω

Standard resistance (Check for short)

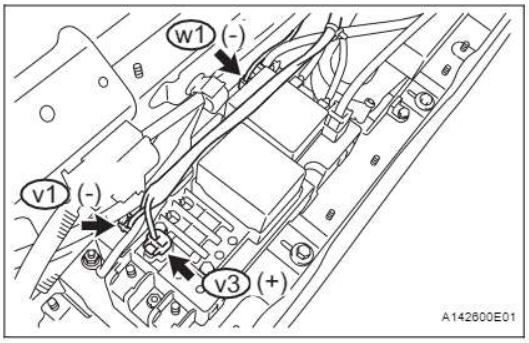
Tester Connection	Specified Condition
NODD (On1-6) or NODD (n4-2) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

HV

10	CHECK HYBRID VEHICLE CONVERTER



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the hybrid vehicle converter connectors from the HV relay assembly (See page HB-104).
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
v1-1 (High voltage -) - v3-1 (High voltage +)	100 kΩ or more
v3-1 (High voltage +) - w1-1 (High voltage precharge)	1 MΩ or more

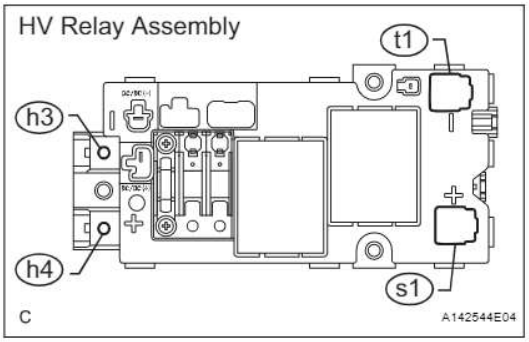
NOTICE:
- **Do not use a megohmmeter.**
- **Make sure that the tester probes are connected to the correct terminals.**

NG → **REPLACE HYBRID VEHICLE CONVERTER (See page HB-123)**

OK

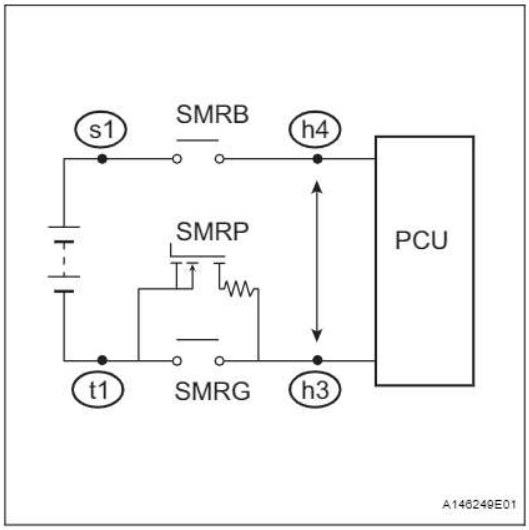
11	CHECK HV RELAY ASSEMBLY

HV



CAUTION:
Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.
(b) Disconnect the high voltage connectors from the HV relay assembly (See page HB-104).



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

Standard resistance

Tester Connection	Specified Condition
h4-1 - h3-1	10 kΩ or more

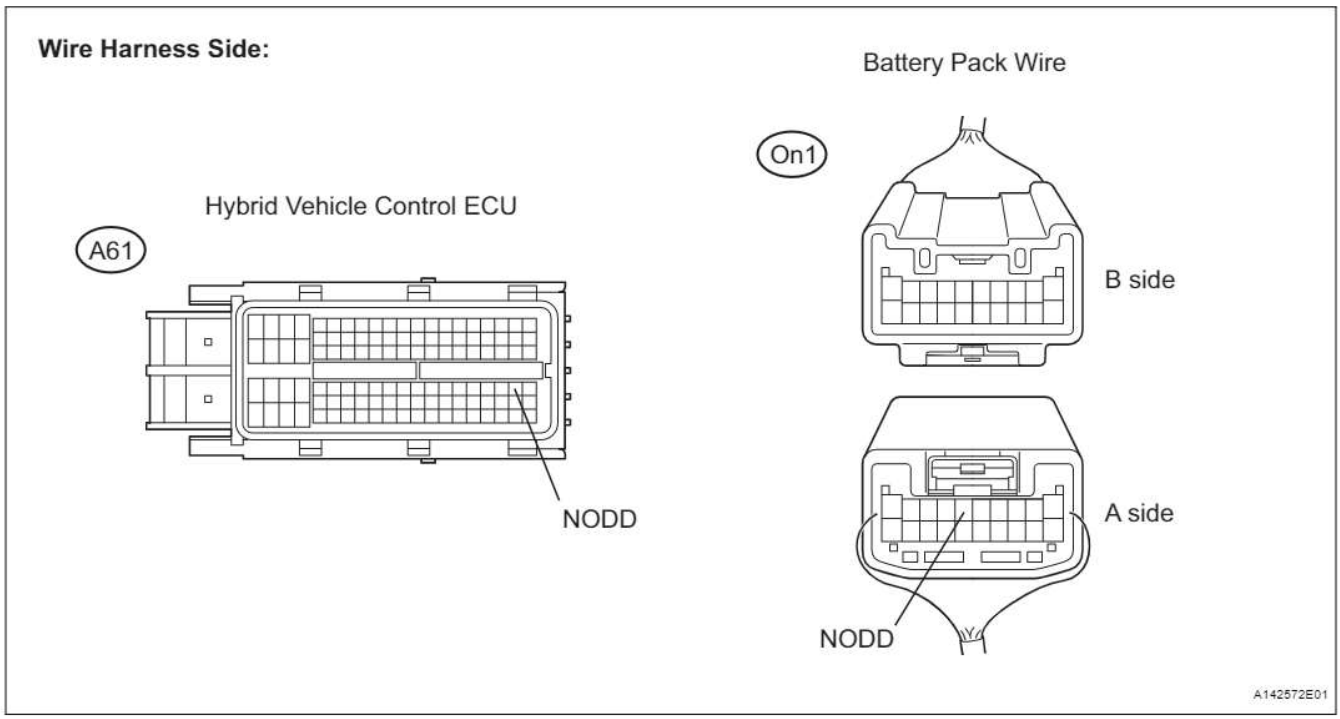
NG → **REPLACE HV RELAY ASSEMBLY (See page HB-104)**

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

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

(a) Disconnect the A61 hybrid vehicle control ECU connector.



(b) Turn the power switch off.

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

Standard resistance (Check for open)

Tester Connection	Specified Condition
NODD (A61-75) - NODD (On1-6)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
NODD (A61-75) or NODD (On1-6) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P3004-803	Power Cable Malfunction

DESCRIPTION

Refer to the description for P0AE6-225 (See page HV-412).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3004	803	While the power switch is ON (READY), the voltage in the inverter with converter assembly (VL, VH) decreases.	• Wire harness or connector • HV relay assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

HV

Result

DTC No.	Relevant Part
P0A95, P0AFA	Open in EV battery 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

YES → GO TO DTC CHART

NO

2	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

3	RECONFIRM DTC OUTPUT

(a) Turn the power switch on (READY), move the shift lever to the D position, and depress both the accelerator pedal and brake pedal.
HINT:
- 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 AND BRK in the inappropriate operation and history data to be counted.

(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(c) Check if DTCs are output.

Result

Result	Proceed to
P3004-803 is output, or no DTCs are output.	A
Power switch is not turned on (READY) and P3004-131 is output.	B

B → GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P3004-131)

A

HV

4	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

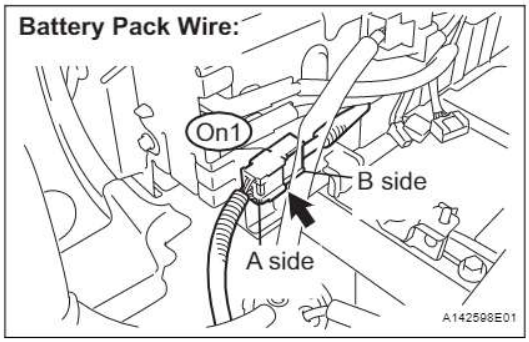
5	CHECK CONNECTOR CONNECTION CONDITION (BATTERY PACK WIRE CONNECTOR) (See page HV-118)

NG → CONNECT SECURELY

OK

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

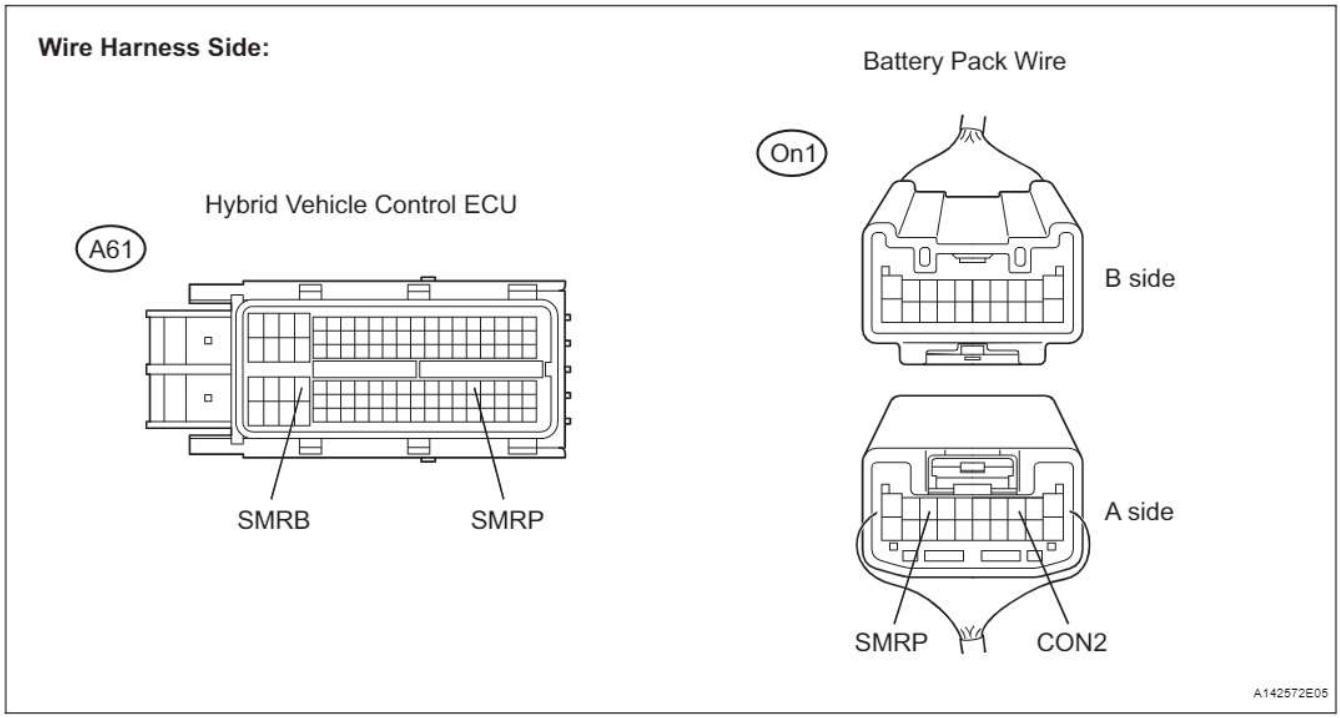
CAUTION:
Be sure to wear insulated gloves.
(a) Turn the power switch off and remove the service plug grip. (See page HV-1)



(b) Disconnect the A61 hybrid vehicle control ECU connector.

(c) Disconnect the On1 battery pack wire connector (See page HB-81).
HINT:
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.

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



Standard resistance

Tester Connection	Specified Condition
SMRB (A61-60) - CON2 (On1-3)	Below 1 Ω
SMRG (A61-96) - CON3 (On1-2)	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

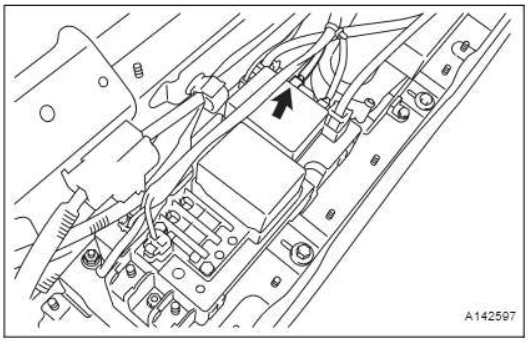
7	CHECK CONNECTOR CONNECTION CONDITION (HV RELAY ASSEMBLY CONNECTOR) (See page HV-484)

NG → CONNECT SECURELY

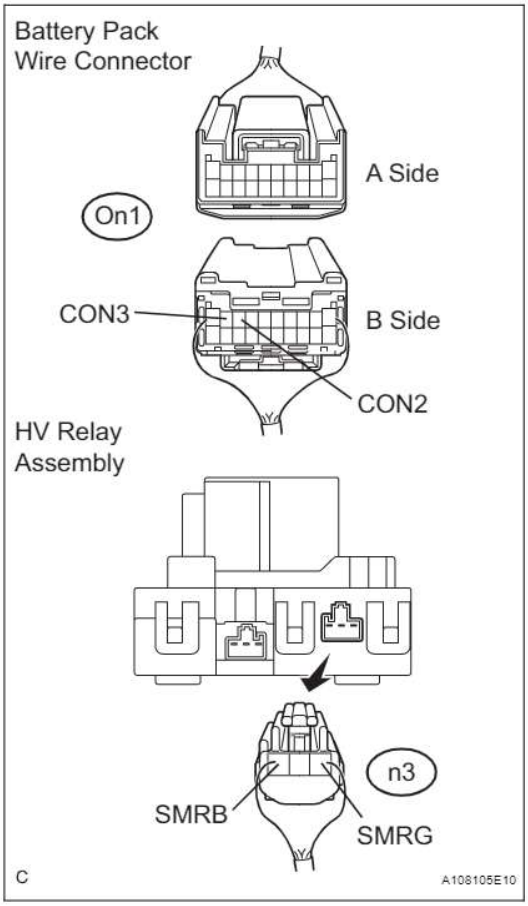
OK

HV

8	CHECK HARNESS AND CONNECTOR (HV RELAY ASSEMBLY - BATTERY PACK WIRE CONNECTOR)



(a) Check that the service plug grip is not installed.
(b) Disconnect the n3 HV relay assembly connector.
HINT:
For the removal and installation procedures related to the HV relay assembly connector, (See page HB-104).



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

Tester Connection	Specified Condition
CON2 (On1-3) - SMRB (n3-3)	Below 1 Ω
CON3 (On1-2) - SMRG (n3-1)	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HV RELAY ASSEMBLY (See page HB-104)

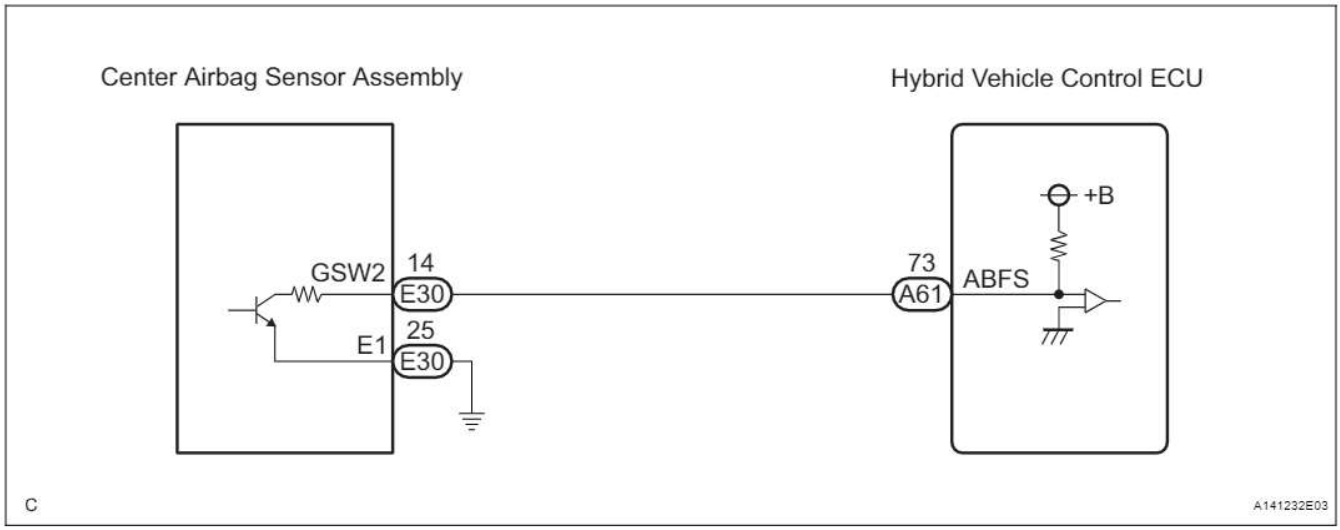
DTC	P3107-213	Airbag ECU Communication Circuit Malfunction

DESCRIPTION

The hybrid vehicle control ECU detects a problem in the collision signal line from the center airbag sensor assembly and alerts the driver.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3107	213	GND short in communication circuit	• Wire harness or connector • Center airbag sensor assembly • Hybrid vehicle control ECU

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (SUPPLEMENTAL RESTRAINT SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / SRS / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

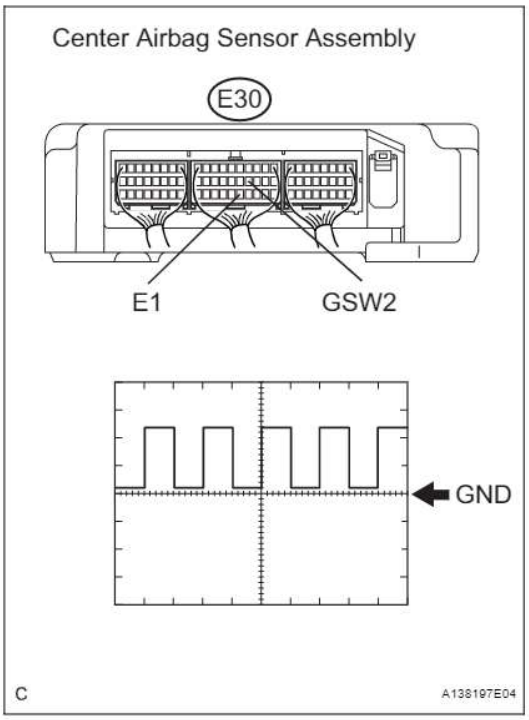
Result:

Airbag system DTCs are output.

YES → GO TO DTC CHART

NO

2 CHECK CENTER AIRBAG SENSOR ASSEMBLY



(a) Connect an oscilloscope between the center airbag sensor assembly terminals specified in the table below, and measure the waveform.

Item	Contents
Terminal	GSW2 (E30-14) - E1 (E30-25)
Equipment Setting	5 V/DIV., 500 ms./DIV.
Condition	Power switch on (READY)

OK:
The waveform appears as shown in the illustration.

NG → Go to step 6

HV

OK

3 CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

4 RECONFIRM DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES
(d) Check if DTCs are output.
Result:
DTC P3107-213 is output.

YES → REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

NO

5 CHECK FOR INTERMITTENT PROBLEMS

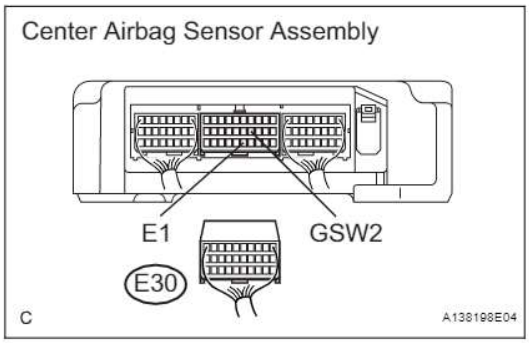
(a) Check for intermittent problems (See page HV-17).

NG → REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

6 CHECK CENTER AIRBAG SENSOR ASSEMBLY



(a) Turn the power switch off.
(b) Disconnect the E30 center airbag sensor assembly connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

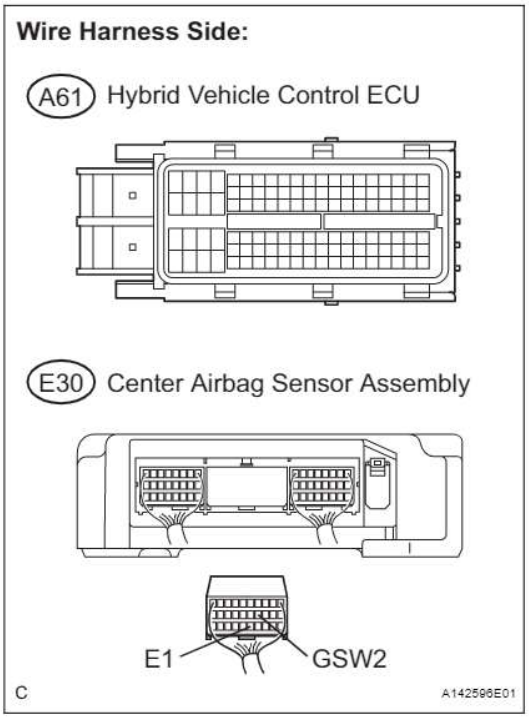
Tester Connection	Specified Condition
GSW2 (E30-14) - E1 (E30-25)	10 kΩ or more

NG → REPLACE CENTER AIRBAG SENSOR ASSEMBLY

OK

HV

7	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - CENTER AIRBAG SENSOR ASSEMBLY)



(a) Disconnect the A61 hybrid vehicle control ECU.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
GSW2 (E30-14) or E1 (E30-25) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

HV

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P3107-214	Airbag ECU Communication Circuit Malfunction

DESCRIPTION

Refer to the circuit description for DTC P3107-213 (See page HV-500).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3107	214	Open or +B short circuit in communication circuit	• Wire harness or connector • Center airbag sensor assembly • Hybrid vehicle control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P3107-213 (See page HV-500).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK CENTER AIRBAG SENSOR ASSEMBLY (See page HV-506)

NG → Go to step 5

OK

2	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

3	RECONFIRM DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES
(d) Check if DTCs are output.

Result:
DTC P3107-214 is output.

YES → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

NO

4	CHECK FOR INTERMITTENT PROBLEMS

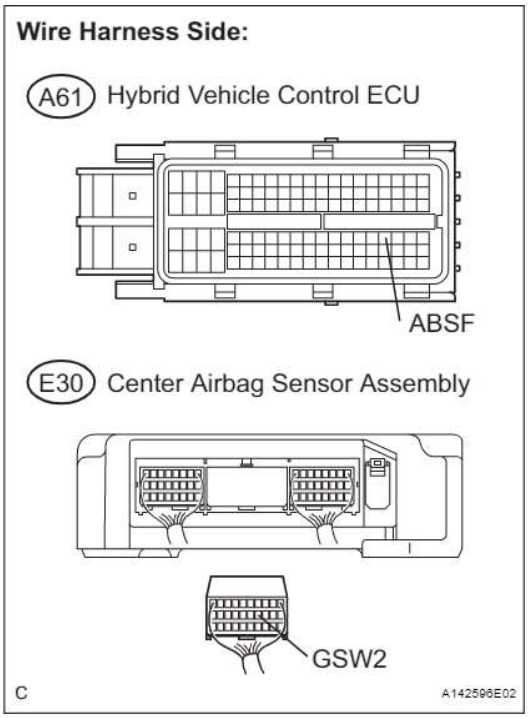
(a) Check for intermittent problems (See page HV-17)

YES → **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

NO

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

5	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - CENTER AIRBAG SENSOR ASSEMBLY)



(a) Turn the power switch off.
(b) Disconnect the E30 center airbag sensor assembly connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
GSW2 (E30-14) - Body ground	Below 1 V

(e) Turn the power switch off.
(f) Disconnect the hybrid vehicle control ECU connector.
(g) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
ABSF (A61-73) - GSW2 (E30-14)	Below 1 Ω

Standard resistance (Check for short)

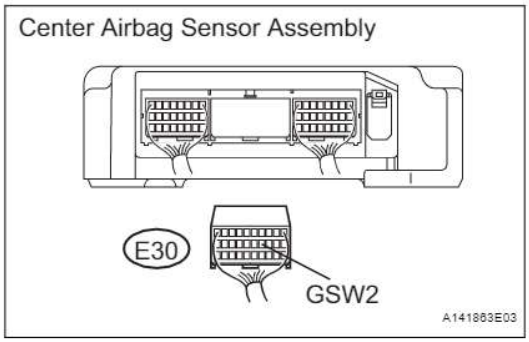
Tester Connection	Specified Condition
ABSF (A61-73) or GSW2 (E30-14) - Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

6	CHECK HYBRID VEHICLE CONTROL ECU

(a) Turn the power switch off.



(b) Connect the hybrid vehicle control ECU connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
GSW2 (E30-14) - Body ground	10 to 14 V

NOTICE:
Turning the power switch on (IG) with the center airbag sensor assembly connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

OK

REPLACE CENTER AIRBAG SENSOR ASSEMBLY

HV

DTC	P3107-215	Airbag ECU Communication Circuit Malfunction

DESCRIPTION

Refer to the circuit description for DTC P3107-213 (See page HV-500).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3107	215	Abnormal communication signal	• Wire harness or connector • Center airbag sensor assembly • Hybrid vehicle control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P3107-213 (See page HV-500).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (SUPPLEMENTAL RESTRAINT SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/MOBD / SRS / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

Airbag system DTCs are output.

YES → **GO TO AIRBAG SYSTEM**

NO

2	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

3	RECONFIRM DTC OUTPUT

(a) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(b) Check if DTCs are output.
Result:
P3107-215 is output.

YES → **Go to step 5**

NO

4	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems (See page HV-17).

YES → **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

NO

REPLACE CENTER AIRBAG SENSOR ASSEMBLY

5	CHECK HYBRID VEHICLE CONTROL ECU (See page HV-506)

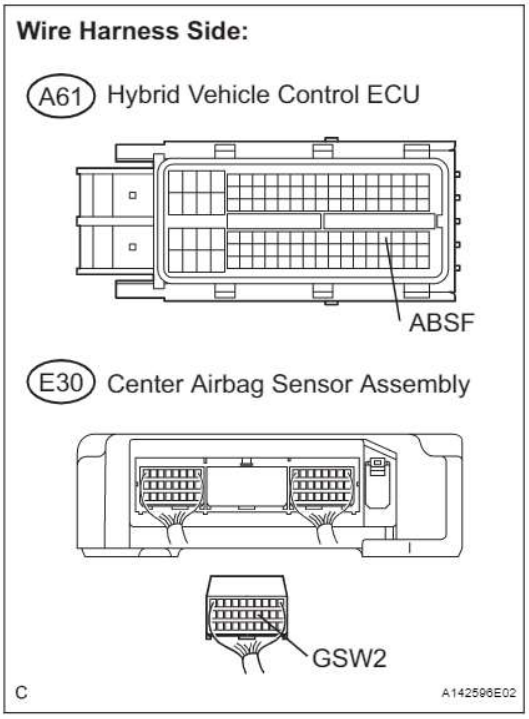
OK → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

NG

6	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - CENTER AIRBAG SENSOR ASSEMBLY)

(a) Turn the power switch off.
(b) Connect the A61 hybrid vehicle control ECU connector.

HV



(c) Disconnect the E30 center airbag sensor assembly.
(d) Turn the power switch on (IG).
(e) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
GSW2 (E30-14) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU and center airbag sensor assembly connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(f) Turn the power switch off.
(g) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
ABSF (A61-73) - GSW2 (E30-14)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
ABSF (A61-73) or GSW2 (E30-14) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

HV

OK → REPLACE CENTER AIRBAG SENSOR ASSEMBLY

DTC	P3108-535	A/C Amplifier Communication Circuit Malfunction

DTC	P3108-536	A/C Amplifier Communication Circuit Malfunction

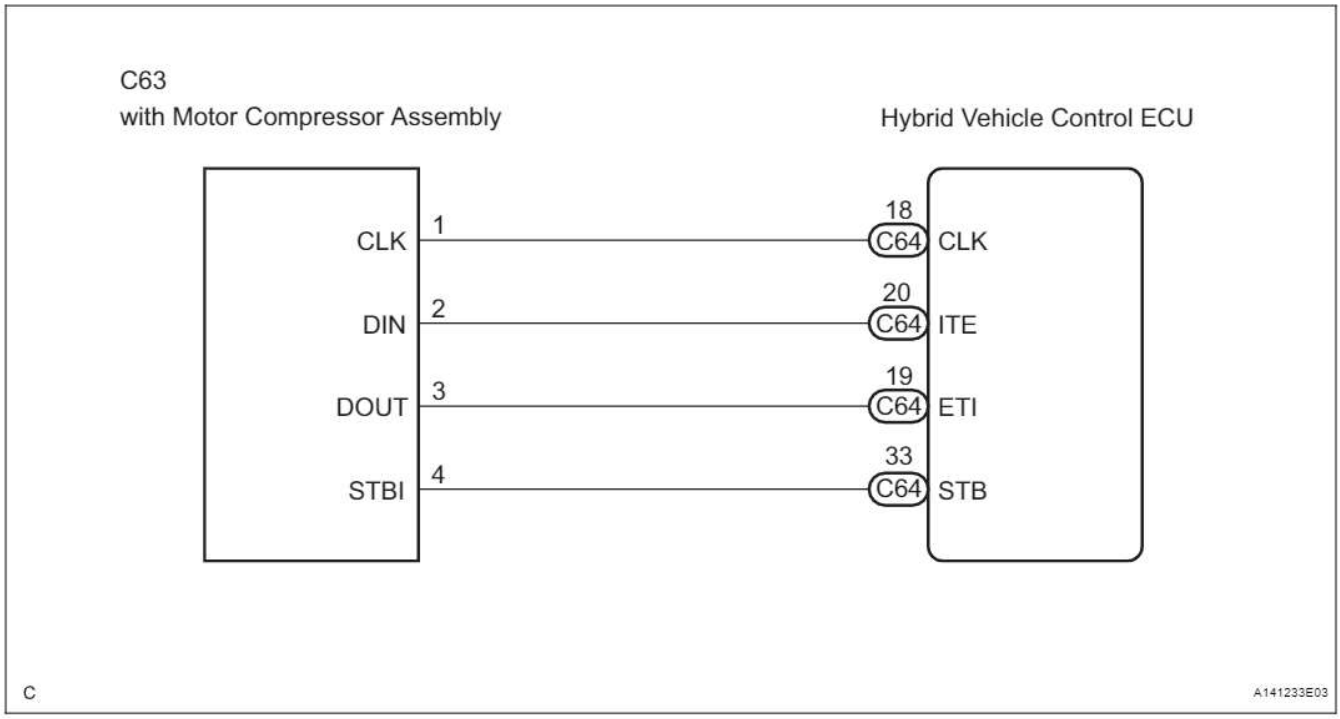
DTC	P3108-538	A/C Amplifier Communication Circuit Malfunction

DESCRIPTION

The hybrid vehicle control ECU detects a wiring malfunction in the serial communication line between it and the with motor compressor assembly.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3108	535	Serial communication malfunction	• Wire harness or connector • Compressor with motor assembly • Hybrid vehicle control ECU
P3108	536	A/C inverter malfunction	• Wire harness or connector • Compressor with motor assembly • Hybrid vehicle control ECU
P3108	538	Open in STB signal circuit	• Wire harness or connector • Compressor with motor assembly • Hybrid vehicle control ECU

WIRING DIAGRAM



HV

HINT:
DTC P3108-535 may be stored due to an open circuit in the SMRB circuit or SMRG circuit.

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

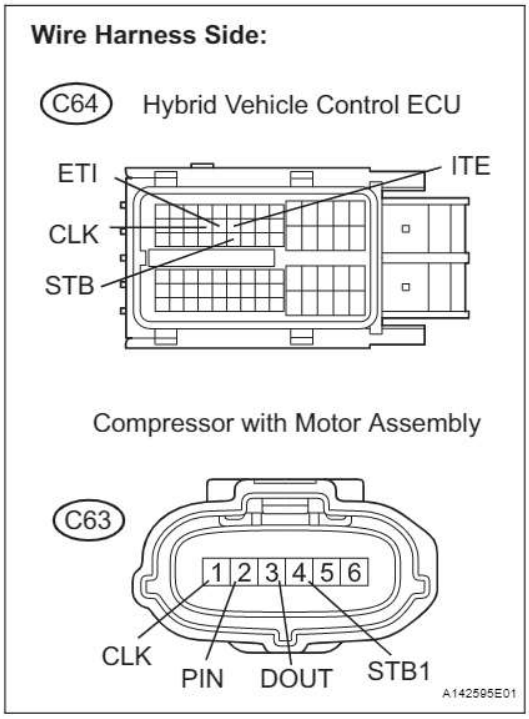
Result

DTC No.	Relevant Diagnosis
P0ADB-227, P0ADC-226	SMRB circuit
P0ADF-229, P0AE0-228	SMRG circuit

YES → GO TO DTC CHART

NO

2	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - COMPRESSOR WITH MOTOR ASSEMBLY)



(a) Disconnect the C64 hybrid vehicle control ECU connector.
(b) Disconnect the C63 compressor with motor assembly connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
CLK (C64-18) - Body ground	Below 1 V
ITE (C64-20) - Body ground	Below 1 V
ETI (C64-19) - Body ground	Below 1 V
STB (C64-33) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
CLK (C64-18) - CLK (C63-1)	Below 1 Ω
ITE (C64-20) - DIN (C63-2)	Below 1 Ω
ETI (C64-19) - DOUT (C63-3)	Below 1 Ω
STB (C64-33) - STB1 (C63-4)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
CLK (C64-18) or CLK (C63-1) - Body ground	10 kΩ or more
ITE (C64-20) or DIN (C63-2) - Body ground	10 kΩ or more
ETI (C64-19) or DOUT (C63-3) - Body ground	10 kΩ or more
STB (C64-33) or STB1 (C63-4) - Body ground	10 kΩ or more

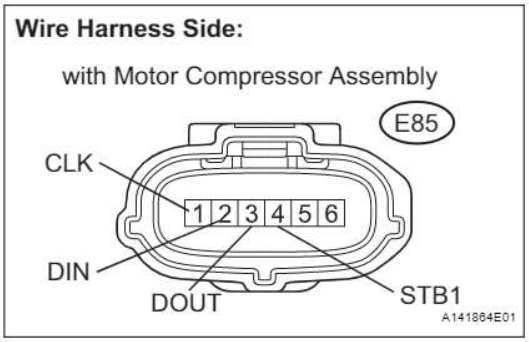
HV

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3	CHECK HYBRID VEHICLE CONTROL ECU

(a) Turn the power switch off.
(b) Connect the hybrid vehicle control ECU connector.



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

Standard resistance

Tester Connection	Specified Condition
DOUT (C63-3) - Body ground	10 kΩ or more
STB1 (C63-4) - Body ground	10 kΩ or more

(d) Turn the power switch on (IG).

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

Standard voltage

Tester Connection	Specified Condition
CLK (C63-1) - Body ground	10 to 14 V
DIN (C63-2) - Body ground	10 to 14 V

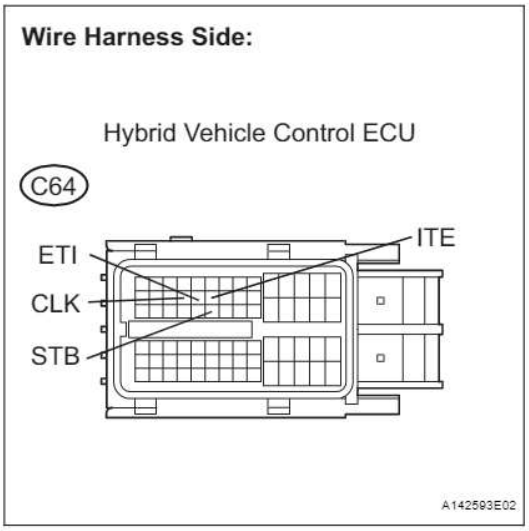
NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → **REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)**

OK

4	CHECK COMPRESSOR WITH MOTOR ASSEMBLY

HV



(a) Turn the power switch off.

(b) Connect the with motor compressor assembly connector.

(c) Disconnect the C64 hybrid vehicle control ECU connector.

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

Standard resistance

Tester Connection	Specified Condition
CLK (C64-18) - Body ground	10 kΩ or more
ITE (C64-20) - Body ground	10 kΩ or more

(e) Turn the power switch on (IG)

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

Standard voltage

Tester Connection	Specified Condition
ETI (C64-19) - Body ground	10 to 14 V
STB (C64-33) - Body ground	10 to 14 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

NG → REPLACE COMPRESSOR WITH MOTOR ASSEMBLY

OK

5	REPLACE HYBRID VEHICLE CONTROL ECU

(a) Replace the hybrid vehicle control ECU (See page HV-569).

NEXT

6	CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

7	RECONFIRM DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES
(d) Check if DTCs are output.
Result:
DTC P3108-535 or 538 is output.

YES → REPLACE COMPRESSOR WITH MOTOR ASSEMBLY

NO

COMPLETED

DTC	P3110-139	IGCT Relay Malfunction

DTC	P3110-223	IGCT Relay Malfunction

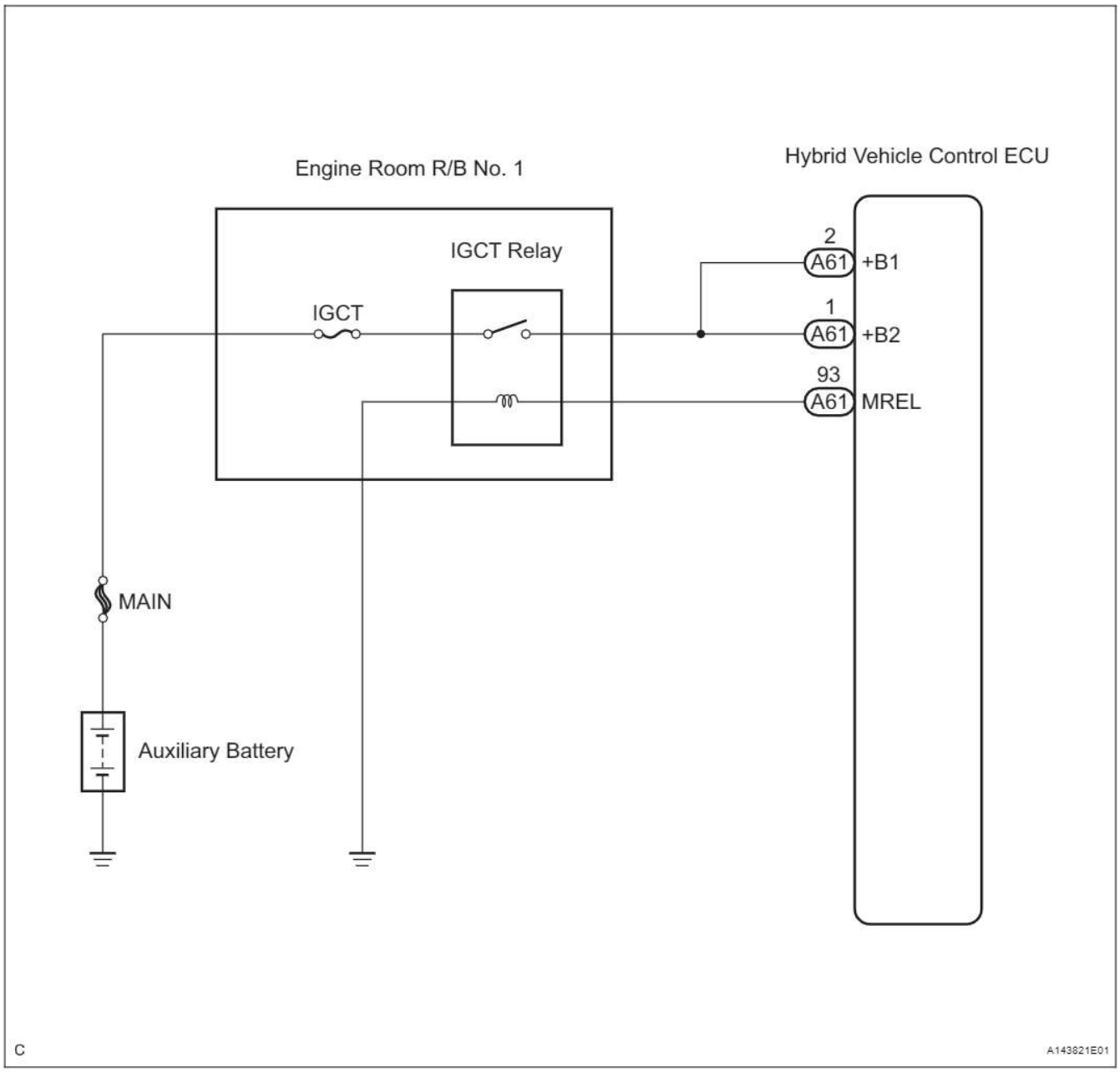
DESCRIPTION

The hybrid vehicle control ECU monitors the IGCT relay and detects malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3110	139	There is a short to +B in the IGCT relay or the IGCT relay is stuck closed.	• Wire harness or connector • IGCT relay • Hybrid vehicle control ECU
P3110	223	The IGCT relay remains stuck closed.	• Wire harness or connector • IGCT relay • Hybrid vehicle control ECU

HV

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

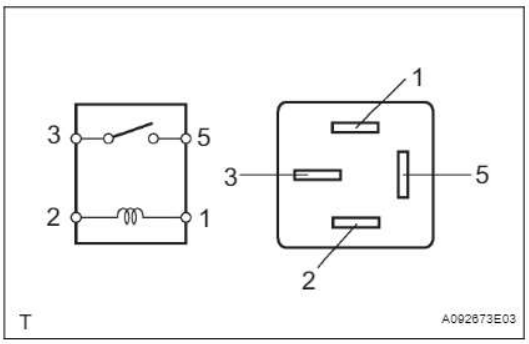
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HINT:

- 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 power switch is off, the circuit is shorted to +B.

1 INSPECT RELAY (IGCT RELAY)



(a) Remove the integration relay from the engine room R/B No. 1.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or more
3 - 5	Below 1 Ω (Apply battery voltage between 1 and 2)

NG → **REPLACE RELAY (IGCT RELAY)**

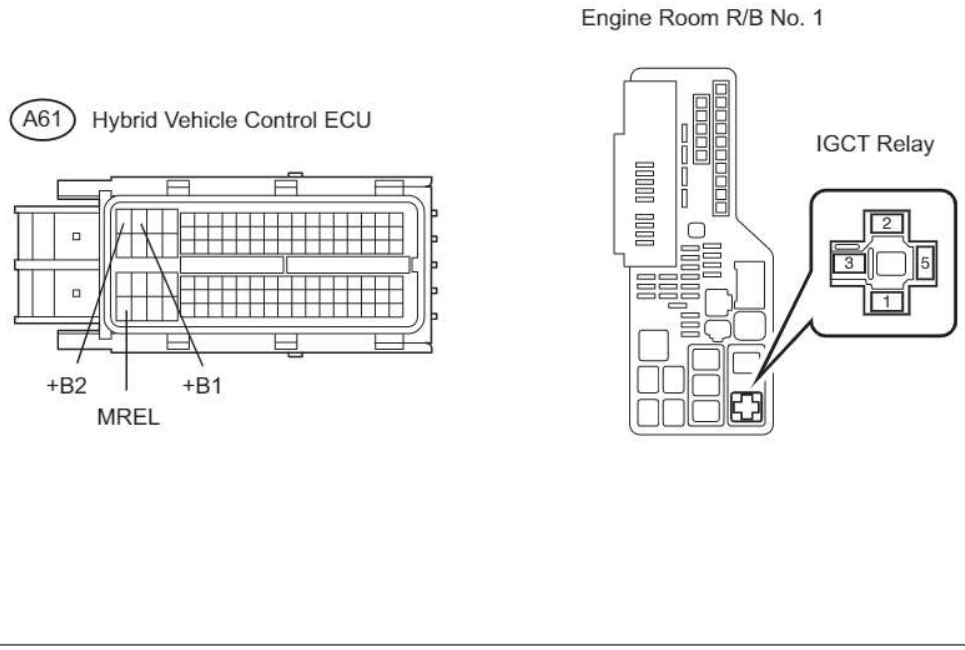
OK

2 CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ENGINE ROOM R/B NO. 1)

(a) Disconnect the A61 hybrid vehicle control ECU connector.
(b) Remove the IGCT relay from the engine room R/B No. 1.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

HV

Wire Harness Side:



NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.
Standard voltage

Tester Connection	Specified Condition
MREL (A61-93) - Body ground	Below 1 V
+B1 (A61-2) - Body ground	Below 1 V
+B2 (A61-1) - Body ground	Below 1 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P3137-348	Collision Sensor Low Input

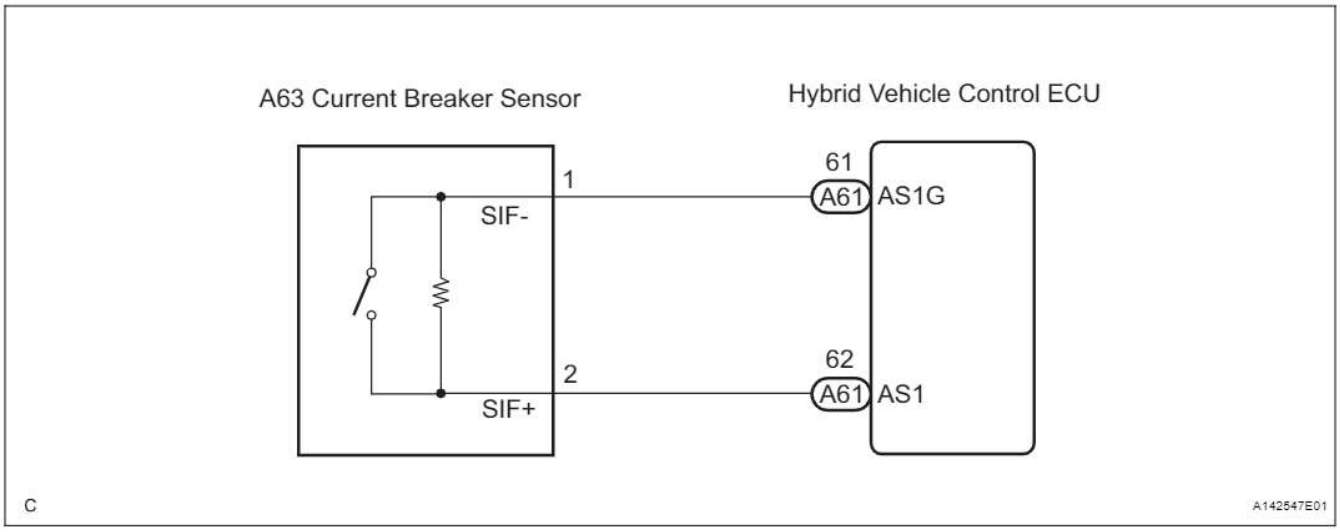
DTC	P3138-349	Collision Sensor High Input

DESCRIPTION

The hybrid vehicle control ECU monitors the connection status of the circuit breaker sensor No. 1 signal (collision signal) line. If the ECU detects a malfunction, it will alert the driver.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3137	348	GND short in circuit breaker sensor No .1 circuit	• Wire harness or connector • Circuit breaker sensor No .1 • Hybrid vehicle control ECU
P3138	349	Open or +B short in circuit breaker sensor No. 1 circuit	• Wire harness or connector • Circuit breaker sensor No. 1 • Hybrid vehicle control ECU

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

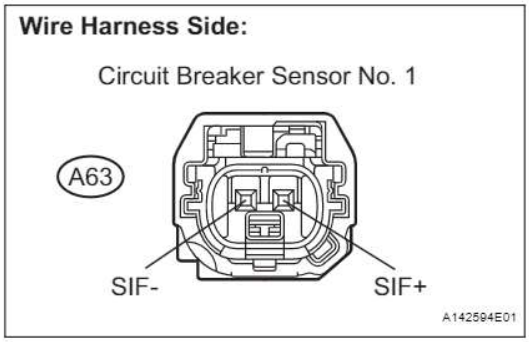
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HINT:

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

1	INSPECT HYBRID VEHICLE CONTROL ECU (VOLTAGE CHECK)

(a) Disconnect the A63 circuit breaker sensor connector.



(b) Turn the power switch on (IG).
(c) Measure the voltage according to the value(s) in the table below.

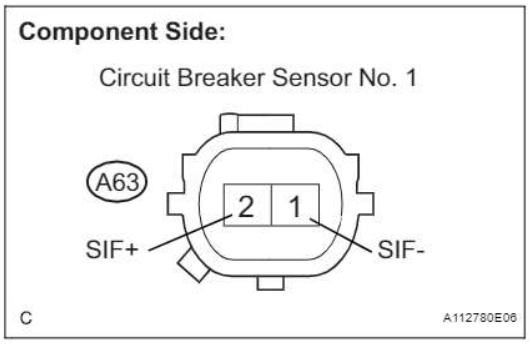
Standard voltage

Tester Connection	Specified Condition
SIF+ (A63-2) - SIF- (A63-1)	4.5 to 5.5 V

NG → **Go to step 5**

OK

2 INSPECT CIRCUIT BREAKER SENSOR NO. 1



(a) Turn the power switch off.
(b) Disconnect the A63 circuit breaker sensor No. 1 connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
SIF- (C17-1) - SIF+ (C17-2)	0.65 to 1.0 kΩ at 20°C (68°F)

NG → **REPLACE CIRCUIT BREAKER SENSOR NO. 1**

OK

3 CLEAR DTC (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(d) Clear the DTCs.

NEXT

4 RECONFIRM DTC OUTPUT (HV)

(a) Turn the power switch on (IG).
(b) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(c) Check if DTCs are output.

Result:

P3137-348 and P3138-349 are output.

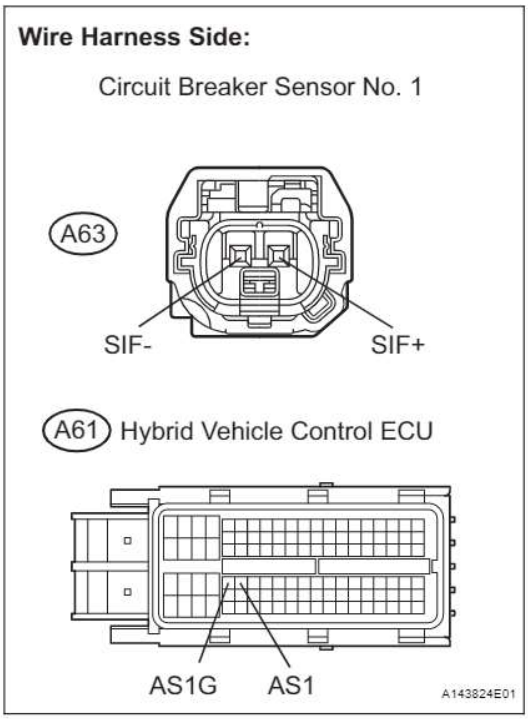
NO → **CHECK FOR INTERMITTENT PROBLEMS (See page HV-17)**

HV

YES

REPAIR HYBRID VEHICLE CONTROL ECU (See page HV-569)

5	CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - CIRCUIT BREAKER SENSOR NO. 1)



(a) Disconnect the A63 circuit breaker sensor No. 1 connector.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
AS1 (A61-62) - Body ground	Below 1 V
AS1G (A61-61) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
AS1 (A61-62) - SIF+ (A63-2)	Below 1 Ω
AS1G (A61-61) - SIF- (A63-1)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
AS1 (A61-62) or SIF+ (A63-2) - Body ground	10 kΩ or more
AS1G (A61-61) or SIF- (A63-1) - Body ground	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPAIR HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	P3147-239	Transmission Malfunction

DTC	P3147-241	Transmission Malfunction

DESCRIPTION

The HV 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 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 No.	INF Code	DTC Detection Condition	Trouble Area
P3147	239	HV transaxle input malfunction (shaft damaged)	• Engine assembly • Hybrid vehicle transaxle assembly (shaft, gear) • Transmission input damper • Wire harness or connector • Inverter with converter assembly
P3147	241	HV transaxle input malfunction (input damper system)	• Engine assembly • Hybrid vehicle transaxle assembly (shaft, gear) • Transmission input damper • Wire harness or connector • Inverter with converter assembly

INSPECTION PROCEDURE

HV

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBDII / ENGINE / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTCs are output.

YES	GO TO DTC CHART

NO

2	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

Result	Proceed to
DTC P3147-240 or P3147-242 is output.	A
DTC P0A1D is output.	B
DTCs other than P3147-239 or P3147-241 are not output.	C

A → REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

B → GO TO INSPECTION PROCEDURE RELEVANT TO OUTPUT DTC (P0A1D)

C

3	CHECK CRANKSHAFT PULLEY REVOLUTION (P POSITION) (See page HV-278)

NG → Go to step 12

OK

4	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - CRANKSHAFT POSITION SENSOR) (See page ES-167)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

5	RECONFIRM OUTPUT DTC (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check for HV system DTCs, freeze frame data, and diagnosis information and note them down.

NEXT

6	CLEAR DTC

(a) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(b) Clear the DTCs of the HV system.

NEXT

7	CHECK READY LIGHT ON

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MG1 REV and ENGINE SPD.
(d) Turn the power switch on (READY).
OK:
The READY light comes on.
HINT:
If the READY light does not come on and the reading on the intelligent tester 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 vehicle transaxle assembly and transmission input damper.

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

8	CHECK ENGINE RACING

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DATA LIST / MG1 REV and ENGINE SPD.
(d) 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.
HINT:
If the engine does not rev up and the reading on the intelligent tester shows DTC P3147-239 (Hybrid vehicle transaxle input malfunction [shaft damaged]), or MG1 turns but the engine does not crank, replace the hybrid vehicle transaxle assembly and transmission input damper.

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

HV

OK

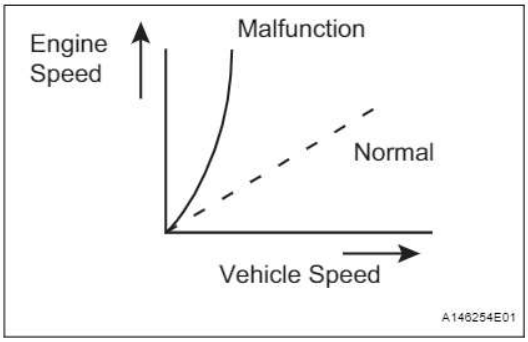
9	CHECK CREEP MOVEMENT

(a) Connect the intelligent tester to the DLC3.
(b) Depress the brake pedal, move the shift lever to the D position, and release the brake pedal.
OK:
The wheels turn (creeping along).
HINT:
If the wheels do not turn and the reading on the intelligent tester shows DTC P3147-239 (Hybrid vehicle transaxle input malfunction (shaft damage)), replace the hybrid vehicle transaxle assembly.

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

10	CHECK ENGINE SPEED



(a) Connect the intelligent tester to the DLC3.
(b) While driving at the vehicle speed of more than 6 mph (10 km/h), fully depress the accelerator pedal to raise the engine speed.
OK:
Engine speed increases smoothly (Check HINT).
HINT:
If the engine over-revs or the reading on the intelligent tester shows DTC P3147-239 (Hybrid vehicle transaxle input malfunction (shaft damage)), replace the transmission input damper assembly.

NG → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)**

OK

11	PERFORM SIMULATION TEST

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (READY).
(c) Drive the vehicle without activating the engine.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(e) Read output DTCs.
Result:
DTC is detected.

NO → **GO TO DTC CHART**

YES

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

12	CHECK FRONT TIRE REVOLUTION

(a) Turn the power switch off and move the shift lever to the N position.
(b) Lift up the vehicle.
(c) Turn the crank pulley by hand to check if the front tires rotate.

CAUTION:
Do not turn the power switch on (IG) while performing this inspection. Be sure to turn the power switch off because the engine may start.

OK:
The front tires rotate.

NG → REPAIR OR REPLACE ENGINE

OK

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

HV

DTC	P3147-240	Transmission Malfunction

DTC	P3147-242	Transmission Malfunction

DESCRIPTION

Refer to the description. (See page HV-522)

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P3147	240	Generator lock	Hybrid Vehicle transaxle assembly
↑	242	Planetary gear lock	Hybrid Vehicle transaxle assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (HV)

HV

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTCs other than P3147-240 and P3147-242 are output.

YES → **GO TO DTC CHART**

NO

REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY (See page HX-10)

DTC	P3221-314	Generator Inverter Temperature Sensor Circuit Range / Performance

DTC	P3221-315	Generator Inverter Temperature Sensor Circuit Range / Performance

DESCRIPTION

Refer to the description for DTC P3222-313 (See page HV-531).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3221	314	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

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

4	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

5	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

HV

NG → CONNECT SECURELY

OK

6	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

7	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 10

OK

8	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

9	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG

11	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 13

OK

12	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - WATER PUMP WITH MOTOR & BRACKET ASSEMBLY) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

13	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

HV

DTC	P3222-313	Generator Inverter Temperature Sensor Circuit High / Low

DTC	P3223-312	Generator Inverter Temperature Sensor Circuit High

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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3222	313	Open or GND short in generator inverter temperature sensor circuit	Inverter with converter assembly
P3223	312	Short to +B in generator inverter temperature sensor circuit	Inverter with converter assembly

INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

COMPLETED

DTC	P3226-562	DC/DC Boost Converter Temperature Sensor

DTC	P3226-563	DC/DC Boost Converter Temperature Sensor

DESCRIPTION

The MG ECU located in the inverter with converter assembly detects the temperature of the boost inverter 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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3226	562	Sudden change in boost converter temperature sensor output	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU
P3226	563	Boost converter temperature sensor output deviation	• Wire harness or connector • Inverter cooling system • Water pump with motor & bracket assembly • Inverter with converter assembly • Cooling fan system • Hybrid vehicle control ECU

INSPECTION PROCEDURE

CAUTION:

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

HV

HINT:

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

1	CHECK DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

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

YES → GO TO DTC CHART

NO

2	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) (See page HV-79)

NG → CONNECT SECURELY

OK

3	CHECK QUANTITY OF HV COOLANT (See page HV-325)

B → ADD COOLANT

C → CHECK FOR COOLANT LEAKS AND ADD COOLANT

A

4	CHECK COOLANT HOSE (See page HV-326)

NG → CORRECT THE PROBLEM

OK

5	CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR) (See page HV-79)

HV

NG → CONNECT SECURELY

OK

6	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR & BRACKET ASSEMBLY CONNECTOR) (See page HV-326)

NG → CONNECT SECURELY

OK

7	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-327)

NG → Go to step 10

OK

8	CHECK CONNECTOR CONNECTION CONDITION (COOLING FAN MOTOR CONNECTOR) (See page HV-327)

NG → CONNECT SECURELY

OK

9	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (COOLING FAN) (See page HV-327)

NG → CHECK COOLING FAN SYSTEM (See page CO-3)

OK

REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

10	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (WATER PUMP) (See page HV-328)

OK → ADD COOLANT

NG

11	CHECK WATER PUMP WITH MOTOR & BRACKET ASSEMBLY (See page HV-329)

NG → Go to step 13

OK

12	CHECK HARNESS AND CONNECTOR (HV CONTROL ECU - WATER PUMP WITH MOTOR & BRACKET ASSEMBLY) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

13	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR POWER SOURCE CIRCUIT) (See page HV-330)

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

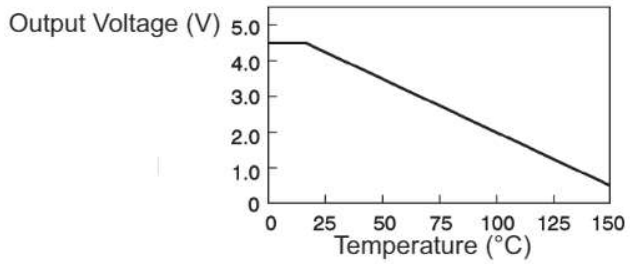
REPLACE WATER PUMP WITH MOTOR & BRACKET ASSEMBLY

DTC	P3227-583	Converter Temperature Sensor Circuit Low

DTC	P3228-584	Converter Temperature Sensor Circuit High

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 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 No.	INF Code	DTC Detection Condition	Trouble Area
P3227	583	Open or GND short in boost converter temperature sensor circuit	Inverter with converter assembly
P3228	584	Short to +B in boost converter temperature sensor circuit	Inverter with converter assembly

HV

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	REPLACE INVERTER WITH CONVERTER ASSEMBLY

NEXT

COMPLETED

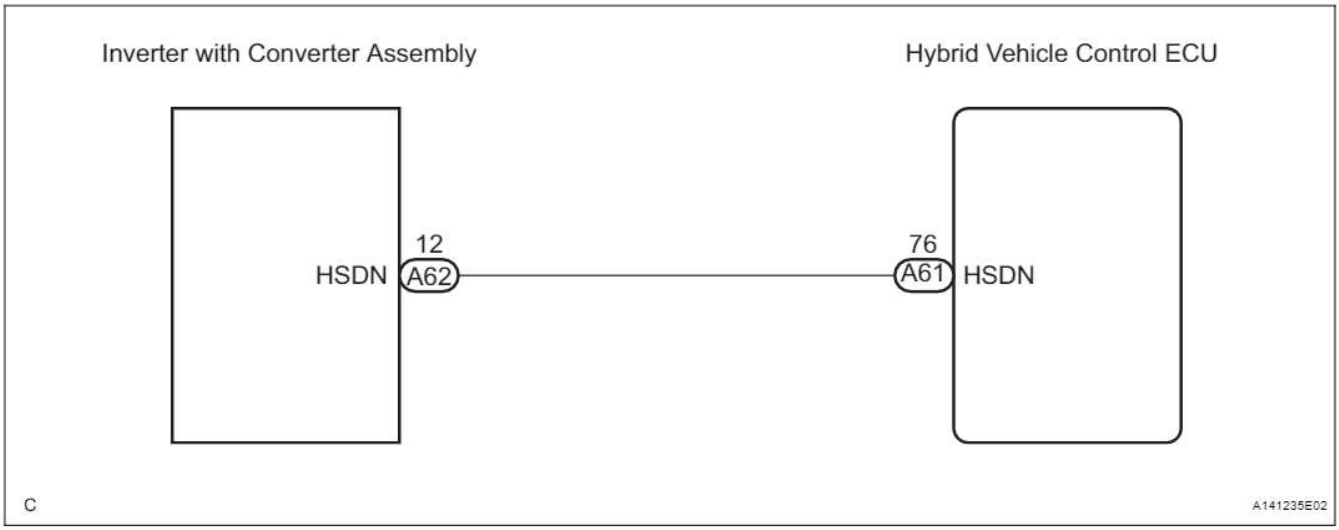
DTC	P3232-749	Open or Short to B+ in Blocking of HV Gate Connection

DESCRIPTION

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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3232	749	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

WIRING DIAGRAM



HV

INSPECTION PROCEDURE

CAUTION:

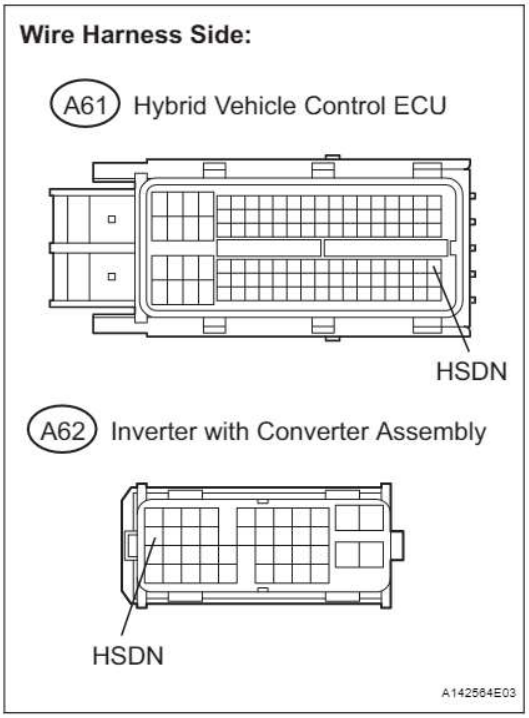
- **Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your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

HINT:

- 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 the power switch on (IG) and off repeatedly makes it easier to reproduce the problem. Do not repeat the operations of turning the power switch on (READY) and turning the power switch off as these will activate system main relay overheat protection.

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

CAUTION:
Be sure to wear insulated gloves.



(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the A61 hybrid vehicle control ECU connector.
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(c) Disconnect the A62 inverter with converter assembly connector.

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

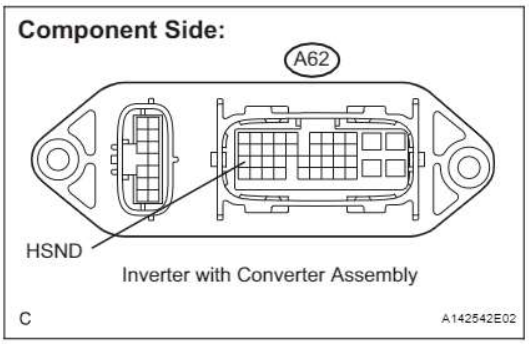
Tester Connection	Specified Condition
HSDN (A61-76) - HSDN (A62-12)	10 kΩ or more

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

HV

2 CHECK INVERTER WITH CONVERTER ASSEMBLY



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

Tester Connection	Specified Condition
HSDN (A62-12) - Body ground	2.65 to 3.55 kΩ

NG → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)**

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

DTC	P3233-750	Short to B+ in Blocking of HV Gate Connection

DESCRIPTION

Refer to the description for DTC P3232-749 (See page HV-536).

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
P3233	750	Open or short to +B in the emergency shutdown signal line when the gate is driving	• Wire harness or connector • Hybrid vehicle control ECU • Inverter with converter assembly

WIRING DIAGRAM

Refer to the wiring diagram for DTC P3232-749 (See page HV-536).

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

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

HV

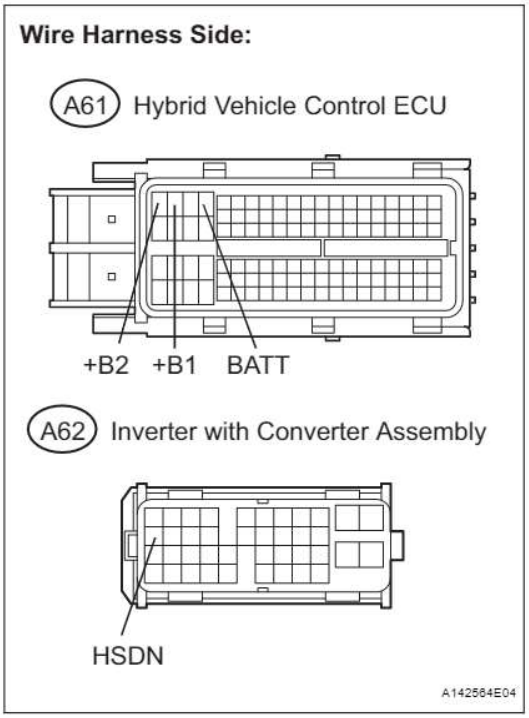
CAUTION:

Be sure to wear insulated gloves.

(a) Turn the power switch off and remove the service plug grip (See page HV-1).

NOTICE:

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



(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Disconnect the A62 inverter with converter assembly connector.
(d) Turn the power switch on (IG).
(e) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
HSDN (A62-12) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(f) Turn the power switch off.
(g) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
HSDN (A61-76) - +B1 (A61-2)	10 kΩ or more
HSDN (A61-76) - +B2 (A61-1)	10 kΩ or more
HSDN (A61-76) - BATT (A61-4)	10 kΩ or more

HINT:
To check for a short to +B, the power switch is turned on (IG). However, the battery voltage is not applied to terminals +B1 and +B2 because the IGCT relay is not turned on with the A61 connector disconnected from the hybrid vehicle control ECU. Therefore, measure the resistance between terminals HSDN and +B1 and also between terminals HSDN and +B2.

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

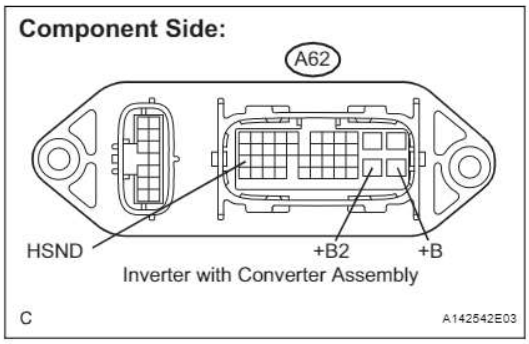
Standard resistance

Tester Connection	Specified Condition
HSDN (A61-76) - HSDN (A62-12)	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

2	CHECK INVERTER WITH CONVERTER ASSEMBLY



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

Standard resistance

Tester Connection	Specified Condition
HSDN (A62-12) - +B (A62-31)	10 kΩ or more
HSDN (A62-12) - +B2 (A62-30)	10 kΩ or more
HSDN (A62-12) - Body ground	2.65 to 3.55 kΩ

NG → REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)

OK

REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

HV

DTC	U0100-211	Lost Communication with ECM / PCM "A"
DTC	U0100-212	Lost Communication with ECM / PCM "A"
DTC	U0100-530	Lost Communication with ECM / PCM "A"
DTC	U0100-774	Lost Communication with ECM / PCM "A"
DTC	U0100-784	Lost Communication with ECM / PCM "A"
DTC	U0129-220	Lost Communication with Brake System Control Module
DTC	U0129-222	Lost Communication with Brake System Control Module
DTC	U0129-528	Lost Communication with Brake System Control Module
DTC	U0133-147	Lost Communication with Active Roll Control Module
DTC	U0146-146	Lost Communication with Gateway "A"

HV

DESCRIPTION

The hybrid vehicle control ECU transmits and receives signals to and from the ECM, skid control ECU assembly, absorber control ECU, and network gateway ECU via CAN communication.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
U0100	211	Problem with CAN communication between the ECM and hybrid vehicle control ECU (communication error between ECUs)	CAN communication system
U0100	212	Problem with CAN communication between the ECM and hybrid vehicle control ECU (signal transmission error)	CAN communication system
U0100	530	Problem with CAN communication between the ECM and hybrid vehicle control ECU (CAN communication system malfunction)	CAN communication system
U0100	774	Problem with CAN communication between the ECM and hybrid vehicle control ECU (signal transmission error)	CAN communication system
U0100	784	Problem with CAN communication between the ECM and hybrid vehicle control ECU (CAN communication system malfunction)	CAN communication system
U0129	220	Problem with CAN communication between the skid control ECU and hybrid vehicle control ECU (no signal reception)	CAN communication system
U0129	222	Problem with CAN communication between the skid control ECU and hybrid vehicle control ECU (signal transmission error)	CAN communication system

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
U0129	528	Problem with CAN communication between the skid control ECU and hybrid vehicle control ECU (CAN communication system malfunction)	CAN communication system
U0133	147	Problem with CAN communication between the absorber control ECU and hybrid vehicle control ECU (CAN communication system malfunction)	CAN communication system
U0146	146	Problem with CAN communication between the network gateway ECU and hybrid vehicle control ECU (CAN communication system malfunction)	CAN communication system

MONITOR DESCRIPTION

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.

MONITOR STRATEGY

Related DTCs	U0100 (INF 211): Receiving check for the specific frame (CAN1) U0100 (INF 212): Sending data check (CAN1) U0100 (INF 530): Receiving check for the one of frames (CAN1) U0100 (INF 774): Receiving check for the one of frames (CAN2) U0100 (INF 784): Sending data check (CAN2)
Required sensors / components	Main: HV control ECU Sub: CAN bus line
Frequency of operation	Continuous
Duration	TOYOTA's intellectual property
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	TOYOTA's intellectual property
Other conditions belong to TOYOTA's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TOYOTA's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC U0100 (INF 211/212/530/774/784) is not detected

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Check for DTCs of all systems by following the prompts on the intelligent tester screen.
HINT:
If DTCs other than CAN communication DTCs are output simultaneously, first repair the CAN communication problem, and then perform troubleshooting for other DTCs.

NEXT

GO TO CAN COMMUNICATION SYSTEM

HV

DTC	U0110-159	Lost Communication with Driver Motor Control Module
DTC	U0110-160	Lost Communication with Driver Motor Control Module
DTC	U0110-656	Lost Communication with Driver Motor Control Module
DTC	U0110-657	Lost Communication with Driver Motor Control Module

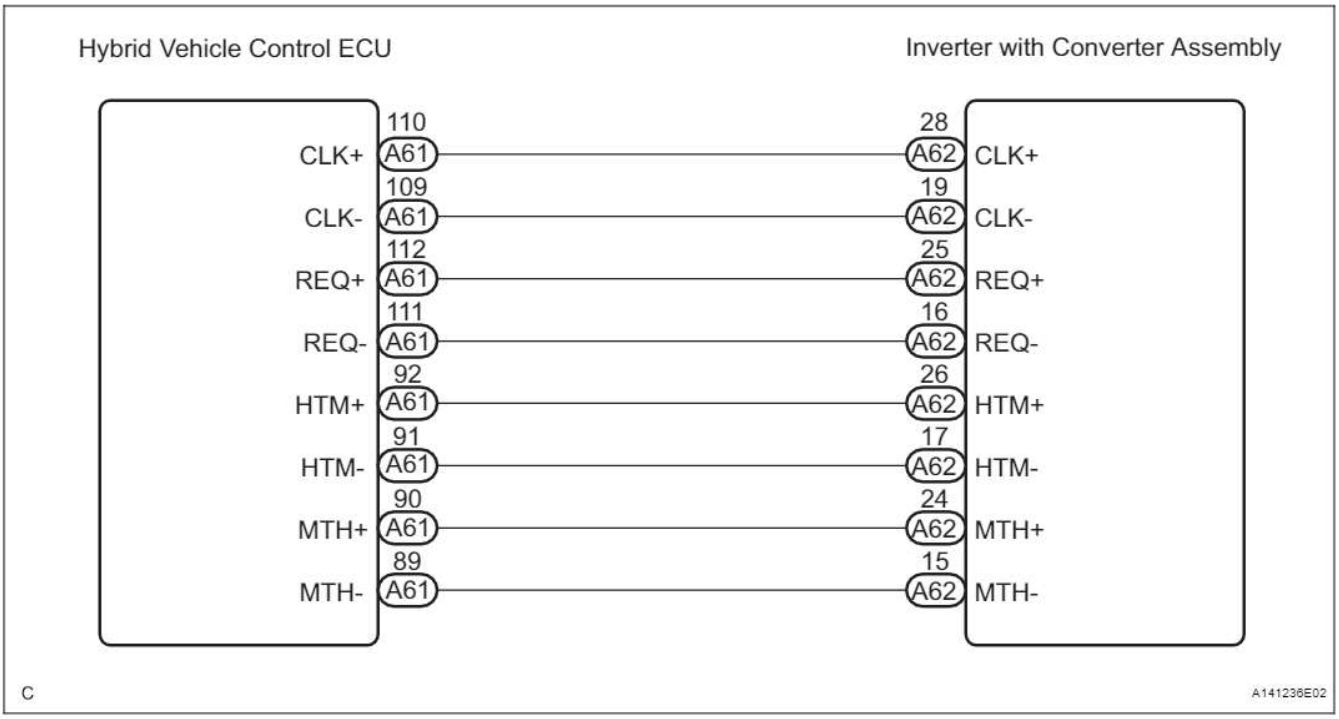
DESCRIPTION

For a description of the inverter with converter assembly, (See page HV-232).
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.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
U0110	159	Error in reception from the inverter with converter assembly (MG ECU) via serial communication (out of communication standard)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU
U0110	160	Error in signal transmission to the inverter with converter assembly (MG ECU) via serial communication (no transmission, out of communication standard)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU
U0110	656	Error in reception from the inverter with converter assembly (MG ECU) via serial communication (out of communication standard)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU
U0110	657	Error in reception from the inverter with converter assembly (MG ECU) via serial communication (no reception)	• Wire harness or connector • Inverter with converter assembly (MG ECU) • Hybrid vehicle control ECU

HV

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

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

HV

NOTICE:

If any of U0110-159, 160, 656 or 657 are detected, clearing DTCs using the intelligent tester will cause DTC P0A1B-788 (power source IC reset) to be output. Proceed to troubleshooting without considering this code.

HINT:

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

1	**CLEAR DTC (HV)**

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Read and record the DTCs and freeze frame data.
(d) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CLEAR CODES.
(e) Clear the DTCs.

NEXT

2	RECONFIRM DTC OUTPUT (HV)

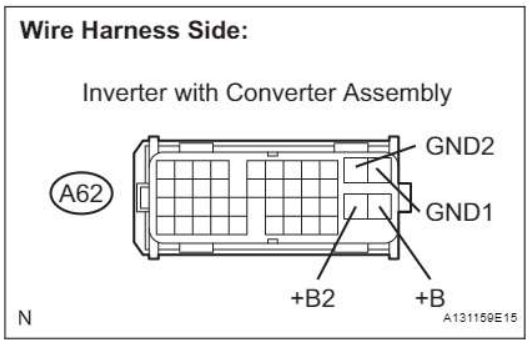
(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTC U0110-159, 160, 656 or 657 is output.

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page HV-17)**

YES

3	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT)

CAUTION:
Be sure to wear insulated gloves.
(a) Turn the power switch off and remove the service plug grip (See page HV-1).
NOTICE:
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.
(b) Disconnect the A62 inverter with converter assembly connector.
(c) Turn the power switch on (IG).
(d) Measure the resistance according to the value(s) in the table below.
Standard resistance



Tester Connection	Specified Condition
GND1 (A62-11) - Body ground	Below 1 Ω
GND2 (A62-10) - Body ground	Below 1 Ω

(e) Turn the power switch on (IG).
Measure the voltage according to the value(s) in the table below.
Standard voltage

Tester Connection	Specified Condition
+B (A62-31) - Body ground	10 to 14 V
+B2 (A62-30) - Body ground	10 to 14 V

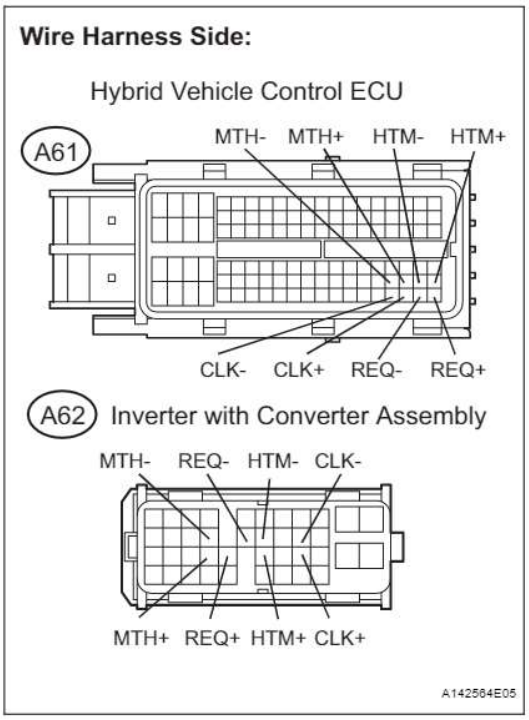
NOTICE:
Turning the power switch on (IG) with the low voltage connector of the inverter with converter assembly disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

HV

NG → REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK

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



(a) Turn the power switch off.
(b) Disconnect the A61 hybrid vehicle control ECU connector.
(c) Turn the power switch on (IG).
(d) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
CLK+ (A61-110) - Body ground	Below 1 V
CLK- (A61-109) - Body ground	Below 1 V
REQ+ (A61-112) - Body ground	Below 1 V
REQ- (A61-111) - Body ground	Below 1 V
HTM+ (A61-92) - Body ground	Below 1 V
HTM- (A61-91) - Body ground	Below 1 V
MTH+ (A61-90) - Body ground	Below 1 V
MTH- (A61-89) - Body ground	Below 1 V

NOTICE:
Turning the power switch on (IG) 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.

(e) Turn the power switch off.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
CLK+ (A61-110) - CLK+ (A62-28)	Below 1 Ω
CLK- (A61-109) - CLK- (A62-19)	Below 1 Ω
REQ+ (A61-112) - REQ+ (A62-25)	Below 1 Ω
REQ- (A61-111) - REQ- (A62-16)	Below 1 Ω
HTM+ (A61-92) - HTM+ (A62-26)	Below 1 Ω
HTM- (A61-91) - HTM- (A62-17)	Below 1 Ω
MTH+ (A61-90) - MTH+ (A62-24)	Below 1 Ω
MTH- (A61-89) - MTH- (A62-15)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
CLK+ (A61-110) or CLK+ (A62-28) - Body ground	10 kΩ or more
CLK- (A61-109) or CLK- (A62-19) - Body ground	10 kΩ or more
REQ+ (A61-112) or REQ+ (A62-25) - Body ground	10 kΩ or more

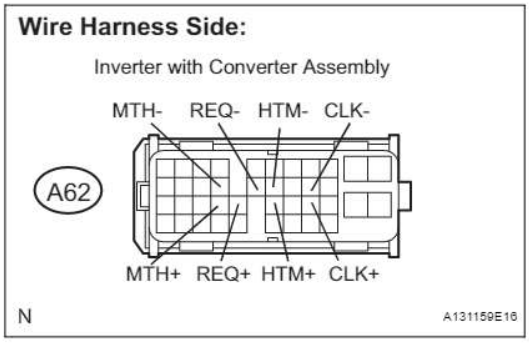
HV

Tester Connection	Specified Condition
REQ- (A61-111) or REQ- (A62-16) - Body ground	10 kΩ or more
HTM+ (A61-92) or HTM+ (A62-26) - Body ground	10 kΩ or more
HTM- (A61-91) or HTM- (A62-17) - Body ground	10 kΩ or more
MTH+ (A61-90) or MTH+ (A62-24) - Body ground	10 kΩ or more
MTH- (A61-89) or MTH- (A62-15) - Body ground	10 kΩ or more

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

5 CHECK HYBRID VEHICLE CONTROL ECU



(a) Turn the power switch off.
(b) Connect the hybrid vehicle control ECU connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

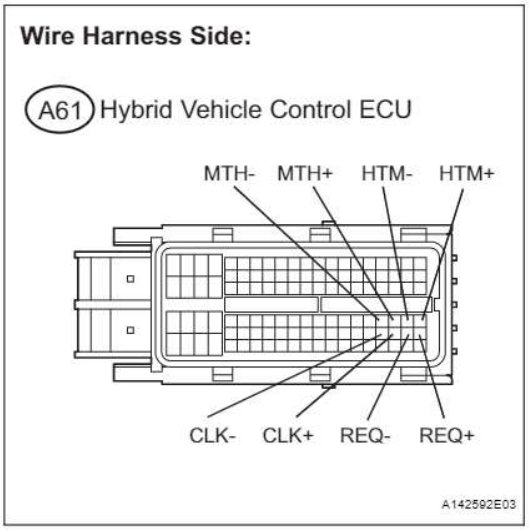
Tester Connection	Specified Condition
CLK+ (A62-28) - CLK- (A62-19)	109 to 139 Ω
REQ+ (A62-25) - REQ- (A62-16)	109 to 139 Ω
HTM+ (A62-26) - HTM- (A62-17)	109 to 139 Ω
MTH+ (A62-24) - MTH- (A62-15)	109 to 139 Ω

NG → REPLACE HYBRID VEHICLE CONTROL ECU (See page HV-569)

OK

6 CHECK INVERTER WITH CONVERTER ASSEMBLY

(a) Turn the power switch off.
(b) Connect the inverter with converter assembly connector.



(c) Disconnect the A61 hybrid vehicle control ECU connector.
(d) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
CLK+ (A61-110) - CLK- (A61-109)	109 to 139 Ω
REQ+ (A61-112) - REQ- (A61-111)	109 to 139 Ω
HTM+ (A61-92) - HTM- (A61-91)	109 to 139 Ω
MTH+ (A61-90) - MTH- (A61-89)	109 to 139 Ω

NG → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)**

OK

7 CHECK NOISE SOURCE

HINT:
Using non-genuine parts may cause electrical noise to be introduced.

Result:

Electrical noise is introduced.

YES → **REPAIR OR REPLACE NOISE SOURCE**

HV

NO

8 REPLACE HYBRID VEHICLE CONTROL ECU

NEXT

9 CLEAR DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

DTC P0A09-591 is output.

NEXT

10 RECONFIRM DTC OUTPUT (HV)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).

(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / HV ECU / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.
Result:
DTC U0110-159, 160, 656 or 657 is output.

YES → **REPLACE INVERTER WITH CONVERTER ASSEMBLY (See page HV-558)**

NO

COMPLETED

HV

DTC	U0146-594	Lost Communication with Gateway "A"

DTC	U0146-827	Lost Communication with Gateway "A"

DESCRIPTION

Since the A/C amplifier is connected to the BEAN, signals sent to the hybrid vehicle control ECU on the CAN move from one network to the other via the network gateway ECU.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
U0146	594	Communication error between ECUs	CAN communication system
U0146	827	CAN communication system malfunction	CAN communication system

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

HV

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / A/C / DTC INF / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Detection Item
B1262	A/C ECU not connected
B1266	Short in instrument panel system bus +B power
B1267	Short to GND in instrument panel system bus

YES → **GO TO MULTIPLEX COMMUNICATION SYSTEM**

NO

2	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Check for and record DTCs of all systems by following the prompts on the intelligent tester screen.

NEXT

GO TO CAN COMMUNICATION SYSTEM

DTC	U0151-763	Lost Communication with Airbag ECU

DESCRIPTION

Since the center airbag sensor is connected to the BEAN, signals sent to the hybrid vehicle control ECU on the CAN move from one network to the other via the network gateway ECU.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
U0151	763	Problem with CAN communication between the center airbag sensor assembly and hybrid vehicle control ECU	• CAN communication system • Multiplex communication system

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / SRS / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result

DTC No.	Detection Item
B1281	Airbag ECU not connected
B1266	Short in instrument panel system bus +B power
B1267	Short to GND in instrument panel system bus

YES → **GO TO MULTIPLEX COMMUNICATION SYSTEM**

NO

2	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Check for and record DTCs of all systems by following the prompts on the intelligent tester screen.

NEXT

GO TO CAN COMMUNICATION SYSTEM

DTC	U0424-537	Lost Communication with A/C ECU

DESCRIPTION

If there is a malfunction in the air conditioning amplifier assembly, DTC P0424-537 will be output.

DTCNo.	INF Code	DTC Detection Condition	Trouble Area
U0424	537	Air conditioning amplifier assembly malfunction	Air conditioning amplifier assembly

INSPECTION PROCEDURE

CAUTION:

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

HINT:

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

1	CHECK DTC OUTPUT (AIR CONDITIONING SYSTEM)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the power switch on (IG).
(c) Select the following menu items: DIAGNOSIS / OBD/ MOBD / A/C / DTC INFO / CURRENT CODES.
(d) Check if DTCs are output.

Result:

Air conditioning system DTCs are output.

YES → **GO TO AIR CONDITIONING SYSTEM**

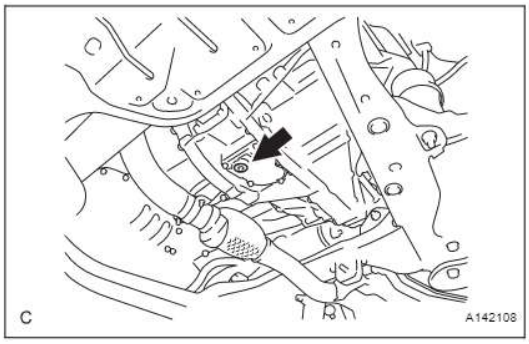
NO

REPLACE AIR CONDITIONING AMPLIFIER ASSEMBLY

HV

REPLACEMENT

1. **DRAIN COOLANT (for Inverter)**
   NOTICE:
   Collect the drained coolant and measure its volume to establish a benchmark. When adding coolant, make sure to add more coolant than the measured amount.
   (a) Remove the inverter reserve tank cap.
   (b) Using a hexagon wrench (10 mm), remove the drain plug indicated in the illustration and drain the coolant.
   (c) Using a hexagon wrench (10 mm), install the drain plug with a new gasket.
   Torque: 39 N*m (398 kgf*cm, 29 ft.*lbf)



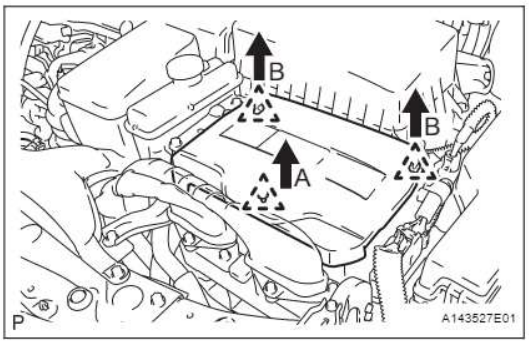
2. **ADD COOLANT (for Inverter)**
   HINT:
   Coolant (for Inverter) capacity: 2.9 liters (3.1 US qts, 2.6 lmp. qts.)
   (a) Add coolant from the reserve tank.
   (b) Connect the intelligent tester to the DLC3.
   (c) Follow the intelligent tester screen to perform the active test of the water pump.
   (d) While adding coolant so that the coolant level is kept between the FULL and LOW lines.
   HINT:
   If the water pump operates without a sufficient amount of coolant for approximately 5 seconds, the protective circuit will activate to stop the water pump for approximately 15 seconds. If a sufficient amount of coolant is added, the water pump will start operating automatically.
   Standard:
   When the operational sound volume of the water pump becomes small or when no air bubbles can be seen in the inverter reserve tank sub-assembly, bleeding of the coolant system is complete.
   (e) After bleeding is completed, stop the water pump, add coolant to the FULL level, and install the inverter radiator cap.
   NOTICE:
   Make sure to add more coolant than was drained initially.

3. **INSPECT FOR COOLANT LEAK (for Inverter)**

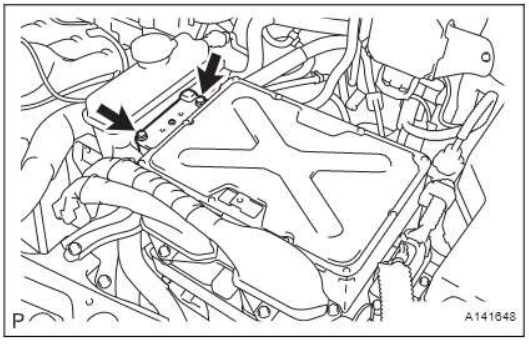
HV

REMOVAL

1. **PRECAUTION**
   See page IN-5
2. **REMOVE LUGGAGE TRIM SERVICE HOLE COVER (See page HB-86)**
3. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
4. **REMOVE SERVICE PLUG GRIP (See page HB-86)**
5. **REMOVE AIR CLEANER INLET ASSEMBLY (See page EM-90)**
6. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY (See page ES-395)**
7. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY (See page EM-90)**
8. **REMOVE NO. 2 ENGINE ROOM SIDE LH COVER**
   (a) Pull the A part upward to disengage the clip.
   (b) Pull the B parts upward by hand to disengage the 2 clips, and remove the No. 2 engine room side LH cover.

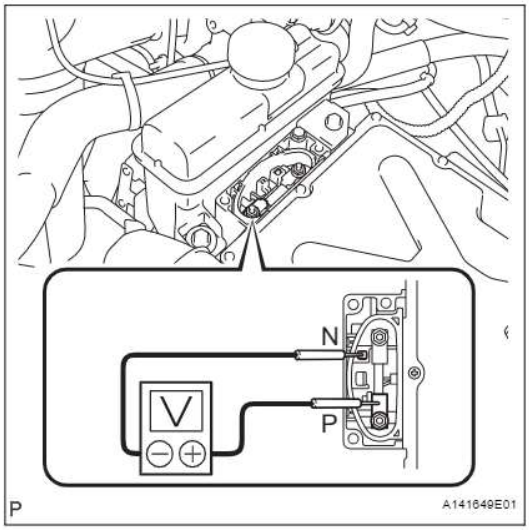


9. **DRAIN COOLANT (for Inverter) (See page HV-556)**



10. **REMOVE CONNECTOR COVER ASSEMBLY**
    (a) Remove the 2 bolts and connector cover assembly.
    CAUTION:
    - **Do not touch the high voltage connectors and terminals for 10 minutes after the service plug grip is removed.**
    - **Wear insulating gloves.**

    NOTICE:
    Do not start the engine with the service plug grip removed because it may cause a malfunction.



11. CHECK TERMINAL VOLTAGE

(a) Using the voltmeter, measure the voltage between the terminals of the 2 phase connectors (N-P).

Standard voltage:

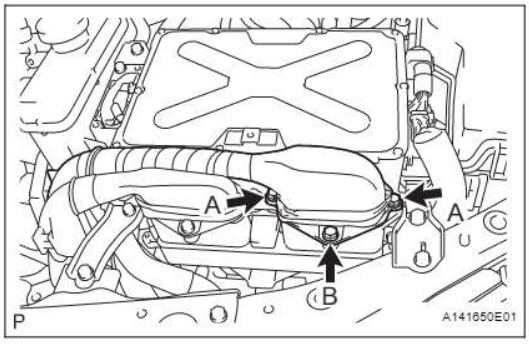
0 V

CAUTION:

Wear insulating gloves.

HINT:

Use measuring range of DC 750 V or more on the voltmeter.



12. SEPARATE MOTOR CABLE

(a) Remove 2 bolts A.

CAUTION:

Wear insulating gloves.

NOTICE:

Removing bolts A and B in a wrong order may cause the cable and the inverter with converter to break.

(b) While loosening bolt B, disconnect the generator cable.

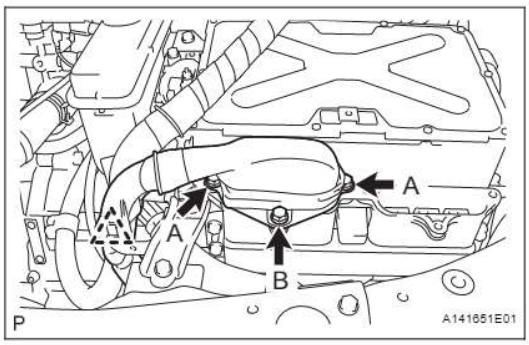
CAUTION:

Wear insulating gloves.

NOTICE:

- **Removing bolts A and B in a wrong order may cause the cable and the inverter with converter to break.**
- **Insulate the removed terminals with insulating tape.**
- **Cover the hole where the cable was connected with tape or equivalent (non-residue type) to prevent entry of foreign matter.**

(c) Disconnect the wire harness clamp.



13. SEPARATE GENERATOR CABLE

(a) Remove 2 bolts A.

CAUTION:

Wear insulating gloves.

NOTICE:

Removing bolts A and B in a wrong order may cause the cable and the inverter with converter to break.

(b) While loosening bolt B, disconnect the motor cable.

CAUTION:

Wear insulating gloves.

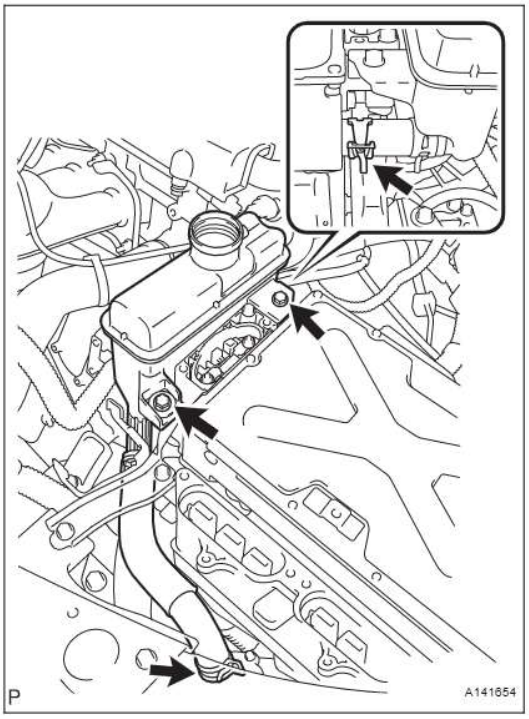
NOTICE:

- **Removing bolts A and B in a wrong order may cause the cable and the inverter with converter to break.**

HV

- **Insulate the removed terminals with insulating tape.**
- **Cover the hole where the cable was connected with tape or equivalent (non-residue type) to prevent entry of foreign matter.**

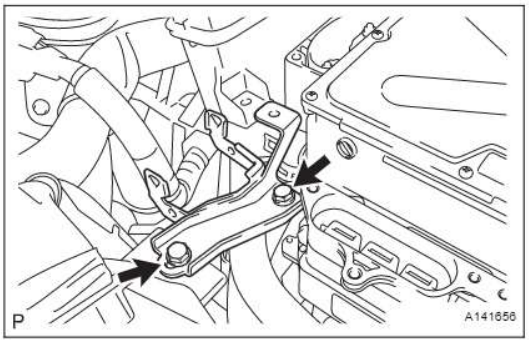
(c) Disconnect the wire harness clamp.



14. REMOVE INVERTER RESERVE TANK SUB-ASSEMBLY

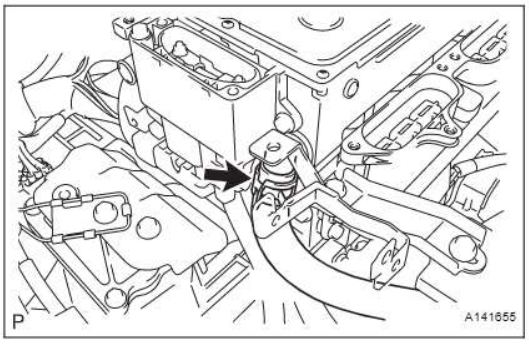
(a) Remove the 2 bolts and inverter reserve tank sub-assembly.

(b) Disconnect the 2 water hoses from the inverter reserve tank sub-assembly.



15. REMOVE NO. 2 INVERTER BRACKET

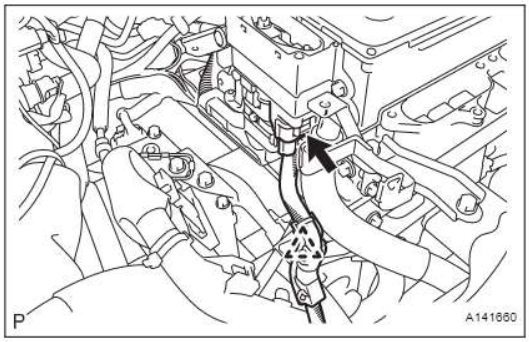
(a) Remove the 2 bolts and No. 2 inverter bracket.



16. DISCONNECT WATER HOSE

(a) Remove the clip, and disconnect the water hose.

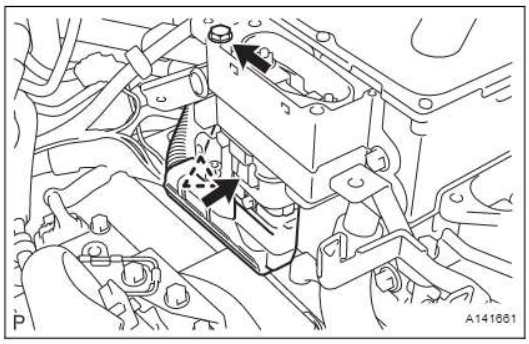
NOTICE:
Do not damage the water hose protector when removing the clip.



17. SEPARATE AIR CONDITIONING HARNESS ASSEMBLY

(a) Disconnect the air conditioning harness assembly.
CAUTION:
Wear insulating gloves.
NOTICE:
Insulate the removed terminals with insulating tape.

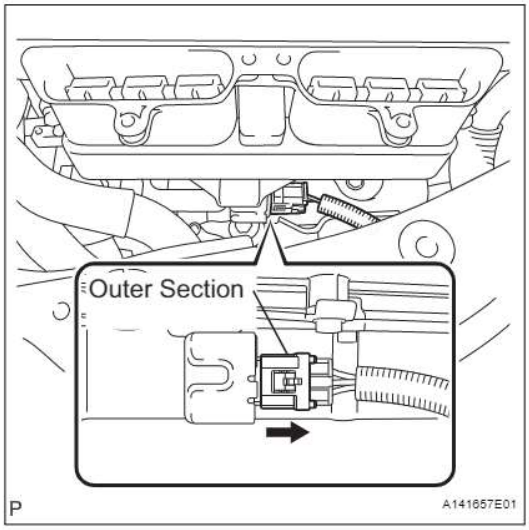
(b) Disconnect the wire harness clamp.



18. SEPARATE FRAME WIRE

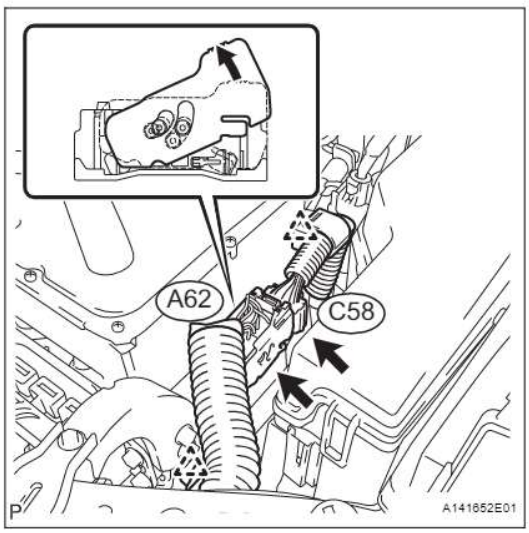
(a) Remove the bolt and disconnect the frame wire.
CAUTION:
Wear insulating gloves.
NOTICE:
- **Insulate the removed terminals with insulating tape.**
- **Install the connector cover to prevent foreign matter from entering.**

(b) Disconnect the wire harness clamp.



19. REMOVE INVERTER WITH CONVERTER ASSEMBLY

(a) Move the outer section to the wire harness side as illustrated, then disconnect the circuit breaker sensor connector.

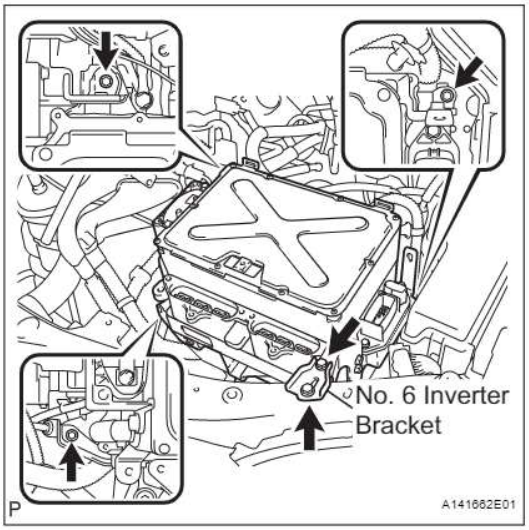


(b) Disconnect the C58 connector.

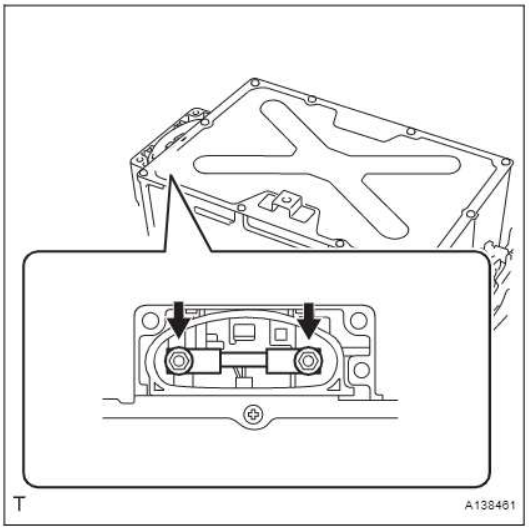
(c) Raise the lock lever and disconnect the A62 connector.
NOTICE:
Cover the hole where the connector was connected with tape or equivalent (non-residue type) to prevent entry of foreign matter.

(d) Disconnect the 2 wire harness clamps.

HV

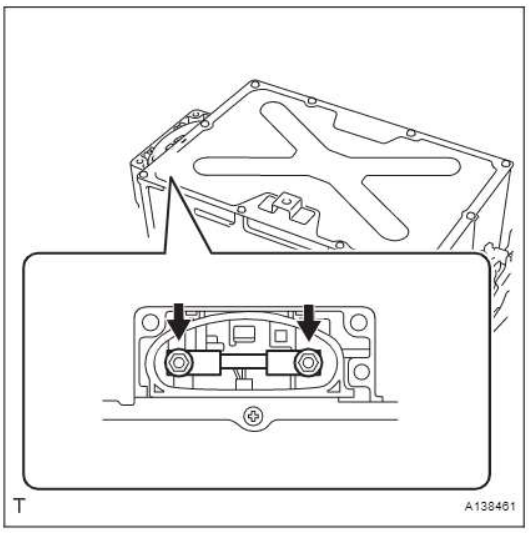


(e) Remove the 2 bolts and No. 6 inverter bracket.
(f) Remove the 3 bolts and inverter with converter assembly.
CAUTION:
Wear insulating gloves.
NOTICE:
- **Do not hold the inverter with converter assembly by the connector terminals when removing it from the vehicle.**
- **Do not hit the No. 1 circuit breaker sensor against the vehicle body or other objects when removing or installing it.**
- **Do not turn over the removed inverter with converter assembly.**



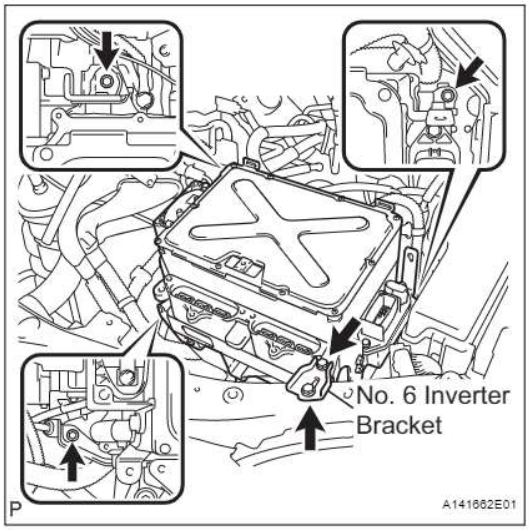
20. REMOVE HIGH VOLTAGE FUSE
(a) Remove the 2 nuts and high voltage fuse.
CAUTION:
Wear insulating gloves.

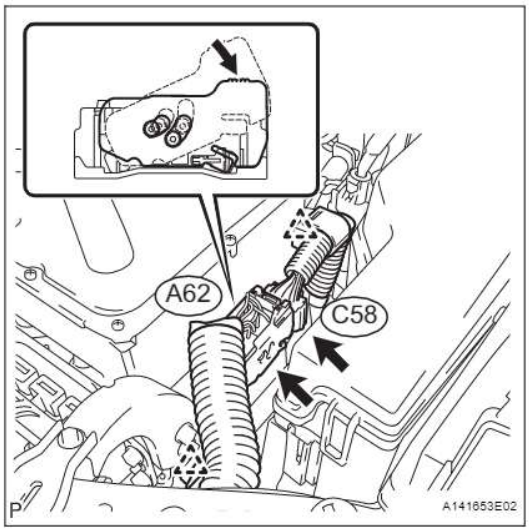
HV

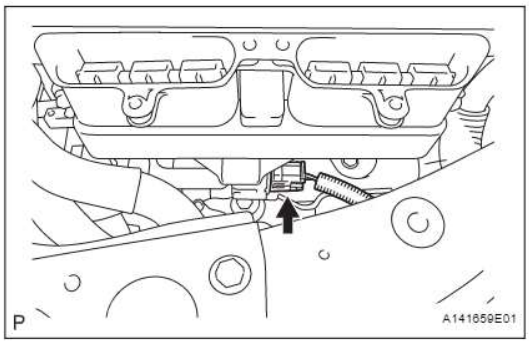


INSTALLATION

1. INSTALL HIGH VOLTAGE FUSE
(a) Install the high voltage fuse with 2 new nuts.
Torque: 4.0 N*m (41 kgf*cm, 35 in.*lbf)
CAUTION:
Wear insulating gloves.
NOTICE:
Be sure to use a torque wrench to tighten the nuts.







2. INSTALL INVERTER WITH CONVERTER ASSEMBLY

(a) Install the inverter with converter assembly with 3 bolts.

Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)

CAUTION:

Wear insulating gloves.

NOTICE:

- **Do not hold the inverter with converter assembly by the connector terminals when removing or installing it from the vehicle.**
- **Do not hit the No. 1 circuit breaker sensor against the vehicle body or other objects when removing or installing it.**

(b) Install the No. 6 inverter bracket with the 2 bolts.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

CAUTION:

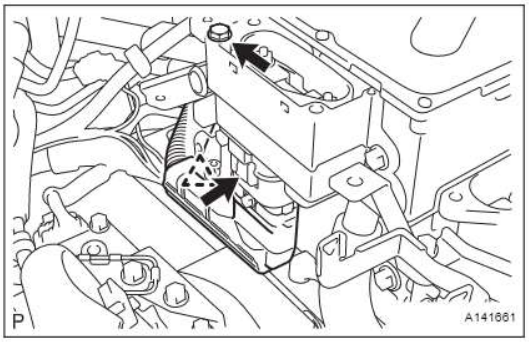
Wear insulating gloves.

(c) Connect the inverter with converter assembly connectors and lock the connector with the lock lever.

(d) Connect the 2 wire harness clamps.

(e) Connect the circuit breaker sensor connector.

HV

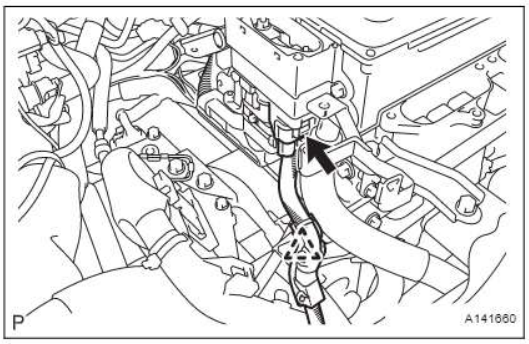


3. CONNECT FRAME WIRE

(a) Connect the frame wire to the inverter with converter assembly.

(b) Fix the frame wire to the inverter with converter assembly with the bolt.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
CAUTION:
Wear insulating gloves.

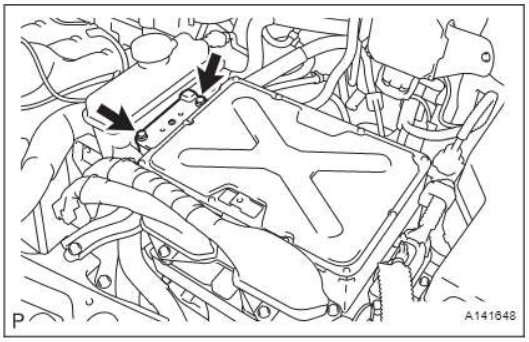
(c) Connect the wire harness clamp.



4. CONNECT AIR CONDITIONING HARNESS ASSEMBLY

(a) Connect the air conditioning harness assembly to the inverter with converter assembly.
CAUTION:
Wear insulating gloves.

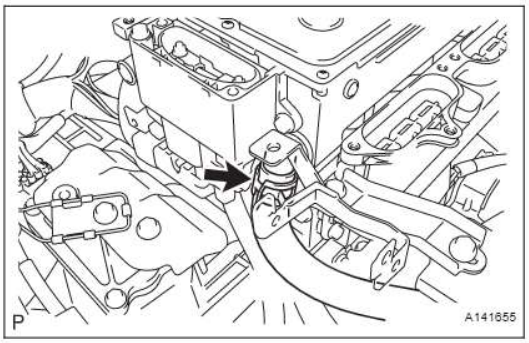
(b) Connect the wire harness clamp.



5. INSTALL CONNECTOR COVER ASSEMBLY

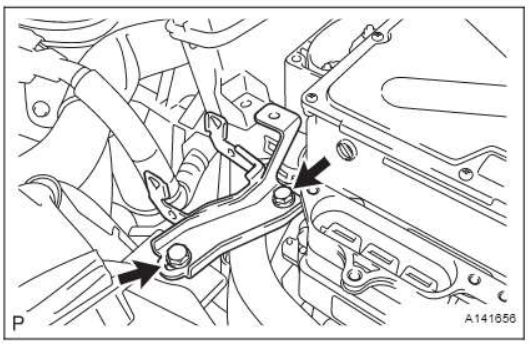
(a) Install the connector cover assembly with the 2 bolts.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
CAUTION:
Wear insulating gloves.

HV



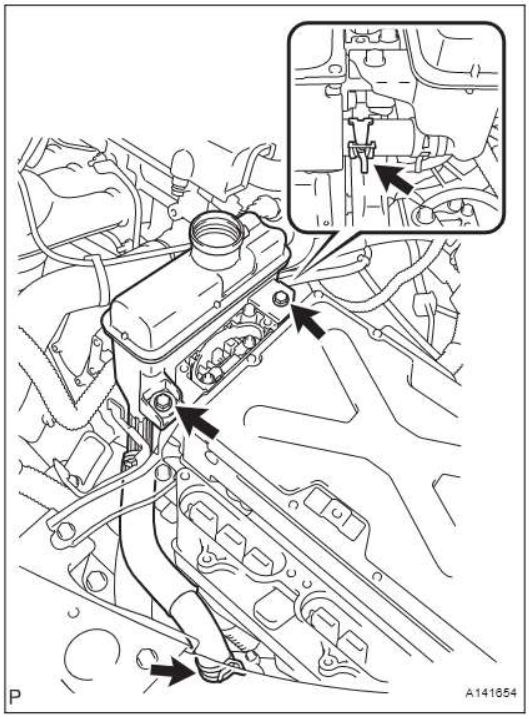
6. CONNECT WATER HOSE

(a) Connect the water hose with the clip.
NOTICE:
Do not damage the water hose protector when installing the clip.



7. INSTALL NO. 2 INVERTER BRACKET

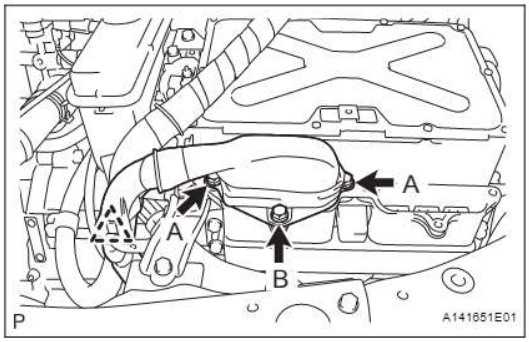
(a) Install the No. 2 inverter bracket with 2 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



8. INSTALL INVERTER RESERVE TANK SUB-ASSEMBLY

(a) Connect the 2 water hoses with the 2 clips.

(b) Install the inverter reserve tank sub-assembly with the 2 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



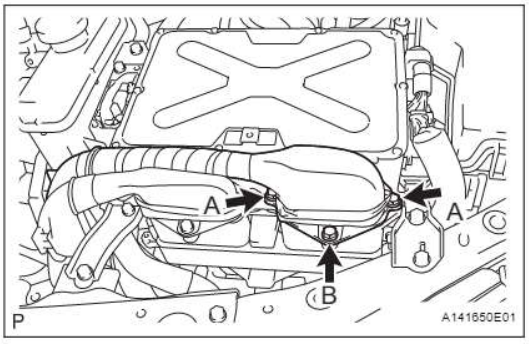
9. CONNECT GENERATOR CABLE

(a) Connect the generator cable. Tighten bolt B and insert the generator cable into the inverter with converter assembly.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
CAUTION:
Wear insulating gloves.
NOTICE:
- **Tightening bolts A and B in a wrong order may cause the cable and the inverter with converter to break.**
- **Make sure that the tightening torque is between 6.4 and 9.6 N*m (65 and 98 kgf*cm).**

(b) Fix the generator cable to the inverter with converter assembly with 2 bolts A.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
CAUTION:
Wear insulating gloves.
NOTICE:
- **Tightening bolts A and B in a wrong order may cause the cable and the inverter with converter to break.**
- **Make sure that the tightening torque is between 6.4 and 9.6 N*m (65 and 98 kgf*cm).**

(c) Connect the wire harness clamp.

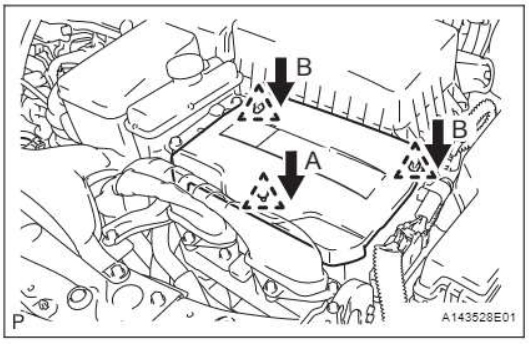
HV



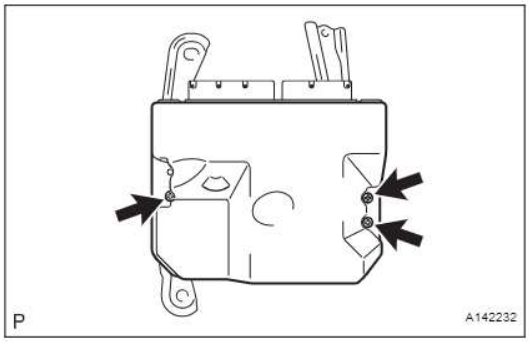
10. **CONNECT MOTOR CABLE**
    (a) Connect the motor cable. Tighten bolt B and insert the motor cable into the inverter with converter assembly.
    Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
    CAUTION:
    Wear insulating gloves.
    NOTICE:
    - **Tightening bolts A and B in a wrong order may cause the cable and the inverter with converter to break.**
    - **Make sure that the tightening torque is between 6.4 and 9.6 N*m (65 and 98 kgf*cm).**

    (b) Fix the motor cable to the inverter with converter assembly with 2 bolts A.
    Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
    CAUTION:
    Wear insulating gloves.
    NOTICE:
    - **Tightening bolts A and B in a wrong order may cause the cable and the inverter with converter to break.**
    - **Make sure that the tightening torque is between 6.4 and 9.6 N*m (65 and 98 kgf*cm).**

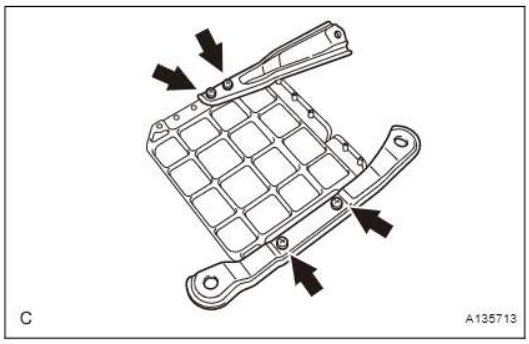
    (c) Connect the wire harness clamp.
11. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY (See page EM-113)**
12. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY (See page ES-398)**
13. **INSTALL AIR CLEANER INLET ASSEMBLY (See page EM-113)**
14. **INSTALL SERVICE PLUG GRIP (See page HB-97)**
15. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
16. **INSTALL LUGGAGE TRIM SERVICE HOLE COVER (See page HB-98)**
17. **ADD COOLANT (for Inverter) (See page HV-556)**
18. **CHECK FOR COOLANT LEAKS (for Inverter) (See page HV-555)**



19. **INSTALL NO. 2 ENGINE ROOM SIDE LH COVER**
    (a) Set the No. 2 engine room side LH cover to the inverter with converter.
    (b) Engage the clip (A) to the inverter with converter.
    (c) Engage the 2 clips (B) to the inverter with converter.
20. **PERFORM INITIALIZATION**
    (a) Perform initialization procedure (See page IN-43).
    HINT:
    Some vehicle systems require initialization after reconnecting the cable to the negative battery terminal.



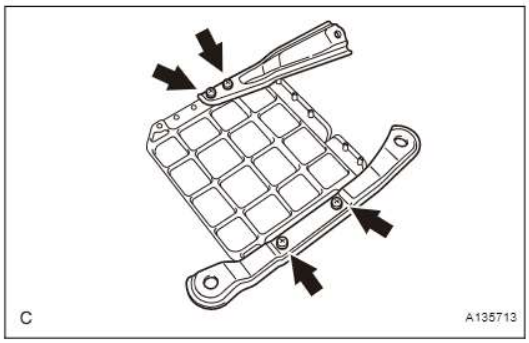
(c) Remove the 3 screws and ECU cover.



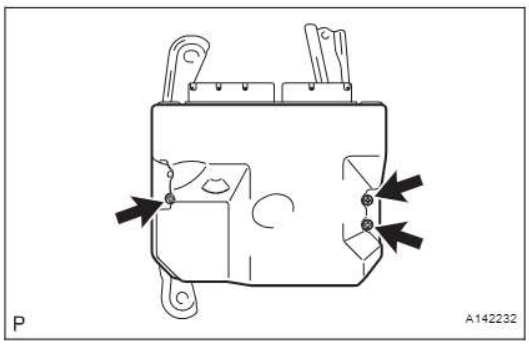
(d) Remove the 4 screws and 2 ECM brackets.

INSTALLATION

1. INSTALL HYBRID VEHICLE CONTROL ECU

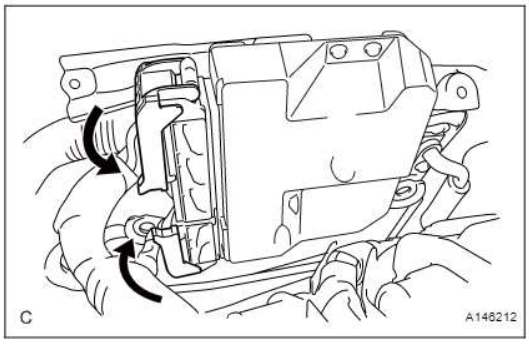


(a) Install the 2 ECM brackets with the 4 screws.
Torque: 3.0 N*m (31 kgf*cm, 27 in.*lbf)



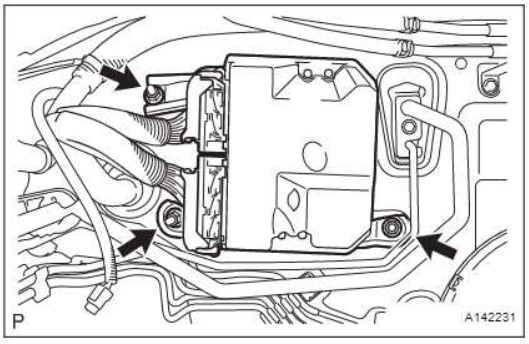
(b) Install the ECU cover with the 3 screws.
Torque: 3.0 N*m (31 kgf*cm, 27 in.*lbf)

(c) Connect the 2 connectors.
NOTICE:
When connecting the connectors, make sure that dirt, water and other foreign matter do not become stuck between the connectors and other parts.



(1) Connect the 2 connectors and lower the 2 levers.
NOTICE:
Make sure that the 2 levers are securely lowered.

HV



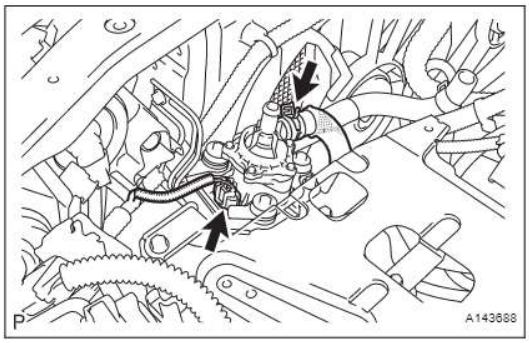
(d) Install the hybrid vehicle control ECU with the 3 nuts.
Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

2. **INSTALL COWL TOP PANEL OUTER SUB-ASSEMBLY (See page ES-405)**
3. **INSTALL BRAKE MASTER CYLINDER RESERVOIR SUB-ASSY (See page ES-383)**
4. **INSTALL WINDSHIELD WIPER MOTOR AND LINK (See page WW-13)**
5. **INSTALL COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY (See page WW-14)**
6. **INSTALL FRONT FENDER TO COWL SIDE SEAL LH (See page WW-14)**
7. **INSTALL FRONT FENDER TO COWL SIDE SEAL RH (See page WW-14)**
8. **INSTALL WINDSHIELD WIPER ARM AND BLADE ASSEMBLY LH (See page WW-14)**
9. **INSTALL WINDSHIELD WIPER ARM AND BLADE ASSEMBLY RH (See page WW-15)**
10. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
11. **PERFORM INITIALIZATION**
    (a) Perform initialization procedure (See page IN-43).
    HINT:
    Some vehicle systems require initialization after reconnecting the cable to the negative battery terminal.

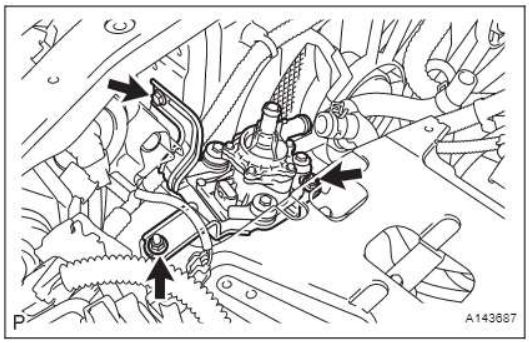
HV

REMOVAL

1. **REMOVE INVERTER WITH CONVERTER ASSEMBLY**
See page HV-559



2. **REMOVE WATER PUMP WITH MOTOR AND BRACKET ASSEMBLY**
   (a) Remove the clip and disconnect the water hose from the water pump with motor and bracket assembly.
   NOTICE:
   Do not damage the water hose protector when removing the clip.
   (b) Disconnect the connector from the water pump with motor and bracket assembly.
   NOTICE:
   Wrap the connectors of the vehicle wire harness and the water pump with motor and bracket assembly with electrical tape to prevent LLC from contaminating the connectors.

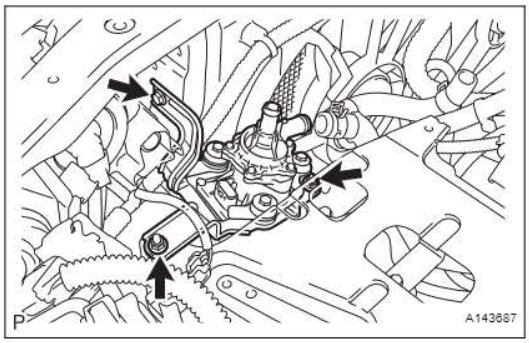


   (c) Remove the bolt, 2 nuts and water pump with motor and bracket assembly.
   NOTICE:
   Do not hold the water pump with motor and bracket assembly by the connector terminals when removing or installing it from the vehicle.

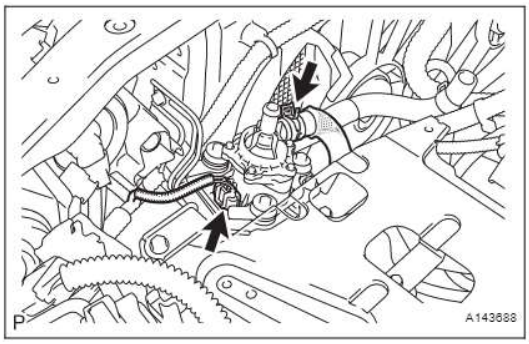
HV

INSTALLATION

1. **INSTALL WATER PUMP WITH MOTOR AND BRACKET ASSEMBLY**



   (a) Install the water pump with motor and bracket assembly with the bolt and 2 nuts.
   Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)
   NOTICE:
   Do not hold the water pump with motor and bracket assembly by the connector terminals when removing or installing it from the vehicle.

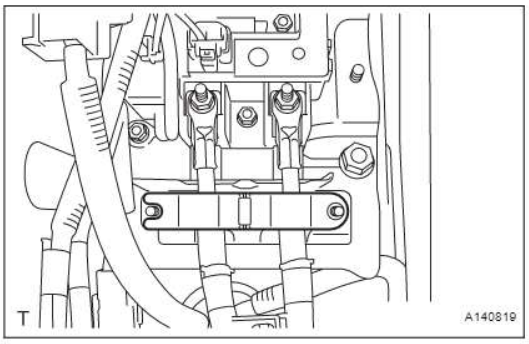


   (b) Connect the connector to the water pump with motor and bracket assembly.
   (c) Connect the water hose to the water pump with motor and bracket assembly with the clip.
   NOTICE:
   Do not damage the water hose protector when installing the clip.

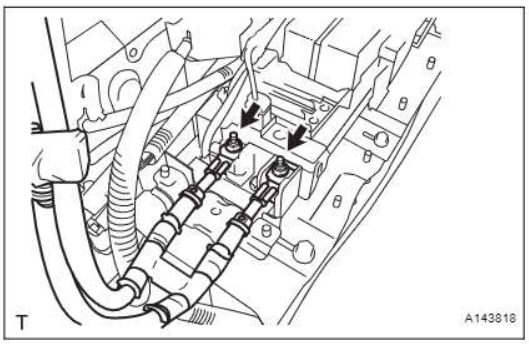
2. **INSTALL INVERTER WITH CONVERTER ASSEMBLY**
See page HV-564

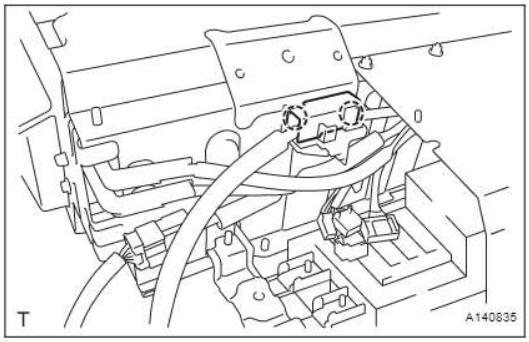
REMOVAL

1. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**
   See page EM-89
2. **REMOVE FUEL TANK ASSEMBLY**
   See page FU-36
3. **REMOVE REAR SEAT HEADREST ASSEMBLY**
4. **REMOVE REAR CENTER SEAT HEADREST ASSEMBLY**
5. **REMOVE REAR SEAT CUSHION ASSEMBLY (See page SE-44)**
6. **REMOVE SEPARATE TYPE REAR SEATBACK ASSEMBLY RH (See page SE-44)**
7. **REMOVE SEPARATE TYPE REAR SEATBACK ASSEMBLY LH (See page SE-44)**
8. **REMOVE FRONT LUGGAGE COMPARTMENT TRIM COVER (See page HB-106)**
9. **REMOVE WIRE HARNESS CLAMP BRACKET (See page HB-107)**
10. **REMOVE UPPER BATTERY CARRIER SUB-ASSEMBLY (See page HB-107)**
11. **DISCONNECT HV BATTERY**
    (a) Remove the battery shield contact.
    CAUTION:
    Wear insulated gloves.

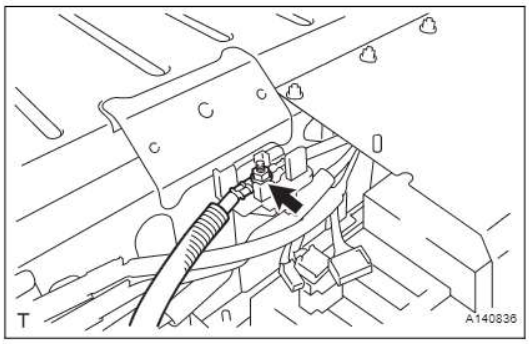


(b) Remove the 2 nuts and disconnect the frame wire (high voltage cable).
CAUTION:
Wear insulated gloves.

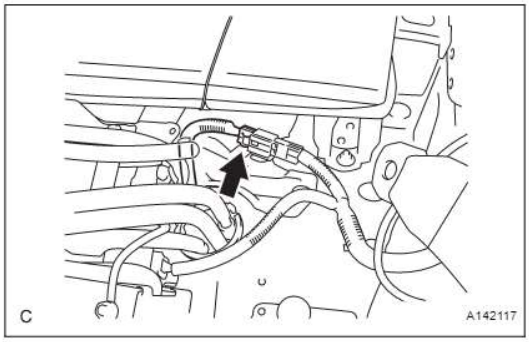




(c) Release the 2 claws and remove the terminal block cover.
CAUTION:
Wear insulated gloves.

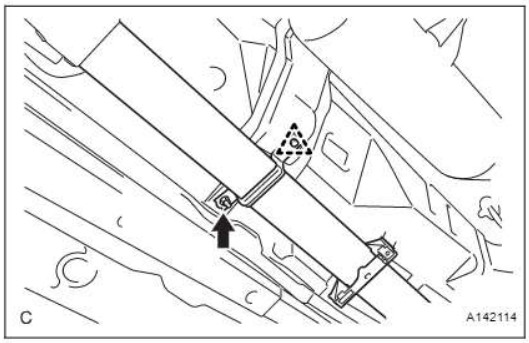


(d) Remove the nut and disconnect the frame wire (AMD cable).
CAUTION:
Wear insulated gloves.



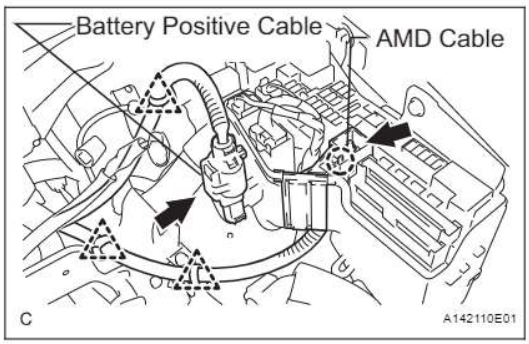
(e) Disconnect the connector (cabin side).
CAUTION:
Wear insulated gloves.

HV



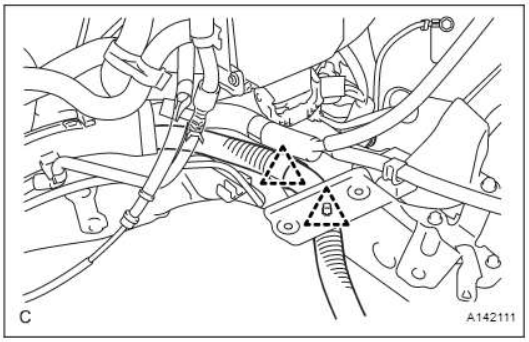
12. REMOVE WIRE HARNESS CLAMP BRACKET

(a) Remove the nut, clamp and wire harness clamp bracket.
HINT:
When removing the clip, break the claw on the clip. This clip cannot be reused.

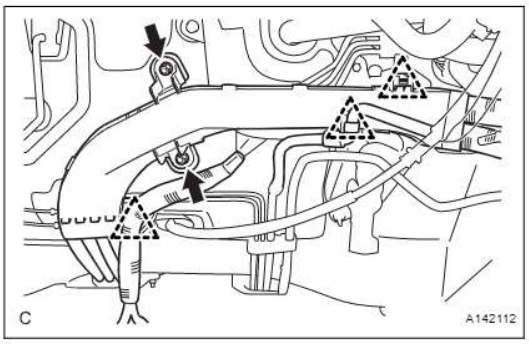


13. REMOVE FRAME WIRE

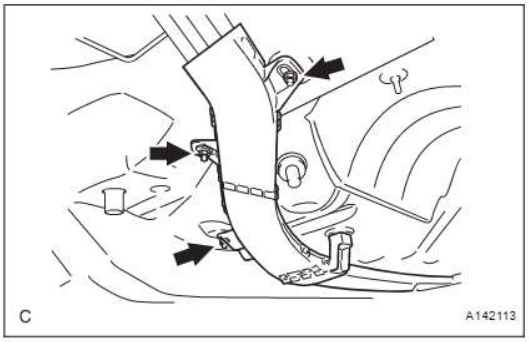
(a) Remove the nut and disengage the claws, and disconnect the frame wire (AMD cable).
(b) Disconnect the frame wire (auxiliary battery positive cable).
(c) Disconnect the 3 wire harness clamps.



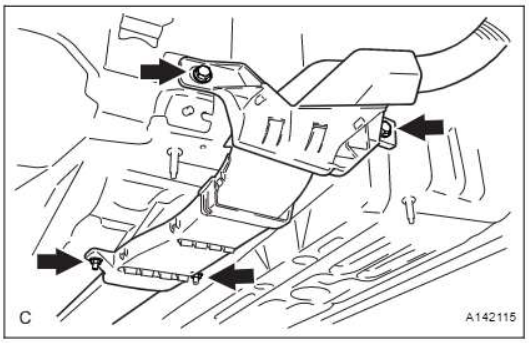
(d) Disconnect the 2 wire harness clamps.



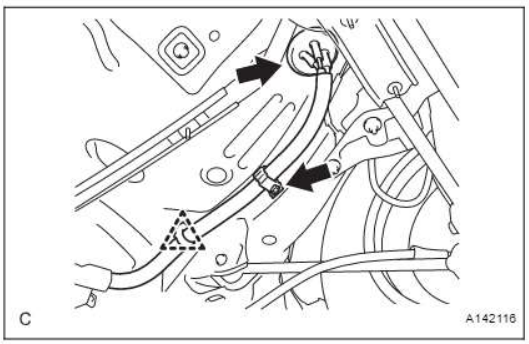
(e) Remove the 2 nuts, and disconnect the 3 clamps.



(f) Remove the 3 nuts.

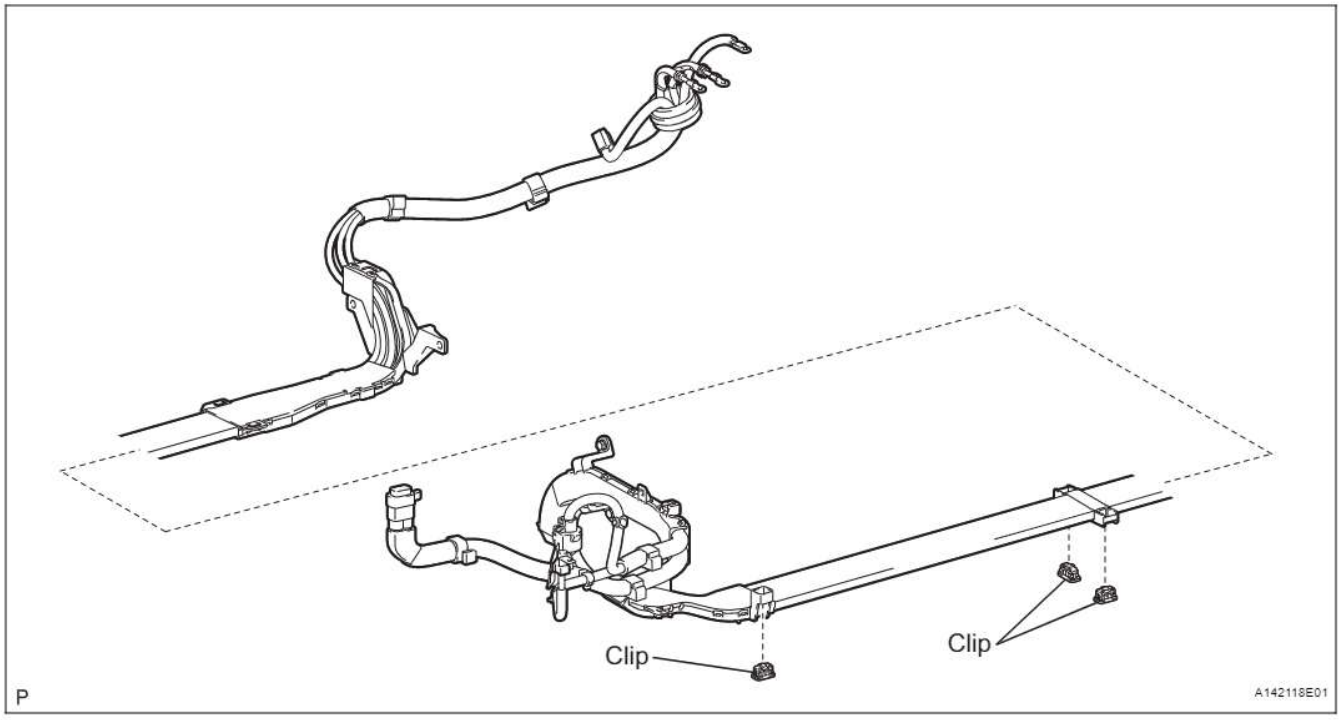


(g) Remove the 2 bolts and 2 nuts.



(h) Remove the bolt, clamp, grommet and pull out the frame wire.

(i) Remove the 3 clips and frame wire.



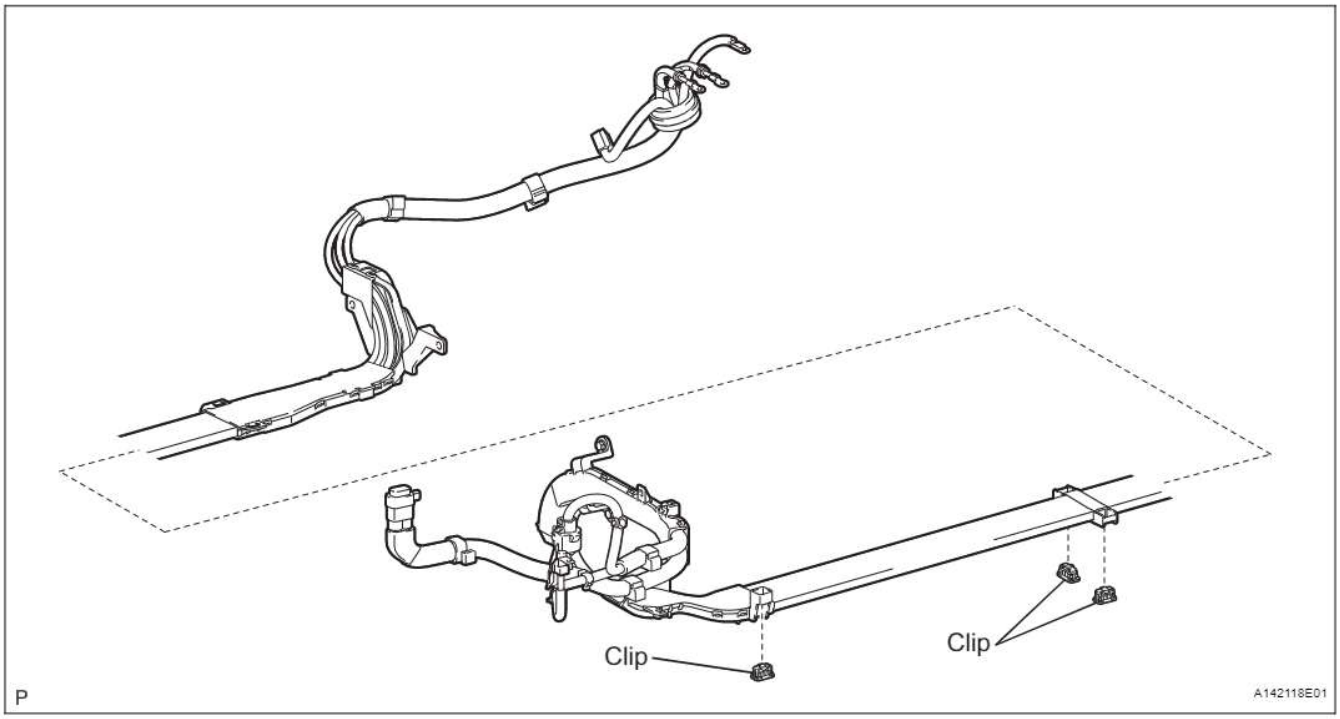
HINT:
When removing the clip, break the claw on the clip.
The clips cannot be reused.

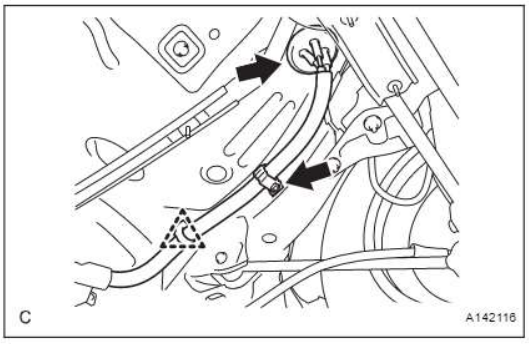
HV

INSTALLATION

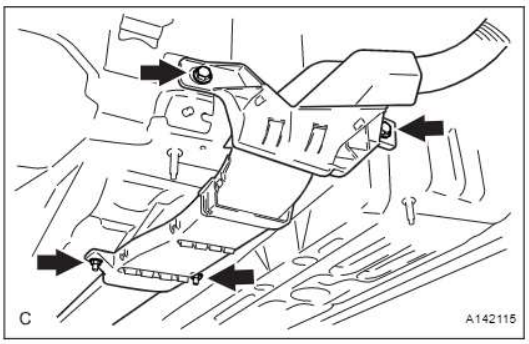
1. INSTALL FRAME WIRE

(a) Install the frame wire with 3 new clips.



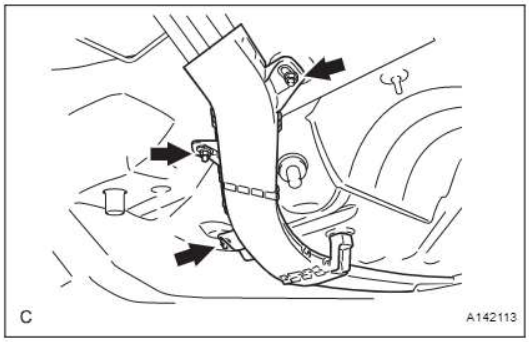


(b) Pass the frame wire to the cabin and install the bolt, clamp and grommet.
Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

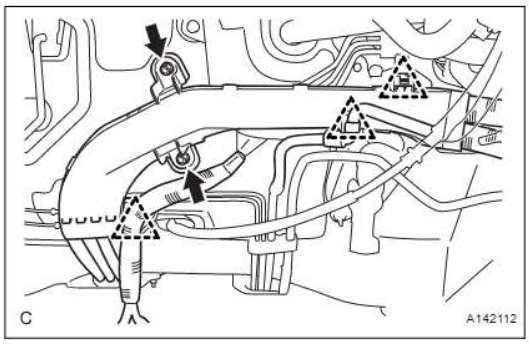


(c) Install the 2 bolts and 2 nuts.
Torque: Bolt
8.4 N*m (85 kgf*cm, 74 in.*lbf)
Nut
8.4 N*m (85 kgf*cm, 74 in.*lbf)

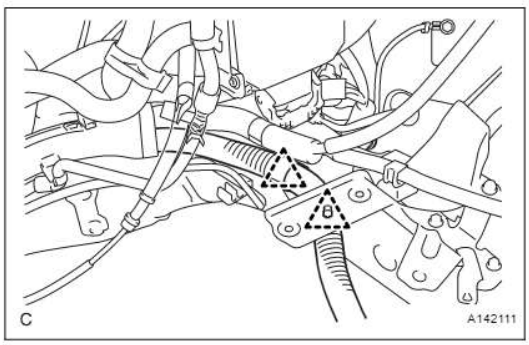
HV



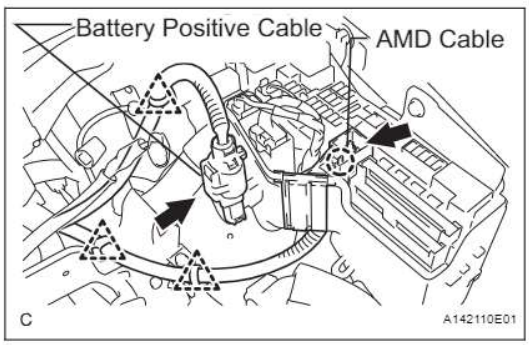
(d) Install the 3 nuts.
Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)



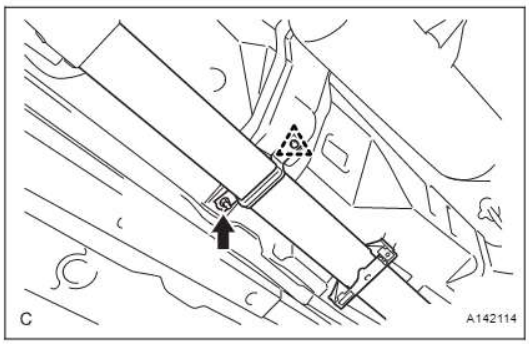
(e) Install the 2 nuts.
Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)
(f) Connect the 3 clamps.



(g) Connect the 2 clamps.



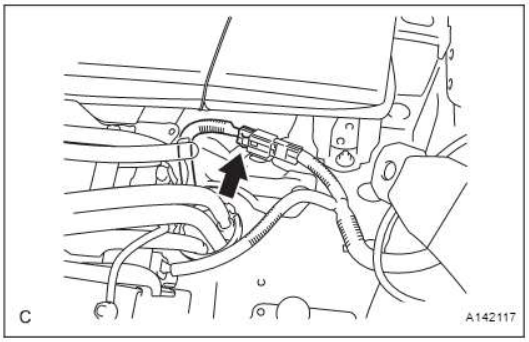
(h) Connect the 3 clamps.
(i) Engage the claw, and connect the frame wire (AMD cable) with the nut.
Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)
(j) Connect the frame wire (auxiliary battery positive cable).



2. INSTALL WIRE HARNESS CLAMP BRACKET

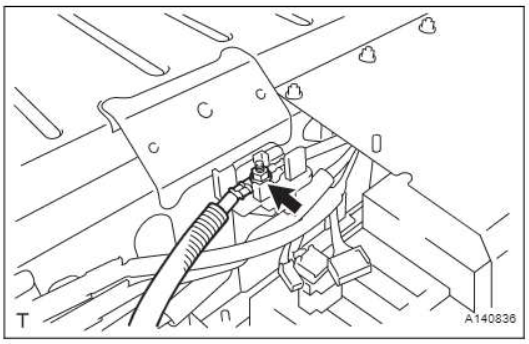
(a) Install the wire harness clamp bracket with the nut and a new clamp.
Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

HV

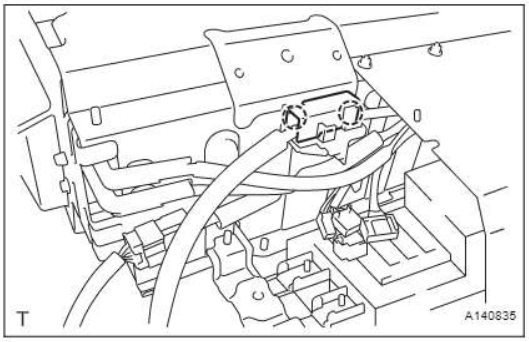


3. CONNECT HV BATTERY

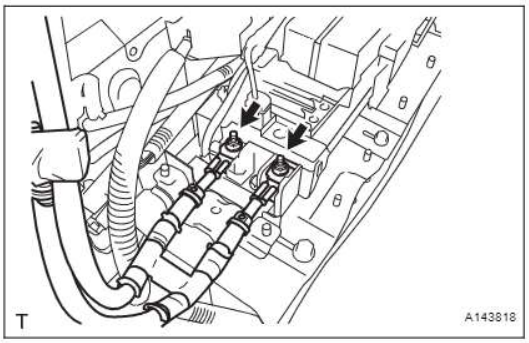
(a) Connect the connector (cabin side).
CAUTION:
Wear insulated gloves.



(b) Connect the frame wire (AMD cable) with the nut.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
CAUTION:
Wear insulated gloves.

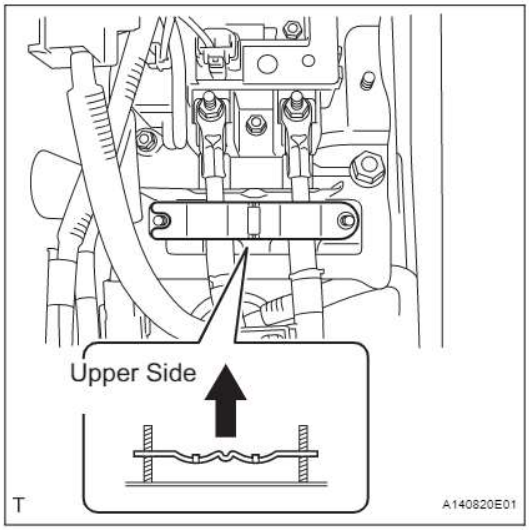


(c) Install the terminal block cover with the 2 claws.
CAUTION:
Wear insulated gloves.



(d) Connect the frame wire (high voltage cable) with the 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
CAUTION:
Wear insulated gloves.

HV



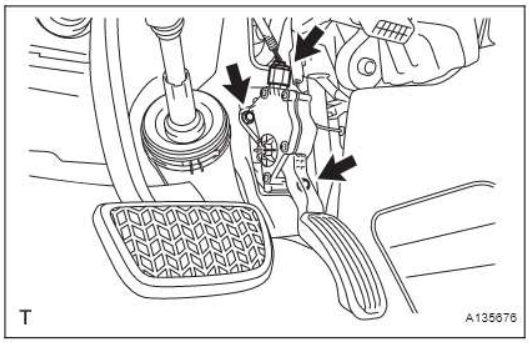
(e) Install the battery shield contact.
CAUTION:
Wear insulated gloves.
NOTICE:
Be sure to install the battery shield contact in the correct direction.

4. **INSTALL UPPER BATTERY CARRIER SUB-ASSEMBLY (See page HB-112)**
5. **INSTALL WIRE HARNESS CLAMP BRACKET (See page HB-112)**
6. **INSTALL FRONT LUGGAGE COMPARTMENT TRIM COVER (See page HB-113)**
7. **INSTALL SEPARATE TYPE REAR SEATBACK ASSEMBLY LH (See page SE-54)**
8. **INSTALL SEPARATE TYPE REAR SEATBACK ASSEMBLY RH (See page SE-54)**
9. **INSTALL REAR SEAT CUSHION ASSEMBLY (See page SE-55)**
10. **INSTALL REAR CENTER SEAT HEADREST ASSEMBLY**
11. **INSTALL REAR SEAT HEADREST ASSEMBLY**
12. **INSTALL FUEL TANK ASSEMBLY**
    See page FU-41
13. **INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**
    See page EM-102

HV

INSTALLATION

1. **INSTALL ACCELERATOR PEDAL ROD**
   NOTICE:
   - **Avoid physical shock to the accelerator pedal assembly.**
   - **Do not disassemble the accelerator pedal assembly.**



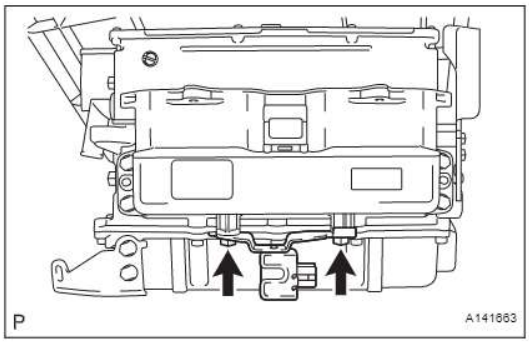
(a) Install the accelerator pedal rod with the 2 bolts.
Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

(b) Connect the accelerator pedal position sensor connector.

HV

REMOVAL

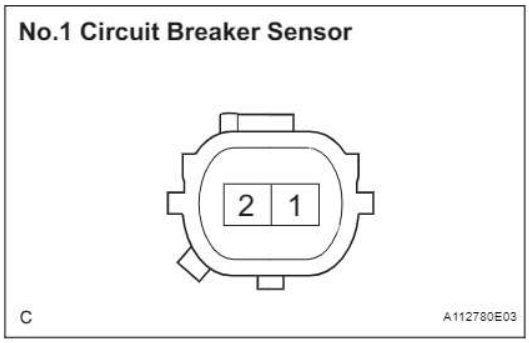
1. **REMOVE INVERTER WITH CONVERTER**
   See page HV-559



2. **REMOVE NO. 1 CIRCUIT BREAKER SENSOR**
   (a) Remove the 2 bolts and No.1 circuit breaker sensor from the inverter with converter.

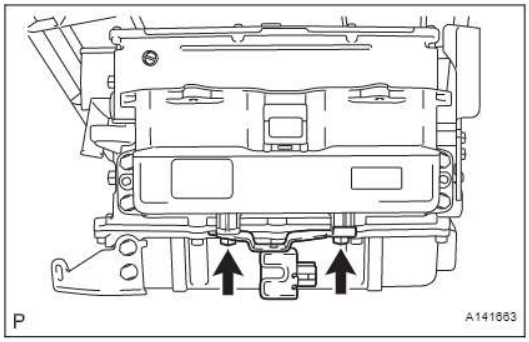
INSPECTION

1. **INSPECT NO. 1 CIRCUIT BREAKER SENSOR**
   (a) Measure the resistance according to the value in the table below.
   Standard Resistance



Tester Connection	Specified Condition
1 - 2	0.65 to 1.0 kΩ at 20°C (68°F)

INSTALLATION



1. **INSTALL NO. 1 CIRCUIT BREAKER SENSOR**
   (a) Install the No. 1 circuit breaker sensor to the inverter with converter with the 2 bolts.
   Torque: 8.5 N*m (87 kgf*cm, 75 in.*lbf)

2. **INSTALL INVERTER WITH CONVERTER**
   See page HV-564

HV

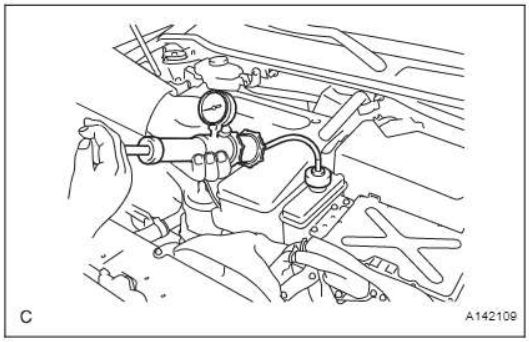
COOLANT (for Inverter)

ON-VEHICLE INSPECTION

1. COOLANT LEAK (for Inverter)

(a) Remove the inverter reserve tank cap.

CAUTION:
To avoid the danger of being burned, do not remove the inverter reserve tank cap while the coolant for inverter is still hot.



(b) Install the radiator cap tester.

(c) Pump the radiator cap tester to 37 kPa (0.38 kgf/cm^2, 5.4 psi), and then check that the pressure does not drop.

HINT:
If the pressure drops, check the hoses, radiator, water pump, inverter with converter, and hybrid vehicle transaxle assembly for leakage.

(d) Reinstall the inverter reserve tank cap.

2. COOLANT LEVEL IN RESERVE TANK (for Inverter)

(a) The coolant should be between the LOW and FULL lines when the coolant for inverter is cold.

HINT:
If the coolant level is low, check for leakage and add TOYOTA Super Long Life Coolant (SLLC) or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, and non-borate coolant with long-life hybrid organic acid technology up to the FULL line.

HV

3. COOLANT (for Inverter)

(a) Remove the inverter reserve tank cap.

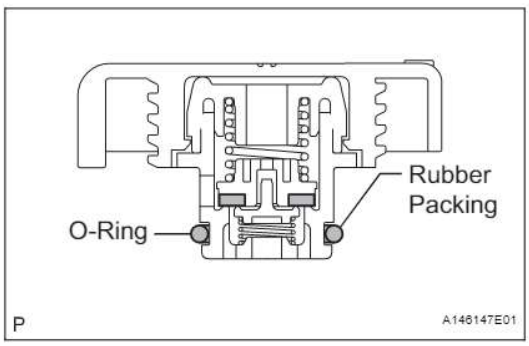
CAUTION:
To avoid the danger of being burned, do not remove the inverter reserve tank cap while the coolant for inverter is still hot.

(b) Check for excessive deposits of rust or scale on and around the inverter reserve tank cap.

HINT:
If excessively dirty, replace the coolant for inverter.

(c) Reinstall the inverter reserve tank cap.

4. INSPECT INVERTER RESERVE TANK CAP

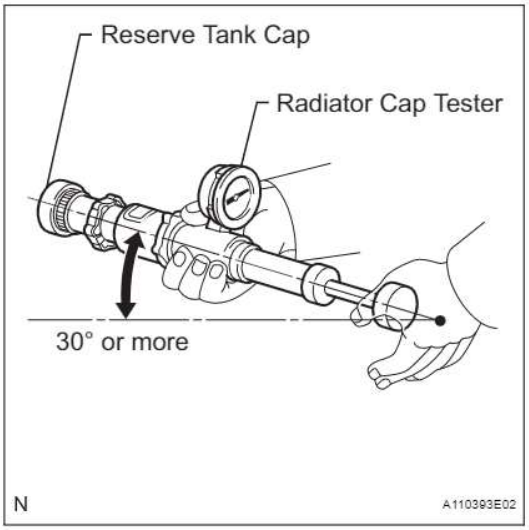


(a) Measure the valve opening pressure.

(1) If there are water stains or foreign matter on the O-ring, clean it with water and finger scouring.

(2) Check that the O-ring 1 is not deformed, cracked, or swollen.

(3) Apply coolant (for inverter) to the O-ring and rubber packing before using a radiator cap tester.



(4) When using the cap tester, tilt it more than 30 degrees.

(5) Pump the cap tester several times, and check the maximum pressure*.

Pump speed:

1 pump per second

*: Even if the cap cannot maintain the maximum pressure, it is not a defect.

Judgment criterion

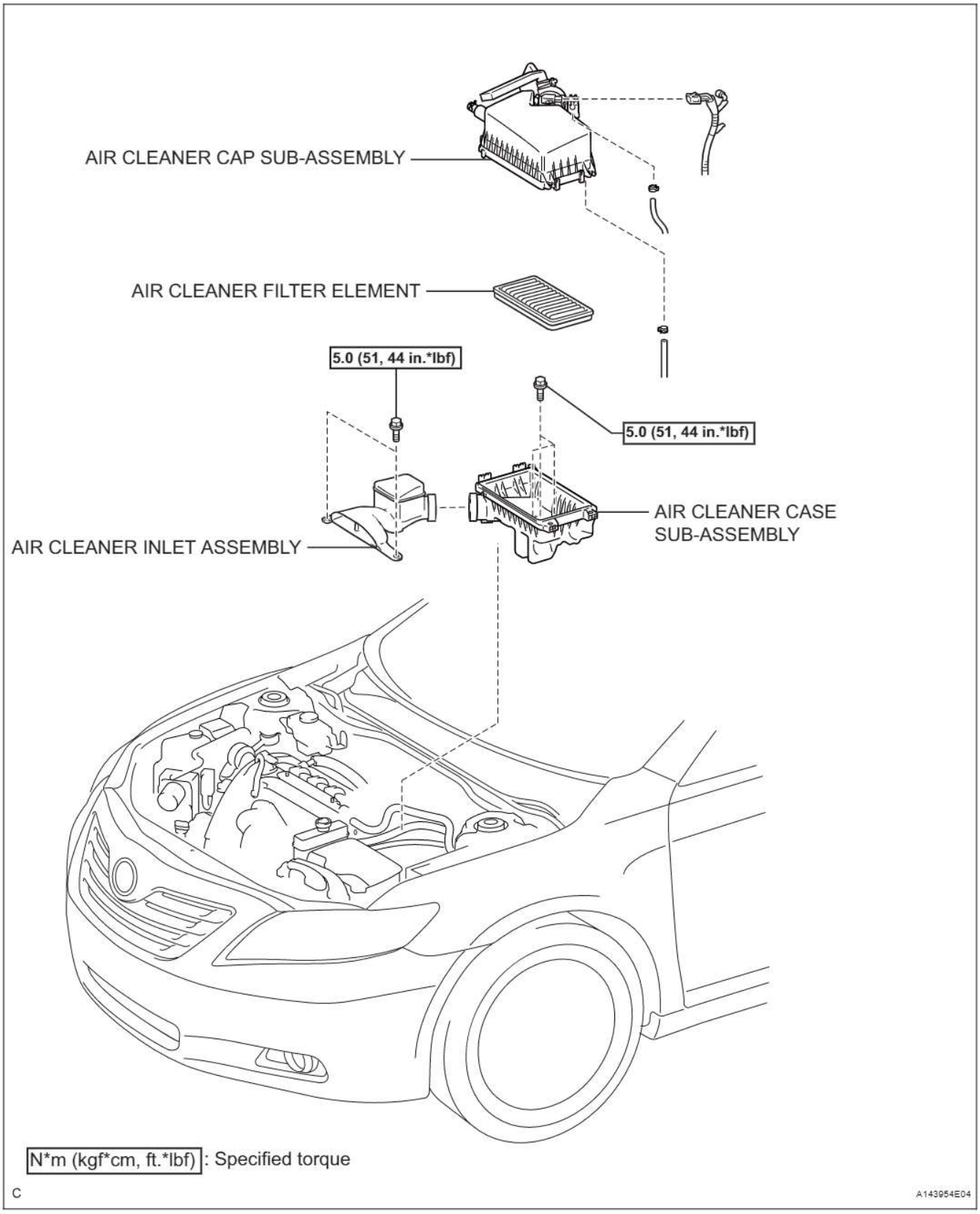
Item	Specified Condition
Standard value (for brand-new cap)	15 to 44 kPa (0.15 to 0.45 kgf*cm^2, 2.1 to 6.4 psi)
Minimum standard value (after using cap)	12 kPa (0.12 kgf*cm^2, 1.7 psi)

If the maximum pressure is less than the minimum standard value, replace the inverter reserve tank sub-assembly.

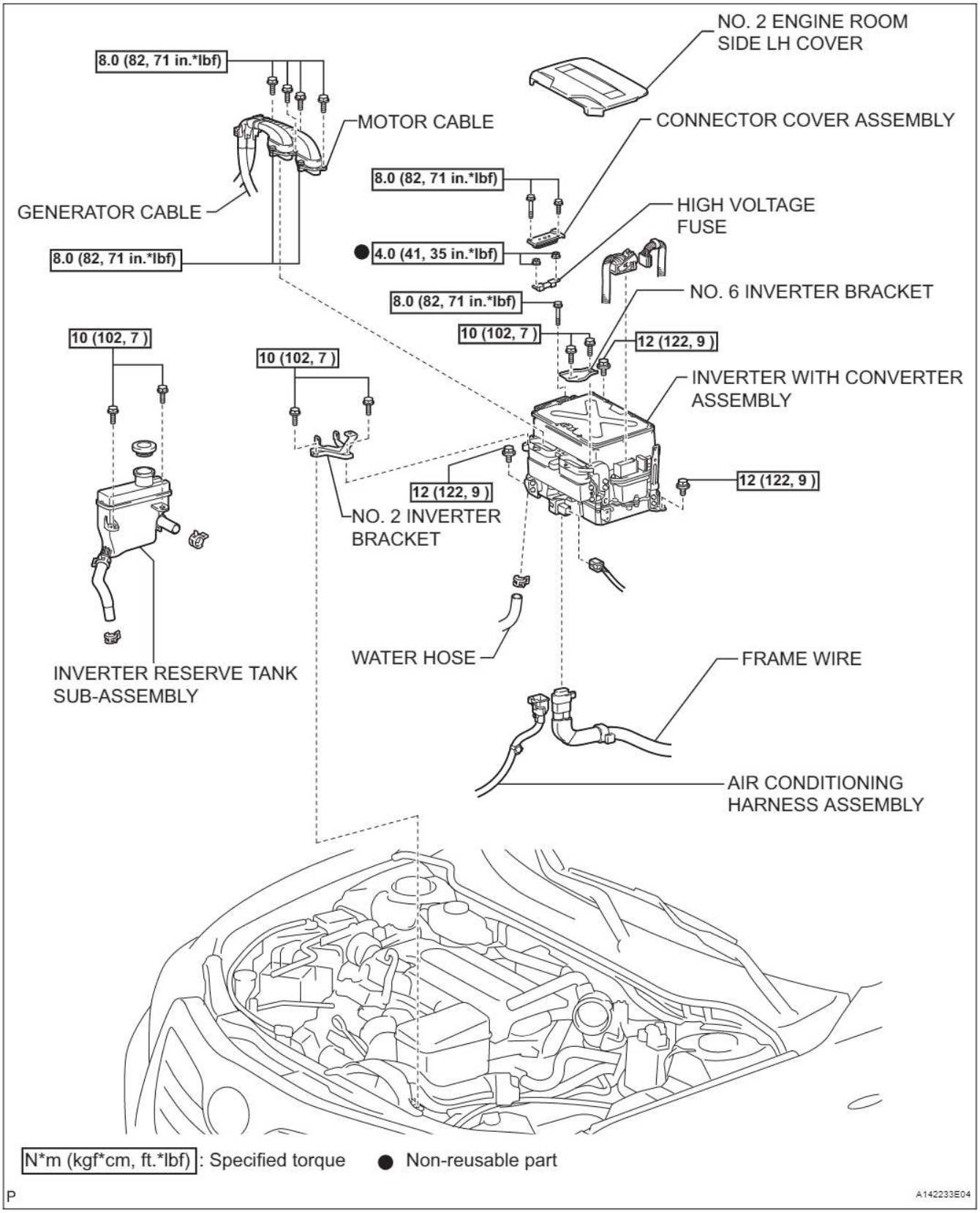
HV

INVERTER WITH CONVERTER

COMPONENTS



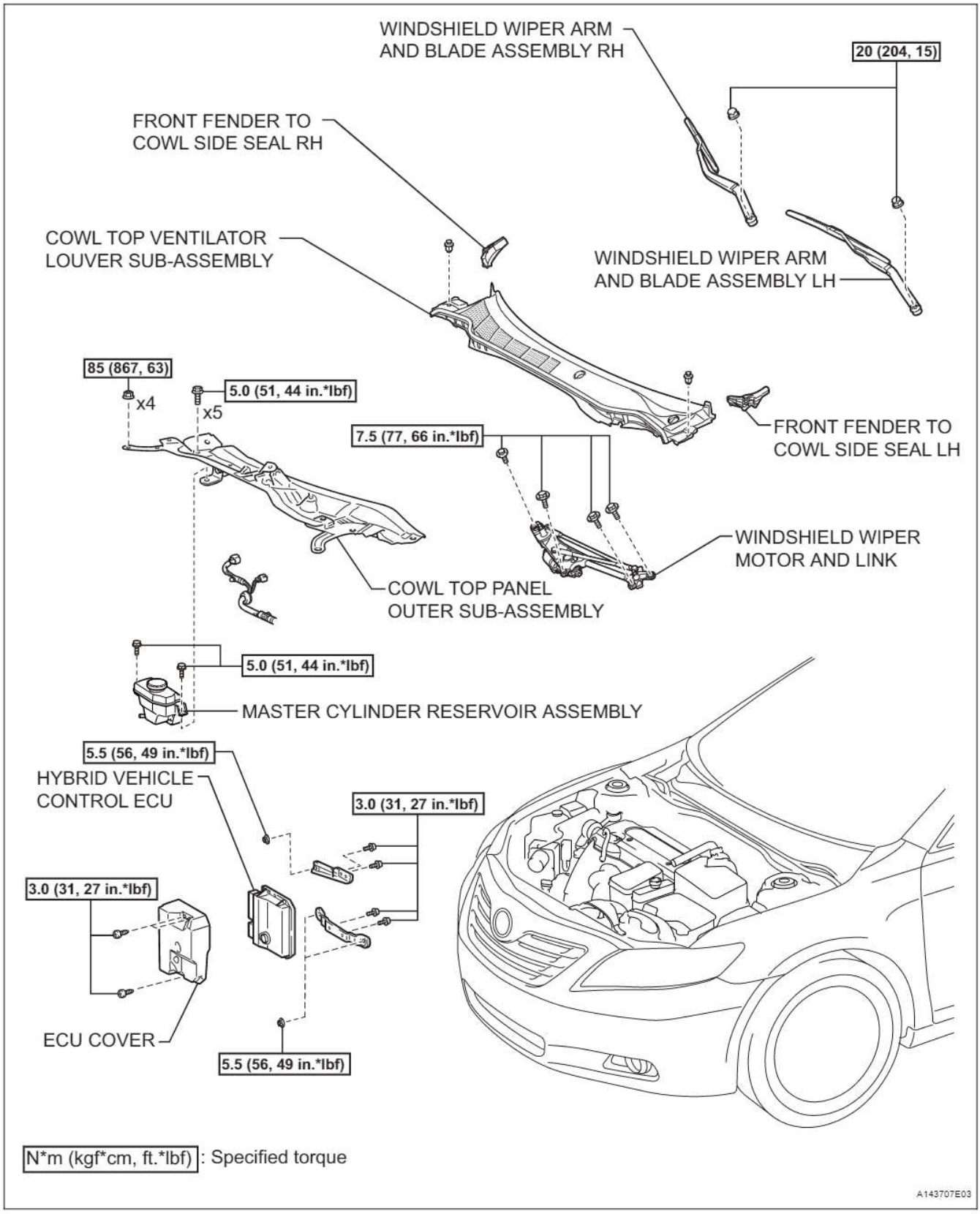
HV


NO. 2 ENGINE ROOM SIDE LH COVER
8.0 (82, 71 in.*lbf)
MOTOR CABLE
CONNECTOR COVER ASSEMBLY
8.0 (82, 71 in.*lbf)
GENERATOR CABLE
HIGH VOLTAGE FUSE
8.0 (82, 71 in.*lbf)
4.0 (41, 35 in.*lbf)
8.0 (82, 71 in.*lbf)
NO. 6 INVERTER BRACKET
10 (102, 7)
10 (102, 7)
10 (102, 7)
12 (122, 9)
INVERTER WITH CONVERTER ASSEMBLY
12 (122, 9)
12 (122, 9)
NO. 2 INVERTER BRACKET
WATER HOSE
FRAME WIRE
INVERTER RESERVE TANK SUB-ASSEMBLY
AIR CONDITIONING HARNESS ASSEMBLY
N*m (kgf*cm, ft.*lbf): Specified torque
Non-reusable part
P
A142233E04

HV

HYBRID VEHICLE CONTROL ECU

COMPONENTS

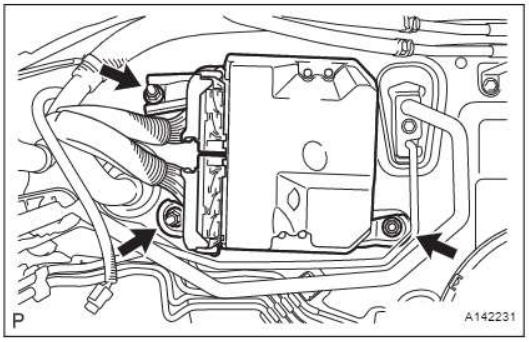


HV

REMOVAL

1. REMOVE LUGGAGE TRIM SERVICE HOLE COVER (See page HB-86)
2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL (See page HV-560)
3. REMOVE WINDSHIELD WIPER ARM AND BLADE ASSEMBLY LH (See page WW-9)
4. REMOVE WINDSHIELD WIPER ARM AND BLADE ASSEMBLY RH (See page WW-9)
5. REMOVE FRONT FENDER TO COWL SIDE SEAL LH (See page WW-9)
6. REMOVE FRONT FENDER TO COWL SIDE SEAL RH (See page WW-9)
7. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY (See page WW-10)
8. REMOVE WINDSHIELD WIPER MOTOR AND LINK (See page WW-10)
9. SEPARATE BRAKE MASTER CYLINDER RESERVOIR SUB-ASSY (See page ES-381)
10. REMOVE COWL TOP OUTER PANEL SUB-ASSEMBLY (See page ES-403)
11. REMOVE HYBRID VEHICLE CONTROL ECU

(a) Remove the 3 nuts.



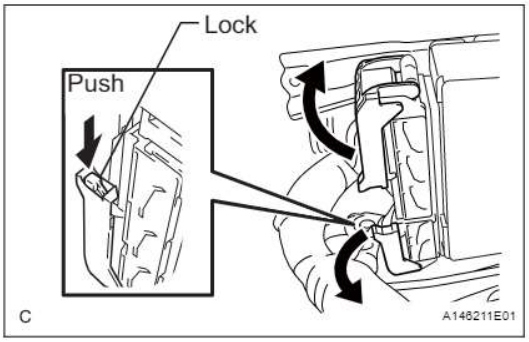
(b) Disconnect the 2 connectors and remove the hybrid vehicle control ECU.

(1) Raise the 2 levers while pushing the locks on the 2 levers, and disconnect the 2 connectors.

NOTICE:

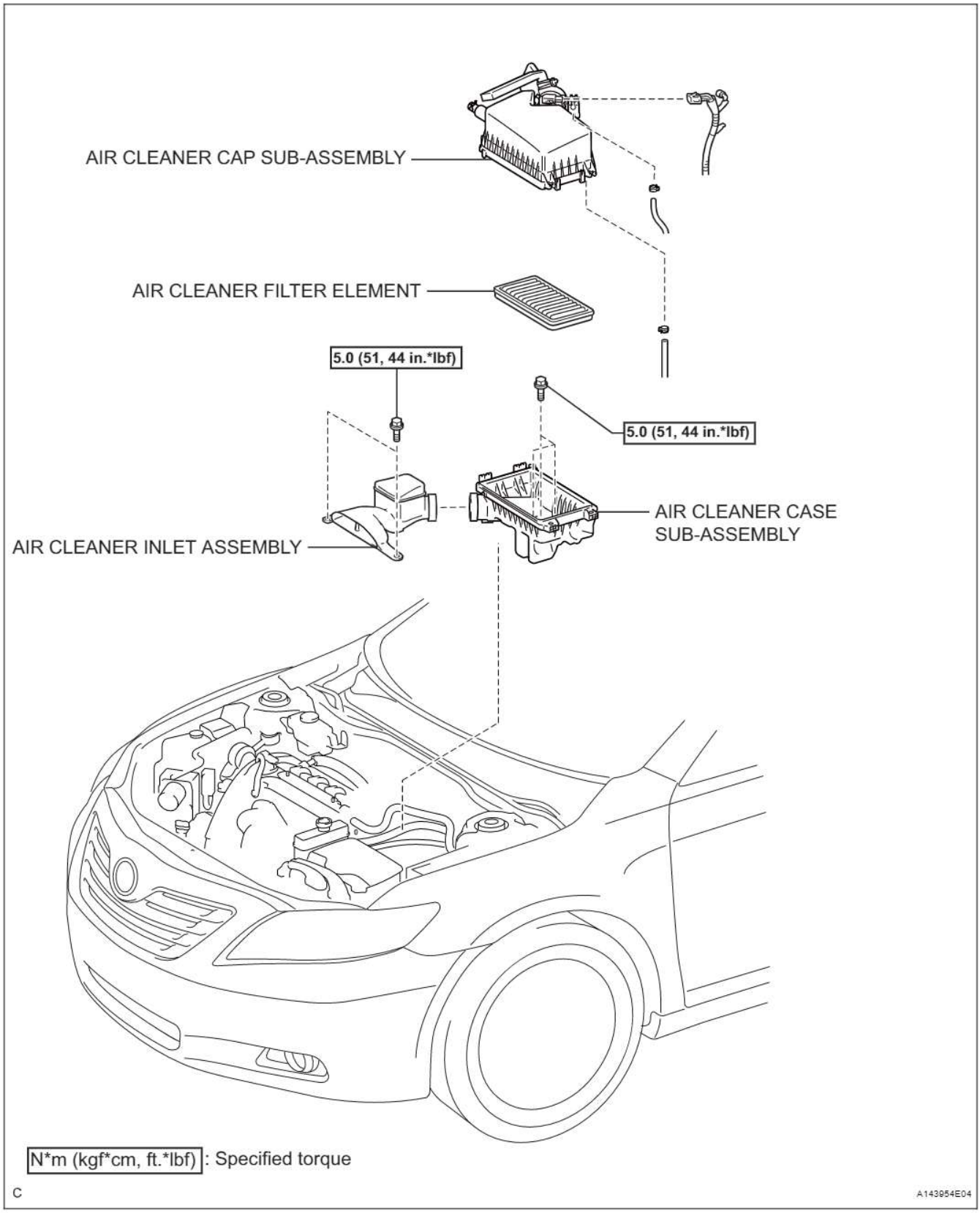
After disconnecting the connectors, make sure that dirt, water and other foreign matter do not contact the connecting parts of the connectors.

(2) Remove the hybrid vehicle control ECU.

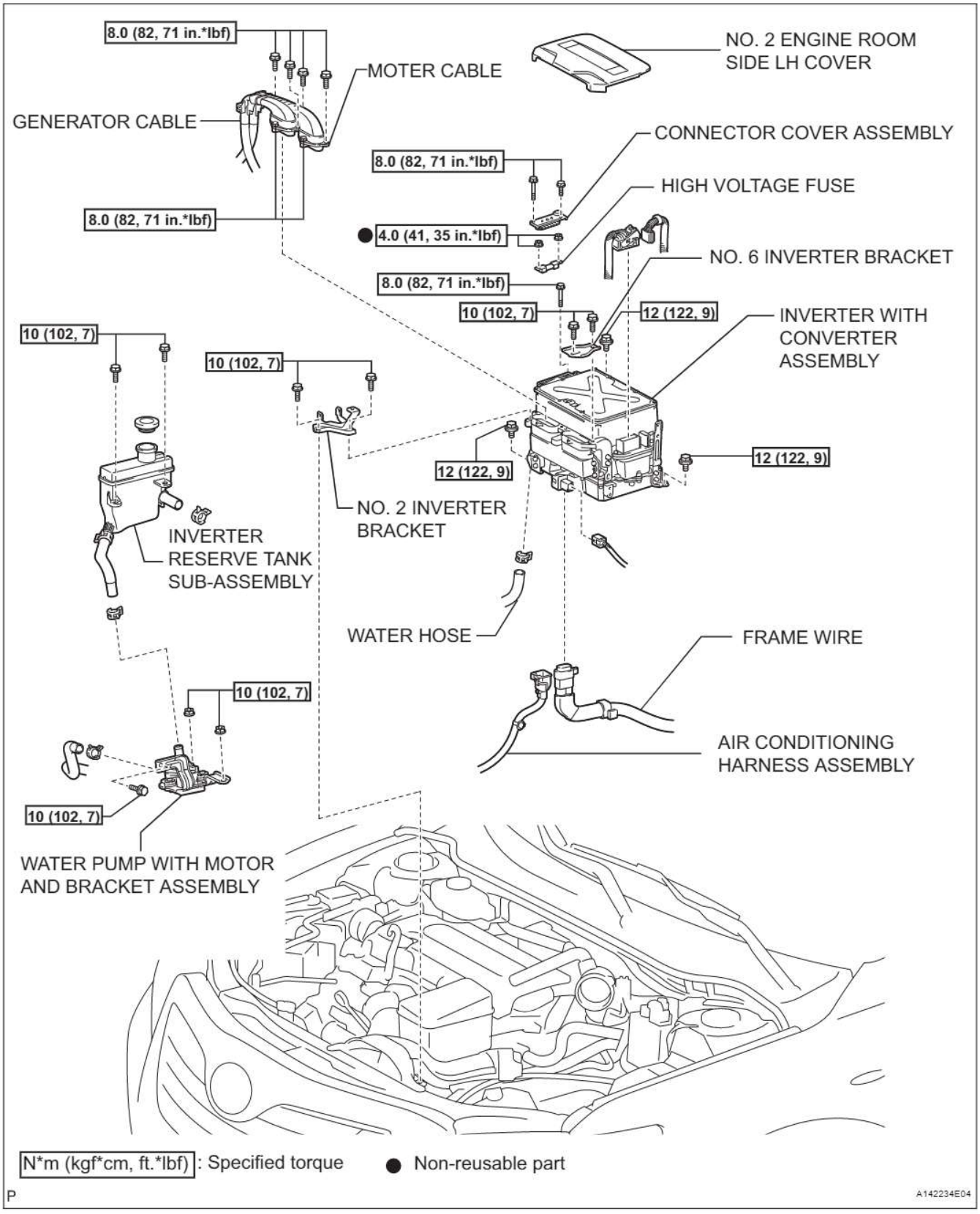


WATER PUMP WITH MOTOR

COMPONENTS

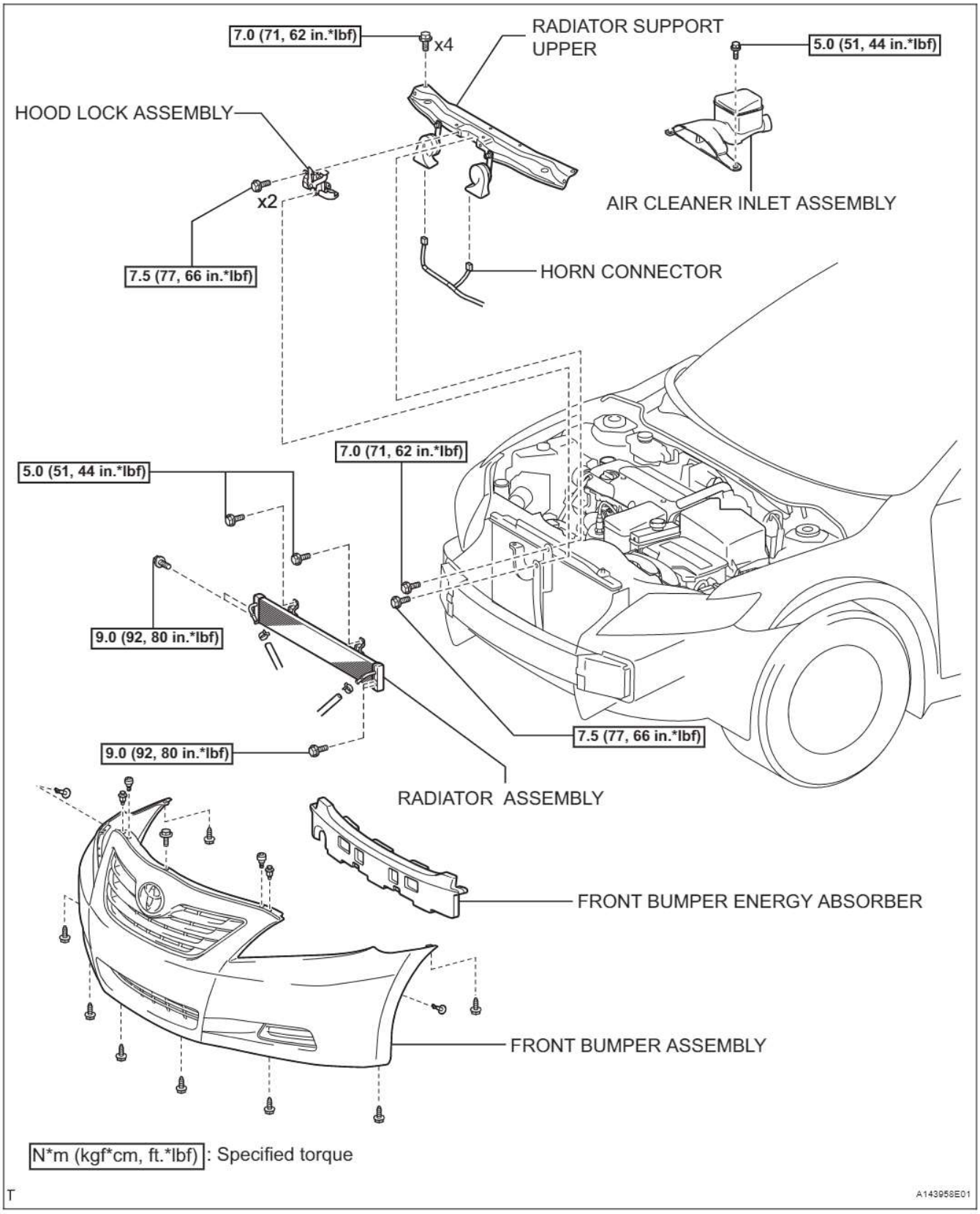


HV


8.0 (82, 71 in.*lbf)
MOTER CABLE
GENERATOR CABLE
8.0 (82, 71 in.*lbf)
NO. 2 ENGINE ROOM SIDE LH COVER
CONNECTOR COVER ASSEMBLY
8.0 (82, 71 in.*lbf)
HIGH VOLTAGE FUSE
4.0 (41, 35 in.*lbf)
NO. 6 INVERTER BRACKET
8.0 (82, 71 in.*lbf)
10 (102, 7)
12 (122, 9)
INVERTER WITH CONVERTER ASSEMBLY
10 (102, 7)
10 (102, 7)
12 (122, 9)
12 (122, 9)
NO. 2 INVERTER BRACKET
INVERTER RESERVE TANK SUB-ASSEMBLY
WATER HOSE
FRAME WIRE
10 (102, 7)
AIR CONDITIONING HARNESS ASSEMBLY
10 (102, 7)
WATER PUMP WITH MOTOR AND BRACKET ASSEMBLY
N*m (kgf*cm, ft.*lbf): Specified torque
Non-reusable part
P
A142234E04

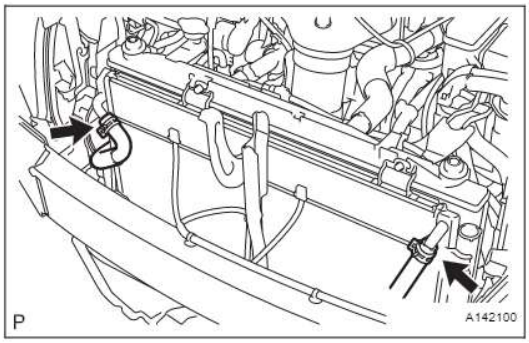
SUB RADIATOR

COMPONENTS

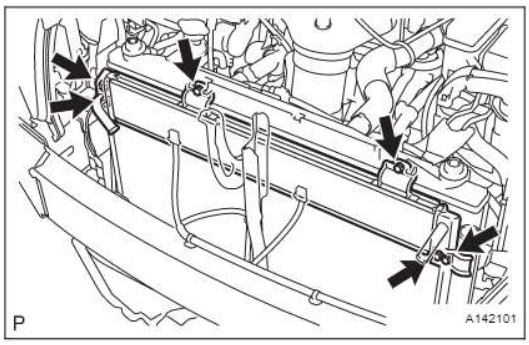


REMOVAL

1. **DRAIN COOLANT (for Inverter) (See page HV-556)**
2. **REMOVE AIR CLEANER INLET ASSEMBLY (See page EM-90)**
3. **REMOVE FRONT BUMPER ASSEMBLY (See page ET-3)**
4. **REMOVE FRONT BUMPER ENERGY ABSORBER (See page ET-6)**
5. **REMOVE RADIATOR SUPPORT UPPER (See page CO-23)**
6. **REMOVE RADIATOR ASSEMBLY**
   (a) Remove the 2 clips and disconnect the 2 water hoses.

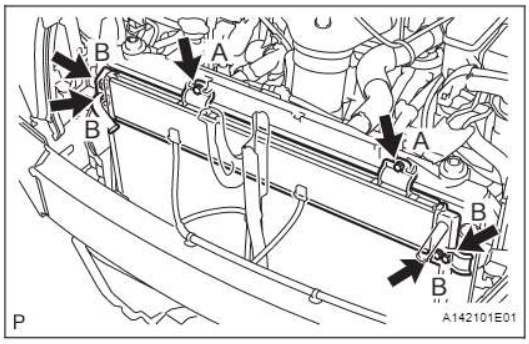


   (b) Remove the 6 bolts and radiator assembly.

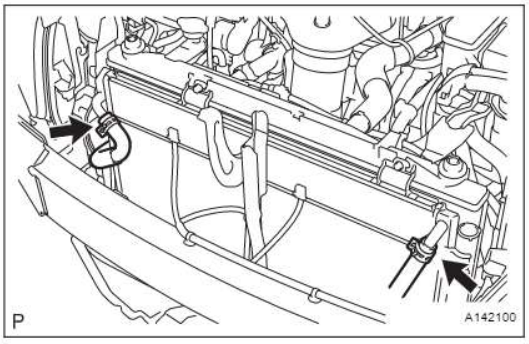


INSTALLATION

1. **INSTALL RADIATOR ASSEMBLY**
   (a) Install the radiator assembly with 2 bolts A.
   Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)
   (b) Install the radiator assembly with 4 bolts B.
   Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



HV



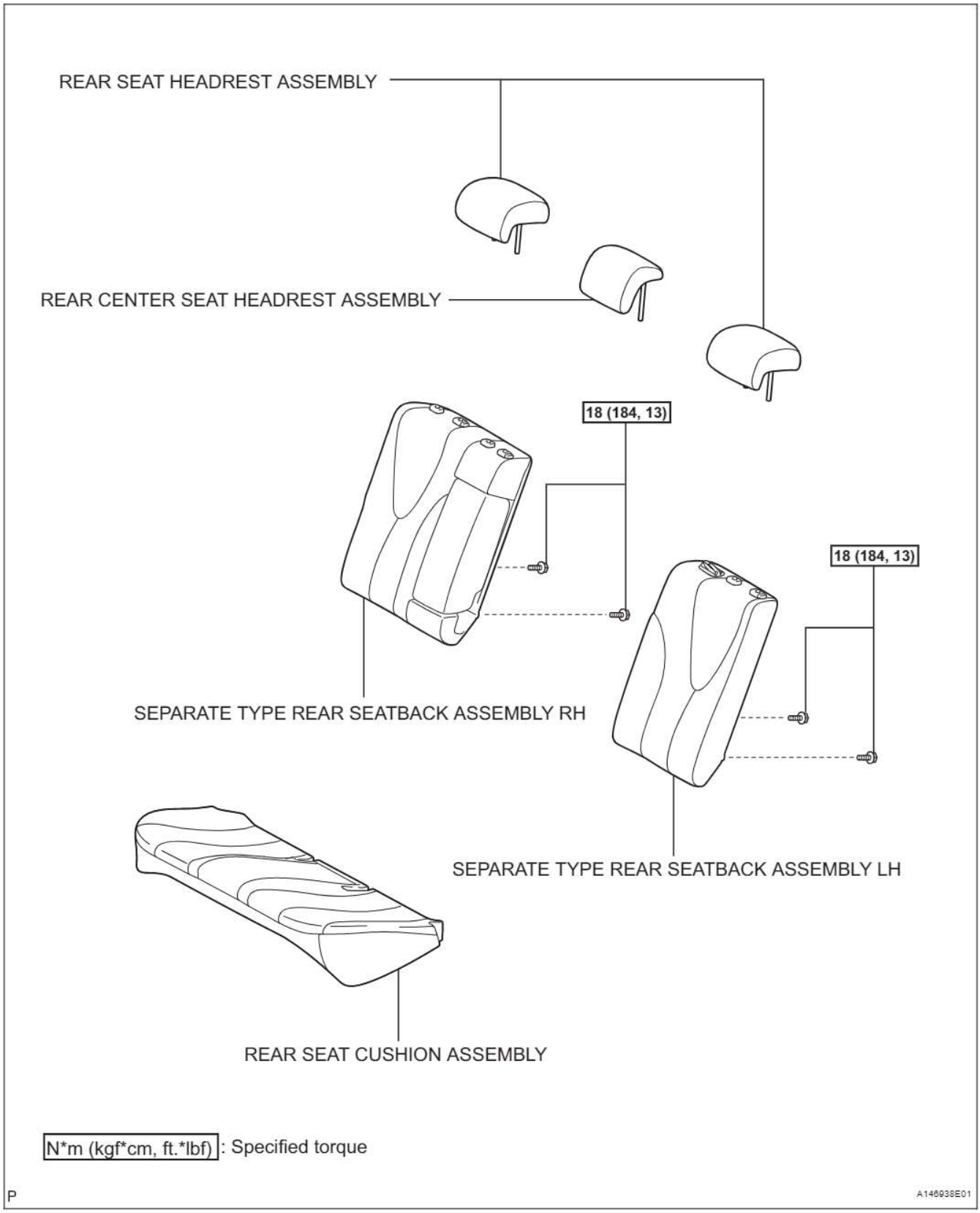
(c) Connect the 2 water hoses with the 2 clips.

2. **INSTALL RADIATOR SUPPORT UPPER (See page CO-29)**
3. **INSTALL AIR CLEANER INLET ASSEMBLY (See page EM-113)**
4. **ADD COOLANT (for Inverter) (See page HV-556)**
5. **INSPECT FOR COOLANT LEAK (for Inverter) (See page HV-555)**
6. **INSTALL FRONT BUMPER ENERGY ABSORBER (See page ET-7)**
7. **INSTALL FRONT BUMPER ASSEMBLY (See page ET-9)**

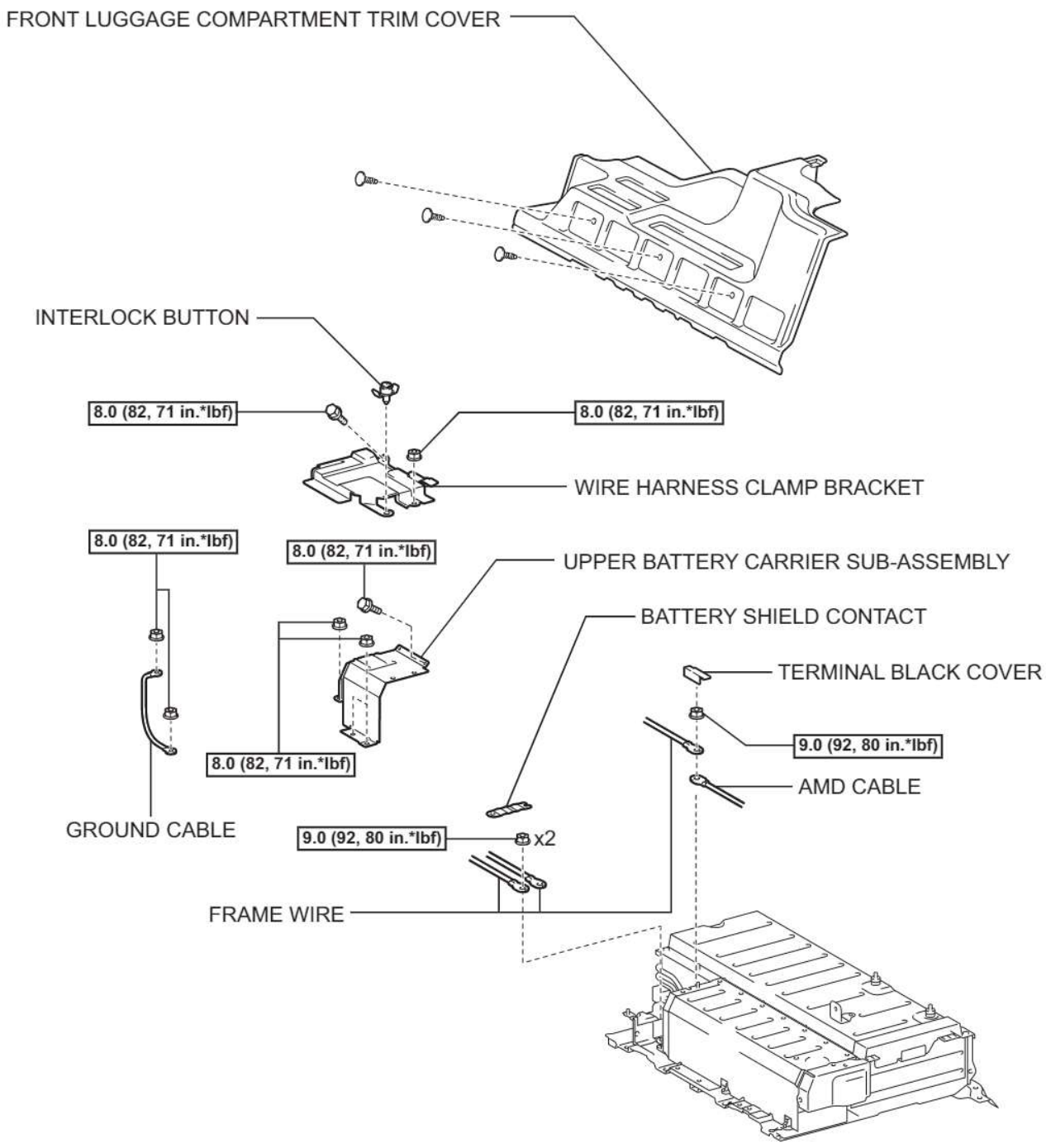
HV

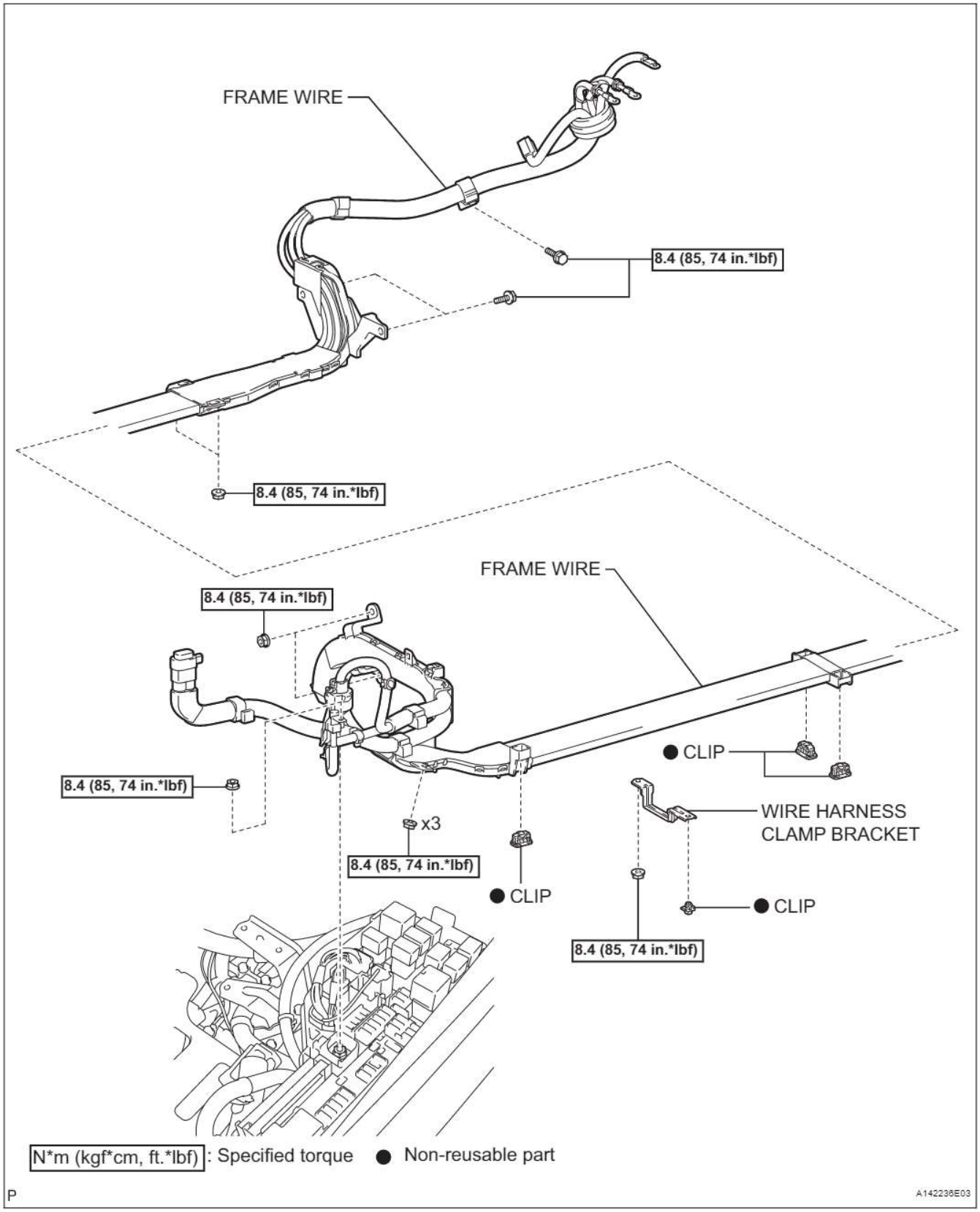
FRAME WIRE

COMPONENTS



HV

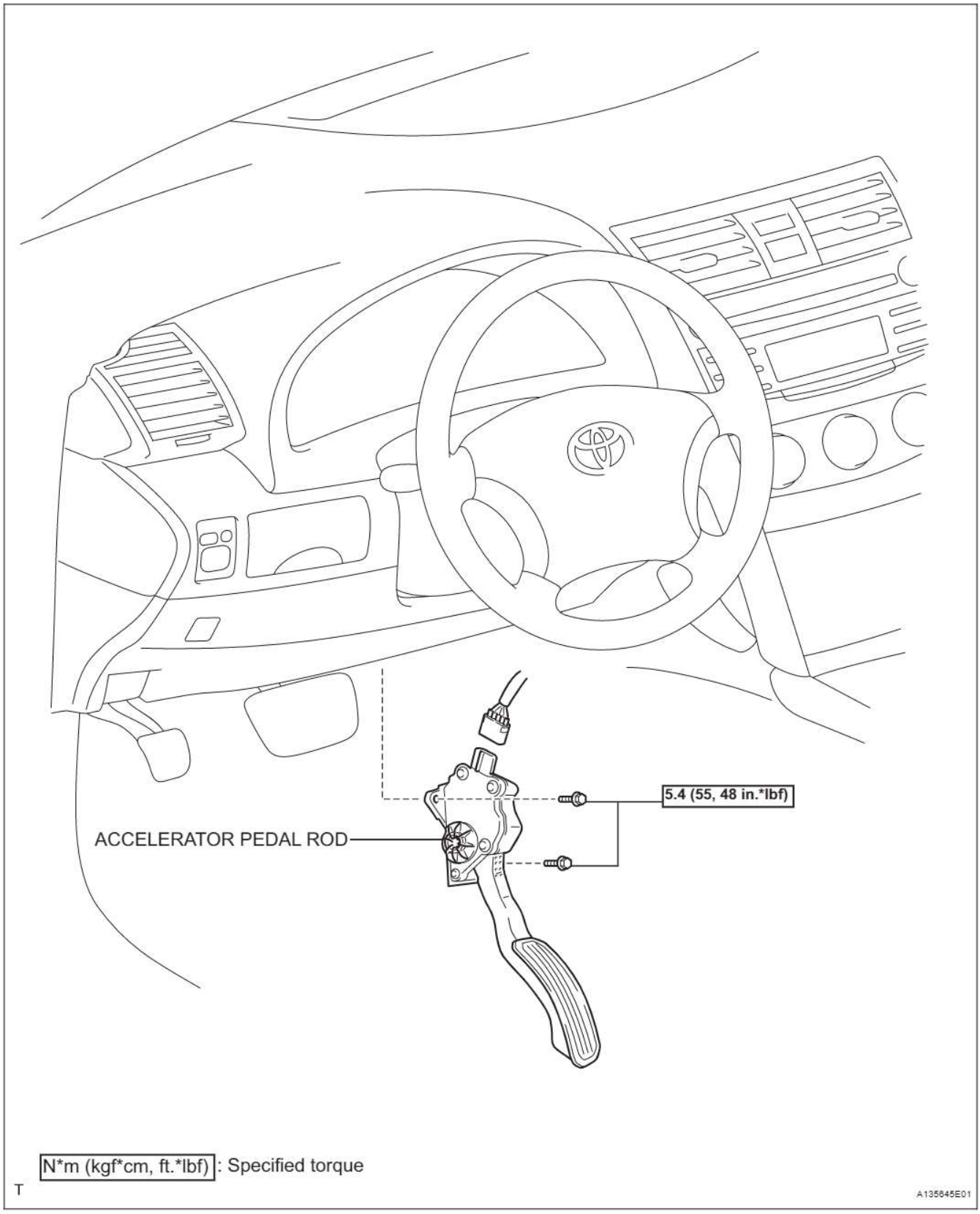

FRONT LUGGAGE COMPARTMENT TRIM COVER
INTERLOCK BUTTON
8.0 (82, 71 in.*lbf)
8.0 (82, 71 in.*lbf)
WIRE HARNESS CLAMP BRACKET
8.0 (82, 71 in.*lbf)
8.0 (82, 71 in.*lbf)
UPPER BATTERY CARRIER SUB-ASSEMBLY
BATTERY SHIELD CONTACT
TERMINAL BLACK COVER
9.0 (92, 80 in.*lbf)
AMD CABLE
8.0 (82, 71 in.*lbf)
GROUND CABLE
9.0 (92, 80 in.*lbf)
x2
FRAME WIRE
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A147041E01


FRAME WIRE
8.4 (85, 74 in.*lbf)
8.4 (85, 74 in.*lbf)
FRAME WIRE
8.4 (85, 74 in.*lbf)
CLIP
8.4 (85, 74 in.*lbf)
WIRE HARNESS CLAMP BRACKET
x3
8.4 (85, 74 in.*lbf)
CLIP
CLIP
8.4 (85, 74 in.*lbf)
N*m (kgf*cm, ft.*lbf): Specified torque ● Non-reusable part
P
A142236E03

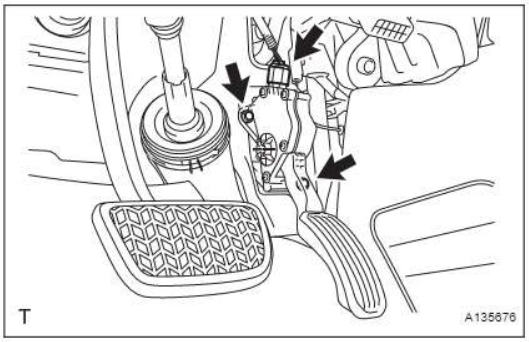
HV

ACCELERATOR PEDAL ROD

COMPONENTS



HV

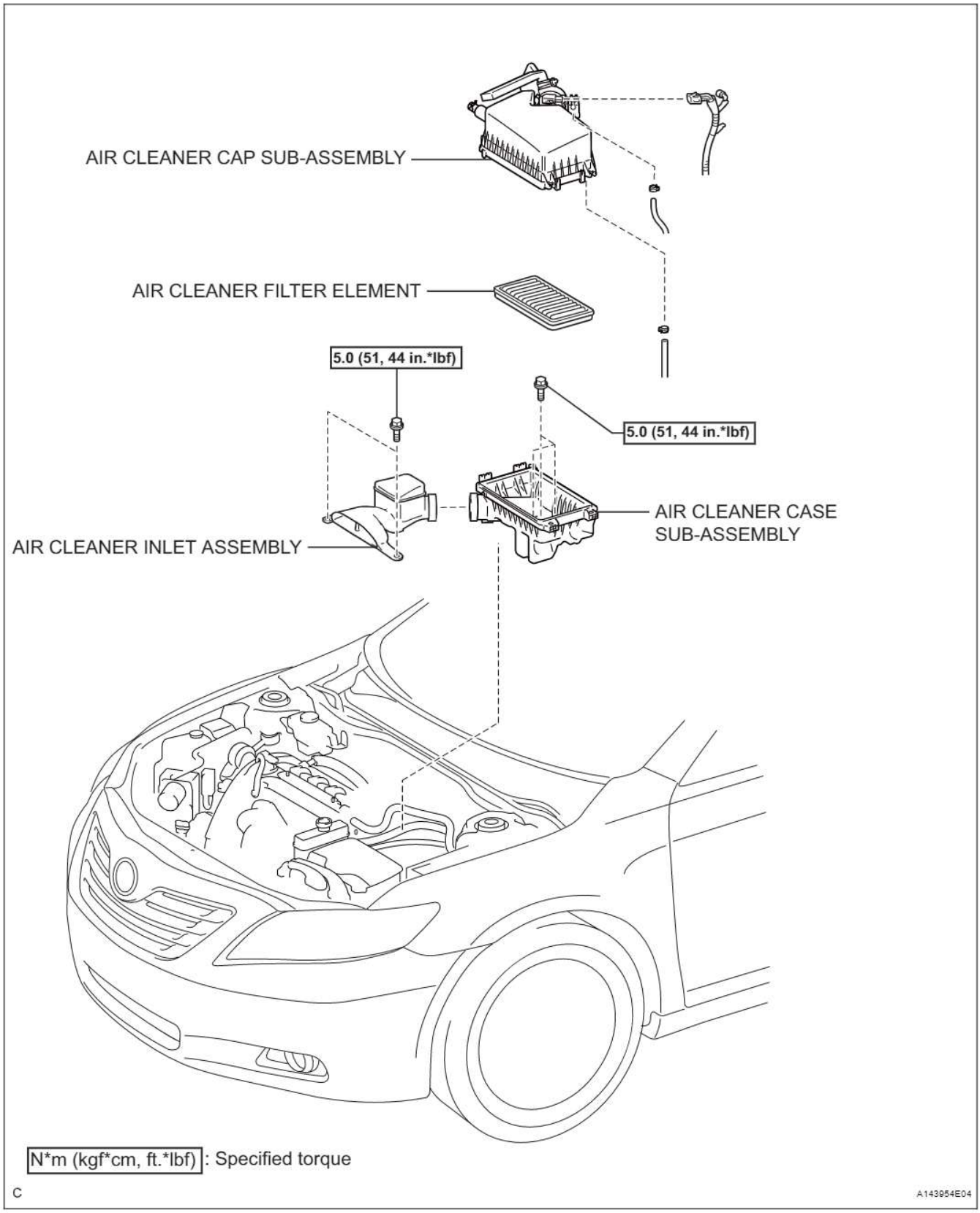


REMOVAL

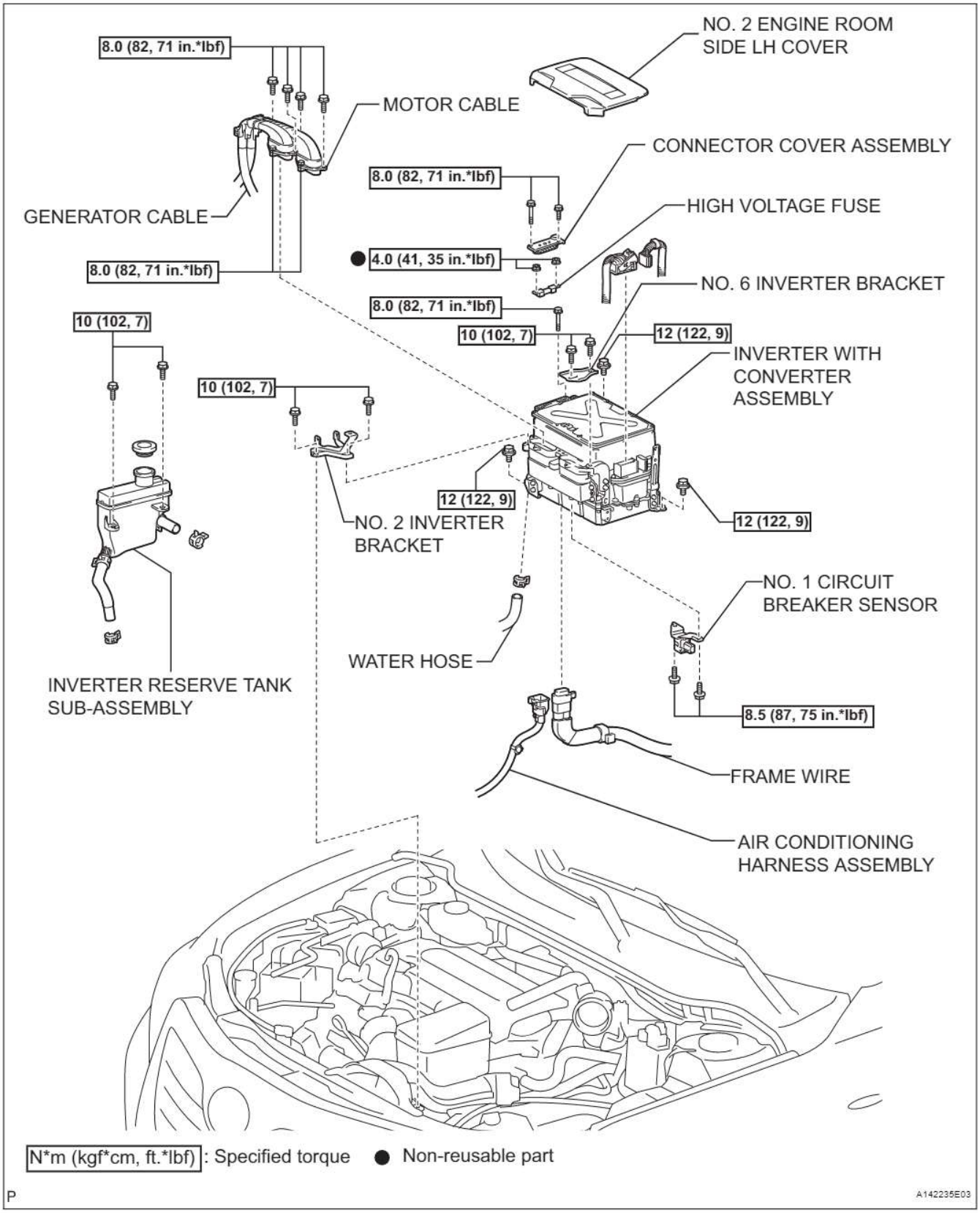
1. **REMOVE ACCELERATOR PEDAL ROD**
   (a) Disconnect the accelerator pedal position sensor connector.
   (b) Remove the 2 bolts and accelerator pedal rod.

FRONT CIRCUIT BREAKER SENSOR

COMPONENTS



HV


8.0 (82, 71 in.*lbf)
NO. 2 ENGINE ROOM SIDE LH COVER
MOTOR CABLE
CONNECTOR COVER ASSEMBLY
8.0 (82, 71 in.*lbf)
GENERATOR CABLE
HIGH VOLTAGE FUSE
4.0 (41, 35 in.*lbf)
8.0 (82, 71 in.*lbf)
NO. 6 INVERTER BRACKET
8.0 (82, 71 in.*lbf)
10 (102, 7)
12 (122, 9)
INVERTER WITH CONVERTER ASSEMBLY
10 (102, 7)
10 (102, 7)
12 (122, 9)
12 (122, 9)
NO. 2 INVERTER BRACKET
NO. 1 CIRCUIT BREAKER SENSOR
WATER HOSE
INVERTER RESERVE TANK SUB-ASSEMBLY
8.5 (87, 75 in.*lbf)
FRAME WIRE
AIR CONDITIONING HARNESS ASSEMBLY
N*m (kgf*cm, ft.*lbf): Specified torque
Non-reusable part
P
A142235E03

HV