WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A1B-168 , 795 or 796 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

4.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

6.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

7.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

8.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

9.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

11.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A1B-198	Drive Motor "A" Control Module

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors its internal operation and it will set DTCs when it detects malfunctions. If any of the following DTCs are output, replace the inverter with converter assembly.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1B	198	R/D converter NM stop error	Inverter with converter assembly

MONITOR DESCRIPTION

The MG ECU (in the inverter with converter assembly) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of those tests, 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 power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1B (INF 198): RD converter NM signal stop 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	-

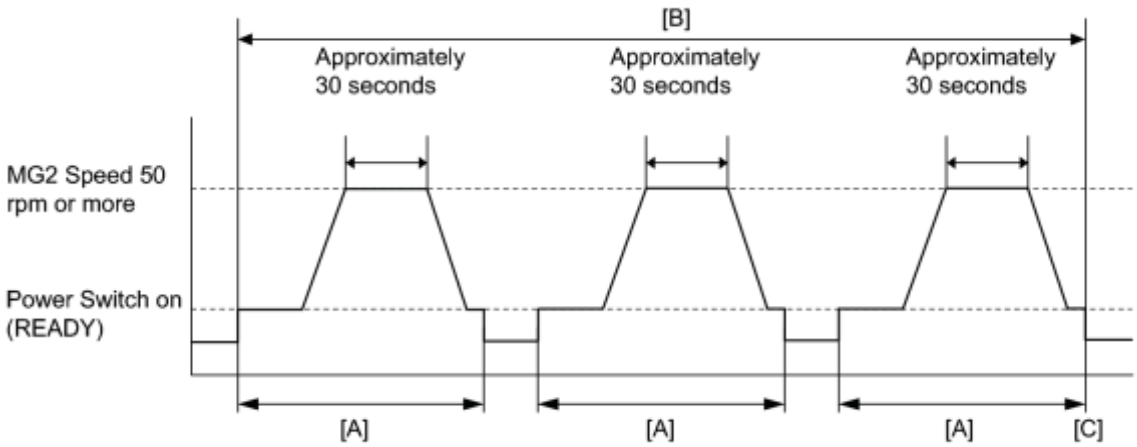
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1B (INF 198) is not detected

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and allow MG2 to rotate at 50 rpm or more for 30 seconds, then turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT **COMPLETED**

DTC	P0A1D-144	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	144	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) performs a self-test. If the power management control ECU (HV CPU) detects an internal problem during this self-test, it will conclude that there is an internal malfunction. The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 144): Primary check malfunction
Required sensors / components	Power management control ECU (HV CPU)
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	-

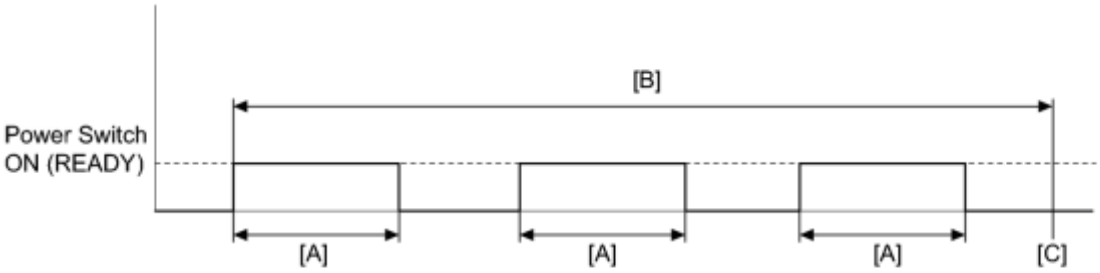
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 144) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT **COMPLETED**

DTC	P0A1D-148	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	148	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) performs a self-test. If the power management control ECU (HV CPU) detects an internal problem during this self-test, it will conclude that there is an internal malfunction. The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 148): HV CPU malfunction
Required sensors / components	Power management control ECU (HV CPU)
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	-

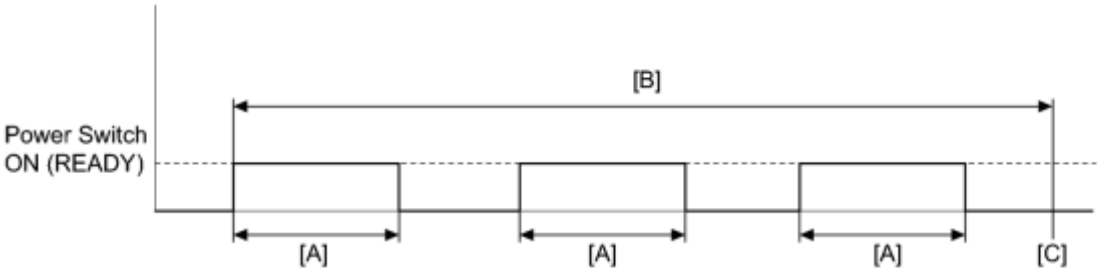
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 148) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

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 power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

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

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) checks the communication bus off count and the message register of the CAN (Controller Area Network) controller. If the power management control ECU (HV CPU) detects an error in the communication bus off count or message register, it will conclude that there is a malfunction in the power management control ECU (HV CPU). The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 162/821/822/823): Lost communication with ECM/PCM
Required sensors / components	Power management control ECU (HV CPU)
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	-

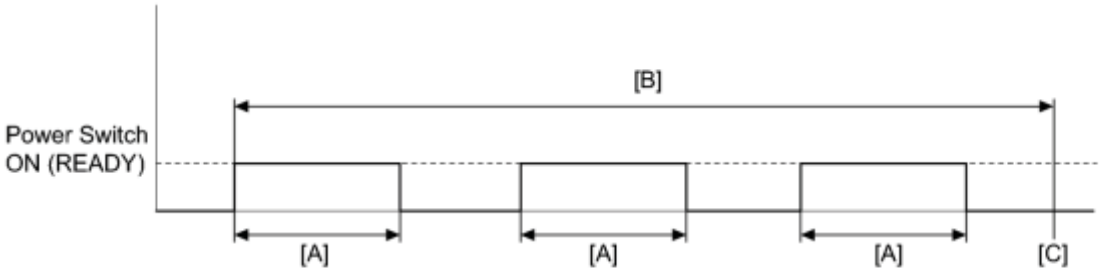
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 162/821/822/823) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT **COMPLETED**

DTC	P0A1D-187	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	187	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs diagnostic tests to verify proper operation of internal and external ECU systems. In one of these tests, the power management control ECU (HV CPU) monitors specific RAM circuits of the power management control ECU (HV CPU). If the power management control ECU (HV CPU) detects an error in the RAM circuits, it will conclude that there is an internal malfunction in the power management control ECU (HV CPU). The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 187): Specific random access memory destruction
Required sensors / components	Power management control ECU (HV CPU)
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	-

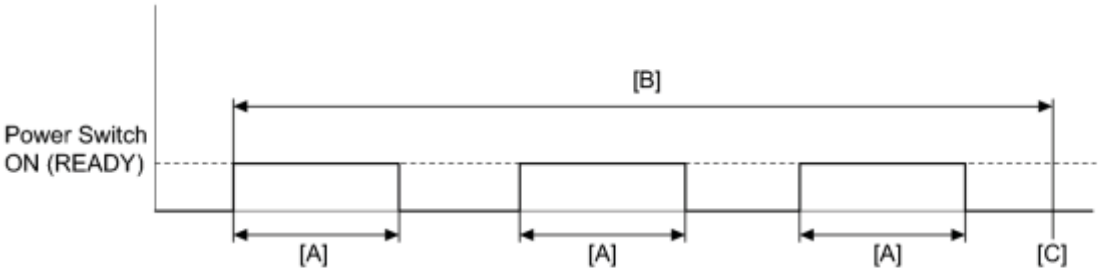
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 187) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

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-787	Hybrid Powertrain Control Module
DTC	P0A1D-818	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	721	ECU internal error	Power management control ECU
P0A1D	722	ECU internal error	Power management control ECU
P0A1D	723	ECU internal error	Power management control ECU
P0A1D	787	ECU internal error	Power management control ECU
P0A1D	818	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) checks the result of the ECM self-test. If the power management control ECU (HV CPU) detects a "Fail" from the ECM self-test, it will conclude that there is an internal malfunction in the ECM. The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 721/722/723/787/818): Monitor CPU malfunction
Required sensors / components	Power management control ECU (HV CPU)
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	-

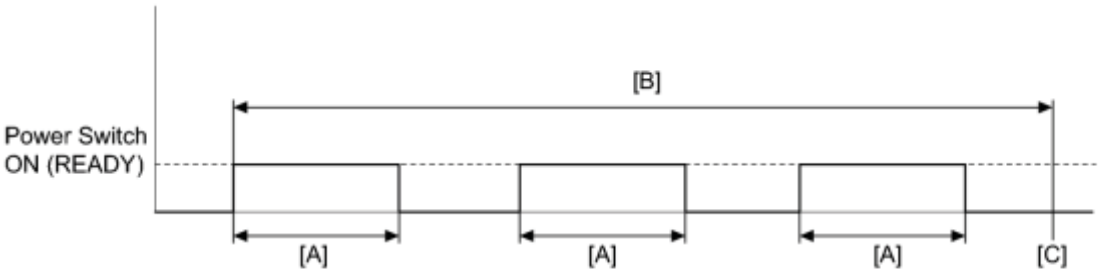
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 721/722/723/787/818) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT ▶ **COMPLETED**

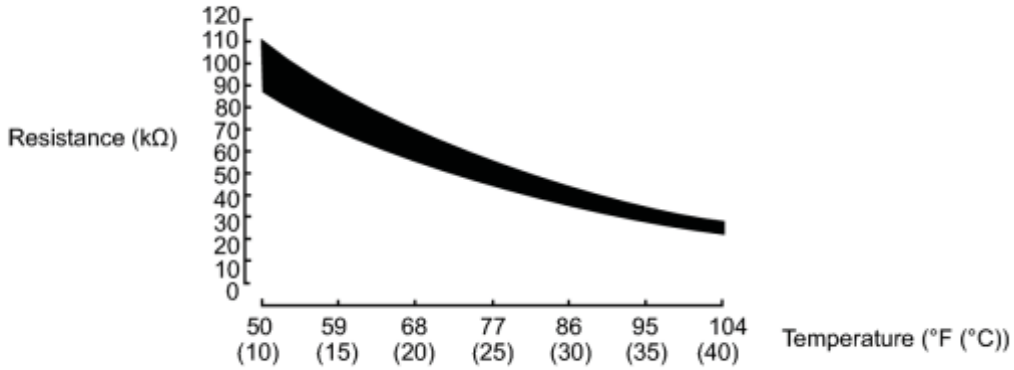
DTC	P0A2B-250	Drive Motor "A" Temperature Sensor Circuit Range / Performance
DTC	P0A2E-248	Drive Motor "A" Temperature Sensor Circuit Intermittent

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 higher the thermistor resistance. Conversely, the higher the temperature, the lower the resistance.

HINT:

The term "drive motor A" indicates MG2.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A2B	250	Motor temperature sensor output does not increase under conditions in which the value should increase, or output does not decrease under conditions in which the value should decrease.	Hybrid vehicle transaxle assembly (Motor temperature sensor)
P0A2E	248	Unusual sudden change in motor temperature sensor output occurs and the condition continues, or unusual sudden change in motor temperature sensor output occurs repeatedly.	

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

HINT:

The motor temperature sensor is not available separately. If it requires replacement, replace the 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

Refer to the description for DTC P0A2B-250 INFO.

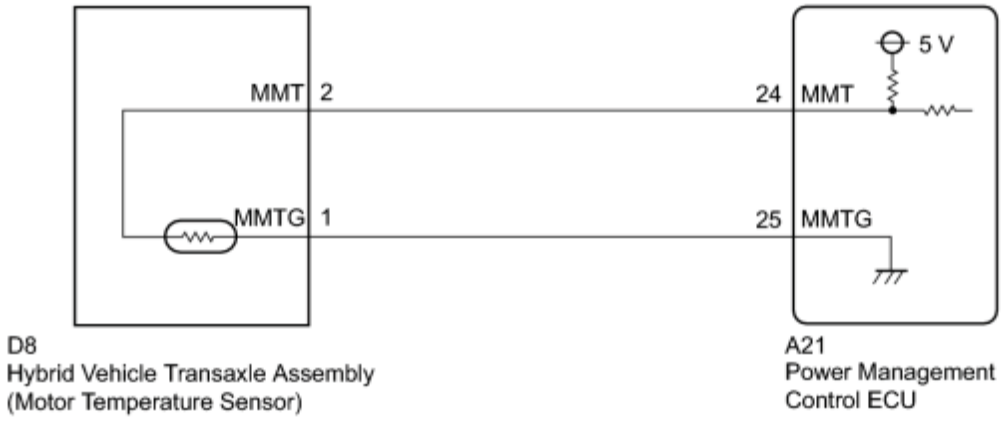
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A2C	247	Short or short to GND in the motor temperature sensor circuit	• Wire harness or connector • Power management control ECU • Hybrid vehicle transaxle assembly (Motor temperature sensor)
P0A2D	249	Open or short to +B in the motor temperature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

HINT:

After confirming that DTC P0A2C-247 or P0A2D-249 is output, use the Techstream to check "Motor Temp No1" in the power management control ECU Data List.

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

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

2.	READ VALUE USING TECHSTREAM (MOTOR TEMP NO1)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(d) Read the Data List.

Result:

Result	Proceed to
-58°F (-50°C)	A
401°F (205°C)	B
Same as actual temperature	C

(e) Turn the power switch off.

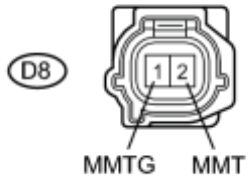
C CHECK FOR INTERMITTENT PROBLEMS
B READ VALUE USING TECHSTREAM (CHECK FOR SHORT)
A

3.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN)

H

(a) Disconnect the motor temperature sensor connector.

*1



H

(b) Connect terminals 2 (MMT) and 1 (MMTG) of vehicle side connector D8 of the motor temperature sensor.

(c) Connect the Techstream to the DLC3.

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

(e) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(f) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No1	Terminals MMT and MMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Front view of wire harness connector (to Motor Temperature Sensor)

HINT:

The motor temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(g) Turn the power switch off.

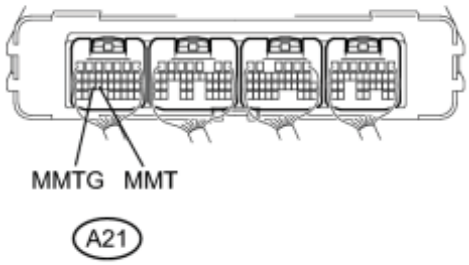
(h) Connect the motor temperature sensor connector.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR TEMPERATURE SENSOR)

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

4.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR TEMPERATURE SENSOR)

*1



P

(a) Connect terminals 24 (MMT) and 25 (MMTG) of connector A21 of the power management control ECU.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No1	Terminals MMT and MMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

(f) Turn the power switch off.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

5.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT)

(a) Disconnect the motor temperature sensor connector.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No1	Power switch on (IG)	-58°F (-50°C)

HINT:

The motor temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(f) Turn the power switch off.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR TEMPERATURE SENSOR)
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

6.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR

	TEMPERATURE SENSOR)

(a) Disconnect the motor temperature sensor connector.

(b) Disconnect connector A21 from the power management control ECU.

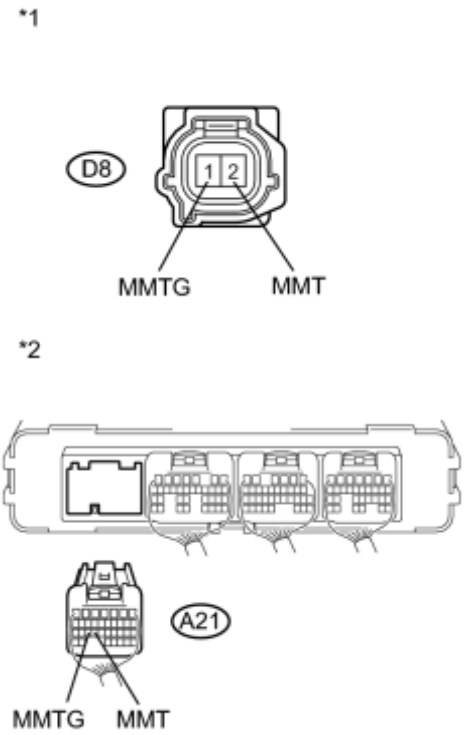
(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
D8-2 (MMT) - A21-24 (MMT)	Power switch off	Below 1 Ω
D8-1 (MMTG) - A21-25 (MMTG)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D8-2 (MMT) or A21-24 (MMT) - Body ground and other terminals	Power switch off	10 kΩ or higher
D8-1 (MMTG) or A21-25 (MMTG) - Body ground and other terminals	Power switch off	10 kΩ or higher



Text in Illustration

*1	Front view of wire harness connector (to Motor Temperature Sensor)
*2	Rear view of wire harness connector (to Power Management Control ECU)

(d) Connect the power management control ECU connector.

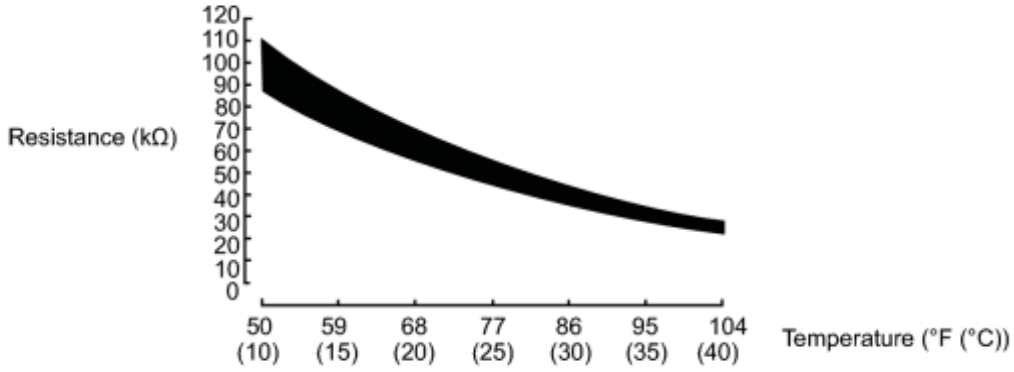
(e) Connect the motor temperature sensor connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

DTC	P0A37-260	Generator Temperature Sensor Circuit Range / Performance
DTC	P0A3A-258	Generator Temperature Sensor Circuit Intermittent

DESCRIPTION

The resistance of the thermistor built into the generator temperature sensor changes in accordance with changes in MG1 temperature. The lower the MG1 temperature, the higher the thermistor resistance. Conversely, the higher the temperature, the lower the resistance.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A37	260	Generator temperature sensor output does not increase in which the value should increase, or output does not decrease under conditions in which the value should decrease.	Hybrid vehicle transaxle assembly (Generator temperature sensor)
P0A3A	258	Unusual sudden change in generator temperature sensor output occurs and the condition continues, or unusual sudden change in generator temperature sensor output occurs repeatedly.	

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

HINT:

The generator temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

DTC	P0A38-257	Generator Temperature Sensor Circuit Low
DTC	P0A39-259	Generator Temperature Sensor Circuit High

DESCRIPTION

Refer to the description for DTC P0A37-260 INFO.

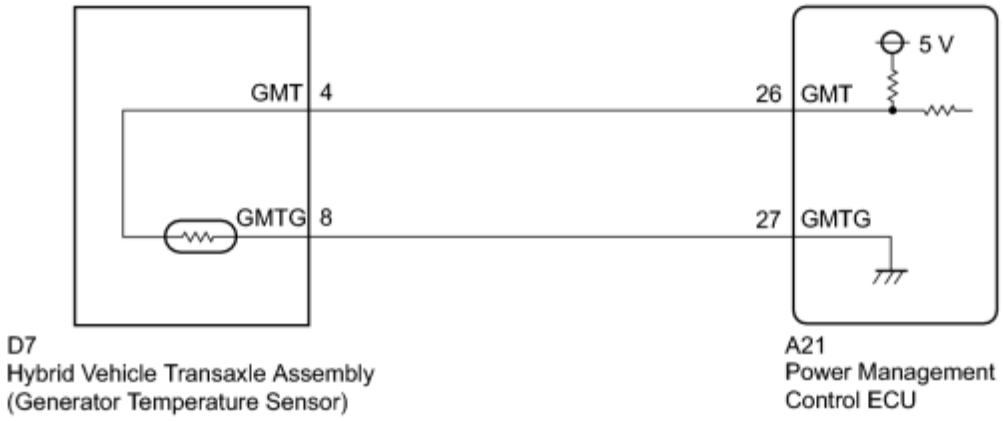
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A38	257	Short to GND in the generator temperature sensor circuit	• Wire harness or connector • Power management control ECU • Hybrid vehicle transaxle assembly (Generator temperature sensor)
P0A39	259	Open or short to +B in the generator temperature sensor circuit	

HINT:

After confirming that DTC P0A38-257 or P0A39-259 is output, use the Techstream to check "Motor Temp No2" in the power management control ECU Data List.

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

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

2.	READ VALUE USING TECHSTREAM (MOTOR TEMP NO2)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(d) Read the Data List.

Result:

Result	Proceed to
-58°F (-50°C)	A
401°F (205°C)	B
Same as actual temperature	C

(e) Turn the power switch off.

C CHECK FOR INTERMITTENT PROBLEMS
B READ VALUE USING TECHSTREAM (CHECK FOR SHORT)
A

3.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN)

H

(a) Disconnect the generator temperature sensor connector.

*1

H

(b) Connect terminals 4 (GMT) and 8 (GMTG) of vehicle side connector D7 of the generator temperature sensor.

(c) Connect the Techstream to the DLC3.

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

(e) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(f) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No2	Terminals GMT and GMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Front view of wire harness connector (to Generator Temperature Sensor)

HINT:

The generator temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(g) Turn the power switch off.

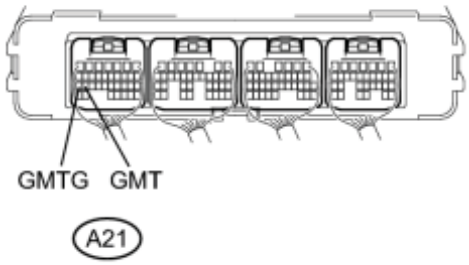
(h) Connect the generator temperature sensor connector.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - GENERATOR TEMPERATURE SENSOR)

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

4.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - GENERATOR TEMPERATURE SENSOR)

*1



P

(a) Connect terminals 26 (GMT) and 27 (GMTG) of connector A21 of the power management control ECU.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No2	Terminals GMT and GMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

(f) Turn the power switch off.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

5.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT)

(a) Disconnect the generator temperature sensor connector.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No2	Power switch on (IG)	-58°F (-50°C)

HINT:

The generator temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(f) Turn the power switch off.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - GENERATOR TEMPERATURE SENSOR)
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

6.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU -

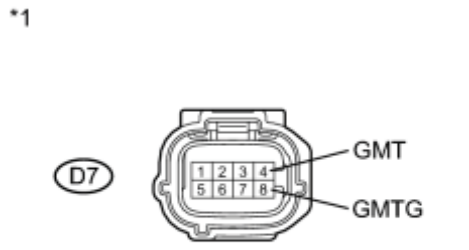
	GENERATOR TEMPERATURE SENSOR)

(a) Disconnect the generator temperature sensor connector.

(b) Disconnect connector A21 from the power management control ECU.

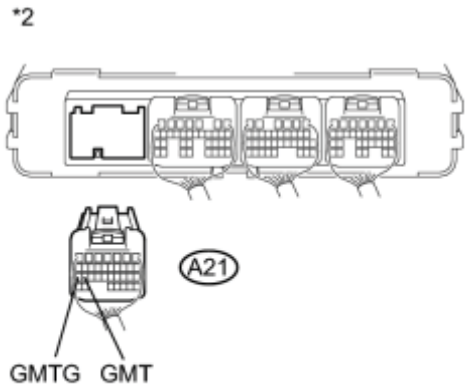
(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):



Tester Connection	Switch Condition	Specified Condition
D7-4 (GMT) - A21-26 (GMT)	Power switch off	Below 1 Ω
D7-8 (GMTG) - A21-27 (GMTG)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):



Tester Connection	Switch Condition	Specified Condition
D7-4 (GMT) or A21-26 (GMT) - Body ground and other terminals	Power switch off	10 kΩ or higher
D7-8 (GMTG) or A21-27 (GMTG) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Generator Temperature Sensor)
*2	Rear view of wire harness connector (to Power Management Control ECU)

(d) Connect the power management control ECU connector.

(e) Connect the generator temperature sensor connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

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 is used to detect the position of the magnetic poles the rotor of a motor generator. Knowing the position of the poles is indispensable for ensuring precise control of MG2 and MG1.

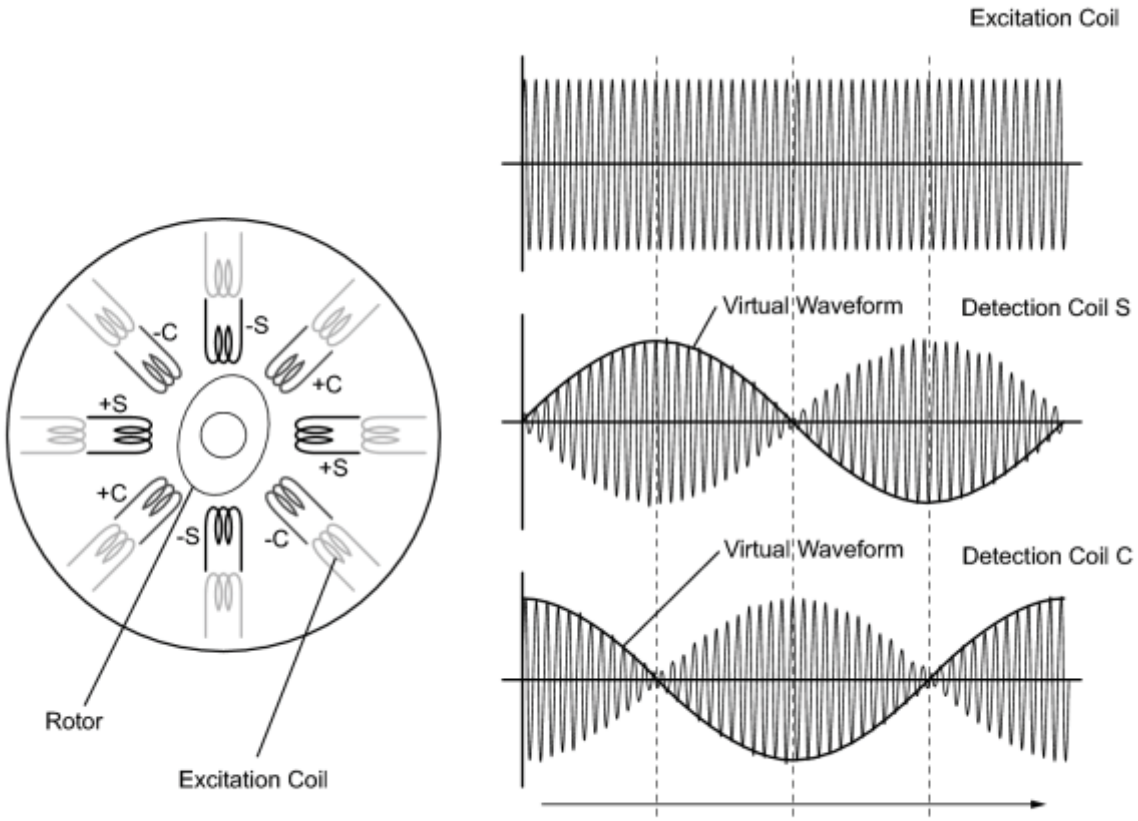
Each resolver contains a stator that has an excitation coil and 2 detection coils (S, C). The gap between the stator and rotor changes as the rotor turns because the rotor is oval shaped. An alternating current with a predetermined frequency flows through the excitation coil, and detection coils S and C output alternating currents in accordance with the sensor rotor position.

The inverter with converter assembly (MG ECU) detects the absolute position of the rotor according to the phases of detection coils S and C and the heights 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.

HINT:

The term "drive motor A" indicates MG2.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A3F	243	Interphase short in the motor resolver circuit	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector
P0A40	500	Motor resolver output is out of the normal range	
P0A41	245	Open or short in the motor resolver circuit	

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. If a malfunction is detected, the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

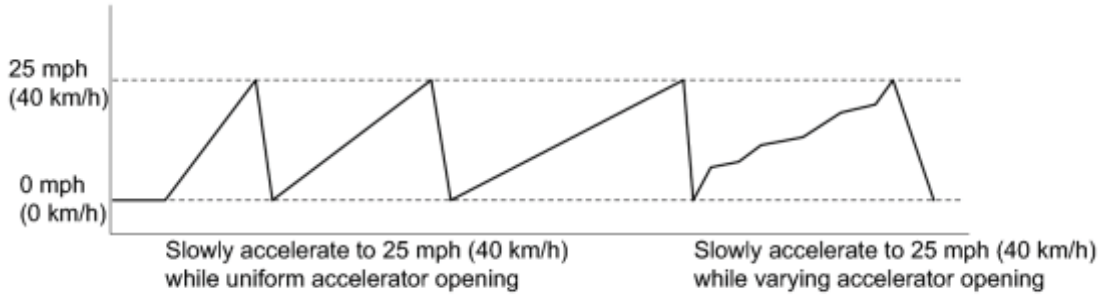
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Motor resolver	DTC P0A3F (INF 243) is not detected DTC P0A40 (INF 500) is not detected DTC P0A41 (INF 245) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.

6. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns.
7. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
8. Check that permanent DTCs are cleared.
9. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

- If INF code 243 is output, there may be an interphase short in the motor resolver due to an intrusion of water into the resolver. If the problem symptom cannot be reproduced, replace the hybrid vehicle transaxle assembly.
- Check for output DTCs again after the repair has been completed. If P0A78-286 or P0A7A-324 is output, replace the inverter with converter assembly.

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.

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

3.	CHECK GENERATOR RESOLVER INFO

NG → CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

5.	CHECK MOTOR RESOLVER INFO

NG → CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ↓

6.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

7.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK → **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

8.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

10.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A4B-253	Generator Position Sensor Circuit
DTC	P0A4C-513	Generator Position Sensor Circuit Range / Performance
DTC	P0A4D-255	Generator Position Sensor Circuit Low

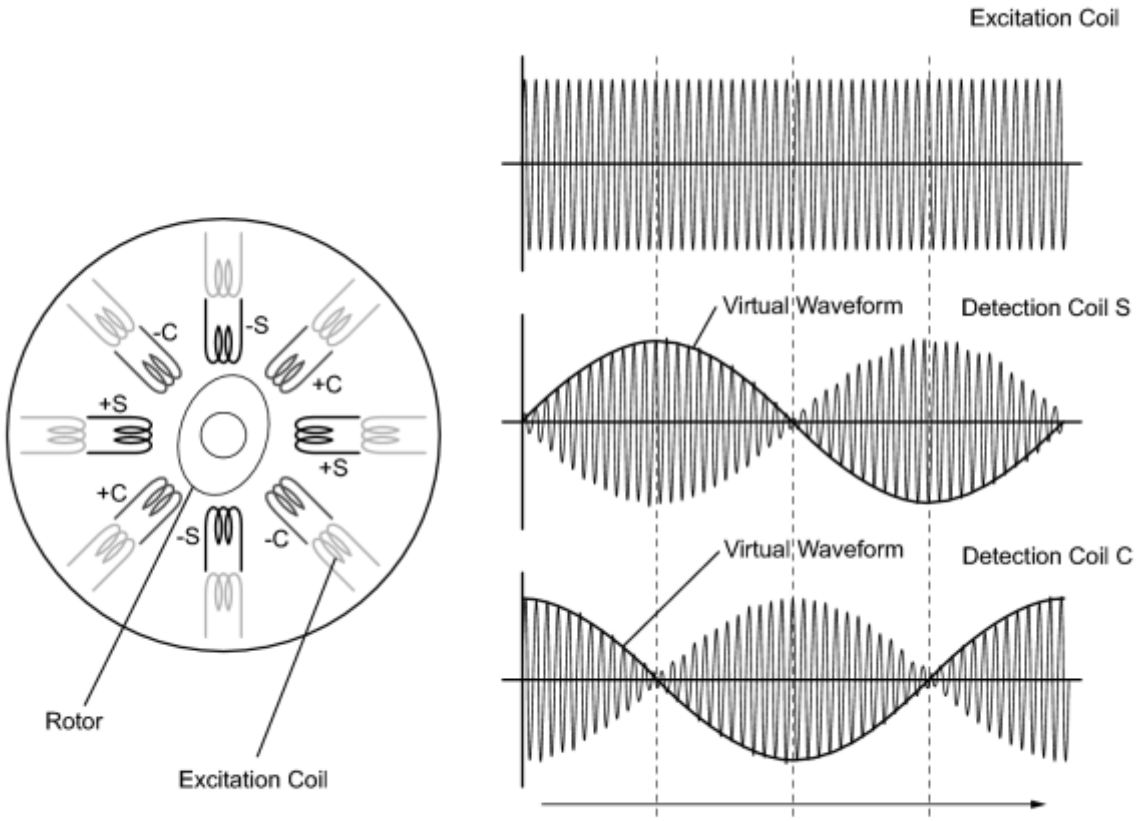
DESCRIPTION

A resolver is a sensor that is used to detect the position of the magnetic poles the rotor of a motor generator. Knowing the position of the poles is indispensable for ensuring precise control of MG2 and MG1.

Each resolver contains a stator that has an excitation coil and 2 detection coils (S, C). 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 inverter with converter assembly (MG ECU) detects the absolute position of the rotor according to the phases of detection coils S and C and the heights of their waveforms. Furthermore, the CPU calculates the amount of change in the position within a predetermined length of time, in order to use the resolver as a speed sensor.

The MG ECU monitors signals output from the motor resolver and detects malfunctions.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A4B	253	Interphase short in the generator resolver circuit	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector
P0A4C	513	Generator resolver output is out of the normal range	
P0A4D	255	Open or short in the generator resolver circuit	

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. If a malfunction is detected, the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

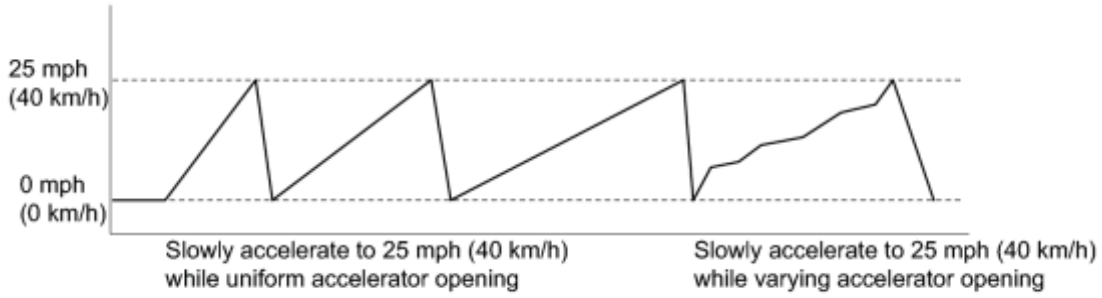
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Generator resolver	DTC P0A4B (INF 253) is not detected DTC P0A4C (INF 513) is not detected DTC P0A4D (INF 255) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.

5. Turn the power switch on (READY) and turn the Techstream on.
6. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns.
7. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
8. Check that permanent DTCs are cleared.
9. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

- If INF code 253 is output, there may be an interphase short in the generator resolver due to an intrusion of water into the resolver. If the problem symptom cannot be reproduced, replace the hybrid vehicle transaxle assembly.
- Check for output DTCs again after the repair has been completed. If P0A78-286 or P0A7A-324 is output, replace the inverter with converter assembly.

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.

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER

	ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

5.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

6.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

7.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

8.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

10.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A51-174	Drive Motor "A" Current Sensor Circuit

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors its internal operation and it will set DTCs when it detects malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A51	174	Motor current sensor high resolution circuit signal is out of range or there is a difference between it and the motor current sensor low resolution circuit current value.	Inverter with converter assembly

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A51-174 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A78-113, 287, 505, 506	Drive Motor "A" Inverter Performance

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A51-174 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 reproduction test to check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

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

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors the motor inverter current sensors. P0A60 and P0A63 indicate malfunctions in current sensors, and they do not indicate malfunctions in the high-voltage system.

HINT:

The term "drive motor A" indicates MG2.

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
P0A60	290	Malfunction in motor inverter current sensor (phase V main sensor)	
P0A60	294	Malfunction in motor inverter current sensor (performance problem or open phase V)	
P0A60	501	Malfunction in motor inverter current sensor (phase V main and sub sensors offset)	
P0A63	296	Malfunction in motor inverter current sensor (phase W sub sensor)	
P0A63	298	Malfunction in motor inverter current sensor (phase W main sensor)	
P0A63	302	Malfunction in motor inverter current sensor (performance problem or open phase W)	

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A63	502	Malfunction in motor inverter current sensor (phase W main and sub sensors offset)	

MONITOR DESCRIPTION

The power management control ECU (HV CPU) monitors the motor inverter current sensor. If the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

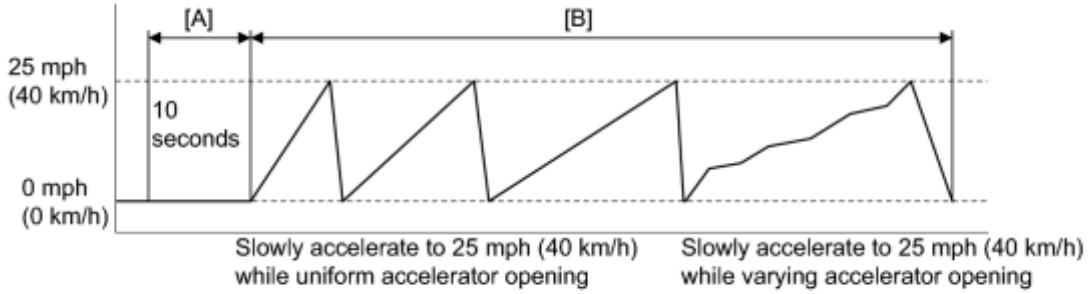
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A60 (INF 288/ 290/ 294/ 501) is not detected DTC P0A63 (INF 296/ 298/ 302/ 502) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. With the vehicle stopped and park (P) selected, move the shift lever to N, wait for 10 seconds and then move the shift lever to D. [A]

   NOTICE:

   Do not leave the vehicle for an extended time with the shift lever in N.

7. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns. [B]
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A60 or P0A63 only is output.	A
P0A78-202 is output.	B

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

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

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors the generator inverter current sensors. P0A72 and P0A75 indicate malfunctions in the current sensors, and they do not indicate 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
P0A72	328	Malfunction in generator inverter current sensor (phase V main sensor)	
P0A72	333	Malfunction in generator inverter current sensor (performance problem or open phase V)	
P0A72	515	Malfunction in generator inverter current sensor (phase V main and sub sensors offset)	
P0A75	334	Malfunction in generator inverter current sensor (phase W sub sensor)	
P0A75	336	Malfunction in generator inverter current sensor (phase W main sensor)	
P0A75	341	Malfunction in generator inverter current sensor (performance problem or open phase W)	
P0A75	516	Malfunction in generator inverter current sensor (phase W main and sub sensors offset)	

MONITOR DESCRIPTION

The power management control ECU (HV CPU) monitors the generator inverter current sensor. If the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

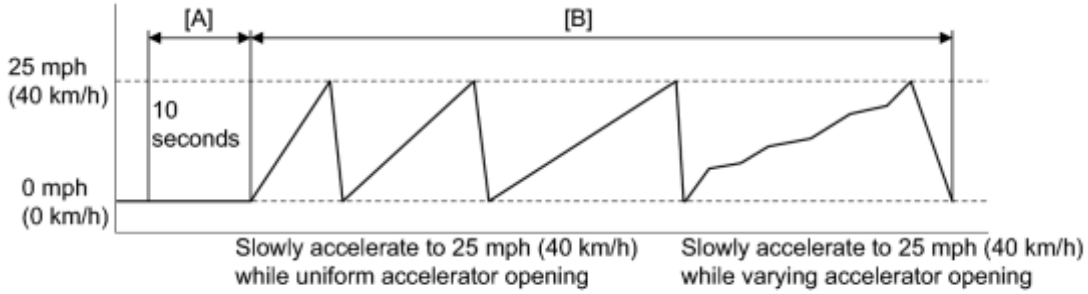
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A72 (INF 326/328/333/515) is not detected DTC P0A75 (INF 334/336/341/516) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. With the vehicle stopped and park (p) selected, move the shift lever to N, wait for 10 seconds and then move the shift lever to D. [A]

   NOTICE:

   Do not leave the vehicle for an extended time with the shift lever in N.

7. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns. [B]
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A72 or P0A75 only is output.	A
P0A7A-203 is output.	B

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

DTC	P0A78-113	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If the motor inverter overheats, has a circuit malfunction, or has an internal short, the inverter transmits this information to 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 (System overcurrent)	• Hybrid vehicle transaxle assembly • Generator cable • Motor cable • Inverter with converter assembly • Power management control ECU • PCU fuse • Wire harness or connector

MONITOR DESCRIPTION

If over-amperage flows through the motor inverter due to an internal short, the motor inverter transmits an inverter fail signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) illuminates the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 113): MFIV detection (Over current malfunction)
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

TMC's intellectual property	-

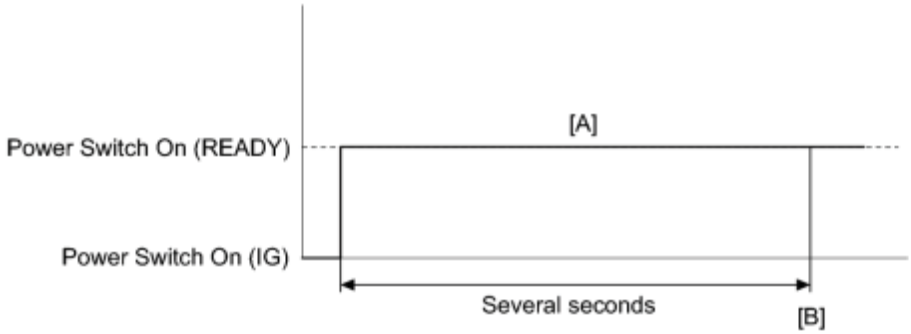
TYPICAL MALFUNCTION THRESHOLDS

Power management control ECU (HV CPU)	DTC P0A78 (INF 113) is not detected

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 113) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-113 is set before any of the DTCs in the table below are set	A
Any of the DTCs in the table below are set before P0A78-113 is set	B

DTC No.	Relevant Diagnosis
P3011-123, P3012-123, P3013-123, P0314-123, P3015-123, P3016-123, P0317-123, P3018-123, P3019-123, P3020-123, P3021-123, P3022-123, P3023-123, P3024-123	Battery Block # Becomes Weak
P0AFC-123	Hybrid Battery Pack Sensor Module
P308A-123	Hybrid Battery Voltage Sensor All Circuits Low
P0AC0-123	Hybrid Battery Pack Current Sensor Circuit Range/Performance
P0AC1-123	Hybrid Battery Pack Current Sensor Circuit Low
P0AC2-123	Hybrid Battery Pack Current Sensor

DTC No.	Relevant Diagnosis
	Circuit High
P0A9C-123	Hybrid Battery Temperature Sensor "A"
P0A9D-123	Hybrid Battery Temperature Sensor "A" Circuit Low
P0A9E-123	Hybrid Battery Temperature Sensor "A" Circuit High
P0AC6-123	Hybrid Battery Temperature Sensor "B" Range/Performance
P0AC7-123	Hybrid Battery Temperature Sensor "B" Circuit Low
P0AC8-123	Hybrid Battery Temperature Sensor "B" Circuit High
P0ACB-123	Hybrid Battery Pack Cooling Fan 3 Performance or Stuck OFF
P0ACC-123	Hybrid Battery Pack Cooling Fan 3 Stuck ON
P0ACD-123	Hybrid Battery Pack Cooling Fan 3 Control Circuit Low
P3065-123	Hybrid Battery Temperature Sensor Correlation for Stack "A"

HINT:

P0A78-113 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-202 is not output.	A
P0A78-202 is also output.	B

NOTICE:

- If P0A78-202 is output, troubleshoot it first. After completing the troubleshooting for P0A78-202, return to perform troubleshooting for this DTC.
- Parts repaired or replaced during troubleshooting for P0A78-202 do not need to be re-inspected in this diagnosis procedure.

(e) Turn the power switch off.

B GO TO DTC CHART

A

3.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

HINT:

- If P0A78-202 was not output in step 2 of this diagnosis procedure, check Table 1 below.
- If P0A78-202 was output in step 2 of this diagnosis procedure, repair that DTC first, then check Table 2 below.

Result:

Result	Proceed to
P0A78-113 only is output	A
Any of the following DTCs are also output.	B

Table 1

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit

DTC No.	Relevant Diagnosis
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

Table 2

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60-294	Drive Motor "A" Phase V Current
P0A63-302	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance

DTC No.	Relevant Diagnosis
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-113 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

4.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

6.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

8.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

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

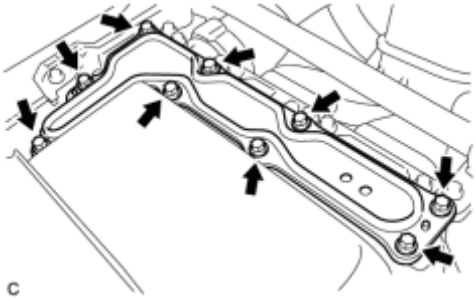
CAUTION:

Be sure to wear insulated gloves.

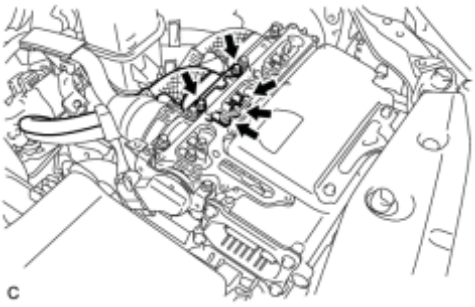
(a) Check that the service plug grip is not installed.

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 inverter terminal cover from the inverter with converter assembly.



(c) Check that the bolts for the generator cable are tightened to the specified torque, the generator cable is connected securely, and there are no contact problems.

Specified Condition:

T=8.0 N*m {82 kgf*cm, 71 in.*lbf}

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).

(d) Check for arc marks at the bolts for the generator cable.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter terminal cover.

C CONNECT SECURELY
B REPLACE MALFUNCTIONING PARTS
A

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

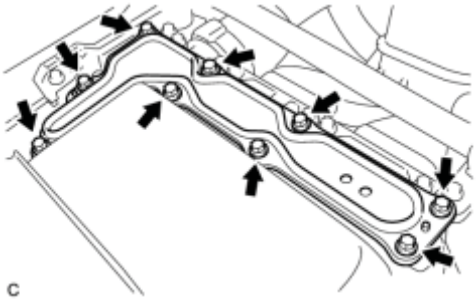
CAUTION:

Be sure to wear insulated gloves.

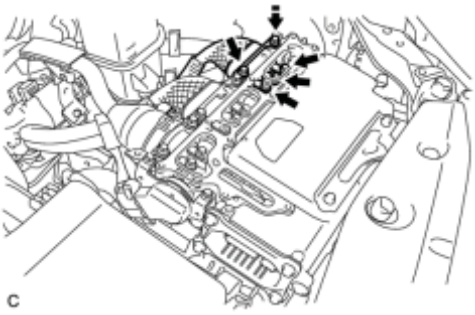
(a) Check that the service plug grip is not installed.

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 inverter terminal cover from the inverter with converter assembly.



(c) Check that the bolts for the motor cable are tightened to the specified torque, the motor cable is connected securely, and there are no contact problems.

Specified Condition:

T=8.0 N*m {82 kgf*cm, 71 in.*lbf}

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).

(d) Check for arc marks at the bolts for the motor cable.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter terminal cover.

C CONNECT SECURELY
B REPLACE MALFUNCTIONING PARTS
A

11.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

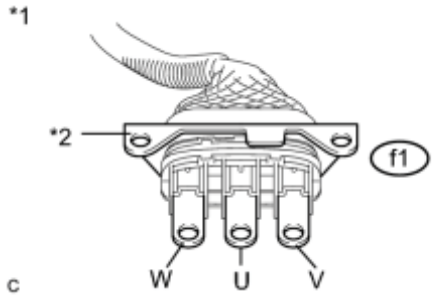
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Remove the inverter terminal cover from the inverter with converter assembly.

(c) Disconnect the generator cable and motor cable from the inverter with converter assembly.

(d) Check MG1 for an interphase short using a milliohmmeter.

(1) Using a milliohmmeter, measure the resistance according to the value(s) in the table below.



HINT:

If the MG1 temperature is high, the resistance will vary greatly from the specification. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - f1-3 (V)	Power switch off	87.0 to 96.2 mΩ
f1-3 (V) - f1-1 (W)	Power switch off	87.0 to 96.2 mΩ

f1-1 (W) - f1-2 (U)	Power switch off	87.0 to 96.2 mΩ

Text in Illustration

*1	Generator Cable
*2	Shield Ground

HINT:

To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 68° F (20°C).

R20 = Rt / {1 + 0.00393 X (T - 20)}

The calculation is based on the following:

R20: Resistance at 68° F (20°C) (mΩ)

Rt: Measured resistance (mΩ)

T: Temperature when the resistance is measured (° C)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

(f) Connect the generator cable and motor cable.

(g) Install the inverter terminal cover.

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK ▼

12.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2)

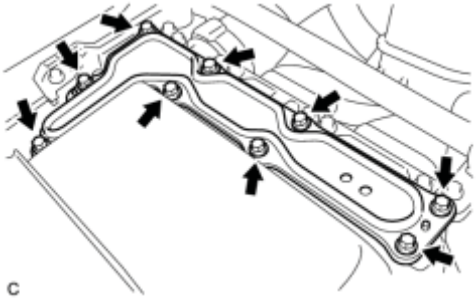
CAUTION:

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) Remove the inverter terminal cover from the inverter with converter assembly.

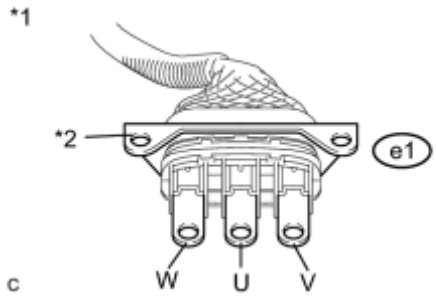
(c) Disconnect the generator cable and motor cable from the inverter with converter assembly.

(d) Check MG2 for an interphase short using a milliohmmeter.

(1) Using a milliohmmeter, measure the resistance according to the value(s) in the table below.

HINT:

If the MG2 temperature is high, the resistance will vary greatly from the specification. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - e1-3 (V)	Power switch off	154 to 170 mΩ
e1-3 (V) - e1-1 (W)	Power switch off	148 to 164 mΩ
e1-1 (W) - e1-2 (U)	Power switch off	149 to 165 mΩ

Text in Illustration

*1	Motor Cable
*2	Shield Ground

HINT:

To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 68° F (20°C).

R20 = Rt / {1 + 0.00393 X (T - 20)}

The calculation is based on the following:

R20: Resistance at 68° F (20°C) (mΩ)

Rt: Measured resistance (mΩ)

T: Temperature when the resistance is measured (° C)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

(f) Connect the generator cable and motor cable.

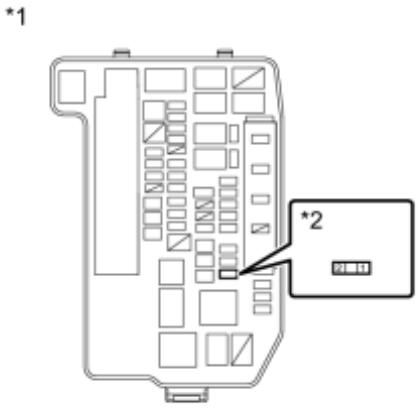
(g) Install the inverter terminal cover.

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ▼

13.	CHECK FUSE (PCU)

(a) Remove the PCU fuse from the engine room junction block assembly.



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

Standard Resistance:

Tester Connection	Condition	Specified Condition
PCU fuse terminal	Always	Below 1Ω

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	PCU fuse

(c) Install the PCU fuse.

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ▼

14.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

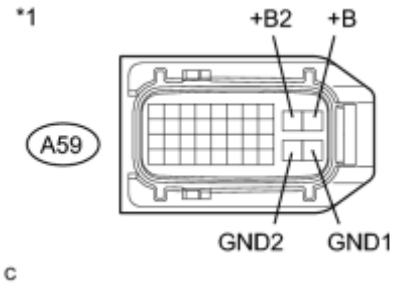
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect connector A59 from inverter with converter assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-28 (GND1) - Body ground	Power switch off	Below 1 Ω
A59-27 (GND2) - Body ground	Power switch off	Below 1 Ω



Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter 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	Switch Condition	Specified Condition
A59-10 (+B) - Body ground	Power switch on (IG)	11 to 14V
A59-9 (+B2) - Body ground	Power switch on (IG)	11 to 14V

(f) Turn the power switch off.

(g) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK ▼

15.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

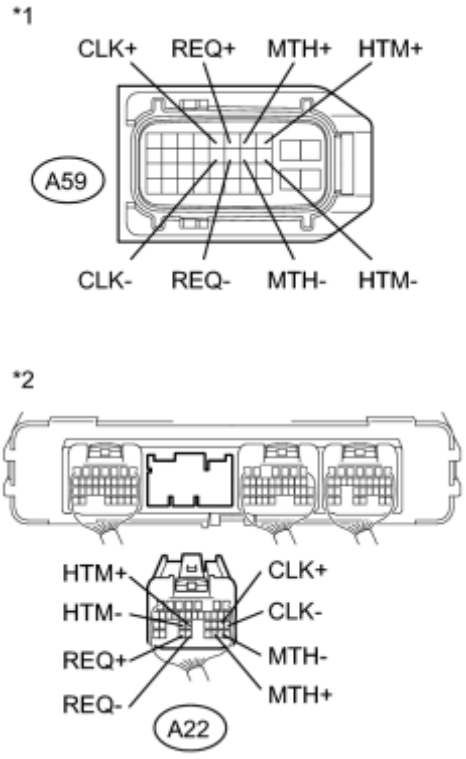
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Turn the power switch off.

(c) Disconnect connector A59 from the inverter with converter assembly.

(d) Disconnect connector A22 from the power management control ECU.

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



Standard Resistance (Check for open):

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) - A59-8 (HTM+)	Power switch off	Below 1 Ω
A22-25 (HTM-) - A59-18 (HTM-)	Power switch off	Below 1 Ω
A22-30 (MTH+) - A59-7 (MTH+)	Power switch off	Below 1 Ω
A22-29 (MTH-) - A59-17 (MTH-)	Power switch off	Below 1 Ω
A22-33 (REQ+) - A59-6 (REQ+)	Power switch off	Below 1 Ω
A22-32 (REQ-) - A59-16 (REQ-)	Power switch off	Below 1 Ω
A22-21 (CLK+) - A59-5 (CLK+)	Power switch off	Below 1 Ω
A22-20 (CLK-) - A59-15 (CLK-)	Power switch off	Below 1 Ω

Standard Resistance (Check for short):

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) or A59-8 (HTM+) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-25 (HTM-) or A59-18 (HTM-) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-30 (MTH+) or A59-7 (MTH+) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-29 (MTH-) or A59-17 (MTH-) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-33 (REQ+) or A59-6 (REQ+) -	Power switch	10 kΩ or

Body ground and other terminals	off	higher
A22-32 (REQ-) or A59-16 (REQ-) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-21 (CLK+) or A59-5 (CLK+) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-20 (CLK-) or A59-15 (CLK-) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Rear view of wire harness connector (to Power Management Control ECU)

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) or A59-8 (HTM+) - Body ground	Power switch on (IG)	Below 1 V
A22-25 (HTM-) or A59-18 (HTM-) - Body ground	Power switch on (IG)	Below 1 V
A22-30 (MTH+) or A59-7 (MTH+) - Body ground	Power switch on (IG)	Below 1 V
A22-29 (MTH-) or A59-17 (MTH-) - Body ground	Power switch on (IG)	Below 1 V
A22-33 (REQ+) or A59-6 (REQ+) - Body ground	Power switch on (IG)	Below 1 V
A22-32 (REQ-) or A59-16 (REQ-) - Body ground	Power switch on (IG)	Below 1 V
A22-21 (CLK+) or A59-5 (CLK+) - Body ground	Power switch on (IG)	Below 1 V
A22-20 (CLK-) or A59-15 (CLK-) - Body ground	Power switch on (IG)	Below 1 V

NOTICE:

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

(h) Turn the power switch off.

(i) Connect the power management control ECU connector.

(j) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

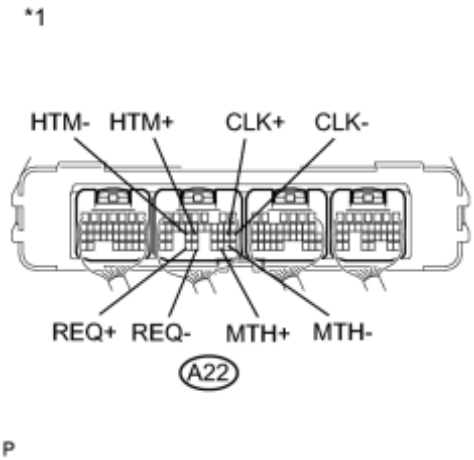
OK ▼

16.	CHECK POWER MANAGEMENT CONTROL ECU

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) - A22-25 (HTM-)	Power switch off	80 to 170 Ω
A22-30 (MTH+) - A22-29 (MTH-)	Power switch off	80 to 170 Ω
A22-33 (REQ+) - A22-32 (REQ-)	Power switch off	80 to 170 Ω
A22-21 (CLK+) - A22-20 (CLK-)	Power switch off	80 to 170 Ω



Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

17.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

18.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

19.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

21.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

23.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

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.

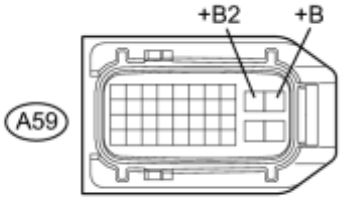
(b) Disconnect connector A59 from the inverter with converter assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-10 (+B) - Body ground	Power switch off	10 kΩ or higher
A59-9 (+B2) - Body ground	Power switch off	10 kΩ or higher

*1



c

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

(d) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

24.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT **REPLACE FUSE (PCU)**

25.	REPAIR OR REPLACE HARNESS OR CONNECTOR

(a) Repair or replace the wire harness or connector.

NEXT **REPLACE FUSE (PCU)**

26.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

CAUTION:

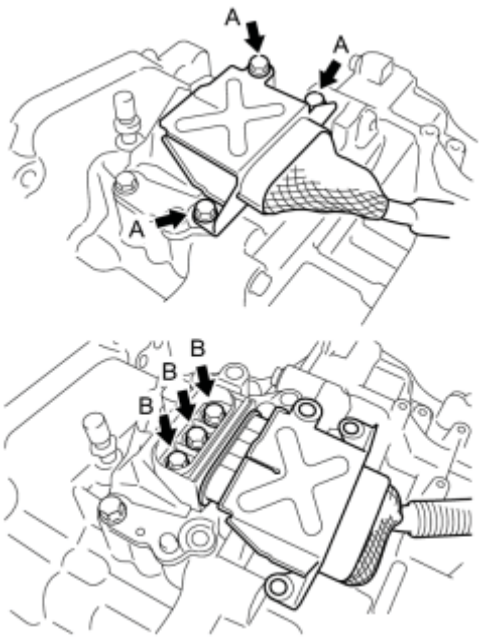
Be sure to wear insulated gloves.

(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) Remove the inverter with converter assembly.



(c) Check that the bolts for the generator cable are tightened to the specified torque, the generator cable is connected securely, and there are no contact problems.

Specified Condition:

Bolt A

T=20 N*m {204 kgf*cm, 15 ft.*lbf}

Bolt B

T=10 N*m {102 kgf*cm, 7 ft.*lbf}

- Make sure that the tightening torque of the bolt A is between 16 and 24 N*m (163 and 245 kgf*cm, 12 and 18 ft.*lbf).
- Make sure that the tightening torque of the bolt B is between 8 and 12 N*m (82 and 122 kgf*cm, 71 and 106 in.*lbf).

(d) Check for arc marks at the bolts for the generator cable.

Result:

Result	Proceed to

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter with converter assembly.

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

27.	CHECK GENERATOR CABLE

CAUTION:

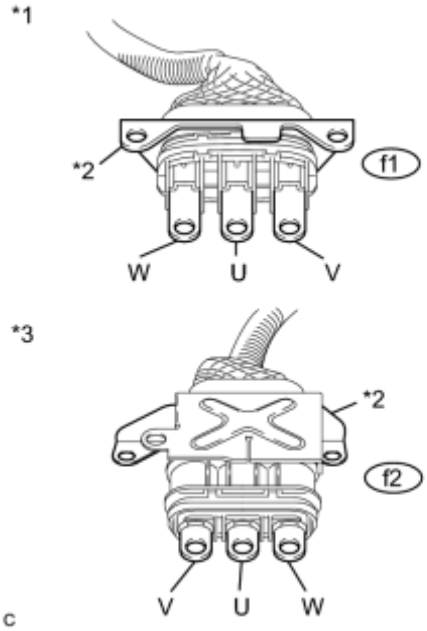
Be sure to wear insulated gloves.

(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) Remove the generator cable.



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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

Text in Illustration

*1	Generator Cable (Inverter with Converter Assembly Side)
*2	Shielded ground
*3	Generator Cable (Hybrid Vehicle Transaxle Assembly Side)

NOTICE:

Wrap the terminal of the three-phase AC cable with insulating tape to prevent them from coming into contact with body ground

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - f2-2 (U)	Power switch off	Below 1 Ω
f1-3 (V) - f2-1 (V)	Power switch off	Below 1 Ω
f1-1 (W) - f2-3 (W)	Power switch off	Below 1 Ω
f1-2 (U) - f2-1 (V)	Power switch off	100 MΩ or higher
f1-3 (V) - f2-3 (W)	Power switch off	100 MΩ or higher
f1-1 (W) - f2-2 (U)	Power switch off	100 MΩ or higher

(e) Install the generator cable.

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

28.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

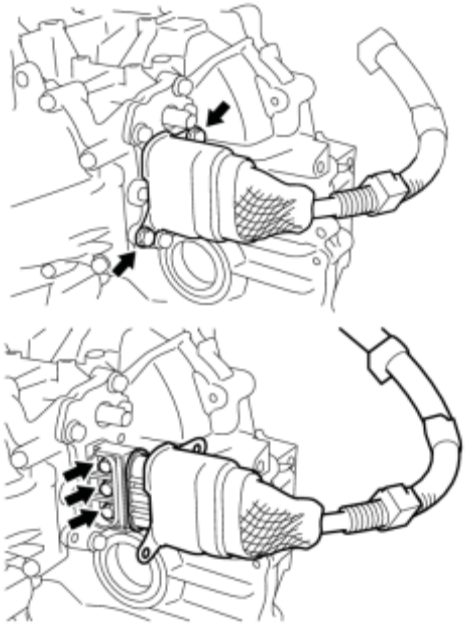
CAUTION:

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 that the bolts for the motor cable are tightened to the specified torque, the motor cable is connected securely, and there are no contact problems.

Specified Condition:

T=10 N*m {102 kgf*cm, 7 ft.*lbf}

NOTICE:

Make sure that the tightening torque of the bolts is between 8 and 12 N*m (82 and 122 kgf*cm, 71 and 106 in.*lbf).

(c) Check for arc marks at the bolts for the motor cable.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

29.	CHECK MOTOR CABLE

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.

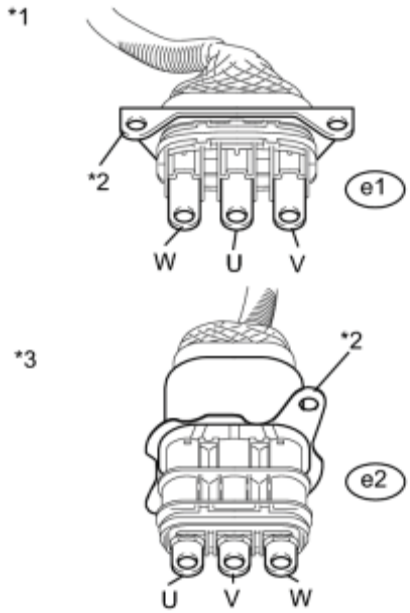
(b) Remove the motor cable.

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

Text in Illustration

*1	Motor Cable (Inverter with Converter Assembly Side)
*2	Shielded ground
*3	Motor Cable (Hybrid Vehicle Transaxle Assembly Side)

NOTICE:

Wrap the terminal of the three-phase AC cable with insulating tape to prevent them from coming into contact with body ground

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - e2-3 (U)	Power switch off	Below 1 Ω
e1-3 (V) - e2-2 (V)	Power switch off	Below 1 Ω
e1-1 (W) - e2-1 (W)	Power switch off	Below 1 Ω
e1-2 (U) - e2-2 (V)	Power switch off	100 MΩ or higher
e1-3 (V) - e2-1 (W)	Power switch off	100 MΩ or higher

Tester Connection	Switch Condition	Specified Condition
e1-1 (W) - e2-3 (U)	Power switch off	100 MΩ or higher

(e) Install the motor cable.

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A78-121	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an overvoltage occurs in the motor inverter or generator inverter, the MG ECU detects it and transmits this information to the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	121	Motor inverter overvoltage signal detection (overvoltage due to system malfunction)	• Hybrid battery junction block • Inverter with converter assembly • Service plug grip (EV battery fuse) • Frame wire • Hybrid vehicle transaxle assembly • Generator Cable • Motor Cable • Power management control ECU • PCU fuse • Wire harness or connector

MONITOR DESCRIPTION

If the motor inverter detects over-voltage, it transmits an over-voltage signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) illuminates the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 121): OVH detection (Over voltage malfunction)
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

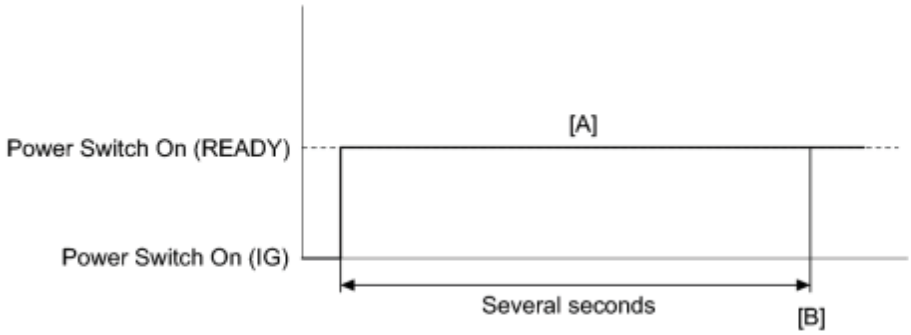
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 121) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P0AE6-225 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-121 is set before any of the DTCs in the table below are set	A
Any of the DTCs in the table below are set before P0A78-121 is set	B

DTC No.	Relevant Diagnosis
P3011-123, P3012-123, P3013-123, P0314-123, P3015-123, P3016-123, P0317-123, P3018-123, P3019-123, P3020-123, P3021-123, P3022-123,	Battery Block # Becomes Weak

DTC No.	Relevant Diagnosis
P3023-123, P3024-123	
P0AFC-123	Hybrid Battery Pack Sensor Module
P308A-123	Hybrid Battery Voltage Sensor All Circuits Low
P0AC0-123	Hybrid Battery Pack Current Sensor Circuit Range/Performance
P0AC1-123	Hybrid Battery Pack Current Sensor Circuit Low
P0AC2-123	Hybrid Battery Pack Current Sensor Circuit High
P0A9C-123	Hybrid Battery Temperature Sensor "A"
P0A9D-123	Hybrid Battery Temperature Sensor "A" Circuit Low
P0A9E-123	Hybrid Battery Temperature Sensor "A" Circuit High
P0AC6-123	Hybrid Battery Temperature Sensor "B" Range/Performance
P0AC7-123	Hybrid Battery Temperature Sensor "B" Circuit Low
P0AC8-123	Hybrid Battery Temperature Sensor "B" Circuit High
P0ACB-123	Hybrid Battery Pack Cooling Fan 3 Performance or Stuck OFF
P0ACC-123	Hybrid Battery Pack Cooling Fan 3 Stuck ON
P0ACD-123	Hybrid Battery Pack Cooling Fan 3 Control Circuit Low
P3065-123	Hybrid Battery Temperature Sensor Correlation for Stack "A"

HINT:

- Refer to the Freeze Frame data to determine the order in which the DTCs were set.
- P0A78-121 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-121 only is output	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-113, 128, 266, 267, 279, 284, 286, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-122, 130, 322, 324, 325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-172, 442, 547, 548, 549, 553, 554, 555, 556, 557, 585, 587, 589, 590	DC/DC Converter Performance
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High

DTC No.	Relevant Diagnosis
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low
P0AE0-228	Hybrid Battery Negative Contactor Control Circuit High
P0C76-523	Hybrid Battery System Discharge Time Too Long
P3004-803	High Voltage Power Resource

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-121 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

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

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

5.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

7.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

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

C → CONNECT SECURELY
B → REPLACE MALFUNCTIONING PARTS
A ↓

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

C → CONNECT SECURELY
B → REPLACE MALFUNCTIONING PARTS
A ↓

10.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) INFO

NG → CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK ↓

11.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) INFO

NG → CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ↓

12.	CHECK INVERTER WITH CONVERTER ASSEMBLY (HIGH VOLTAGE CONNECTOR CONNECTION CONDITION)

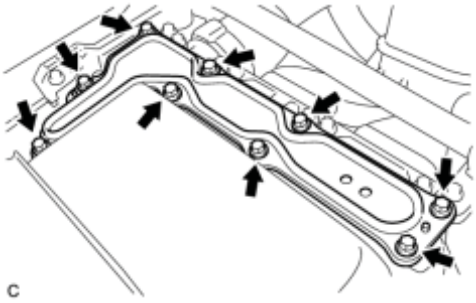
CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

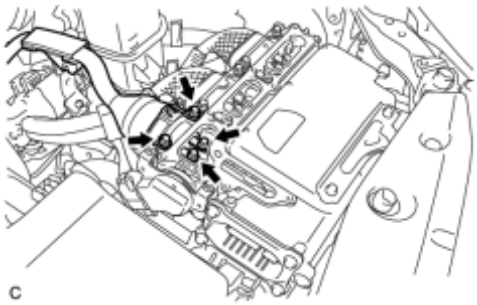
NOTICE:

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) Remove the inverter terminal cover from the inverter with converter assembly.

(c) Check that the bolts for the frame wire are tightened to the specified



torque, the frame wire is connected securely, and there are no contact problems.

Specified Condition:

T=8.0 N*m {82 kgf*cm, 71 in.*lbf}

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).

(d) Check for arc marks at the bolts for the frame wire.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter terminal cover.

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

13.	CHECK SERVICE PLUG GRIP (CONNECTION CONDITION)

CAUTION:

Be sure to wear insulated gloves.

(a) Visually check the connection of the service plug grip to the HV battery. Remove the service plug grip and check for contamination.

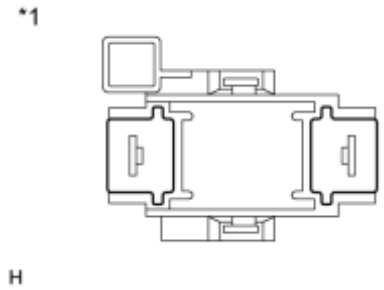
OK:

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

NG ▶ REPLACE SERVICE PLUG GRIP
OK ▼

14.	CHECK SERVICE PLUG GRIP

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



Standard Resistance:

Tester Connection	Condition	Specified Condition
Service plug grip terminals	Always	Below 1 Ω

Text in Illustration

*1	Service plug grip

NG ▶ REPLACE SERVICE PLUG GRIP

OK ▼

15.	CHECK FRAME WIRE

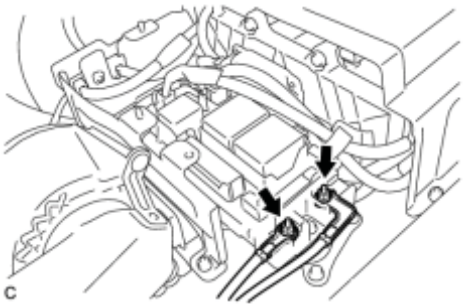
CAUTION:

Be sure to wear insulated gloves.

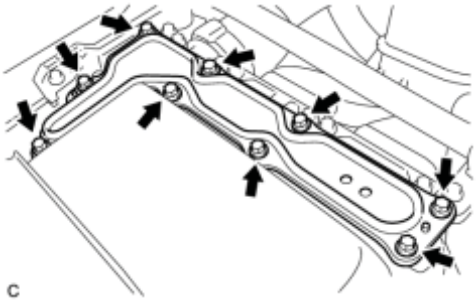
(a) Check that the service plug grip is not installed.

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.

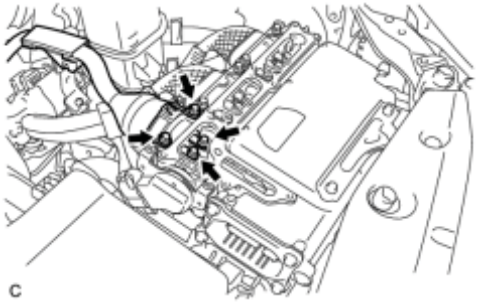


(b) Disconnect the frame wire from the hybrid battery junction block.

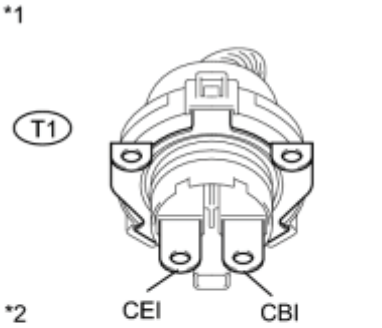


(c) Remove the inverter terminal cover from the inverter with converter assembly.

(d) Disconnect the frame wire from the inverter with converter assembly.

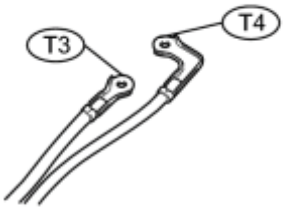


(e) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
T4-1 - T1-2 (CBI) (Positive terminal)	Power switch off	Below 1 Ω
T3-1 - T1-1 (CEI) (Negative terminal)	Power switch off	Below 1 Ω



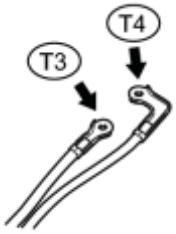
Text in Illustration

*1	Frame Wire (Inverter with Converter Assembly Side)
*2	Frame Wire (Hybrid Battery Junction Block Side)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
T4-1 - Body ground and shielded ground	Power switch off	10 MΩ or higher
T3-1 - Body ground and shielded ground	Power switch off	10 MΩor higher
T3-1 - T4-1	Power switch off	10 MΩ or higher

(g) Connect the frame wire to the hybrid battery junction block.

(h) Connect the frame wire to the inverter with converter assembly.

(i) Install the inverter terminal cover.

NG ▶ REPLACE FRAME WIRE

OK

▼

16.	INSPECT HYBRID BATTERY JUNCTION BLOCK (SMRB)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

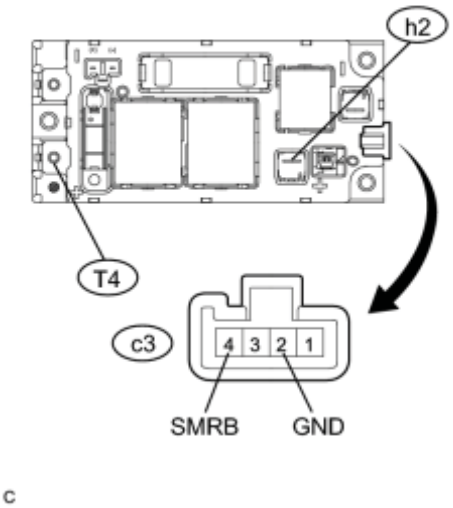
NOTICE:

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) Remove the hybrid battery junction block.

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

Standard Resistance:



Tester Connection	Condition	Specified Condition
h2 - T4	Auxiliary battery voltage is not applied between terminals c3-4 (SMRB) and c3-2 (GND)	10 kΩ or higher
h2 - T4	Auxiliary battery voltage is applied between terminals c3-4 (SMRB) and c3-2 (GND)	Below 1 Ω

Text in Illustration

*1	Hybrid Battery Junction Block

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

Standard Resistance:

Tester Connection	Condition	Specified Condition
c3-4 (SMRB) - c3-2 (GND)	-40 to 176°F(-40 to 80°C)	19.0 to 35.5 Ω

(e) Install the hybrid battery junction block.

NG ▶ REPLACE HYBRID BATTERY JUNCTION BLOCK

OK ▼

17.	INSPECT HYBRID BATTERY JUNCTION BLOCK (SMRG)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

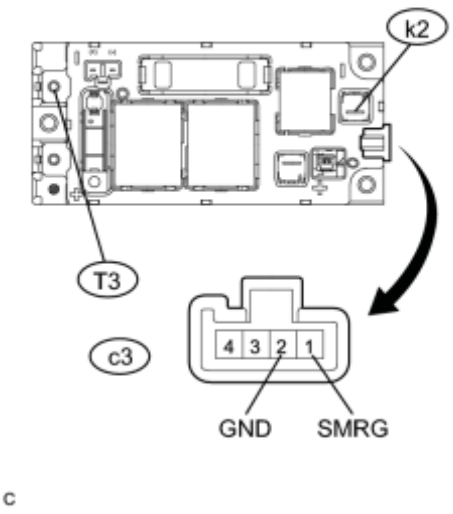
NOTICE:

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) Remove the hybrid battery junction block.

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

Standard Resistance:



Tester Connection	Condition	Specified Condition
k2 - T3	Auxiliary battery voltage is not applied between terminals c3-1 (SMRG) and c3-2 (GND)	10 kΩ or higher
k2 - T3	Auxiliary battery voltage is applied between terminals c3-1 (SMRG) and c3-2 (GND)	Below 1 Ω

Text in Illustration

*1	Hybrid Battery Junction Block

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

Standard Resistance:

Tester Connection	Condition	Specified Condition
c3-1 (SMRG) - c3-2 (GND)	-40 to 176°F (-40 to 80°C)	19.0 to 35.5 Ω

(e) Install the hybrid battery junction block.

NG → REPLACE HYBRID BATTERY JUNCTION BLOCK

OK ↓

18.	CHECK FUSE (PCU) INFO

NG → CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ↓

19.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT) INFO

NG → REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK ↓

20.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER) INFO

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

21.	CHECK POWER MANAGEMENT CONTROL ECU INFO

NG → REPLACE POWER MANAGEMENT CONTROL ECU

OK ↓

22.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

23.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK → **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

24.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

26.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

28.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▼

29.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ **REPLACE FUSE (PCU)**

30.	REPAIR OR REPLACE HARNESS OR CONNECTOR

(a) Repair or replace the wire harness or connector.

NEXT ▶ **REPLACE FUSE (PCU)**

31.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

32.	CHECK GENERATOR CABLE INFO

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

33.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

34.	CHECK MOTOR CABLE INFO

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A78-128	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an abnormal amount of current flows through the motor inverter, the MG ECU detects it and sends a signal to inform the power management control ECU (HV CPU) of the malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	128	Abnormal motor current value detection (System malfunction)	• Hybrid vehicle transaxle assembly • Generator cable • Motor cable • Inverter with converter assembly • Power management control ECU • PCU fuse • Wire harness or connector

MONITOR DESCRIPTION

The MG ECU monitors the motor inverter electric current. If the current exceeds the threshold for a specified period of time, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 128): Motor inverter abnormal current
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

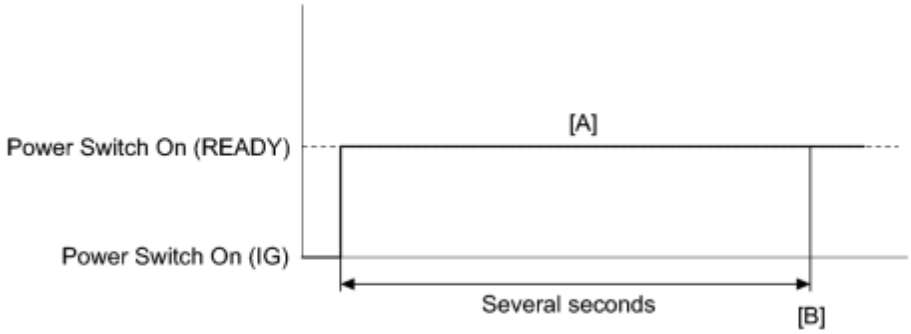
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 128) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-202 is not output	A
P0A78-202 is also output	B

NOTICE:

- If P0A78-202 is output, troubleshoot it first. After completing the troubleshooting for P0A78-202, return to perform troubleshooting for this DTC.
- Parts repaired or replaced during troubleshooting for P0A78-202 do not need to be re-inspected in this diagnosis procedure.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

HINT:

- If P0A78-202 was not output in step 1 of this diagnosis procedure, check Table 1 below.
- If P0A78-202 was output in step 1 of this diagnosis procedure, repair that DTC first, then check Table 2 below.

Result:

Result	Proceed to
P0A78-128 only is output.	A
Any of the following DTCs are also output.	B

Table 1

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance

DTC No.	Relevant Diagnosis
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

Table 2

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60-294	Drive Motor "A" Phase V Current
P0A63-302	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-128 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

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

NG ▶ CONNECT SECURELY

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

5.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

7.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A

10.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK

11.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ▼

12.	CHECK FUSE (PCU) INFO

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ▼

13.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT) INFO

NG ▶ REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK ▼

14.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

15.	CHECK POWER MANAGEMENT CONTROL ECU INFO

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

16.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

17.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

18.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

20.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

22.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK

23.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ **REPLACE FUSE (PCU)**

24.	REPAIR OR REPLACE HARNESS OR CONNECTOR

(a) Repair or replace the wire harness or connector.

NEXT ▶ **REPLACE FUSE (PCU)**

25.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A

26.	CHECK GENERATOR CABLE INFO

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

27.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A

28.	CHECK MOTOR CABLE INFO

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A78-202	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	202	Malfunction (short circuit) in the motor inverter inside the inverter with converter assembly	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Motor cable

MONITOR DESCRIPTION

The MG ECU monitors the motor inverter electric current. If the current exceeds the threshold for a specified period of time, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 202): MFIV detection (Short circuit malfunction)
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

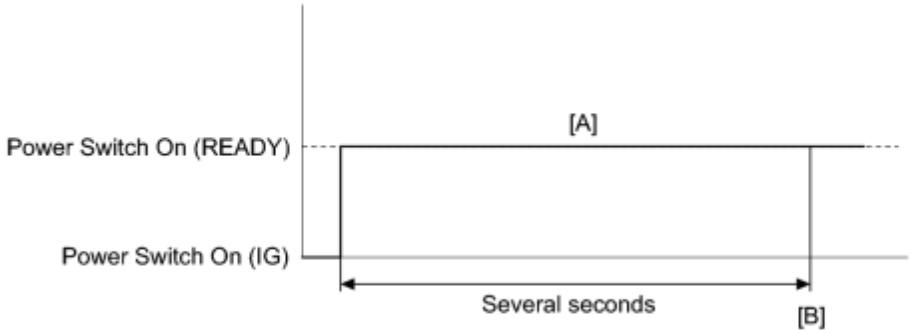
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 202) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

- DTC P0A78-202 is stored after any of DTCs P0A78-113, 128, 284, 286, 287, 505, 506, 806, 807 and 808 are stored. After troubleshooting and repairing DTC P0A78-202, be sure to troubleshoot all the other DTCs.
- Depending on the conditions in which the vehicle is being operated when a short circuit occurs in the inverter with converter assembly, the hybrid vehicle transaxle assembly may be affected. As this DTC is stored if a short circuit occurs in the inverter with converter assembly, it is necessary to perform a road test to check the hybrid vehicle transaxle assembly. If problems are found, replace the malfunctioning parts.
- After completing the repair, including the repair of previously output DTCs, drive the vehicle at a speed of approximately 25 mph (40 km/h) for 1 minute and check that DTC P0A90-251 (Drive Motor "A" Performance) is not output. If DTC P0A90-251 (Drive Motor "A" Performance) is output, replace the hybrid vehicle transaxle assembly.

HINT:

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

PROCEDURE

1.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY INFO

NG ▶ CHECK MOTOR CABLE

OK ▼

2.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ CHECK DTC OUTPUT (HV)

3.	CHECK MOTOR CABLE INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2)

OK ▼

4.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

NEXT ▼

5.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ CHECK DTC OUTPUT (HV)

6.	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 from the hybrid vehicle transaxle assembly.

(c) Check MG2 for an interphase short using a milliohmmeter.

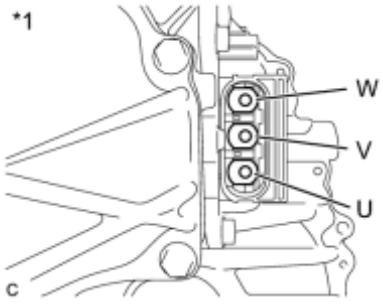
(1) Using a milliohmmeter, measure the resistance according to the value(s) in the table below.

HINT:

If the MG2 temperature is high, the resistance will vary greatly from the specification. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e2-3 (U) - e2-2 (V)	Power switch off	154 to 170 mΩ
e2-2 (V) - e2-1 (W)	Power switch off	148 to 164 mΩ
e2-1 (W) - e2-3 (U)	Power switch off	149 to 165 mΩ



Text in Illustration

*1	Hybrid Vehicle Transaxle Assembly

HINT:

To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 68° F (20°C).

R20 = Rt / {1 + 0.00393 X (T - 20)}

The calculation is based on the following:

R20: Resistance at 68° F (20°C) (mΩ)

Rt: Measured resistance (mΩ)

T: Temperature when the resistance is measured (° C)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e2-3 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
e2-2 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
e2-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

(e) Connect the motor cable.

NG ▶ REPLACE MOTOR CABLE

OK

▼

7.	REPLACE MOTOR CABLE

(a) Replace the motor cable INFO.

NEXT

▼

8.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ CHECK DTC OUTPUT (HV)

9.	REPLACE MOTOR CABLE

(a) Replace the motor cable INFO.

NEXT

▼

10.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

NEXT

▼

11.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT

12.	CHECK DTC OUTPUT (HV)

(a) Check the other DTCs that were output together with DTC P0A78-202.

Result:

DTC No.	Relevant Diagnosis
P0A78-113, 128, 284, 286, 287, 505, 506, 806, 807, 808	Drive Motor "A" Inverter Performance

NOTICE:

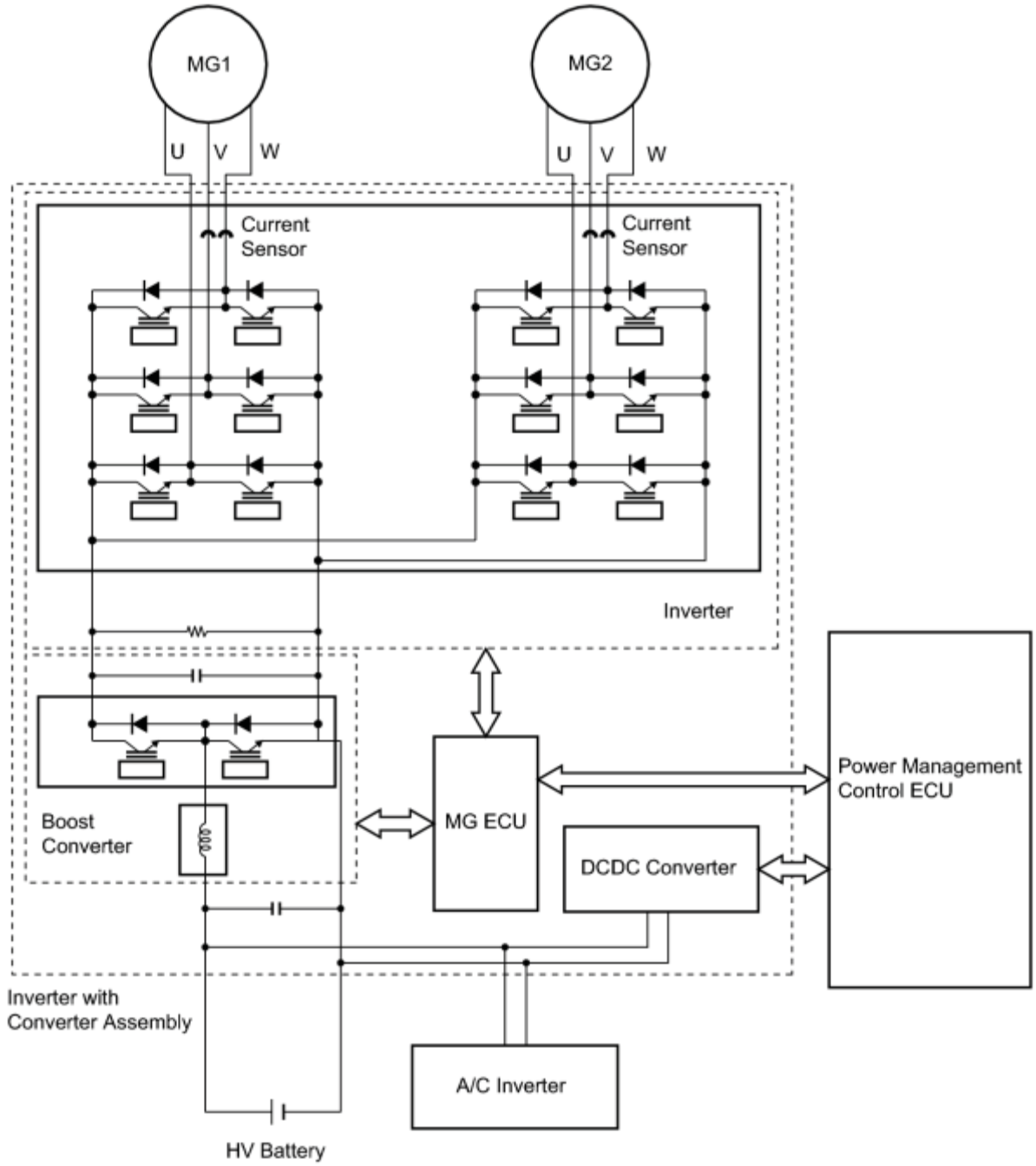
DTC P0A78-202 is stored after any of DTCs P0A78-113, 128, 284, 286, 287, 505, 506, 806, 807 and 808 are stored. After troubleshooting and repairing DTC P0A78-202, be sure to troubleshoot all the other DTCs.

NEXT **GO TO DTC CHART**

DTC	P0A78-266	Drive Motor "A" Inverter Performance
DTC	P0A78-267	Drive Motor "A" Inverter Performance

DESCRIPTION

The inverter contains a three-phase bridge circuit, which consists of six power transistors (IGBTs) each for MG1 and MG2. The inverter converts high-voltage direct current from the HV battery into three-phase alternating current for MG1 and MG2; it also converts three-phase alternating current supplied by MG1 and MG2 into direct current for the HV battery. The MG ECU controls the actuation of the power transistors (IGBTs). The inverter transmits information necessary for control, such as amperage and voltage, to the MG ECU.



c

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

The MG ECU monitors the inverter voltage sensor and detects the following malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	266	Short to GND in the inverter voltage (VH) signal line	Inverter with converter assembly
P0A78	267	Open or short to +B in the inverter voltage (VH) signal line	

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 power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 266): VH malfunction (GND short malfunction) P0A78 (INF 267): VH malfunction (+B short and disconnection malfunction)
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

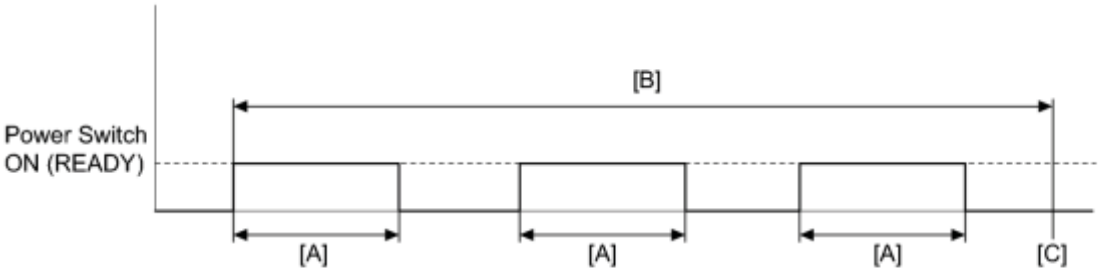
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 266/267) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

HINT:

The signal line from the inverter voltage (VH) sensor is connected to the MG ECU inside the inverter with converter assembly. If P0A78-266 or P0A78-267 is output, replace the inverter with converter assembly.

NEXT **COMPLETED**

DTC	P0A78-279	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an overvoltage occurs in the motor inverter or generator inverter, the MG ECU detects it and transmits this information to the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	279	Motor inverter overvoltage signal detection (overvoltage (inverter malfunction))	Inverter with converter assembly

MONITOR DESCRIPTION

If the motor inverter detects overvoltage, it will transmit an overvoltage signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 279): OVH detection (Over 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

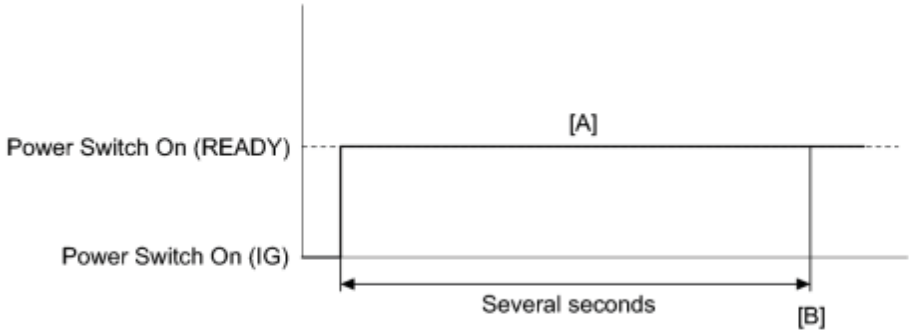
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 279) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-279 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A78-266, 267, 287, 505, 506, 565, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A94-554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
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

DTC No.	Relevant Diagnosis
P0AE0-228	Hybrid Battery Negative Contactor Control Circuit High
P3004-803	High Voltage Power Resource
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-279 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

DTC	P0A78-282	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an overvoltage occurs in the motor inverter or generator inverter, the MG ECU detects it and transmits this information to the power management control ECU (HV CPU).

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 will transmit a motor inverter overvoltage signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) 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	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	-

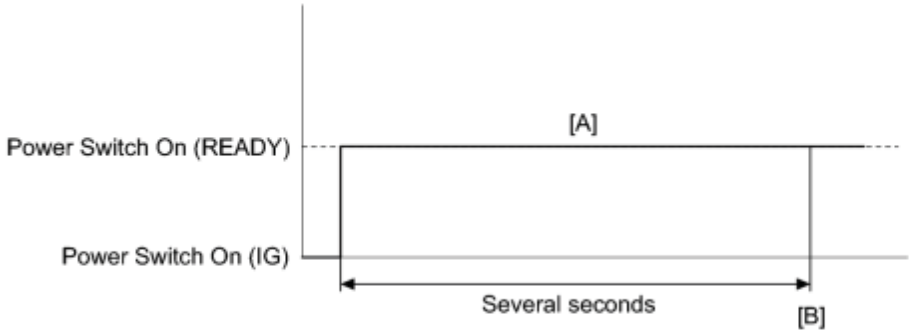
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 282) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY
OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

DTC	P0A78-284	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If the motor inverter overheats, has a circuit malfunction, or has an internal short, the inverter transmits this information to 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)	• Inverter cooling system • Cooling fan system • Power management control ECU • Inverter with converter assembly • Hybrid vehicle transaxle assembly • Generator cable • Motor cable • Water pump with motor assembly • Wire harness or connector • IGCT No. 3 fuse • PCU fuse

MONITOR DESCRIPTION

If the motor inverter overheats, it will transmit an inverter fail signal to the MG ECU. The MG ECU will send information about the malfunction to the power management control ECU (HV CPU). Upon receiving this information, the power management control ECU (HV CPU) 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	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	-

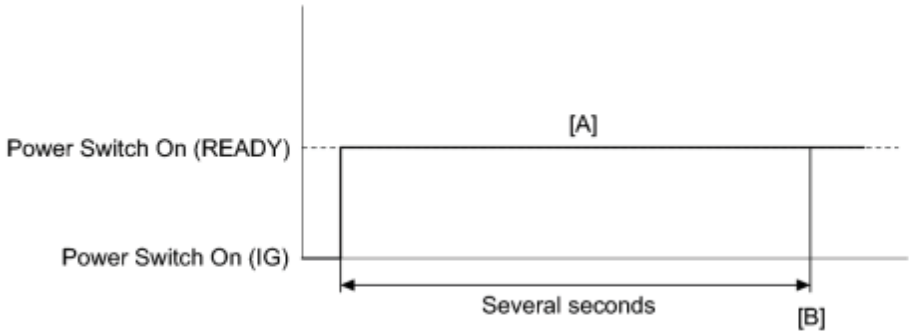
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 284) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A01-726 INFO.

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

After troubleshooting and repairing all output DTCs, 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.

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-202 is not output	A
P0A78-202 is also output	B

NOTICE:

- If P0A78-202 is output, troubleshoot it first. After completing the troubleshooting for P0A78-202, return to perform troubleshooting for this DTC.
- Parts repaired or replaced during troubleshooting for P0A78-202 do not need to be re-inspected in this diagnosis procedure.

(e) Turn the power switch off.

B GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

HINT:

- If P0A78-202 was not output in step 1 of this diagnosis procedure, check Table 1 below.
- If P0A78-202 was output in step 1 of this diagnosis procedure, repair that DTC first, then check Table 2 below.

Result:

Result	Proceed to
P0A78-284 only is output.	A
Any of the following DTCs are also output.	B

Table 1

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance

DTC No.	Relevant Diagnosis
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

Table 2

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60-294	Drive Motor "A" Phase V Current
P0A63-302	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-284 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. After troubleshooting and repairing all output DTCs, be sure to replace the inverter with converter assembly.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

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

NG ▶ CONNECT SECURELY

OK ▼

4.	CHECK QUANTITY OF HV COOLANT INFO

C ▶ INSPECT FOR COOLANT LEAK AND ADD COOLANT

B ▶ ADD HV COOLANT

A ▼

5.	CHECK COOLANT HOSE INFO

NG ▶ CORRECT THE PROBLEM

OK ▼

6.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE WATER PUMP) INFO

NG ▶ CHECK FUSE (IGCT NO. 3)

OK ▼

7.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE ELECTRIC COOLING FAN) INFO

NG ▶ CHECK COOLING FAN SYSTEM

OK ▼

8.	CHECK HV COOLANT (CHECK FOR CONDITIONS THAT MAY HAVE CAUSED FREEZING) INFO

B ▶ REPLACE HV COOLANT

A ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

10.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

12.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A ▼

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A ▼

15.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK ▼

16.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ▼

17.	CHECK FUSE (PCU) INFO

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ▼

18.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT) INFO

NG → REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK ↓

19.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER) INFO

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

20.	CHECK POWER MANAGEMENT CONTROL ECU INFO

NG → REPLACE POWER MANAGEMENT CONTROL ECU

OK ↓

21.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

22.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK → **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

23.	CHECK FUSE (IGCT NO. 3) INFO

NG → CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR)

OK ↓

24.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

25.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

26.	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR ASSEMBLY CIRCUIT) INFO

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

27.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG → REPLACE WATER PUMP WITH MOTOR ASSEMBLY

OK → **REPLACE POWER MANAGEMENT CONTROL ECU**

28.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

30.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

32.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

33.	REPLACE INVERTER WITH CONVERTER ASSEMBLY INFO

NEXT ▶ **REPLACE FUSE (PCU)**

34.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

35.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

36.	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR ASSEMBLY CIRCUIT) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

37.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY

OK

38.	REPLACE POWER MANAGEMENT CONTROL ECU INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

39.	CONNECT SECURELY INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

40.	CONNECT SECURELY INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

41.	REPAIR OR REPLACE HARNESS OR CONNECTOR INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

42.	REPLACE WATER PUMP WITH MOTOR ASSEMBLY INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

43.	REPAIR OR REPLACE HARNESS OR CONNECTOR INFO

NEXT ▶ **REPLACE FUSE (PCU)**

44.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

45.	CHECK GENERATOR CABLE INFO

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

46.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

47.	CHECK MOTOR CABLE INFO

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

48.	REPLACE HV COOLANT INFO

NEXT ▼

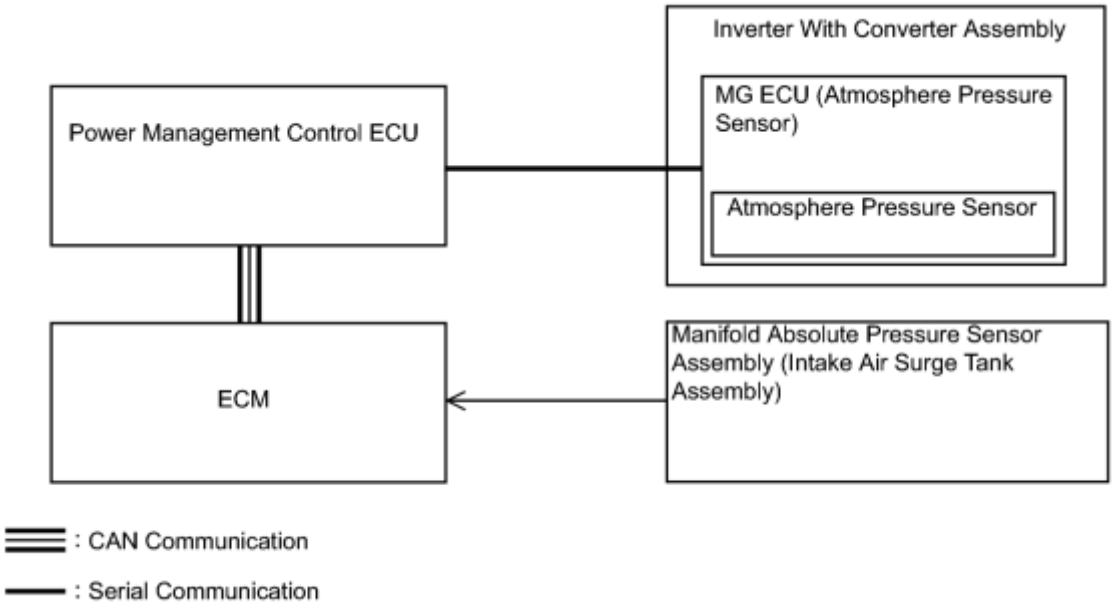
49.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY
OK ▶ **COMPLETED**

DTC	P0069-273	Manifold Absolute Pressure - Barometric Pressure Correlation

DESCRIPTION

The atmospheric pressure sensor mounted on the MG ECU circuit board detects the atmospheric pressure. This reading is used to perform system control that considers vehicle usage conditions.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0069	273	Difference between the atmospheric pressure value of the atmospheric pressure sensor in the inverter with converter assembly and the manifold absolute pressure sensor (for EGR control) exceeds a specified value. The same condition recurs within 3 hours when driving in EV mode.	• Inverter with converter assembly • Manifold absolute pressure sensor • ECM • Wire harness or connector

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (ENGINE CONTROL)

(a) Connect the Techstream to the DLC3.

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

(c) Fully depress the accelerator pedal for 5 seconds to start the engine and keep it running.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check if DTCs are output.

Result:

Result	Proceed to
DTCs other than those listed in the following table are output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input
P106A	Evaporative Emission System Pressure Sensor - Manifold Absolute Pressure Correlation

HINT:

P0069-273 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 reproduction test to check that no DTCs are output.

(f) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0069-273 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A1A-151, 155, 156, 658, 659	Generator Control Module
P0A1B-193, 512, 661, 786	Drive Motor "A" Control Module

DTC No.	Relevant Diagnosis
P0A1D-148	Hybrid Powertrain Control Module
P2228-268	Barometric Pressure Sensor "A" Circuit Low
P2229-269	Barometric Pressure Sensor "A" Circuit High
P2511-149	HV CPU Power Relay Sense Circuit Intermittent No Continuity
P324E-788	MG-ECU Power Relay Intermittent Circuit
U0100-211, 530	Lost Communication with ECM/PCM "A"
U0110 (all INF codes)*1	Lost Communication with Drive Motor Control Module "A"

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0069-273 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 reproduction test to check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

3.	READ VALUE USING TECHSTREAM (MAP, ATMOSPHERE PRESSURE)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / MAP, Atmosphere Pressure.

(d) Using the table, read the normal atmospheric pressure value for the applicable altitude.

*1

*2	*3	*4
0	-20 (-4)	101.3 (14.7)
	-10 (14)	101.3 (14.7)
	0 (32)	101.3 (14.7)
	10 (50)	101.3 (14.7)
	20 (68)	101.3 (14.7)
	30 (86)	101.3 (14.7)
200 (656)	-20 (-4)	98.6 (14.3)
	-10 (14)	98.7 (14.3)
	0 (32)	98.8 (14.3)
	10 (50)	98.9 (14.3)
	20 (68)	99.0 (14.4)
	30 (86)	99.1 (14.4)
400 (1312)	-20 (-4)	96.0 (13.9)
	-10 (14)	96.2 (14.0)
	0 (32)	96.4 (14.0)
	10 (50)	96.6 (14.0)
	20 (68)	96.7 (14.0)
	30 (86)	96.9 (14.1)
600 (1969)	-20 (-4)	93.5 (13.6)
	-10 (14)	93.8 (13.6)
	0 (32)	94.0 (13.6)
	10 (50)	94.3 (13.7)
	20 (68)	94.5 (13.7)
	30 (86)	94.7 (13.7)
800 (2625)	-20 (-4)	91.1 (13.2)
	-10 (14)	91.4 (13.3)
	0 (32)	91.8 (13.3)
	10 (50)	92.1 (13.4)
	20 (68)	92.4 (13.4)
	30 (86)	92.7 (13.4)
1000 (3281)	-20 (-4)	88.7 (12.9)
	-10 (14)	89.1 (12.9)
	0 (32)	89.5 (13.0)
	10 (50)	89.9 (13.0)
	20 (68)	90.3 (13.1)
	30 (86)	90.6 (13.1)
1200 (3937)	-20 (-4)	86.4 (12.5)
	-10 (14)	86.9 (12.6)
	0 (32)	87.4 (12.7)
	10 (50)	87.8 (12.7)
	20 (68)	88.3 (12.8)
	30 (86)	88.7 (12.9)
1400 (4593)	-20 (-4)	84.2 (12.2)
	-10 (14)	84.7 (12.3)
	0 (32)	85.3 (12.4)
	10 (50)	85.8 (12.4)
	20 (68)	86.3 (12.5)
	30 (86)	86.7 (12.6)
1600 (5250)	-20 (-4)	82.0 (11.9)
	-10 (14)	82.6 (12.0)
	0 (32)	83.3 (12.1)
	10 (50)	83.8 (12.2)
	20 (68)	84.4 (12.2)
	30 (86)	84.9 (12.3)

*2	*3	*4
1800 (5906)	-20 (-4)	79.9 (11.6)
	-10 (14)	80.6 (11.7)
	0 (32)	81.3 (11.8)
	10 (50)	81.9 (11.9)
	20 (68)	82.5 (12.0)
	30 (86)	83.0 (12.0)
2000 (6592)	-20 (-4)	77.9 (11.3)
	-10 (14)	78.6 (11.4)
	0 (32)	79.4 (11.5)
	10 (50)	80.0 (11.6)
	20 (68)	80.7 (11.7)
	30 (86)	81.3 (11.8)
2200 (7218)	-20 (-4)	75.9 (11.0)
	-10 (14)	76.7 (11.1)
	0 (32)	77.5 (11.2)
	10 (50)	78.2 (11.3)
	20 (68)	78.9 (11.4)
	30 (86)	79.5 (11.5)
2400 (7874)	-20 (-4)	74.0 (10.7)
	-10 (14)	74.9 (10.9)
	0 (32)	75.7 (11.0)
	10 (50)	76.4 (11.1)
	20 (68)	77.2 (11.2)
	30 (86)	77.8 (11.3)
2600 (8531)	-20 (-4)	72.1 (10.5)
	-10 (14)	73.0 (10.6)
	0 (32)	73.9 (10.7)
	10 (50)	74.7 (10.8)
	20 (68)	75.5 (11.0)
	30 (86)	76.2 (11.1)
2800 (9187)	-20 (-4)	70.3 (10.2)
	-10 (14)	71.3 (10.3)
	0 (32)	72.2 (10.5)
	10 (50)	73.0 (10.6)
	20 (68)	73.8 (10.7)
	30 (86)	74.6 (10.8)
3000 (9843)	-20 (-4)	68.6 (9.95)
	-10 (14)	69.6 (10.1)
	0 (32)	70.5 (10.2)
	10 (50)	71.4 (10.4)
	20 (68)	72.2 (10.5)
	30 (86)	73.0 (10.6)
3200 (10499)	-20 (-4)	66.9 (9.70)
	-10 (14)	67.9 (9.85)
	0 (32)	68.9 (9.99)
	10 (50)	69.8 (10.1)
	20 (68)	70.7 (10.3)
	30 (86)	71.5 (10.4)
3400 (11155)	-20 (-4)	65.3 (9.47)
	-10 (14)	66.3 (9.62)
	0 (32)	67.3 (9.76)
	10 (50)	68.3 (9.91)
	20 (68)	69.1 (10.0)
	30 (86)	70.0 (10.2)

*2	*3	*4
3600 (11812)	-20 (-4)	63.7 (9.24)
	-10 (14)	64.7 (9.38)
	0 (32)	65.8 (9.54)
	10 (50)	66.7 (9.67)
	20 (68)	67.7 (9.82)
	30 (86)	68.5 (9.94)
3800 (12468)	-20 (-4)	62.1 (9.01)
	-10 (14)	63.2 (9.17)
	0 (32)	64.3 (9.33)
	10 (50)	65.3 (9.47)
	20 (68)	66.2 (9.60)
	30 (86)	67.1 (9.73)
4000 (13124)	-20 (-4)	60.6 (8.79)
	-10 (14)	61.7 (8.95)
	0 (32)	62.8 (9.11)
	10 (50)	63.8 (9.25)
	20 (68)	64.8 (9.40)
	30 (86)	65.7 (9.53)
4200 (13780)	-20 (-4)	59.1 (8.57)
	-10 (14)	60.3 (8.75)
	0 (32)	61.4 (8.91)
	10 (50)	62.5 (9.07)
	20 (68)	63.4 (9.20)
	30 (86)	64.4 (9.34)
4400 (14436)	-20 (-4)	57.7 (8.37)
	-10 (14)	58.9 (8.54)
	0 (32)	60.0 (8.70)
	10 (50)	61.1 (8.86)
	20 (68)	62.1 (9.01)
	30 (86)	63.1 (9.15)
4600 (15093)	-20 (-4)	56.3 (8.17)
	-10 (14)	57.5 (8.34)
	0 (32)	58.7 (8.51)
	10 (50)	59.8 (8.67)
	20 (68)	60.8 (8.82)
	30 (86)	61.8 (8.96)
4800 (15749)	-20 (-4)	55.0 (7.98)
	-10 (14)	56.2 (8.15)
	0 (32)	57.4 (8.33)
	10 (50)	58.5 (8.49)
	20 (68)	59.5 (8.63)
	30 (86)	60.5 (8.78)
5000 (16405)	-20 (-4)	53.7 (7.79)
	-10 (14)	54.9 (7.96)
	0 (32)	56.1 (8.14)
	10 (50)	57.2 (8.30)
	20 (68)	58.3 (8.46)
	30 (86)	59.3 (8.60)

c

Text in Illustration

*1	Altitude, Temperature and Atmospheric Pressure Correlation Table	*2	Altitude (m (ft))
*3	Temperature (°C (°F))	*4	Atmospheric Pressure (kPa (psi))

(e) Compare the MAP and Atmosphere Pressure values in the Data List with the normal atmospheric value from the table.

Result:

Result	Proceed to
Other than the following.	A
Difference between MAP in Data List and normal atmospheric pressure value is 10 kPa or more.	B
Difference between Atmosphere Pressure in Data List and normal atmospheric pressure value is 10 kPa or more.	C

(f) Turn the power switch off.

C ▶ REPLACE INVERTER WITH CONVERTER ASSEMBLY
B ▶ CHECK TERMINAL VOLTAGE (MANIFOLD ABSOLUTE PRESSURE SENSOR)
A ▼

4.	READ VALUE USING TECHSTREAM (MAP)

(a) Push the P position switch.

(b) Enter the following menus: Powertrain / Hybrid Control / Data List / MAP

(c) Read the MAP value in the Data List with the engine stopped.

(d) While depressing the brake pedal, turn the power switch on (READY).

(e) With the READY indicator light illuminated, fully depress the accelerator pedal.

(f) Read the MAP value in the Data List with the engine running.

(g) Compare the MAP value noted with the engine stopped and the MAP value noted with the engine running.

OK:

The MAP value changes (pressure decreases when the engine is started).

(h) Turn the power switch off.

NG ▶ CHECK TERMINAL VOLTAGE (MANIFOLD ABSOLUTE PRESSURE SENSOR)
OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

5.	CHECK TERMINAL VOLTAGE (MANIFOLD ABSOLUTE PRESSURE SENSOR) INFO

B ▶ REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR
A ▼

6.	CHECK HARNESS AND CONNECTOR (MANIFOLD ABSOLUTE PRESSURE SENSOR - ECM)

	INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE ECM**

7.	REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Replace the manifold absolute pressure sensor INFO.

NEXT ▼

8.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
DTC P0069-273 is not output.	A
DTC P0069-273 is output again.	B

(e) Turn the power switch off.

B ▶ REPLACE ECM
A ▶ **END**

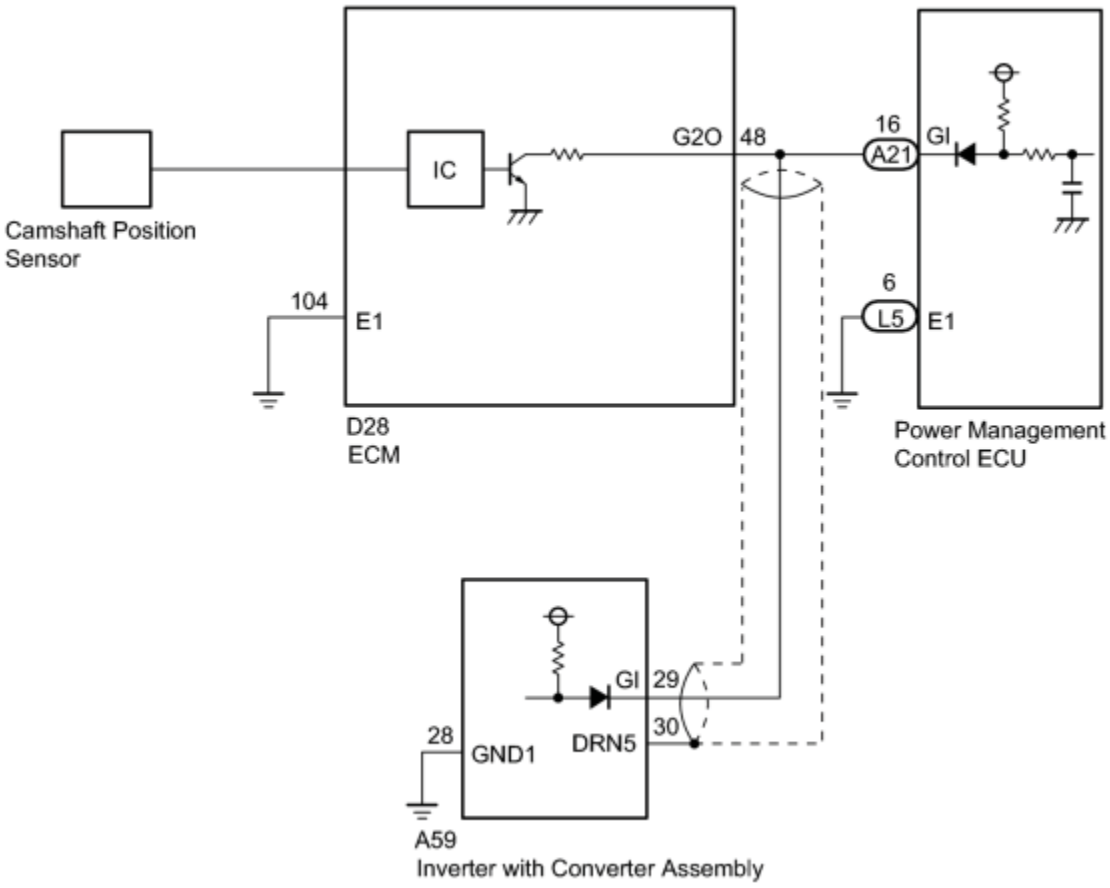
DTC	P0340-886	Camshaft Position Sensor "A" Circuit

DESCRIPTION

The power management control ECU (HV CPU) compares the engine speed sent from the ECM via CAN communication and the engine speed that is indicated by pulses sent from the ECM. If the pulse input is not normal, the power management control ECU (HV CPU) sets this DTC.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0340	886	Malfunction in the engine speed sensor (GI signal) circuit	• Wire harness or connector • Camshaft position sensor • Inverter with converter assembly • ECM • Power management 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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

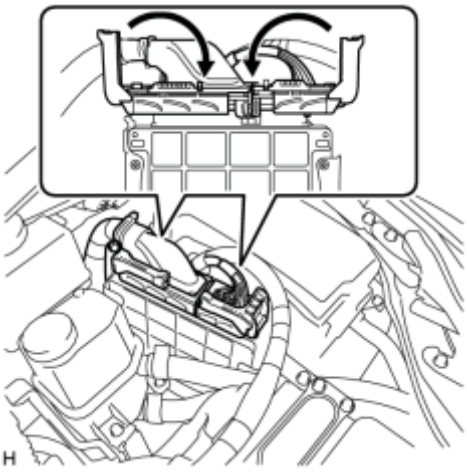
Result	Proceed to
DTC P0340-886 only is output.	A
DTC P0343-747 is also output.	B

(e) Turn the power switch off.

B ▶ CHECK HARNESS AND CONNECTOR (ECM - POWER MANAGEMENT CONTROL ECU, INVERTER WITH CONVERTER)

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (ECM CONNECTOR)



(a) Check the connections of the ECM connectors.

OK:

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

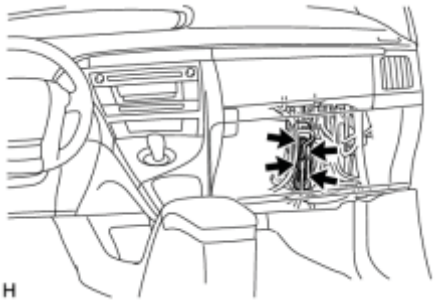
NG ▶ CONNECT SECURELY

OK ▼

3.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR)

(a) Check the connections of the power management control ECU connectors.

OK:



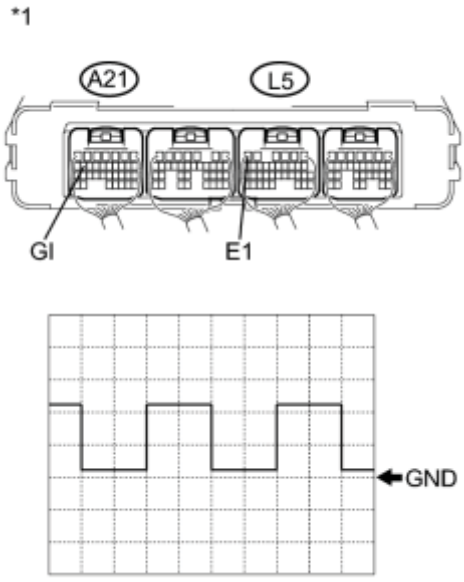
The connectors are connected securely and there are no contact problems.

NG ▶ CONNECT SECURELY

OK ▼

4.	CHECK POWER MANAGEMENT CONTROL ECU (CHECK WAVEFORM)

(a) Turn the power switch on (READY).



(b) Connect an oscilloscope between the power management control ECU terminals specified in the table below, and measure the waveform.

Item	Content
Terminal	A21-16 (GI) - L5-6 (E1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Power switch on (READY) with engine running

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

Result:

Result	Proceed to
Normal	A
Waveform is flat, and is stuck on the +B side.	B
Waveform is flat, and is stuck on the GND side.	C

C ▶ CHECK HARNESS AND CONNECTOR (ECM - POWER MANAGEMENT CONTROL ECU,

INVERTER WITH CONVERTER)

B CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU)

A

5.	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems INFO.

NG REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK **REPLACE POWER MANAGEMENT CONTROL ECU**

6.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU)

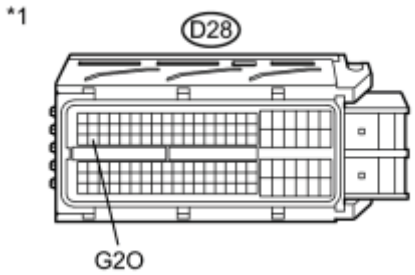
(a) Disconnect connector D28 from the ECM.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D28-48 (G2O) - Body ground	Power switch on (IG)	11 to 14 V



Text in Illustration

*1	Front view of wire harness connector (to ECM)

NOTICE:

Turning the power switch on (IG) with the ECM connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(d) Turn the power switch off.

(e) Connect the ECM connector.

NG REPAIR OR REPLACE HARNESS OR CONNECTOR

OK **REPLACE ECM**

7.	CHECK HARNESS AND CONNECTOR (ECM - POWER MANAGEMENT CONTROL ECU, INVERTER WITH CONVERTER)

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 connector D28 from the ECM.

(c) Disconnect connector A21 from the power management control ECU.

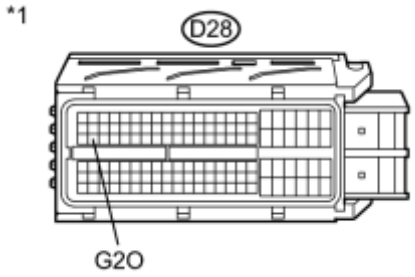
(d) Disconnect connector A59 from the inverter with converter assembly.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D28-48 (G2O) - Body ground	Power switch on (IG)	Below 1 V



Text in Illustration

*1	Front view of wire harness connector (to ECM)

NOTICE:

Turning the power switch on (IG) with the inverter with converter assembly connector, power management control ECU connector and ECM connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(g) Turn the power switch off.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition

Tester Connection	Switch Condition	Specified Condition
D28-48 (G2O) - Body ground	Power switch off	10 kΩ or higher

(i) Connect the ECM connector.

(j) Connect the power management control ECU connector.

(k) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

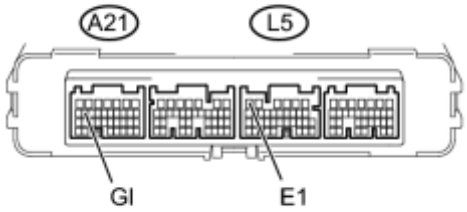
OK ▼

8.	CHECK POWER MANAGEMENT CONTROL ECU

(a) Disconnect all the connectors from the power management control ECU.

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

*1



P

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A21-16 (GI) - L5-6 (E1)	Always	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (Power Management Control ECU)

(c) Connect the power management control ECU connectors.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

9.	CHECK INVERTER WITH CONVERTER ASSEMBLY

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

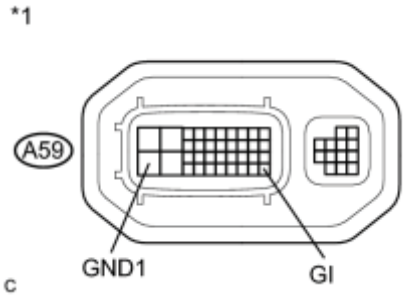
NOTICE:

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 connector A59 from the inverter with converter assembly.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
A59-29 (GI) - A59-28 (GND1)	Power switch off	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (Inverter with Converter Assembly)

(d) Connect the inverter with converter assembly connector.

NG ▶ REPLACE INVERTER WITH CONVERTER ASSEMBLY
OK ▶ **REPLACE ECM**

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

DESCRIPTION

Refer to the description for DTC P0340-886 INFO.

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.	• SFI system • Inverter with converter assembly • ECM • Power management control ECU • Wire harness or connector

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0340-886 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Engine and ECT/ Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
Engine control system DTCs are not output.	A
Any of the following DTCs are output.	B

DTC No.	Relevant Diagnosis
P0340	Camshaft Position Sensor Circuit Malfunction
P0342	Camshaft Position Sensor "A" Circuit Low Input (Bank 1 or Single Sensor)
P0343	Camshaft Position Sensor "A" Circuit High Input (Bank 1 or Single Sensor)

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
None of the following DTCs are output.	A
Any of the following DTCs are output.	B

DTC No.	Relevant Diagnosis
P0A1B (all INF codes)*1	Drive Motor "A" Control Module

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0343-747 may be set due to a malfunction which also causes the DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

3.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

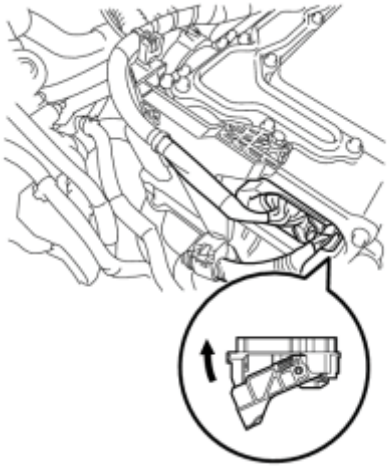
Result	Proceed to
P0340-886 is not output.	A
P0340-886 is also output.	B

(e) Turn the power switch off.

B CHECK CONNECTOR CONNECTION CONDITION (ECM CONNECTOR)

A

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



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.

NOTICE:

Before disconnecting the connector, confirm that it is properly connected by checking that the locking claws are engaged and that the connector does not pull out.

(b) Check the connection of the low voltage connector of the inverter with

converter assembly.

OK:

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

HINT:

When connecting the connector, insert it with the locking lever in the raised position. Rotate the lever downward and make sure that the connector is pulled into its socket. When the locking lever is in its fully closed position, a click will be heard as its locking claws engage. After the click is heard, pull up on the connector to confirm that it is properly connected.

NG ▶ CONNECT SECURELY

OK ▼

5.	CHECK CONNECTOR CONNECTION CONDITION (ECM CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

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 low voltage connector A59 from the inverter with converter assembly.

(c) Disconnect connector D28 from the ECM.

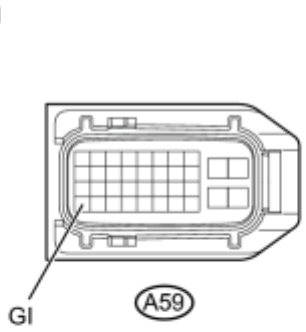
(d) Turn the power switch on (IG).

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A59-29 (GI) - Body ground	Power switch on (IG)	Below 1 V

Text in Illustration



*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Front view of wire harness connector (to ECM)

NOTICE:

Turning the power switch on (IG) with the inverter with converter assembly connector and ECM 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	Switch Condition	Specified Condition
A59-29 (GI) - D28-48 (G2O)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
A59-29 (GI) or D28-48 (G2O) - Body ground and other terminals	Power switch off	10 kΩ or higher

(h) Connect the ECM connector.

(i) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

7.	CHECK CONNECTOR CONNECTION CONDITION (ECM CONNECTOR) INFO

NG ▶ CONNECT SECURELY
OK ▼

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

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 low voltage connector A59 from the inverter with converter assembly.

(c) Disconnect connector D28 from the ECM.

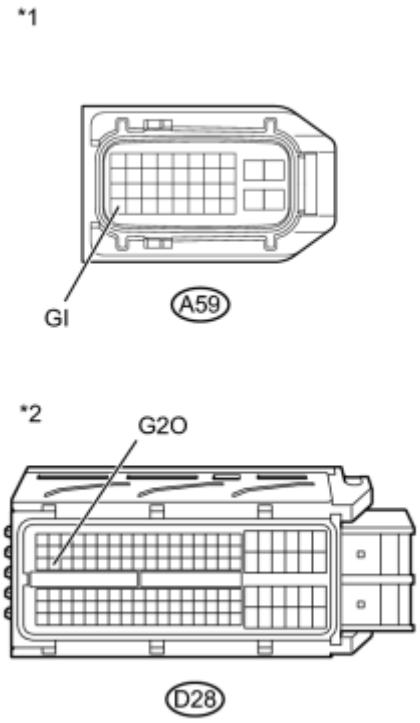
(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
A59-29 (GI) - D28-48 (G2O)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
A59-29 (GI) or D28-48 (G2O) - Body ground and other terminals	Power switch off	10 kΩ or higher



Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Front view of wire harness connector (to ECM)

(e) Connect the ECM connector.

(f) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

9.	CHECK HARNESS AND CONNECTOR (ECM - POWER MANAGEMENT CONTROL ECU)

(a) Disconnect connector D28 from the ECM.

(b) Disconnect connector A21 from the power management control ECU.

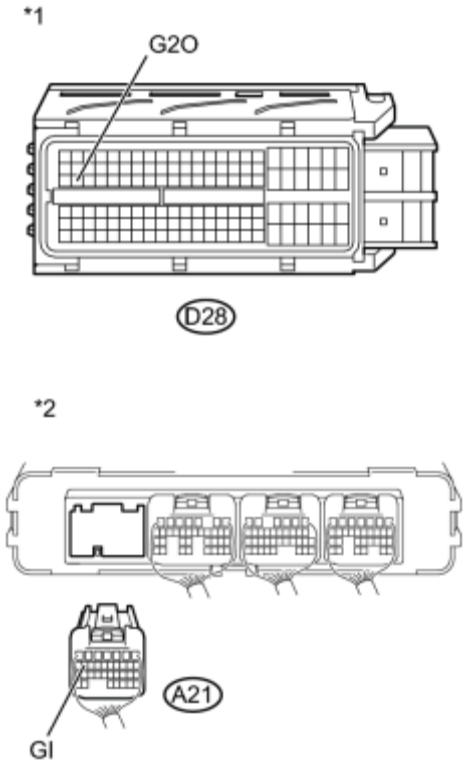
(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
D28-48 (G2O) - A21-16 (GI)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D28-48 (G2O) or A21-16 (GI) - Body ground and other terminals	Power switch off	10 kΩ or higher



Text in Illustration

*1	Front view of wire harness connector (to ECM)
*2	Rear view of wire harness connector (to Power Management Control ECU)

(d) Connect the power management control ECU connector.

(e) Connect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

10.	CHECK INVERTER WITH CONVERTER ASSEMBLY

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

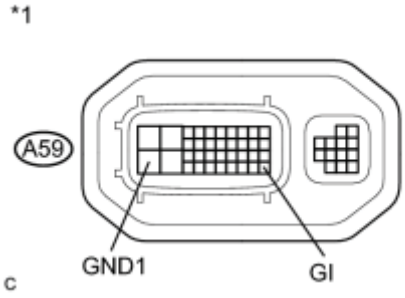
NOTICE:

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 low voltage connector A59 from the inverter with converter assembly.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
A59-29 (GI) - A59-28 (GND1)	Power switch off	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (Inverter with Converter Assembly)

(d) Connect the inverter with converter assembly connector.

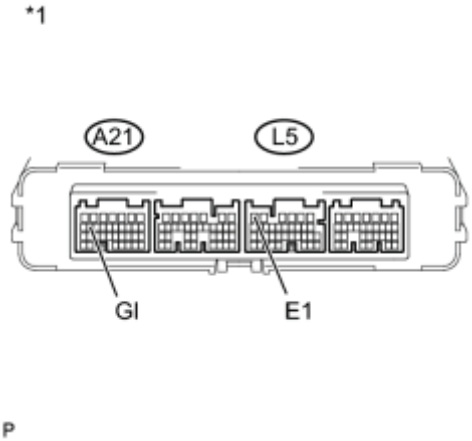
NG ▶ REPLACE INVERTER WITH CONVERTER ASSEMBLY
OK
▼

11.	CHECK POWER MANAGEMENT CONTROL ECU

(a) Disconnect connectors A21 and L5 from the power management control ECU.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
A21-16 (GI) - L5-6 (E1)	Power switch off	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (Power Management Control ECU)

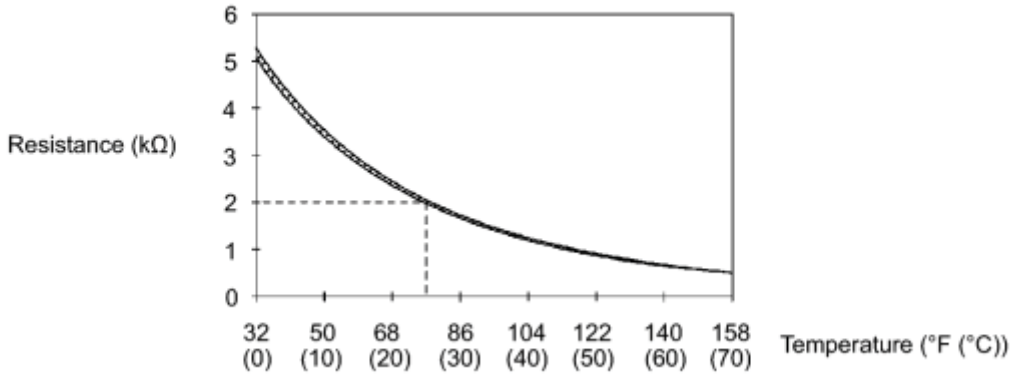
(c) Connect the power management control ECU connector.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPLACE ECM**

DTC	P0516-769	Battery Temperature Sensor Circuit Low
DTC	P0517-770	Battery Temperature Sensor Circuit High

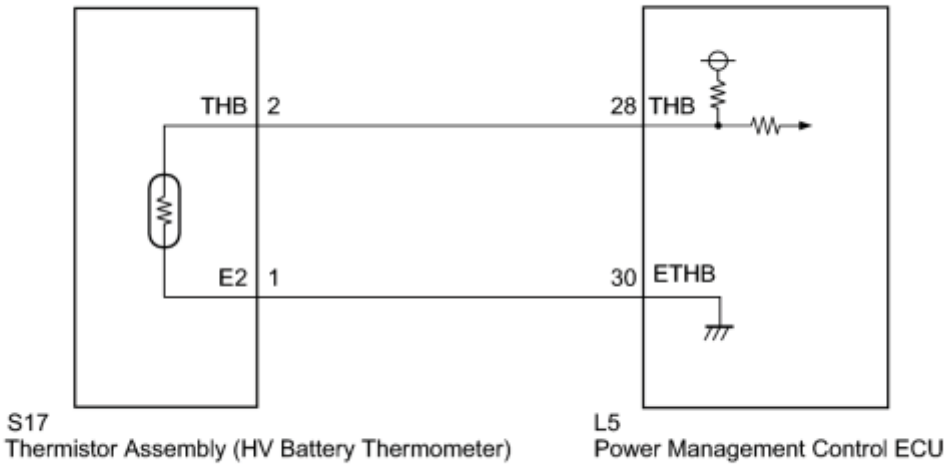
DESCRIPTION

- The thermistor assembly (battery temperature sensor) detects the auxiliary battery temperature. The resistance of the thermistor assembly built into the thermistor changes in accordance with changes in the auxiliary battery temperature. The lower the auxiliary battery temperature, the higher the thermistor assembly resistance. Conversely, the higher the temperature, the lower the resistance. The thermistor is connected to the power management control ECU (HV CPU). A voltage of 5 V is supplied to the thermistor assembly from the THB terminal of the power management control ECU (HV CPU) through its internal resistor R. This means that resistor R and the thermistor assembly 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 power management control ECU (HV CPU) reduces the charging current when the auxiliary battery temperature is high to protect the auxiliary battery.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0516	769	Malfunction in the thermistor assembly (battery temperature sensor) circuit (short to GND)	• Thermistor assembly • Wire harness or connector • Power management control ECU
P0517	770	Malfunction in the thermistor assembly (battery temperature sensor) circuit (open or short to +B))	

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read the freeze frame data using the Techstream. In the freeze frame data, some information is recorded about the engine conditions at the moment a malfunction occurred. This information can be helpful when troubleshooting.
- Characteristics of the thermistor resistance (reference values) are as follows.

Terminal	THB (with Connector Disconnected)	Resistance	Ambient Temperature
THB - E2	4.5 to 5.5 V	3.00 to 3.75 kΩ	Approximately 50°F (10°C)
		1.60 to 1.80 kΩ	Approximately 77°F (25°C)
		0.80 to 1.00 kΩ	Approximately 104°F (40°C)

PROCEDURE

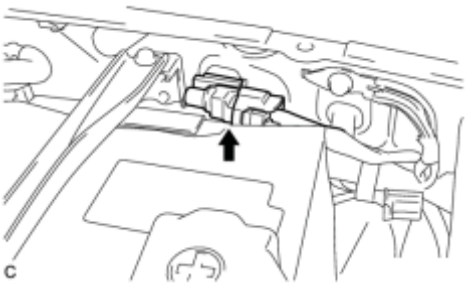
1.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (THERMISTOR ASSEMBLY CONNECTOR)

(a) Check the connection of the thermistor assembly connector.



OK:

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

NG ▶ CONNECT SECURELY

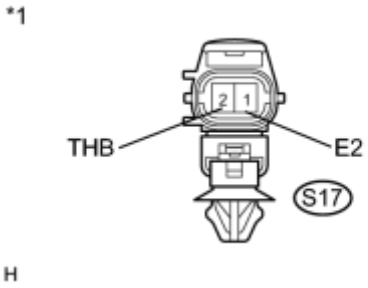
OK ▼

3.	CHECK THERMISTOR ASSEMBLY

(a) Disconnect connector S17 from the thermistor assembly.

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

Standard Resistance:



Tester Connection	Condition	Specified Condition
S17-2 (THB) - S17-1 (E2)	50° F (10°C)	3.00 to 3.73 kΩ
	77° F (25°C)	1.60 to 1.80 kΩ
	104° F (40°C)	0.80 to 1.00 kΩ

Text in Illustration

*1	Component without harness connected (Thermistor Assembly)

(c) Connect the thermistor assembly connector.

NG ▶ REPLACE THERMISTOR ASSEMBLY

OK ▼

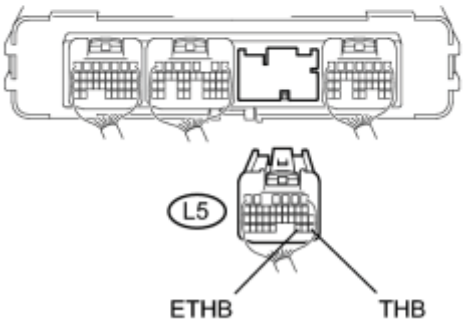
4.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - THERMISTOR ASSEMBLY)

(a) Disconnect connector S17 from the thermistor assembly.

(b) Disconnect connector L5 from the power management control ECU.

*1

*2



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

Standard Resistance (Check for open):

Tester Connection	Switch Condition	Specified Condition
L5-28 (THB) - S17-2 (THB)	Power switch off	Below 1 Ω
L5-30 (ETHB) - S17-1 (E2)	Power switch off	Below 1 Ω

Standard Resistance (Check for short):

Tester Connection	Switch Condition	Specified Condition
L5-28 (THB) or S17-2 (THB) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-30 (ETHB) or S17-1 (E2) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Thermistor Assembly)
*2	Rear view of wire harness connector (to Power Management Control ECU)

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
L5-28 (THB) or S17-2 (THB) - Body ground	Power switch on (IG)	Below 1 V

NOTICE:

Turning the power switch on (IG) with the power management control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(f) Turn the power switch off.

(g) Connect the thermistor assembly connector.

(h) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

DTC	P060B-134	Internal Control Module A/D Processing Performance
DTC	P060B-135	Internal Control Module A/D Processing Performance
DTC	P060B-570	Internal Control Module A/D Processing Performance

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation and it will set this DTC when it detects an internal malfunction. If this DTC is output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P060B	134	ECU internal error	Power Management Control ECU
	135	ECU internal error	
	570	ECU internal error	

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs diagnostic tests to verify proper operation of internal ECU systems. One of these monitors the rationality of internal analog (signal) to digital conversions. The power management control ECU (CPU) monitors the internal A/D (Analog/Digital converter) value. If there is an A/D converter malfunction, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P060B (INF 134/135/570): Internal control module A/D processing performance
Required sensors / components	Power management 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

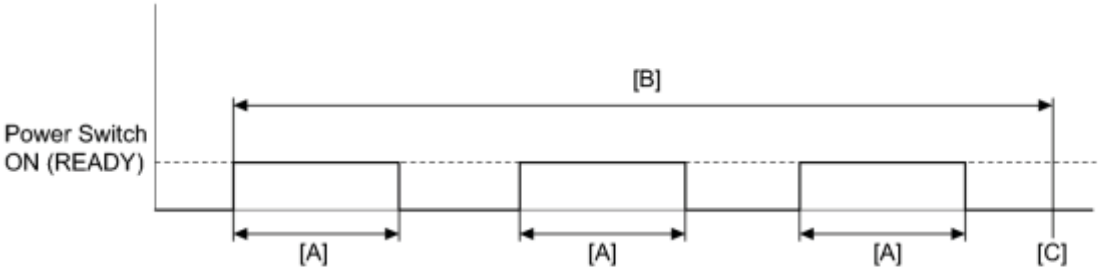
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P060B (INF 134/135/570) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

DTC	P062F-143	EEPROM Malfunction
DTC	P062F-165	EEPROM Malfunction

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation and it will set this DTC when it detects an internal malfunction. If this DTC is output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P062F	143	ECU internal error	Power Management Control ECU
P062F	165	ECU internal error	

MONITOR DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation. If the internal operation is malfunctioning, the power management control ECU (HV CPU) illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P062F (INF 143): Internal control module EEPROM P062F (INF 165): Internal control module EEPROM for battery data
Required sensors / components	Power management 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

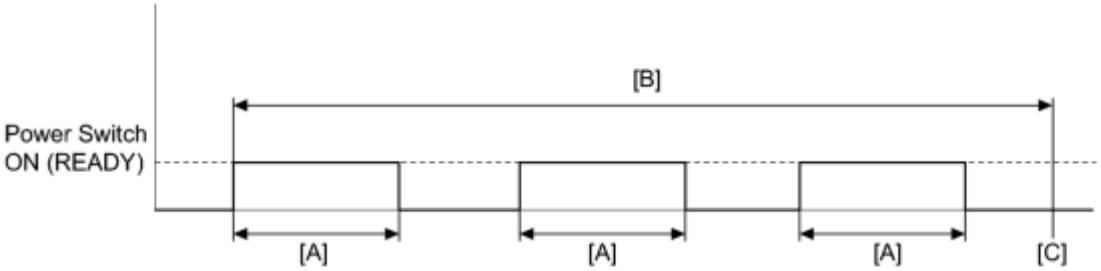
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P062F (INF 143) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT **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 power management control ECU (HV CPU) or the input VIN is not accurate. Input the VIN with the Techstream INFO.

DTC No.	INF No.	DTC Detection Condition	Trouble Area
P0630	804	• VIN not stored in power management control ECU • Input VIN in power management control ECU not accurate	Power management control ECU

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

NOTICE:

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

NEXT

2.	INPUT VIN WITH TECHSTREAM

(a) Input the VIN with the Techstream INFO.

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 Techstream to the DLC3.

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

(c) Enter the following menus : Powertrain / Hybrid Control / Trouble Codes.

(d) Read output DTC.

OK:

DTC P0630-804 is not output.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **COMPLETED**

DTC	P06A4-209	Sensor Reference Voltage "D" Circuit Low
DTC	P06A5-210	Sensor Reference Voltage "D" Circuit High

DESCRIPTION

The power management control ECU (HV CPU) monitors voltage of 5 V power supply (VC) used for the sensors. If the power management control ECU (HV CPU) detects a malfunction, it will set a DTC.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P06A4	209	VC power-supply voltage is lower than 4.2 V	Power management control ECU
P06A5	210	VC power-supply voltage is higher than 5.8 V	Power management control ECU

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P06A4-209 to P06A5-210 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0516-769	Battery Temperature Sensor Circuit Low
P0517-770	Battery Temperature Sensor Circuit High
P0A2C-247	Drive Motor "A" Temperature Sensor Circuit Low
P0A2D-249	Drive Motor "A" Temperature Sensor Circuit High
P0A38-257	Generator Temperature Sensor Circuit Low
P0A39-259	Generator Temperature Sensor Circuit High
P2120-152	Throttle/Pedal Position Sensor/Switch "D" Circuit
P2122-104	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input

DTC No.	Relevant Diagnosis
P2123-105	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input
P2125-153	Throttle/Pedal Position Sensor/Switch "E" Circuit
P2127-107	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input
P2128-108	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input

HINT:

P06A4-209 or P06A5-210 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

B GO TO DTC CHART

A **REPLACE POWER MANAGEMENT CONTROL ECU**

DTC	P082B-575	Gear Lever X Position Circuit Low
DTC	P082C-576	Gear Lever X Position Circuit High
DTC	P082E-571	Gear Lever Y Position Circuit Low
DTC	P082F-572	Gear Lever Y Position Circuit High
DTC	P181A-596	Gear Lever X Position Circuit "A" / "B" Correlation
DTC	P181B-595	Gear Lever Y Position Circuit "A" / "B" Correlation
DTC	P182B-577	Gear Lever X Position "B" Circuit Low
DTC	P182C-578	Gear Lever X Position "B" Circuit High
DTC	P182E-573	Gear Lever Y Position "B" Circuit Low
DTC	P182F-574	Gear Lever Y Position "B" Circuit High

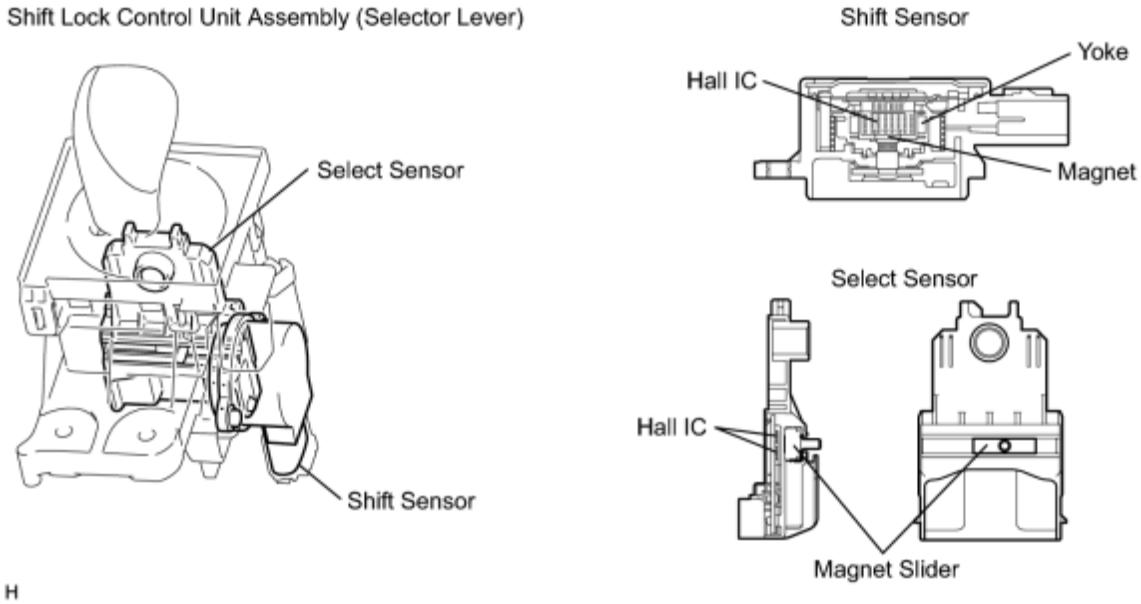
DESCRIPTION

HINT:

- The electronic shift lever system is a linkless type that does not use a shift cable.
- The shift and select sensors are non-contact type sensors.

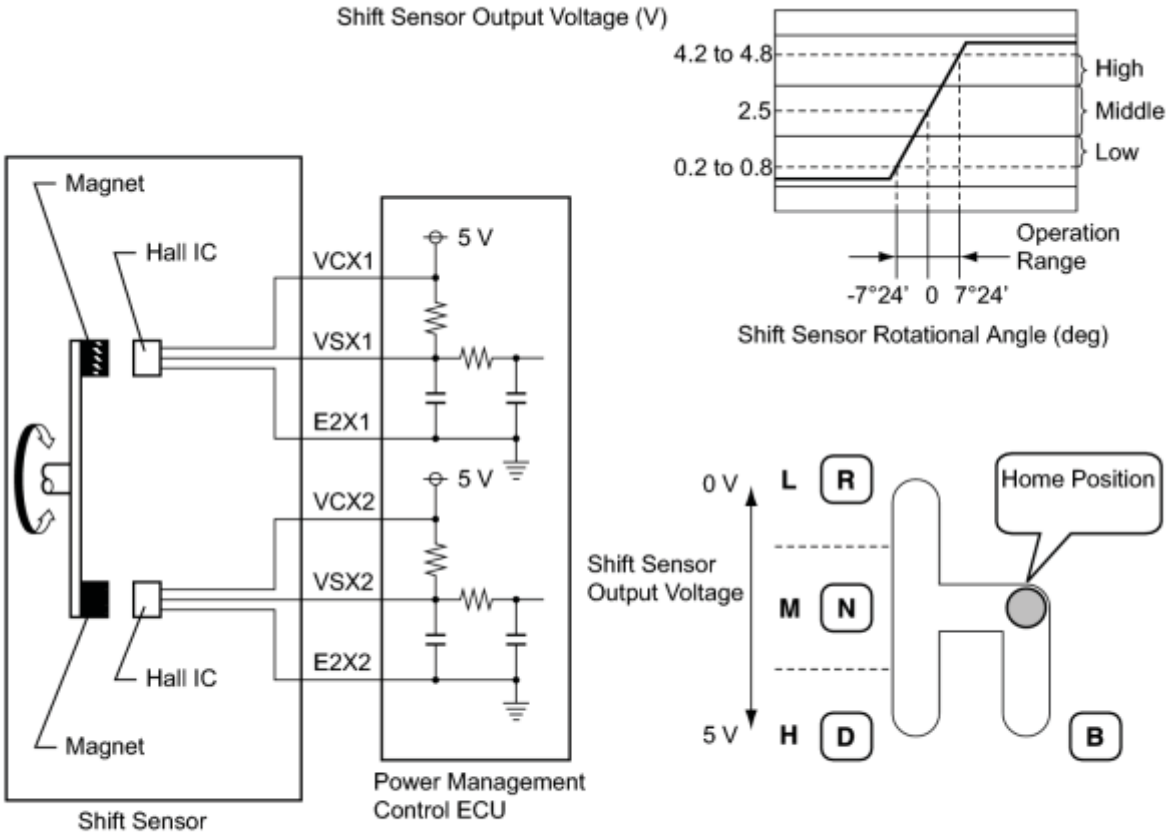
- The shift lock control unit assembly (selector lever) is a momentary type, which returns to its home position by spring reaction as the driver's hand is released from the selector lever after shifting.

The shift lock control unit assembly (selector lever) contains a shift sensor and a select sensor to detect the selector lever position (R, N, D or B). Because both sensors operate using Hall elements, they can accurately detect shift positions in a reliable manner. Both sensors contain two detection circuits, a main and a sub circuit.



H

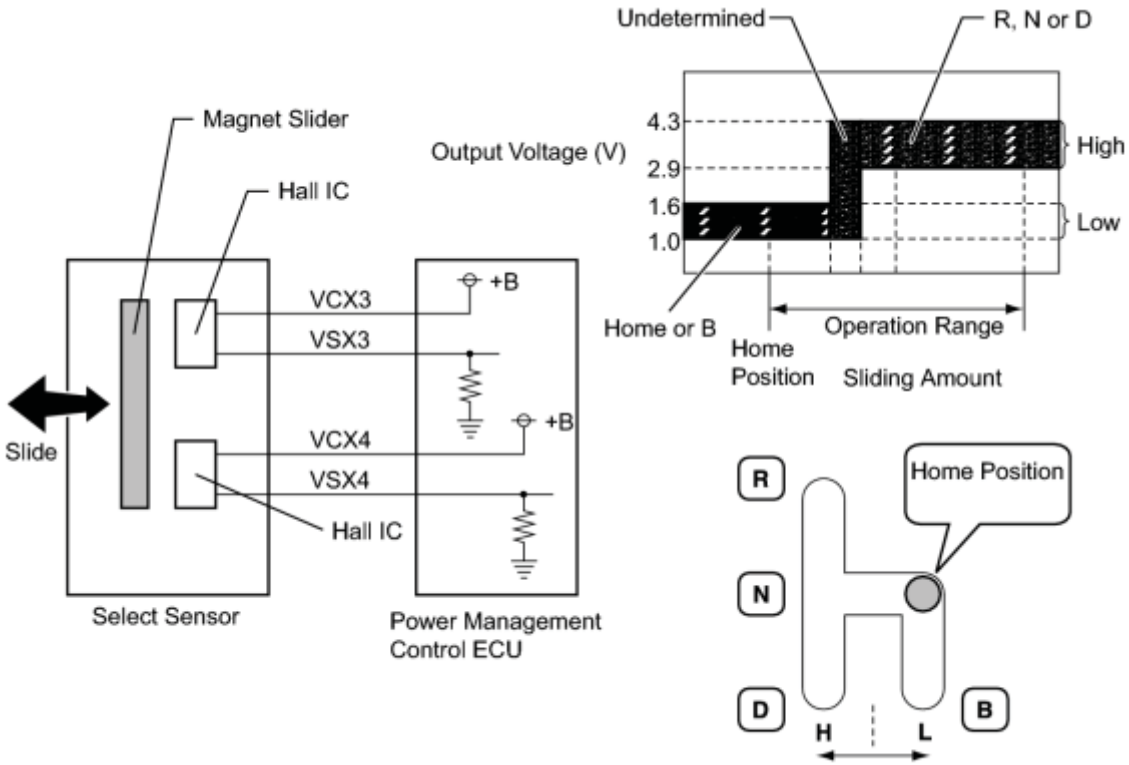
- The shift sensor outputs voltage, which varies between 0 and 5 V in accordance with the vertical movement of the selector lever, to the power management control ECU (HV CPU). The power management control ECU (HV CPU) interprets low level voltage input from the shift sensor as the D or B position, middle level voltage as the home or N position, and high level voltage as the R position.



H

- The select sensor outputs voltage, which varies between 0 and 5 V in accordance with the horizontal movement of the selector lever, to the power management control ECU (HV CPU). The power management control ECU (HV CPU) interprets low level voltage input from the select sensor as the home or B position, and high level voltage as the R, N, or D position.

The power management control ECU (HV CPU) determines the position of the selector lever in accordance with the combination of the signals from the shift sensor and select sensor.



H

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P082B	575	Open or GND short in select main sensor circuit	• Wire harness or connector • Shift lock control unit assembly • Power management control ECU
P082C	576	+B short in select main sensor circuit	
P082E	571	Open or GND short in shift main sensor circuit	
P082F	572	+B short in shift main sensor circuit	
P181A	596	Difference between select main sensor value and select sub sensor value is large	
P181B	595	Difference between shift main sensor value and shift sub sensor value is large	
P182B	577	Open or GND short in select sub sensor circuit	
P182C	578	+B short in select sub sensor circuit	
P182E	573	Open or GND short in shift sub sensor circuit	
P182F	574	+B short in shift sub sensor circuit	

HINT:

When any of DTCs P082E-571, P082F-572, P182E-573 or P182F-574 are output, check shift sensor main and shift sensor sub voltages using the Techstream.

Shift Sensor Main, Shift Sensor Sub

R position (Main)	Home or N position (Main)	D or B position (Main)	R position (Sub)	Home or N position (Sub)	D or B position (Sub)	Trouble Area
0.2 to 1.0 V	2.0 to 3.0 V	4.0 to 4.8 V	0.2 to 1.0 V	2.0 to 3.0 V	4.0 to 4.8 V	Correct shift sensor voltage
0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0.2 to 1.0 V	2.0 to 3.0 V	4.0 to 4.8 V	Open in VCX1 circuit GND short in VSX1 circuit
0.2 to 1.0 V	2.0 to 3.0 V	4.0 to 4.8 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	Open in VCX2 circuit GND short in VSX2 circuit
4.8 to 5.0 V	4.8 to 5.0 V	4.8 to 5.0 V	0.2 to 1.0 V	2.0 to 3.0 V	4.0 to 4.8 V	Open in VSX1 circuit Open in E2X1 circuit
0.2 to 1.0 V	2.0 to 3.0 V	4.0 to 4.8 V	4.8 to 5.0 V	4.8 to 5.0 V	4.8 to 5.0 V	Open in VSX2 circuit Open in E2X2 circuit

HINT:

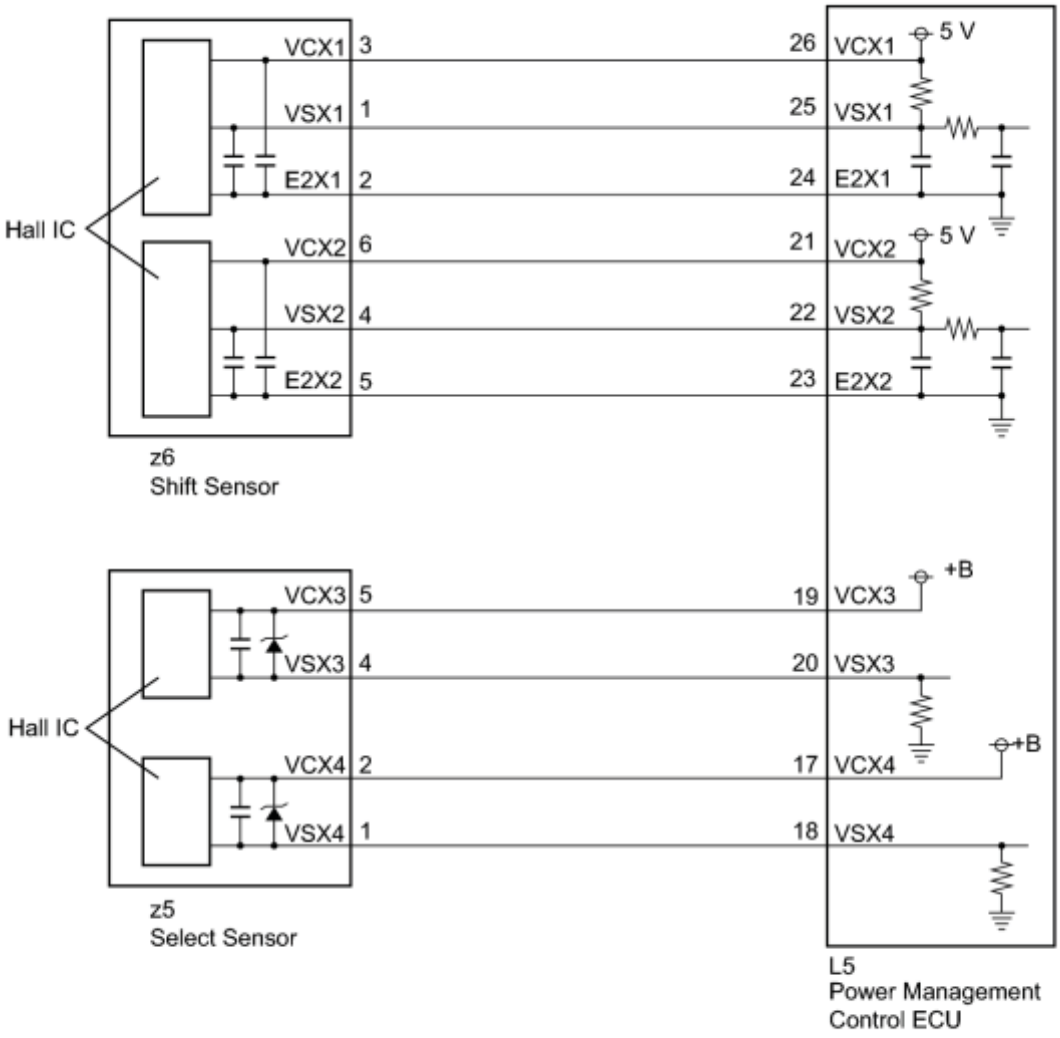
When any of DTCs P082B-575, P082C-576, P182B-577 or P182C-578 are output, check shift sensor select main and shift sensor select sub voltages using the Techstream.

Shift Sensor Select Main, Shift Sensor Select Sub

R, N or D Position Select Main)	Home or B Position Select Main)	R, N or D Position Select Sub)	Home or B Position Select Sub)	Trouble Area
2.9 to 4.3 V	1.0 to 1.6 V	2.9 to 4.3 V	1.0 to 1.6 V	Correct select sensor voltage
0 to 0.5 V	0 to 0.5 V	2.9 to 4.3 V	1.0 to 1.6 V	Open in VCX3 circuit Open or GND short in VSX3 circuit
2.9 to 4.3 V	1.0 to 1.6 V	0 to 0.5 V	0 to 0.5 V	Open in VCX4 circuit Open or GND short in VSX4

R, N or D Position Select Main)	Home or B Position Select Main)	R, N or D Position Select Sub)	Home or B Position Select Sub)	Trouble Area
				circuit
4.9 to 5 V	4.9 to 5 V	2.9 to 4.3 V	1.0 to 1.6 V	+B short in VSX3 circuit
2.9 to 4.3 V	1.0 to 1.6 V	4.9 to 5 V	4.9 to 5 V	+B short in VSX4 circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	READ VALUE USING TECHSTREAM (SHIFT SENSOR MAIN, SHIFT SENSOR SUB)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Shift Sensor Main, Shift Sensor Sub.

(d) Read the Data List.

Result:

Tester Display	Condition	Specified Condition
Shift Sensor Main	R position	0.2 to 1.0 V
	Home or N position	2.0 to 3.0 V
	D or B position	4.0 to 4.8 V
Shift Sensor Sub	R position	0.2 to 1.0 V
	Home or N position	2.0 to 3.0 V
	D or B position	4.0 to 4.8 V

(e) Turn the power switch off.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - SHIFT SENSOR)

OK ▼

2.	READ VALUE USING TECHSTREAM (SHIFT SENSOR SELECT MAIN, SHIFT SENSOR SELECT SUB)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Shift Sensor Select Main, Shift Sensor Select Sub.

(d) Read the Data List.

Result:

Tester Display	Condition	Specified Condition
Shift Sensor Select Main	R, N or D Position	2.9 to 4.3 V
	Home or B Position	1.0 to 1.6 V
Shift Sensor Select Sub	R, N or D Position	2.9 to 4.3 V
	Home or B Position	1.0 to 1.6 V

(e) Turn the power switch off.

NG → CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - SELECT SENSOR)

OK ↓

3.	REPLACE SHIFT LOCK CONTROL UNIT ASSEMBLY

(a) Replace the shift lock control unit assembly INFO.

NEXT ↓

4.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read and record the DTCs and freeze frame data.

(e) Clear DTCs and freeze frame data.

(f) Turn the power switch off.

NEXT ↓

5.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Perform a road test.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check if DTCs are output.

Result:

Result	Proceed to
No DTCs are output.	A
P082B-575, P082C-576, P082E-571, P082F-572, P181A-596, P181B-595, P182B-577, P182C-578, P182E-573 or P182F-574 is output again.	B

(f) Turn the power switch off.

B REPLACE POWER MANAGEMENT CONTROL ECU
A **COMPLETED**

6.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - SHIFT SENSOR)

(a) Disconnect connector L5 from the power management control ECU.

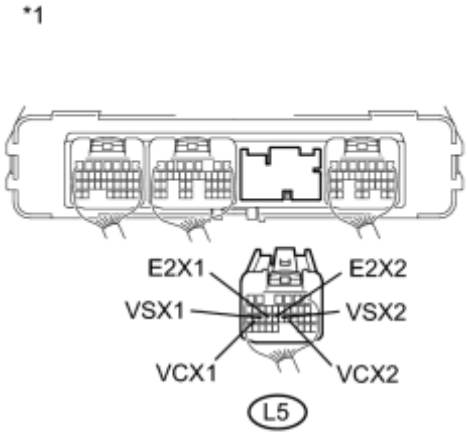
(b) Disconnect connector z6 from the shift sensor.

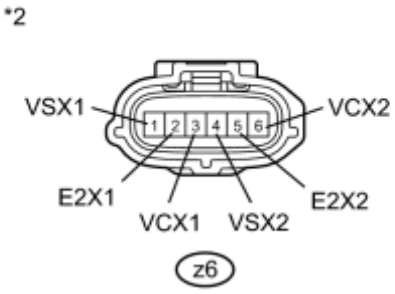
(c) Turn the power switch on (IG).

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
L5-26 (VCX1) - Body ground	Power switch on (IG)	Below 1 V
L5-25 (VSX1) - Body ground	Power switch on (IG)	Below 1 V
L5-24 (E2X1) - Body ground	Power switch on (IG)	Below 1 V
L5-21 (VCX2) - Body ground	Power switch on (IG)	Below 1 V
L5-22 (VSX2) - Body ground	Power switch on (IG)	Below 1 V
L5-23 (E2X2) - Body ground	Power switch on (IG)	Below 1 V





Text in Illustration

*1	Rear view of wire harness connector: (to Power Management Control ECU)
*2	Front view of wire harness connector: (to Shift Sensor)

NOTICE:

Turning the power switch on (IG) with the power management 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	Switch Condition	Specified Condition
L5-26 (VCX1) - z6-3 (VCX1)	Power switch off	Below 1 Ω
L5-25 (VSX1) - z6-1 (VSX1)	Power switch off	Below 1 Ω
L5-24 (E2X1) - z6-2 (E2X1)	Power switch off	Below 1 Ω
L5-21 (VCX2) - z6-6 (VCX2)	Power switch off	Below 1 Ω
L5-22 (VSX2) - z6-4 (VSX2)	Power switch off	Below 1 Ω
L5-23 (E2X2) - z6-5 (E2X2)	Power switch off	Below 1 Ω

Standard Resistance (Check for short):

Tester Connection	Switch Condition	Specified Condition
L5-26 (VCX1) or z6-3 (VCX1) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-25 (VSX1) or z6-1 (VSX1) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-24 (E2X1) or z6-2 (E2X1) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-21 (VCX2) or z6-6 (VCX2) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-22 (VSX2) or z6-4 (VSX2) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-23 (E2X2) or z6-5 (E2X2) - Body ground and other terminals	Power switch off	10 kΩ or higher

(g) Connect the shift sensor connector.

(h) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

7.	CHECK POWER MANAGEMENT CONTROL ECU (VCX1, VCX2 VOLTAGE)

(a) Disconnect connector z6 from the shift sensor.

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

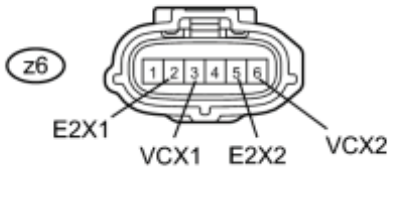
(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
z6-3 (VCX1) - z6-2 (E2X1)	Power switch on (IG)	4.5 to 5.5 V

z6-6 (VCX2) - z6-5 (E2X2)	Power switch on (IG)	4.5 to 5.5 V

*1



Text in Illustration

*1	Front view of wire harness connector: (to Shift Sensor)

(d) Connect the shift sensor connector.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

8.	REPLACE SHIFT LOCK CONTROL UNIT ASSEMBLY

(a) Replace the shift lock control unit assembly INFO.

NEXT ▼

9.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read and record the DTCs and freeze frame data.

(e) Clear DTCs and freeze frame data.

(f) Turn the power switch off.

NEXT ▼

10.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Perform a road test.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check if DTCs are output.

Result:

Result	Proceed to
No DTCs are output.	A
P082B-575, P082C-576, P082E-571, P082F-572, P181A-596, P181B-595, P182B-577, P182C-578, P182E-573 or P182F-574 is output again.	B

(f) Turn the power switch off.

B ▶ REPLACE POWER MANAGEMENT CONTROL ECU
A ▶ **COMPLETED**

11.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - SELECT SENSOR)

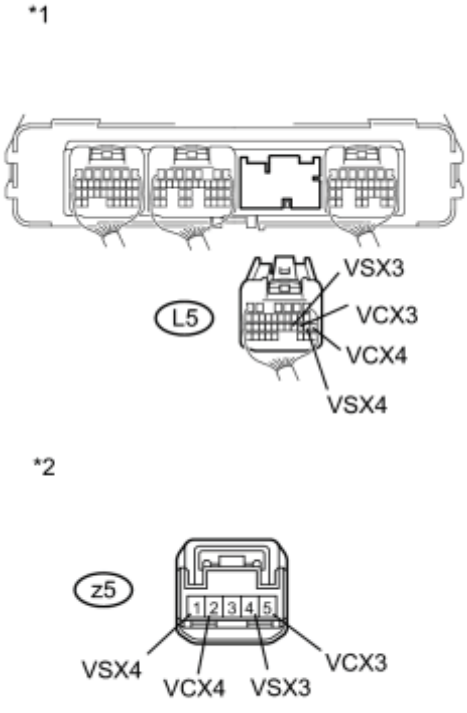
(a) Disconnect connector L5 from the power management control ECU.

(b) Disconnect connector z5 from the select sensor.

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

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

Standard Voltage:



Tester Connection	Switch Condition	Specified Condition
L5-19 (VCX3) - Body ground	Power switch on (IG)	Below 1 V
L5-20 (VSX3) - Body ground	Power switch on (IG)	Below 1 V
L5-17 (VCX4) - Body ground	Power switch on (IG)	Below 1 V
L5-18 (VSX4) - Body ground	Power switch on (IG)	Below 1 V

Text in Illustration

*1	Rear view of wire harness connector: (to Power Management Control ECU)
*2	Front view of wire harness connector: (to Select Sensor)

NOTICE:

Turning the power switch on (IG) with the power management 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	Switch Condition	Specified Condition
L5-19 (VCX3) - z5-5 (VCX3)	Power switch off	Below 1 Ω
L5-20 (VSX3) - z5-4 (VSX3)	Power switch off	Below 1 Ω
L5-17 (VCX4) - z5-2 (VCX4)	Power switch off	Below 1 Ω
L5-18 (VSX4) - z5-1 (VSX4)	Power switch off	Below 1 Ω

Standard Resistance (Check for short):

Tester Connection	Switch Condition	Specified Condition
L5-19 (VCX3) or z5-5 (VCX3) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-20 (VSX3) or z5-4 (VSX3) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-17 (VCX4) or z5-2 (VCX4) - Body ground and other terminals	Power switch off	10 kΩ or higher
L5-18 (VSX4) or z5-1 (VSX4) - Body ground and other terminals	Power switch off	10 kΩ or higher

(g) Connect the select sensor connector.

(h) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

▼

12.	CHECK POWER MANAGEMENT CONTROL ECU (VCX3, VCX4 VOLTAGE)

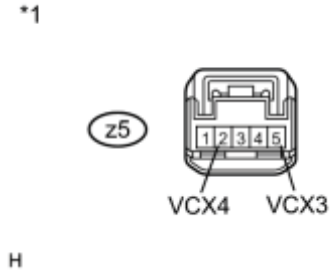
(a) Disconnect connector z5 from the select sensor.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition



z5-5 (VCX3) - Body ground	Power switch on (IG)	9 to 14 V
z5-2 (VCX4) - Body ground	Power switch on (IG)	9 to 14 V

Text in Illustration

*1	Front view of wire harness connector: (to Select Sensor)

(d) Connect the select sensor connector.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

13.	REPLACE SHIFT LOCK CONTROL UNIT ASSEMBLY

(a) Replace the shift lock control unit assembly INFO.

NEXT ▼

14.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read and record the DTCs and freeze frame data.

(e) Clear DTCs and freeze frame data.

(f) Turn the power switch off.

NEXT ▼

15.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Perform a road test.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check if DTCs are output.

Result:

Result	Proceed to
No DTCs are output.	A
P082B-575, P082C-576, P082E-571, P082F-572, P181A-596, P181B-595, P182B-577, P182C-578, P182E-573 or P182F-574 is output again.	B

(f) Turn the power switch off.

B ▶ REPLACE POWER MANAGEMENT CONTROL ECU
A ▶ **COMPLETED**

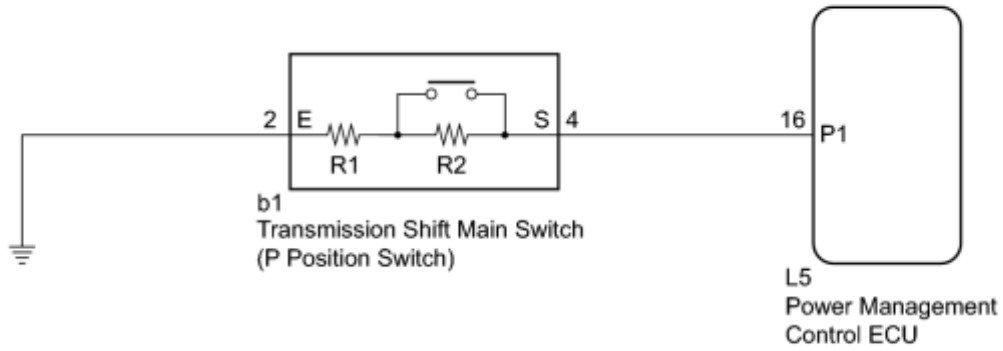
DTC	P0851-579	Park / Neutral Switch Input Circuit Low
DTC	P0852-580	Park / Neutral Switch Input Circuit High

DESCRIPTION

- Instead of having a parking position as one of the positions of the conventional selector lever, a transmission shift main switch (P position switch) is provided independently above the selector lever. The switch is a momentary type, in which the button does not lock mechanically.
- The transmission shift main switch (P position switch) contains resistors R1 and R2. When the transmission shift main switch (P position switch) is not pressed, the switch provides a combined resistance of R1 and R2; and when the transmission shift main switch (P position switch) is pressed, the switch provides only the resistance of R1. The voltage at the P1 terminal of the power management control ECU (HV CPU) varies with the changes in the resistance of the switch. The power management control ECU (HV CPU) determines the transmission shift main switch (P position switch) operation according to this resistance signal.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0851	579	GND short in P position switch circuit	• Wire harness or connector • Transmission shift main switch (P position switch) • Power management control ECU
P0852	580	Open or +B short in P position switch circuit	

WIRING DIAGRAM



H

INSPECTION PROCEDURE

PROCEDURE

1.	INSPECT TRANSMISSION SHIFT MAIN SWITCH (P POSITION SWITCH)

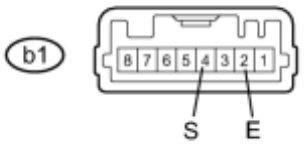
(a) Disconnect connector b1 from the transmission shift main switch (P position switch).

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
b1-4 (S) - b1-2 (E)	Switch pressed	680 Ω
b1-4 (S) - b1-2 (E)	Switch released	4580 Ω

*1



H

Text in Illustration

*1	Component without harness connected (Transmission Shift Main Switch (P Position Switch))

(c) Connect the transmission shift main switch (P position switch) connector.

NG ▶ REPLACE TRANSMISSION SHIFT MAIN SWITCH

OK ▼

2.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - P POSITION SWITCH)

(a) Disconnect connector L5 from the power management control ECU.

(b) Disconnect connector b1 from the transmission shift main switch (P position switch).

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

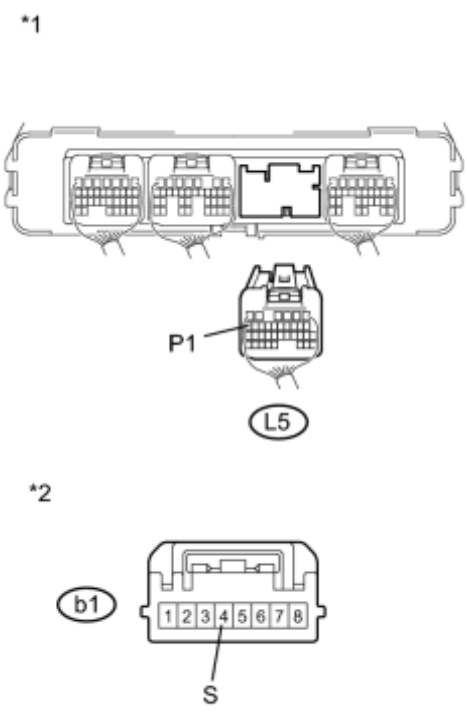
(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
L5-16 (P1) - Body ground	Power switch on (IG)	Below 1 V

Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)



*2	Front view of wire harness connector (to Transmission Shift Main Switch (P Position Switch))

NOTICE:

Turning the power switch on (IG) with the power management 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	Switch Condition	Specified Condition
L5-16 (P1) - b1-4 (S)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
L5-16 (P1) or b1-4 (S) - Body ground and other terminals	Power switch off	10 kΩ or higher

(g) Connect the transmission shift main switch (P position switch) connector.

(h) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

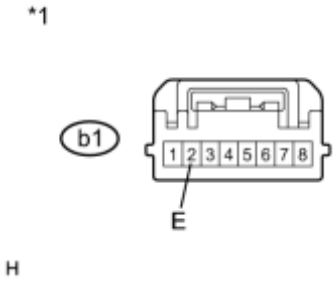
3.	CHECK HARNESS AND CONNECTOR (P POSITION SWITCH - BODY GROUND)

(a) Disconnect connector b1 from the transmission shift main switch (P position switch).

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

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
b1-2 (E) - Body ground	Power switch off	Below 1 Ω



Text in Illustration

*1	Front view of wire harness connector (to Transmission Shift Main Switch (P Position Switch))

(c) Connect the transmission shift main switch (P position switch) connector.

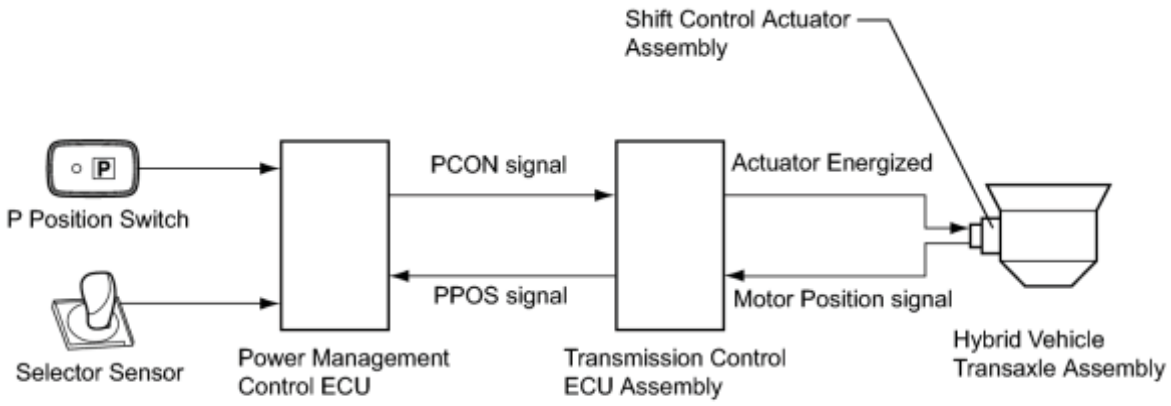
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

DTC	P085D-582	Gear Shift Control Module "A" Performance
DTC	P085D-599	Gear Shift Control Module "A" Performance
DTC	P0861-597	Gear Shift Control Module "A" Communication Circuit Low
DTC	P0862-598	Gear Shift Control Module "A" Communication Circuit High

DESCRIPTION

When a signal is input from the transmission shift main switch (P position switch) or selector lever, the power management control ECU (HV CPU) transmits a P position control (PCON) signal to the transmission control ECU assembly. Based on this signal, the transmission control ECU assembly actuates the shift control actuator assembly in order to mechanically lock or unlock the counter drive gear in the hybrid vehicle transaxle assembly.

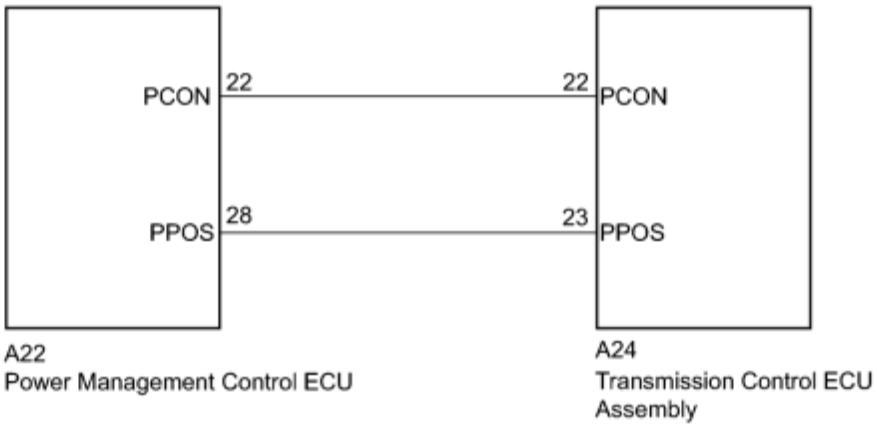
P position state (engaged or released) of the actuator assembly is sent to the power management control ECU (HV CPU) as a P position (PPOS) signal.



H

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P085D	582	P position (PPOS) signal is logically inconsistent	• Wire harness or connector • Transmission control ECU assembly • Power management control ECU
	599	P position (PPOS) signal malfunction (output pulse is abnormal)	
P0861	597	GND short in P position (PPOS) signal circuit	
P0862	598	+B short in P position (PPOS) signal circuit	

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (TRANSMISSION CONTROL)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Chassis / Transmission Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
Electronic shift lever system DTCs are not output.	A
Any of the following DTCs are output.	B

DTC No.	Relevant Diagnosis
C2309	Open in B+ Circuit
C2311	Communication Error from HV ECU

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A

2.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - TRANSMISSION CONTROL ECU)

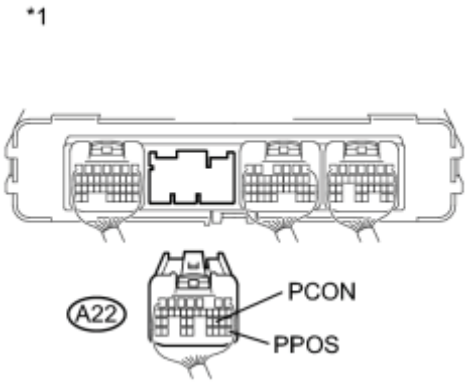
(a) Disconnect connector A22 from the power management control ECU.

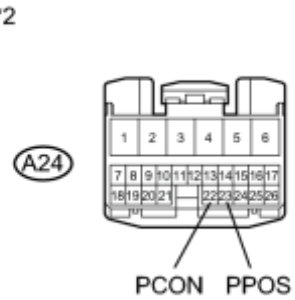
(b) Disconnect connector A24 from the transmission control ECU assembly.

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

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

Standard Voltage:





Tester Connection	Switch Condition	Specified Condition
A24-22 (PCON) - Body ground	Power switch on (IG)	Below 1 V
A24-23 (PPOS) - Body ground	Power switch on (IG)	Below 1 V

Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)
*2	Front view of wire harness connector (to Transmission Control ECU Assembly)

NOTICE:

Turning the power switch on (IG) with the power management 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	Switch Condition	Specified Condition
A22-22 (PCON) - A24-22 (PCON)	Power switch off	Below 1 Ω
A22-28 (PPOS) - A24-23 (PPOS)	Power switch off	Below 1 Ω

Standard Resistance (Check for short):

Tester Connection	Switch Condition	Specified Condition
A22-22 (PCON) or A24-22 (PCON) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-28 (PPOS) or A24-23 (PPOS) - Body ground and other terminals	Power switch off	10 kΩ or higher

(g) Connect the transmission control ECU assembly connector.

(h) Connect the power management control ECU connector.

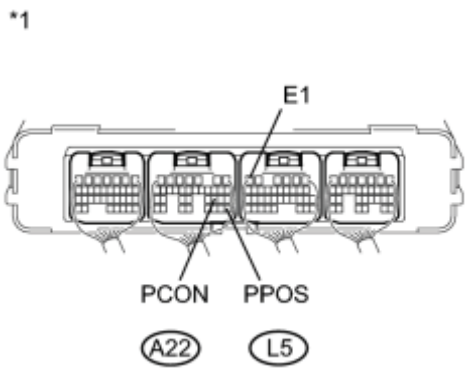
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

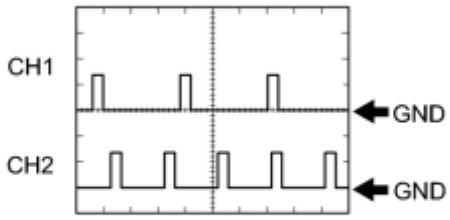
OK ▼

3.	CHECK POWER MANAGEMENT CONTROL ECU

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

(b) Connect an oscilloscope between the power management control ECU terminals specified in the table below, and measure the waveform.





Item	Content
Terminal	CH1: A22-22 (PCON) - L5-6 (E1) CH2: A22-28 (PPOS) - L5-6 (E1)
Equipment Setting	5V/DIV., 20ms/DIV.
Condition	Power switch on (IG)

Result:

Result	Proceed to
P position control (PCON) signal waveform appears	A
P position control (PCON) signal waveform does not appear	B
P position (PPOS) signal waveform appears	B
P position (PPOS) signal waveform does not appear	A

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

(c) Turn the power switch off.

B REPLACE POWER MANAGEMENT CONTROL ECU
A **REPLACE TRANSMISSION CONTROL ECU ASSEMBLY**

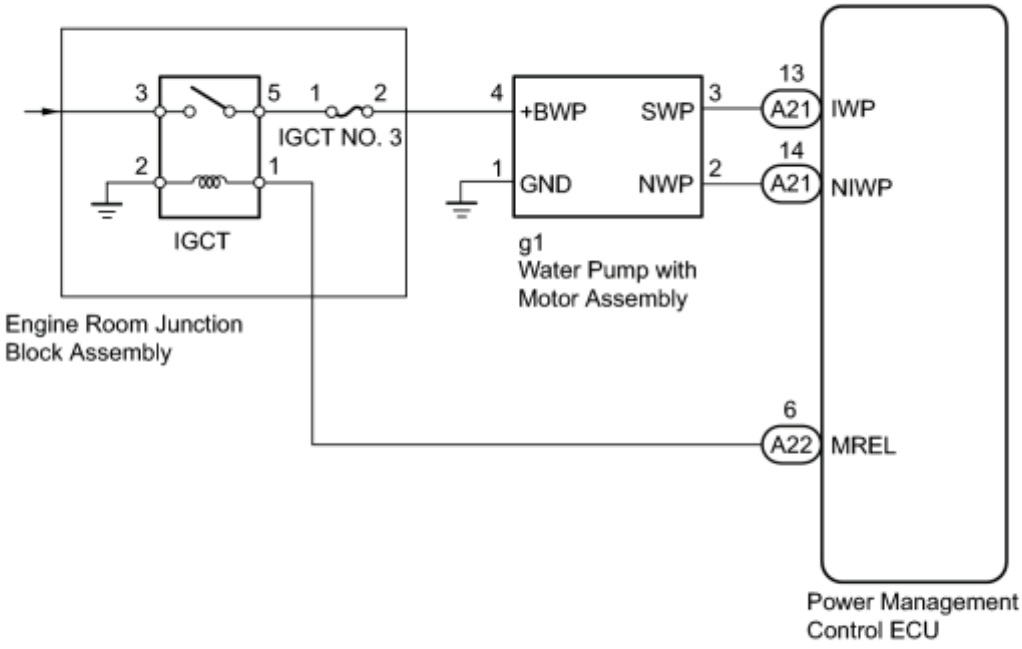
DTC	P0A01-726	Motor Electronics Coolant Temperature Sensor Circuit Range / Performance
DTC	P0A04-725	Motor Electronics Coolant Temperature Sensor Circuit Intermittent

DESCRIPTION

The power management control ECU (HV CPU) detects HV coolant temperature using the coolant temperature sensor built into the inverter with converter assembly. The power management control ECU (HV CPU) uses signals from the coolant temperature sensor to check the effectiveness of the inverter cooling system. If necessary, the power management control ECU (HV CPU) will limit inverter output to help prevent inverter overheating. The power management control ECU (HV CPU) also detects malfunctions in the sensor based on the HV coolant temperature sensor values. The inverter with converter assembly detects malfunctions in the HV coolant temperature sensor and its wiring.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A01	726	Temperature calculated by power management control ECU and actual temperature are different for 10 seconds or more.	• Inverter cooling system • Cooling fan system • Power management control ECU • Inverter with converter assembly • Water pump with motor assembly • Wire harness or connector • IGCT No. 3 fuse
P0A04	725	Unusual sudden change in HV coolant temperature sensor output occurs and the offset continues, or unusual sudden change in HV coolant temperature sensor output occurs repeatedly.	

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Select the following menu items: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A01-726 or P0A04-725 is output	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A93-346	Inverter Cooling System Performance
P0C73-776	Motor Electronics Coolant Pump "A" Control Performance
P314A-828	Inverter Coolant Pump Speed Signal

HINT:

P0A01-726 or P0A04-725 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

3.	CHECK QUANTITY OF HV COOLANT

(a) Check the coolant level in the inverter reserve tank.

(b) Check for coolant leaks.

Result

Result	Proceed to
Coolant leaks are not evident. A sufficient amount of coolant remains in the inverter reserve tank.	A
Coolant leaks are not evident. No coolant remains in the inverter reserve tank.	B
Coolant leaks are evident.	C

HINT:

After repairing the coolant leaks and adding coolant, perform the "Activate the Water Pump" Active Test (HV Active Test item) and the "Control the Electric Cooling Fan" Active Test (Engine Active Test item) and make sure that there are no malfunctions.

C ▶ INSPECT FOR COOLANT LEAK AND ADD COOLANT
B ▶ ADD HV 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.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE WATER PUMP)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Active Test / Activate the Water Pump.

(d) Select Inverter W/P Revolution in the Data List.

(e) While performing the "Activate the Water Pump" Active Test, check Inverter W/P Revolution in the Data List.

Result:

Data List Item	Specified Condition
Inverter W/P Revolution	2250 to 5625 rpm

HINT:

Perform the Active Test with the inverter coolant temperature between 5 to 149°F (-15 and 65°C).

(f) Turn the power switch off.

NG ▶ CHECK FUSE (IGCT NO. 3)
OK ▼

6.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE ELECTRIC COOLING FAN)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Electric Cooling Fan.

(d) Perform the "Control the Electric Cooling Fan" Active Test.

OK:

The cooling fan rotates.

(e) Turn the power switch off.

NG ▶ CHECK COOLING FAN SYSTEM
OK
▼

7.	CHECK HV COOLANT (CHECK FOR CONDITIONS THAT MAY HAVE CAUSED FREEZING)

(a) Connect the Techstream to the DLC3.

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

(c) Read the freeze frame data Ambient Temperature using the Techstream.

(d) Check if the freeze frame data Ambient Temperature is below freezing.

Result:

Result	Proceed to
Ambient Temperature value is above freezing temperature of the HV coolant	A
Ambient Temperature value is below freezing temperature of the HV coolant	B

HINT:

- HV coolant (SLLC) with a 30% concentration freezes at 5°F (-15 °C) and HV coolant (SLLC) with a 50% concentration freezes at -31°F (-35°C).
- If the HV coolant freezes in the HV radiator or HV water pump, the coolant temperature in the inverter with converter assembly rises because the HV coolant cannot circulate. As a result, a DTC may be set.
- A DTC is set when the water pump impeller cannot rotate due to freezing of the HV coolant.
- If a DTC is set due to freezing of HV coolant, the problem cannot be reproduced. Judge whether freezing of HV coolant occurred according to the freeze point of the HV coolant, HV coolant change history and ambient temperature when the DTC was set.

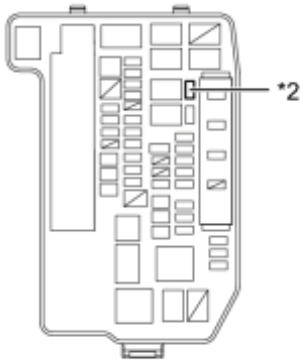
(e) Turn the power switch off.

B ▶ REPLACE HV COOLANT
A ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

8.	CHECK FUSE (IGCT NO. 3)

(a) Remove the IGCT No. 3 fuse from the engine room junction block assembly.

*1



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

Standard Resistance:

Tester Connection	Condition	Specified Condition
IGCT No. 3 fuse	Always	Below 1Ω

Text in Illustration

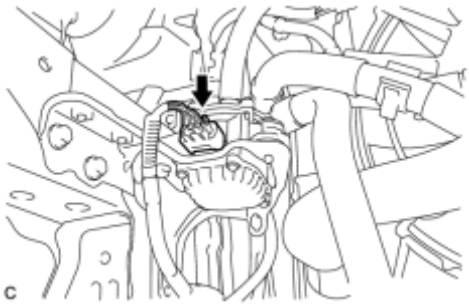
*1	Engine Room Junction Block Assembly
*2	IGCT No. 3 Fuse

(c) Install the IGCT No. 3 fuse.

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY)

OK ▼

9.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY)



(a) Check the connection of the water pump with motor assembly connector.

OK:

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

NG ▶ CONNECT SECURELY

OK ▼

10.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

11.	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR ASSEMBLY CIRCUIT)

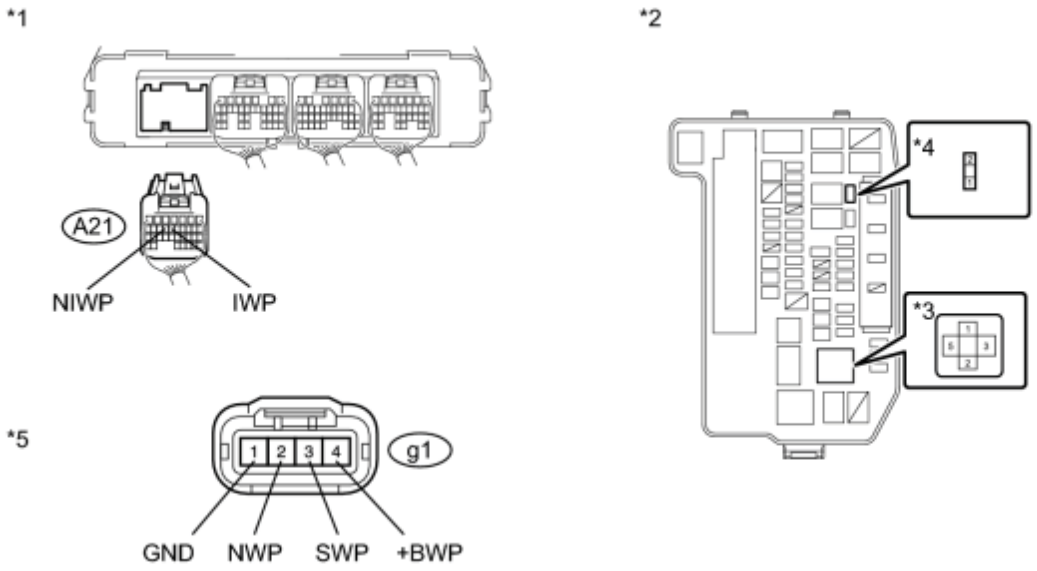
(a) Remove the IGCT No. 3 fuse from the engine room junction block assembly.

(b) Remove the IGCT relay from the engine room junction block assembly.

(c) Disconnect connector A21 from the power management control ECU.

(d) Disconnect connector g1 from the water pump with motor assembly.

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



Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)	*2	Engine Room Junction Block Assembly
*3	IGCT Relay	*4	IGCT No. 3 Fuse
*5	Front view of wire harness connector (to Water Pump with Motor Assembly)	-	-

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
2 (IGCT No. 3 fuse) - g1-4 (+BWP)	Power switch off	Below 1 Ω
1 (IGCT No. 3 fuse) - 3 (IGCT relay)	Power switch off	Below 1 Ω
g1-1 (GND) - Body ground	Power switch off	Below 1 Ω
g1-2 (NWP) - A21-14 (NIWP)	Power switch off	Below 1 Ω
g1-3 (SWP) - A21-13 (IWP)	Power switch off	Below 1 Ω
2 (IGCT No. 3 fuse) or g1-4 (+BWP) - Body ground and other terminals	Power switch off	10kΩ or higher
1 (IGCT No. 3 fuse) or 3 (IGCT relay) - Body ground and other terminals	Power switch off	10kΩ or higher
g1-2 (NWP) or A21-14 (NIWP) - Body ground and other terminals	Power switch off	10kΩ or higher
g1-3 (SWP) or A21-13 (IWP) - Body ground and other terminals	Power switch off	10kΩ or higher

NOTICE:

Do not apply excessive force when using the probes of the tester to perform the inspection. If excessive force is used, the terminals will be damaged.

(f) Install the IGCT No. 3 fuse.

(g) Install the IGCT relay.

(h) Connect the power management control ECU connector.

(i) Connect the water pump with motor assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

▼

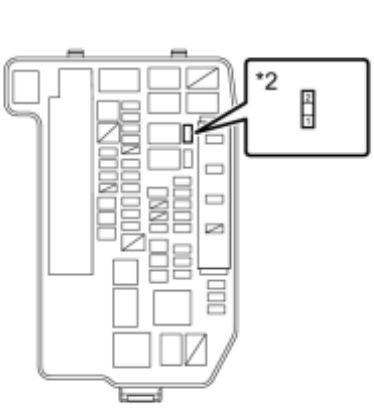
12.	CHECK WATER PUMP WITH MOTOR ASSEMBLY

(a) Connect the Techstream to the DLC3.

(b) Remove the IGCT No. 3 fuse from the engine room junction block assembly.

Text in Illustration

*1	Engine Room junction Block Assembly
*2	IGCT No. 3 Fuse



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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Inverter W/P Revolution

(e) Apply 12 V to terminal 2 of the IGCT No. 3 fuse holder of the engine room junction block assembly.

(f) Read the Data List.

OK:

Inverter W/P Revolution is between 2250 and 5625 rpm.

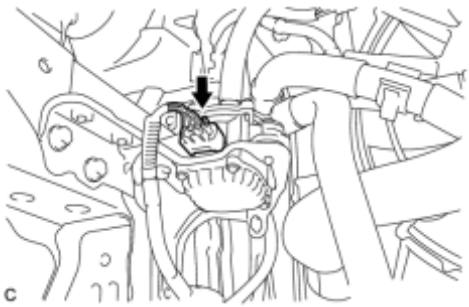
NOTICE:

Do not apply excessive force when using the probes of the tester to perform the inspection. If excessive force is used, the terminals will be damaged.

(g) Install the IGCT No. 3 fuse.

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

13.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY)



(a) Check the connection of the water pump with motor assembly connector.

OK:

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

NG ▶ CONNECT SECURELY
OK ▼

14.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

15.	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR ASSEMBLY CIRCUIT)

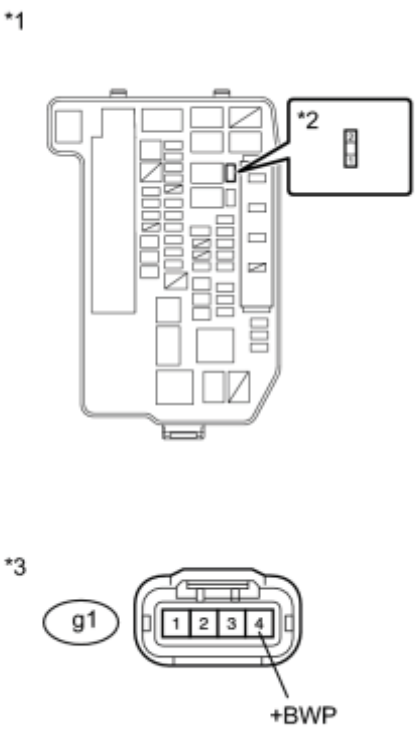
(a) Remove the IGCT No. 3 fuse from the engine room junction block assembly.

(b) Disconnect connector g1 from the water pump with motor assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
2 (IGCT No. 3 fuse) or g1-4 (+BWP) - Body ground and other terminals	Power switch off	10 kΩ or higher



Text in Illustration

*1	Engine Room Junction Block Assembly
*2	IGCT No. 3 Fuse
*3	Front view of wire harness connector (to Water Pump with Motor Assembly)

NOTICE:

Do not apply excessive force when using the probes of the tester to perform the inspection. If excessive force is used, the terminals will be damaged.

(d) Install the IGCT No. 3 fuse.

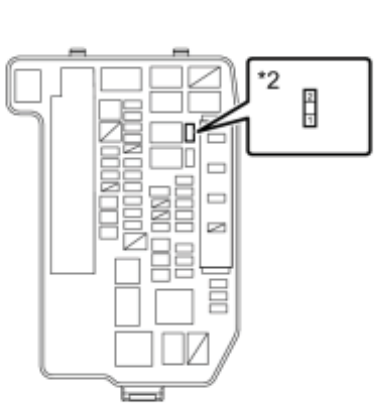
(e) Connect the water pump with motor assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

16.	CHECK WATER PUMP WITH MOTOR ASSEMBLY

(a) Connect the Techstream to the DLC3.



(b) Remove the IGCT No. 3 fuse from the engine room junction block assembly.

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	IGCT No. 3 Fuse

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Inverter W/P Revolution

(e) Apply 12 V to terminal 2 of the IGCT No. 3 fuse holder of the engine room junction block assembly.

(f) Read the Data List.

OK:

Inverter W/P Revolution is between 2250 and 5625 rpm.

NOTICE:

Do not apply excessive force when using the probes of the tester to perform the inspection. If excessive force is used, the terminals will be damaged.

(g) Install the IGCT No. 3 fuse.

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY

OK ▼

17.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

18.	REPLACE HV COOLANT

(a) Replace the HV coolant with coolant having an appropriate concentration (appropriate freeze point) for the vehicle usage conditions INFO.

NEXT ▼

19.	CHECK WATER PUMP WITH MOTOR ASSEMBLY

(a) Perform a road test and check that DTCs are not stored.

OK:

DTCs are not stored.

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY
OK ▶ **COMPLETED**

20.	CONNECT SECURELY

(a) Connect the power management control ECU connectors securely.

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

21.	CONNECT SECURELY

(a) Connect the inverter with converter assembly connector securely.

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

22.	REPAIR OR REPLACE HARNESS OR CONNECTOR

(a) Repair or replace the wire harness or connector.

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

23.	REPLACE WATER PUMP WITH MOTOR ASSEMBLY

(a) Replace the water pump with motor assembly INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

DTC	P0A02-719	Motor Electronics Coolant Temperature Sensor Circuit Low
DTC	P0A03-720	Motor Electronics Coolant Temperature Sensor Circuit High

DESCRIPTION

Refer to the description for DTC P0A01-726 INFO.

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	

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

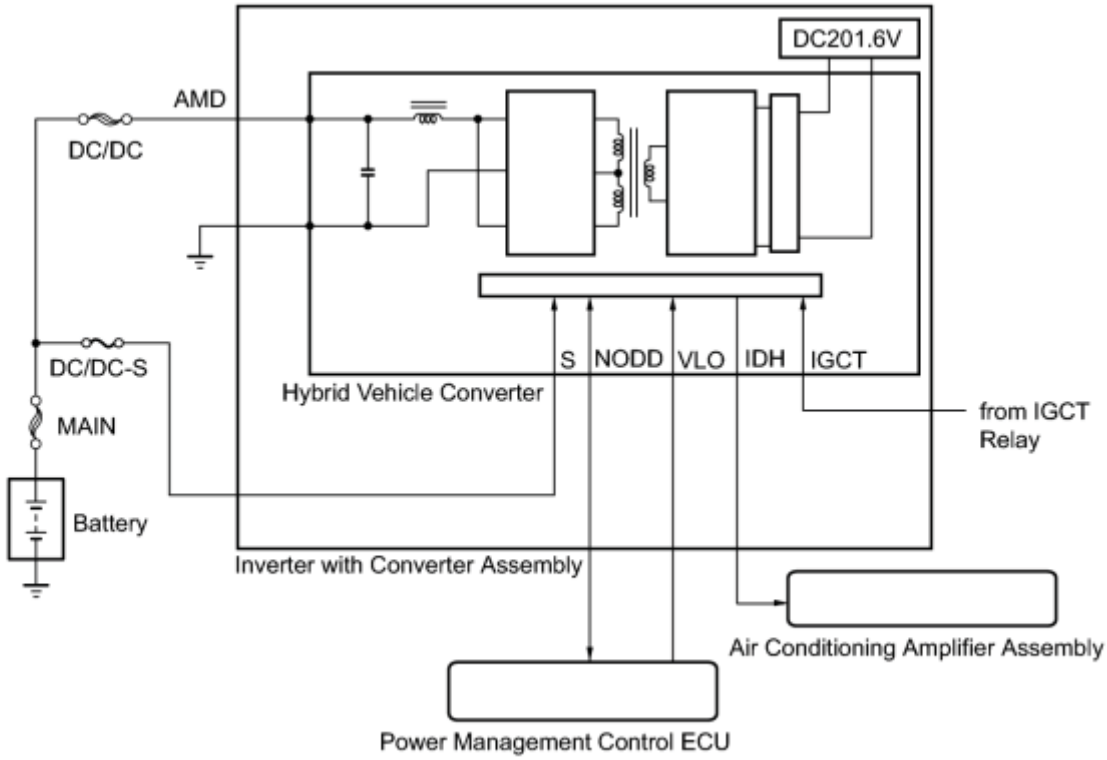
NEXT **COMPLETED**

DTC	P0A08-264	DC / DC Converter Status Circuit

DESCRIPTION

The hybrid vehicle converter (DC/DC converter) converts the DC 201.6 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 201.6 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.

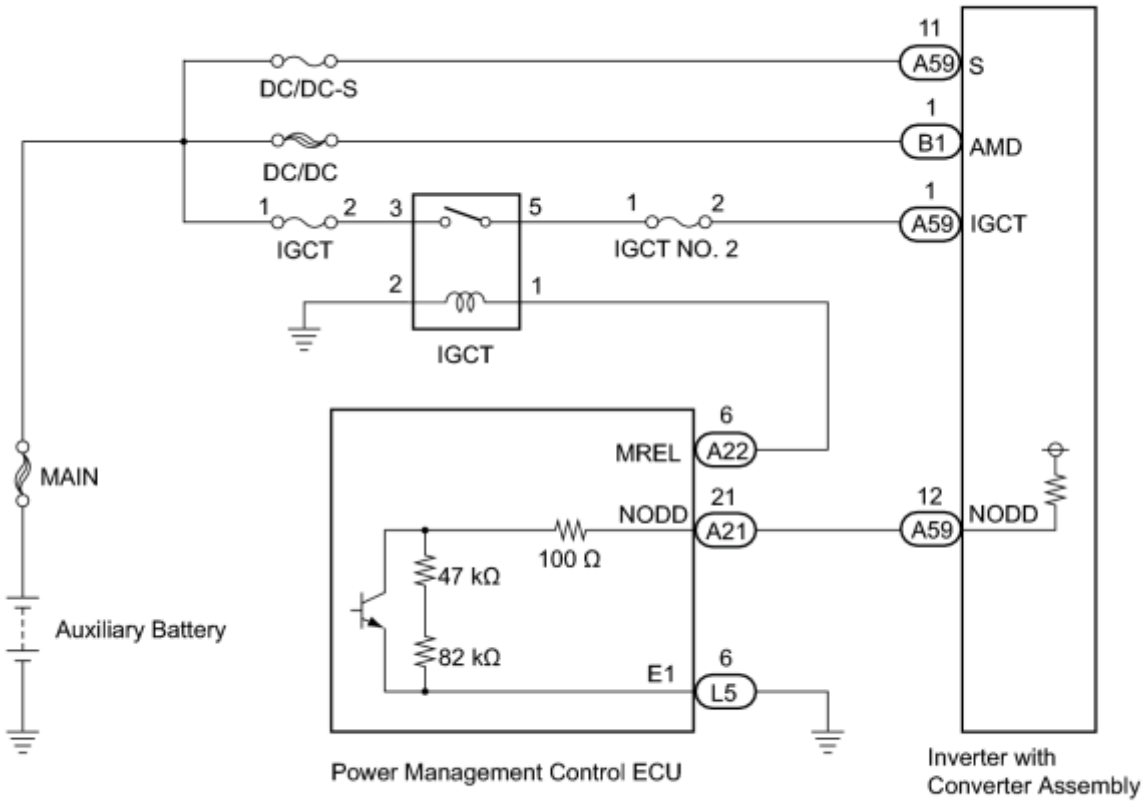
The power management control ECU (HV CPU) uses the NODD signal line to transmit a stop command to the hybrid vehicle converter and receive signals indicating the normal or abnormal condition of the 12 V charging system. If the vehicle is being driven with an inoperative hybrid vehicle converter, the voltage of the auxiliary battery will drop, which will prevent the continued operation of the vehicle. Therefore, the power management control ECU (HV CPU) 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
P0A08	264	DC/DC converter malfunction	• Wire harness or connector • Water pump with motor assembly • Inverter cooling system • Hybrid vehicle transaxle assembly • Generator cable

DTC No.	INF Code	DTC Detection Condition	Trouble Area
			• Motor cable • Frame wire • Inverter with converter assembly • Fusible link block assembly (MAIN) • Fuse (DC/DC-S, IGCT, IGCT No. 2, IGCT No. 3) • Fusible link block assembly (DC/DC)

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
DTC P0A08-264 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A93-346	Inverter Cooling System Performance
P0A94-547, 548, 549	DC / DC Converter Performance
P0AA6-526, 613	Hybrid Battery Voltage System Isolation Fault
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low
P0AE6-225	Hybrid Battery Precharge Contactor Control Circuit Low
P0C73-776	Motor Electronics Coolant Pump "A" Control Performance
P3004-131, 803	Power Cable Malfunction

(e) Turn the power switch off.

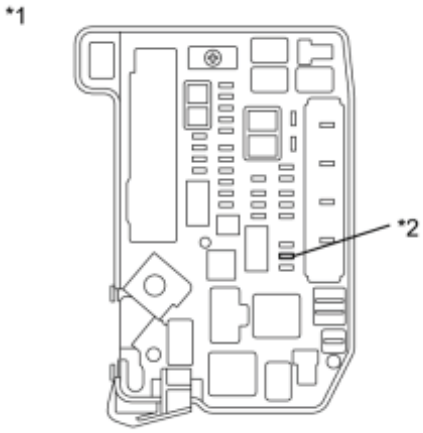
B ▶ GO TO DTC CHART

A ▼

2.	CHECK FUSE (IGCT NO. 2)

(a) Disconnect the cable from the negative auxiliary battery terminal.

(b) Remove the IGCT No. 2 fuse from the engine room junction block assembly.



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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
IGCT No. 2 fuse terminals	Always	Below 1 Ω

Text in Illustration

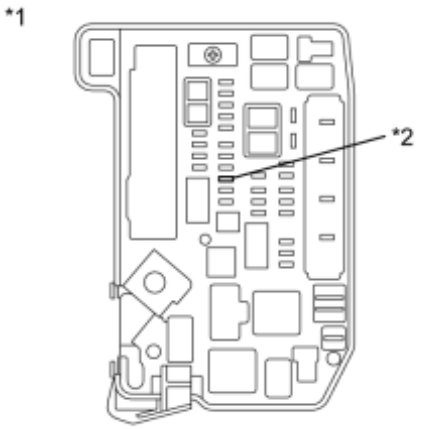
*1	Engine Room Junction Block Assembly
*2	IGCT No. 2 Fuse

(d) Install the IGCT No. 2 fuse.

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - IGCT NO. 2 FUSE)

OK ▼

3.	CHECK FUSE (DC/DC-S)



(a) Remove the DC/DC-S fuse from the engine room junction block assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
DC/DC-S fuse terminals	Always	Below 1 Ω

Text in Illustration

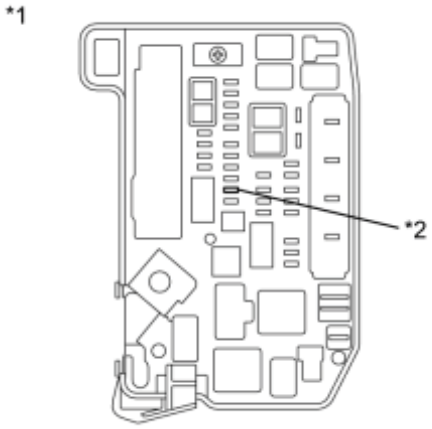
*1	Engine Room Junction Block Assembly
*2	DC/DC-S Fuse

(c) Install the DC/DC-S fuse.

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - DC/DC-S FUSE)

OK ▼

4.	CHECK FUSE (IGCT)



(a) Remove the IGCT fuse from the engine room junction block assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
IGCT fuse terminals	Always	Below 1 Ω

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	IGCT Fuse

(c) Install the IGCT fuse.

NG ▶ CHECK ENGINE ROOM JUNCTION BLOCK (IGCT RELAY, IGCT FUSE, IGCT NO. 2 FUSE)

OK ▼

5.	CHECK FUSIBLE LINK (DC/DC)

(a) Disconnect connector 1E from the engine room junction block assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
1E-1 - terminal A	Always	Below 1 Ω

(c) Check the fusible links (DC/DC) in the engine room junction block assembly for improper installation.

OK:

The fusible link is installed securely.

(d) Connect the engine room junction block assembly connector.

NG ▶ REPLACE FUSIBLE LINK (DC/DC)

OK ▼

6.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ CONNECT SECURELY

OK ▼

8.	CHECK CABLE AND WIRE HARNESS

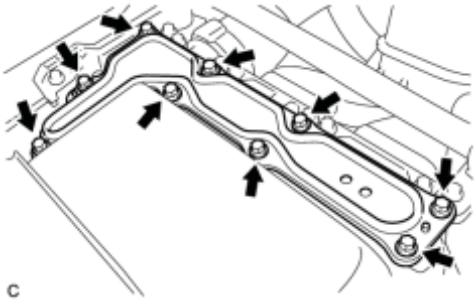
CAUTION:

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.



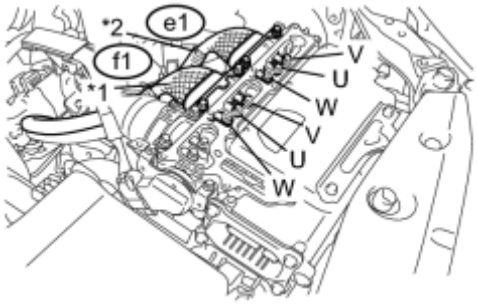
(b) Remove the inverter terminal cover from the inverter with converter assembly.

(c) Using a megohmmeter set to 500 V, measure the insulation resistance according to the value(s) in the table below.

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
f1-3 (V) - Body ground and shield ground	Power switch off	1 MΩ or higher
f1-2 (U) - Body ground and shield ground	Power switch off	1 MΩ or higher
f1-1 (W) - Body ground and shield ground	Power switch off	1 MΩ or higher
e1-3 (V) - Body ground and shield ground	Power switch off	1 MΩ or higher
e1-2 (U) - Body ground and shield ground	Power switch off	1 MΩ or higher
e1-1 (W) - Body ground and shield ground	Power switch off	1 MΩ or higher

Text in Illustration

*1	Three-phase AC Cable for MG1
*2	Three-phase AC Cable for MG2

HINT:

Perform this inspection while the three-phase AC cable for MG1 and for

MG2 are connected.

(d) Install the inverter terminal cover to the inverter with converter assembly.

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1)

OK ▼

9.	CHECK AMD TERMINAL

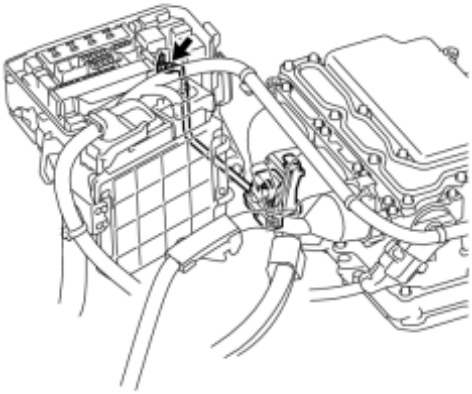
CAUTION:

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 that the nuts for the AMD terminal is tightened to the specified torque, the AMD terminal is connected securely, and there is no contact problem.

Torque:

T=8.3 N*m {85 kgf*cm, 73 in.*lbf }

Result:

Result		Proceed to
There are no arc marks.	The terminal is connected securely and there is no contact problem.	A
There are no arc marks.	The terminal is not connected securely and there is a contact problem.	B
There are arc marks.	-	C

C ▶ REPLACE MALFUNCTIONING PARTS

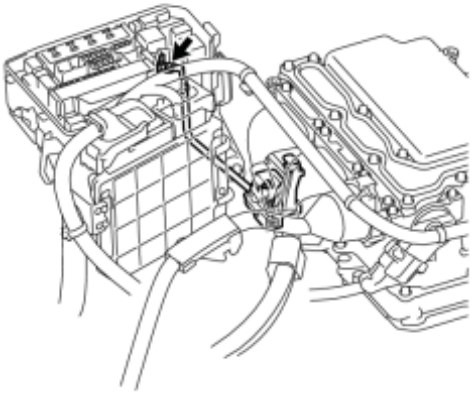
B ▶ CONNECT SECURELY

A ▼

10.	CHECK AMD TERMINAL (ENGINE ROOM JUNCTION BLOCK ASSEMBLY SIDE)

CAUTION:

Be sure to wear insulated gloves.



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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
AMD terminal (Engine Room Junction Block Assembly side) - Body ground	Power switch off	11 to 14 V

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

11.	CHECK HARNESS AND CONNECTOR

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

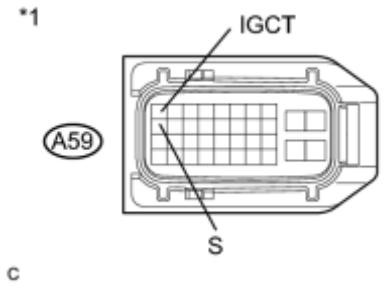
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect connector A59 from the inverter with converter assembly.

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

HINT:

Turning the power switch on (IG) with the service grip removed causes interlock switch system DTC P0A0D-350 to be output.



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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A59-1 (IGCT) - Body ground	Power switch on (IG)	11 to 14 V
A59-11 (S) - Body ground		

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

(e) Turn the power switch off.

(f) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

▼

12.	CHECK POWER MANAGEMENT CONTROL ECU

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

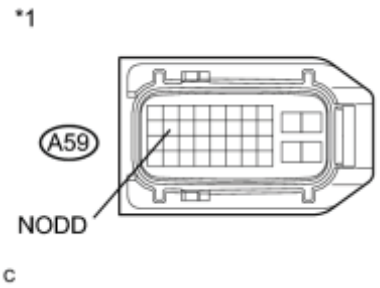
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect connector A59 from the inverter with converter assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-12 (NODD) - Body ground	Power switch off	120 to 140 kΩ



c

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

(d) Connect the inverter with converter assembly connector.

NG INSPECT POWER MANAGEMENT CONTROL ECU

OK

13.	CHECK DC/DC CONVERTER FUNCTION

HINT:

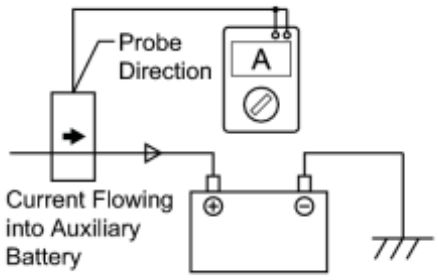
The current at the AMD terminal cannot be measured directly because of space limitations. Measure the current flowing at the auxiliary battery instead.

(a) Connect the AC/DC 400 A probe to the positive auxiliary battery line.

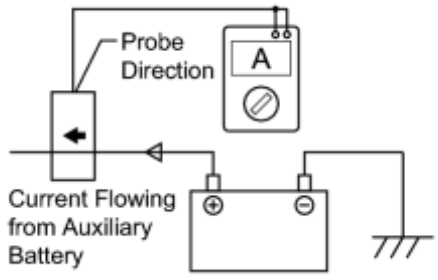
(b) Install the service plug grip.

(c) Turn the power switch on (READY) and leave the vehicle as it is until the electric current flowing into the auxiliary battery becomes 10 A or less.

(d) Measure the current flowing from the auxiliary battery with the power switch on (READY), the headlight position switch and blower motor switch in the HI position, and the rear window defogger turned on.



c



c

Standard Current:

Item	Switch Condition	Specified Condition
Current flowing from auxiliary battery	Power switch on (READY) (The headlight position switch and blower motor switch are in the HI position, and the rear window defogger is turned on.)	0 A or less (no current from auxiliary battery)

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
Auxiliary battery voltage	Power switch on (READY) (The headlight position switch and blower motor switch are in the HI position, and the rear window defogger is turned on.)	13 to 15 V

(f) Turn the power switch off.

NG ▶ REPLACE INVERTER WITH CONVERTER ASSEMBLY

OK ▼

14.	CHECK QUANTITY OF HV COOLANT INFO

C ▶ INSPECT FOR COOLANT LEAK AND ADD COOLANT

B ▶ ADD HV COOLANT

A ▼

15.	CHECK COOLANT HOSE INFO

NG ▶ CORRECT THE PROBLEM

OK ▼

16.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVE THE WATER PUMP) INFO

NG ▶ CHECK FUSE (IGCT NO. 3)

OK ▼

17.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE ELECTRIC COOLING FAN) INFO

NG ▶ CHECK COOLING FAN SYSTEM

OK ▼

18.	CHECK HV COOLANT (CHECK FOR CONDITIONS THAT MAY HAVE CAUSED FREEZING) INFO

B ▶ REPLACE HV COOLANT

A **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

19.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1)

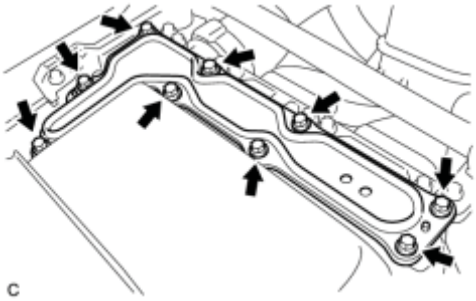
CAUTION:

Be sure to wear insulated gloves.

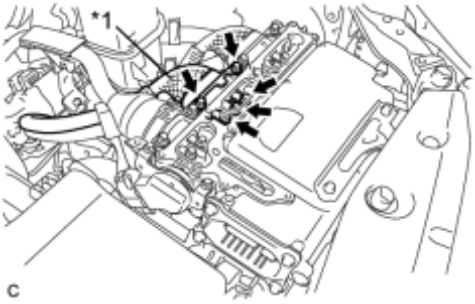
(a) Check that the service plug grip is not installed.

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) Remove the inverter terminal cover from the inverter with converter assembly.



(c) Disconnect the three-phase AC cables for MG1 from the inverter with converter assembly.

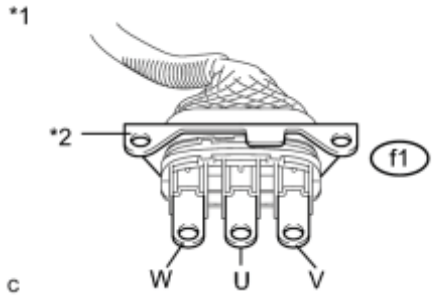
Text in Illustration

*1	Three-phase AC Cables for MG1

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-2 (U) - Body ground and shield	Power switch	100 MΩ or higher

ground	off	
f1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

Text in Illustration

*1	Three-phase AC Cables for MG1
*2	Shield Ground

(e) Connect the three-phase AC cables for MG1 to the inverter with converter assembly.

(f) Install the inverter terminal cover to the inverter with converter assembly.

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK ▼

20.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2)

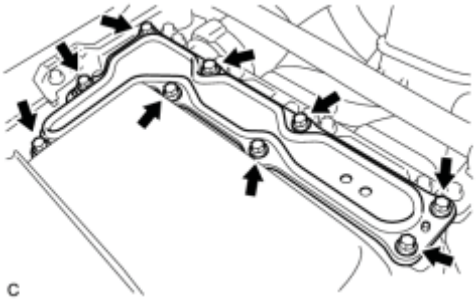
CAUTION:

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.

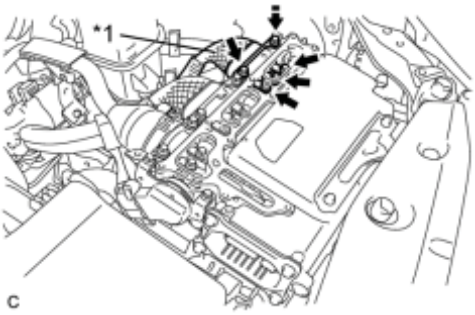


(b) Remove the inverter terminal cover from the inverter with converter assembly.

(c) Disconnect the three-phase AC cables for MG2 from the inverter with converter assembly.

Text in Illustration

*1	Three-phase AC Cables for MG2

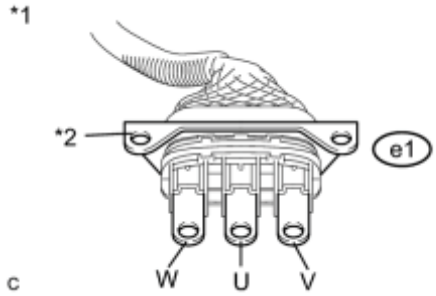


(d) Using a megohmmeter set to 500 V, measure the insulation resistance according to the value(s) in the table below.

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
e1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

Text in Illustration

*1	Three-phase AC Cables for MG2
*2	Shield Ground

(e) Connect the three-phase AC cables for MG2 to the inverter with converter assembly.

(f) Install the inverter terminal cover to the inverter with converter assembly.

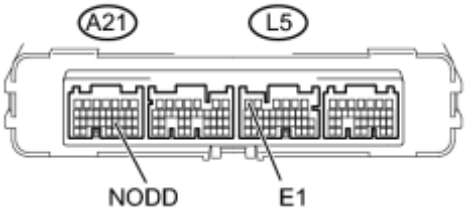
NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

21.	INSPECT POWER MANAGEMENT CONTROL ECU

(a) Disconnect all the connectors from the power management control ECU.

*1



P

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A21-21 (NODD) - L5-6 (E1)	Power switch off	120 to 140 kΩ

Text in Illustration

*1	Component without harness connected (Power Management Control ECU)

(c) Connect the power management control ECU connectors.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

22.	CHECK FUSE (IGCT NO. 3) INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR)

OK ▼

23.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY
OK ▼

24.	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR ASSEMBLY CIRCUIT) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▼

25.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

26.	REPLACE HV COOLANT INFO

NEXT ▼

27.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY
OK ▶ **COMPLETED**

28.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

29.	CHECK GENERATOR CABLE INFO

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

30.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

31.	CHECK MOTOR CABLE INFO

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

32.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR) INFO

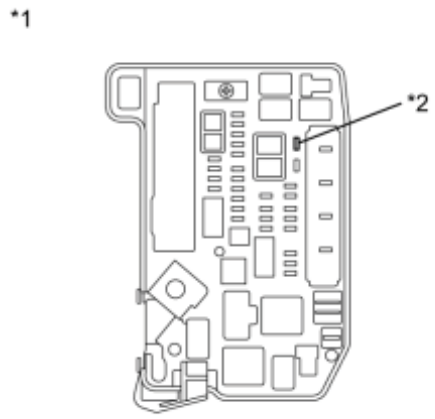
NG ▶ CONNECT SECURELY
OK ▼

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

(a) Disconnect connector A21 from the power management control ECU.

(b) Remove the IGCT No. 3 fuse from the engine room junction block assembly.

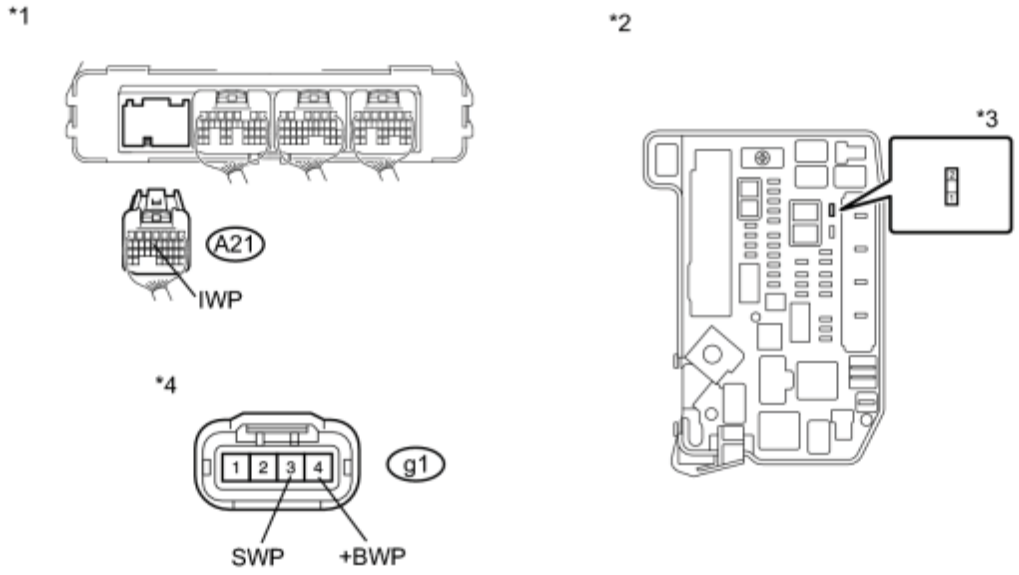
Text in Illustration



*1	Engine Room Junction Block Assembly
*2	IGCT No. 3 Fuse

(c) Disconnect the water pump with motor assembly connector.

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



Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)	*2	Engine Room Junction Block Assembly
*3	IGCT No. 3 Fuse	*4	Front view of wire harness connector (to Water Pump with Motor Assembly)

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A21-13 (IWP) or g1-3 (SWP) - Body ground and other terminals	Power switch off	10 kΩ or higher
2 (IGCT No. 3 fuse) or g1-4 (+BWP) - Body ground and other terminals	Power switch off	10 kΩ or higher

(e) Connect the water pump with motor assembly connector.

(f) Connect the power management control ECU connector.

(g) Install the IGCT No. 3 fuse.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

34.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY

OK ▼

35.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

36.	CONNECT SECURELY

(a) Connect the water pump with motor assembly connector securely.

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

37.	REPAIR OR REPLACE HARNESS OR CONNECTOR

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

38.	REPLACE WATER PUMP WITH MOTOR ASSEMBLY

(a) Replace the water pump with motor assembly INFO.

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

39.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - IGCT NO. 2 FUSE)

CAUTION:

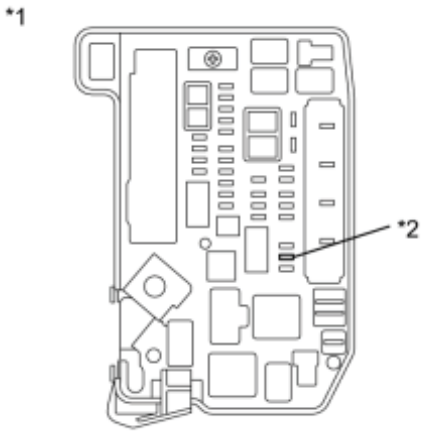
Be sure to wear insulated gloves.

(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 connector A59 from the inverter with converter assembly.

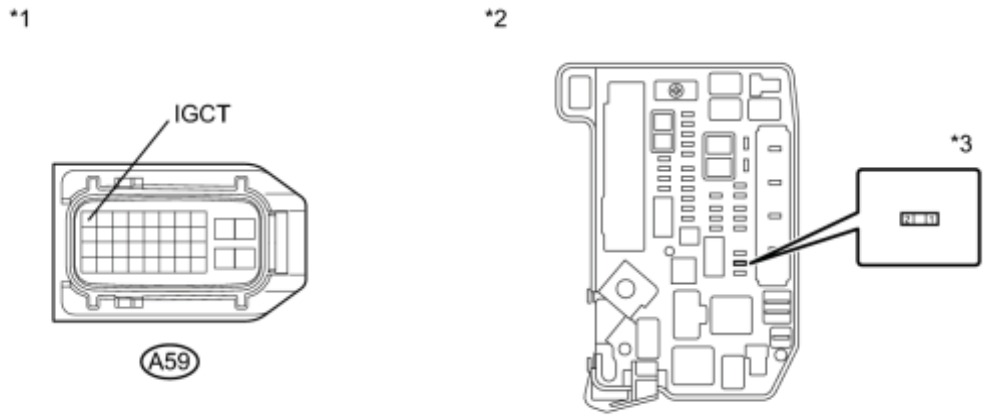


(c) Remove the IGCT No. 2 fuse from the engine room junction block assembly.

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	IGCT No. 2 Fuse

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



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-1 (IGCT) or 2 (IGCT No. 2 fuse) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)	*2	Engine Room Junction Block Assembly
*3	IGCT No. 2 Fuse	-	-

(e) Install the IGCT No. 2 fuse.

(f) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

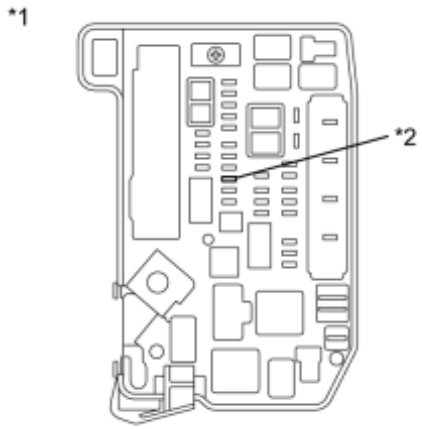
40.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ **REPLACE FUSE (IGCT NO. 2)**

41.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - DC/DC-S FUSE)

(a) Disconnect connector A59 from the inverter with converter assembly.

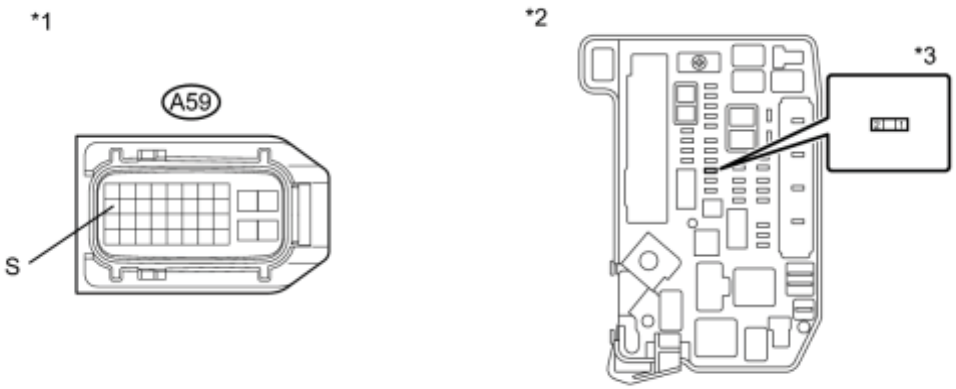


(b) Remove the DC/DC-S fuse from the engine room junction block assembly.

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	DC/DC-S Fuse

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



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-11 (S) or 2 (DC/DC-S fuse) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)	*2	Engine Room Junction Block Assembly
*3	DC/DC-S Fuse	-	-

(d) Install the DC/DC-S fuse.

(e) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

42.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

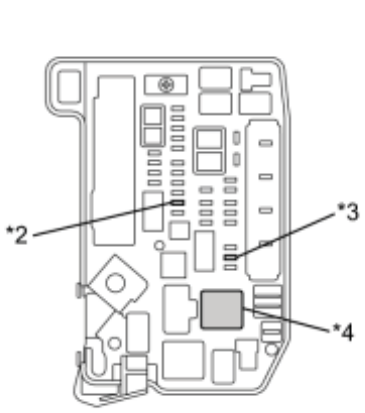
(a) Replace the inverter with converter assembly INFO.

NEXT ▶ **REPLACE FUSE (DC/DC-S)**

43.	CHECK ENGINE ROOM JUNCTION BLOCK (IGCT RELAY, IGCT FUSE, IGCT NO. 2 FUSE)

(a) Remove the IGCT relay, IGCT fuse and IGCT No. 2 fuse from the engine room junction block assembly.

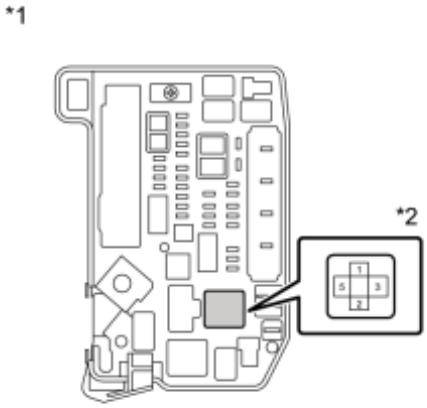
Text in Illustration



*1	Engine Room Junction Block Assembly
*2	IGCT Fuse
*3	IGCT No. 2 Fuse
*4	IGCT Relay

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
3 (IGCT relay block) - Body ground and other terminals	Always	10 kΩ or higher
5 (IGCT relay block) - Body ground and other terminals	Always	10 kΩ or higher

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	IGCT Relay

(c) Install the IGCT relay, IGCT fuse and IGCT No. 2 fuse.

NG ▶ REPAIR OR REPLACE ENGINE ROOM JUNCTION BLOCK
OK ▶ **REPLACE FUSE (IGCT)**

44.	REPAIR OR REPLACE HARNESS OR CONNECTOR

NEXT ▶ **REPLACE FUSE (IGCT NO. 2)**

45.	REPAIR OR REPLACE HARNESS OR CONNECTOR

NEXT ▶ **REPLACE FUSE (DC/DC-S)**

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

DESCRIPTION

Refer to the description for DTC P0A08-264 INFO.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A09	265	Open or GND short in NODD signal circuit of DC/DC converter	• Wire harness or connector • Inverter with converter assembly • Power management control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A08-264 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

3.	CHECK POWER MANAGEMENT CONTROL ECU (NODD)

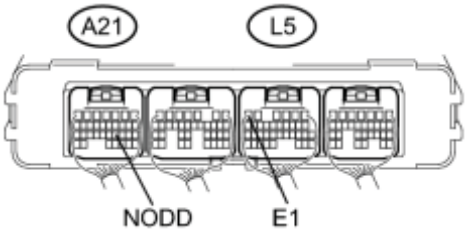
(a) Turn the power switch on (READY).

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A21-21 (NODD) - L5-6 (E1)	Power switch on (READY)	5 to 7 V

*1



P

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

(c) Turn the power switch off.

NG ▶ CHECK POWER MANAGEMENT CONTROL ECU

OK ▼

4.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Clear DTCs and freeze frame data.

NEXT ▼

5.	CHECK DTC OUTPUT (HV)

(a) Turn the power switch on (READY).

(b) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(c) Check if DTCs are output.

Result:

Result	Proceed to
DTC P0A09-265 is not output.	A
DTC P0A09-265 is output again.	B

(d) Turn the power switch off.

B ▶ REPLACE POWER MANAGEMENT CONTROL ECU

A ▼

6.	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems INFO.

NG ▶ REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

7.	CHECK POWER MANAGEMENT CONTROL ECU INFO

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER MANAGEMENT CONTROL ECU)

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

8.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER MANAGEMENT CONTROL ECU)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

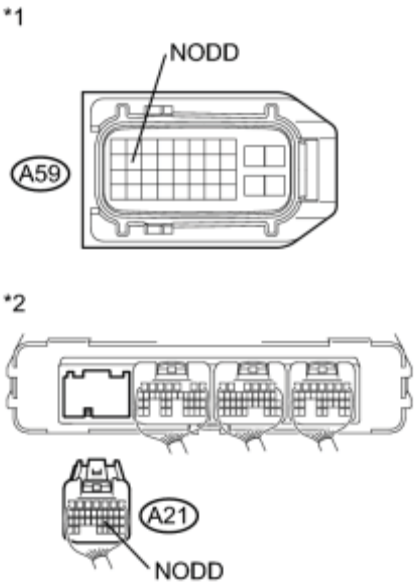
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect connector A59 from the inverter with converter assembly.

(c) Disconnect connector A21 from the power management control ECU.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
A59-12 (NODD) - A21-21 (NODD)	Power switch off	Below 1 Ω
A59-12 (NODD) or A21-21 (NODD) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Rear view of wire harness connector (to Power Management Control ECU)

(e) Connect the inverter with converter assembly connector.

(f) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

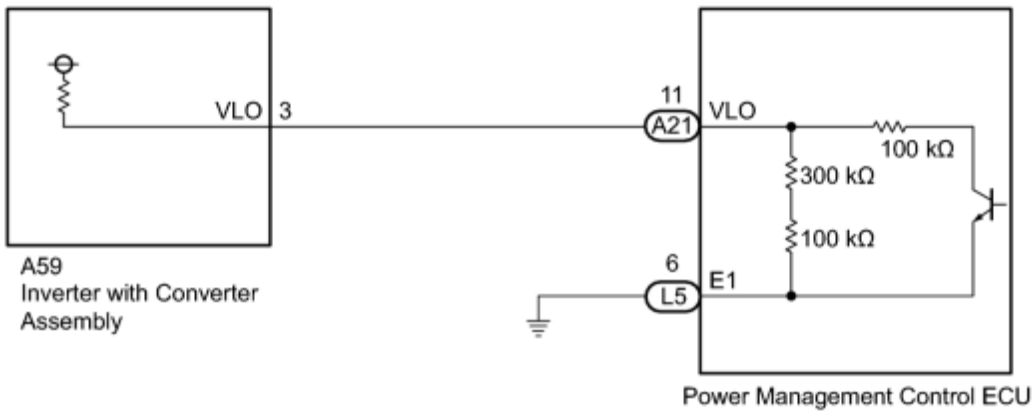
DTC	P0A09-591	DC / DC Converter Status Circuit Low Input

DESCRIPTION

The hybrid vehicle converter (DC/DC converter) controls output voltage (12 V) based on duty ratio signals sent from the power management control ECU (HV CPU) .

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)	• Wire harness or connector • Inverter with converter assembly • Power management 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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

3.	CHECK POWER MANAGEMENT CONTROL ECU (CHECK WAVEFORM)

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

(b) Connect an oscilloscope between the power management control ECU terminals specified in the table below, and measure the waveform.

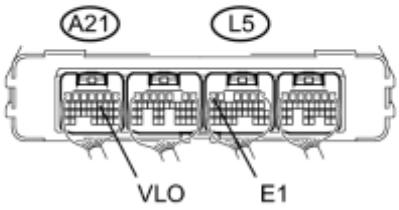
Item	Content
Terminal	A21-11 (VLO) - L5-6 (E1)
Equipment Setting	5V/DIV., 50ms/DIV.
Condition	Power switch on (IG)

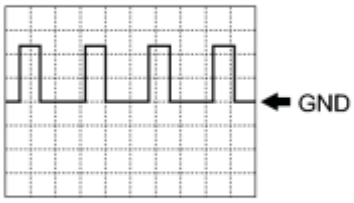
Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

OK:

*1





The waveform appears as shown in the illustration.

Perform this inspection with the power management control ECU connector connected.

(c) Turn the power switch off.

NG ▶ CHECK POWER MANAGEMENT CONTROL ECU

OK

▼

4.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Clear DTCs and freeze frame data.

NEXT

▼

5.	CHECK DTC OUTPUT (HV)

(a) Turn the power switch on (READY).

(b) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(c) Check if DTCs are output.

Result:

Result	Proceed to
DTC P0A09-591 is not output.	A
DTC P0A09-591 is output again.	B

(d) Turn the power switch off.

B ▶ REPLACE POWER MANAGEMENT CONTROL ECU

A ▼

6.	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems INFO.

NG ▶ REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

7.	CHECK POWER MANAGEMENT CONTROL ECU

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

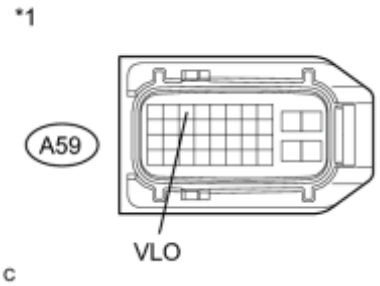
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect connector A59 from the inverter with converter assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-3 (VLO) - Body ground	Power switch off	370 to 430 kΩ



Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

(d) Connect the inverter with converter assembly connector.

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER

MANAGEMENT CONTROL ECU)

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

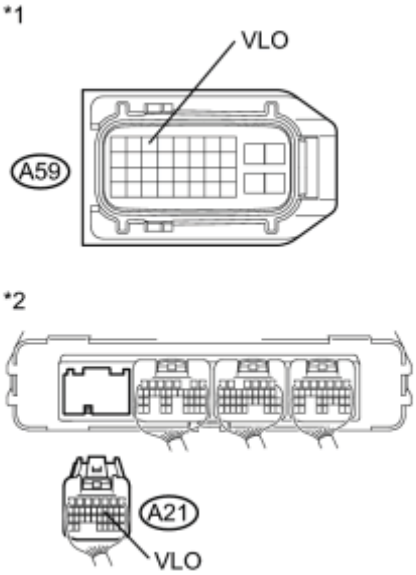
8.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER MANAGEMENT CONTROL ECU)

(a) Disconnect connector A59 from the inverter with converter assembly.

(b) Disconnect connector A21 from the power management control ECU.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
A59-3 (VLO) - A21-11 (VLO)	Power switch off	Below 1 Ω
A59-3 (VLO) or A21-11 (VLO) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Rear view of wire harness connector (to Power Management Control ECU)

(d) Connect the inverter with converter assembly connector.

(e) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

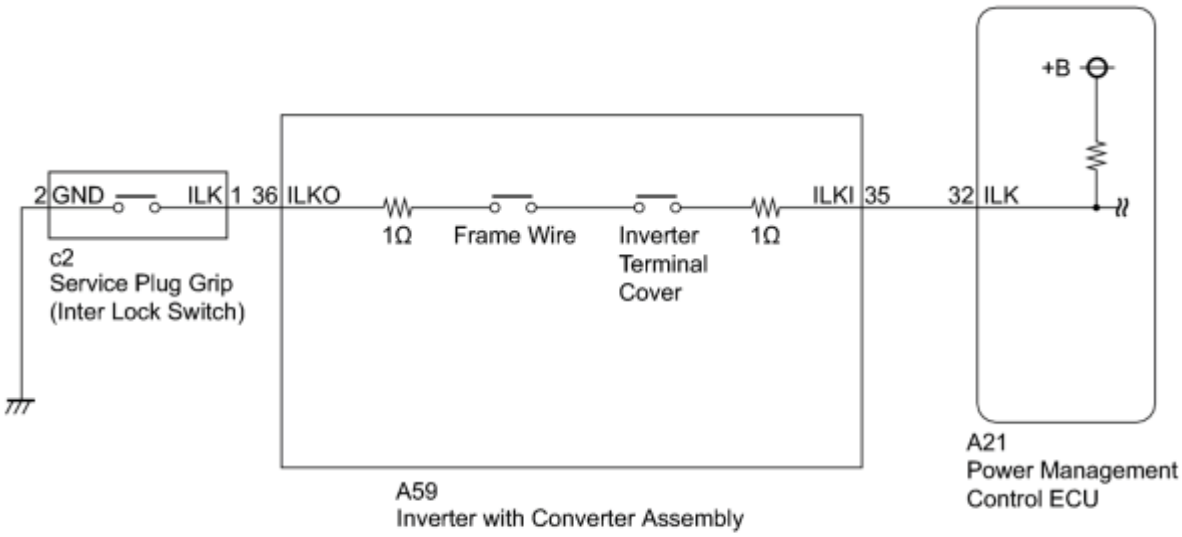
DTC	P0A0D-350	High Voltage System Inter-Lock Circuit High
DTC	P0A0D-351	High Voltage System Inter-Lock Circuit High

DESCRIPTION

- When the power management control ECU detects that a safety device is operated, it will prohibit hybrid system operation or shut off the system main relay. There are four safety devices in three different locations. The first safety device is located at the service plug grip. The second one is located at the frame wire that is connected to the inverter with converter assembly. The third one is located at the inverter terminal cover where the motor and generator cables and No. 2 engine wire (air conditioning harness) are connected to the inverter with converter assembly. If the service plug grip, inverter terminal cover, or frame wire is removed, the interlock signal line will be open. If the vehicle is being driven, this condition will be determined to be an open circuit and the system main relays will not be shut off. If the safety devices are re-installed correctly, the system will return to normal when the power switch is turned on (IG).

DTC No.	INF Code	DTC Detection Condition	Trouble Are
P0A0D	350	Operating any of the safety devices with the vehicle stopped (ILK signal is ON) and turning the power switch on (IG)	• Wire harness or connector • Power Management Control ECU • Service plug grip • Inverter with converter assembly • Frame wire • Inverter terminal cover
P0A0D	351	Interlock signal line opens (ILK signal is ON) while the vehicle is being driven	

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A0D only is output.	A
P0A1D is output	B

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CLEAR DTC (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read and record the DTCs and freeze frame data.

(e) Clear DTCs and freeze frame data.

(f) Turn the power switch off.

NEXT ▼

3.	RECONFIRM DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A0D-350 or P0A0D-351 is output again.	A
Neither P0A0D-350 or P0A0D-351 is output again.	B

(e) Turn the power switch off.

B ▶ CHECK CONNECTOR CONNECTION CONDITION (INTERLOCK CIRCUIT)

A

▼

4.	CHECK SERVICE PLUG GRIP

CAUTION:

Be sure to wear insulated gloves.

(a) Check if the service plug grip is installed correctly.

HINT:

- For the removal and installation procedures INFO.
- P0A0D-350 is also set if the power switch is turned on (IG) with the service plug grip removed. Confirm the conditions when the malfunction occurred.

NG ▶ INSTALL PARTS CORRECTLY

OK

▼

5.	CHECK INVERTER TERMINAL COVER

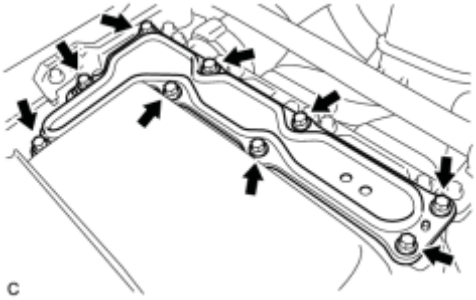
CAUTION:

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 if the inverter terminal cover of the inverter with converter assembly is installed correctly.

OK:

The inverter terminal cover is installed correctly.

NG ▶ INSTALL PARTS CORRECTLY

OK

▼

6.	CHECK FRAME WIRE

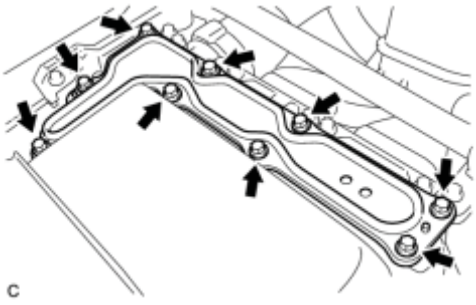
CAUTION:

Be sure to wear insulated gloves.

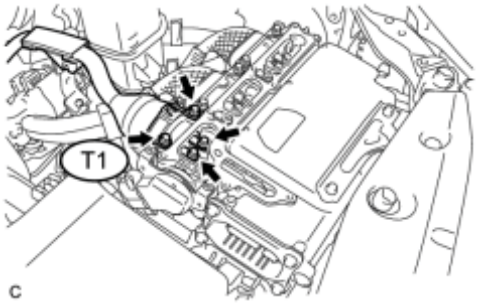
(a) Check that the service plug grip is not installed.

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) Remove the inverter terminal cover from the inverter with converter assembly.



(c) Check if the frame wire T1 is connected correctly.

OK:

The frame wire connector is connected correctly.

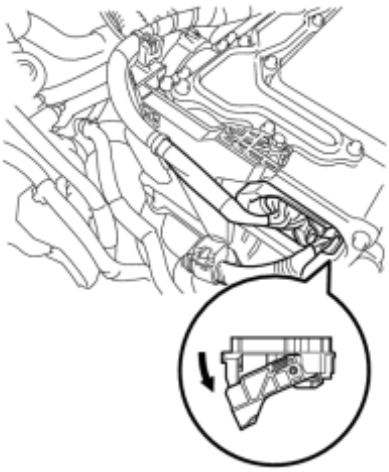
(d) Install the inverter terminal cover from the inverter with converter assembly.

NG ▶ INSTALL PARTS CORRECTLY

OK

▼

7.	CHECK POWER MANAGEMENT CONTROL ECU



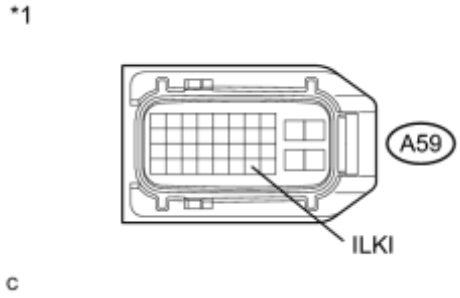
(a) Disconnect connector A59 from the inverter with converter assembly.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A59-35 (ILKI) - Body ground	Power switch off	10 to 14 V



Text in Illustration

*1	Front view of wire harness connector: (to Inverter with Converter Assembly)

(d) Turn the power switch off.

(e) Connect the inverter with converter assembly connector.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER)

OK ▼

8.	CHECK INVERTER WITH CONVERTER ASSEMBLY (INTERLOCK)

CAUTION:

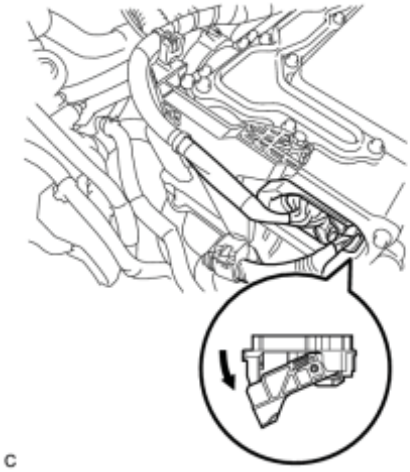
Be sure to wear insulated gloves.

(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 connector A59 from the inverter with converter assembly.



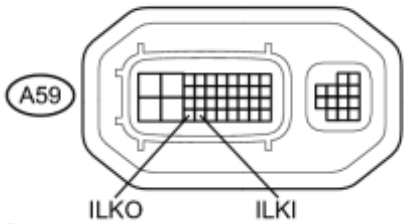
c

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-35 (ILKI) - A59-36 (ILKO)	Power switch off	Less than 3 Ω

*1



c

Text in Illustration

*1	Component without harness connected: (Inverter with Converter Assembly)

NOTICE:

Do not remove the inverter terminal cover.

(d) Connect the inverter with converter assembly connector.

NG ▶ CHECK INVERTER TERMINAL COVER

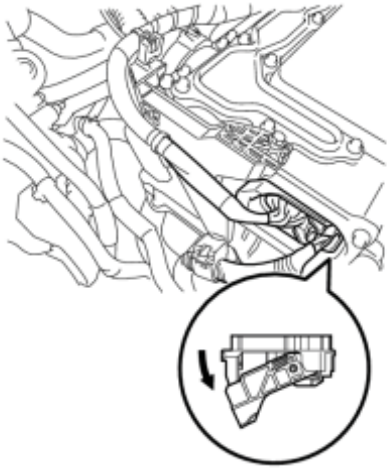
OK

▼

9.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - BODY GROUND)

(a) Install the service plug grip INFO.

(b) Disconnect connector A59 from the inverter with converter assembly.

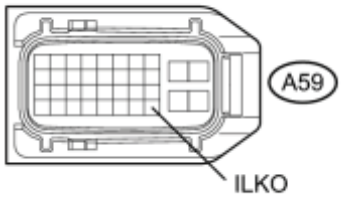


c

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

Standard Resistance:

*1



c

Tester Connection	Switch Condition	Specified Condition
A59-36 (ILKO) - Body ground	Power switch off	Less than 1 Ω

Text in Illustration

*1	Front view of wire harness connector: (to Inverter with Converter Assembly)

(d) Connect the inverter with converter assembly connector.

NG ▶ CHECK SERVICE PLUG GRIP

OK

▼

10.	CHECK CONNECTOR CONNECTION CONDITION (INTERLOCK CIRCUIT)

(a) Check the connections of each connector.

OK:

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

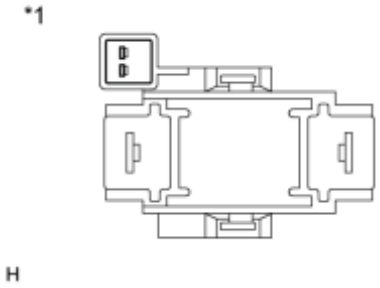
NG ▶ REPAIR OR REPLACE CONNECTOR

OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

11.	CHECK SERVICE PLUG GRIP

(a) Remove the service plug grip INFO.

(b) Check the condition of the service plug grip interlock.



Text in Illustration

*1	Service Plug Grip

OK:

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

(c) Install the service plug grip INFO.

NG ▶ REPLACE SERVICE PLUG GRIP

OK ▼

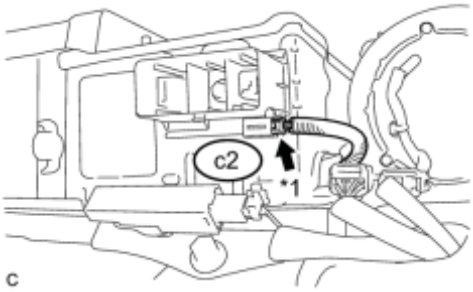
12.	CHECK HARNESS AND CONNECTOR

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



Text in Illustration

*1	Inter Lock Connector

OK:

The connector is connected correctly.

NG ▶ INSTALL PARTS CORRECTLY

OK ▼

13.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - SERVICE PLUG GRIP)

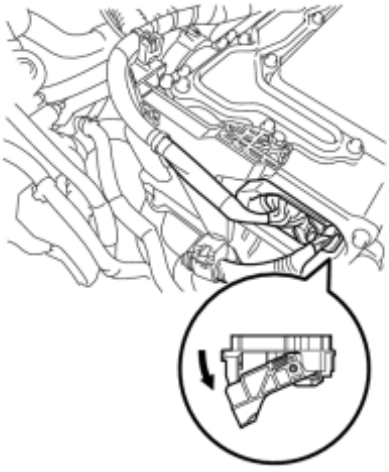
CAUTION:

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.

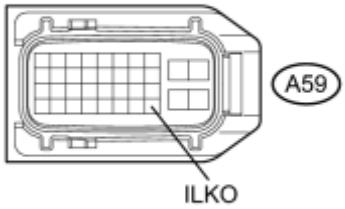


c

(b) Disconnect connector A59 from the inverter with converter assembly.

(c) Disconnect connector c2.

*1

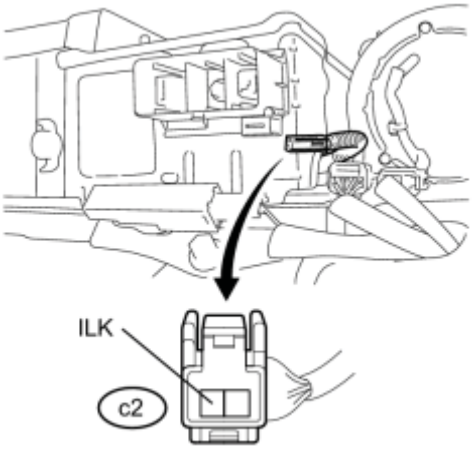


(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-36 (ILKO) - c2-1 (ILK)	Power switch off	Below 1 Ω

*2



Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Front view of wire harness connector (to Service Plug Grip)

(e) Connect the service plug grip connector.

(f) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

14.	CHECK INVERTER TERMINAL COVER

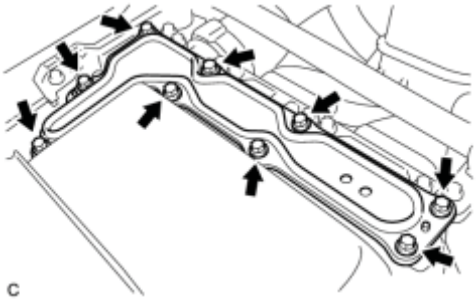
CAUTION:

Be sure to wear insulated gloves.

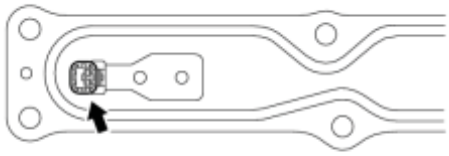
(a) Check that the service plug grip is not installed.

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) Remove the inverter terminal cover from the inverter with converter assembly.



(c) Check the condition of the inverter terminal cover interlock.

OK:

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

(d) Install the inverter terminal cover from the inverter with converter assembly.

NG ▶ REPLACE INVERTER TERMINAL COVER
OK ▼

15.	CHECK FRAME WIRE (FRAME WIRE CONNECTOR)

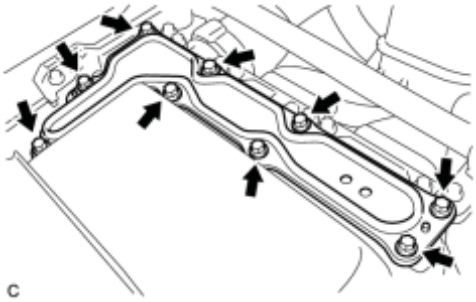
CAUTION:

Be sure to wear insulated gloves.

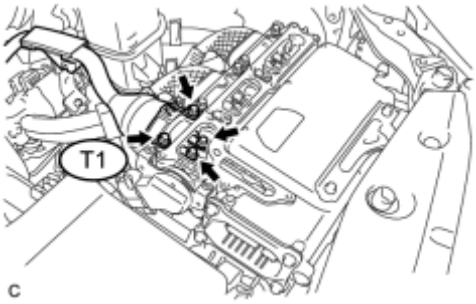
(a) Check that the service plug grip is not installed.

NOTICE:

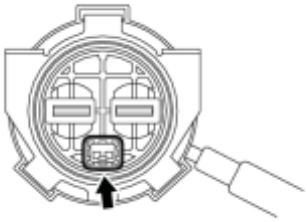
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.



(b) Remove the inverter terminal cover from the inverter with converter assembly.



(c) Disconnect the frame wire T1 from the inverter with converter assembly.



(d) Check the frame wire interlock.

OK:

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

(e) Connect the frame wire to the inverter with converter assembly.

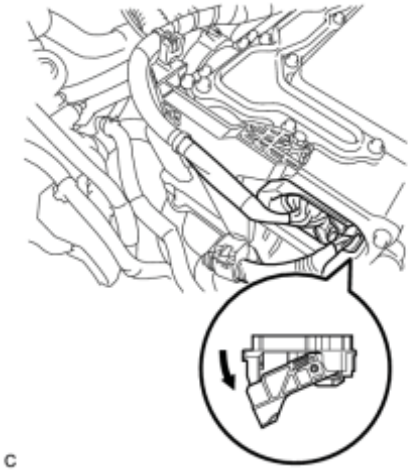
(f) Install the inverter terminal cover from the inverter with converter assembly.

NG ▶ REPLACE FRAME WIRE
OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

16.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER)

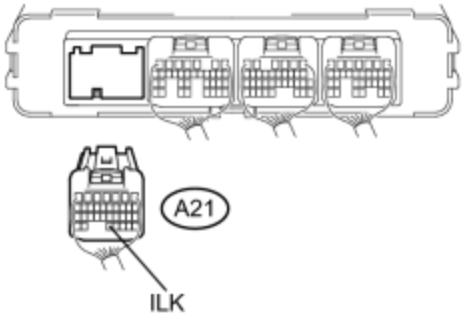
(a) Turn the power switch off.

(b) Disconnect connector A59 from the inverter with converter assembly.



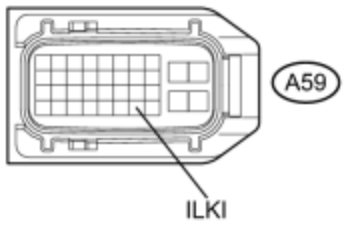
c

*1



(c) Disconnect connector A21 from the power management control ECU.

*2



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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A21-32 (ILK) - A59-35 (ILKI)	Power switch off	Below 1 Ω

Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)

*2	Front view of wire harness connector (to Inverter with Converter Assembly)

(e) Connect the power management control ECU connector.

(f) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

DTC	P0A0F-204	Engine Failed to Start
DTC	P0A0F-205	Engine Failed to Start
DTC	P0A0F-206	Engine Failed to Start
DTC	P0A0F-524	Engine Failed to Start
DTC	P0A0F-525	Engine Failed to Start

DESCRIPTION

If an engine malfunction occurs, an engine malfunction signal is sent from the ECM to the power management control ECU (HV CPU) . When the power management control ECU (HV CPU) receives this signal, it sets a DTC and performs fail-safe control.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A0F	204	Signal indicating abnormality input from the ECM (abnormal engine output)	• SFI system • Power management control ECU
	205	Signal indicating abnormality input from the ECM (engine is unable to start)	
	206	Signal indicating abnormality input from the ECM (engine component malfunction)	
	524	Signal indicating abnormality input from the ECM (NE signal error)	
	525	Signal indicating abnormality input from the ECM (GI signal error)	

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (ENGINE CONTROL SYSTEM)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
Engine control system DTCs are not output.	A
Engine control system DTCs are output.	B

HINT:

If P0A0F-204, 205, 206, 524, or 525 is output even though the ECM has not detected a malfunction, there is a malfunction in the Power management control ECU.

(e) Turn the power switch off.

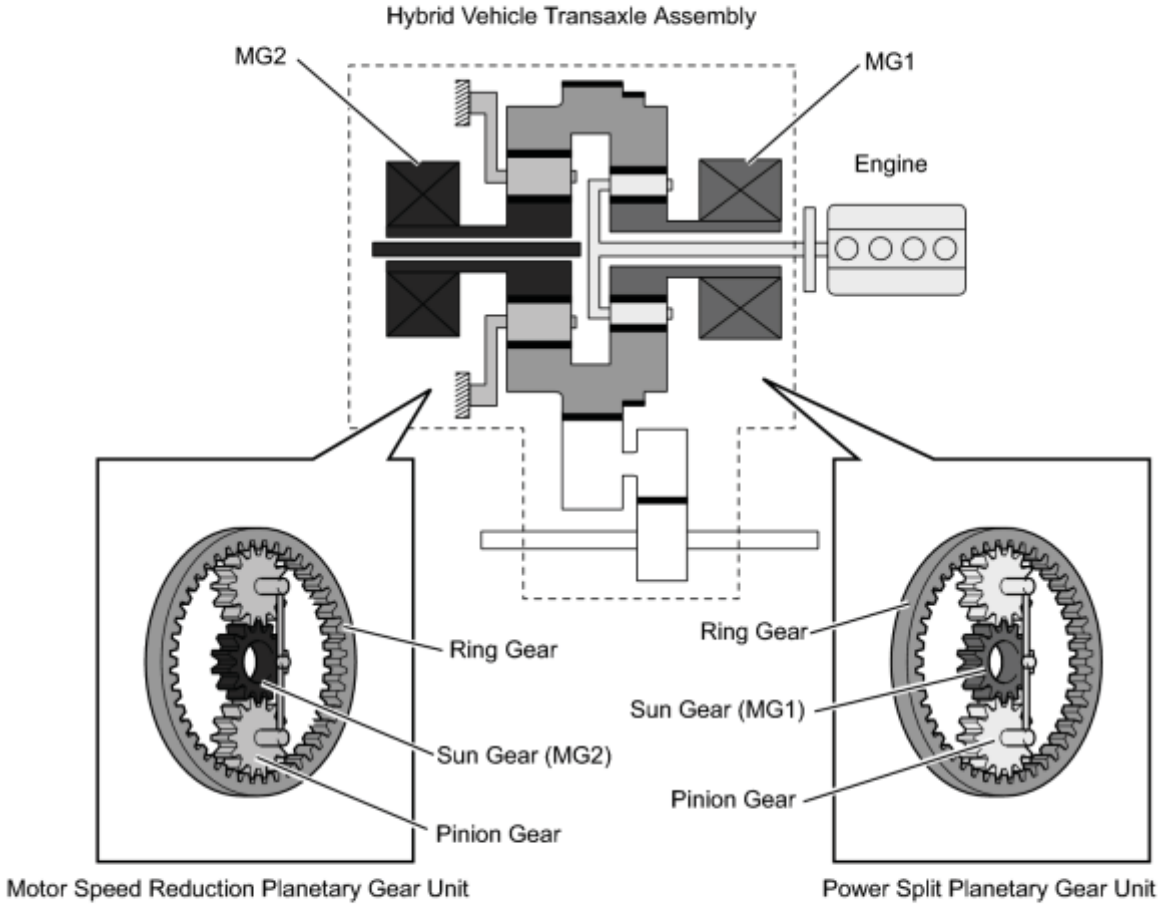
B ▶ GO TO DTC CHART
A ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

DTC	P0A0F-238	Engine Failed to Start

DESCRIPTION

If the power management control ECU (HV CPU) detects that the engine or transmission gear has seized, the power management control ECU (HV CPU) will perform fail-safe control. Also, if a substance or object is preventing the engine or transmission internal components from rotating, the power management control ECU (HV CPU) will perform fail-safe control.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A0F	238	Engine does not start even though it is being cranked (transaxle input malfunction [engine system])	• Hybrid vehicle transaxle assembly • Transmission input damper assembly • Power management control ECU • Engine



INSPECTION PROCEDURE

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A0F-238 only is output.	A
P0A1D (hybrid vehicle control ECU circuit malfunction) is output.	B

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CRANKSHAFT PULLEY REVOLUTION (PARK (P) SELECTED)

(a) Push the P position switch.

(b) Lift up the vehicle.

(c) Turn the crankshaft pulley using hand tools to check if the crankshaft can rotate smoothly.

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.

NOTICE:

Engine compression causes resistance when turning the crankshaft pulley. Check if the crankshaft rotates smoothly (or if it is locked) by manually applying sufficient torque to turn the crankshaft pulley. The torque required to turn the crankshaft pulley should be the same as for a known good vehicle of the same type.

OK:

The crankshaft rotates smoothly.

NG ▶ CHECK CRANKSHAFT PULLEY REVOLUTION (SELECTOR LEVER IN N)

OK ▼

3.	CLEAR DTC (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read and record the DTCs and freeze frame data.

(e) Clear DTCs and freeze frame data.

(f) Turn the power switch off.

NEXT

4.	CHECK ENGINE RACING

(a) Connect the Techstream to the DLC3.

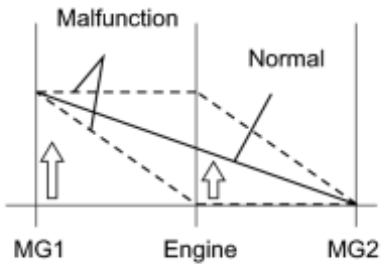
(b) Turn the power switch on (IG).

(c) Push the P position switch.

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Generator (MG1) Rev, Engine Revolution.

(e) Read the Data List.

(f) Turn the power switch on (READY).



(g) While the READY indicator is on, fully depress the accelerator pedal for 10 seconds.

OK:

Generator (MG1) Rev increases to approximately 3.6 times that of Engine Revolution.

HINT:

Refer to the graph for Data List confirmation of "Generator (MG1) Rev" and " Engine Revolution".

Data List	ENGINE REV	MG1 REV
Reference Value	Approximately 1000 rpm	Approximately 3600 rpm
	Approximately 1500 rpm	Approximately 5400 rpm
	Approximately 2500 rpm	Approximately 9000 rpm

(h) Turn the power switch off.

NG ▶ REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

OK

5.	CHECK CREEP MOVEMENT

(a) Turn the power switch on (READY).

(b) Depress the brake pedal, move the selector lever to D, and release the brake pedal.

OK:

The wheels turn (the vehicle creeps forward).

(c) Turn the power switch off.

NG ▶ REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

OK ▼

6.	INSPECT ENGINE SPEED

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor (MG2) Revolution, Generator (MG1) Rev, Engine Revolution.

(d) Read the Data List.

(e) Fully depress the accelerator pedal to accelerate the vehicle from a stop.

NOTICE:

Perform this test only in an appropriate safe location, in accordance with all local laws.

OK:

The difference between Engine Revolution and 0.28 X Generator (MG1) Rev + 0.27 X Motor (MG2) Revolution is 500 rpm or more and it is maintained for 1 second.

(f) Turn the power switch off.

NG ▶ REPLACE TRANSMISSION INPUT DAMPER ASSEMBLY

OK ▼

7.	SIMULATION TEST

(a) Perform steps 2 through 6 again.

OK:

The problem symptom is not reproduced.

NG ▶ REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

8.	CHECK CRANKSHAFT PULLEY REVOLUTION (SELECTOR LEVER IN N)

(a) Lift up the vehicle.

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

(c) Move the selector lever to N.

(d) Turn the crankshaft pulley using hand tools to check if the crankshaft can rotate smoothly.

CAUTION:

Do not turn the power switch on (READY) while performing this inspection. Be sure to turn the power switch on (IG) before performing this inspection, to prevent the engine from starting.

NOTICE:

Engine compression causes resistance when turning the crankshaft pulley. Check if the crankshaft rotates smoothly (or if it is locked) by manually applying sufficient torque to turn the crankshaft pulley. The torque required to turn the crankshaft pulley should be the same as for a known good vehicle of the same type.

OK:

The crankshaft rotates smoothly.

NG ▶ REPAIR OR REPLACE ENGINE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

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

DESCRIPTION

Refer to the description for DTC P0A08-264 INFO.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A10	263	Short to +B in the hybrid vehicle converter (DC/DC converter) NODD signal line	• Wire harness or connector • Inverter with converter assembly • Power management control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A08-264 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK POWER MANAGEMENT CONTROL ECU (NODD) INFO

NG ▶ CHECK POWER MANAGEMENT CONTROL ECU (NODD)

OK ▼

2.	CLEAR DTC INFO

NEXT

3.	CHECK DTC OUTPUT (HV)

(a) Turn the power switch on (READY).

(b) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(c) Check if DTCs are output.

Result:

Result	Proceed to
DTC P0A10-263 is not output.	A
DTC P0A10-263 is output again.	B

(d) Turn the power switch off.

B REPLACE POWER MANAGEMENT CONTROL ECU

A

4.	CHECH FOR INTERMITTENT PROBLEMS INFO

NG REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK **REPLACE POWER MANAGEMENT CONTROL ECU**

5.	CHECK POWER MANAGEMENT CONTROL ECU (NODD)

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.

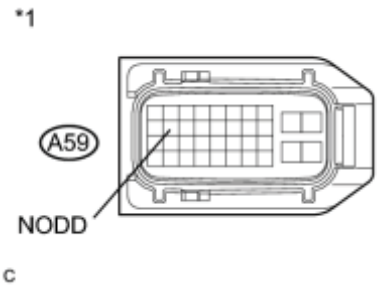
(b) Disconnect connector A59 from the inverter with converter assembly.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified



		Condition
A59-12 (NODD) - Body ground	Power switch on (IG)	Below 1 V

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

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.

(e) Turn the power switch off.

(f) Connect the inverter with converter assembly connector.

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER MANAGEMENT CONTROL ECU)

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

6.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER MANAGEMENT CONTROL ECU)

(a) Disconnect connector A59 from the inverter with converter assembly.

(b) Disconnect connector A21 from the power management control ECU.

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

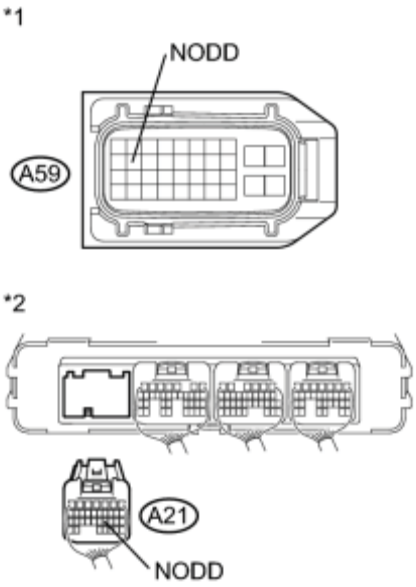
(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A59-12 (NODD) or A21-21 (NODD) - Body ground	Power switch on (IG)	Below 1 V

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)



*2	Rear view of wire harness connector (to Power Management Control ECU)

NOTICE:

Turning the power switch on (IG) with the inverter with converter assembly connector and the power management control ECU connectors disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the power switch off.

(f) Connect the inverter with converter assembly connector.

(g) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

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

DESCRIPTION

Refer to the description for DTC P0A09-591 INFO.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A10	592	Hybrid vehicle converter (DC/DC converter) voltage switching (VLO) signal circuit malfunction (short to +B)	• Wire harness or connector • Inverter with converter assembly • Power management control ECU

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A09-591 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK POWER MANAGEMENT CONTROL ECU (CHECK WAVEFORM) INFO

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER MANAGEMENT CONTROL ECU)

OK

2.	CLEAR DTC INFO

NEXT

3.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
DTC P0A10-592 is not output.	A
DTC P0A10-592 is output again.	B

(e) Turn the power switch off.

B REPLACE POWER MANAGEMENT CONTROL ECU

A

4.	CHECK FOR INTERMITTENT PROBLEMS

(a) Check for intermittent problems INFO.

NG REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK **REPLACE POWER MANAGEMENT CONTROL ECU**

5.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER - POWER MANAGEMENT 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 connector A59 from the inverter with converter assembly.

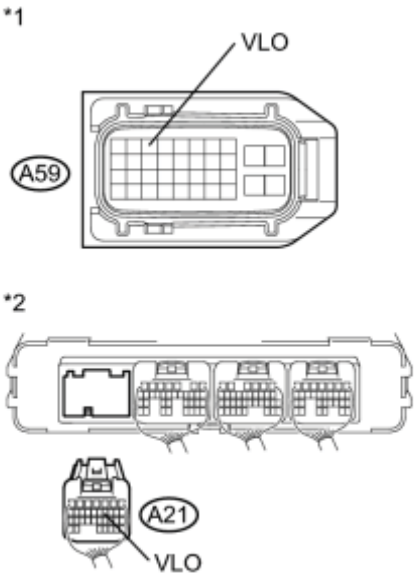
(c) Disconnect connector A21 from the power management control ECU.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A59-3 (VLO) or A21-11 (VLO) - Body ground	Power switch on (IG)	Below 1 V



Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Rear view of wire harness connector (to Power Management Control ECU)

NOTICE:

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

(f) Turn the power switch off.

(g) Connect the inverter with converter assembly connector.

(h) Connect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

▼

6.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT

▼

7.	CLEAR DTC INFO

NEXT

8.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
DTC P0A10-592 is not output.	A
DTC P0A10-592 is output again.	B

(e) Turn the power switch off.

B REPLACE INVERTER WITH CONVERTER ASSEMBLY
A **COMPLETED**

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

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors its internal operation and it will set DTCs when it detects malfunctions. If any of the following DTCs are output, replace the inverter with converter assembly.

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

MONITOR DESCRIPTION

The MG ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In one of those tests, 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 power management control ECU (HV CPU) 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 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 assembly (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	-

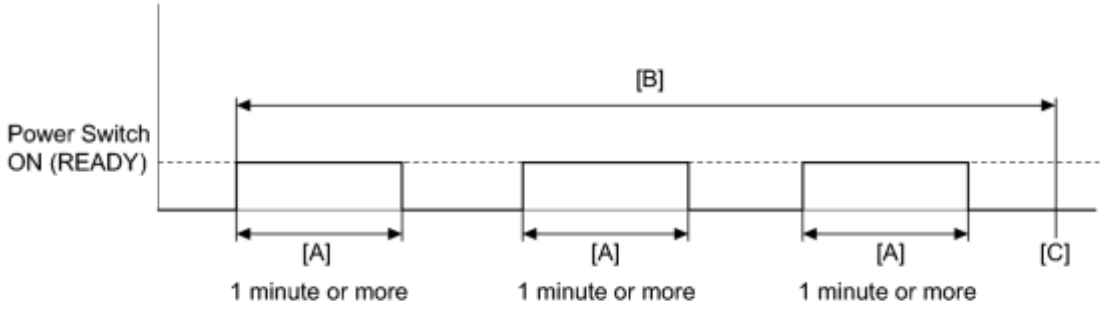
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1A (INF 151/155/156/658/659/791) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.

3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after 1 minute or more, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly 

.

NEXT **COMPLETED**

DTC	P0A1A-166	Generator Control Module

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors its internal operation and it will set DTCs when it detects malfunctions. If any of the following DTCs are output, replace the inverter with converter assembly.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1A	166	R/D converter NM stop error	Inverter with converter assembly

MONITOR DESCRIPTION

The MG ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In 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 power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1A (INF 166): RD converter NM signal stop abnormality
Required sensors / components	Inverter with converter assembly (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	-

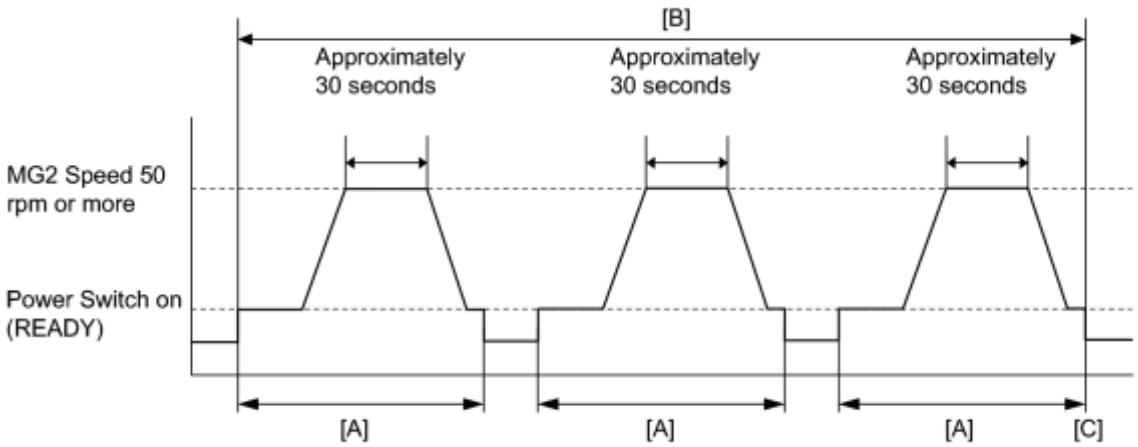
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU	DTC P0A1A (INF 166) is not detected

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and allow MG2 to rotate at 50 rpm or more for 30 seconds, then turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

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 the following malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1A	200	The difference between the resolver angle for control and estimated resolver angle exceeds the allowable value.	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector
	792	Resolver REF signal cycle error	
	793	Resolver REF signal oscillation stop error	

MONITOR DESCRIPTION

The MG ECU performs many diagnostic tests to verify proper operation of internal ECU systems. In 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 power management control ECU (HV CPU) 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 stop)
Required sensors / components	Inverter with converter assembly (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	-

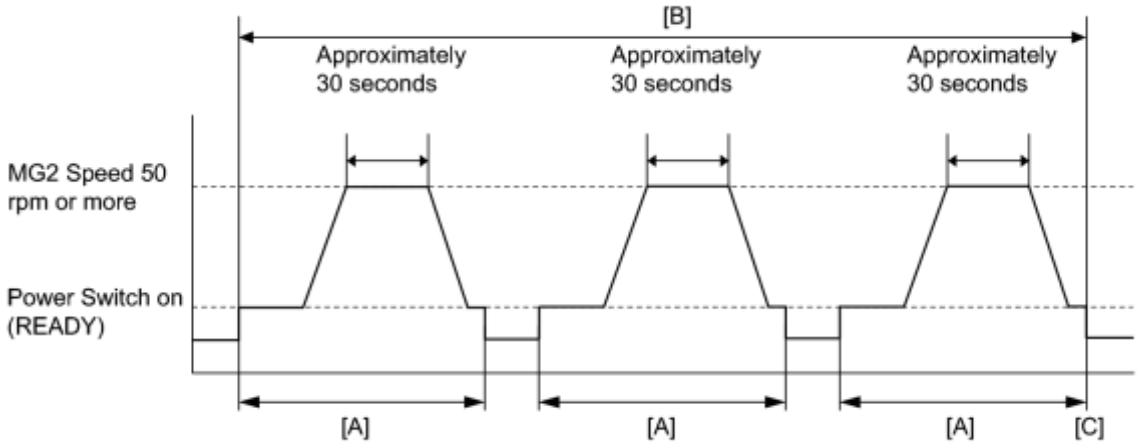
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1A (INF 200/792/793) is not detected

CONFIRMATION DRIVING PATTERN

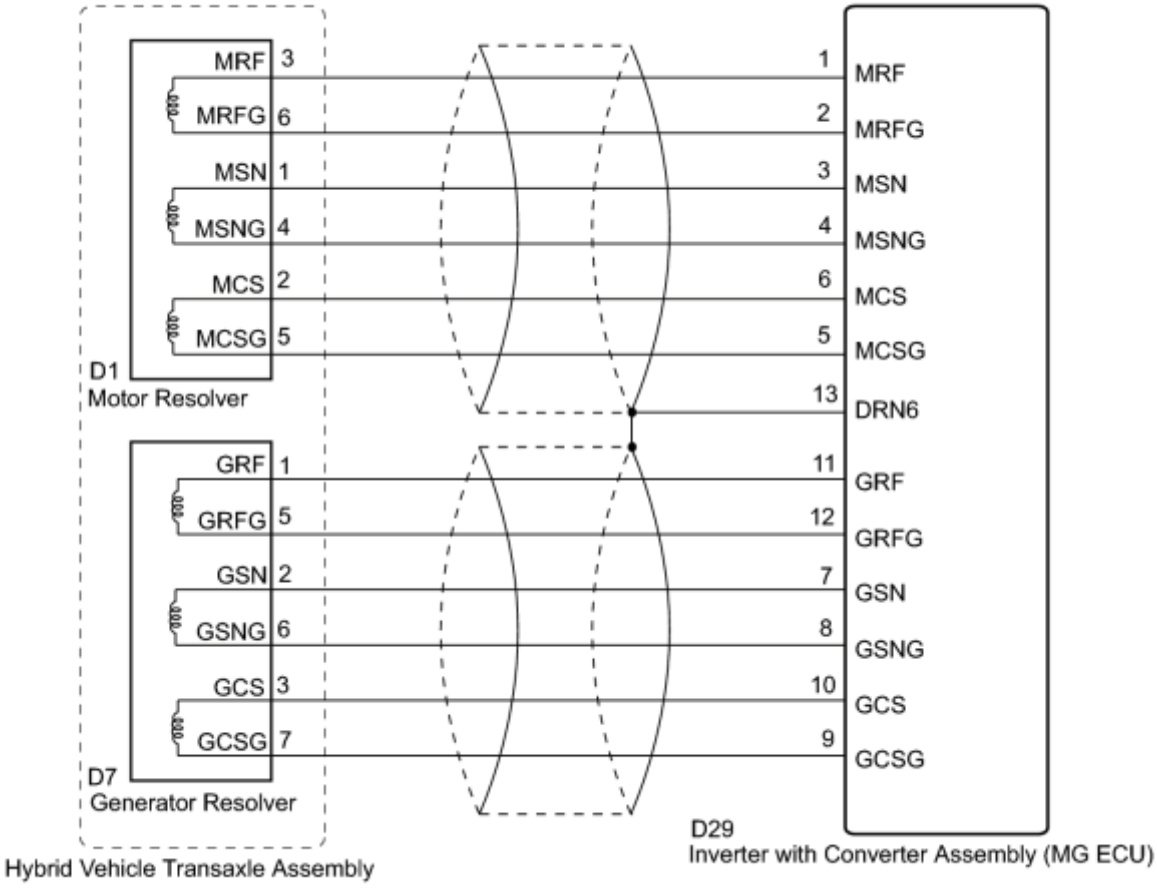


1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and allow MG2 to rotate at 50 rpm or more for 30 seconds, then turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A1A-200, 792, or 793 only is output.	A
Any of the following DTCs are also output.	B

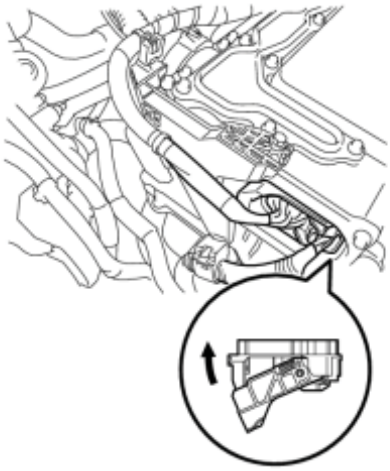
DTC No.	Relevant Diagnosis
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range / Performance
P0A4D-255	Generator Position Sensor Circuit Low

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

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



C

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.

NOTICE:

Before disconnecting the connector, confirm that it is properly connected by checking that the locking claws are engaged and that the connector does not pull out.

(b) Check the connection of the low voltage connector of the inverter with converter assembly.

OK:

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

HINT:

When connecting the connector, insert it with the locking lever in the raised position. Rotate the lever downward and make sure that the connector is pulled into its socket. When the locking lever is in its fully closed position, a click will be heard as its locking claws engage. After the click is heard, pull up on the connector to confirm that it is properly connected.

NG ▶ CONNECT SECURELY

OK ▼

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

CAUTION:

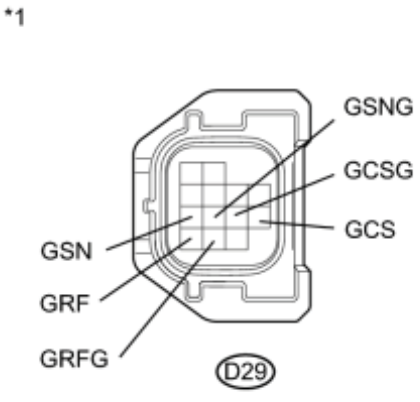
Be sure to wear insulated gloves.

(a) Disconnect the low voltage connector D29 from the inverter with converter assembly.

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

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

Standard Voltage:



Tester Connection	Switch Condition	Specified Condition
D29-11 (GRF) - Body ground	Power switch on (IG)	Below 1 V
D29-12 (GRFG) - Body ground	Power switch on (IG)	Below 1 V
D29-7 (GSN) - Body ground	Power switch on (IG)	Below 1 V
D29-8 (GSNG) - Body ground	Power switch on (IG)	Below 1 V
D29-10 (GCS) - Body ground	Power switch on (IG)	Below 1 V
D29-9 (GCSG) - Body	Power switch on	Below 1 V

ground	(IG)	

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

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.

(d) Turn the power switch off.

(e) Connect the low voltage connector from the inverter with converter assembly.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

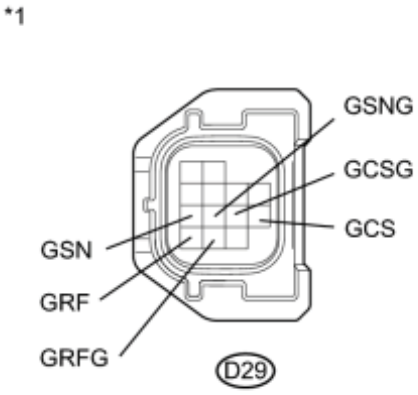
OK ▼

4.	CHECK GENERATOR RESOLVER

(a) Disconnect the low voltage connector D29 from the inverter with converter assembly.

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

Standard Resistance (Check for Open):



Tester Connection	Switch Condition	Specified Condition
D29-11 (GRF) - D29-12 (GRFG)	Power switch off	9.5 to 15.5 Ω
D29-7 (GSN) - D29-8 (GSNG)	Power switch off	15 to 27 Ω
D29-10 (GCS) - D29-9 (GCSG)	Power switch off	14 to 26 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D29-11 (GRF) or D29-12 (GRFG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D29-7 (GSN) or D29-8 (GSNG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D29-10 (GCS) or D29-9 (GCSG) -	Power switch	10 kΩ or

Body ground and other terminals	off	higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

(c) Connect the inverter with converter assembly connector.

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK

▼

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

CAUTION:

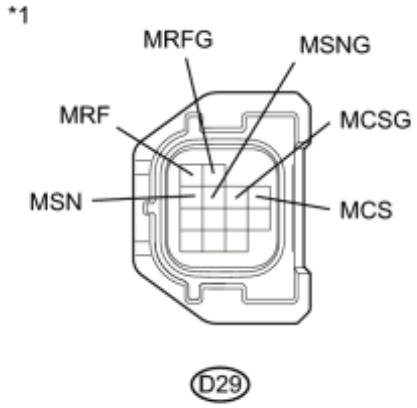
Be sure to wear insulated gloves.

(a) Disconnect the low voltage connector D29 from the inverter with converter assembly.

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

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

Standard Voltage:



Tester Connection	Switch Condition	Specified Condition
D29-1 (MRF) - Body ground	Power switch on (IG)	Below 1 V
D29-2 (MRFG) - Body ground	Power switch on (IG)	Below 1 V
D29-3 (MSN) - Body ground	Power switch on (IG)	Below 1 V
D29-4 (MSNG) - Body ground	Power switch on (IG)	Below 1 V
D29-6 (MCS) - Body ground	Power switch on (IG)	Below 1 V
D29-5 (MCSG) - Body ground	Power switch on (IG)	Below 1 V

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

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.

(d) Turn the power switch off.

(e) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

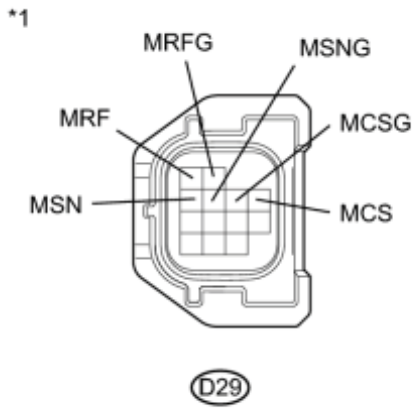
6.	CHECK MOTOR RESOLVER

(a) Disconnect the low voltage connector D29 from the inverter with converter assembly.

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

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
D29-1 (MRF) - D29-2 (MRFG)	Power switch off	9.5 to 15.5 Ω
D29-3 (MSN) - D29-4 (MSNG)	Power switch off	15 to 27 Ω
D29-6 (MCS) - D29-5 (MCSG)	Power switch off	14 to 26 Ω



Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D29-1 (MRF) or D29-2 (MRFG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D29-3 (MSN) or D29-4 (MSNG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D29-6 (MCS) or D29-5 (MCSG) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

(c) Connect the inverter with converter assembly connector.

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

7.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

H

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

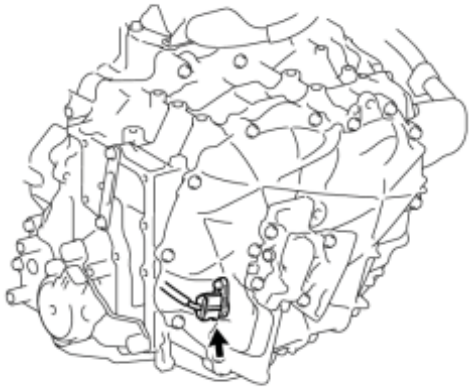
OK:

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

NG ▶ CONNECT SECURELY

OK ▼

8.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)



H

(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 ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

9.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

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

H

OK:

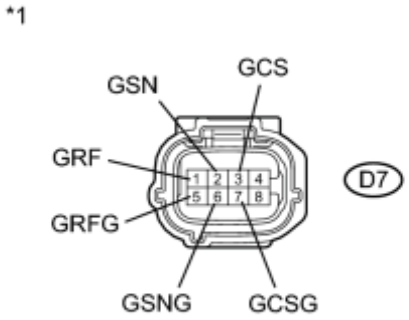
The connector is connected securely and there are no contact problems.

NG ▶ CONNECT SECURELY

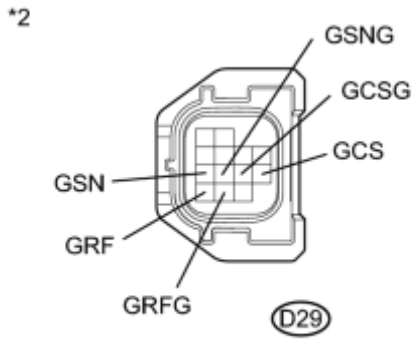
OK ▼

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

(a) Disconnect the low voltage connector D29 from the inverter with converter assembly.



(b) Disconnect the generator resolver connector.



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

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
D7-1 (GRF) - D29-11 (GRF)	Power switch off	Below 1 Ω
D7-5 (GRFG) - D29-12 (GRFG)	Power switch off	Below 1 Ω
D7-2 (GSN) - D29-7 (GSN)	Power switch off	Below 1 Ω
D7-6 (GSNG) - D29-8 (GSNG)	Power switch off	Below 1 Ω
D7-3 (GCS) - D29-10 (GCS)	Power switch off	Below 1 Ω
D7-7 (GCSG) - D29-9 (GCSG)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D7-1 (GRF) or D29-11 (GRF) - Body ground and other terminals	Power switch off	10 kΩ or higher
D7-5 (GRFG) or D29-12 (GRFG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D7-2 (GSN) or D29-7 (GSN) - Body ground and other terminals	Power switch off	10 kΩ or higher
D7-6 (GSNG) or D29-8 (GSNG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D7-3 (GCS) or D29-10 (GCS) - Body ground and other terminals	Power switch off	10 kΩ or higher
D7-7 (GCSG) or D29-9 (GCSG) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Generator Resolver)
*2	Front view of wire harness connector (to Inverter with Converter Assembly)

HINT:

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

(d) Connect the generator resolver connector.

(e) Connect the inverter with converter assembly connector.

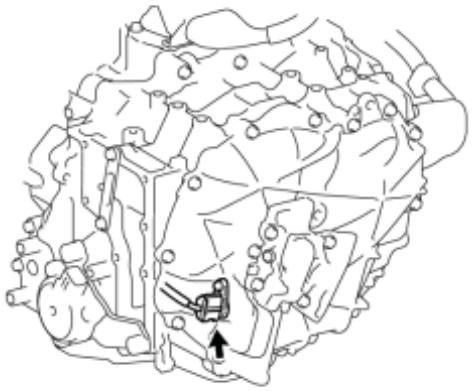
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

11.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

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

OK:

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



H

NG ▶ CONNECT SECURELY

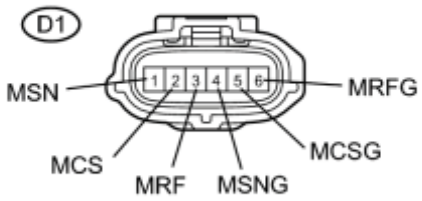
OK

▼

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

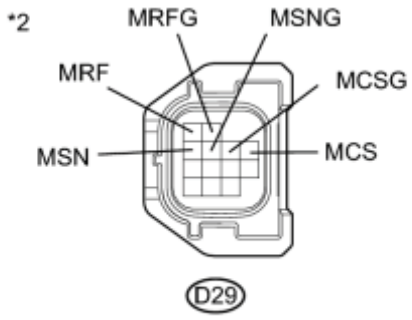
(a) Disconnect the low voltage connector D29 from the inverter with converter assembly.

*1



(b) Disconnect the motor resolver connector.

*2



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

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
D1-3 (MRF) - D29-1 (MRF)	Power switch off	Below 1 Ω
D1-6 (MRFG) - D29-2 (MRFG)	Power switch off	Below 1 Ω
D1-1 (MSN) - D29-3 (MSN)	Power switch off	Below 1 Ω
D1-4 (MSNG) - D29-4 (MSNG)	Power switch off	Below 1 Ω
D1-2 (MCS) - D29-6 (MCS)	Power switch off	Below 1 Ω
D1-5 (MCSG) - D29-5 (MCSG)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D1-3 (MRF) or D29-1 (MRF) - Body ground and other terminals	Power switch off	10 kΩ or higher
D1-6 (MRFG) or D29-2 (MRFG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D1-1 (MSN) or D29-3 (MSN) - Body ground and other terminals	Power switch off	10 kΩ or higher
D1-4 (MSNG) or D29-4 (MSNG) - Body ground and other terminals	Power switch off	10 kΩ or higher
D1-2 (MCS) or D29-6 (MCS) - Body ground and other terminals	Power switch off	10 kΩ or higher
D1-5 (MCSG) or D29-5 (MCSG) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Motor Resolver)
*2	Front view of wire harness connector (to Inverter with Converter Assembly)

HINT:

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

(d) Connect the motor resolver connector.

(e) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

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-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

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors its internal operation and it will set DTCs when it detects malfunctions. If any of the following DTCs are output, replace the inverter with converter assembly.

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

MONITOR DESCRIPTION

The MG ECU (in the inverter with converter assembly) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of those tests, the MG ECU checks the result of the motor CPU self-test. If the MG ECU detects a "Fail" from the motor CPU self-test, it will conclude that there is an internal

malfunction in the motor CPU. The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1B (INF 163): Motor CPU power malfunction (15V) P0A1B (INF 164): Motor CPU power malfunction (-5V) P0A1B (INF 192): A/D malfunction (2 MG CPU) P0A1B (INF 193): RAM and ROM destruction) P0A1B (INF 511): Motor CPU power malfunction (2.5V) P0A1B (INF 512): Motor CPU power malfunction (5VD) P0A1B (INF 661): 2 MG CPU communication malfunction (2 MG CPU to 1 MG CPU) P0A1B (INF 786): MG CPU ALU malfunction P0A1B (INF 794): 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

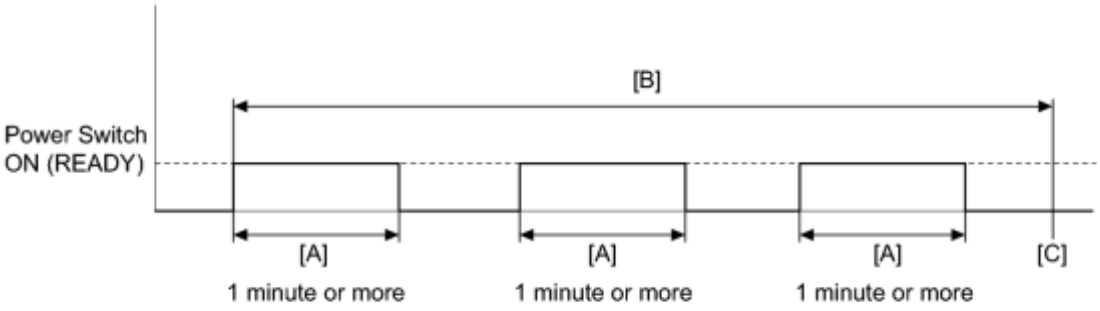
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1B (INF 163/164/192/193/511/512/661/786/794) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after 1 minute or more, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT **COMPLETED**

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.

HINT:

The term "drive motor A" indicates MG2.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1B	168	The difference between the resolver angle for control and estimated resolver angle exceeds the allowable value.	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector
	795	Resolver REF signal cycle error	
	796	Resolver REF signal oscillation stop error	

MONITOR DESCRIPTION

The MG ECU (in the inverter with converter assembly) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of those tests, 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 power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

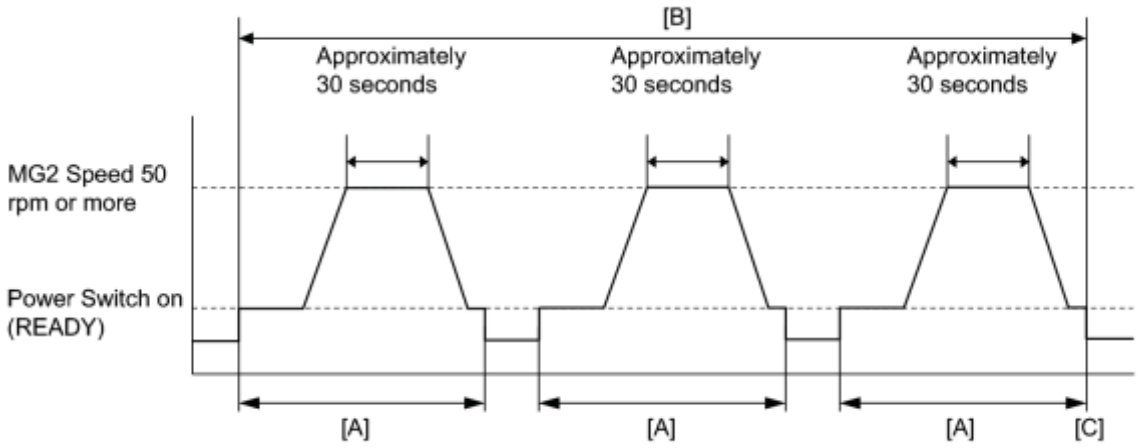
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1B (INF 168/795/796) is not detected

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and allow MG2 to rotate at 50 rpm or more for 30 seconds, then turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A1B-168 , 795 or 796 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

4.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

6.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

7.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

8.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

9.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR
OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

11.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY
OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR
OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A1B-198	Drive Motor "A" Control Module

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors its internal operation and it will set DTCs when it detects malfunctions. If any of the following DTCs are output, replace the inverter with converter assembly.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1B	198	R/D converter NM stop error	Inverter with converter assembly

MONITOR DESCRIPTION

The MG ECU (in the inverter with converter assembly) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of those tests, 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 power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1B (INF 198): RD converter NM signal stop 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	-

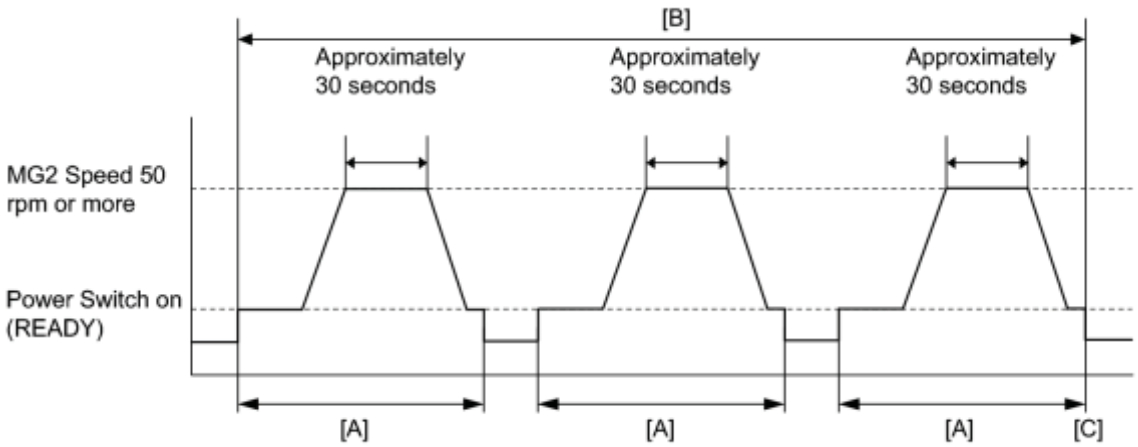
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1B (INF 198) is not detected

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and allow MG2 to rotate at 50 rpm or more for 30 seconds, then turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT **COMPLETED**

DTC	P0A1D-144	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	144	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) performs a self-test. If the power management control ECU (HV CPU) detects an internal problem during this self-test, it will conclude that there is an internal malfunction. The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 144): Primary check malfunction
Required sensors / components	Power management control ECU (HV CPU)
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	-

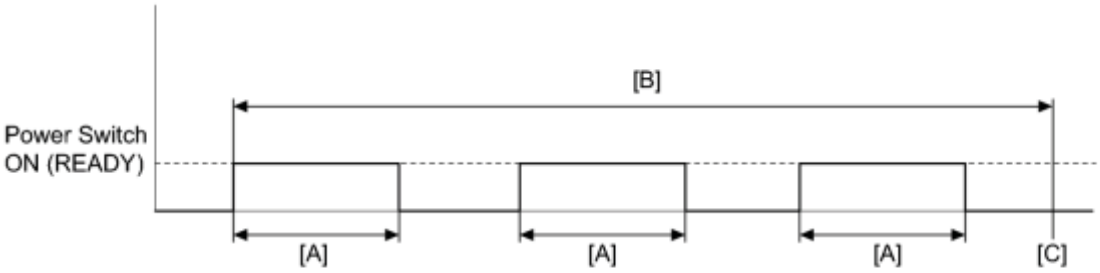
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 144) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT **COMPLETED**

DTC	P0A1D-148	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	148	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) performs a self-test. If the power management control ECU (HV CPU) detects an internal problem during this self-test, it will conclude that there is an internal malfunction. The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 148): HV CPU malfunction
Required sensors / components	Power management control ECU (HV CPU)
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	-

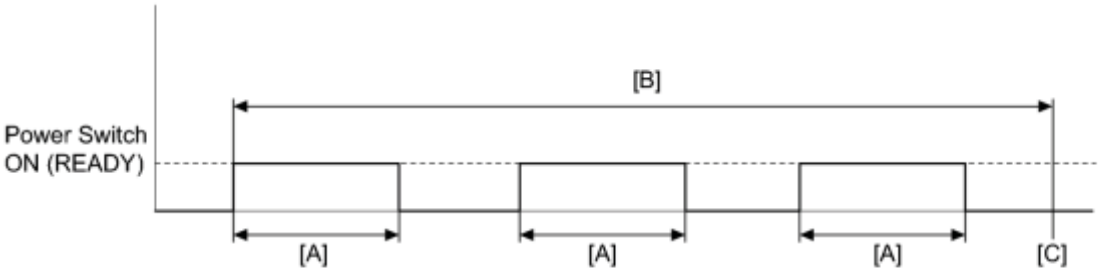
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 148) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

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 power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

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

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) checks the communication bus off count and the message register of the CAN (Controller Area Network) controller. If the power management control ECU (HV CPU) detects an error in the communication bus off count or message register, it will conclude that there is a malfunction in the power management control ECU (HV CPU). The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 162/821/822/823): Lost communication with ECM/PCM
Required sensors / components	Power management control ECU (HV CPU)
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	-

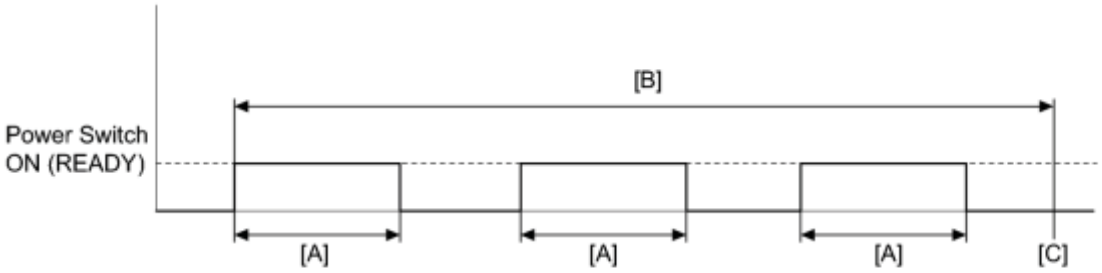
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 162/821/822/823) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT **COMPLETED**

DTC	P0A1D-187	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	187	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs diagnostic tests to verify proper operation of internal and external ECU systems. In one of these tests, the power management control ECU (HV CPU) monitors specific RAM circuits of the power management control ECU (HV CPU). If the power management control ECU (HV CPU) detects an error in the RAM circuits, it will conclude that there is an internal malfunction in the power management control ECU (HV CPU). The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 187): Specific random access memory destruction
Required sensors / components	Power management control ECU (HV CPU)
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	-

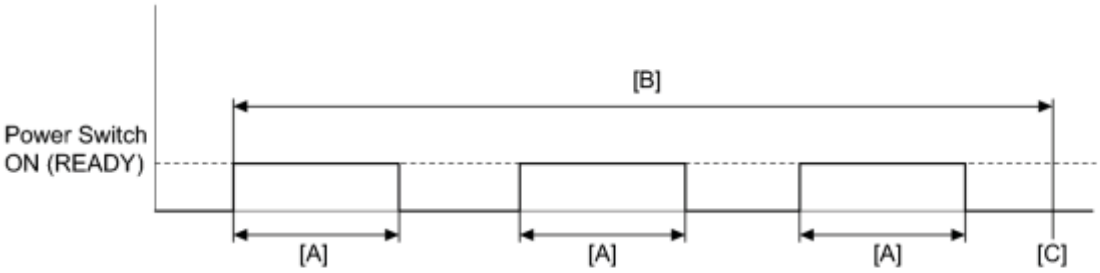
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 187) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

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-787	Hybrid Powertrain Control Module
DTC	P0A1D-818	Hybrid Powertrain Control Module

DESCRIPTION

The power management control ECU (HV CPU) monitors its internal operation, it will set DTCs and perform fail-safe control when it detects the following malfunctions. If any of the following DTCs are output, replace the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A1D	721	ECU internal error	Power management control ECU
P0A1D	722	ECU internal error	Power management control ECU
P0A1D	723	ECU internal error	Power management control ECU
P0A1D	787	ECU internal error	Power management control ECU
P0A1D	818	ECU internal error	Power management control ECU

MONITOR DESCRIPTION

The power management control ECU (HV CPU) performs many diagnostic tests to verify proper operation of internal ECU systems. In one of these tests, the power management control ECU (HV CPU) checks the result of the ECM self-test. If the power management control ECU (HV CPU) detects a "Fail" from the ECM self-test, it will conclude that there is an internal malfunction in the ECM. The power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A1D (INF 721/722/723/787/818): Monitor CPU malfunction
Required sensors / components	Power management control ECU (HV CPU)
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	-

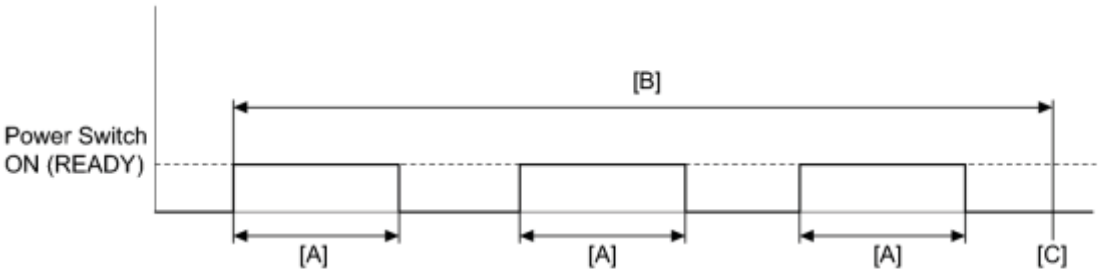
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A1D (INF 721/722/723/787/818) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE POWER MANAGEMENT CONTROL ECU

(a) Replace the power management control ECU INFO.

NEXT **COMPLETED**

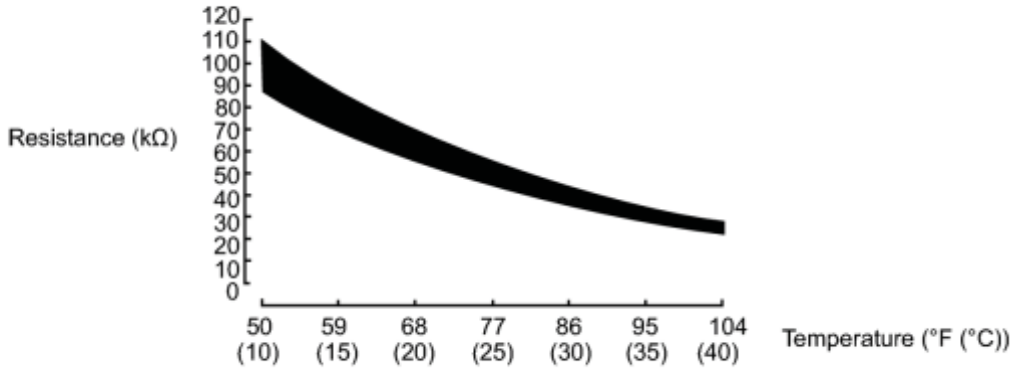
DTC	P0A2B-250	Drive Motor "A" Temperature Sensor Circuit Range / Performance
DTC	P0A2E-248	Drive Motor "A" Temperature Sensor Circuit Intermittent

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 higher the thermistor resistance. Conversely, the higher the temperature, the lower the resistance.

HINT:

The term "drive motor A" indicates MG2.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A2B	250	Motor temperature sensor output does not increase under conditions in which the value should increase, or output does not decrease under conditions in which the value should decrease.	Hybrid vehicle transaxle assembly (Motor temperature sensor)
P0A2E	248	Unusual sudden change in motor temperature sensor output occurs and the condition continues, or unusual sudden change in motor temperature sensor output occurs repeatedly.	

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

HINT:

The motor temperature sensor is not available separately. If it requires replacement, replace the 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

Refer to the description for DTC P0A2B-250 INFO.

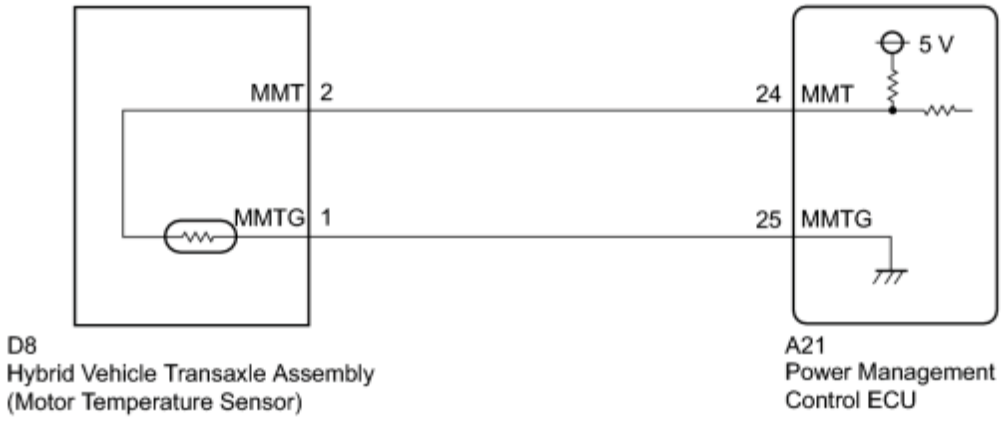
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A2C	247	Short or short to GND in the motor temperature sensor circuit	• Wire harness or connector • Power management control ECU • Hybrid vehicle transaxle assembly (Motor temperature sensor)
P0A2D	249	Open or short to +B in the motor temperature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

HINT:

After confirming that DTC P0A2C-247 or P0A2D-249 is output, use the Techstream to check "Motor Temp No1" in the power management control ECU Data List.

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

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

2.	READ VALUE USING TECHSTREAM (MOTOR TEMP NO1)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(d) Read the Data List.

Result:

Result	Proceed to
-58°F (-50°C)	A
401°F (205°C)	B
Same as actual temperature	C

(e) Turn the power switch off.

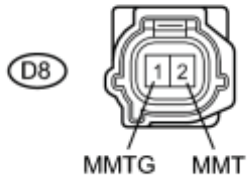
C CHECK FOR INTERMITTENT PROBLEMS
B READ VALUE USING TECHSTREAM (CHECK FOR SHORT)
A

3.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN)

H

(a) Disconnect the motor temperature sensor connector.

*1



H

(b) Connect terminals 2 (MMT) and 1 (MMTG) of vehicle side connector D8 of the motor temperature sensor.

(c) Connect the Techstream to the DLC3.

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

(e) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(f) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No1	Terminals MMT and MMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Front view of wire harness connector (to Motor Temperature Sensor)

HINT:

The motor temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(g) Turn the power switch off.

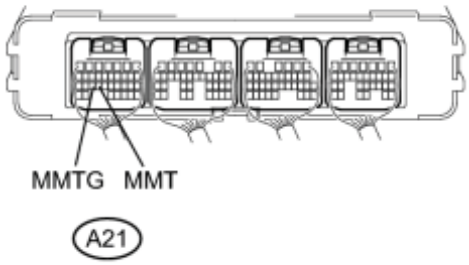
(h) Connect the motor temperature sensor connector.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR TEMPERATURE SENSOR)

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

4.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR TEMPERATURE SENSOR)

*1



P

(a) Connect terminals 24 (MMT) and 25 (MMTG) of connector A21 of the power management control ECU.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No1	Terminals MMT and MMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

(f) Turn the power switch off.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

5.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT)

(a) Disconnect the motor temperature sensor connector.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No1.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No1	Power switch on (IG)	-58°F (-50°C)

HINT:

The motor temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(f) Turn the power switch off.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR TEMPERATURE SENSOR)
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

6.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - MOTOR

	TEMPERATURE SENSOR)

(a) Disconnect the motor temperature sensor connector.

(b) Disconnect connector A21 from the power management control ECU.

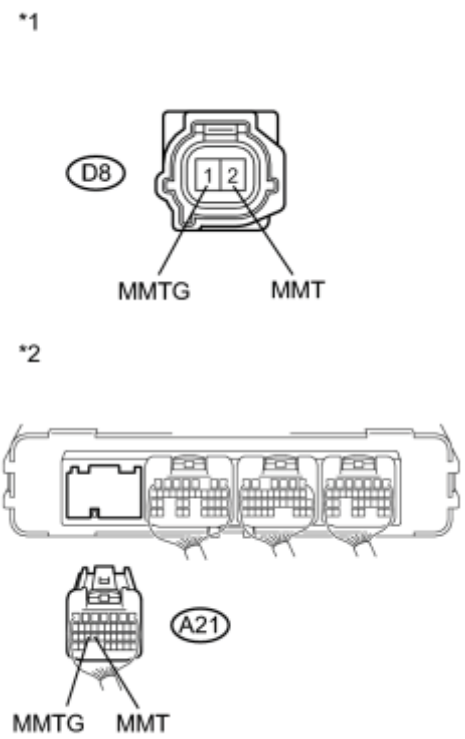
(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
D8-2 (MMT) - A21-24 (MMT)	Power switch off	Below 1 Ω
D8-1 (MMTG) - A21-25 (MMTG)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D8-2 (MMT) or A21-24 (MMT) - Body ground and other terminals	Power switch off	10 kΩ or higher
D8-1 (MMTG) or A21-25 (MMTG) - Body ground and other terminals	Power switch off	10 kΩ or higher



Text in Illustration

*1	Front view of wire harness connector (to Motor Temperature Sensor)
*2	Rear view of wire harness connector (to Power Management Control ECU)

(d) Connect the power management control ECU connector.

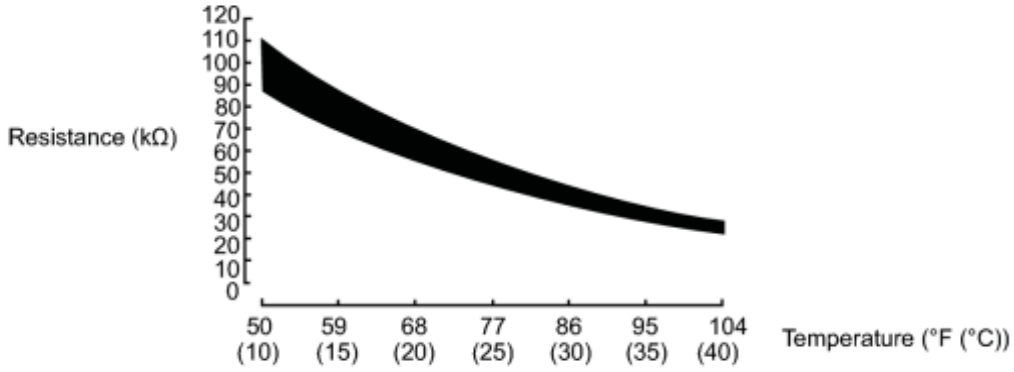
(e) Connect the motor temperature sensor connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

DTC	P0A37-260	Generator Temperature Sensor Circuit Range / Performance
DTC	P0A3A-258	Generator Temperature Sensor Circuit Intermittent

DESCRIPTION

The resistance of the thermistor built into the generator temperature sensor changes in accordance with changes in MG1 temperature. The lower the MG1 temperature, the higher the thermistor resistance. Conversely, the higher the temperature, the lower the resistance.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A37	260	Generator temperature sensor output does not increase in which the value should increase, or output does not decrease under conditions in which the value should decrease.	Hybrid vehicle transaxle assembly (Generator temperature sensor)
P0A3A	258	Unusual sudden change in generator temperature sensor output occurs and the condition continues, or unusual sudden change in generator temperature sensor output occurs repeatedly.	

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

HINT:

The generator temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

DTC	P0A38-257	Generator Temperature Sensor Circuit Low
DTC	P0A39-259	Generator Temperature Sensor Circuit High

DESCRIPTION

Refer to the description for DTC P0A37-260 INFO.

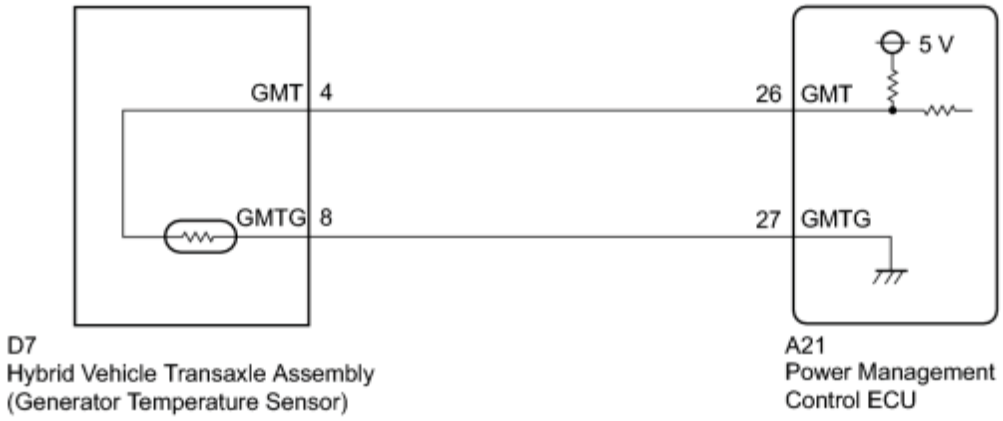
DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A38	257	Short to GND in the generator temperature sensor circuit	• Wire harness or connector • Power management control ECU • Hybrid vehicle transaxle assembly (Generator temperature sensor)
P0A39	259	Open or short to +B in the generator temperature sensor circuit	

HINT:

After confirming that DTC P0A38-257 or P0A39-259 is output, use the Techstream to check "Motor Temp No2" in the power management control ECU Data List.

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

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

2.	READ VALUE USING TECHSTREAM (MOTOR TEMP NO2)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(d) Read the Data List.

Result:

Result	Proceed to
-58°F (-50°C)	A
401°F (205°C)	B
Same as actual temperature	C

(e) Turn the power switch off.

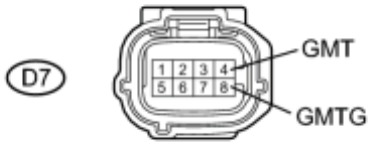
C CHECK FOR INTERMITTENT PROBLEMS
B READ VALUE USING TECHSTREAM (CHECK FOR SHORT)
A

3.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN)

H

(a) Disconnect the generator temperature sensor connector.

*1



H

(b) Connect terminals 4 (GMT) and 8 (GMTG) of vehicle side connector D7 of the generator temperature sensor.

(c) Connect the Techstream to the DLC3.

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

(e) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(f) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No2	Terminals GMT and GMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Front view of wire harness connector (to Generator Temperature Sensor)

HINT:

The generator temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(g) Turn the power switch off.

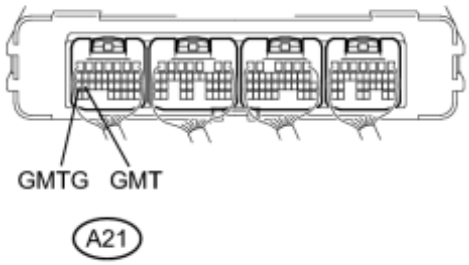
(h) Connect the generator temperature sensor connector.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - GENERATOR TEMPERATURE SENSOR)

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

4.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - GENERATOR TEMPERATURE SENSOR)

*1



P

(a) Connect terminals 26 (GMT) and 27 (GMTG) of connector A21 of the power management control ECU.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No2	Terminals GMT and GMTG connected. Power switch on (IG)	401°F (205°C)

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

(f) Turn the power switch off.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

5.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT)

(a) Disconnect the generator temperature sensor connector.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / Motor Temp No2.

(e) Read the Data List.

OK:

Tester Display	Condition	Specified Condition
Motor Temp No2	Power switch on (IG)	-58°F (-50°C)

HINT:

The generator temperature sensor is not available separately. If it requires replacement, replace the hybrid vehicle transaxle assembly.

(f) Turn the power switch off.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - GENERATOR TEMPERATURE SENSOR)
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

6.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU -

	GENERATOR TEMPERATURE SENSOR)

(a) Disconnect the generator temperature sensor connector.

(b) Disconnect connector A21 from the power management control ECU.

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

Standard Resistance (Check for Open):

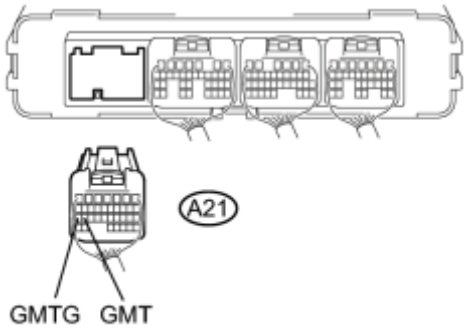
Tester Connection	Switch Condition	Specified Condition
D7-4 (GMT) - A21-26 (GMT)	Power switch off	Below 1 Ω
D7-8 (GMTG) - A21-27 (GMTG)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
D7-4 (GMT) or A21-26 (GMT) - Body ground and other terminals	Power switch off	10 kΩ or higher
D7-8 (GMTG) or A21-27 (GMTG) - Body ground and other terminals	Power switch off	10 kΩ or higher

*1

*2



Text in Illustration

*1	Front view of wire harness connector (to Generator Temperature Sensor)
*2	Rear view of wire harness connector (to Power Management Control ECU)

(d) Connect the power management control ECU connector.

(e) Connect the generator temperature sensor connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

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 is used to detect the position of the magnetic poles the rotor of a motor generator. Knowing the position of the poles is indispensable for ensuring precise control of MG2 and MG1.

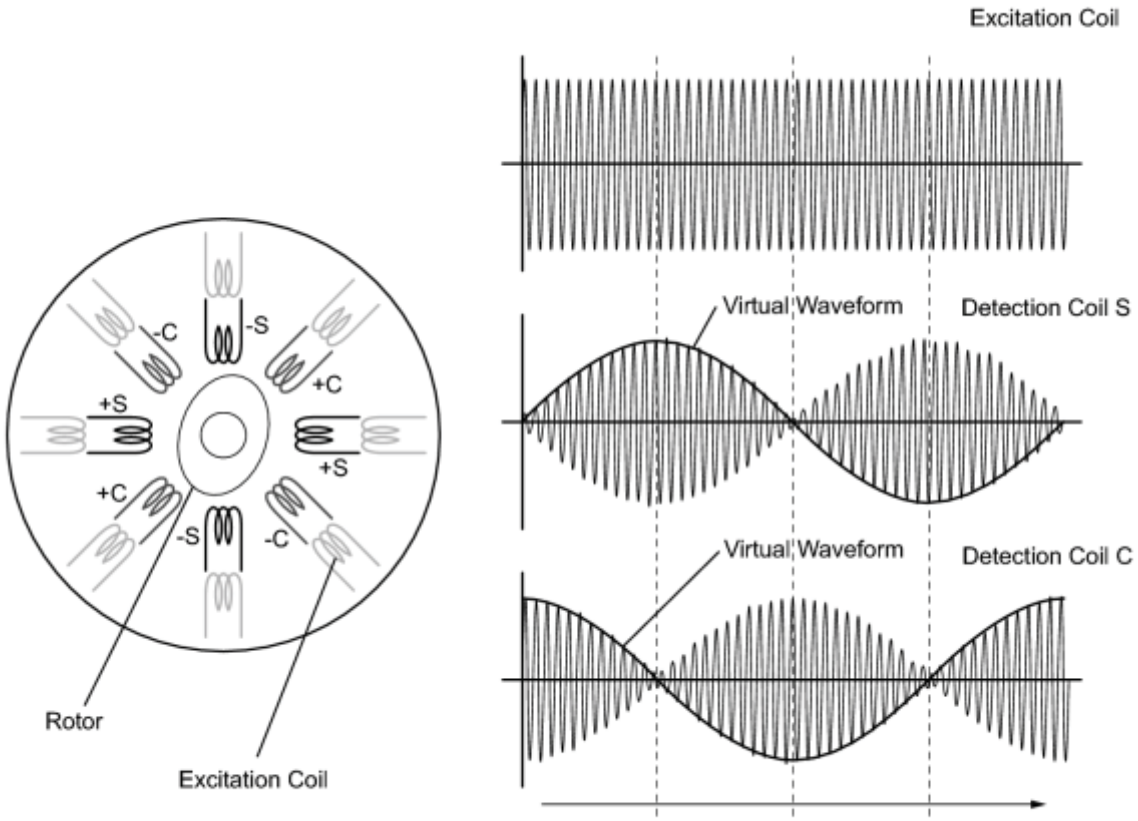
Each resolver contains a stator that has an excitation coil and 2 detection coils (S, C). The gap between the stator and rotor changes as the rotor turns because the rotor is oval shaped. An alternating current with a predetermined frequency flows through the excitation coil, and detection coils S and C output alternating currents in accordance with the sensor rotor position.

The inverter with converter assembly (MG ECU) detects the absolute position of the rotor according to the phases of detection coils S and C and the heights 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.

HINT:

The term "drive motor A" indicates MG2.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A3F	243	Interphase short in the motor resolver circuit	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector
P0A40	500	Motor resolver output is out of the normal range	
P0A41	245	Open or short in the motor resolver circuit	

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. If a malfunction is detected, the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

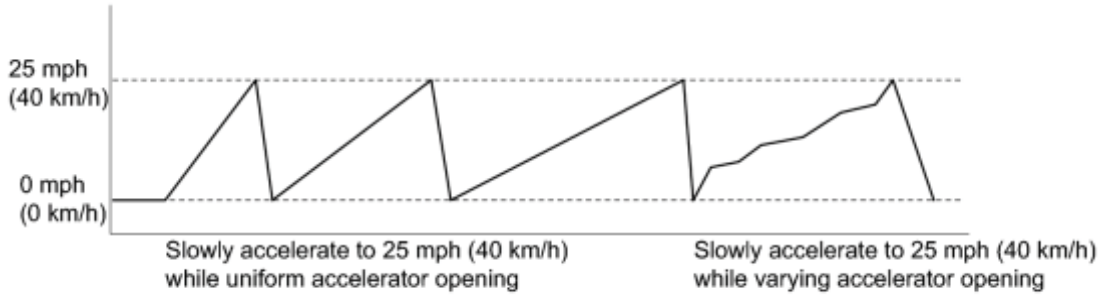
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Motor resolver	DTC P0A3F (INF 243) is not detected DTC P0A40 (INF 500) is not detected DTC P0A41 (INF 245) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.

6. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns.
7. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
8. Check that permanent DTCs are cleared.
9. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

- If INF code 243 is output, there may be an interphase short in the motor resolver due to an intrusion of water into the resolver. If the problem symptom cannot be reproduced, replace the hybrid vehicle transaxle assembly.
- Check for output DTCs again after the repair has been completed. If P0A78-286 or P0A7A-324 is output, replace the inverter with converter assembly.

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.

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

3.	CHECK GENERATOR RESOLVER INFO

NG → CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

5.	CHECK MOTOR RESOLVER INFO

NG → CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ↓

6.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

7.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK → **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

8.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

10.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A4B-253	Generator Position Sensor Circuit
DTC	P0A4C-513	Generator Position Sensor Circuit Range / Performance
DTC	P0A4D-255	Generator Position Sensor Circuit Low

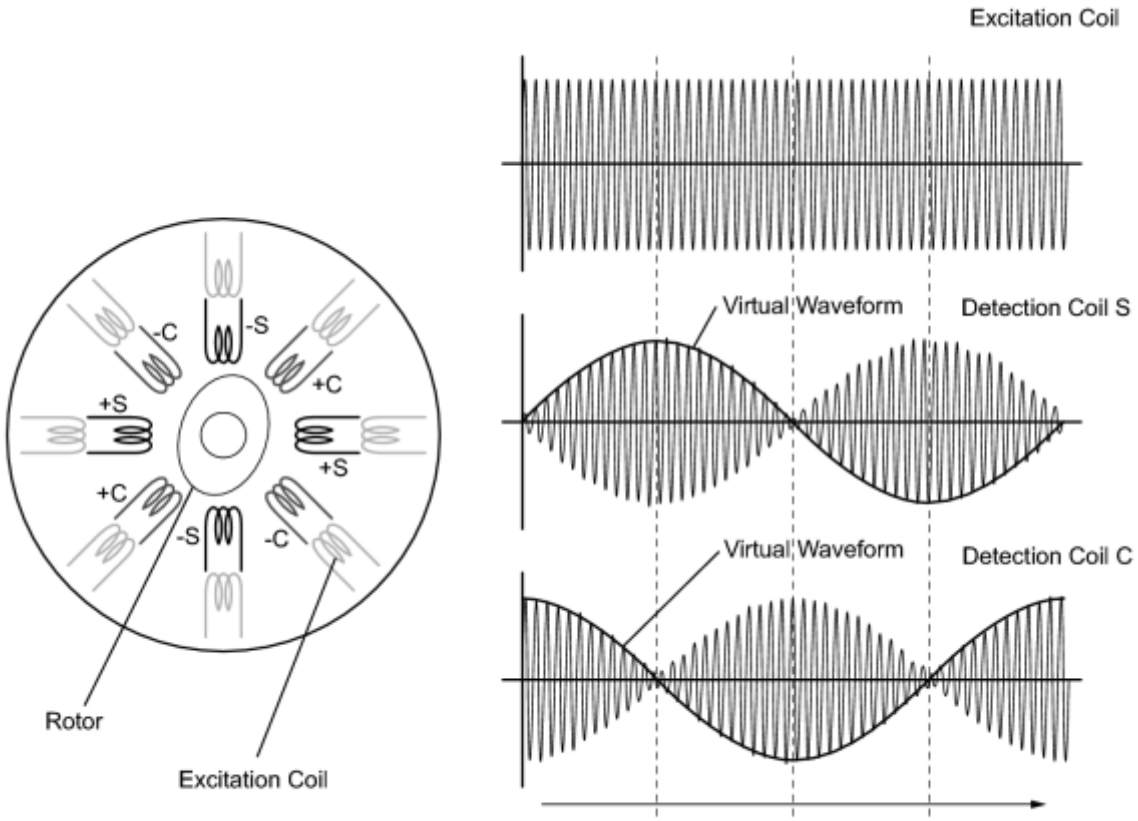
DESCRIPTION

A resolver is a sensor that is used to detect the position of the magnetic poles the rotor of a motor generator. Knowing the position of the poles is indispensable for ensuring precise control of MG2 and MG1.

Each resolver contains a stator that has an excitation coil and 2 detection coils (S, C). 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 inverter with converter assembly (MG ECU) detects the absolute position of the rotor according to the phases of detection coils S and C and the heights of their waveforms. Furthermore, the CPU calculates the amount of change in the position within a predetermined length of time, in order to use the resolver as a speed sensor.

The MG ECU monitors signals output from the motor resolver and detects malfunctions.



DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A4B	253	Interphase short in the generator resolver circuit	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector
P0A4C	513	Generator resolver output is out of the normal range	
P0A4D	255	Open or short in the generator resolver circuit	

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. If a malfunction is detected, the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

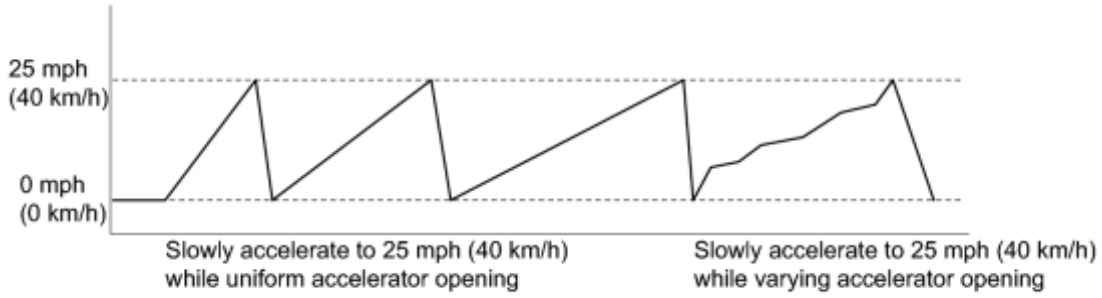
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Generator resolver	DTC P0A4B (INF 253) is not detected DTC P0A4C (INF 513) is not detected DTC P0A4D (INF 255) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.

5. Turn the power switch on (READY) and turn the Techstream on.
6. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns.
7. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
8. Check that permanent DTCs are cleared.
9. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

- If INF code 253 is output, there may be an interphase short in the generator resolver due to an intrusion of water into the resolver. If the problem symptom cannot be reproduced, replace the hybrid vehicle transaxle assembly.
- Check for output DTCs again after the repair has been completed. If P0A78-286 or P0A7A-324 is output, replace the inverter with converter assembly.

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.

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER

	ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

5.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

6.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

7.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

8.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

10.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A51-174	Drive Motor "A" Current Sensor Circuit

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors its internal operation and it will set DTCs when it detects malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A51	174	Motor current sensor high resolution circuit signal is out of range or there is a difference between it and the motor current sensor low resolution circuit current value.	Inverter with converter assembly

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A51-174 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A78-113, 287, 505, 506	Drive Motor "A" Inverter Performance

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A51-174 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 reproduction test to check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

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

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors the motor inverter current sensors. P0A60 and P0A63 indicate malfunctions in current sensors, and they do not indicate malfunctions in the high-voltage system.

HINT:

The term "drive motor A" indicates MG2.

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
P0A60	290	Malfunction in motor inverter current sensor (phase V main sensor)	
P0A60	294	Malfunction in motor inverter current sensor (performance problem or open phase V)	
P0A60	501	Malfunction in motor inverter current sensor (phase V main and sub sensors offset)	
P0A63	296	Malfunction in motor inverter current sensor (phase W sub sensor)	
P0A63	298	Malfunction in motor inverter current sensor (phase W main sensor)	
P0A63	302	Malfunction in motor inverter current sensor (performance problem or open phase W)	

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A63	502	Malfunction in motor inverter current sensor (phase W main and sub sensors offset)	

MONITOR DESCRIPTION

The power management control ECU (HV CPU) monitors the motor inverter current sensor. If the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

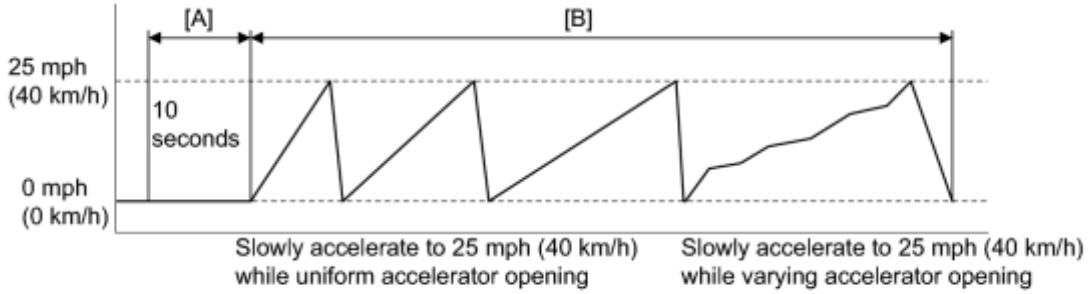
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A60 (INF 288/ 290/ 294/ 501) is not detected DTC P0A63 (INF 296/ 298/ 302/ 502) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. With the vehicle stopped and park (P) selected, move the shift lever to N, wait for 10 seconds and then move the shift lever to D. [A]

   NOTICE:

   Do not leave the vehicle for an extended time with the shift lever in N.

7. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns. [B]
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A60 or P0A63 only is output.	A
P0A78-202 is output.	B

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

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

DESCRIPTION

The MG ECU located in the inverter with converter assembly monitors the generator inverter current sensors. P0A72 and P0A75 indicate malfunctions in the current sensors, and they do not indicate 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
P0A72	328	Malfunction in generator inverter current sensor (phase V main sensor)	
P0A72	333	Malfunction in generator inverter current sensor (performance problem or open phase V)	
P0A72	515	Malfunction in generator inverter current sensor (phase V main and sub sensors offset)	
P0A75	334	Malfunction in generator inverter current sensor (phase W sub sensor)	
P0A75	336	Malfunction in generator inverter current sensor (phase W main sensor)	
P0A75	341	Malfunction in generator inverter current sensor (performance problem or open phase W)	
P0A75	516	Malfunction in generator inverter current sensor (phase W main and sub sensors offset)	

MONITOR DESCRIPTION

The power management control ECU (HV CPU) monitors the generator inverter current sensor. If the power management control ECU (HV CPU) 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

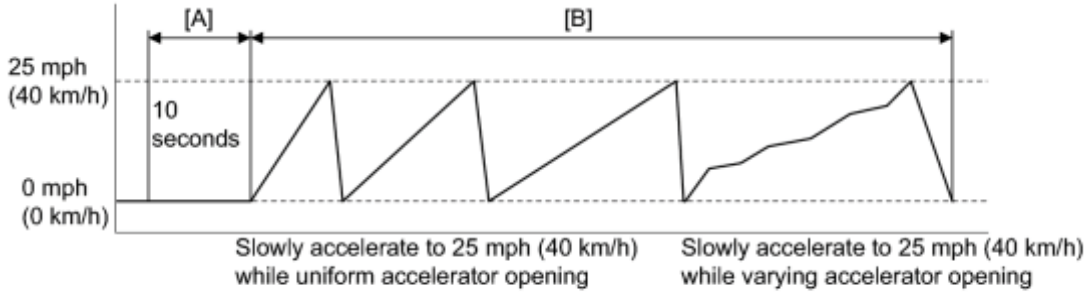
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A72 (INF 326/328/333/515) is not detected DTC P0A75 (INF 334/336/341/516) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. With the vehicle stopped and park (p) selected, move the shift lever to N, wait for 10 seconds and then move the shift lever to D. [A]

   NOTICE:

   Do not leave the vehicle for an extended time with the shift lever in N.

7. Slowly accelerate from a stop (0 mph (0 km/h)) to 25 mph (40 km/h) several times while using different acceleration patterns. [B]
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A72 or P0A75 only is output.	A
P0A7A-203 is output.	B

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

DTC	P0A78-113	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If the motor inverter overheats, has a circuit malfunction, or has an internal short, the inverter transmits this information to 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 (System overcurrent)	• Hybrid vehicle transaxle assembly • Generator cable • Motor cable • Inverter with converter assembly • Power management control ECU • PCU fuse • Wire harness or connector

MONITOR DESCRIPTION

If over-amperage flows through the motor inverter due to an internal short, the motor inverter transmits an inverter fail signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) illuminates the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 113): MFIV detection (Over current malfunction)
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

TMC's intellectual property	-

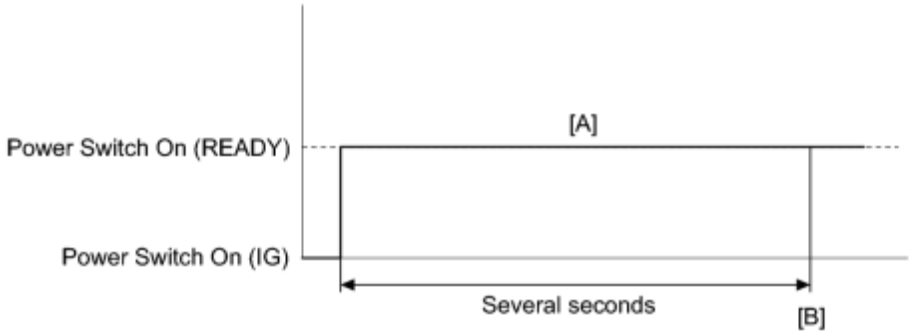
TYPICAL MALFUNCTION THRESHOLDS

Power management control ECU (HV CPU)	DTC P0A78 (INF 113) is not detected

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 113) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-113 is set before any of the DTCs in the table below are set	A
Any of the DTCs in the table below are set before P0A78-113 is set	B

DTC No.	Relevant Diagnosis
P3011-123, P3012-123, P3013-123, P0314-123, P3015-123, P3016-123, P0317-123, P3018-123, P3019-123, P3020-123, P3021-123, P3022-123, P3023-123, P3024-123	Battery Block # Becomes Weak
P0AFC-123	Hybrid Battery Pack Sensor Module
P308A-123	Hybrid Battery Voltage Sensor All Circuits Low
P0AC0-123	Hybrid Battery Pack Current Sensor Circuit Range/Performance
P0AC1-123	Hybrid Battery Pack Current Sensor Circuit Low
P0AC2-123	Hybrid Battery Pack Current Sensor

DTC No.	Relevant Diagnosis
	Circuit High
P0A9C-123	Hybrid Battery Temperature Sensor "A"
P0A9D-123	Hybrid Battery Temperature Sensor "A" Circuit Low
P0A9E-123	Hybrid Battery Temperature Sensor "A" Circuit High
P0AC6-123	Hybrid Battery Temperature Sensor "B" Range/Performance
P0AC7-123	Hybrid Battery Temperature Sensor "B" Circuit Low
P0AC8-123	Hybrid Battery Temperature Sensor "B" Circuit High
P0ACB-123	Hybrid Battery Pack Cooling Fan 3 Performance or Stuck OFF
P0ACC-123	Hybrid Battery Pack Cooling Fan 3 Stuck ON
P0ACD-123	Hybrid Battery Pack Cooling Fan 3 Control Circuit Low
P3065-123	Hybrid Battery Temperature Sensor Correlation for Stack "A"

HINT:

P0A78-113 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-202 is not output.	A
P0A78-202 is also output.	B

NOTICE:

- If P0A78-202 is output, troubleshoot it first. After completing the troubleshooting for P0A78-202, return to perform troubleshooting for this DTC.
- Parts repaired or replaced during troubleshooting for P0A78-202 do not need to be re-inspected in this diagnosis procedure.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

3.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

HINT:

- If P0A78-202 was not output in step 2 of this diagnosis procedure, check Table 1 below.
- If P0A78-202 was output in step 2 of this diagnosis procedure, repair that DTC first, then check Table 2 below.

Result:

Result	Proceed to
P0A78-113 only is output	A
Any of the following DTCs are also output.	B

Table 1

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit

DTC No.	Relevant Diagnosis
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

Table 2

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60-294	Drive Motor "A" Phase V Current
P0A63-302	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance

DTC No.	Relevant Diagnosis
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-113 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

4.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

6.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

8.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

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

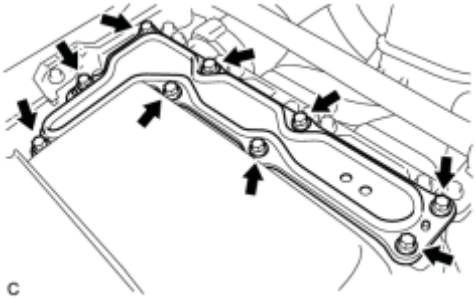
CAUTION:

Be sure to wear insulated gloves.

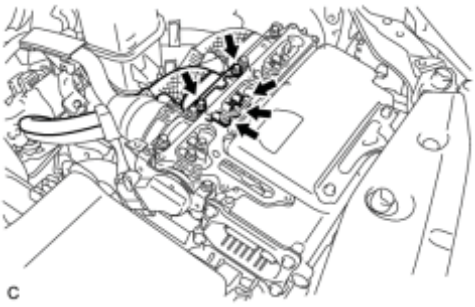
(a) Check that the service plug grip is not installed.

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 inverter terminal cover from the inverter with converter assembly.



(c) Check that the bolts for the generator cable are tightened to the specified torque, the generator cable is connected securely, and there are no contact problems.

Specified Condition:

T=8.0 N*m {82 kgf*cm, 71 in.*lbf}

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).

(d) Check for arc marks at the bolts for the generator cable.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter terminal cover.

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A

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

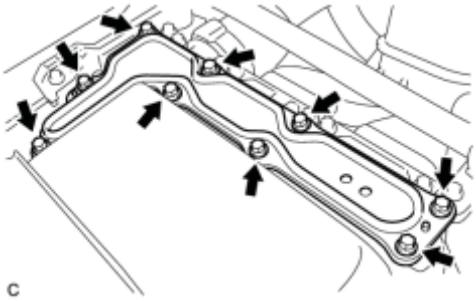
CAUTION:

Be sure to wear insulated gloves.

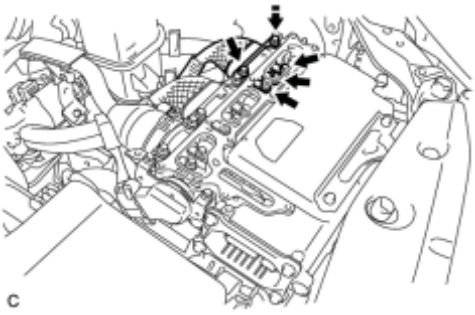
(a) Check that the service plug grip is not installed.

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 inverter terminal cover from the inverter with converter assembly.



(c) Check that the bolts for the motor cable are tightened to the specified torque, the motor cable is connected securely, and there are no contact problems.

Specified Condition:

T=8.0 N*m {82 kgf*cm, 71 in.*lbf}

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).

(d) Check for arc marks at the bolts for the motor cable.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter terminal cover.

C CONNECT SECURELY
B REPLACE MALFUNCTIONING PARTS
A

11.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1)

CAUTION:

Be sure to wear insulated gloves.

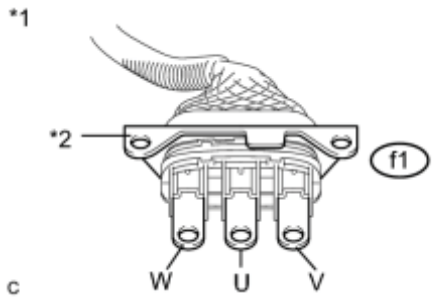
(a) Check that the service plug grip is not installed.

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) Remove the inverter terminal cover from the inverter with converter assembly.

(c) Disconnect the generator cable and motor cable from the inverter with converter assembly.



(d) Check MG1 for an interphase short using a milliohmmeter.

(1) Using a milliohmmeter, measure the resistance according to the value(s) in the table below.

HINT:

If the MG1 temperature is high, the resistance will vary greatly from the specification. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - f1-3 (V)	Power switch off	87.0 to 96.2 mΩ
f1-3 (V) - f1-1 (W)	Power switch off	87.0 to 96.2 mΩ

f1-1 (W) - f1-2 (U)	Power switch off	87.0 to 96.2 mΩ

Text in Illustration

*1	Generator Cable
*2	Shield Ground

HINT:

To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 68° F (20°C).

R20 = Rt / {1 + 0.00393 X (T - 20)}

The calculation is based on the following:

R20: Resistance at 68° F (20°C) (mΩ)

Rt: Measured resistance (mΩ)

T: Temperature when the resistance is measured (° C)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

(f) Connect the generator cable and motor cable.

(g) Install the inverter terminal cover.

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK ▼

12.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2)

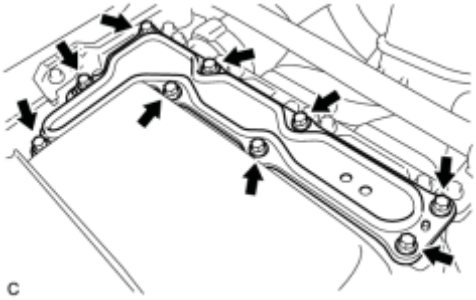
CAUTION:

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) Remove the inverter terminal cover from the inverter with converter assembly.

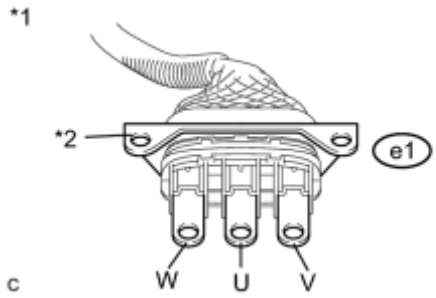
(c) Disconnect the generator cable and motor cable from the inverter with converter assembly.

(d) Check MG2 for an interphase short using a milliohmmeter.

(1) Using a milliohmmeter, measure the resistance according to the value(s) in the table below.

HINT:

If the MG2 temperature is high, the resistance will vary greatly from the specification. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - e1-3 (V)	Power switch off	154 to 170 mΩ
e1-3 (V) - e1-1 (W)	Power switch off	148 to 164 mΩ
e1-1 (W) - e1-2 (U)	Power switch off	149 to 165 mΩ

Text in Illustration

*1	Motor Cable
*2	Shield Ground

HINT:

To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 68° F (20°C).

R20 = Rt / {1 + 0.00393 X (T - 20)}

The calculation is based on the following:

R20: Resistance at 68° F (20°C) (mΩ)

Rt: Measured resistance (mΩ)

T: Temperature when the resistance is measured (° C)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

(f) Connect the generator cable and motor cable.

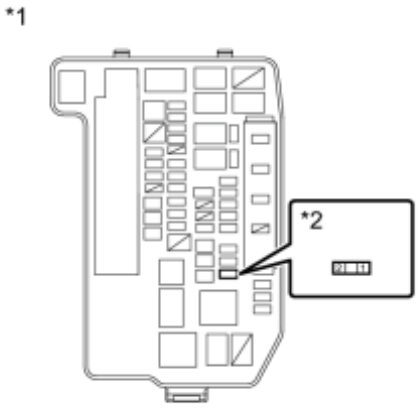
(g) Install the inverter terminal cover.

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ▼

13.	CHECK FUSE (PCU)

(a) Remove the PCU fuse from the engine room junction block assembly.



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

Standard Resistance:

Tester Connection	Condition	Specified Condition
PCU fuse terminal	Always	Below 1Ω

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	PCU fuse

(c) Install the PCU fuse.

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ▼

14.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

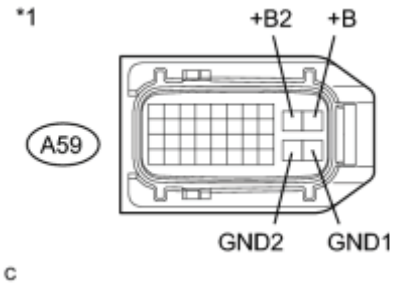
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect connector A59 from inverter with converter assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-28 (GND1) - Body ground	Power switch off	Below 1 Ω
A59-27 (GND2) - Body ground	Power switch off	Below 1 Ω



Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter 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	Switch Condition	Specified Condition
A59-10 (+B) - Body ground	Power switch on (IG)	11 to 14V
A59-9 (+B2) - Body ground	Power switch on (IG)	11 to 14V

(f) Turn the power switch off.

(g) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK

▼

15.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

NOTICE:

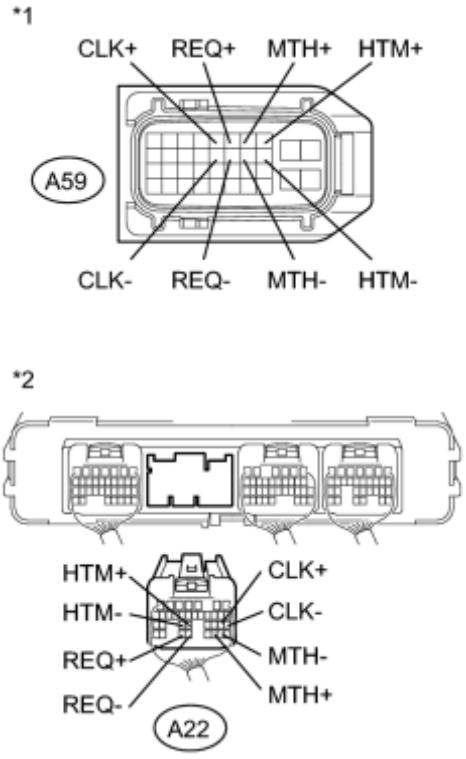
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Turn the power switch off.

(c) Disconnect connector A59 from the inverter with converter assembly.

(d) Disconnect connector A22 from the power management control ECU.

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



Standard Resistance (Check for open):

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) - A59-8 (HTM+)	Power switch off	Below 1 Ω
A22-25 (HTM-) - A59-18 (HTM-)	Power switch off	Below 1 Ω
A22-30 (MTH+) - A59-7 (MTH+)	Power switch off	Below 1 Ω
A22-29 (MTH-) - A59-17 (MTH-)	Power switch off	Below 1 Ω
A22-33 (REQ+) - A59-6 (REQ+)	Power switch off	Below 1 Ω
A22-32 (REQ-) - A59-16 (REQ-)	Power switch off	Below 1 Ω
A22-21 (CLK+) - A59-5 (CLK+)	Power switch off	Below 1 Ω
A22-20 (CLK-) - A59-15 (CLK-)	Power switch off	Below 1 Ω

Standard Resistance (Check for short):

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) or A59-8 (HTM+) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-25 (HTM-) or A59-18 (HTM-) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-30 (MTH+) or A59-7 (MTH+) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-29 (MTH-) or A59-17 (MTH-) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-33 (REQ+) or A59-6 (REQ+) -	Power switch	10 kΩ or

Body ground and other terminals	off	higher
A22-32 (REQ-) or A59-16 (REQ-) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-21 (CLK+) or A59-5 (CLK+) - Body ground and other terminals	Power switch off	10 kΩ or higher
A22-20 (CLK-) or A59-15 (CLK-) - Body ground and other terminals	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)
*2	Rear view of wire harness connector (to Power Management Control ECU)

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) or A59-8 (HTM+) - Body ground	Power switch on (IG)	Below 1 V
A22-25 (HTM-) or A59-18 (HTM-) - Body ground	Power switch on (IG)	Below 1 V
A22-30 (MTH+) or A59-7 (MTH+) - Body ground	Power switch on (IG)	Below 1 V
A22-29 (MTH-) or A59-17 (MTH-) - Body ground	Power switch on (IG)	Below 1 V
A22-33 (REQ+) or A59-6 (REQ+) - Body ground	Power switch on (IG)	Below 1 V
A22-32 (REQ-) or A59-16 (REQ-) - Body ground	Power switch on (IG)	Below 1 V
A22-21 (CLK+) or A59-5 (CLK+) - Body ground	Power switch on (IG)	Below 1 V
A22-20 (CLK-) or A59-15 (CLK-) - Body ground	Power switch on (IG)	Below 1 V

NOTICE:

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

(h) Turn the power switch off.

(i) Connect the power management control ECU connector.

(j) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

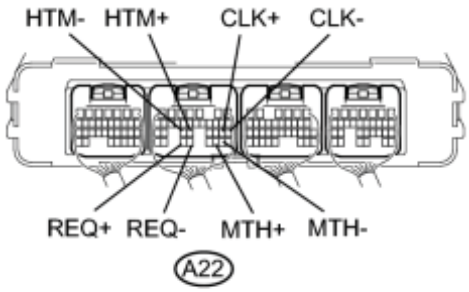
16.	CHECK POWER MANAGEMENT CONTROL ECU

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A22-24 (HTM+) - A22-25 (HTM-)	Power switch off	80 to 170 Ω
A22-30 (MTH+) - A22-29 (MTH-)	Power switch off	80 to 170 Ω
A22-33 (REQ+) - A22-32 (REQ-)	Power switch off	80 to 170 Ω
A22-21 (CLK+) - A22-20 (CLK-)	Power switch off	80 to 170 Ω

*1



P

Text in Illustration

*1	Component with harness connected (Power Management Control ECU)

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

17.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

18.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

19.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

21.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

23.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

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.

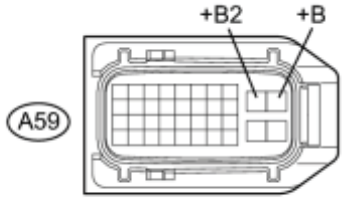
(b) Disconnect connector A59 from the inverter with converter assembly.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
A59-10 (+B) - Body ground	Power switch off	10 kΩ or higher
A59-9 (+B2) - Body ground	Power switch off	10 kΩ or higher

*1



c

Text in Illustration

*1	Front view of wire harness connector (to Inverter with Converter Assembly)

(d) Connect the inverter with converter assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

24.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT **REPLACE FUSE (PCU)**

25.	REPAIR OR REPLACE HARNESS OR CONNECTOR

(a) Repair or replace the wire harness or connector.

NEXT **REPLACE FUSE (PCU)**

26.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

CAUTION:

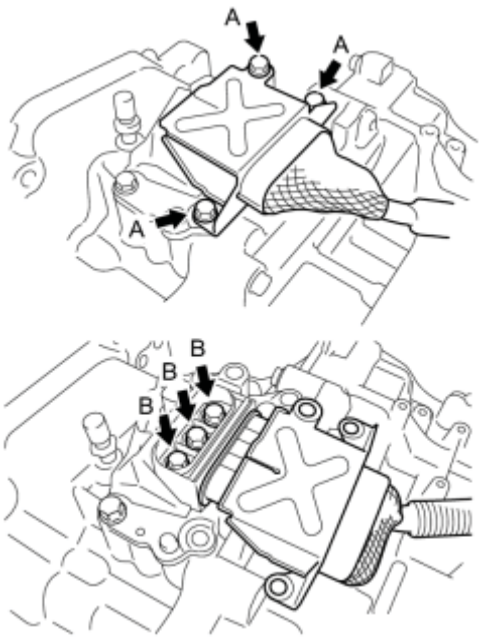
Be sure to wear insulated gloves.

(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) Remove the inverter with converter assembly.



(c) Check that the bolts for the generator cable are tightened to the specified torque, the generator cable is connected securely, and there are no contact problems.

Specified Condition:

Bolt A

T=20 N*m {204 kgf*cm, 15 ft.*lbf}

Bolt B

T=10 N*m {102 kgf*cm, 7 ft.*lbf}

- Make sure that the tightening torque of the bolt A is between 16 and 24 N*m (163 and 245 kgf*cm, 12 and 18 ft.*lbf).
- Make sure that the tightening torque of the bolt B is between 8 and 12 N*m (82 and 122 kgf*cm, 71 and 106 in.*lbf).

(d) Check for arc marks at the bolts for the generator cable.

Result:

Result	Proceed to

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter with converter assembly.

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

27.	CHECK GENERATOR CABLE

CAUTION:

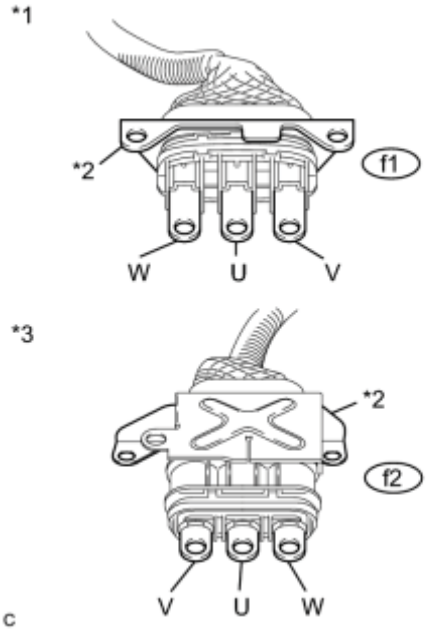
Be sure to wear insulated gloves.

(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) Remove the generator cable.



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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
f1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

Text in Illustration

*1	Generator Cable (Inverter with Converter Assembly Side)
*2	Shielded ground
*3	Generator Cable (Hybrid Vehicle Transaxle Assembly Side)

NOTICE:

Wrap the terminal of the three-phase AC cable with insulating tape to prevent them from coming into contact with body ground

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
f1-2 (U) - f2-2 (U)	Power switch off	Below 1 Ω
f1-3 (V) - f2-1 (V)	Power switch off	Below 1 Ω
f1-1 (W) - f2-3 (W)	Power switch off	Below 1 Ω
f1-2 (U) - f2-1 (V)	Power switch off	100 MΩ or higher
f1-3 (V) - f2-3 (W)	Power switch off	100 MΩ or higher
f1-1 (W) - f2-2 (U)	Power switch off	100 MΩ or higher

(e) Install the generator cable.

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

28.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

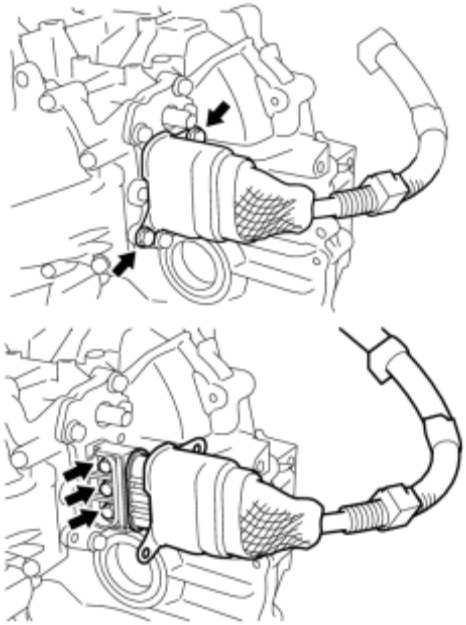
CAUTION:

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 that the bolts for the motor cable are tightened to the specified torque, the motor cable is connected securely, and there are no contact problems.

Specified Condition:

T=10 N*m {102 kgf*cm, 7 ft.*lbf}

NOTICE:

Make sure that the tightening torque of the bolts is between 8 and 12 N*m (82 and 122 kgf*cm, 71 and 106 in.*lbf).

(c) Check for arc marks at the bolts for the motor cable.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A ▼

29.	CHECK MOTOR CABLE

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.

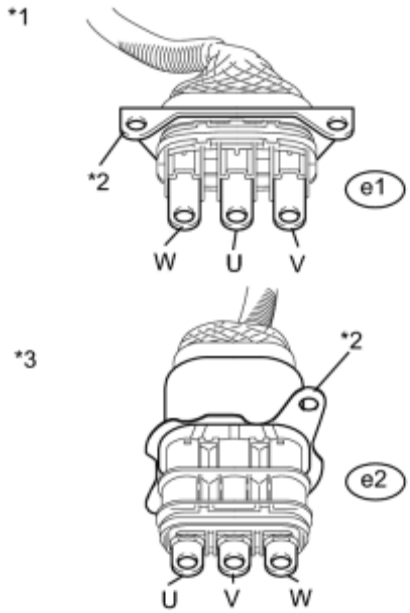
(b) Remove the motor cable.

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-3 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
e1-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

Text in Illustration

*1	Motor Cable (Inverter with Converter Assembly Side)
*2	Shielded ground
*3	Motor Cable (Hybrid Vehicle Transaxle Assembly Side)

NOTICE:

Wrap the terminal of the three-phase AC cable with insulating tape to prevent them from coming into contact with body ground

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e1-2 (U) - e2-3 (U)	Power switch off	Below 1 Ω
e1-3 (V) - e2-2 (V)	Power switch off	Below 1 Ω
e1-1 (W) - e2-1 (W)	Power switch off	Below 1 Ω
e1-2 (U) - e2-2 (V)	Power switch off	100 MΩ or higher
e1-3 (V) - e2-1 (W)	Power switch off	100 MΩ or higher

Tester Connection	Switch Condition	Specified Condition
e1-1 (W) - e2-3 (U)	Power switch off	100 MΩ or higher

(e) Install the motor cable.

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A78-121	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an overvoltage occurs in the motor inverter or generator inverter, the MG ECU detects it and transmits this information to the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	121	Motor inverter overvoltage signal detection (overvoltage due to system malfunction)	• Hybrid battery junction block • Inverter with converter assembly • Service plug grip (EV battery fuse) • Frame wire • Hybrid vehicle transaxle assembly • Generator Cable • Motor Cable • Power management control ECU • PCU fuse • Wire harness or connector

MONITOR DESCRIPTION

If the motor inverter detects over-voltage, it transmits an over-voltage signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) illuminates the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 121): OVH detection (Over voltage malfunction)
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

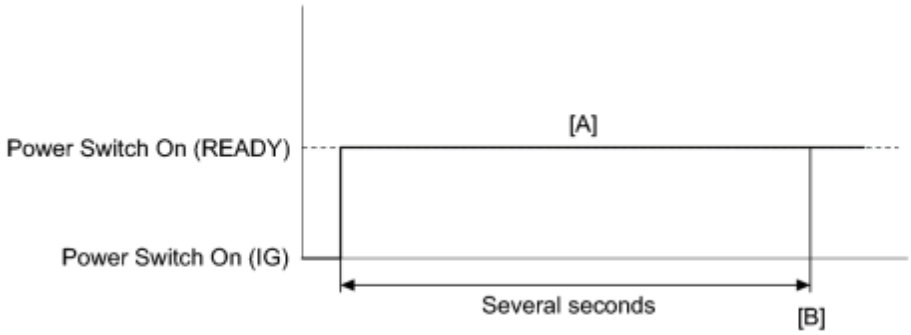
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 121) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P0AE6-225 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-121 is set before any of the DTCs in the table below are set	A
Any of the DTCs in the table below are set before P0A78-121 is set	B

DTC No.	Relevant Diagnosis
P3011-123, P3012-123, P3013-123, P0314-123, P3015-123, P3016-123, P0317-123, P3018-123, P3019-123, P3020-123, P3021-123, P3022-123,	Battery Block # Becomes Weak

DTC No.	Relevant Diagnosis
P3023-123, P3024-123	
P0AFC-123	Hybrid Battery Pack Sensor Module
P308A-123	Hybrid Battery Voltage Sensor All Circuits Low
P0AC0-123	Hybrid Battery Pack Current Sensor Circuit Range/Performance
P0AC1-123	Hybrid Battery Pack Current Sensor Circuit Low
P0AC2-123	Hybrid Battery Pack Current Sensor Circuit High
P0A9C-123	Hybrid Battery Temperature Sensor "A"
P0A9D-123	Hybrid Battery Temperature Sensor "A" Circuit Low
P0A9E-123	Hybrid Battery Temperature Sensor "A" Circuit High
P0AC6-123	Hybrid Battery Temperature Sensor "B" Range/Performance
P0AC7-123	Hybrid Battery Temperature Sensor "B" Circuit Low
P0AC8-123	Hybrid Battery Temperature Sensor "B" Circuit High
P0ACB-123	Hybrid Battery Pack Cooling Fan 3 Performance or Stuck OFF
P0ACC-123	Hybrid Battery Pack Cooling Fan 3 Stuck ON
P0ACD-123	Hybrid Battery Pack Cooling Fan 3 Control Circuit Low
P3065-123	Hybrid Battery Temperature Sensor Correlation for Stack "A"

HINT:

- Refer to the Freeze Frame data to determine the order in which the DTCs were set.
- P0A78-121 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-121 only is output	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-113, 128, 266, 267, 279, 284, 286, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-122, 130, 322, 324, 325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-172, 442, 547, 548, 549, 553, 554, 555, 556, 557, 585, 587, 589, 590	DC/DC Converter Performance
P0ADB-227	Hybrid Battery Positive Contactor Control Circuit Low
P0ADC-226	Hybrid Battery Positive Contactor Control Circuit High

DTC No.	Relevant Diagnosis
P0ADF-229	Hybrid Battery Negative Contactor Control Circuit Low
P0AE0-228	Hybrid Battery Negative Contactor Control Circuit High
P0C76-523	Hybrid Battery System Discharge Time Too Long
P3004-803	High Voltage Power Resource

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-121 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

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

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

5.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

7.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

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

C CONNECT SECURELY
B REPLACE MALFUNCTIONING PARTS
A

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

C CONNECT SECURELY
B REPLACE MALFUNCTIONING PARTS
A

10.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) INFO

NG CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK

11.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) INFO

NG CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK

12.	CHECK INVERTER WITH CONVERTER ASSEMBLY (HIGH VOLTAGE CONNECTOR CONNECTION CONDITION)

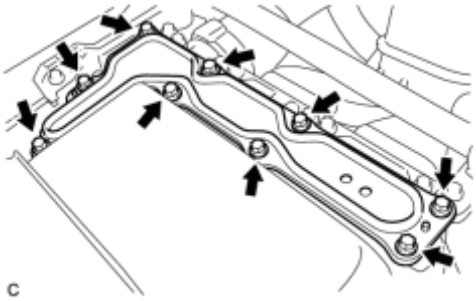
CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

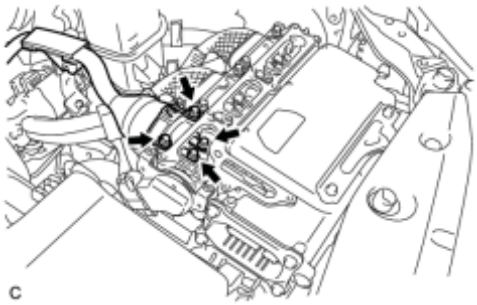
NOTICE:

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) Remove the inverter terminal cover from the inverter with converter assembly.

(c) Check that the bolts for the frame wire are tightened to the specified



torque, the frame wire is connected securely, and there are no contact problems.

Specified Condition:

T=8.0 N*m {82 kgf*cm, 71 in.*lbf}

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).

(d) Check for arc marks at the bolts for the frame wire.

Result:

Result		Proceed to
The terminals are connected securely and there are no contact problems.	There are no arc marks.	A
The terminals are not connected securely and there is a contact problem.	There are arc marks.	B
The terminals are not connected securely and there is a contact problem.	There are no arc marks.	C
The terminals are connected securely and there are no contact problems.	There are arc marks.	B

(e) Install the inverter terminal cover.

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A
▼

13.	CHECK SERVICE PLUG GRIP (CONNECTION CONDITION)

CAUTION:

Be sure to wear insulated gloves.

(a) Visually check the connection of the service plug grip to the HV battery. Remove the service plug grip and check for contamination.

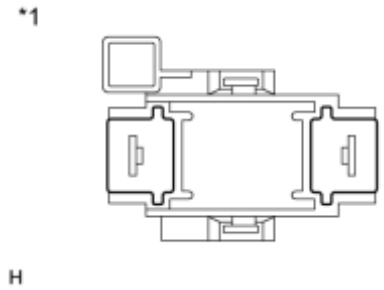
OK:

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

NG ▶ REPLACE SERVICE PLUG GRIP
OK
▼

14.	CHECK SERVICE PLUG GRIP

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



Standard Resistance:

Tester Connection	Condition	Specified Condition
Service plug grip terminals	Always	Below 1 Ω

Text in Illustration

*1	Service plug grip

NG ▶ REPLACE SERVICE PLUG GRIP

OK ▼

15.	CHECK FRAME WIRE

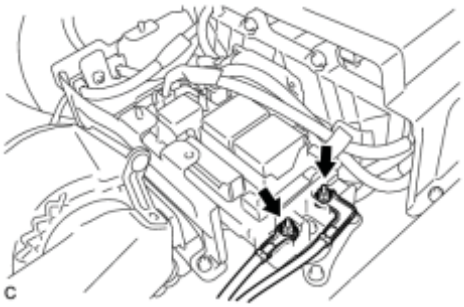
CAUTION:

Be sure to wear insulated gloves.

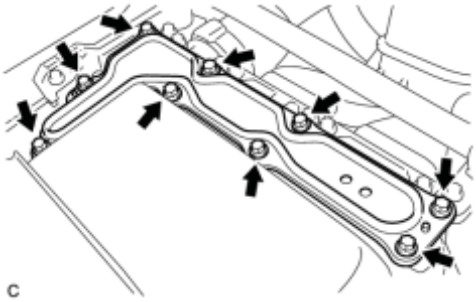
(a) Check that the service plug grip is not installed.

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.

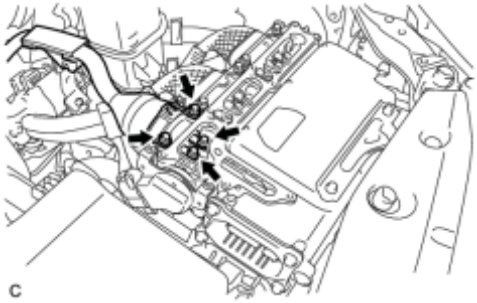


(b) Disconnect the frame wire from the hybrid battery junction block.



(c) Remove the inverter terminal cover from the inverter with converter assembly.

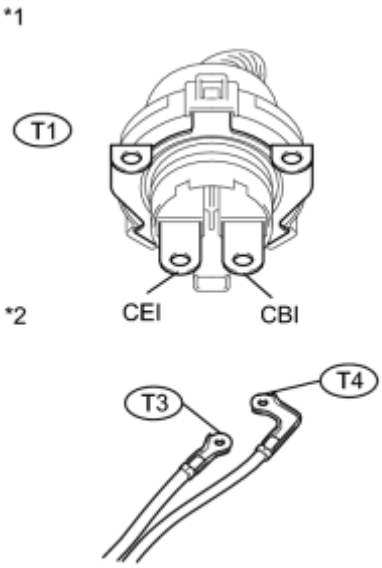
(d) Disconnect the frame wire from the inverter with converter assembly.



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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
T4-1 - T1-2 (CBI) (Positive terminal)	Power switch off	Below 1 Ω
T3-1 - T1-1 (CEI) (Negative terminal)	Power switch off	Below 1 Ω



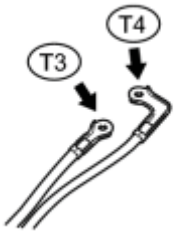
Text in Illustration

*1	Frame Wire (Inverter with Converter Assembly Side)
*2	Frame Wire (Hybrid Battery Junction Block Side)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.



Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
T4-1 - Body ground and shielded ground	Power switch off	10 MΩ or higher
T3-1 - Body ground and shielded ground	Power switch off	10 MΩor higher
T3-1 - T4-1	Power switch off	10 MΩ or higher

(g) Connect the frame wire to the hybrid battery junction block.

(h) Connect the frame wire to the inverter with converter assembly.

(i) Install the inverter terminal cover.

NG ▶ REPLACE FRAME WIRE

OK

▼

16.	INSPECT HYBRID BATTERY JUNCTION BLOCK (SMRB)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

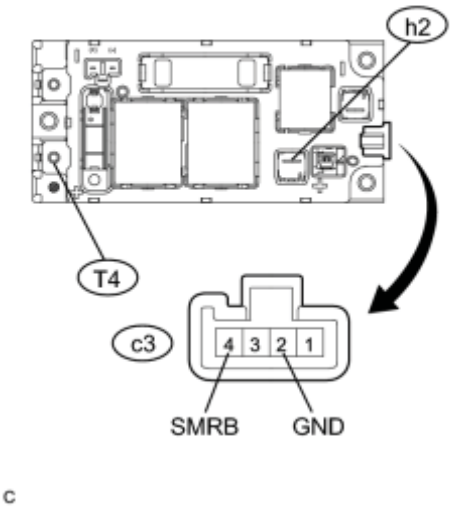
NOTICE:

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) Remove the hybrid battery junction block.

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

Standard Resistance:



Tester Connection	Condition	Specified Condition
h2 - T4	Auxiliary battery voltage is not applied between terminals c3-4 (SMRB) and c3-2 (GND)	10 kΩ or higher
h2 - T4	Auxiliary battery voltage is applied between terminals c3-4 (SMRB) and c3-2 (GND)	Below 1 Ω

Text in Illustration

*1	Hybrid Battery Junction Block

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

Standard Resistance:

Tester Connection	Condition	Specified Condition
c3-4 (SMRB) - c3-2 (GND)	-40 to 176°F(-40 to 80°C)	19.0 to 35.5 Ω

(e) Install the hybrid battery junction block.

NG ▶ REPLACE HYBRID BATTERY JUNCTION BLOCK

OK ▼

17.	INSPECT HYBRID BATTERY JUNCTION BLOCK (SMRG)

CAUTION:

Be sure to wear insulated gloves.

(a) Check that the service plug grip is not installed.

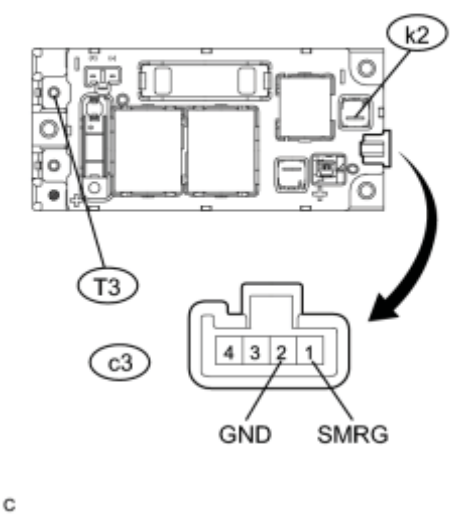
NOTICE:

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) Remove the hybrid battery junction block.

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

Standard Resistance:



Tester Connection	Condition	Specified Condition
k2 - T3	Auxiliary battery voltage is not applied between terminals c3-1 (SMRG) and c3-2 (GND)	10 kΩ or higher
k2 - T3	Auxiliary battery voltage is applied between terminals c3-1 (SMRG) and c3-2 (GND)	Below 1 Ω

Text in Illustration

*1	Hybrid Battery Junction Block

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

Standard Resistance:

Tester Connection	Condition	Specified Condition
c3-1 (SMRG) - c3-2 (GND)	-40 to 176°F (-40 to 80°C)	19.0 to 35.5 Ω

(e) Install the hybrid battery junction block.

NG ▶ REPLACE HYBRID BATTERY JUNCTION BLOCK

OK ▼

18.	CHECK FUSE (PCU) INFO

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ▼

19.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT) INFO

NG ▶ REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK ▼

20.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

21.	CHECK POWER MANAGEMENT CONTROL ECU INFO

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

22.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

23.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

24.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

26.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

28.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▼

29.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ **REPLACE FUSE (PCU)**

30.	REPAIR OR REPLACE HARNESS OR CONNECTOR

(a) Repair or replace the wire harness or connector.

NEXT ▶ **REPLACE FUSE (PCU)**

31.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

32.	CHECK GENERATOR CABLE INFO

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

33.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

34.	CHECK MOTOR CABLE INFO

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A78-128	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an abnormal amount of current flows through the motor inverter, the MG ECU detects it and sends a signal to inform the power management control ECU (HV CPU) of the malfunction.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	128	Abnormal motor current value detection (System malfunction)	• Hybrid vehicle transaxle assembly • Generator cable • Motor cable • Inverter with converter assembly • Power management control ECU • PCU fuse • Wire harness or connector

MONITOR DESCRIPTION

The MG ECU monitors the motor inverter electric current. If the current exceeds the threshold for a specified period of time, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 128): Motor inverter abnormal current
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

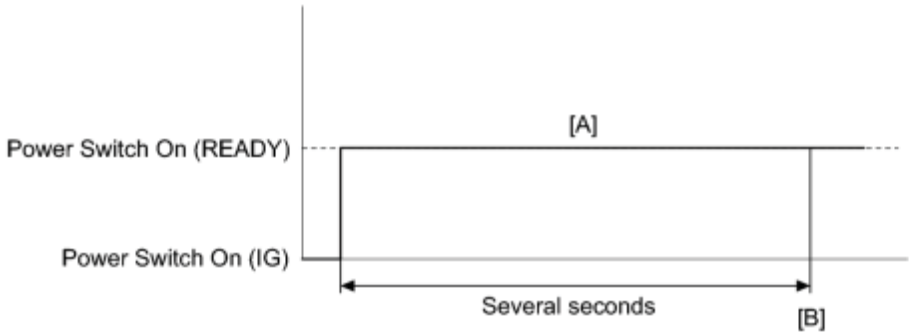
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 128) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-202 is not output	A
P0A78-202 is also output	B

NOTICE:

- If P0A78-202 is output, troubleshoot it first. After completing the troubleshooting for P0A78-202, return to perform troubleshooting for this DTC.
- Parts repaired or replaced during troubleshooting for P0A78-202 do not need to be re-inspected in this diagnosis procedure.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

HINT:

- If P0A78-202 was not output in step 1 of this diagnosis procedure, check Table 1 below.
- If P0A78-202 was output in step 1 of this diagnosis procedure, repair that DTC first, then check Table 2 below.

Result:

Result	Proceed to
P0A78-128 only is output.	A
Any of the following DTCs are also output.	B

Table 1

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance

DTC No.	Relevant Diagnosis
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

Table 2

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60-294	Drive Motor "A" Phase V Current
P0A63-302	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-128 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B GO TO DTC CHART

A

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

NG ▶ CONNECT SECURELY

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

5.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

7.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A

10.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK

11.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) INFO

NG → CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ↓

12.	CHECK FUSE (PCU) INFO

NG → CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ↓

13.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT) INFO

NG → REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK ↓

14.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER) INFO

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

15.	CHECK POWER MANAGEMENT CONTROL ECU INFO

NG → REPLACE POWER MANAGEMENT CONTROL ECU

OK ↓

16.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

17.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK → **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

18.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK → **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

20.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

22.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK

23.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ **REPLACE FUSE (PCU)**

24.	REPAIR OR REPLACE HARNESS OR CONNECTOR

(a) Repair or replace the wire harness or connector.

NEXT ▶ **REPLACE FUSE (PCU)**

25.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A

26.	CHECK GENERATOR CABLE INFO

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

27.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A

28.	CHECK MOTOR CABLE INFO

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

DTC	P0A78-202	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	202	Malfunction (short circuit) in the motor inverter inside the inverter with converter assembly	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Motor cable

MONITOR DESCRIPTION

The MG ECU monitors the motor inverter electric current. If the current exceeds the threshold for a specified period of time, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 202): MFIV detection (Short circuit malfunction)
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

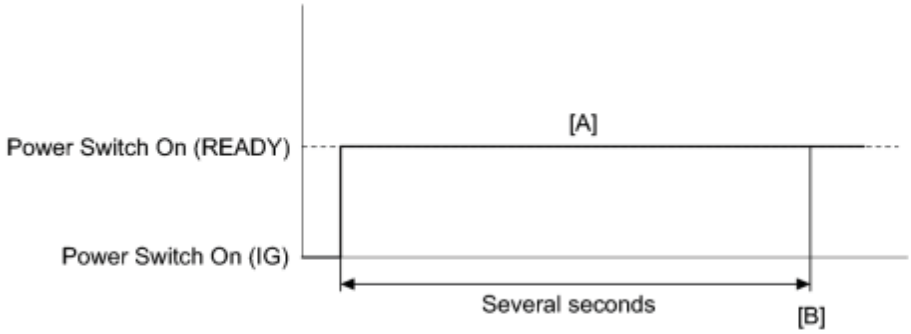
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 202) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

- DTC P0A78-202 is stored after any of DTCs P0A78-113, 128, 284, 286, 287, 505, 506, 806, 807 and 808 are stored. After troubleshooting and repairing DTC P0A78-202, be sure to troubleshoot all the other DTCs.
- Depending on the conditions in which the vehicle is being operated when a short circuit occurs in the inverter with converter assembly, the hybrid vehicle transaxle assembly may be affected. As this DTC is stored if a short circuit occurs in the inverter with converter assembly, it is necessary to perform a road test to check the hybrid vehicle transaxle assembly. If problems are found, replace the malfunctioning parts.
- After completing the repair, including the repair of previously output DTCs, drive the vehicle at a speed of approximately 25 mph (40 km/h) for 1 minute and check that DTC P0A90-251 (Drive Motor "A" Performance) is not output. If DTC P0A90-251 (Drive Motor "A" Performance) is output, replace the hybrid vehicle transaxle assembly.

HINT:

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

PROCEDURE

1.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY INFO

NG ▶ CHECK MOTOR CABLE

OK ▼

2.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ CHECK DTC OUTPUT (HV)

3.	CHECK MOTOR CABLE INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2)

OK ▼

4.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

NEXT ▼

5.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ CHECK DTC OUTPUT (HV)

6.	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 from the hybrid vehicle transaxle assembly.

(c) Check MG2 for an interphase short using a milliohmmeter.

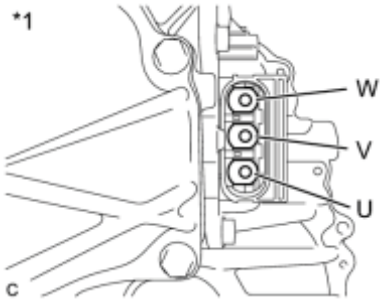
(1) Using a milliohmmeter, measure the resistance according to the value(s) in the table below.

HINT:

If the MG2 temperature is high, the resistance will vary greatly from the specification. Therefore, measure the resistance at least 8 hours after the vehicle is stopped.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e2-3 (U) - e2-2 (V)	Power switch off	154 to 170 mΩ
e2-2 (V) - e2-1 (W)	Power switch off	148 to 164 mΩ
e2-1 (W) - e2-3 (U)	Power switch off	149 to 165 mΩ



Text in Illustration

*1	Hybrid Vehicle Transaxle Assembly

HINT:

To correct the variation of the measured resistance due to temperature, use the following formula to calculate the resistance at 68° F (20°C).

R20 = Rt / {1 + 0.00393 X (T - 20)}

The calculation is based on the following:

R20: Resistance at 68° F (20°C) (mΩ)

Rt: Measured resistance (mΩ)

T: Temperature when the resistance is measured (° C)

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

NOTICE:

Be sure to set the megohmmeter to 500 V when performing this test. Using a setting higher than 500 V can result in damage to the component being inspected.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
e2-3 (U) - Body ground and shield ground	Power switch off	100 MΩ or higher
e2-2 (V) - Body ground and shield ground	Power switch off	100 MΩ or higher
e2-1 (W) - Body ground and shield ground	Power switch off	100 MΩ or higher

(e) Connect the motor cable.

NG ▶ REPLACE MOTOR CABLE

OK

▼

7.	REPLACE MOTOR CABLE

(a) Replace the motor cable INFO.

NEXT

▼

8.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT ▶ CHECK DTC OUTPUT (HV)

9.	REPLACE MOTOR CABLE

(a) Replace the motor cable INFO.

NEXT

▼

10.	REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Replace the hybrid vehicle transaxle assembly INFO.

NEXT

▼

11.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

NEXT

12.	CHECK DTC OUTPUT (HV)

(a) Check the other DTCs that were output together with DTC P0A78-202.

Result:

DTC No.	Relevant Diagnosis
P0A78-113, 128, 284, 286, 287, 505, 506, 806, 807, 808	Drive Motor "A" Inverter Performance

NOTICE:

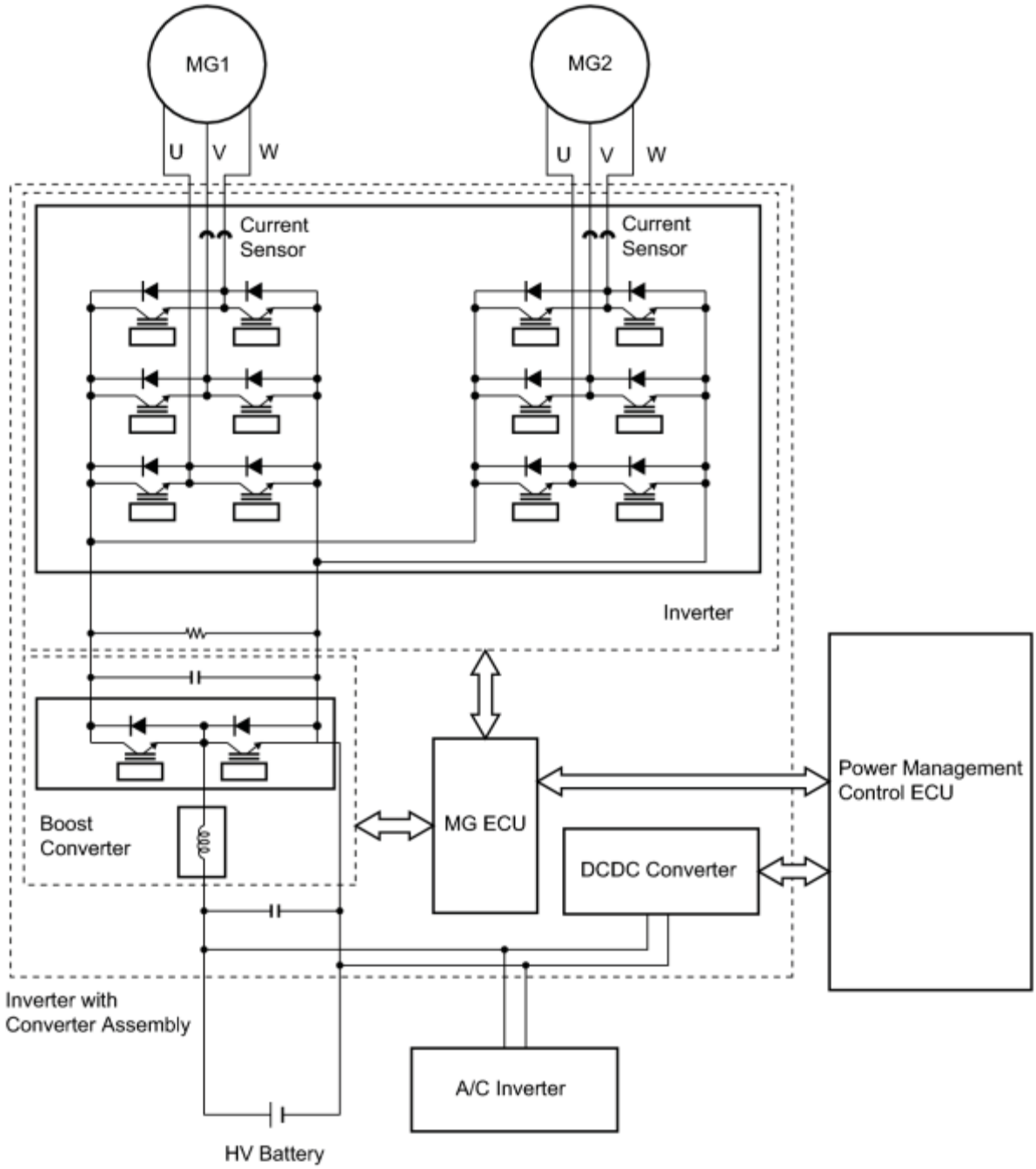
DTC P0A78-202 is stored after any of DTCs P0A78-113, 128, 284, 286, 287, 505, 506, 806, 807 and 808 are stored. After troubleshooting and repairing DTC P0A78-202, be sure to troubleshoot all the other DTCs.

NEXT **GO TO DTC CHART**

DTC	P0A78-266	Drive Motor "A" Inverter Performance
DTC	P0A78-267	Drive Motor "A" Inverter Performance

DESCRIPTION

The inverter contains a three-phase bridge circuit, which consists of six power transistors (IGBTs) each for MG1 and MG2. The inverter converts high-voltage direct current from the HV battery into three-phase alternating current for MG1 and MG2; it also converts three-phase alternating current supplied by MG1 and MG2 into direct current for the HV battery. The MG ECU controls the actuation of the power transistors (IGBTs). The inverter transmits information necessary for control, such as amperage and voltage, to the MG ECU.



c

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

The MG ECU monitors the inverter voltage sensor and detects the following malfunctions.

DTC No.	INF Code	DTC Detection Condition	Trouble Area

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	266	Short to GND in the inverter voltage (VH) signal line	Inverter with converter assembly
P0A78	267	Open or short to +B in the inverter voltage (VH) signal line	

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 power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 266): VH malfunction (GND short malfunction) P0A78 (INF 267): VH malfunction (+B short and disconnection malfunction)
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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

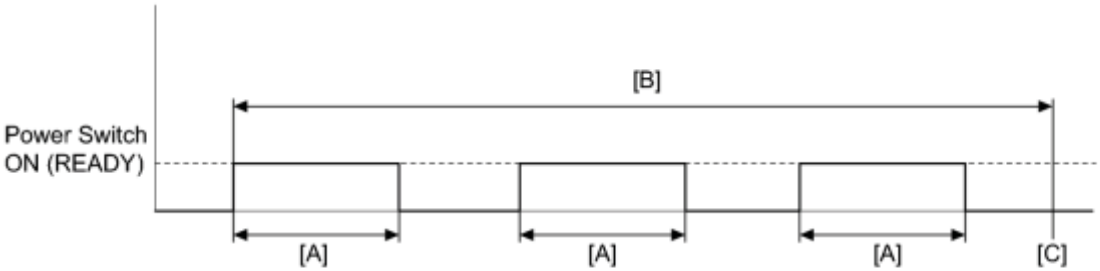
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 266/267) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	REPLACE INVERTER WITH CONVERTER ASSEMBLY

(a) Replace the inverter with converter assembly INFO.

HINT:

The signal line from the inverter voltage (VH) sensor is connected to the MG ECU inside the inverter with converter assembly. If P0A78-266 or P0A78-267 is output, replace the inverter with converter assembly.

NEXT **COMPLETED**

DTC	P0A78-279	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an overvoltage occurs in the motor inverter or generator inverter, the MG ECU detects it and transmits this information to the power management control ECU (HV CPU).

DTC No.	INF Code	DTC Detection Condition	Trouble Area
P0A78	279	Motor inverter overvoltage signal detection (overvoltage (inverter malfunction))	Inverter with converter assembly

MONITOR DESCRIPTION

If the motor inverter detects overvoltage, it will transmit an overvoltage signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A78 (INF 279): OVH detection (Over 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 DTCs are not present	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

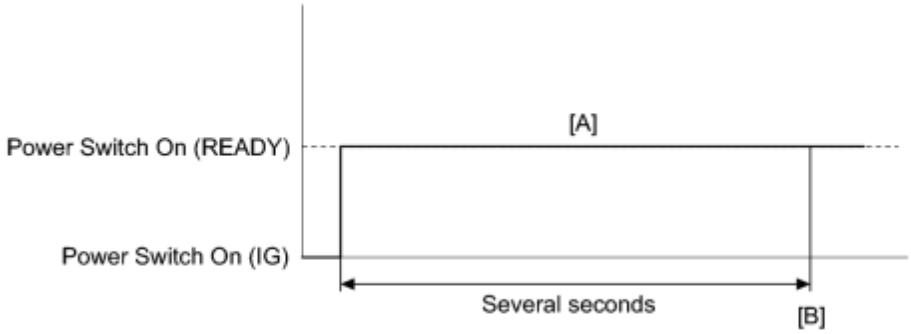
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 279) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

HINT:

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

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-279 only is output.	A
Any of the following DTCs are also output.	B

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A78-266, 267, 287, 505, 506, 565, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A94-554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
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

DTC No.	Relevant Diagnosis
P0AE0-228	Hybrid Battery Negative Contactor Control Circuit High
P3004-803	High Voltage Power Resource
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-279 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. Then, perform a test to attempt to reproduce the problems, and check that no DTCs are output.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

DTC	P0A78-282	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If an overvoltage occurs in the motor inverter or generator inverter, the MG ECU detects it and transmits this information to the power management control ECU (HV CPU).

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 will transmit a motor inverter overvoltage signal to the MG ECU. Upon receiving this signal, the power management control ECU (HV CPU) 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	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	-

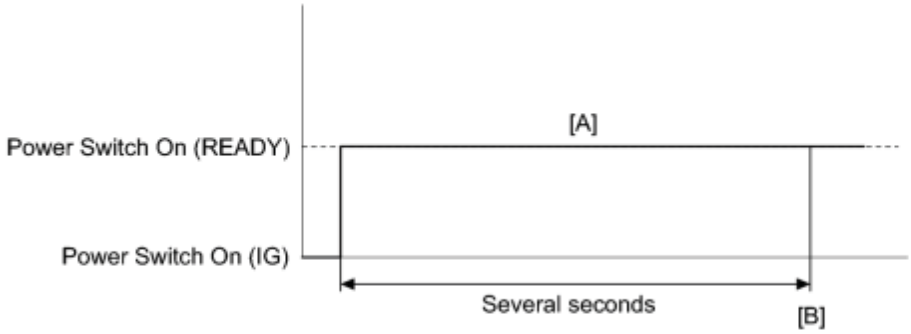
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 282) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY
OK ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

DTC	P0A78-284	Drive Motor "A" Inverter Performance

DESCRIPTION

For a description of the inverter, INFO.

If the motor inverter overheats, has a circuit malfunction, or has an internal short, the inverter transmits this information to 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)	• Inverter cooling system • Cooling fan system • Power management control ECU • Inverter with converter assembly • Hybrid vehicle transaxle assembly • Generator cable • Motor cable • Water pump with motor assembly • Wire harness or connector • IGCT No. 3 fuse • PCU fuse

MONITOR DESCRIPTION

If the motor inverter overheats, it will transmit an inverter fail signal to the MG ECU. The MG ECU will send information about the malfunction to the power management control ECU (HV CPU). Upon receiving this information, the power management control ECU (HV CPU) 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	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	-

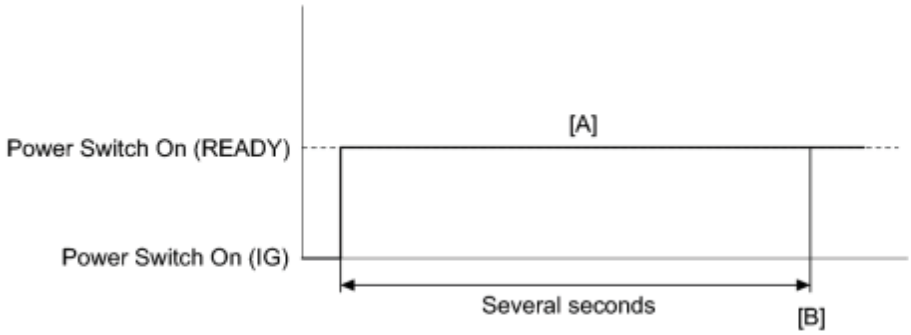
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Power management control ECU (HV CPU)	DTC P0A78 (INF 284) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG) and check that there are no abnormalities (abnormal sounds, coolant leaks, DTC output, etc).
6. Turn the power switch on (READY) and turn the Techstream on. [A]
7. With park (P) selected, wait for several seconds.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [B]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform a universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A01-726 INFO.

Refer to the wiring diagram for DTC P0A1A-200 INFO.

Refer to the wiring diagram for DTC P324E-788 INFO.

Refer to the wiring diagram for DTC U0110-159 INFO.

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. After waiting for 10 minutes, check the voltage at the terminals in the inspection point in the inverter with converter assembly. The voltage should be 0 V before beginning work.

NOTICE:

After troubleshooting and repairing all output DTCs, 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.

PROCEDURE

1.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

Result:

Result	Proceed to
P0A78-202 is not output	A
P0A78-202 is also output	B

NOTICE:

- If P0A78-202 is output, troubleshoot it first. After completing the troubleshooting for P0A78-202, return to perform troubleshooting for this DTC.
- Parts repaired or replaced during troubleshooting for P0A78-202 do not need to be re-inspected in this diagnosis procedure.

(e) Turn the power switch off.

B GO TO DTC CHART

A

2.	CHECK DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Check if DTCs are output.

HINT:

- If P0A78-202 was not output in step 1 of this diagnosis procedure, check Table 1 below.
- If P0A78-202 was output in step 1 of this diagnosis procedure, repair that DTC first, then check Table 2 below.

Result:

Result	Proceed to
P0A78-284 only is output.	A
Any of the following DTCs are also output.	B

Table 1

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance

DTC No.	Relevant Diagnosis
P0A4D-255	Generator Position Sensor Circuit Low
P0A60 (all INF codes)*1	Drive Motor "A" Phase V Current
P0A63 (all INF codes)*1	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 306, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A90-509	Drive Motor "A" Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

Table 2

DTC No.	Relevant Diagnosis
P0A1A (all INF codes)*1	Generator Control Module
P0A1B (all INF codes)*1	Drive Motor "A" Control Module
P0A1D (all INF codes)*1	Hybrid Powertrain Control Module
P0A3F-243	Drive Motor "A" Position Sensor Circuit
P0A40-500	Drive Motor "A" Position Sensor Circuit Range/Performance
P0A41-245	Drive Motor "A" Position Sensor Circuit Low
P0A4B-253	Generator Position Sensor Circuit
P0A4C-513	Generator Position Sensor Circuit Range/Performance
P0A4D-255	Generator Position Sensor Circuit Low
P0A60-294	Drive Motor "A" Phase V Current
P0A63-302	Drive Motor "A" Phase W Current
P0A72 (all INF codes)*1	Generator Phase V Current
P0A75 (all INF codes)*1	Generator Phase W Current
P0A78-266, 267, 279, 287, 503, 504, 505, 506, 586, 806, 807, 808	Drive Motor "A" Inverter Performance
P0A7A-325, 344, 517, 518, 809, 810, 811	Generator Inverter Performance
P0A92-521	Hybrid Generator Performance
P0A94-442, 547, 548, 549, 554, 555, 556, 585, 587, 589, 590	DC/DC Converter Performance
P0C76-523	Hybrid Battery System Discharge Time Too Long

HINT:

- *1: If any INF codes are output for this DTC, refer to the corresponding diagnostic procedure.
- P0A78-284 may be set due to a malfunction which also causes DTCs in the preceding table to be set. In this case, first troubleshoot the output DTCs in the preceding table. After troubleshooting and repairing all output DTCs, be sure to replace the inverter with converter assembly.

(e) Turn the power switch off.

B ▶ GO TO DTC CHART

A ▼

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

NG ▶ CONNECT SECURELY

OK ▼

4.	CHECK QUANTITY OF HV COOLANT INFO

C ▶ INSPECT FOR COOLANT LEAK AND ADD COOLANT

B ▶ ADD HV COOLANT

A ▼

5.	CHECK COOLANT HOSE INFO

NG ▶ CORRECT THE PROBLEM

OK ▼

6.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE WATER PUMP) INFO

NG ▶ CHECK FUSE (IGCT NO. 3)

OK ▼

7.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE ELECTRIC COOLING FAN) INFO

NG ▶ CHECK COOLING FAN SYSTEM

OK ▼

8.	CHECK HV COOLANT (CHECK FOR CONDITIONS THAT MAY HAVE CAUSED FREEZING) INFO

B ▶ REPLACE HV COOLANT

A ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

10.	CHECK GENERATOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR)

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

12.	CHECK MOTOR RESOLVER INFO

NG ▶ CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR)

OK ▼

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A ▼

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

C ▶ CONNECT SECURELY

B ▶ REPLACE MALFUNCTIONING PARTS

A ▼

15.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG1) INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION)

OK ▼

16.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MG2) INFO

NG ▶ CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION)

OK ▼

17.	CHECK FUSE (PCU) INFO

NG ▶ CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE)

OK ▼

18.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY POWER SOURCE CIRCUIT) INFO

NG → REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK ↓

19.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INVERTER WITH CONVERTER) INFO

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

20.	CHECK POWER MANAGEMENT CONTROL ECU INFO

NG → REPLACE POWER MANAGEMENT CONTROL ECU

OK ↓

21.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

22.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG → CONNECT SECURELY

OK → **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

23.	CHECK FUSE (IGCT NO. 3) INFO

NG → CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR)

OK ↓

24.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

25.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG → CONNECT SECURELY

OK ↓

26.	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR ASSEMBLY CIRCUIT) INFO

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ↓

27.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG → REPLACE WATER PUMP WITH MOTOR ASSEMBLY

OK → **REPLACE POWER MANAGEMENT CONTROL ECU**

28.	CHECK CONNECTOR CONNECTION CONDITION (GENERATOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

30.	CHECK CONNECTOR CONNECTION CONDITION (MOTOR RESOLVER CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

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

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

32.	CHECK HARNESS AND CONNECTOR (INVERTER WITH CONVERTER ASSEMBLY - PCU FUSE) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

33.	REPLACE INVERTER WITH CONVERTER ASSEMBLY INFO

NEXT ▶ **REPLACE FUSE (PCU)**

34.	CHECK CONNECTOR CONNECTION CONDITION (WATER PUMP WITH MOTOR ASSEMBLY CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

35.	CHECK CONNECTOR CONNECTION CONDITION (POWER MANAGEMENT CONTROL ECU CONNECTOR) INFO

NG ▶ CONNECT SECURELY

OK ▼

36.	CHECK HARNESS AND CONNECTOR (WATER PUMP WITH MOTOR ASSEMBLY CIRCUIT) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

37.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY

OK

38.	REPLACE POWER MANAGEMENT CONTROL ECU INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

39.	CONNECT SECURELY INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

40.	CONNECT SECURELY INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

41.	REPAIR OR REPLACE HARNESS OR CONNECTOR INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

42.	REPLACE WATER PUMP WITH MOTOR ASSEMBLY INFO

NEXT ▶ **REPLACE FUSE (IGCT NO. 3)**

43.	REPAIR OR REPLACE HARNESS OR CONNECTOR INFO

NEXT ▶ **REPLACE FUSE (PCU)**

44.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (GENERATOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

45.	CHECK GENERATOR CABLE INFO

NG ▶ REPLACE GENERATOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

46.	CHECK HYBRID VEHICLE TRANSAXLE ASSEMBLY (MOTOR CABLE CONNECTION CONDITION) INFO

C ▶ CONNECT SECURELY
B ▶ REPLACE MALFUNCTIONING PARTS
A ▼

47.	CHECK MOTOR CABLE INFO

NG ▶ REPLACE MOTOR CABLE
OK ▶ **REPLACE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

48.	REPLACE HV COOLANT INFO

NEXT ▼

49.	CHECK WATER PUMP WITH MOTOR ASSEMBLY INFO

NG ▶ REPLACE WATER PUMP WITH MOTOR ASSEMBLY
OK ▶ **COMPLETED**

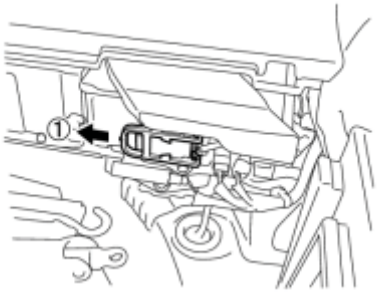
PRECAUTION

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

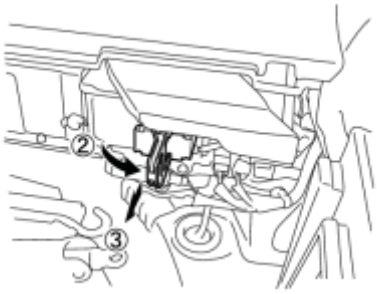
NOTICE:

After removing the service plug grip, turning the power switch on (READY) may 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:



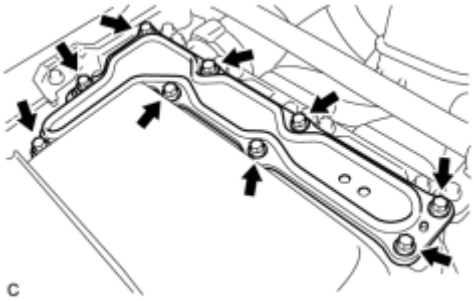
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

C

(c) Check the voltage at the terminals in the inspection point in the inverter with converter assembly.

CAUTION:

Be sure to wear insulated gloves.

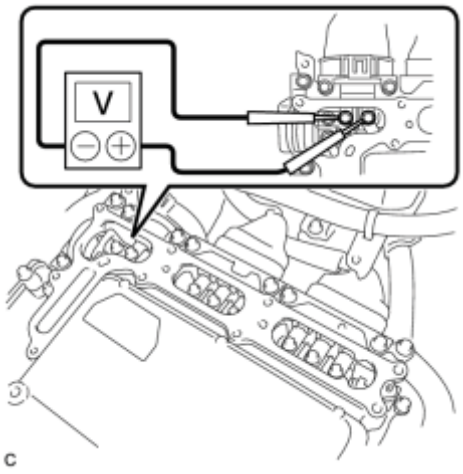


(1) Remove the 9 bolts and inverter terminal cover. INFO

NOTICE:

Cover the opening with non-residue tape to prevent entry of foreign matter or liquid after removing the connector cover.

C



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

Standard Voltage:

Tester Connection	Condition	Specified Condition
Inspection point	10 minutes passed after removing the service plug	0 V

HINT:

Set the tester to DC750 V or more to measure the voltage.

(d) When turning the power switch on (IG) during inspections, do not press the power switch with the brake pedal depressed.

CAUTION:

Pressing the power switch with the brake pedal depressed causes the system to enter the READY-on state. This is very dangerous because high voltage may be applied to the inspection area.

(e) Turn the power switch off, wear insulated gloves, and disconnect the cable from the negative (-) terminal of the auxiliary battery before touching any of the orange-colored wires of the high-voltage system.

(f) Turn the power switch off before performing any resistance checks.

(g) Turn the power switch off before disconnecting or reconnecting any connectors.

(h) When high-voltage connectors are removed, wrap the connectors with insulation tape to prevent them from contacting foreign objects.

2. NOTICE FOR HYBRID CONTROL SYSTEM ACTIVATION

(a) When the warning light is illuminated, or 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 start the hybrid system.

3. PRECAUTIONS FOR DISCONNECTING AMD TERMINAL

HINT:

The AMD terminal is connected to the positive terminal of the auxiliary battery. To prevent damage when the AMD terminal is being disconnected, use the following procedure.

(a) Be sure to disconnect the cable from the negative (-) terminal of the auxiliary battery before disconnecting the AMD terminal from the engine room junction block assembly.

(b) After disconnecting the AMD terminal, wrap the terminal with insulation tape.

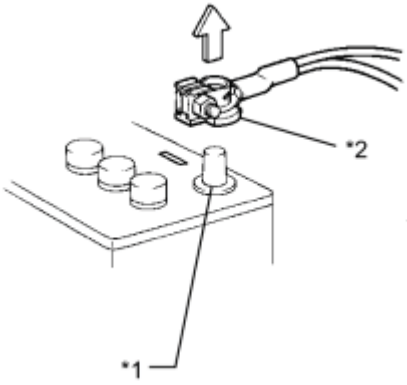
(c) Be sure to reconnect the AMD terminal to the engine room junction block assembly before reconnecting the cable of the negative (-) terminal of the auxiliary battery.

NOTICE:

A short circuit to ground may occur if the AMD terminal is disconnected before the cable is disconnected from the negative (-) terminal of the auxiliary battery. If a short circuit to ground occurs, it can result in an open circuit in a fusible link or fuse.

4. DISCONNECTING AND RECONNECTING NEGATIVE BATTERY CABLE

(a) Before performing work on electronic components, disconnect the cable from the negative (-) battery terminal to prevent damage to the electrical system or electrical components.



Text in Illustration

*1	Negative (-) Battery Terminal
*2	Cable

(b) Before disconnecting and reconnecting the battery cable, turn the power switch off and the headlight switch off. Then loosen the terminal nut completely. Do not damage the cable or terminal.

(c) When the battery cable is disconnected, the clock and radio settings and stored DTCs are cleared. Therefore, before disconnecting the battery cable, make a note of them.

- When the cable is disconnected from the negative (-) battery terminal, initialize the following system(s) after the cable is reconnected.

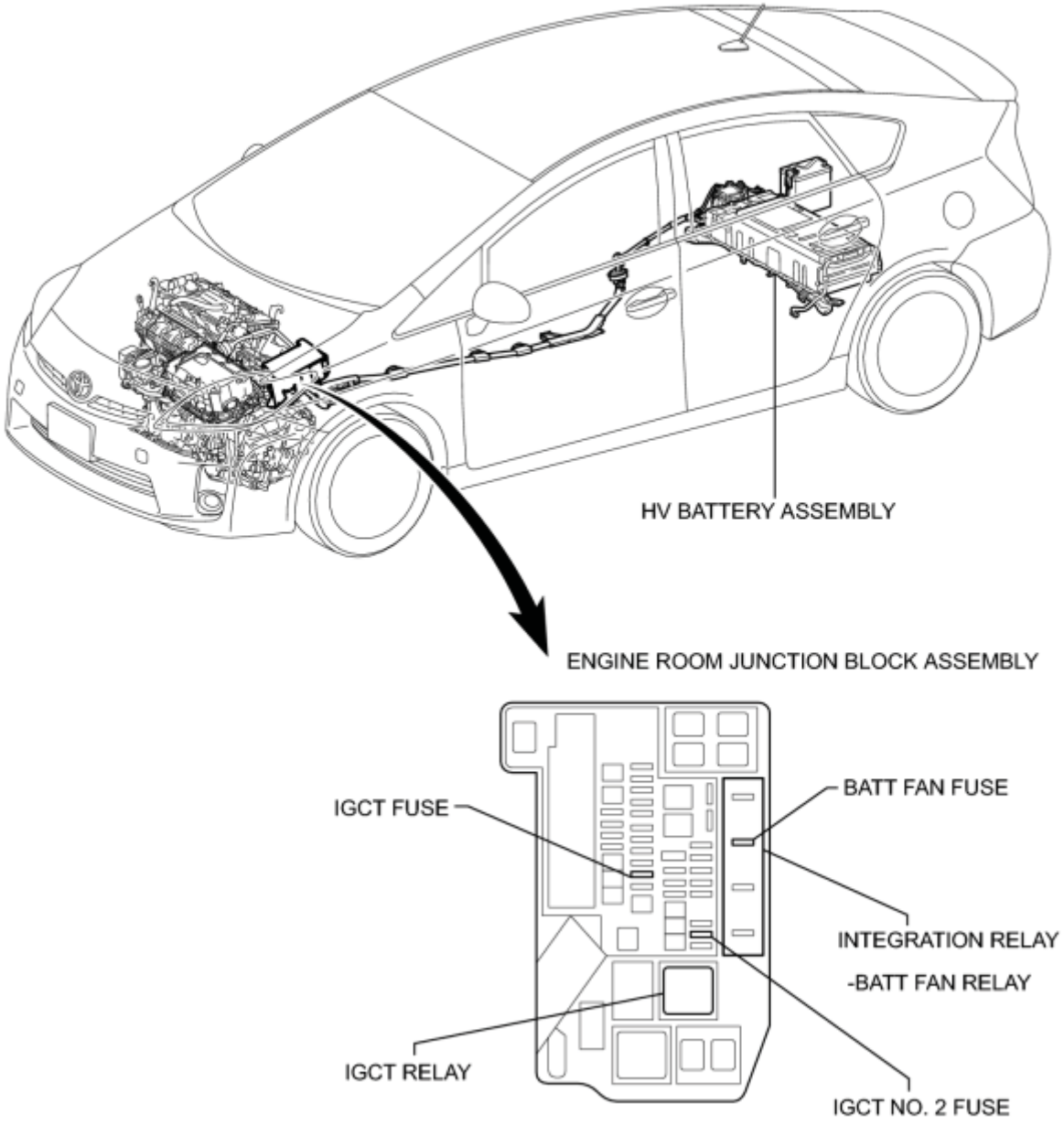
System Name	See Procedure
Advanced Parking Guidance System	INFO

DEFINITION OF TERMS

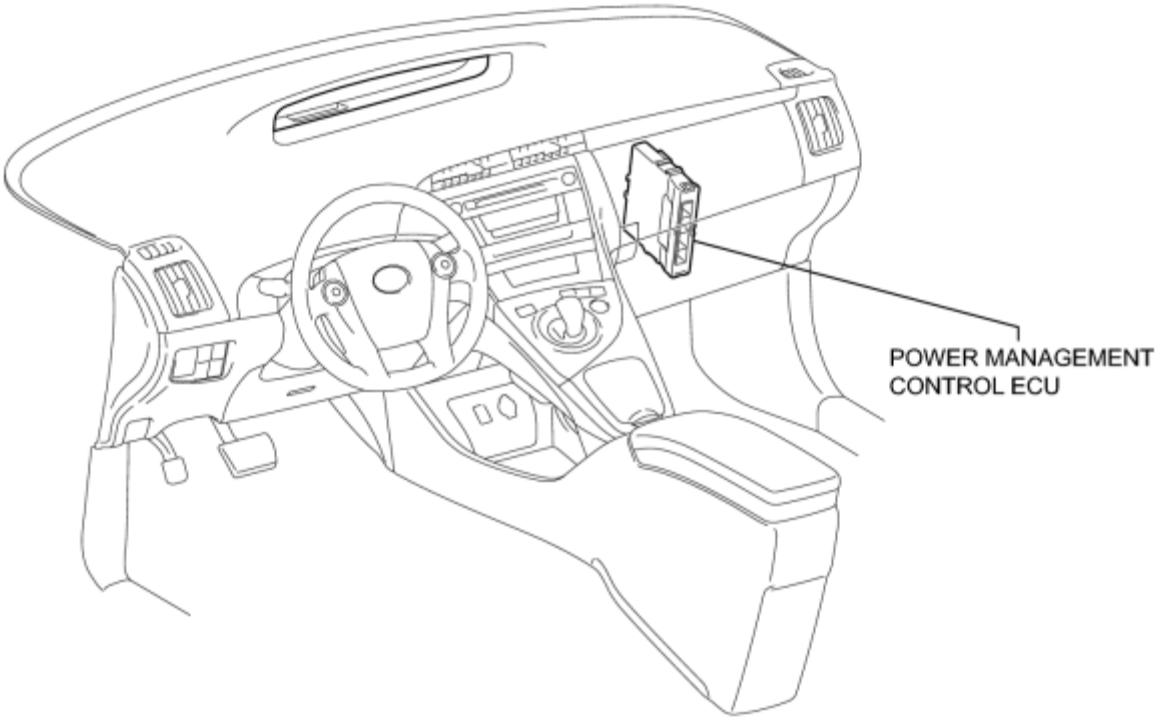
Terms	Definition
Monitor Description	Description of what the power management control ECU (HV CPU) monitors and how to detects malfunctions (monitoring purpose and its details).
Related DTCs	A group of diagnostic trouble codes that are output by the power management control ECU (HV CPU) based on the same malfunction detection logic.
Typical Enabling Condition	Preconditions that allow the power management control ECU (HV CPU) to detect malfunctions. With all preconditions satisfied, the power management control ECU (HV CPU) 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 Sensor/Components	Sensors and components used by the power management control ECU (HV CPU) to detect each malfunction.
Frequency of Operation	Number of times the power management control ECU (HV CPU) checks for each malfunction during each driving cycle. "Once per driving cycle" means that the power management control ECU (HV CPU) only checks for malfunctions once during a single driving cycle. "Continuous" means that the power management control ECU (HV CPU) checks for malfunctions whenever enabling conditions are met.
Duration	Minimum time for which the power management control ECU (HV CPU) 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 power management control ECU (HV CPU) determines malfunctions exist and sets DTCs.
MIL Operation	Timing of MIL illumination after a malfunction is detected. "Immediate" means that the power management control ECU (HV CPU) illuminates the MIL as soon as a malfunction is detected. "2 driving cycles" means that the power management control ECU (HV CPU) illuminates the MIL if the same malfunction is detected again during the next driving cycle.

PARTS LOCATION

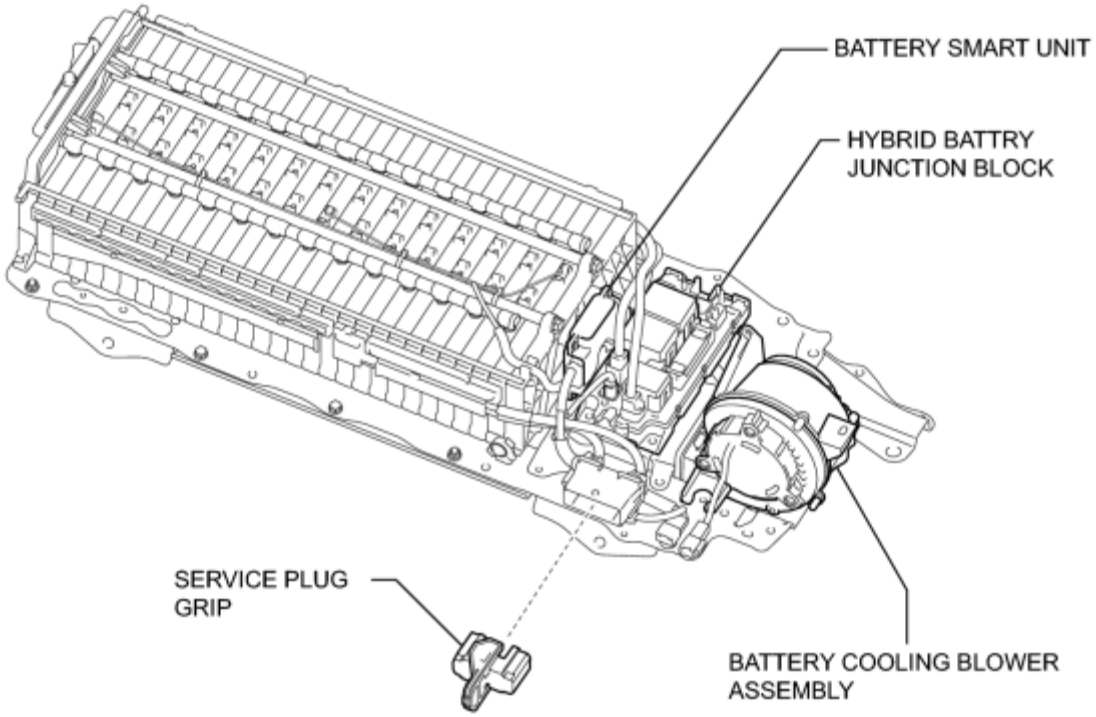
ILLUSTRATION



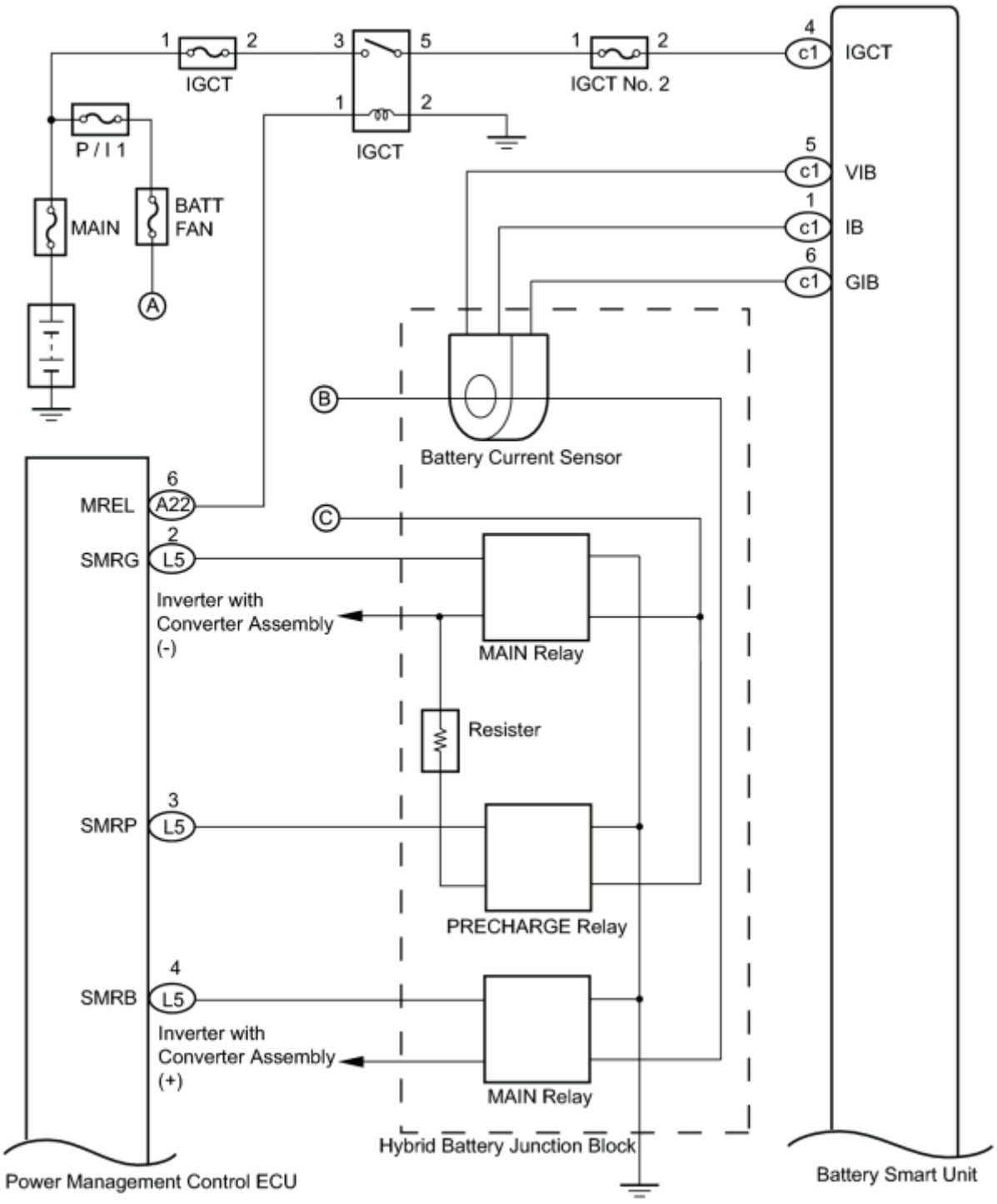
ILLUSTRATION

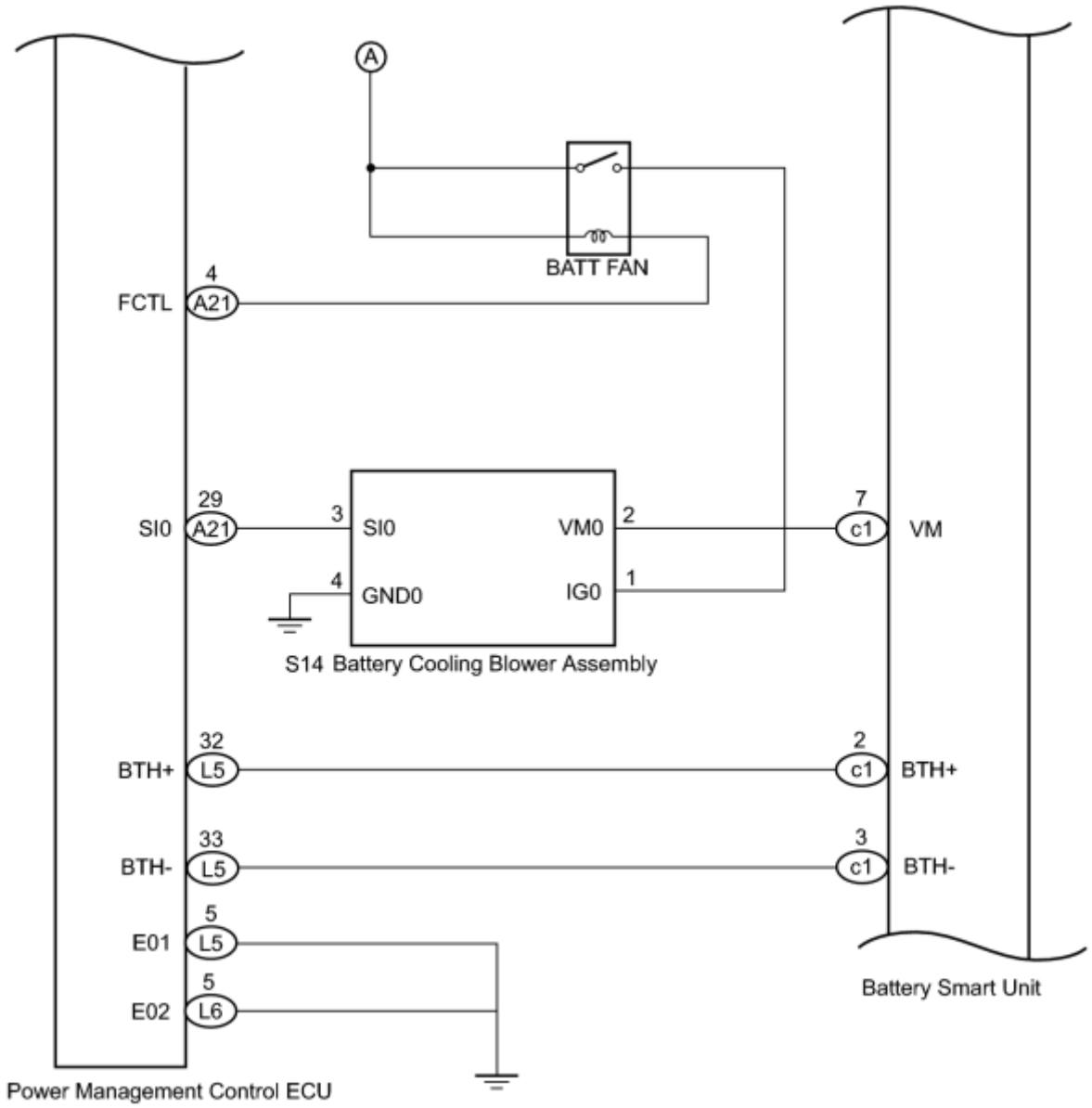


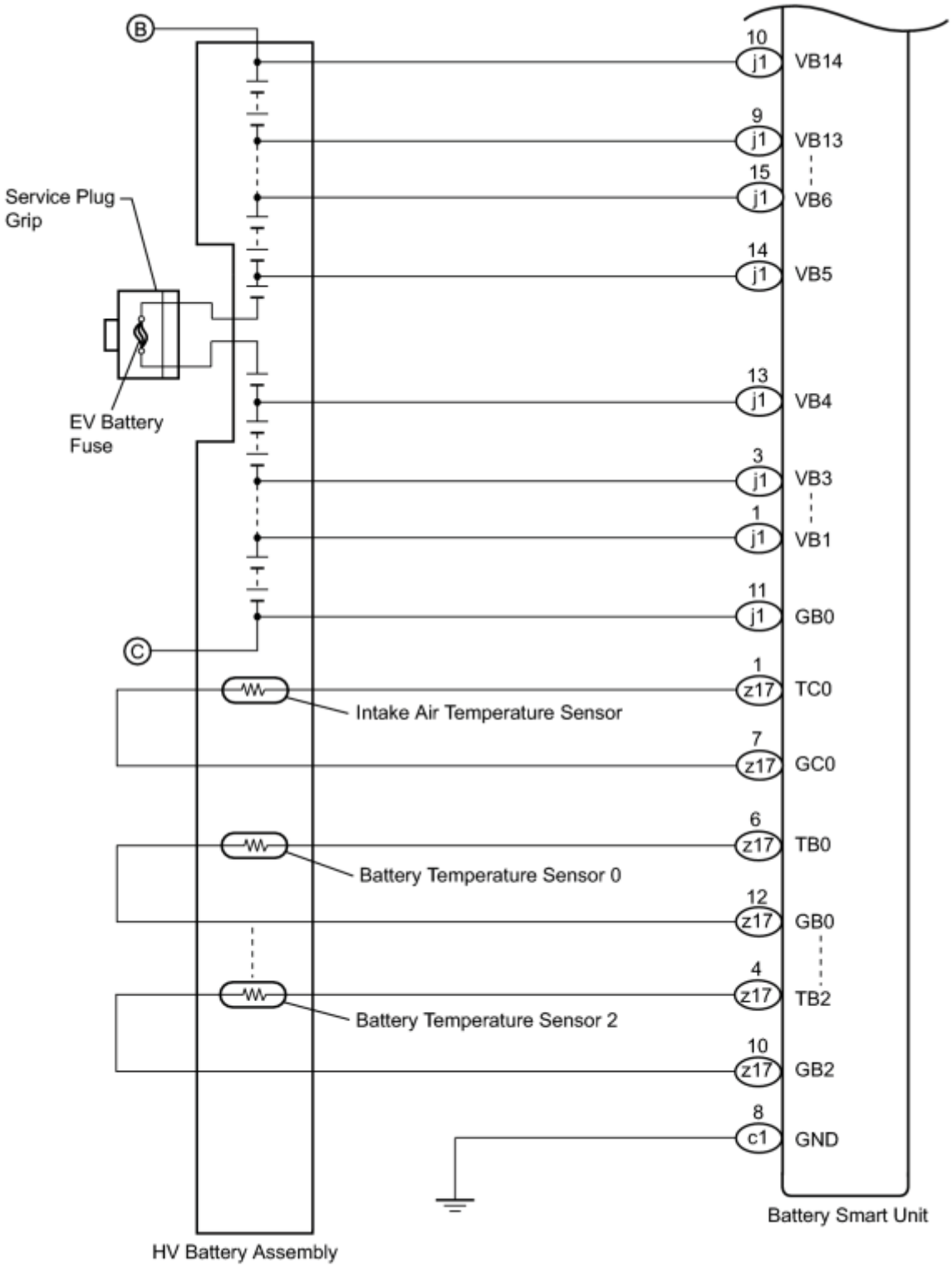
ILLUSTRATION



SYSTEM DIAGRAM



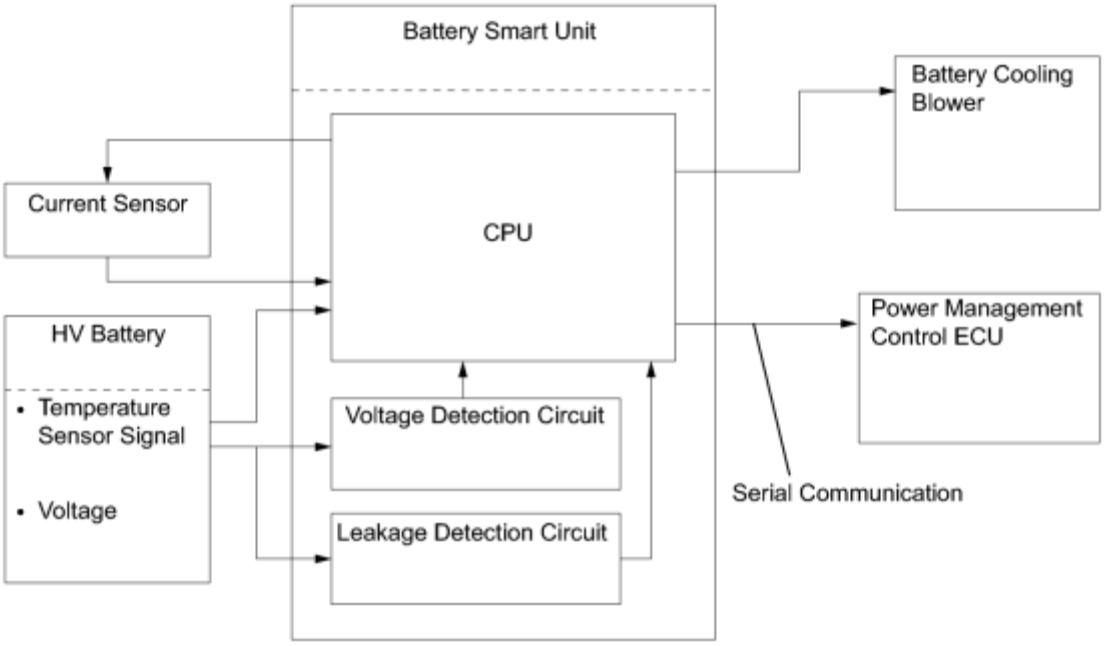

A
BATT FAN
4
FCTL
A21
29
SI0
A21
3
SI0
VM0
2
4
GND0
IG0
1
S14 Battery Cooling Blower Assembly
7
c1
VM
32
BTH+
L5
2
c1
BTH+
33
BTH-
L5
3
c1
BTH-
5
E01
L5
5
E02
L6
Power Management Control ECU
Battery Smart Unit


B
C
Service Plug Grip
EV Battery Fuse
HV Battery Assembly
10
j1
VB14
9
j1
VB13
15
j1
VB6
14
j1
VB5
13
j1
VB4
3
j1
VB3
1
j1
VB1
11
j1
GB0
1
z17
TC0
Intake Air Temperature Sensor
7
z17
GC0
6
z17
TB0
Battery Temperature Sensor 0
12
z17
GB0
4
z17
TB2
Battery Temperature Sensor 2
10
z17
GB2
8
c1
GND
Battery Smart Unit

SYSTEM DESCRIPTION

1. BATTERY SMART UNIT CONTROL

- The battery smart unit converts the HV battery condition signals (voltage, current, and temperature), which are needed to determine the charging or discharging values that are calculated by the power management control ECU into digital signals, and transmits them to the power management control ECU via serial communication.
- A leakage detection circuit is provided in the battery smart unit in order to detect any leakage from the HV battery. Furthermore, the battery smart unit detects the voltage of the cooling fan, which is needed by the power management control ECU to effect cooling fan control. The battery smart unit also converts these signals into digital signals and transmits them to the power management control ECU via serial communication.



c

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- *: Use the Techstream
- Use the following procedure to troubleshoot the hybrid battery system.

1.	VEHICLE BROUGHT TO WORKSHOP

NEXT

2.	CUSTOMER PROBLEM ANALYSIS

NEXT

3.	CONNECT TECHSTREAM 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* INFO

HINT:

- Make sure to save freeze frame data because the data is necessary for a simulation test.
- For the hybrid vehicle control system, there are many DTCs, many of which can be stored due to a single malfunction. As a result, in some of the diagnosis procedures an instruction is provided to check for other DTCs and their corresponding INF codes. By following the diagnosis path based on the combination of output DTCs and INF codes, it is possible to narrow down the problem early and avoid unnecessary diagnosis.

NEXT

5.	CLEAR DTC AND FREEZE FRAME DATA* INFO

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* INFO

Result:

Result	Proceed to
DTC is output	A
DTC is not output	B

B ▶ GO TO STEP 11

A ▼

10.	REFER TO DTC CHART INFO

NEXT ▶ **GO TO STEP 13**

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 INFO

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 INFO.

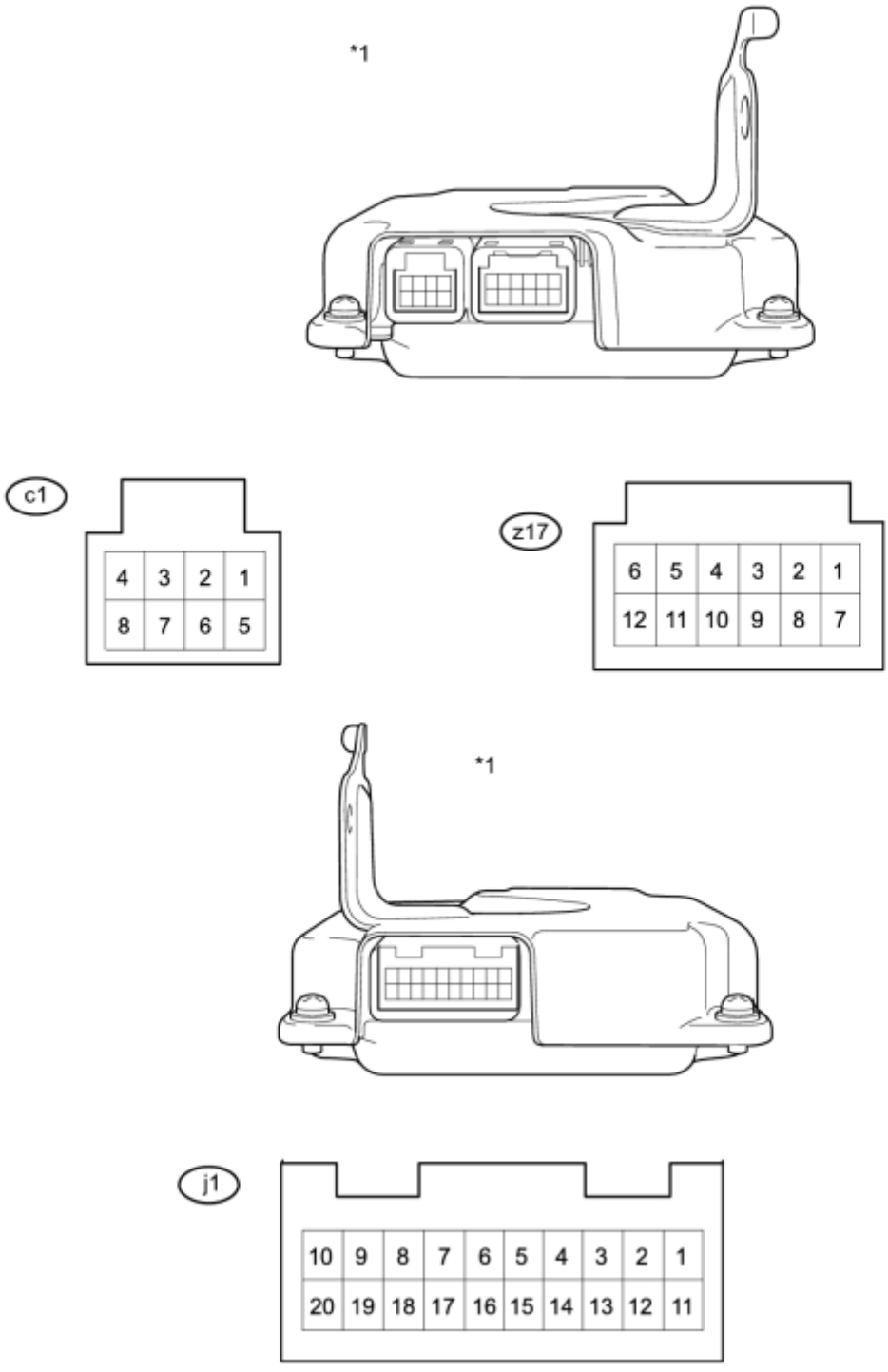
(1) For the simulation test, reproduce the driving conditions that were present when the trouble occurred. These conditions should be based on the customer's comments and freeze frame data that is recorded with DTCs, such as the opening angle of the accelerator pedal, SOC (state of charge), engine coolant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

(b) Check the connector(s) and terminal(s) INFO.

(c) Wiggle the harness and connector(s) INFO.

(d) Heat or cool suspected parts INFO.

TERMINALS OF ECU



Text in Illustration

*1	Battery Smart Unit	-	-

ECU TERMINAL CHART

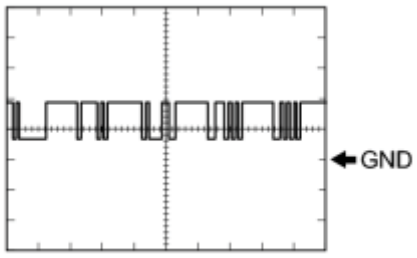
Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Standard (V)
z17-4 (TB2) - z17-10 (GB2)	L - L	Battery temperature sensor 2	HV battery temperature: -40 to 194°F (-40 to 90°C)	4.8 (-40°F(-40°C)) to 1.0 (194°F(90°C))
z17-5 (TB1) - z17-11 (GB1)	B - B	Battery temperature sensor 1	HV battery temperature: -40 to 194°F (-40 to 90°C)	4.8 (-40°F(-40°C)) to 1.0 (194°F(90°C))
z17-6 (TB0) - z17-12 (GB0)	W - W	Battery temperature sensor 0	HV battery temperature: -40 to 194°F (-40 to 90°C)	4.8 (-40°F(-40°C)) to 1.0 (194°F(90°C))
c1-1 (IB) - c1-6 (GIB)	P - B	Current sensor	Power switch on (READY)	0.5 to 4.5
c1-5 (VIB) - c1-6 (GIB)	G - B	Power source for battery current sensor	Power switch on (IG)	4.5 to 5.5
c1-4 (IGCT) - c1-8 (GND)	L - W-B	Control signal	Power switch on (READY)	11 to 14
c1-2 (BTH+) - c1-8 (GND)	R - W-B	Serial communication	Power switch on (IG)	Pulse generation (waveform 1)
c1-3 (BTH-) - c1-8 (GND)	G - W-B	Serial communication	Power switch on (IG)	Pulse generation (waveform 2)
c1-7 (VM) - c1-8 (GND)	V - W-B	Battery cooling blower No. 0 monitor signal	Cooling blower activated	0 to 5
c1-8 (GND) - Body ground	W-B	Ground	Always (continuity check)	Below 1 Ω

1. Oscilloscope waveforms

HINT:

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

(a) Waveform 1



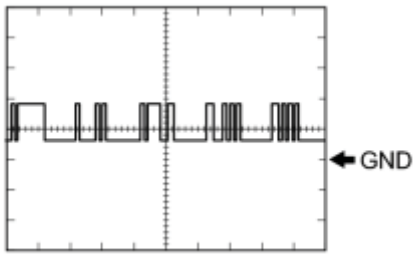
Item	Content
Terminal	c1-2 (BTH+) - c1-8 (GND)
Equipment Setting	2 V/DIV, 500 µs/DIV
Condition	Power switch on (IG)

HINT:

The waveform will vary depending on the content of the digital

communication (digital signal).

(b) Waveform 2



Item	Content
Terminal	c1-3 (BTH-) - c1-8 (GND)
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).

DIAGNOSIS SYSTEM

1. DESCRIPTION

(a) The power management control ECU (HV CPU) has a self-diagnosis system. If the computer, power management control ECU (HV CPU), 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 in the combination meter and provides other appropriate messages on the multi-information display, such as an HV system warning message, HV battery warning message or discharge warning message.

HINT:

The master warning light will illuminate when the hybrid control system malfunctions and the light will blink when in inspection mode.

- When troubleshooting OBD II (On-Board Diagnostics) vehicles, the Techstream (complying with SAE J1987) must be connected to the DLC3 (Data Link Connector 3) of the vehicle. Various data in the vehicle ECM (Engine Control Module) can then be read.
- OBD II regulations require that the vehicle's on-board computer illuminate the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in:

a. The emission control system components.
b. The powertrain control components (which affect vehicle emissions).
c. The computer itself.

In addition, the applicable DTCs prescribed by SAE J2012 are recorded in the power management control ECU (HV CPU) memory. If the malfunction does not recur in 3 consecutive

trips, the MIL turns off automatically but the DTCs remain recorded in the power management control ECU (HV CPU) memory.

- To check for DTCs, connect the Techstream to the DLC3. The Techstream displays DTCs, freeze frame data, and a variety of hybrid control system data. The DTCs and freeze frame data can be cleared with the Techstream. In order to enhance the OBD function on vehicles and develop the Off-Board diagnosis system, Controller Area Network (CAN) communication is used in this system. CAN is a network which uses a pair of data transmission lines spanning multiple computers and sensors. It allows for high speed communications between the systems and simplification of the wire harness connections.

2. 2 TRIP DETECTION LOGIC

- When a malfunction is first detected, the malfunction is temporarily stored in the power management control ECU (HV CPU) memory (1st trip). If the same malfunction is detected during the next drive cycle, the MIL is illuminated (2nd trip).

3. FREEZE FRAME DATA

- The power management control ECU (HV CPU) records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, as well as other data recorded at the time of a malfunction.

4. AUXILIARY BATTERY VOLTAGE

Standard Voltage:

Switch Condition	Specified Condition
Power switch on (IG)	11 to 14 V

- If voltage is below 11 V, replace or recharge the battery.

5. MIL (Malfunction Indicator Lamp)

(a) The MIL is illuminated when the power switch is first turned on (IG), before the READY indicator comes on.

(b) When the READY indicator turns on, the MIL should turn off. If the MIL remains illuminated, the diagnosis system has detected a malfunction or abnormality in the system.

HINT:

If the MIL is not illuminated when the power switch is first turned on (IG), check the MIL circuit INFO.

DTC CHECK / CLEAR

1. CHECK FOR DTCS

(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check the DTCs and freeze frame data, and then write them down.

(f) Check the details of the DTCs 

.

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:

A 3-digit information code (INF code) will be displayed as the value for one of the Information 1 to Information 5 lines.

(c) Read the information for the information code.

(1) Select the item from among Information 1 to Information 5 that has an information code and click the engine icon to view the additional information.

3. CHECK FOR DTCS (SYSTEMS OTHER THAN POWER MANAGEMENT CONTROL ECU (HV CPU))

HINT:

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

(a) 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 INFO, and operation history data INFO.

(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on.

(d) Check that park (P) is selected.

(e) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

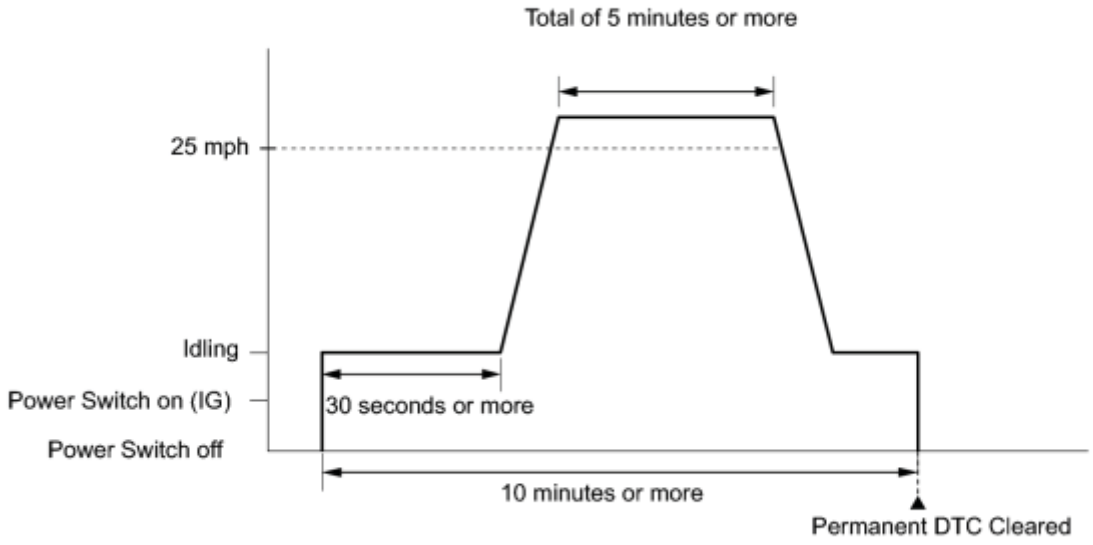
(f) Clear DTCs and freeze frame data.

5. CLEAR PERMANENT DTC

HINT:

Even if the following procedure is not performed, permanent DTCs are cleared by obtaining a normal judgment during 3 consecutive driving cycles.

Universal Trip Driving Pattern



(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check if permanent DTCs are stored.

HINT:

If permanent DTCs are not output, it is not necessary to continue this procedure.

(f) Clear the DTCs.

(g) Perform the respective confirmation driving patterns in order to obtain a normal judgment for the output DTCs.

HINT:

- Confirmation driving patterns do not need to be performed for misfire and fuel system DTCs.
- For the confirmation driving pattern, refer to the procedures for the relevant DTC INFO.

(h) Perform the universal trip.

HINT:

The driving pattern to obtain a normal judgment and the universal trip driving can be performed consecutively in the same driving cycle.

1. Put the engine in inspection mode INFO.
2. Idle the engine for 30 seconds or more.
3. Drive the vehicle at 25 mph (40 km/h) or more for a total of 5 minutes or more.

   HINT:

   It is possible to complete the drive pattern even if the vehicle decelerates to less than 25 mph (40 km/h) during the driving cycle provided that the vehicle is driven at 25 mph (40 km/h) or more for a total of 5 minutes.

4. Allow 10 minutes or more to elapse from the time the engine is started.

(i) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(j) Check that the permanent DTCs have been cleared.

HINT:

The permanent DTCs are cleared when the universal trip is completed.

FREEZE FRAME DATA

1. FREEZE FRAME DATA

HINT:

The power management control ECU (HV CPU) 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 Techstream to the DLC3.

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

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Select a DTC in order to display its freeze frame data.

(f) Check the freeze frame information recorded with the DTC.

HINT:

For the freeze frame data chart, 

.

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.

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List.

(d) Check the results by referring to the following table.

HINT:

For the data list, 

.

2. Active Test

Using the Techstream 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 tester DLC connector becomes disconnected or if a communication error occurs during an Active Test, the vehicle could become inoperative (the READY indicator may go off).

(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on. Enter the following menus: Powertrain / Hybrid Control / Active Test.

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

HINT:

For the active test chart, 

.

DIAGNOSTIC TROUBLE CODE CHART

Hybrid Battery System

DTC Code	Detection Item	Trouble Area	MIL	See page
P0A7F-123	Hybrid Battery Pack Deterioration	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P0A80-123	Replace Hybrid Battery Pack	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P0A82-123	Hybrid Battery Pack Cooling Fan 1	1. Battery cooling blower assembly 2. Battery smart unit 3. Power management control ECU 4. HV battery intake duct 5. Wire harness or connector	-	INFO
P0A84-123	Hybrid Battery Pack Cooling Fan 1	1. Wire harness or connector 2. Integration relay 3. Battery cooling blower assembly 4. Battery smart unit 5. Power management control ECU	-	INFO
P0A85-123	Hybrid Battery Pack Cooling Fan 1	1. Wire harness or connector 2. Battery cooling blower assembly 3. Battery smart unit 4. HV battery assembly	-	INFO
P0A95-123	High Voltage Fuse	1. Service plug grip 2. HV battery assembly	-	INFO

DTC Code	Detection Item	Trouble Area	MIL	See page
P0A9C-123	Hybrid Battery Temperature Sensor "A" Range / Performance	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector	Comes on	INFO
P0A9D-123	Hybrid Battery Temperature Sensor "A" Circuit Low	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	Comes on	INFO
P0A9E-123	Hybrid Battery Temperature Sensor "A" Circuit High	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	Comes on	INFO
P0AAE-123	Hybrid Battery Pack Air Temperature Sensor "A" Circuit Low	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	-	INFO
P0AAF-123	Hybrid Battery Pack Air Temperature Sensor "A" Circuit High	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	-	INFO
P0ABF-123	Hybrid Battery Pack Current Sensor Circuit	1. Hybrid battery junction block	Comes on	INFO

DTC Code	Detection Item	Trouble Area	MIL	See page
		2. Battery smart unit 3. Wire harness or connector		
P0AC0-123	Hybrid Battery Pack Current Sensor Circuit Range / Performance	1. Hybrid battery junction block 2. Battery smart unit	Comes on	INFO
P0AC1-123	Hybrid Battery Pack Current Sensor Circuit Low	1. Hybrid battery junction block 2. Battery smart unit 3. Wire harness or connector	Comes on	INFO
P0AC2-123	Hybrid Battery Pack Current Sensor Circuit High	1. Hybrid battery junction block 2. Battery smart unit 3. Wire harness or connector	Comes on	INFO
P0AC6-123	Hybrid Battery Temperature Sensor "B" Range / Performance	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector	Comes on	INFO
P0AC7-123	Hybrid Battery Temperature Sensor "B" Circuit Low	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	Comes on	INFO
P0AC8-123	Hybrid Battery Temperature Sensor "B" Circuit High	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	Comes on	INFO

DTC Code	Detection Item	Trouble Area	MIL	See page
P0ACB-123	Hybrid Battery Temperature Sensor "C" Range / Performance	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector	Comes on	INFO
P0ACC-123	Hybrid Battery Temperature Sensor "C" Circuit Low	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	Comes on	INFO
P0ACD-123	Hybrid Battery Temperature Sensor "C" Circuit High	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector 4. Hybrid battery junction block	Comes on	INFO
P0AFC-123	Hybrid Battery Pack Sensor Module	1. Battery smart unit 2. Wire harness or connector 3. IGCT fuse 4. IGCT No. 2 fuse 5. IGCT relay	Comes on	INFO
P0B3D-123	Hybrid Battery Voltage Sensor "A" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B42-123	Hybrid Battery Voltage Sensor "B" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B47-123	Hybrid Battery Voltage Sensor "C" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B4C-123	Hybrid Battery Voltage Sensor "D" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO

DTC Code	Detection Item	Trouble Area	MIL	See page
P0B51-123	Hybrid Battery Voltage Sensor "E" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B56-123	Hybrid Battery Voltage Sensor "F" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B5B-123	Hybrid Battery Voltage Sensor "G" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B60-123	Hybrid Battery Voltage Sensor "H" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B65-123	Hybrid Battery Voltage Sensor "I" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B6A-123	Hybrid Battery Voltage Sensor "J" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B6F-123	Hybrid Battery Voltage Sensor "K" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B74-123	Hybrid Battery Voltage Sensor "L" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B79-123	Hybrid Battery Voltage Sensor "M" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B7E-123	Hybrid Battery Voltage Sensor "N" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P0B83-123	Hybrid Battery Voltage Sensor "O" Circuit Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
P3011-123	Battery Block 1 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3012-123	Battery Block 2 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3013-123	Battery Block 3 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO

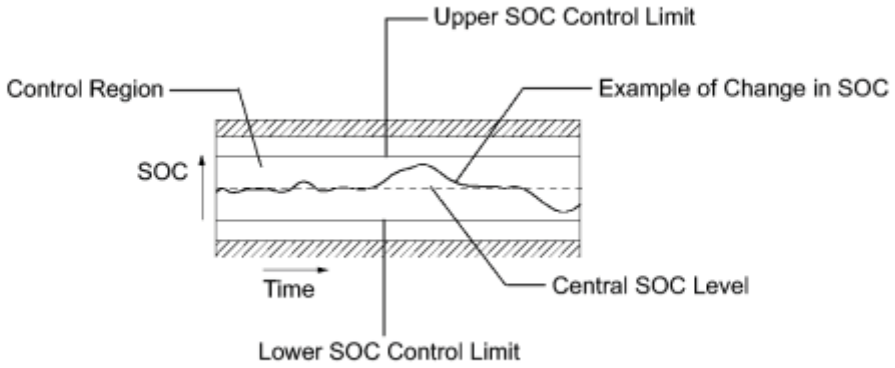
DTC Code	Detection Item	Trouble Area	MIL	See page
P3014-123	Battery Block 4 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3015-123	Battery Block 5 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3016-123	Battery Block 6 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3017-123	Battery Block 7 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3018-123	Battery Block 8 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3019-123	Battery Block 9 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3020-123	Battery Block 10 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3021-123	Battery Block 11 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3022-123	Battery Block 12 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3023-123	Battery Block 13 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3024-123	Battery Block 14 Becomes Weak	1. HV battery assembly 2. Battery smart unit	Comes on	INFO
P3065-123	Hybrid Battery Temperature Sensor Range / Perfoemance Stack A	1. HV battery assembly 2. Battery smart unit 3. Wire harness or connector	Comes on	INFO
P308A-123	Hybrid Battery Voltage Sensor All Circuits Low	1. Battery smart unit 2. HV battery assembly	Comes on	INFO
U029A-123	Lost Communication with Hybrid Battery Pack Sensor Module	1. Wire harness or	Comes on	INFO

DTC Code	Detection Item	Trouble Area	MIL	See page
		connector 2. Power management control ECU 3. Battery smart unit 4. IGCT fuse 5. IGCT NO. 2 fuse 6. IGCT relay		

DTC	P0A7F-123	Hybrid Battery Pack Deterioration

DESCRIPTION

- The battery smart unit and the power management control ECU calculate the SOC (state of charge) of the HV battery through the accumulated amperage in the HV battery. The battery smart unit sends the condition of the HV battery to the power management control ECU. Then the power management control ECU calculates the SOC based on the information and controls HV battery charge and discharge according to the driving condition.



DTC No.	DTC Detection Condition	Trouble Area
P0A7F-123	• Internal resistance of the HV battery is higher than the standard (1 trip detection) • Difference in the capacity between battery blocks is larger than the standard (2 trip detection)	• HV battery assembly • Battery smart unit

HINT:

P0A7F-123 will not be set unless the vehicle is driven for approximately 10 minutes after clearing the DTC.

MONITOR DESCRIPTION

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

MONITOR STRATEGY

Related DTCs	P0A7F (INF 123): Battery cell malfunction
Required sensors / components	Main: Battery voltage sensor inside battery smart unit, battery current sensor

	Sub: Battery temperature sensor
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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	-

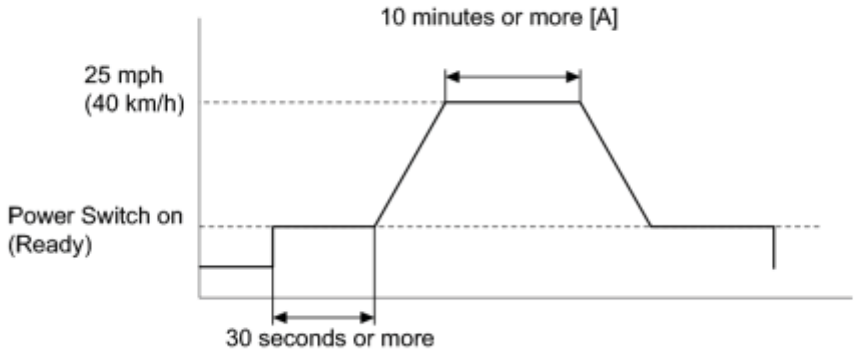
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Battery smart unit	DTC P0A7F (INF 123) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Turn the power switch on (READY) and wait for 30 seconds or more.
7. Drive the vehicle on urban roads at a speed of 25 mph (40 km/h) or more for a total of at least 10 minutes. [A]

NOTICE:

Avoid abrupt acceleration or braking.

8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read output DTCs INFO.

Result:

Result	Proceed to
P0AFC-123 is not output.	A
P0AFC-123 is also output.	B

(e) Disconnect the Techstream from the DLC3.

B GO TO DTC CHART

A

2.	CHECK BATTERY SMART UNIT

(a) Ensure the safety of the areas in front and at the back of the vehicle.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Data List / VB0 to 14 Batt block.

(e) Fully warm up the engine and turn the air conditioning off.

(f) Firmly depress the brake pedal with your left foot.

(g) Move the select lever to D.

(h) Record each battery block voltage from the data list (V1 to 14 Batt block) while fully depressing the accelerator pedal.

(i) Compare the battery block voltages (VB0 to 13 Batt block) between the even and odd number groups in each combination shown in the table below.

Even Number Group	Odd number group	Battery block voltages to be compared
V0 BATT BLOCK	V1 BATT BLOCK	VB0 - VB1
V2 BATT BLOCK	V3 BATT BLOCK	VB2 - VB3
V4 BATT BLOCK	V5 BATT BLOCK	VB4 - VB5
V6 BATT BLOCK	V7 BATT BLOCK	VB6 - VB7
V8 BATT BLOCK	V9 BATT BLOCK	VB8 - VB9
V10 BATT BLOCK	V11 BATT BLOCK	VB10 - VB11
V12 BATT BLOCK	V13 BATT BLOCK	VB12 - VB13

(j) Check the difference in voltage of each combination.

Result

Result	Proceed to
Difference in voltage of each combination is less than 0.3 V.	A
Difference in voltage of each combination is 0.3 V or more.	B

HINT:

If the difference in voltage of each combination is 0.3 V or more, it is due to a battery smart unit internal error.

(k) Turn the power switch off.

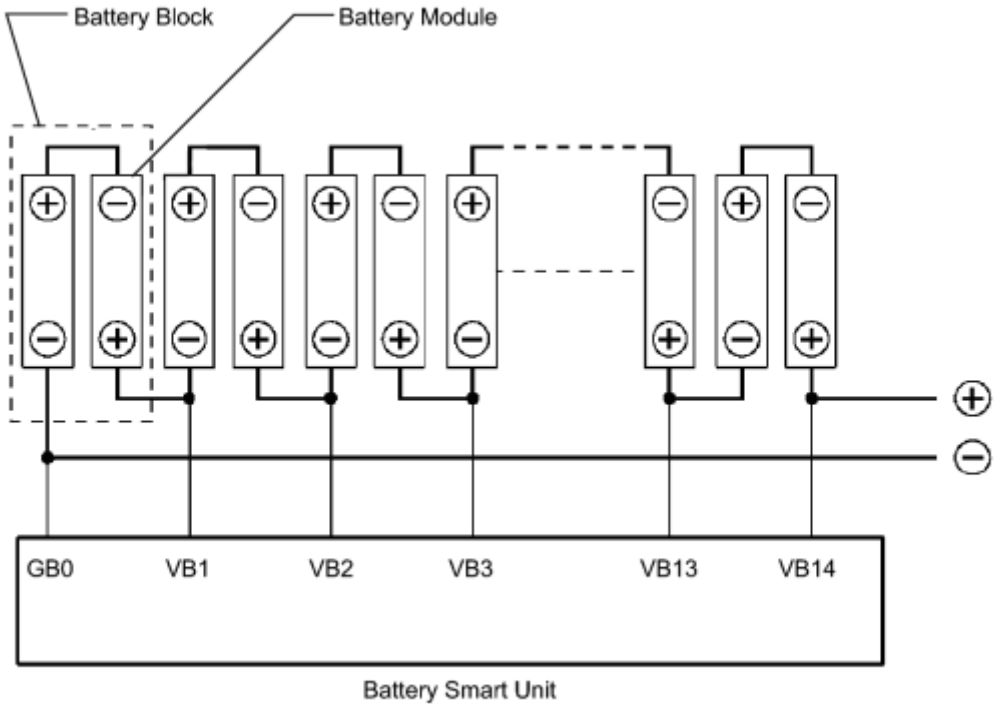
(l) Disconnect the Techstream from the DLC3.

B ▶ REPLACE BATTERY SMART UNIT
A ▶ **REPLACE HV BATTERY ASSEMBLY**

DTC	P0A80-123	Replace Hybrid Battery Pack

DESCRIPTION

- The HV battery uses nickel metal-hydride batteries and does not require external charging. The power management control ECU controls the SOC (state of charge) of the HV battery at a constant level during driving. The HV battery is composed of 28 modules, and each module consists of eight 1.2 V cells in series. The battery smart unit monitors battery block voltage at 14 locations. Each battery block is composed of 2 modules in a set.



DTC No.	DTC Detection Condition	Trouble Area
P0A80-123	Difference in voltage between battery blocks is larger than the standard (2 trip detection)	• HV battery assembly • Battery smart unit

HINT:

- P0A80-123 will not be set unless the vehicle is driven for approximately 10 minutes after clearing the DTC.

MONITOR DESCRIPTION

The battery smart unit, which monitors the voltage of the battery blocks, determines that malfunction has occurred if a voltage difference between the battery blocks exceeds the standard. When the malfunction detection condition is satisfied, the power management control ECU (HV CPU) will illuminates the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A80 (INF 123): Rationality
Required sensors / components	Main: Battery voltage sensor inside battery smart unit Sub: Battery current sensor, battery temperature sensor
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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

Battery smart unit	DTC P0A80 (INF 123) is not detected

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Perform a universal trip.
7. With the select lever in N, leave the vehicle until SOC drops to 30%.

   HINT:

   Although DTC P3000 (INF 388) may be stored if the SOC drops to 20% or lower, this is not a malfunction.

8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
9. Check that permanent DTCs are cleared.

   HINT:

- If the permanent DTC is not cleared, repeat steps 6 and 7.
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B ▶ GO TO DTC CHART

A ▼

2.	CHECK BATTERY SMART UNIT INFO

B ▶ REPLACE BATTERY SMART UNIT

A ▶ **REPLACE HV BATTERY ASSEMBLY**

DTC	P0A82-123	Hybrid Battery Pack Cooling Fan 1

DESCRIPTION

- Refer to the circuit description for DTC P0A84-123 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0A82-123	The speed of the battery cooling blower assembly is not within the specified range (1 trip detection)	• Battery cooling blower assembly • Battery smart unit • Power management control ECU • HV battery intake duct • Wire harness or connector

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A84-123 INFO.

INSPECTION PROCEDURE

CAUTION:

- 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.

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

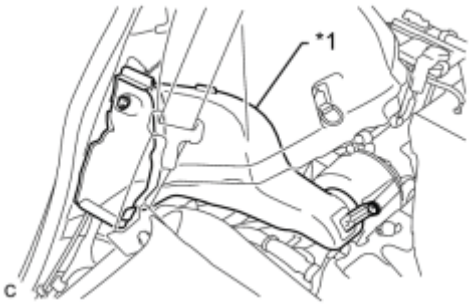
PROCEDURE

1.	CHECK FOR DTCS (DTC P0A1F-123 IS OUTPUT) INFO	
B	GO TO DTC CHART	

A

2.	CHECK DUCT AND BLOWER

(a) Remove the upper hybrid battery cover sub-assembly INFO.



(b) Check that the No. 1 hybrid battery intake duct and battery cooling blower are not disconnected, damaged, or clogged with foreign objects, and that the acoustical materials have not peeled.

OK:

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

Text in Illustration

*1	No. 1 Hybrid Battery Intake Duct

(c) Install the upper hybrid battery cover sub-assembly INFO.

NG ▶ CORRECT THE PROBLEM

OK

3.	CHECK HARNESS AND CONNECTOR (BATTERY COOLING BLOWER - POWER MANAGEMENT CONTROL ECU)

(a) Disconnect the cable from the negative (-) battery terminal.

(b) Check that the service plug grip is not installed.

NOTICE:

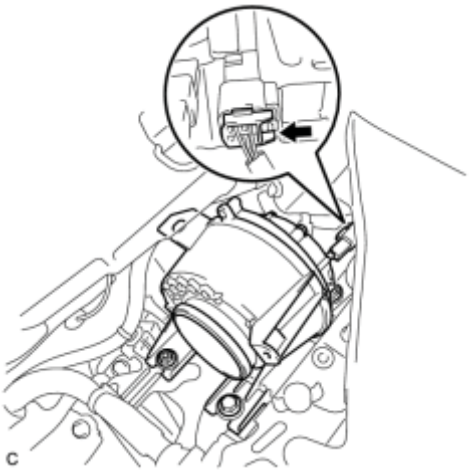
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(c) Disconnect the battery cooling blower assembly connector.

(d) Disconnect the A21 connector from the power management control ECU INFO.

(e) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

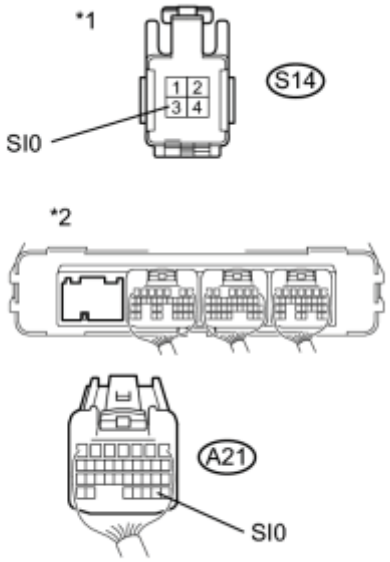
(f) Disconnect the S14 connector from the battery cooling blower assembly.



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

Standard Resistance:

Tester Connection	Specified Condition
S14-3 (SI0) or A21-29 (SI0) - Body ground	10 kΩ or higher
S14-3 (SI0) - A21-29 (SI0)	Below 1 Ω



Text in Illustration

*1	Front view of wire harness connector (to Battery Cooling Blower Assembly)
*2	Rear view of wire harness connector (Power Management Control ECU)

(h) Connect the S14 connector to the battery cooling blower assembly.

(i) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(j) Connect the A21 connector to the power management control ECU INFO.

(k) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

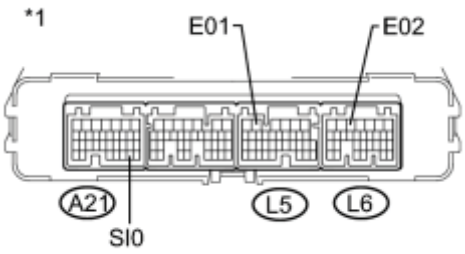
OK ▼

4.	CHECK POWER MANAGEMENT CONTROL ECU (GROUND SHORT CHECK)

(a) Remove the power management control ECU INFO.

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

Standard Resistance:



Tester Connection	Specified Condition
A21-29 (SI0) - L5-5 (E01)	10 kΩ or higher
A21-29 (SI0) - L6-5 (E02)	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (to Power Management Control ECU)

(c) Install the power management control ECU INFO.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU

OK ▼

5.	READ VALUE USING TECHSTREAM

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Connect the cable to the negative (-) battery terminal.

(e) Connect the Techstream to the DLC3.

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

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.
- If the power switch is turned on (IG) with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be stored. If this DTC is output, clear the DTC using the Techstream INFO.

(g) Enter the following menus: Powertrain / Hybrid Control / Active Test / Driving the Battery Cooling Fan.

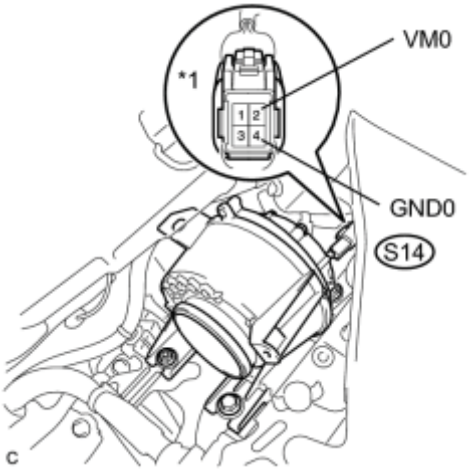
HINT:

Check "Cooling Fan Mode 1" in the data list using the Techstream. If the "Cooling Fan Mode 1" is 1 to 6, it is not necessary to perform the Active Test.

(h) Enter the following menus: All Data / VMF Fan Motor Voltage 1.

(i) Select each air volume mode (1 to 6) in the "Driving the Battery Cooling Fan" active test to operate the battery cooling blower assembly.

(j) While the cooling fan is operating, compare the value in the data list (VMF Fan Motor Voltage 1) with the voltage value that was actually measured at the battery cooling blower assembly connector.



Standard:

Tester Connection	Condition	Specified Condition
S14-2 (VM0) - S14-4 (GND0)	Battery cooling blower is operating	Difference between the value in the Data List (VMF Fan Motor Voltage 1) and the actual measurement value is 1 V or less.

Text in Illustration

*1	Component with harness connected (Battery Cooling Blower assembly)

HINT:

Compare the values in each air volume mode (1 to 6).

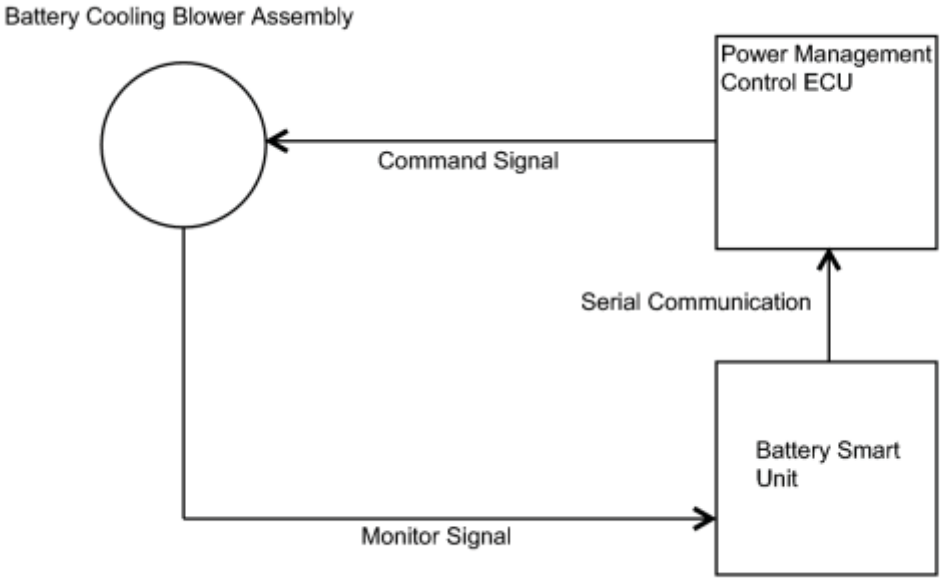
(k) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ REPLACE BATTERY SMART UNIT
OK ▶ **REPLACE BATTERY COOLING BLOWER ASSEMBLY**

DTC	P0A84-123	Hybrid Battery Pack Cooling Fan 1

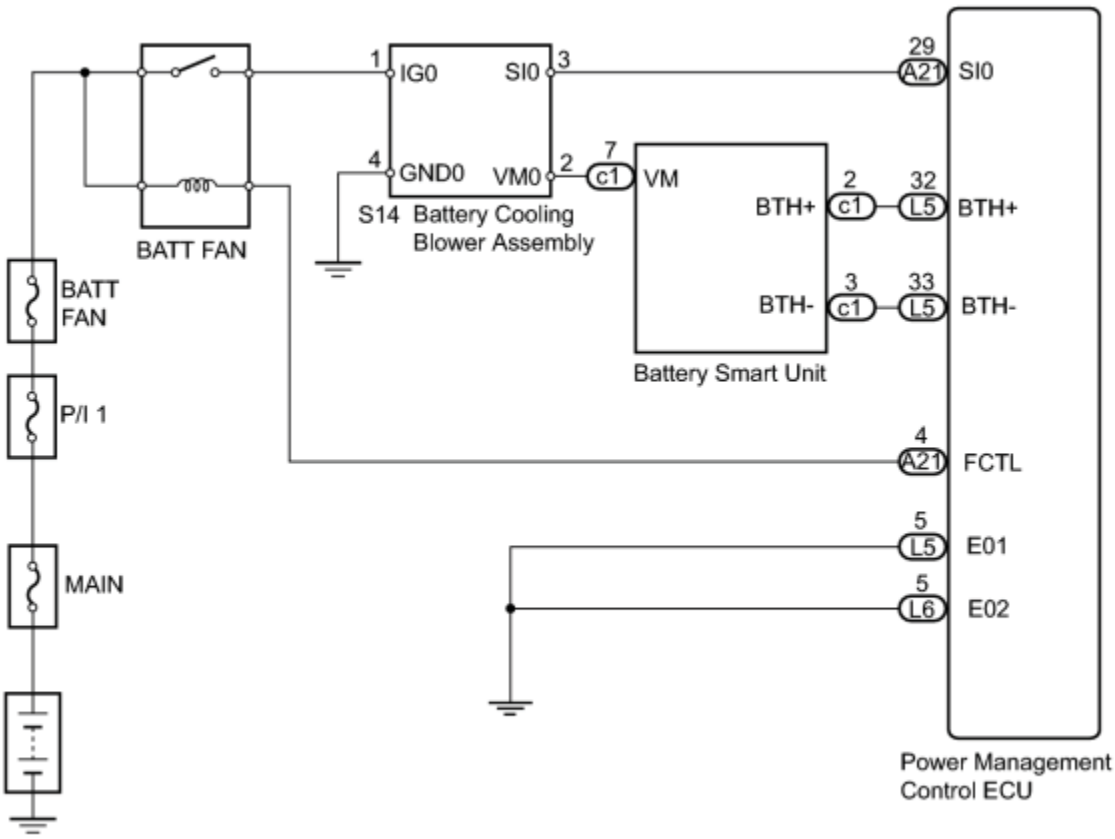
DESCRIPTION

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



DTC No.	DTC Detection Condition	Trouble Area
P0A84-123	When the output voltage of the battery cooling blower assembly (VM) is too low compared to the target control voltage range (1 trip detection)	• Wire harness or connector • Integration relay • Battery cooling blower assembly • Battery smart unit • Power management control ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- 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.

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK FOR DTCS (DTC P0AFC-123 IS OUTPUT) INFO

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM

(a) Remove the rear side seatback assembly RH INFO.

(b) Connect the Techstream to the DLC3.

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

(d) Enter the following menus: Powertrain / Hybrid Control / Active Test / Driving the Battery Cooling Fan.

HINT:

Check Cooling Fan Mode1 in the Data List. If the mode is 6, it is not necessary to perform the Active Test.

(e) Select air volume mode 6 in the "Driving the Battery Cooling Fan" active test to operate the battery cooling blower assembly.

(f) Check that the fan operates and air is sucked into the inlet duct.

HINT:

The cooling fan may not stop even when turning the cooling fan off in the "Driving the Battery Cooling Fan" active test. This is due to HV system control and not a malfunction.

OK:

The fan operates.

(g) Install the rear side seatback assembly RH INFO.

NG ▶ CHECK INTEGRATION NO.1 RELAY (BATT FAN)

OK ▼

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

CAUTION:

Be sure to wear insulated gloves.

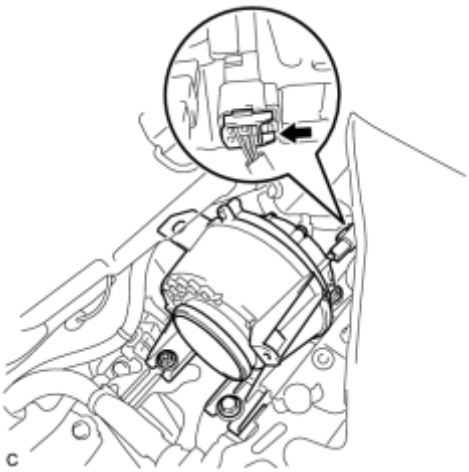
(a) Disconnect the cable from the negative (-) battery terminal.

(b) Check that the service plug grip is not installed.

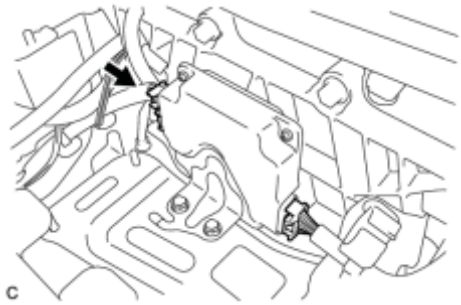
NOTICE:

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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(d) Disconnect the S14 connector of the battery cooling blower assembly.



(e) Disconnect the c1 connector of the battery smart unit.

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

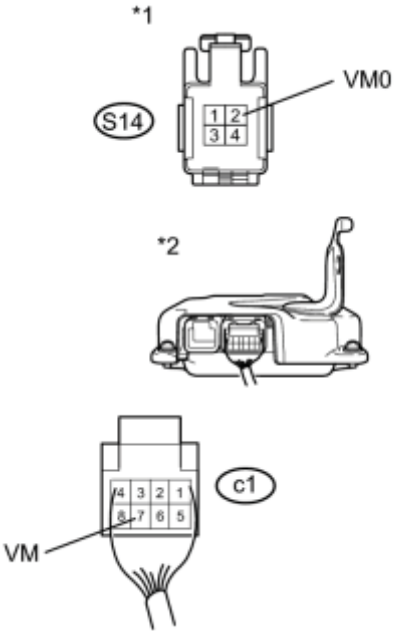
Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
S14-2 (VM0) - c1-7 (VM)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
S14-2 (VM0) or c1-7 (VM) - Body ground	Power switch off	10 kΩ or higher

Text in Illustration



*1	Front view of wire harness connector (to Battery Cooling Blower Assembly)
*2	Rear view of wire harness connector (to Battery Smart Unit)

(g) Connect the S14 connector of the battery cooling blower assembly.

(h) Connect the c1 connector of the battery smart unit.

(i) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

▼

4.	CHECK BATTERY COOLING BLOWER ASSEMBLY (VOLTAGE) INFO

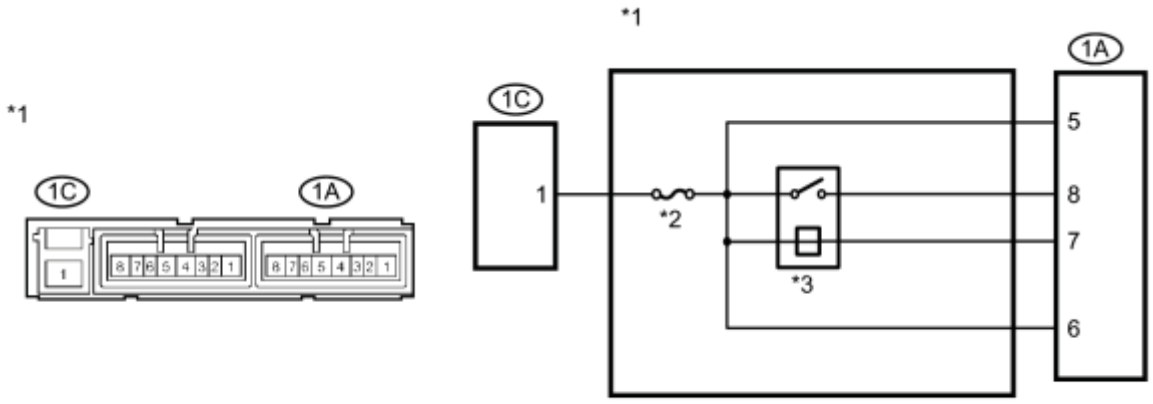
NG ▶ REPLACE BATTERY SMART UNIT

OK ▶ **REPLACE BATTERY COOLING BLOWER ASSEMBLY**

5.	CHECK INTEGRATION NO.1 RELAY (BATT FAN)

(a) Remove the integration relay from the engine room junction block assembly INFO.

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



Standard Resistance:

Tester Connection	Condition	Specified Condition
1C-1 - 1A-8	Battery voltage is applied across terminals 1A-6 and 1A-7	Below 1 Ω
	No battery voltage is applied across terminals 1A-6 and 1A-7	10 kΩ or higher

Text in Illustration

*1	Integration Relay	*2	BATT FAN Fuse
*3	BATT FAN Fuse	-	-

(c) Install the integration relay INFO.

NG ▶ REPLACE INTEGRATION NO.1 RELAY

OK ▼

6.	CHECK HARNESS AND CONNECTOR (VOLTAGE)

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Connect the cable to the negative (-) battery terminal.

(e) Connect the Techstream to the DLC3.

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

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.
- If the power switch is turned on (IG) with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be stored. If this DTC is output, clear the DTC using the Techstream INFO.

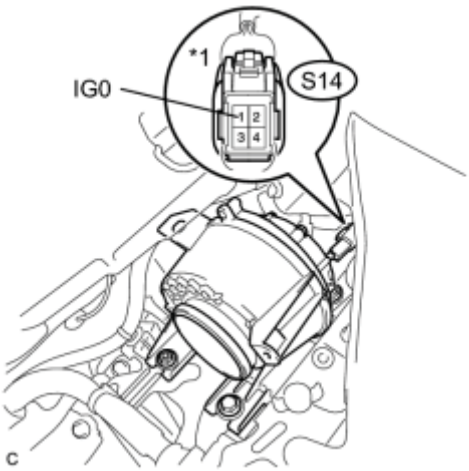
(g) Enter the following menus: Powertrain / Hybrid Control / Active Test / Driving the Battery Cooling Fan.

HINT:

Check "Cooling Fan Mode 1" in the data list using the Techstream. If the "Cooling Fan Mode 1" is 1 to 6, it is not necessary to perform the Active Test.

(h) Enter the following menus: All Data / VMF Fan Motor Voltage 1.

(i) Select each air volume mode (1 to 6) in the "Driving the Battery Cooling Fan" active test to operate the battery cooling blower assembly.



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

Standard Voltage:

Tester Connection	Condition	Specified Condition
S14-1 (IG0) - Body ground	Battery cooling blower is operating	11 to 14 V

Text in Illustration

*1	Component with harness connected (Battery Cooling Blower)

HINT:

Measure the voltage on the wire side of the connector that is part of the battery cooling blower.

(k) Turn the power switch off.

(l) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY - POWER MANAGEMENT CONTROL ECU)

OK

7.	CHECK BATTERY COOLING BLOWER ASSEMBLY

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Connect the cable to the negative (-) battery terminal.

(e) Connect the Techstream to the DLC3.

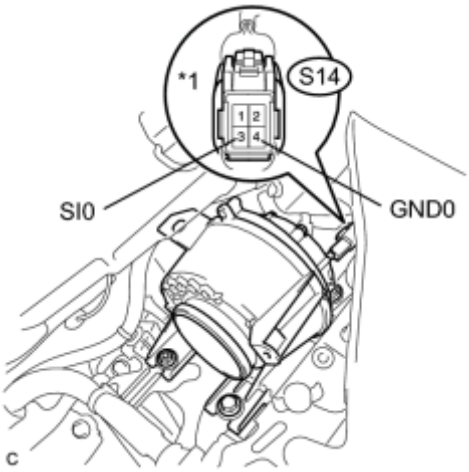
(f) Turn the power switch on (IG).

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.
- If the power switch is turned on (IG) with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be stored. If this DTC is output, clear the DTC using the Techstream INFO.

(g) Enter the following menus: Powertrain / Hybrid Control / Active Test / Driving the Battery Cooling Fan.

(h) Select air volume mode 0 in the "Driving the Battery Cooling Fan" active test to operate the battery cooling blower assembly.



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

Standard Voltage:

Tester Connection	Condition	Specified Condition
S14-3 (SI0) - S14-4 (GND)	Battery cooling blower is operating	4.5 to 5.5 V

Text in Illustration

*1	Component with harness connected (Battery Cooling Blower)

HINT:

Measure the voltage on the wire side of the connector that is part of the battery cooling blower.

(j) Turn the power switch off.

(k) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ REPLACE BATTERY COOLING BLOWER ASSEMBLY

OK ▼

8.	CHECK HARNESS AND CONNECTOR (BATTERY COOLING BLOWER - POWER MANAGEMENT CONTROL ECU)

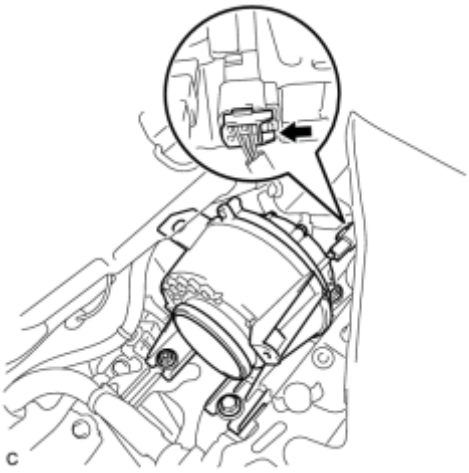
(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



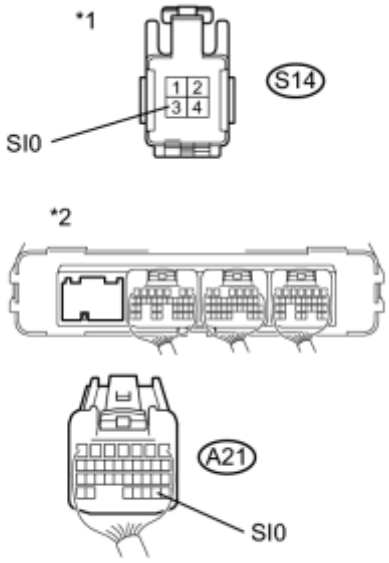
(d) Remove the S14 connector of the battery cooling blower assembly.

(e) Disconnect the A21 connector of the power management control ECU INFO.

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

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
S14-3 (SI0) - A21-29 (SI0)	Power switch off	Below 1 Ω



Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
S14-3 (SI0) or A21-29 (SI0) - Body ground	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Battery Cooling Blower Assembly)
*2	Rear view of wire harness connector (to Power Management Control ECU)

NOTICE:

When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(g) Connect the cable to the negative (-) battery terminal.

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

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.
- If the power switch is turned on (IG) with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be stored. If this DTC is output, clear the DTC using the Techstream INFO.

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
S14-3 (SI0) - Body ground	Power switch on (IG)	Below 1 V

(j) Turn the power switch off.

(k) Connect the S14 connector of the battery cooling blower assembly.

(l) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(m) Connect the A21 connector of the power management control ECU INFO.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

9.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY - POWER MANAGEMENT CONTROL ECU)

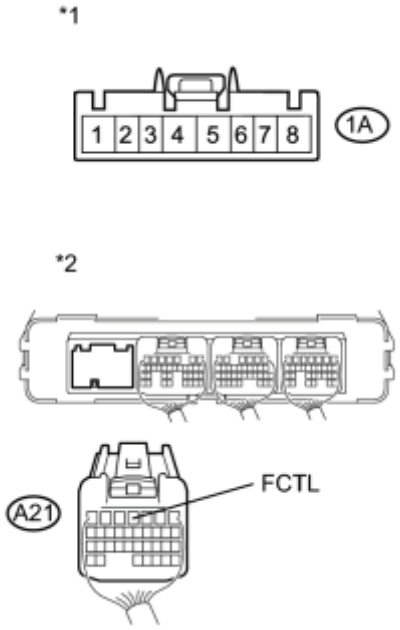
(a) Disconnect the cable from the negative (-) battery terminal.

(b) Disconnect the A21 connector of the power management control ECU INFO.

(c) Remove the integration relay INFO.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
1A-7 - A21-4 (FCTL)	Power switch off	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Integration Relay)
*2	Rear view of wire harness connector (to Power Management Control ECU)

NOTICE:

When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(e) Connect the cable to the negative (-) battery terminal.

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A21-4 (FCTL) - Body ground	Power switch off	Below 1 V
	Power switch on (IG)	Below 1 V

NOTICE:

If the power switch is turned on (IG) with the connector removed, DTC will be stored. If the DTC is output, clear the DTC using the Techstream INFO.

(g) Connect the A21 connector of the power management control ECU INFO.

(h) Install the integration relay INFO.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

10.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - BODY GROUND)

(a) Disconnect the cable from the negative (-) battery terminal.

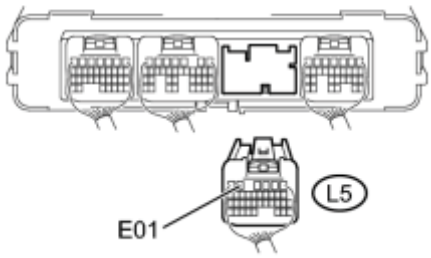
(b) Disconnect the L5 connector of the power management control ECU INFO.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
L5-5 (E01) - Body ground	Power switch off	Below 1 Ω

*1



Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)

NOTICE:

When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(d) Connect the L5 connector of the power management control ECU INFO.

(e) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

11.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - BODY GROUND)

(a) Disconnect the cable from the negative (-) battery terminal.

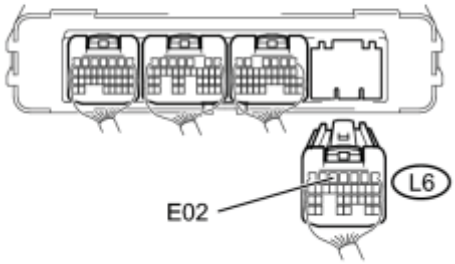
(b) Disconnect the L6 connector of the power management control ECU INFO.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
L6-5 (E02) - Body ground	Power switch off	Below 1 Ω

*1



Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)

NOTICE:

When taking a measurement with a tester, do not apply excessive force to the tester probe to avoid damaging the holder.

(d) Connect the L6 connector of the power management control ECU INFO.

(e) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

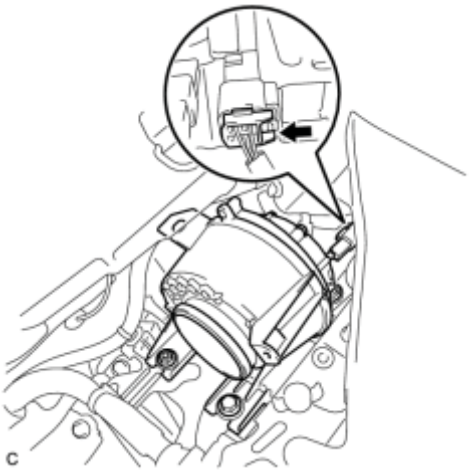
12.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY - BATTERY COOLING BLOWER ASSEMBLY)

(a) Disconnect the cable from the negative (-) battery terminal.

(b) Remove the integration relay INFO.

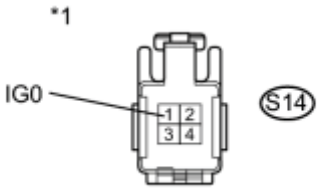
(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Disconnect the S14 connector of the battery cooling blower assembly.

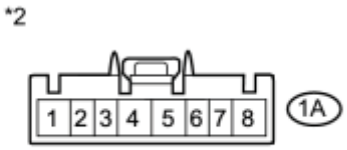


(e) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
1A-8 - S14-1 (IG0)	Power switch off	Below 1 Ω



Text in Illustration

*1	Front view of wire harness connector (to Battery Cooling Blower Assembly)
*2	Front view of wire harness connector (to Integration Relay)

(f) Install the integration relay INFO.

(g) Connect the S14 connector of the battery cooling blower assembly.

(h) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(i) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

13.	REPLACE INTEGRATION NO.1 RELAY

(a) Replace the integration relay INFO.

NEXT ▼

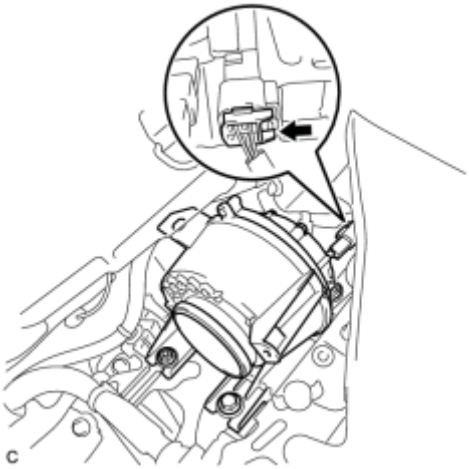
14.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY - BATTERY COOLING

	BLOWER ASSEMBLY)

(a) Disconnect the cable from the negative (-) battery terminal.

(b) Remove the integration relay INFO.

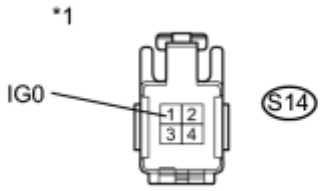
(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



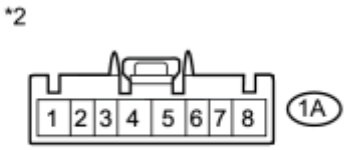
(d) Disconnect the S14 connector of the battery cooling blower assembly.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
S14-1 (IG0) - Terminals other than 1A-8 and body ground	Power switch off	10 kΩ or higher



Text in Illustration

*1	Front view of wire harness connector (to Battery Cooling Blower Assembly)
*2	Front view of wire harness connector (to Integration Relay)

(f) Install the integration relay INFO.

(g) Connect the S14 connector of the battery cooling blower assembly.

(h) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(i) Connect the cable to the negative (-) battery terminal.

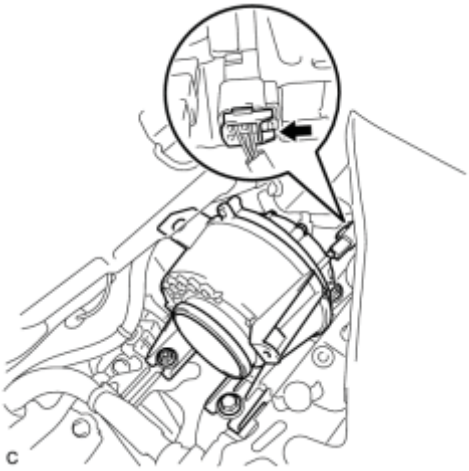
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

15.	CHECK BATTERY COOLING BLOWER ASSEMBLY

(a) Disconnect the cable from the negative (-) battery terminal.

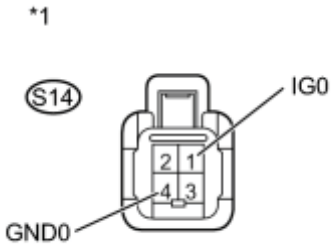
(b) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(c) Disconnect the S14 connector of the battery cooling blower assembly.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
S14-1 (IG0) - S14-4 (GND0) and body ground	Power switch off	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (Battery Cooling Blower Assembly)

(e) Connect the S14 connector of the battery cooling blower assembly.

(f) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(g) Connect the cable to the negative (-) battery terminal.

NG ▶ REPLACE BATTERY COOLING BLOWER ASSEMBLY

OK ▶ **RECOVERY TO NORMAL**

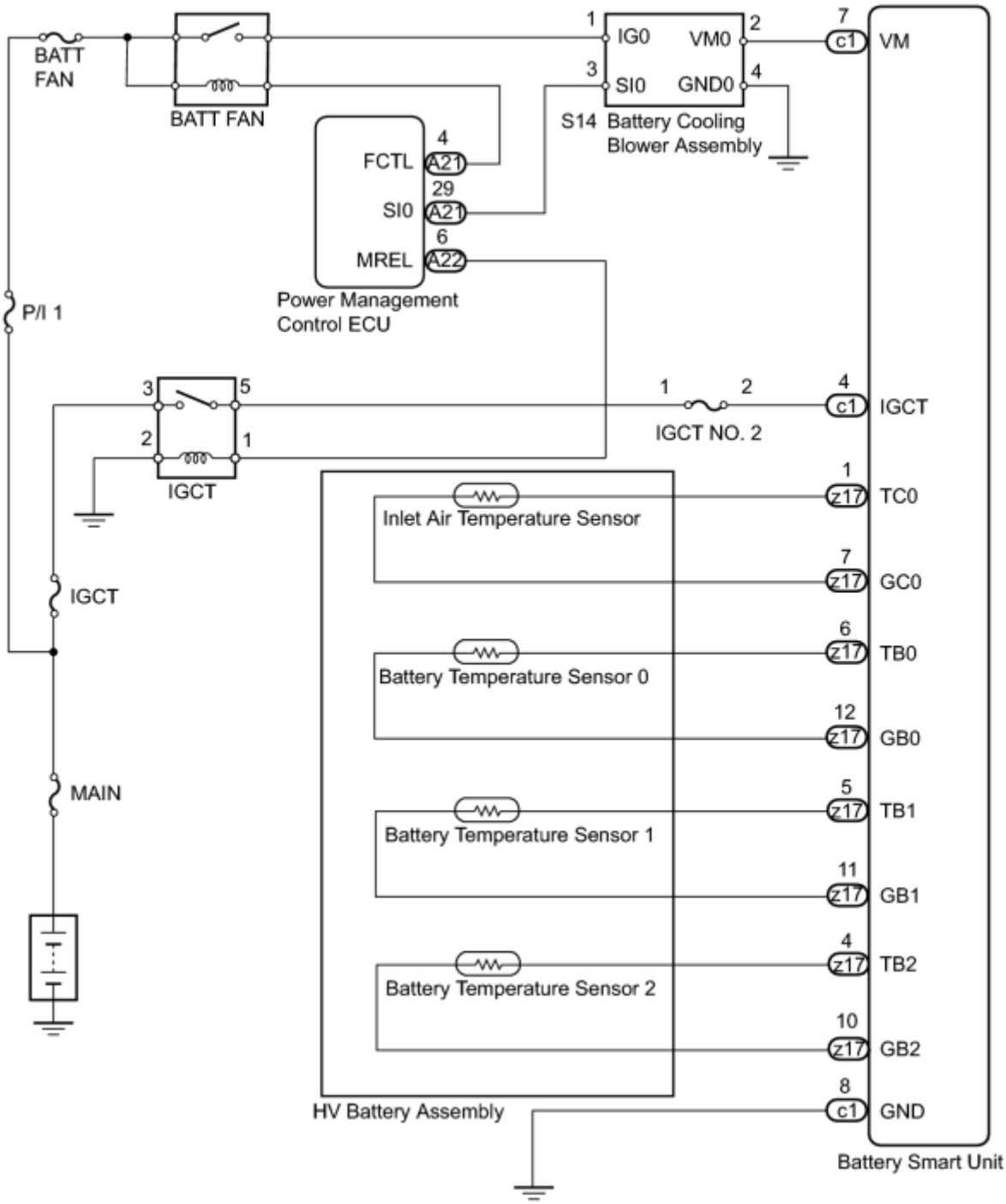
DTC	P0A85-123	Hybrid Battery Pack Cooling Fan 1

DESCRIPTION

Refer to the circuit description for DTC P0A84-123 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0A85-123	When the output voltage of the battery cooling blower assembly (VM) is too high compared to the target control voltage range (1 trip detection)	• Wire harness or connector • Battery cooling blower assembly • Battery smart unit • HV battery assembly

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- 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.

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK FOR DTCS (DTC P0AFC-123 IS OUTPUT) INFO

B GO TO DTC CHART

A

2.	CHECK HARNESS AND CONNECTOR (VOLTAGE)

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Connect the cable to the negative (-) battery terminal.

(e) Connect the Techstream to the DLC3.

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

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.

- If the power switch is turned on (IG) with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be stored. If this DTC is output, clear the DTC using the Techstream INFO.

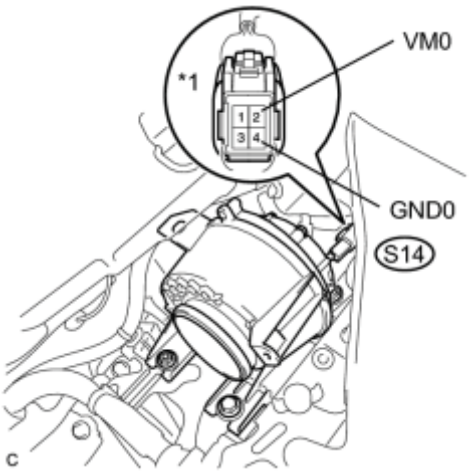
(g) Enter the following menus: Powertrain / Hybrid Control / Active Test / Driving the Battery Cooling Fan.

HINT:

Check "Cooling Fan Mode 1" in the data list using the Techstream. If the "Cooling Fan Mode 1" is 6, it is not necessary to perform the Active Test.

(h) Select each air volume mode (1 to 6) in the "Driving the Battery Cooling Fan" active test to operate the battery cooling blower assembly.

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



Standard Voltage:

Tester Connection	Condition	Specified Condition
S14-2 (VM0) - S14-4 (GND0)	Battery cooling blower is operating	Below 5 V

Text in Illustration

*1	Component with harness connected (Battery Cooling Blower Assembly)

HINT:

Measure the voltage on the wire side of the connector that is part of the battery cooling blower.

(j) Turn the power switch off.

(k) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ CHECK HARNESS AND CONNECTOR (VOLTAGE)

OK ▼

3.	CHECK HV BATTERY ASSEMBLY (BATTERY TEMPERATURE SENSOR AND INLET AIR TEMPERATURE SENSOR)

CAUTION:

Be sure to wear insulated gloves.

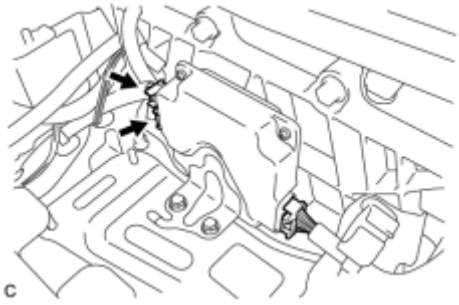
(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

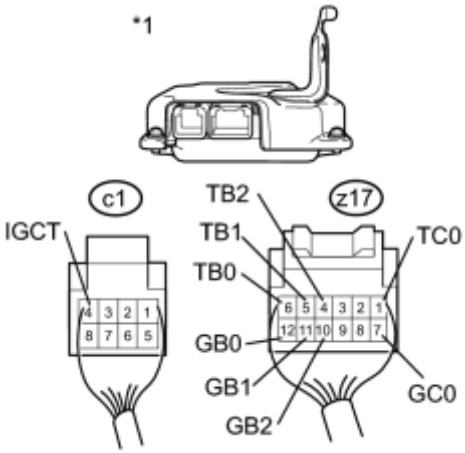
(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(d) Disconnect the c1 and z17 connectors from the battery smart unit.

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

Standard Resistance:



Tester Connection	Switch Condition	Specified Condition
z17-6 (TB0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-12 (GB0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-5 (TB1) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-11 (GB1) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-4 (TB2) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-10 (GB2) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-1 (TC0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-7 (GC0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher

Text in Illustration

*1	Rear view of wire harness connector (to Battery Smart Unit)

(f) Connect the c1 and z17 connectors to the battery smart unit.

(g) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(h) Connect the cable to the negative (-) battery terminal.

NG ▶ CHECK HARNESS AND CONNECTOR (INLET AIR TEMPERATURE SENSOR AND BATTERY

TEMPERATURE SENSOR)

OK ▶ **REPLACE BATTERY SMART UNIT**

4.	CHECK HARNESS AND CONNECTOR (INLET AIR TEMPERATURE SENSOR AND BATTERY TEMPERATURE SENSOR)

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the upper hybrid battery cover sub-assembly INFO.

(d) Check the wire harness and connectors of the battery temperature sensor and inlet air temperature sensor for abnormalities by sight and touch.

Specified Condition:

There are no open or short circuits in the wire harness and connectors. There are no short circuits to other wire harnesses.

(e) Install the upper hybrid battery cover sub-assembly INFO.

(f) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR HARNESS OR CONNECTOR

OK ▶ **REPLACE HV BATTERY ASSEMBLY**

5.	CHECK HARNESS AND CONNECTOR (VOLTAGE)

CAUTION:

Be sure to wear insulated gloves.

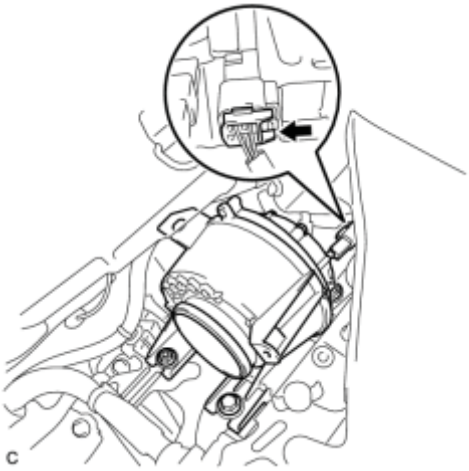
(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(d) Disconnect the S14 connector of the battery cooling blower assembly.

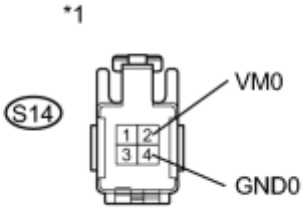
(e) Connect the cable to the negative (-) battery terminal.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
S14-2 (VM0) - S14-4 (GND0)	Power switch on (IG)	Below 5 V



Text in Illustration

*1	Front view of wire harness connector (to Battery Cooling Blower Assembly)

NOTICE:

If the power switch is turned on (IG) with the battery cooling blower assembly connector removed, DTC P0A84-123 will be stored. If this DTC is output, clear the DTC using the Techstream INFO.

(h) Connect the S14 connector of the battery cooling blower assembly.

(i) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ CHECK HARNESS AND CONNECTOR (BATTERY COOLING BLOWER - BATTERY SMART UNIT)

OK ▶ **REPLACE BATTERY COOLING BLOWER ASSEMBLY**

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

CAUTION:

Be sure to wear insulated gloves.

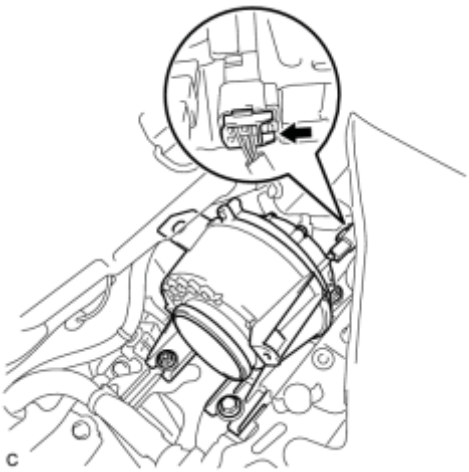
(a) Disconnect the cable from the negative (-) battery terminal.

(b) Check that the service plug grip is not installed.

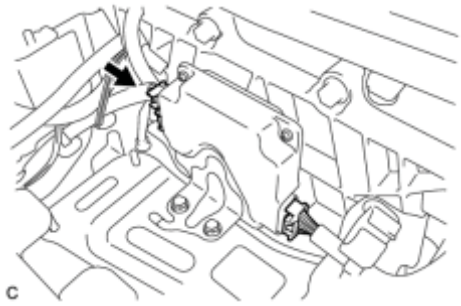
NOTICE:

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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(d) Disconnect the S14 connector of the battery cooling blower assembly.

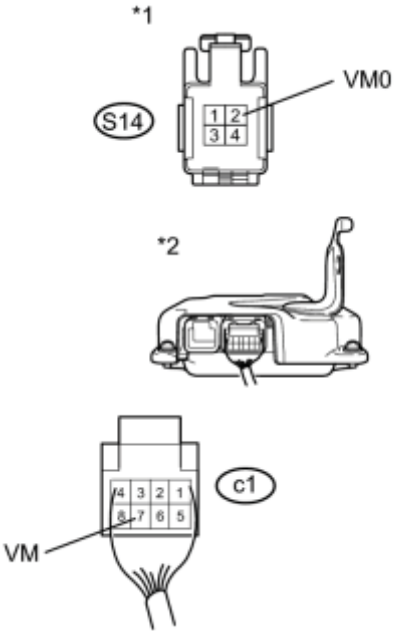


(e) Disconnect the c1 connector of the battery smart unit.

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition



S14-2 (VM0) and c1-7 (VM) - Other terminal	Power switch off	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Battery Cooling Blower Assembly)
*2	Rear view of wire harness connector (to Battery Smart Unit)

(g) Connect the c1 connector of the battery smart unit.

(h) Connect the S14 connector of the battery cooling blower assembly.

(i) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(j) Connect the cable to the negative (-) battery terminal.

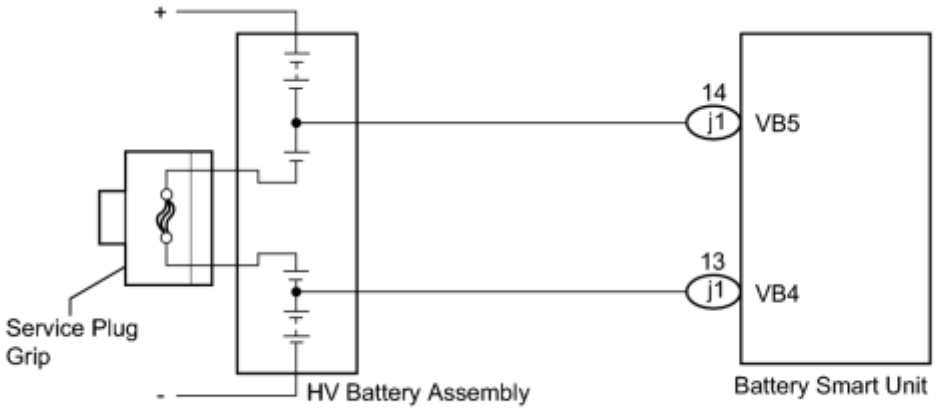
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE BATTERY SMART UNIT**

DTC	P0A95-123	High Voltage Fuse

DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
P0A95-123	Voltage between VBB4 and VBB5 terminals is below the standard despite the interlock switch being engaged (1 trip detection)	• Service plug grip • HV battery assembly

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B GO TO DTC CHART

A

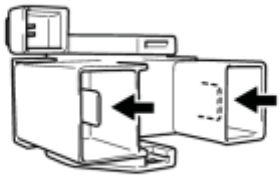
2.	CHECK SERVICE PLUG GRIP

(a) Turn the power switch off.

(b) 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.



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

Standard Resistance:

Tester Connection	Standard Resistance
Service plug grip	Below 1 Ω

C

NG REPLACE SERVICE PLUG GRIP

OK **REPLACE HV BATTERY ASSEMBLY**

DTC	P0A9C-123	Hybrid Battery Temperature Sensor "A" Range / Performance
DTC	P0AC6-123	Hybrid Battery Temperature Sensor "B" Range / Performance
DTC	P0ACB-123	Hybrid Battery Temperature Sensor "C" Range / Performance
DTC	P3065-123	Hybrid Battery Temperature Sensor Range / Perfoemance Stack A

DESCRIPTION

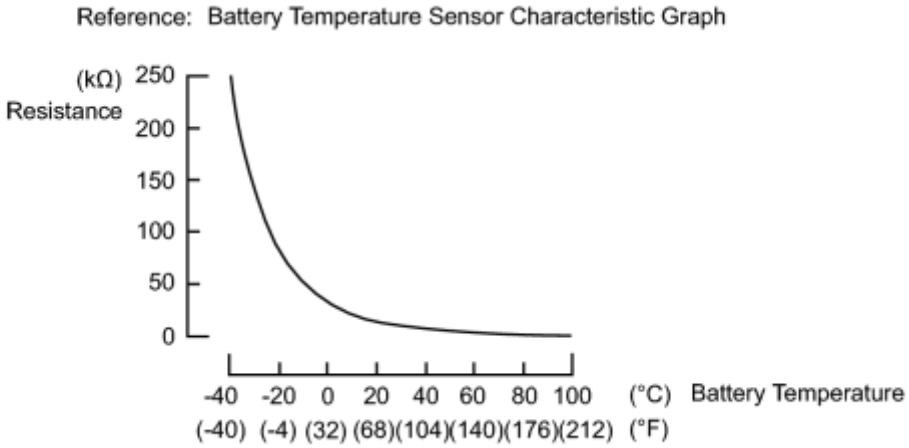
- The battery temperature sensors are provided at 3 locations of the HV battery. The resistance of the thermistor, which is built into each battery temperature sensor, varies in accordance with changes in the HV battery temperature. The lower the battery temperature, the higher the thermistor resistance. Conversely, the higher the temperature, the lower the resistance. The battery smart unit uses the battery temperature sensors to detect the HV battery temperature, and sends the detected value to the power management control ECU. Based on the results of this detection, the power management control ECU controls the blower fan. (The blower fan starts when HV battery temperature rises above a predetermined level.)

Temperature Sensor Identification Cross Reference Table:

DTC Title Sensor	Battery Temperature Sensor	Techstream Display
A	0	1
B	1	2
C	2	3

HINT:

For example, sensor A in the DTC title is battery temperature sensor (No. 0). This sensor is displayed as Temp of Batt TB1 in the Data List.



DTC No.	DTC Detection Condition	Trouble Area
P0A9C-123 P0AC6-123 P0ACB-123 P3065-123	When the battery temperature sensor performance is abnormal (1 trip detection/2 trip detection)	• HV battery assembly • Battery smart unit • Wire harness or connector

MONITOR DESCRIPTION

If the temperature indicated by the battery temperature sensor is lower than the standard level (open), or is higher than the standard level (short), the battery smart unit interprets this as a sensor malfunction. If the battery smart unit detects that HV battery temperature is out of the normal range or its value is abnormal, the power management control ECU (HV CPU) illuminates the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A9C (INF 123): Battery temperature sensor malfunction (stuck) P0AC6 (INF 123): Battery temperature sensor malfunction (stuck) P0ACB (INF 123): Battery temperature sensor malfunction (stuck) P3065 (INF 123): Battery temperature sensor malfunction (stuck)
Required sensors / components	Battery temperature sensor
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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	-

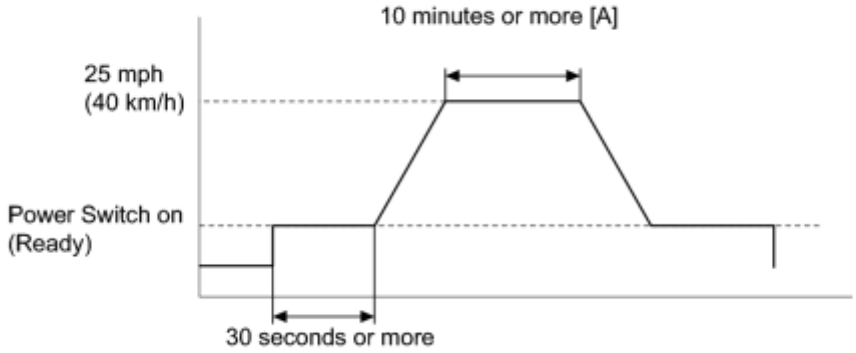
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Battery smart unit	DTC P0A9C (INF 123) is not detected DTC P0AC6 (INF 123) is not detected DTC P0ACB (INF 123) is not detected DTC P3065 (INF 123) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Check that the temperature of each temperature sensor is 14°F (-10°C) or more.

   HINT:

   If any of temperature sensor values are less than 14°F (-10°C), raise the temperature to 14°F (-10°C) or more and then perform the next step.

7. Turn the power switch on (READY) and wait for 30 seconds or more.
8. Drive the vehicle on urban roads at a speed of 25 mph (40 km/h) or more for a total of at least 10 minutes. [A]

   NOTICE:

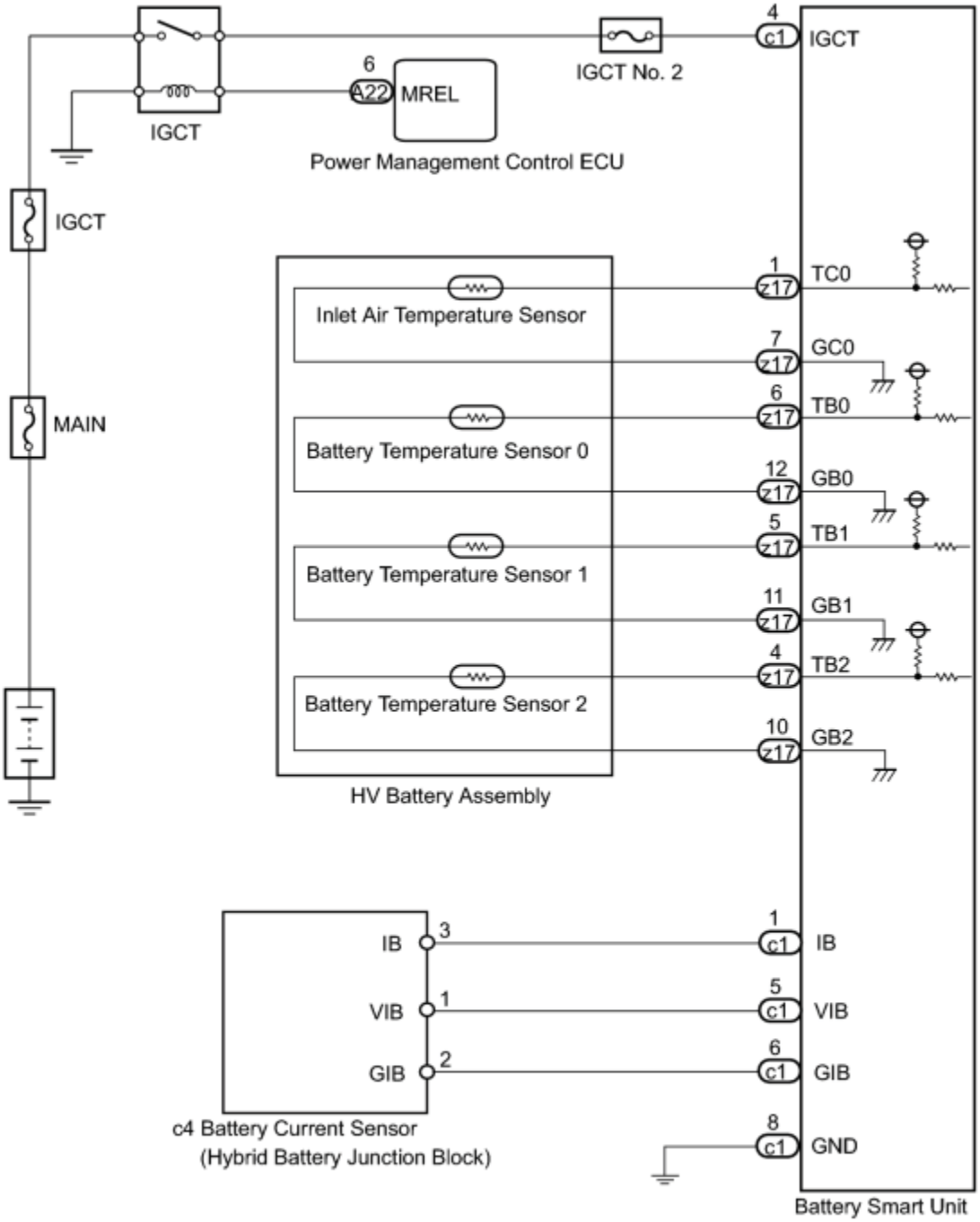
   Avoid abrupt acceleration or braking.

9. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
10. Check that permanent DTCs are cleared.
11. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0A1D-390 IS OUTPUT)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read output DTCs INFO.

Result:

Result	Proceed to
P0A1D-390 is not output.	A
P0A1D-390 is also output.	B

(e) Disconnect the Techstream from the DLC3.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B ▶ GO TO DTC CHART

A

3.	CHECK INSTALLATION OF BATTERY TEMPERATURE SENSOR

CAUTION:

Be sure to wear insulated gloves and protective goggles.

(a) Disconnect the cable from the negative (-) battery terminal.

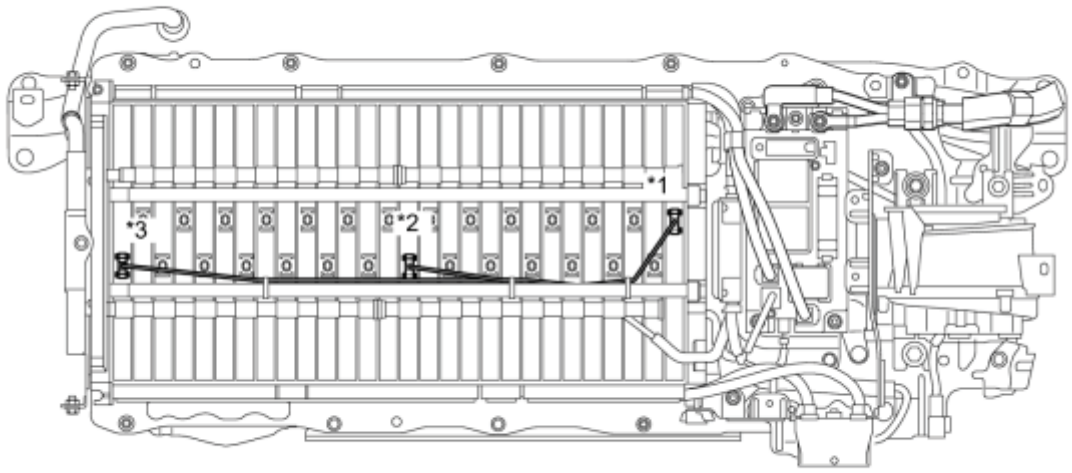
(b) Check that the service plug grip is not installed.

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.

(c) Remove the upper hybrid battery cover sub-assembly INFO.

(d) Visually check the installation condition of the relevant battery temperature sensor.



Standard Condition:

Each battery temperature sensor is installed in the correct location with the correct orientation and its claws are engaged securely.

Result:

Result	Proceed to
Each battery temperature sensor is installed in the correct location with the correct orientation and its claws are engaged securely	A
Claws are damaged.	B
Any of battery temperature sensors are not installed correctly, but claws are not damaged.	C

NOTICE:

Do not use a stick or similar object to push on the sensors when inspecting them. Doing so may result in damage to the sensors.

Text in Illustration

*1	Battery Temperature Sensor 0	*2	Battery Temperature Sensor 1
*3	Battery Temperature Sensor 2	-	-

(e) Install the upper hybrid battery cover sub-assembly INFO.

(f) Connect the cable to the negative (-) battery terminal.

C INSTALL PARTS CORRECTLY
B REPLACE HV BATTERY ASSEMBLY
A

4.	CHECK HV BATTERY ASSEMBLY (BATTERY TEMPERATURE SENSOR)

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

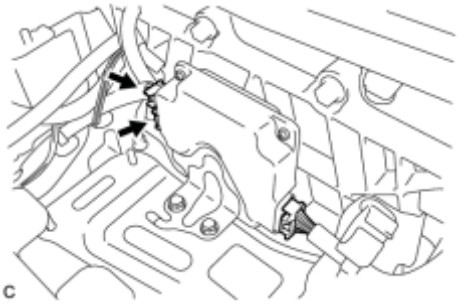
(b) Check that the service plug grip is not installed.

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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

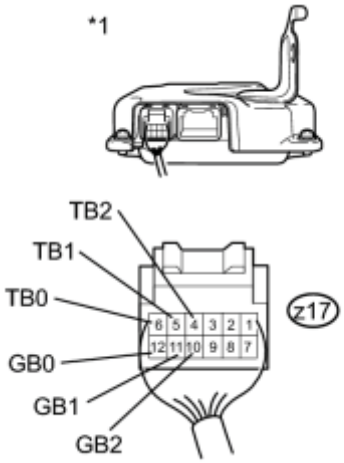
(d) Disconnect the z17 and c1 connectors of the battery smart unit.



(e) Measure the resistance of the circuit for the malfunctioning sensor (battery temperature sensor 0 to 2).

Tester Connection

Tester Connection	Battery Temperature Sensor No.
z17-6 (TB0) - z17-12 (GB0)	0
z17-5 (TB1) - z17-11 (GB1)	1
z17-4 (TB2) - z17-10 (GB2)	2



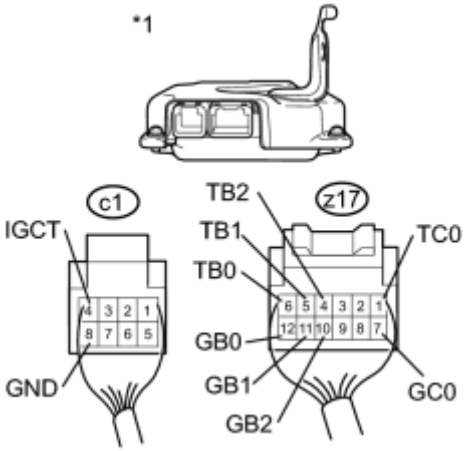
Standard Resistance

Thermistor Temperature	Switch Condition	Specified Condition
32°F (0°C)	Power switch off	26.7 to 27.8 kΩ
77°F (25°C)	Power switch off	9.9 to 10.1 kΩ
104°F (40°C)	Power switch off	5.73 to 5.92 kΩ

Text in Illustration

*1	Rear view of wire harness connector (to Battery Smart Unit)

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



Standard Resistance:

Tester Connection	Switch Condition	Standard Resistance
z17-6 (TB0) - c1-4 (IGCT)	Power switch off	10 kΩ or more
z17-6 (TB0) - c1-8 (GND)	Power switch off	10 kΩ or more
z17-12 (GB0) - c1-4 (IGCT)	Power switch off	10 kΩ or more
z17-12 (GB0) - c1-8 (GND)	Power switch off	10 kΩ or more
z17-5 (TB1) - c1-4 (IGCT)	Power switch off	10 kΩ or more
z17-5 (TB1) - c1-8 (GND)	Power switch off	10 kΩ or more
z17-11 (GB1) - c1-4 (IGCT)	Power switch off	10 kΩ or more

z17-11 (GB1) - c1-8 (GND)	Power switch off	10 kΩ or more
z17-4 (TB2) - c1-4 (IGCT)	Power switch off	10 kΩ or more
z17-4 (TB2) - c1-8 (GND)	Power switch off	10 kΩ or more
z17-10 (GB2) - c1-4 (IGCT)	Power switch off	10 kΩ or more
z17-10 (GB2) - c1-8 (GND)	Power switch off	10 kΩ or more
z17-1 (TC0) - c1-4 (IGCT)	Power switch off	10 kΩ or more
z17-1 (TC0) - c1-8 (GND)	Power switch off	10 kΩ or more
z17-7 (GC0) - c1-4 (IGCT)	Power switch off	10 kΩ or more
z17-7 (GC0) - c1-8 (GND)	Power switch off	10 kΩ or more

Text in Illustration

*1	Rear view of wire harness connector (to Battery Smart Unit)

(g) Connect the z17 and c1 connectors of the battery smart unit.

(h) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(i) Connect the cable to the negative (-) battery terminal.

NG ▶ CHECK HARNESS AND CONNECTOR (BATTERY TEMPERATURE SENSOR)
OK ▶ **REPLACE BATTERY SMART UNIT**

5.	CHECK HARNESS AND CONNECTOR (BATTERY TEMPERATURE SENSOR)

CAUTION:

Be sure to wear insulated gloves and protective goggles.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the upper hybrid battery cover sub-assembly INFO.

(d) Check the wire harness and connectors of the battery temperature sensor for abnormalities by sight and touch.

Specified Condition:

There are no open or short circuits in the wire harness and connectors. There are no short circuits to other wire harnesses.

(e) Install the upper hybrid battery cover sub-assembly INFO.

(f) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR HARNESS OR CONNECTOR
OK ▶ **REPLACE HV BATTERY ASSEMBLY**

DTC	P0A9D-123	Hybrid Battery Temperature Sensor "A" Circuit Low
DTC	P0A9E-123	Hybrid Battery Temperature Sensor "A" Circuit High
DTC	P0AC7-123	Hybrid Battery Temperature Sensor "B" Circuit Low
DTC	P0AC8-123	Hybrid Battery Temperature Sensor "B" Circuit High
DTC	P0ACC-123	Hybrid Battery Temperature Sensor "C" Circuit Low
DTC	P0ACD-123	Hybrid Battery Temperature Sensor "C" Circuit High

DESCRIPTION

- Refer to the description for DTC P0A9C-123 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0A9D-123 P0A9E-123 P0AC7-123 P0AC8-123 P0ACC-123 P0ACD-123	When the temperature of the battery temperature sensor is less than the standard value (open) or higher than the standard value (shorted) (1 trip detection).	• HV battery assembly • Battery smart unit • Wire harness or connector • Hybrid battery junction block

HINT:

After confirming that a DTC is output, use the Techstream to check "Temp of BATT TB 1 to 3" in the hybrid vehicle control system ECU data list.

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

MONITOR DESCRIPTION

If the temperature indicated by the battery temperature sensor is lower than the standard level (open), or is higher than the standard level (short), the battery smart unit interprets this as a sensor malfunction. If the battery smart unit detects that HV battery temperature is out of the normal range or its value is abnormal, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0A9D (INF 123): Battery temperature sensor circuit malfunction (GND short) P0A9E (INF 123): Battery temperature sensor circuit malfunction (open) P0AC7 (INF 123): Battery temperature sensor circuit malfunction (GND short) P0AC8 (INF 123): Battery temperature sensor circuit malfunction (open) P0ACC (INF 123): Battery temperature sensor circuit malfunction (GND short) P0ACD (INF 123): Battery temperature sensor circuit malfunction (open)
Required sensors / components	Battery temperature sensor
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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

Battery smart unit	DTC P0A9D (INF 123) is not detected DTC P0A9E (INF 123) is not detected DTC P0AC7 (INF 123) is not detected

	DTC P0AC8 (INF 123) is not detected DTC P0ACC (INF 123) is not detected DTC P0ACD (INF 123) is not detected

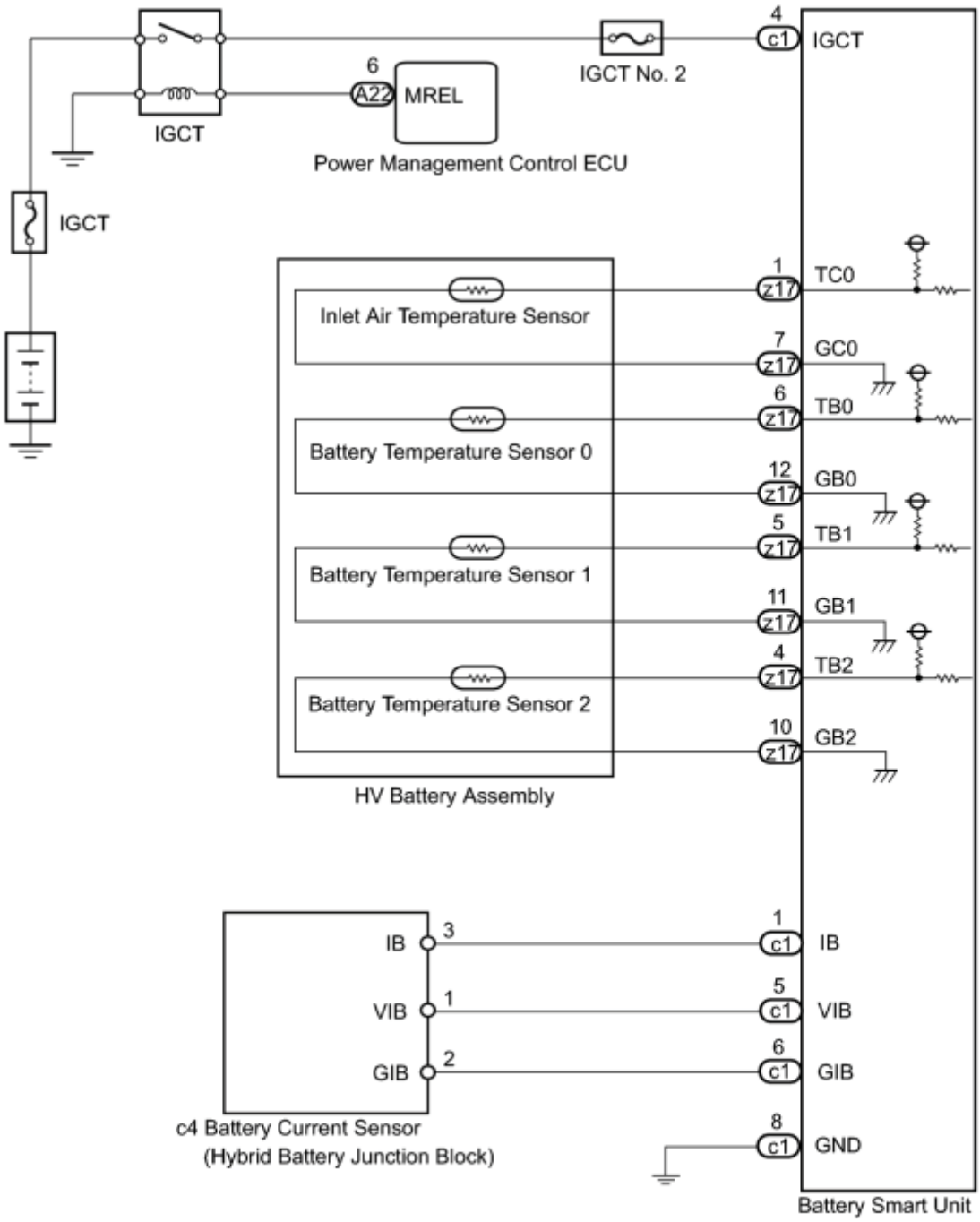
CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Perform the universal trip.
7. Enter the following menus: Powertrain / HV / Trouble Codes.
8. Check that permanent DTCs are cleared.

   HINT:

   - If a permanent DTC is output, the system is malfunctioning.
   - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.

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

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List / Temp of Batt TB 1 to 3.

HINT:

Compare the temperature of the 3 battery temperature sensors to determine the sensor with the malfunction (Temp of Batt TB1 to TB3).

NEXT ▼

3.	CHECK CONNECTOR CONNECTION CONDITION

CAUTION:

Be sure to wear insulated gloves.

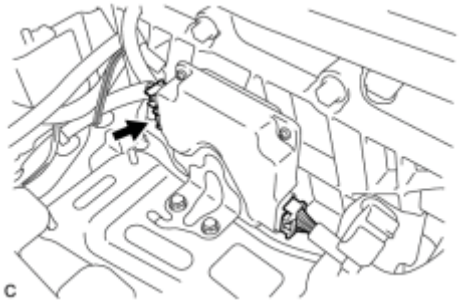
(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(d) Check the connections of the z17 connector of the battery smart unit.

OK:

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

(e) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(f) Connect the cable to the negative (-) battery terminal.

NG ▶ CONNECT SECURELY

OK ▼

4.	CHECK HV BATTERY ASSEMBLY (BATTERY TEMPERATURE SENSOR) INFO

NG ▶ CHECK HARNESS AND CONNECTOR (BATTERY TEMPERATURE SENSOR)

OK ▼

5.	CHECK BATTERY SMART UNIT (VIB VOLTAGE)

NOTICE:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

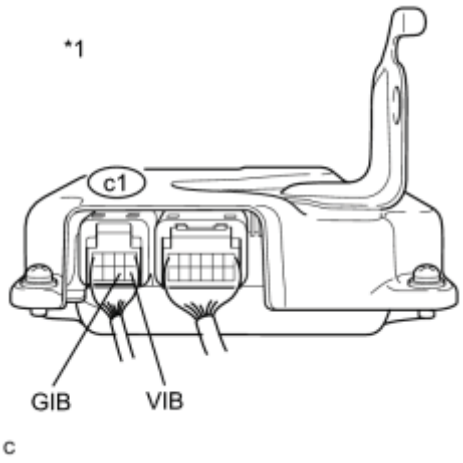
(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Connect the cable to the negative (-) battery terminal.

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

NOTICE:

Turning the power switch on (IG) with the service plug grip removed causes an interlock switch system DTC (P0A0D-350) to be set. Use the Techstream to clear the DTCs INFO.



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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
c1-5 (VIB) - c1-6 (GIB)	Power switch on (IG)	4.6 to 5.4 V

Text in Illustration

*1	Component with harness connected (Battery Smart Unit)

(g) Turn the power switch off.

(h) Disconnect the cable from the negative (-) battery terminal.

(i) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(j) Connect the cable to the negative (-) battery terminal.

NG ▶ CHECK HYBRID BATTERY JUNCTION BLOCK
OK ▶ **REPLACE BATTERY SMART UNIT**

6.	CHECK HYBRID BATTERY JUNCTION BLOCK

NOTICE:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Disconnect the c4 battery current sensor connector from the hybrid battery junction block.

(e) Connect the cable to the negative (-) battery terminal.

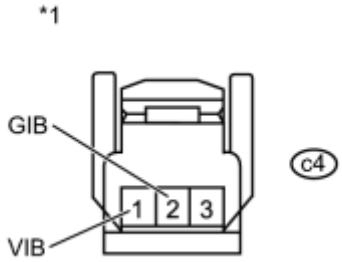
(f) Turn the power switch on (IG).

NOTICE:

Turning the power switch on (IG) with the HV relay assembly (battery current sensor) connector disconnected causes DTC P0AC2-123 to be set. Use the Techstream to clear the DTCs INFO.

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

Standard Voltage:



Tester Connection	Switch Condition	Specified Condition
c4-1 (VIB) - c4-2 (GIB)	Power switch on (IG)	4.6 to 5.4 V

Text in Illustration

*1	Front view of wire harness connector (to Hybrid Battery Junction Block)

(h) Turn the power switch off.

(i) Connect the c4 battery current sensor connector to the hybrid battery junction block.

(j) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HYBRID BATTERY JUNCTION BLOCK)

OK ▶ **REPLACE HYBRID BATTERY JUNCTION BLOCK**

7.	CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HYBRID BATTERY JUNCTION BLOCK)

NOTICE:

Be sure to wear insulated gloves.

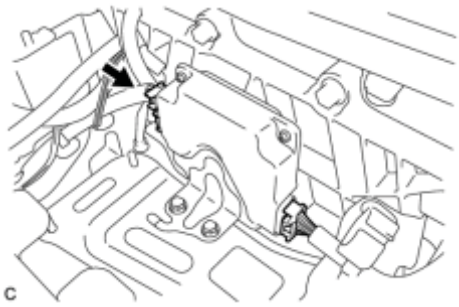
(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(d) Disconnect only the c1 connector of the battery smart unit.

(e) Disconnect the c4 battery current sensor connector from the hybrid battery junction block.

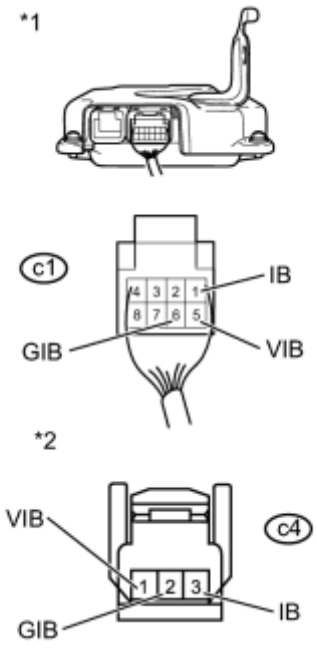
(f) Measure the resistance according to the value(s) in the tables below.

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
c1-1 (IB) - c4-3 (IB)	Power switch off	Below 1 Ω
c1-6 (GIB) - c4-2 (GIB)	Power switch off	Below 1 Ω
c1-5 (VIB) - c4-1 (VIB)	Power switch off	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Switch Condition	Specified Condition
c1-1 (IB) or c4-3 (IB) - Body ground and other terminals	Power switch off	10 kΩ or higher
c1-6 (GIB) or c4-2 (GIB) - Body ground and other terminals	Power switch off	10 kΩ or higher
c1-5 (VIB) or c4-1 (VIB) - Body ground and other terminals	Power switch off	10 kΩ or higher



Text in Illustration

*1	Rear view of wire harness connector (to Battery Smart Unit)
*2	Front view of wire harness connector (to Hybrid Battery Junction Block)

(g) Connect the c1 connector to the battery smart unit.

(h) Connect the c4 battery current sensor connector to the hybrid battery junction block.

(i) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(j) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE BATTERY SMART UNIT**

8.	CHECK HARNESS AND CONNECTOR (BATTERY TEMPERATURE SENSOR) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE HV BATTERY ASSEMBLY**

DTC	P0AAE-123	Hybrid Battery Pack Air Temperature Sensor "A" Circuit Low
DTC	P0AAF-123	Hybrid Battery Pack Air Temperature Sensor "A" Circuit High

DESCRIPTION

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

DTC No.	DTC Detection Condition	Trouble Area
P0AAE-123 P0AAF-123	When the temperature indicated by the inlet air temperature sensor is lower than a predetermined limit (open circuit) or is higher than a predetermined limit (short circuit)	• HV battery assembly • Battery smart unit • Wire harness or connector • Hybrid battery junction block

HINT:

After confirming that DTC P0AAE-123 or P0AAF-123 is output, use the Techstream to check "Inhaling Air Temp" in the HV ECU data list.

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

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0A9D-123 INFO.

INSPECTION PROCEDURE

CAUTION:

- 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.

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK FOR DTCS (DTC P0AFC-123 IS OUTPUT) INFO

B GO TO DTC CHART

A

2.	CHECK INSTALLATION OF INLET AIR TEMPERATURE SENSOR

CAUTION:

Be sure to wear insulated gloves and protective goggles.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

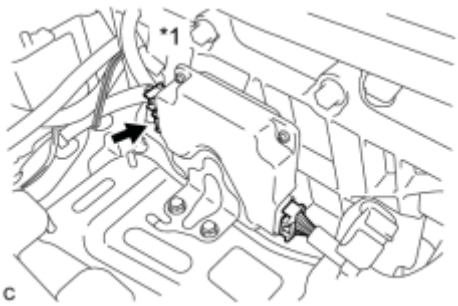
(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Check installation of inlet air temperature sensor

(1) Check the connections of the z17 connector of the battery smart unit.

OK:

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



Result:

Result	Proceed to
NG	B
OK	Go to next step

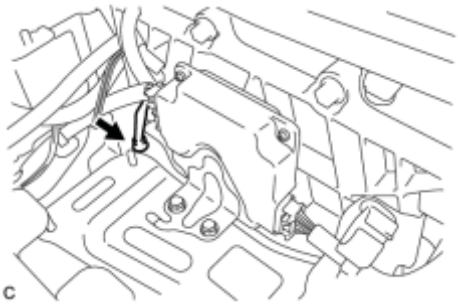
Text in Illustration

*1	Battery Smart Unit

(2) Visually check the installation condition of the inlet air temperature sensor.

OK:

The inlet air temperature sensor is installed in the correct location and its claws are engaged securely.



Result:

Result	Proceed to
The inlet air temperature sensor is installed in the correct location and its claws are engaged securely	A
Claws are damaged.	C
Inlet air temperature sensor is not installed correctly, but claws are not damaged.	D

(e) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(f) Connect the cable to the negative (-) battery terminal.

D ▶ INSTALL PARTS CORRECTLY
C ▶ REPLACE HV BATTERY ASSEMBLY
B ▶ CONNECT SECURELY
A ▼

3.	CHECK HV BATTERY ASSEMBLY (INLET AIR TEMPERATURE SENSOR AND BATTERY TEMPERATURE SENSOR)

CAUTION:

Be sure to wear insulated gloves.

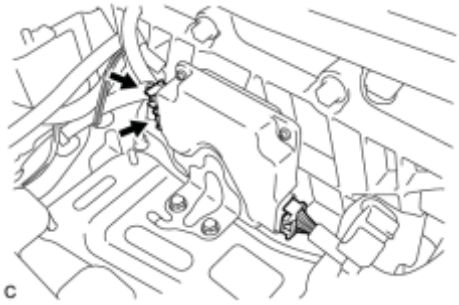
(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

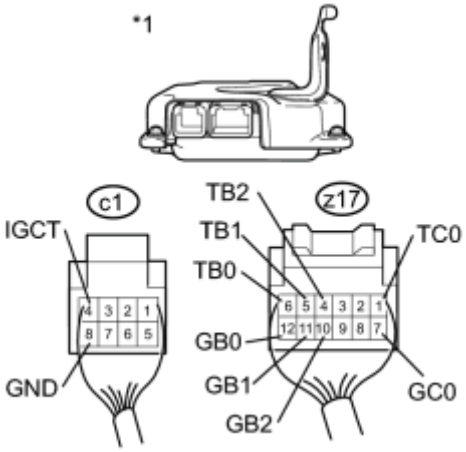


(d) Disconnect the c1 and z17 connectors from the battery smart unit.

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

Standard Resistance:

Tester Connection	Condition	Specified Condition
z17-1 (TC0) - z17-7 (GC0)	32°F (0°C)	26.7 to 27.8 kΩ
	77°F (25°C)	9.9 to 10.1 kΩ
	104°F (40°C)	5.73 to 5.92 kΩ



Text in Illustration

*1	Rear view of wire harness connector (to Battery Smart Unit)

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
z17-1 (TC0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-1 (TC0) - c1-8 (GND)	Power switch off	10 kΩ or higher
z17-7 (GC0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-7 (GC0) - c1-8 (GND)	Power switch off	10 kΩ or higher

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

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
z17-6 (TB0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-6 (TB0) - c1-8 (GND)	Power switch off	10 kΩ or higher
z17-12 (GB0) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-12 (GB0) - c1-8 (GND)	Power switch off	10 kΩ or higher

Tester Connection	Switch Condition	Specified Condition
z17-5 (TB1) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-5 (TB1) - c1-8 (GND)	Power switch off	10 kΩ or higher
z17-11 (GB1) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-11 (GB1) - c1-8 (GND)	Power switch off	10 kΩ or higher
z17-4 (TB2) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-4 (TB2) - c1-8 (GND)	Power switch off	10 kΩ or higher
z17-10 (GB2) - c1-4 (IGCT)	Power switch off	10 kΩ or higher
z17-10 (GB2) - c1-8 (GND)	Power switch off	10 kΩ or higher

(h) Connect the c1 and z17 connectors to the battery smart unit.

(i) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(j) Connect the cable to the negative (-) battery terminal.

NG ▶ CHECK HARNESS AND CONNECTOR (INLET AIR TEMPERATURE SENSOR AND BATTERY TEMPERATURE SENSOR)

OK ▼

4.	CHECK BATTERY SMART UNIT (VIB VOLTAGE) INFO

NG ▶ CHECK HYBRID BATTERY JUNCTION BLOCK

OK ▶ **REPLACE BATTERY SMART UNIT**

5.	CHECK HYBRID BATTERY JUNCTION BLOCK INFO

NG ▶ CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HYBRID BATTERY JUNCTION BLOCK)

OK ▶ **REPLACE HYBRID BATTERY JUNCTION BLOCK**

6.	CHECK HARNESS AND CONNECTOR (BATTERY SMART UNIT - HYBRID BATTERY JUNCTION BLOCK) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE BATTERY SMART UNIT**

7.	CHECK HARNESS AND CONNECTOR (INLET AIR TEMPERATURE SENSOR AND BATTERY TEMPERATURE SENSOR) INFO

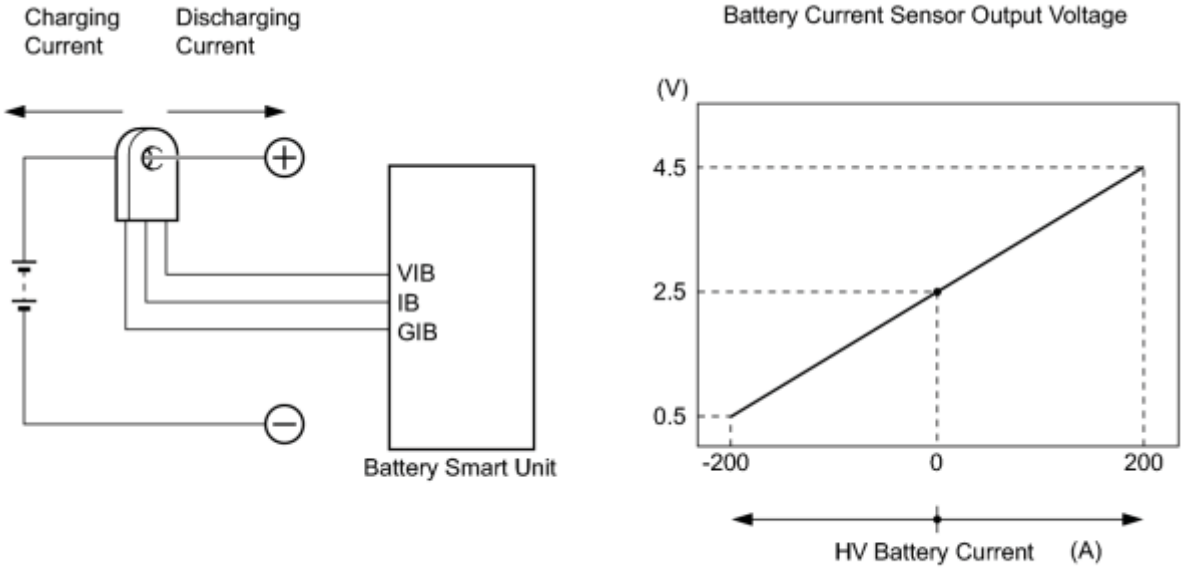
NG ▶ REPAIR HARNESS OR CONNECTOR

OK ▶ **REPLACE HV BATTERY ASSEMBLY**

DTC	P0ABF-123	Hybrid Battery Pack Current Sensor Circuit
DTC	P0AC1-123	Hybrid Battery Pack Current Sensor Circuit Low
DTC	P0AC2-123	Hybrid Battery Pack Current Sensor Circuit High

DESCRIPTION

- The battery current sensor, which is mounted on the positive cable side of the HV battery assembly, detects the amperage that flows into the HV battery. The battery smart unit inputs a voltage, which varies between 0 and 5 V in proportion to the amperage, into the IB terminal from the battery current sensor. An output voltage of the battery current sensor below 2.5 V indicates that the HV battery is being charged, and above 2.5 V indicates that the HV battery is being discharged. The power management control ECU determines the charging and discharging amperage of the HV battery based on the signals that are input to its IB terminal from the battery smart unit, and calculates the SOC (state of charge) of the HV battery through the accumulated amperage.



G

DTC No.	DTC Detection Condition	Trouble Area
P0ABF-123 P0AC1-123 P0AC2-123	When the battery current sensor is abnormal (1 trip detection)	• Hybrid battery junction block • Battery smart unit • Wire harness or connector

MONITOR DESCRIPTION

If the battery smart unit detects a malfunction in the battery current sensor, the power management control ECU (HV CPU) illuminates the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0ABF (INF 123): Power-supply circuit for current sensor malfunction (GND short/ +B short) P0AC1 (INF 123): Current sensor circuit malfunction (GND short) P0AC2 (INF 123): Current sensor circuit malfunction (open)
Required sensors / components	Battery current sensor
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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

Battery smart unit	DTC P0ABF (INF 123) is not detected DTC P0AC1 (INF 123) is not detected DTC P0AC2 (INF 123) is not detected

CONFIRMATION DRIVING PATTERN

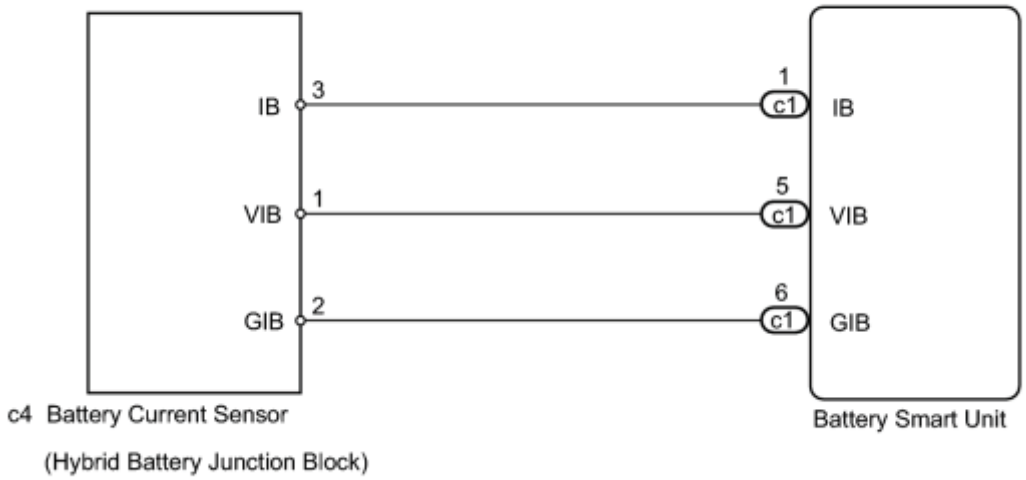
1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Perform the universal trip.
7. Enter the following menus: Powertrain / HV / Trouble Codes.

8. Check that permanent DTCs are cleared.

   HINT:

   - If a permanent DTC is output, the system is malfunctioning.
   - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B ▶ GO TO DTC CHART

A ▼

2.	CHECK HARNESS AND CONNECTOR (HYBRID BATTERY JUNCTION BLOCK - BATTERY SMART UNIT) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	CHECK BATTERY SMART UNIT (VIB VOLTAGE) INFO

NG ▶ REPLACE BATTERY SMART UNIT

OK ▼

4.	CHECK BATTERY SMART UNIT

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

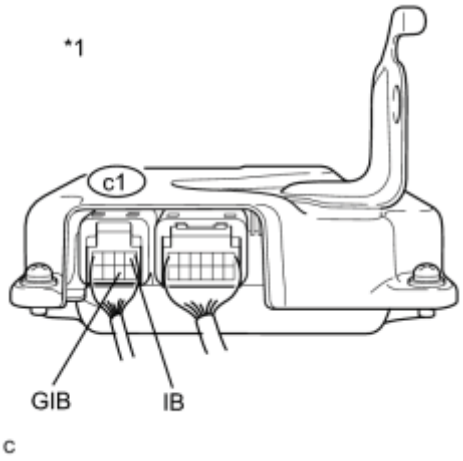
(d) Connect the cable to the negative (-) battery terminal.

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

NOTICE:

Turning the power switch on (IG) with the service plug grip removed causes an interlock switch system DTC (P0A0D-350) to be set. Use the Techstream to clear the DTCs INFO.

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



Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
c1-1 (IB) - c1-6 (GIB)	Power switch on (IG)	2.46 to 2.54 V

Text in Illustration

*1	Component with harness connected (Battery Smart Unit)

(g) Turn the power switch off.

(h) Disconnect the cable from the negative (-) battery terminal.

(i) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(j) Connect the cable to the negative (-) battery terminal.

NG ▶ REPLACE HYBRID BATTERY JUNCTION BLOCK
OK ▶ **REPLACE BATTERY SMART UNIT**

DTC	P0AC0-123	Hybrid Battery Pack Current Sensor Circuit Range / Performance

DESCRIPTION

Refer to the Description for DTC P0ABF-123 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0AC0-123	When the battery current sensor is abnormal (1 or 2 trip detection)	• Hybrid battery junction block • Battery smart unit

MONITOR DESCRIPTION

If the battery smart unit detects a malfunction in the battery current sensor, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0AC0 (INF 123): Current sensor malfunction
Required sensors / components	Battery current sensor
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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

Battery smart unit	P0AC0 (INF 123) is not detected

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.

2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (IG), wait for 10 seconds or more and then turn the power switch off.
6. Turn the power switch on (READY) and turn the Techstream on.
7. Perform a universal trip.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
9. Check that permanent DTCs are cleared.

   HINT:

   - If a permanent DTC is output, the system is malfunctioning.
   - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

CAUTION:

- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B ▶ GO TO DTC CHART

A ▼

2.	REPLACE HYBRID BATTERY JUNCTION BLOCK

(a) Replace the hybrid battery junction block INFO.

NEXT ▼

3.	CLEAR DTC (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Clear the DTCs and freeze frame data INFO.

(e) Perform a road test to charge and discharge the HV battery assembly.

HINT:

2 trip detection logic is used. After the first road test, turn the power switch off and perform a road test again.

(f) Disconnect the Techstream from the DLC3.

NEXT

4.	RECONFIRM DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read output DTCs INFO.

Result

Result	Proceed to
DTCs P0AC0-123 is not output.	A
DTCs P0AC0-123 is output.	B

(e) Disconnect the Techstream from the DLC3.

B REPLACE BATTERY SMART UNIT
A **RECOVERY TO NORMAL**

DTC	P0AFC-123	Hybrid Battery Pack Sensor Module

DESCRIPTION

• If the battery smart unit detects an internal malfunction, it sends an error signal to the power management control ECU. When the power management control ECU receives the error signal from the battery smart unit, the ECU warns the driver and performs fail-safe control.

DTC No.	DTC Detection Condition	Trouble Area
P0AFC-123	The power management control ECU receives an error signal from the battery smart unit.	• Battery smart unit • Wire harness or connector • IGCT fuse • IGCT No. 2 fuse • IGCT relay

MONITOR DESCRIPTION

If the battery smart unit detects an internal malfunction in the unit itself, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0AFC (INF 123): Hybrid Battery Pack Sensor Module
Required sensors / components	Battery smart unit
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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

Battery smart unit	DTC P0AFC (INF 123) is not detected

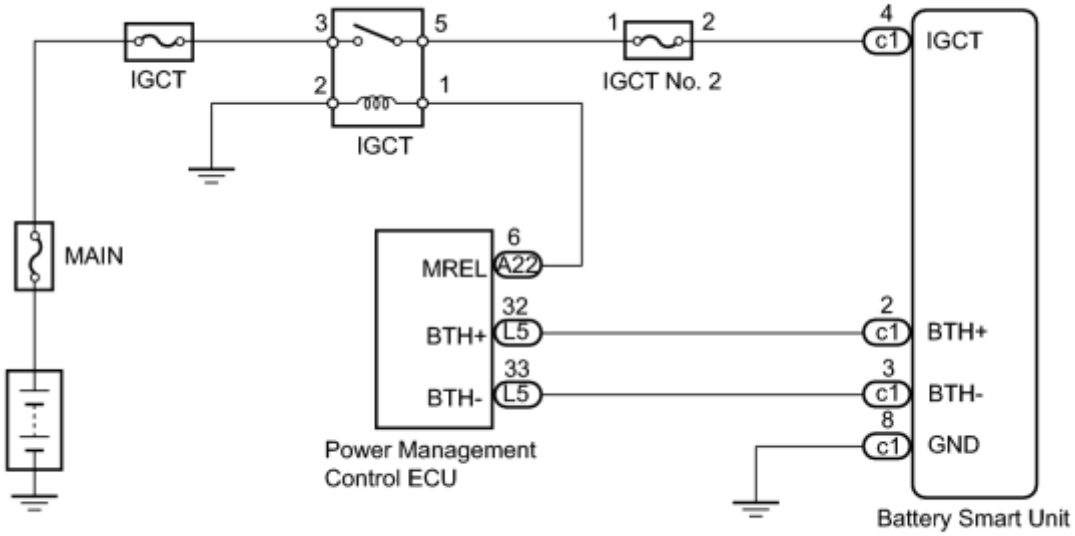
CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Perform the universal trip.
7. Enter the following menus: Powertrain / HV / Trouble Codes.
8. Check that permanent DTCs are cleared.

   HINT:

   - If a permanent DTC is output, the system is malfunctioning.
   - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

CAUTION:

- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.

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

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

HINT:

After repairing, restart the system (turn the power switch on (READY)) and recheck for DTCs INFO.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (IGCT VOLTAGE)

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) 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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

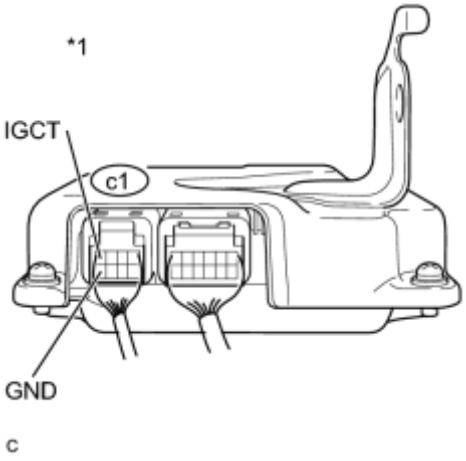
(d) Connect the cable to the negative (-) battery terminal.

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

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

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
c1-4 (IGCT) - c1-8 (GND)	Power switch on (IG)	11 to 14 V



- 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.
- Turning the power switch on (IG) with the service plug grip removed causes an interlock switch system DTC (P0A0D-350) to be set. Use the Techstream to clear the DTCs INFO.

Text in Illustration

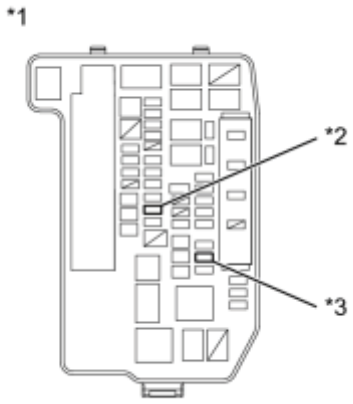
*1	Component with harness connected (Battery Smart Unit)

(g) Turn the power switch off.

(h) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

NG ▶ CHECK FUSE (IGCT, IGCT NO. 2)
OK ▶ **REPLACE BATTERY SMART UNIT**

2.	CHECK FUSE (IGCT, IGCT NO. 2)



(a) Remove the IGCT and IGCT No. 2 fuses from the engine room junction block assembly.

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	IGCT Fuse
*3	IGCT No. 2 Fuse

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

Standard Resistance:

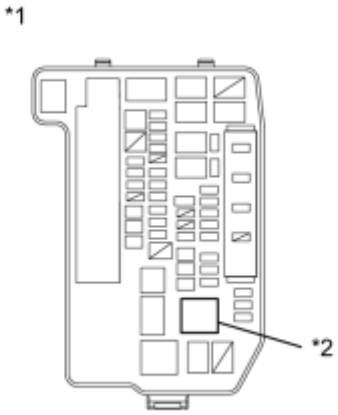
Tester Connection	Condition	Specified Condition
IGCT fuse	Always	Below 1 Ω
IGCT No. 2 fuse	Always	Below 1 Ω

(c) Install the IGCT and IGCT No. 2 fuses to the engine room junction block assembly.

NG ▶ REPLACE FUSE (IGCT, IGCT NO. 2)

OK

3.	CHECK RELAY (IGCT)



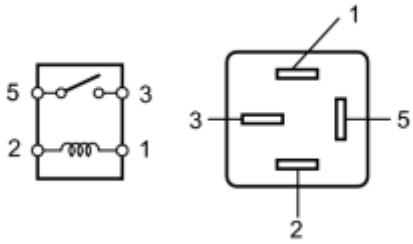
(a) Remove the IGCT relay from the engine room junction block assembly.

Text in Illustration

*1	Engine Room Junction Block Assembly
*2	IGCT Relay

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

Standard Resistance:



Tester Connection	Condition	Specified Condition
3 - 5	Auxiliary battery voltage is applied between terminals 1 and 2	10 kΩ or more
	Auxiliary battery voltage is not applied between terminals 1 and 2	below 1 Ω

(c) Install the IGCT relay to the engine room junction block assembly.

NG ▶ REPLACE RELAY (IGCT)

OK

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

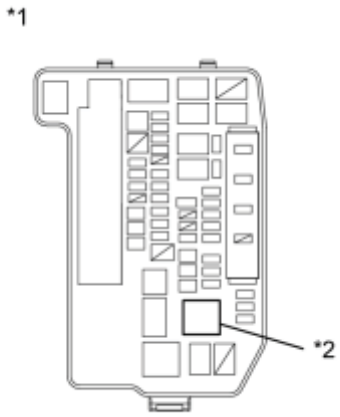
CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) Remove the IGCT relay from the engine room junction block assembly.

Text in Illustration



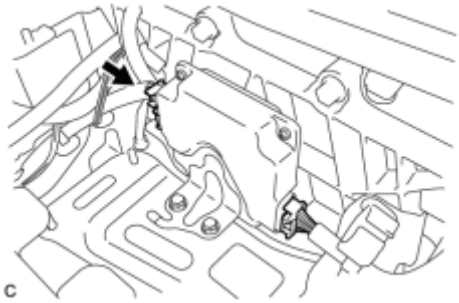
*1	Engine Room Junction Block Assembly
*2	IGCT Relay

(c) 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.

(d) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.



(e) Disconnect only the c1 connector of the battery smart unit.

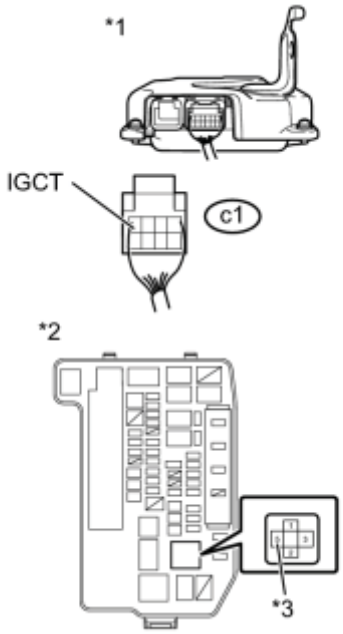
(f) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Switch Condition	Specified Condition
IGCT relay terminal 5 - c1-4 (IGCT)	Power switch off	Below 1 Ω

Text in Illustration

*1	Rear view of wire harness connector (to Battery Smart Unit)
*2	Engine Room Junction Block Assembly



*3	IGCT relay terminal 5

(g) Connect the c1 connector of the battery smart unit.

(h) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(i) Install the IGCT relay to the engine room junction block assembly.

(j) Connect the cable to the negative (-) battery terminal.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **CHECK AND REPAIR POWER SOURCE CIRCUIT**

DTC	P0B3D-123	Hybrid Battery Voltage Sensor "A" Circuit Low
DTC	P0B42-123	Hybrid Battery Voltage Sensor "B" Circuit Low
DTC	P0B47-123	Hybrid Battery Voltage Sensor "C" Circuit Low
DTC	P0B4C-123	Hybrid Battery Voltage Sensor "D" Circuit Low
DTC	P0B51-123	Hybrid Battery Voltage Sensor "E" Circuit Low
DTC	P0B56-123	Hybrid Battery Voltage Sensor "F" Circuit Low
DTC	P0B5B-123	Hybrid Battery Voltage Sensor "G" Circuit Low
DTC	P0B60-123	Hybrid Battery Voltage Sensor "H" Circuit Low
DTC	P0B65-123	Hybrid Battery Voltage Sensor "I" Circuit Low
DTC	P0B6A-123	Hybrid Battery Voltage Sensor "J" Circuit Low
DTC	P0B6F-123	Hybrid Battery Voltage Sensor "K" Circuit Low
DTC	P0B74-123	Hybrid Battery Voltage Sensor "L" Circuit Low
DTC	P0B79-123	Hybrid Battery Voltage Sensor "M" Circuit Low
DTC	P0B7E-123	Hybrid Battery Voltage Sensor "N" Circuit Low
DTC	P0B83-123	Hybrid Battery Voltage Sensor "O" Circuit Low
DTC	P308A-123	Hybrid Battery Voltage Sensor All Circuits Low

DESCRIPTION

- Refer to the description for DTC P0A80-123 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0B3D-123	Each battery block voltage becomes less than 2.5 V (open) (1 trip detection)	• Battery smart unit • HV battery assembly

DTC No.	DTC Detection Condition	Trouble Area
P0B42-123 P0B47-123 P0B4C-123 P0B51-123 P0B56-123 P0B5B-123 P0B60-123 P0B65-123 P0B6A-123 P0B6F-123 P0B74-123 P0B79-123 P0B7E-123 P0B83-123 P308A-123		

HINT:

- Values smaller than 2.0 V may not be shown in the Data List because a fail-safe value is substituted.
- Hybrid battery voltage sensor in the DTC titles refers to the battery smart unit.

MONITOR DESCRIPTION

If the battery smart unit detects voltage drop in a battery module, the power management control ECU (HV CPU) will illuminate the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0B3D (INF 123) / P0B42 (INF 123) / P0B47 (INF 123) / P0B4C (INF 123) / P0B51 (INF 123) / P0B56 (INF 123) / P0B5B (INF 123) / P0B60 (INF 123) / P0B65 (INF 123) / P0B6A (INF 123) / P0B6F (INF 123) / P0B74 (INF 123) / P0B79 (INF 123) / P0B7E (INF 123) / P0B83 (INF 123) / P308A (INF 123): Battery voltage sensor circuit malfunction (open)
Required sensors / components	Battery smart unit
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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

Battery smart unit	DTC P0B3D (INF 123) / P0B42 (INF 123) / P0B47 (INF 123) / P0B4C (INF 123) / P0B51 (INF 123) / P0B56 (INF 123) / P0B5B (INF 123) / P0B60 (INF 123) / P0B65 (INF 123) / P0B6A (INF 123) / P0B6F (INF 123) / P0B74 (INF 123) / P0B79 (INF 123) / P0B7E (INF 123) / P0B83 (INF 123) / P308A (INF 123) is not detected

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Perform the universal trip.
7. Enter the following menus: Powertrain / HV / Trouble Codes.
8. Check that permanent DTCs are cleared.

   HINT:

   - If a permanent DTC is output, the system is malfunctioning.
   - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

CAUTION:

- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B ▶ GO TO DTC CHART

A ▼

2.	CHECK CONNECTOR CONNECTION CONDITION

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

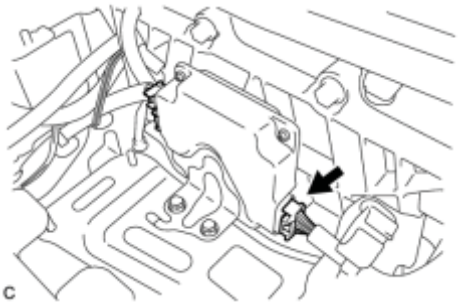
(b) Check that the service plug grip is not installed.

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.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(d) Check the connections of the j1 connector of the battery smart unit.



OK:

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

(e) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(f) Connect the cable to the negative (-) battery terminal.

NG ▶ CONNECT SECURELY

OK ▼

3.	REPLACE BATTERY SMART UNIT

(a) Replace the battery smart unit INFO.

NEXT ▼

4.	CLEAR DTC (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Clear the DTCs and freeze frame data INFO.

(e) Perform a road test to charge and discharge the HV battery assembly.

(f) Disconnect the Techstream from the DLC3.

NEXT ▼

5.	RECONFIRM DTC OUTPUT (HV)

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(d) Read output DTCs INFO.

Result

Result	Proceed to
Battery temperature sensor DTCs for this diagnostic procedure are not output	A
Battery temperature sensor DTCs for this diagnostic procedure are output	B

HINT:

Turning the power switch on (IG) with the service plug grip removed causes an interlock switch system DTC (P0A0D-350) to be set. Use the Techstream to clear the DTCs INFO.

(e) Disconnect the Techstream from the DLC3.

B ▶REPLACE HV BATTERY ASSEMBLY
A ▶**RETURN TO NORMAL OPERATION**

DTC	P3011-123	Battery Block 1 Becomes Weak
DTC	P3012-123	Battery Block 2 Becomes Weak
DTC	P3013-123	Battery Block 3 Becomes Weak
DTC	P3014-123	Battery Block 4 Becomes Weak
DTC	P3015-123	Battery Block 5 Becomes Weak
DTC	P3016-123	Battery Block 6 Becomes Weak
DTC	P3017-123	Battery Block 7 Becomes Weak
DTC	P3018-123	Battery Block 8 Becomes Weak
DTC	P3019-123	Battery Block 9 Becomes Weak
DTC	P3020-123	Battery Block 10 Becomes Weak
DTC	P3021-123	Battery Block 11 Becomes Weak
DTC	P3022-123	Battery Block 12 Becomes Weak
DTC	P3023-123	Battery Block 13 Becomes Weak
DTC	P3024-123	Battery Block 14 Becomes Weak

DESCRIPTION

- Refer to the Description for DTC P0A9C-123 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P3011-123 P3012-123 P3013-123	Presence of a malfunctioning block is determined based on each battery block voltage (1 trip detection).	• HV battery assembly • Battery smart unit

DTC No.	DTC Detection Condition	Trouble Area
P3014-123 P3015-123 P3016-123 P3017-123 P3018-123 P3019-123 P3020-123 P3021-123 P3022-123 P3023-123 P3024-123		

HINT:

P3011-123 and P3024-123 will not be set unless the vehicle is driven for approximately 10 minutes after clearing the DTCs.

MONITOR DESCRIPTION

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

MONITOR STRATEGY

Related DTCs	P3011 to P3024 (INF 123): Rationality

Required sensors / components	HV battery
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	TMC's intellectual property
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

Battery smart unit	DTC P3011 (INF 123) to P3024 (INF 123) is not detected

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and turn the Techstream on.
6. Perform a universal trip.
7. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.
8. Check that permanent DTCs are cleared.

   HINT:

   - If a permanent DTC is output, the system is malfunctioning.
   - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK DTC OUTPUT (DTC P0AFC-123 IS OUTPUT) INFO

B GO TO DTC CHART

A

2.	CHECK BATTERY SMART UNIT INFO

B ▶ REPLACE BATTERY SMART UNIT

A ▶ **REPLACE HV BATTERY ASSEMBLY**

DTC	U029A-123	Lost Communication with Hybrid Battery Pack Sensor Module

DESCRIPTION

The battery smart unit detects the HV battery conditions (voltage, current, and temperature) and the battery cooling fan voltage, and sends the detected signals to the power management control ECU via the serial communication system.

DTC No.	DTC Detection Condition	Trouble Area
U029A-123	Problem in serial communication between the battery smart unit and power management control ECU (1 trip detection)	• Wire harness or connector • Power management control ECU • Battery smart unit • IGCT fuse • IGCT NO. 2 fuse • IGCT relay

MONITOR DESCRIPTION

If a malfunction in communication line between the battery smart unit and power management control ECU (HV CPU) is detected, the power management control ECU (HV CPU) illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	U029A (INF 123): Battery Smart Unit communication malfunction
Required sensors / components	Main: Battery smart unit Sub: Communication line
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	-

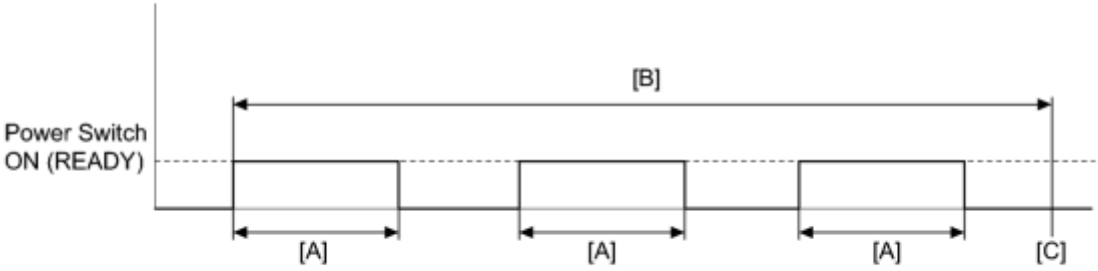
TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

TMC's intellectual property	DTC U029A (INF 123) is not detected

CONFIRMATION DRIVING PATTERN



c

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the power switch off.
5. Turn the power switch on (READY) and after a few seconds, turn the power switch off. [A]
6. Repeat [A] 3 times. [B]
7. Turn the power switch on (IG) and turn the Techstream on.
8. Enter the following menus: Powertrain / Hybrid Control / Trouble Codes. [C]
9. Check that permanent DTCs are cleared.
10. If the permanent DTCs are not cleared, perform the universal trip, and then check for permanent DTCs again.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P0AFC-123 INFO.

INSPECTION PROCEDURE

CAUTION:

- If the battery cover is removed, install it before turning the power switch on (IG) or (READY). If the power switch is turned on (IG) or (READY) with the battery cover removed, U029A-123 may be set.
- Before inspecting the high-voltage system, take safety precautions to prevent electrical shocks, such as wearing insulated gloves and 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.
- After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

  HINT:

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

NOTICE:

After the power switch is turned off, the display and navigation module display (HDD navigation system) records various types of memory and settings. As a result, after turning the power switch off, make sure to wait at least 60 seconds before disconnecting the cable from the negative (-) battery terminal.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (IGCT VOLTAGE) INFO

NG ▶ CHECK FUSE (IGCT, IGCT NO. 2)

OK ▼

2.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - BATTERY SMART UNIT)

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) Check that the service plug grip is not installed.

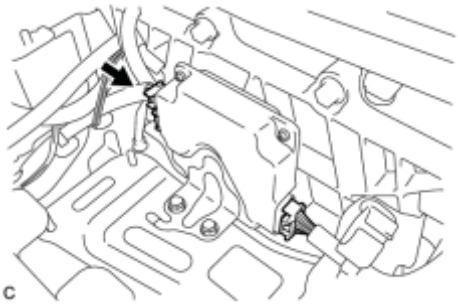
NOTICE:

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.

(c) Disconnect the L5 connector from the power management control ECU INFO.

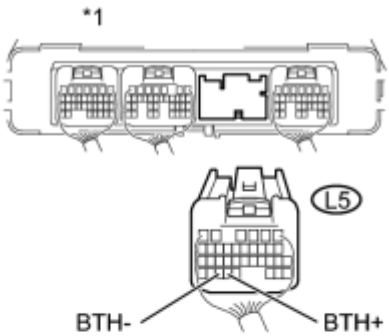
(d) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

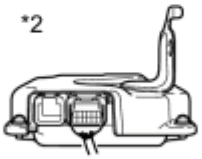
(e) Disconnect only the c1 connector of the battery smart unit.

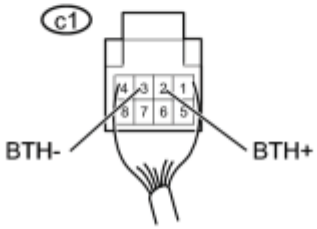


(f) Measure the resistance according to the value(s) in the table below.

Standard Resistance:







Tester Connection	Switch Condition	Specified Condition
L5-32 (BTH+) - c1-2 (BTH+)	Power switch off	Below 1 Ω
L5-33 (BTH-) - c1-3 (BTH-)	Power switch off	Below 1 Ω
L5-32 (BTH+) - Body ground and other terminals	Power switch off	10 kΩ or more
L5-33 (BTH-) - Body ground and other terminals	Power switch off	10 kΩ or more

Text in Illustration

*1	Rear view of wire harness connector (to Power Management Control ECU)
*2	Rear view of wire harness connector (to Battery Smart Unit)

(g) Connect the cable to the negative (-) battery terminal.

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

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

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.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition

Tester Connection	Switch Condition	Specified Condition
L5-32 (BTH+) - Body ground	Power switch on (IG)	Below 1 V
L5-33 (BTH-) - Body ground	Power switch on (IG)	Below 1 V

NOTICE:

- If the power switch is turned on (IG) with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be stored. If this DTC is stored, clear the DTC using the Techstream INFO.
- If the power switch is turned on (IG) with the connector removed from the sensor, DTCs will be stored. If DTC are stored, clear the DTCs using the Techstream INFO.

(j) Connect the c1 connector of the battery smart unit.

(k) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(l) Connect the L5 connector to the power management control ECU INFO.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	CHECK WAVEFORM

CAUTION:

Be sure to wear insulated gloves.

(a) Disconnect the cable from the negative (-) battery terminal.

(b) Check that the service plug grip is not installed.

NOTICE:

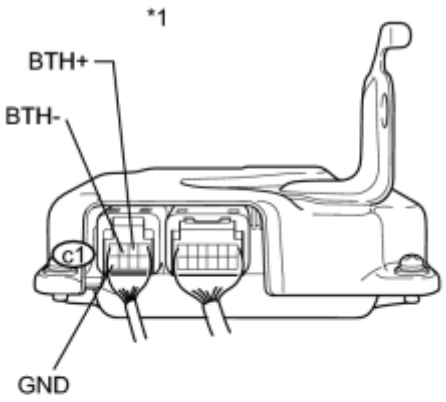
After removing the service plug grip, do not turn the power switch on (READY), unless instructed by the repair manual because this may cause a malfunction.

(c) Remove the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

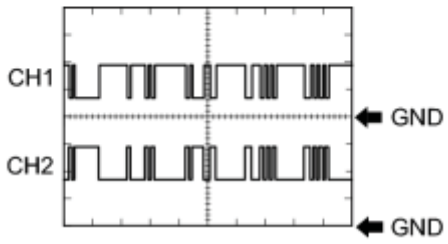
(d) Connect the cable to the negative (-) battery terminal.

(e) Connect an oscilloscope between the battery smart unit terminals specified in the table below, and measure the waveform.

Item	Content
Tester Connection	CH1: c1-2 (BTH+) - c1-8 (GND) CH2: c1-3 (BTH-) - c1-8 (GND)



Equipment Setting	2 V/DIV., 500 µs/DIV.
Condition	Power switch on (IG)



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.
- If the power switch is turned on (IG) with the service plug grip removed, DTC P0A0D-350 for the interlock switch system will be stored. If this DTC is output, clear the DTC using the Techstream INFO.

Text in Illustration

*1	Component with harness connected (Battery Smart Unit)

(f) Turn the power switch off.

(g) Disconnect the cable from the negative (-) battery terminal.

(h) Install the No. 1 hybrid vehicle battery carrier bracket sub-assembly INFO.

(i) Connect the cable to the negative (-) battery terminal.

NG ▶ REPLACE BATTERY SMART UNIT
OK ▶ **REPLACE POWER MANAGEMENT CONTROL ECU**

4.	CHECK FUSE (IGCT, IGCT NO. 2) INFO

NG ▶ REPLACE FUSE (IGCT, IGCT NO. 2)

OK

5.	CHECK RELAY (IGCT) INFO

NG → REPLACE RELAY (IGCT)

OK

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK → **CHECK AND REPAIR POWER SOURCE CIRCUIT**

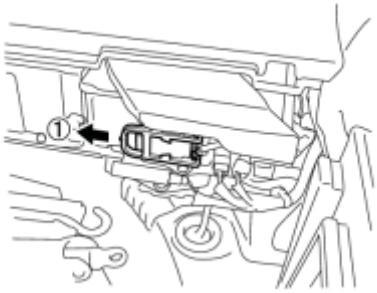
PRECAUTION

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

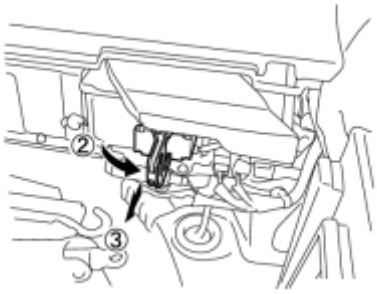
NOTICE:

After removing the service plug grip, turning the power switch on (READY) may 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:



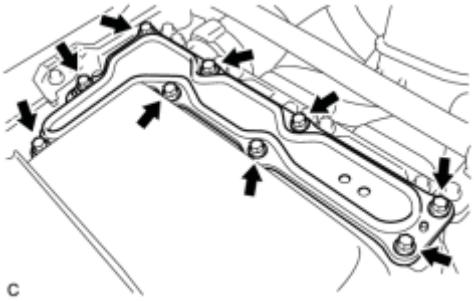
Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

C

(c) Check the voltage at the terminals in the inspection point in the inverter with converter assembly.

CAUTION:

Be sure to wear insulated gloves.

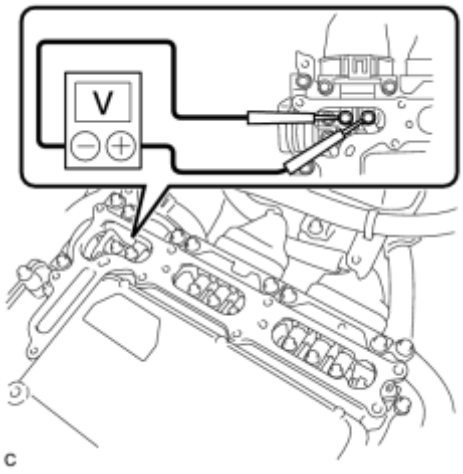


(1) Remove the 9 bolts and inverter terminal cover. INFO

NOTICE:

Cover the opening with non-residue tape to prevent entry of foreign matter or liquid after removing the connector cover.

C



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

Standard Voltage:

Tester Connection	Condition	Specified Condition
Inspection point	10 minutes passed after removing the service plug	0 V

HINT:

Set the tester to DC750 V or more to measure the voltage.

(d) When turning the power switch on (IG) during inspections, do not press the power switch with the brake pedal depressed.

CAUTION:

Pressing the power switch with the brake pedal depressed causes the system to enter the READY-on state. This is very dangerous because high voltage may be applied to the inspection area.

(e) Turn the power switch off, wear insulated gloves, and disconnect the cable from the negative (-) terminal of the auxiliary battery before touching any of the orange-colored wires of the high-voltage system.

(f) Turn the power switch off before performing any resistance checks.

(g) Turn the power switch off before disconnecting or reconnecting any connectors.

(h) When high-voltage connectors are removed, wrap the connectors with insulation tape to prevent them from contacting foreign objects.

2. NOTICE FOR HYBRID CONTROL SYSTEM ACTIVATION

(a) When the warning light is illuminated, or 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 start the hybrid system.

3. PRECAUTIONS FOR DISCONNECTING AMD TERMINAL

HINT:

The AMD terminal is connected to the positive terminal of the auxiliary battery. To prevent damage when the AMD terminal is being disconnected, use the following procedure.

(a) Be sure to disconnect the cable from the negative (-) terminal of the auxiliary battery before disconnecting the AMD terminal from the engine room junction block assembly.

(b) After disconnecting the AMD terminal, wrap the terminal with insulation tape.

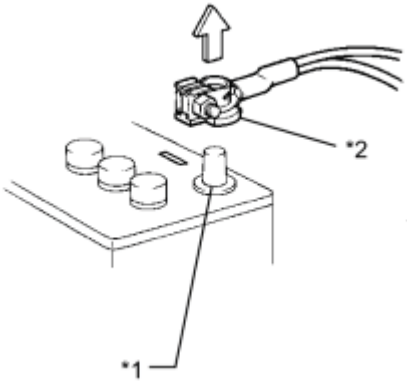
(c) Be sure to reconnect the AMD terminal to the engine room junction block assembly before reconnecting the cable of the negative (-) terminal of the auxiliary battery.

NOTICE:

A short circuit to ground may occur if the AMD terminal is disconnected before the cable is disconnected from the negative (-) terminal of the auxiliary battery. If a short circuit to ground occurs, it can result in an open circuit in a fusible link or fuse.

4. DISCONNECTING AND RECONNECTING NEGATIVE BATTERY CABLE

(a) Before performing work on electronic components, disconnect the cable from the negative (-) battery terminal to prevent damage to the electrical system or electrical components.



Text in Illustration

*1	Negative (-) Battery Terminal
*2	Cable

(b) Before disconnecting and reconnecting the battery cable, turn the power switch off and the headlight switch off. Then loosen the terminal nut completely. Do not damage the cable or terminal.

(c) When the battery cable is disconnected, the clock and radio settings and stored DTCs are cleared. Therefore, before disconnecting the battery cable, make a note of them.

- When the cable is disconnected from the negative (-) battery terminal, initialize the following system(s) after the cable is reconnected.

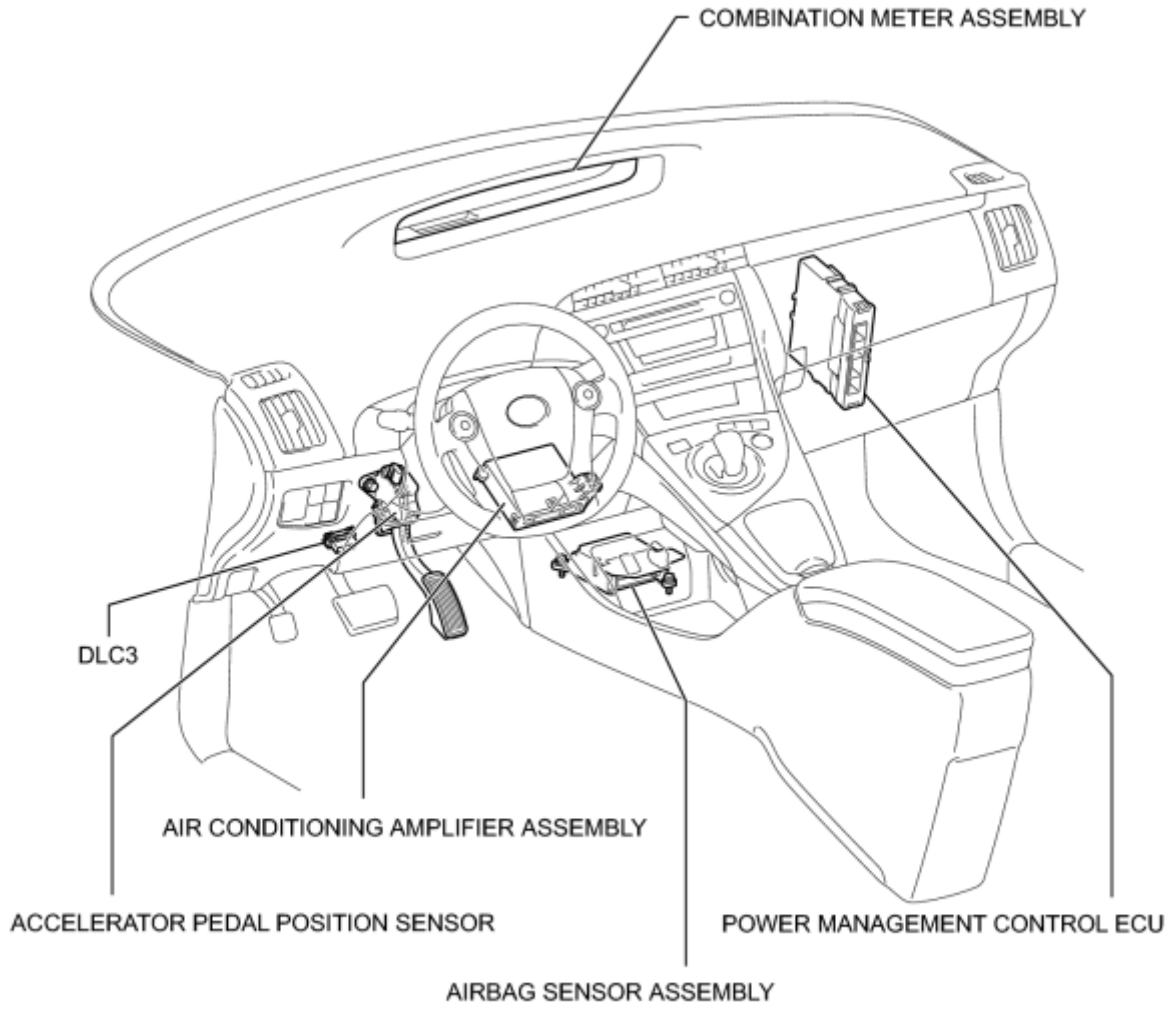
System Name	See Procedure
Advanced Parking Guidance System	INFO

DEFINITION OF TERMS

Terms	Definition
Monitor Description	Description of what the power management control ECU (HV CPU) monitors and how to detects malfunctions (monitoring purpose and its details).
Related DTCs	A group of diagnostic trouble codes that are output by the power management control ECU (HV CPU) based on the same malfunction detection logic.
Typical Enabling Condition	Preconditions that allow the power management control ECU (HV CPU) to detect malfunctions. With all preconditions satisfied, the power management control ECU (HV CPU) 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 Sensor/Components	Sensors and components used by the power management control ECU (HV CPU) to detect each malfunction.
Frequency of Operation	Number of times the power management control ECU (HV CPU) checks for each malfunction during each driving cycle. "Once per driving cycle" means that the power management control ECU (HV CPU) only checks for malfunctions once during a single driving cycle. "Continuous" means that the power management control ECU (HV CPU) checks for malfunctions whenever enabling conditions are met.
Duration	Minimum time for which the power management control ECU (HV CPU) 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 power management control ECU (HV CPU) determines malfunctions exist and sets DTCs.
MIL Operation	Timing of MIL illumination after a malfunction is detected. "Immediate" means that the power management control ECU (HV CPU) illuminates the MIL as soon as a malfunction is detected. "2 driving cycles" means that the power management control ECU (HV CPU) illuminates the MIL if the same malfunction is detected again during the next driving cycle.

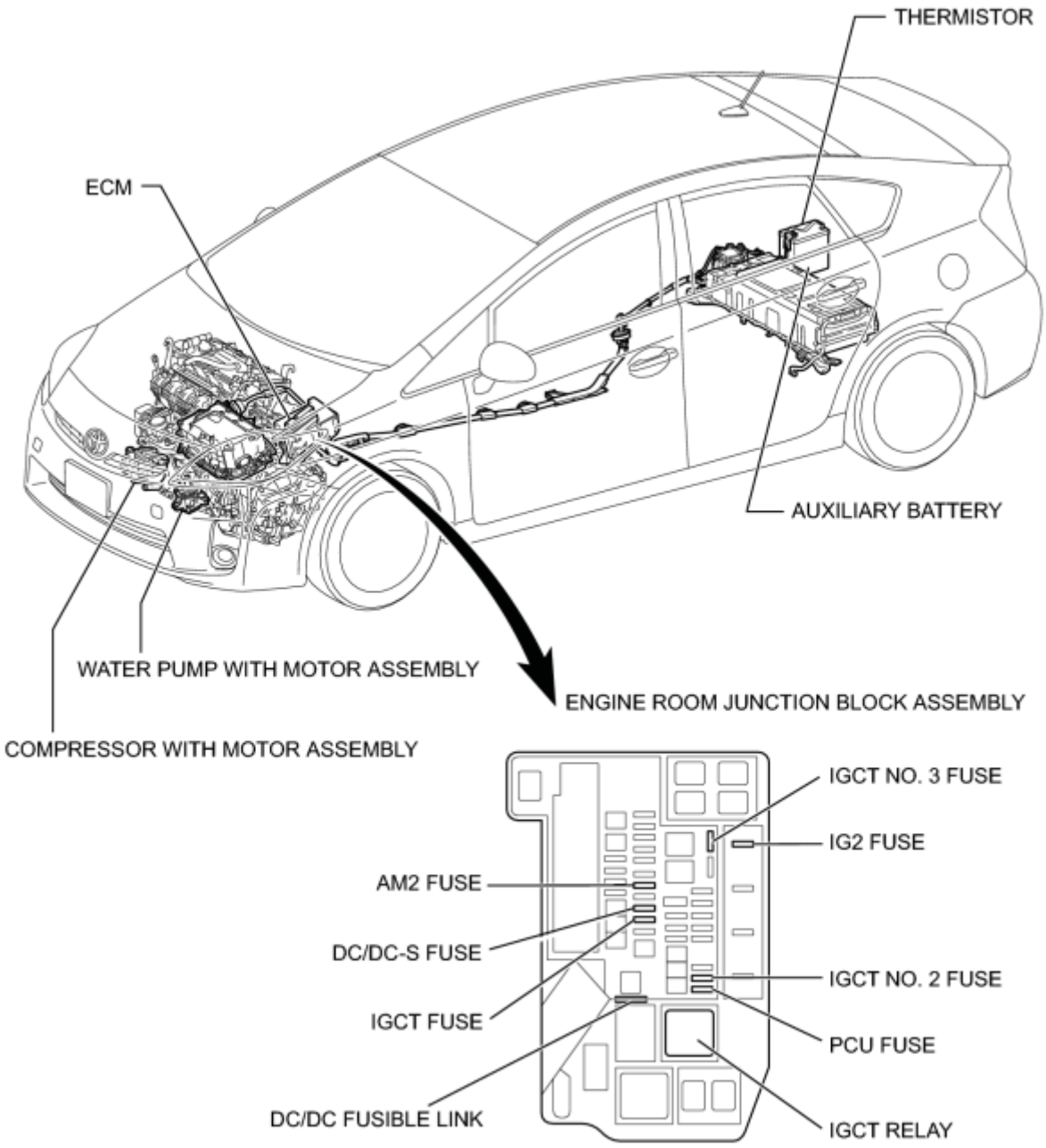
PARTS LOCATION

ILLUSTRATION



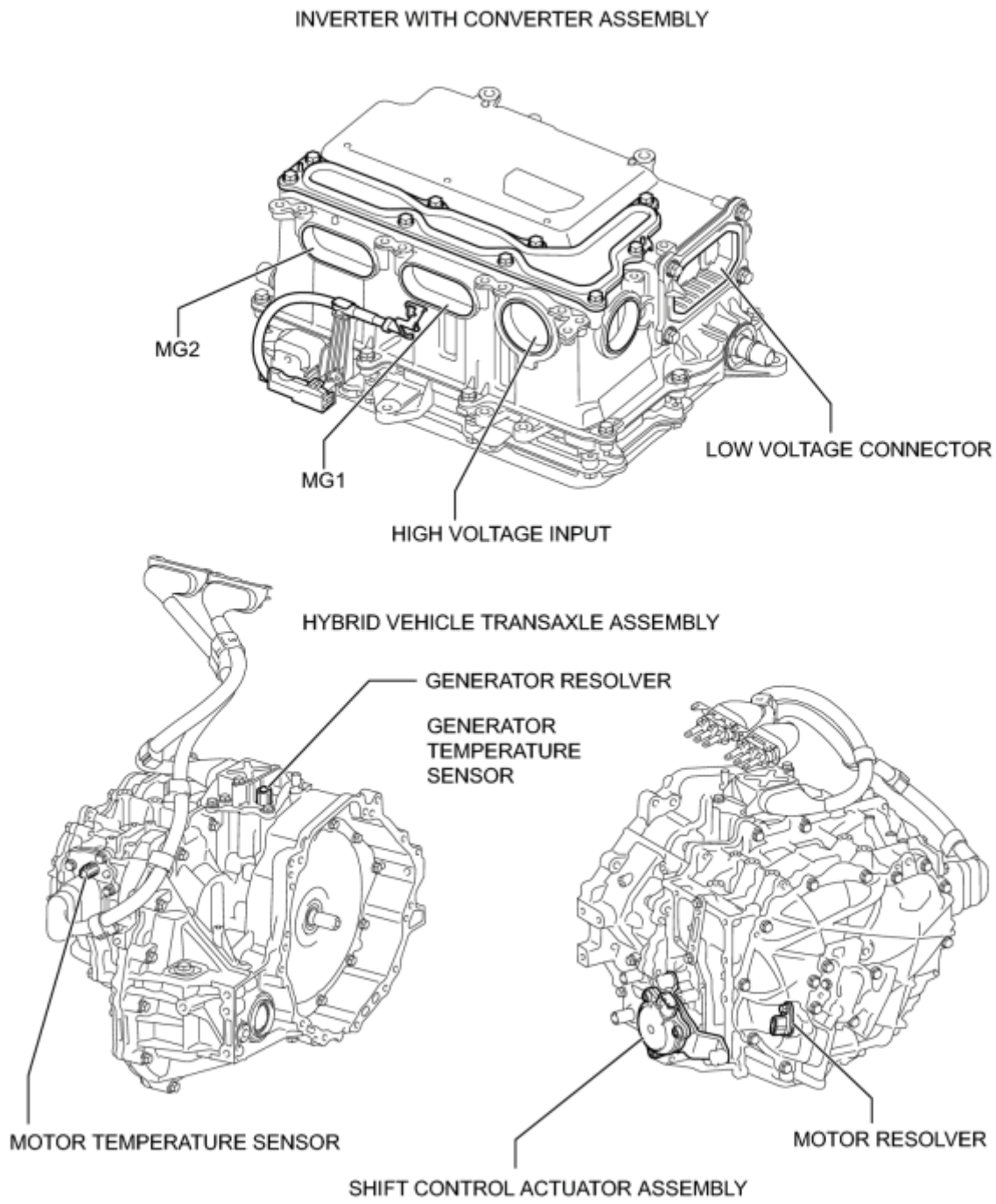
c

ILLUSTRATION



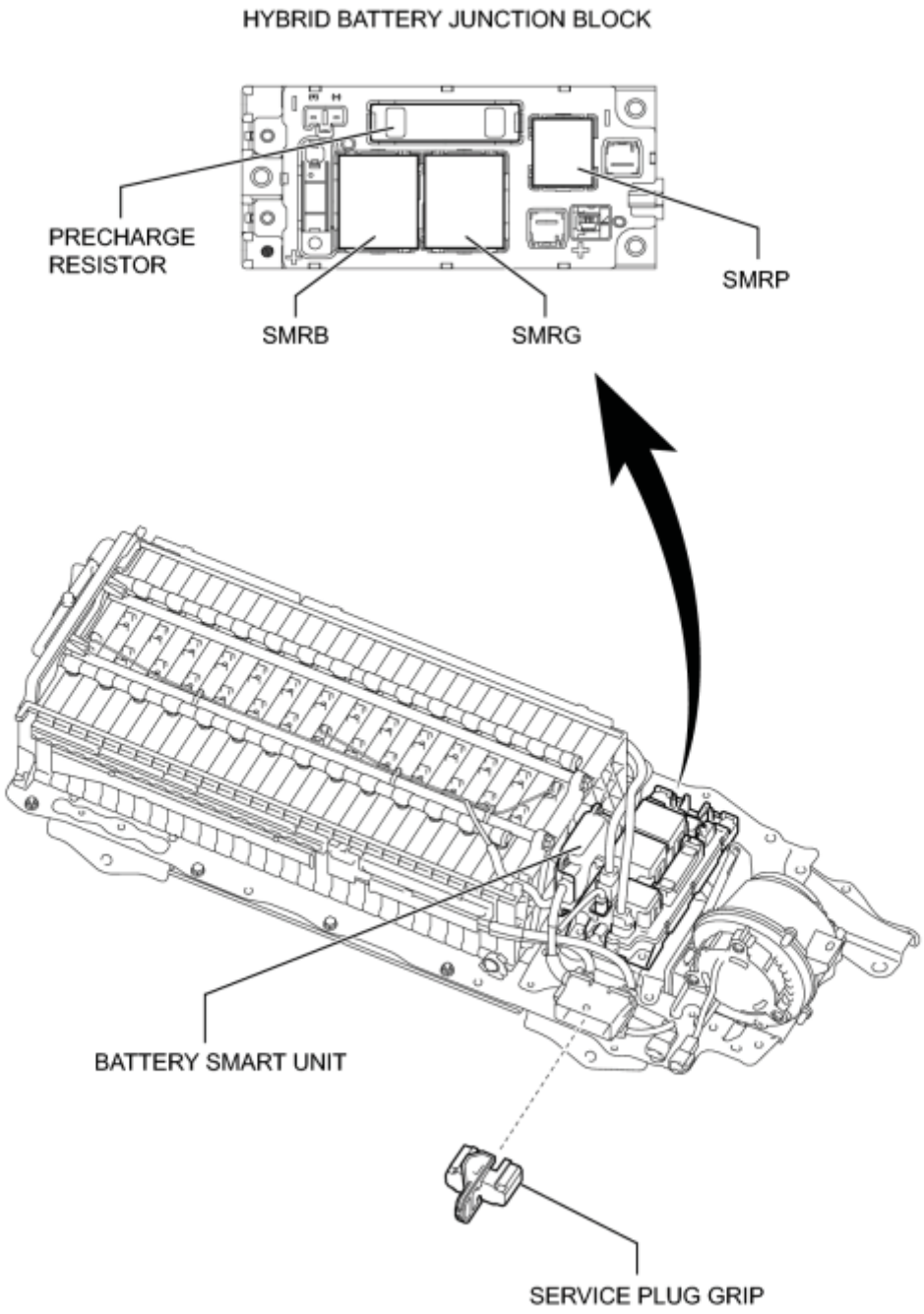
c

ILLUSTRATION



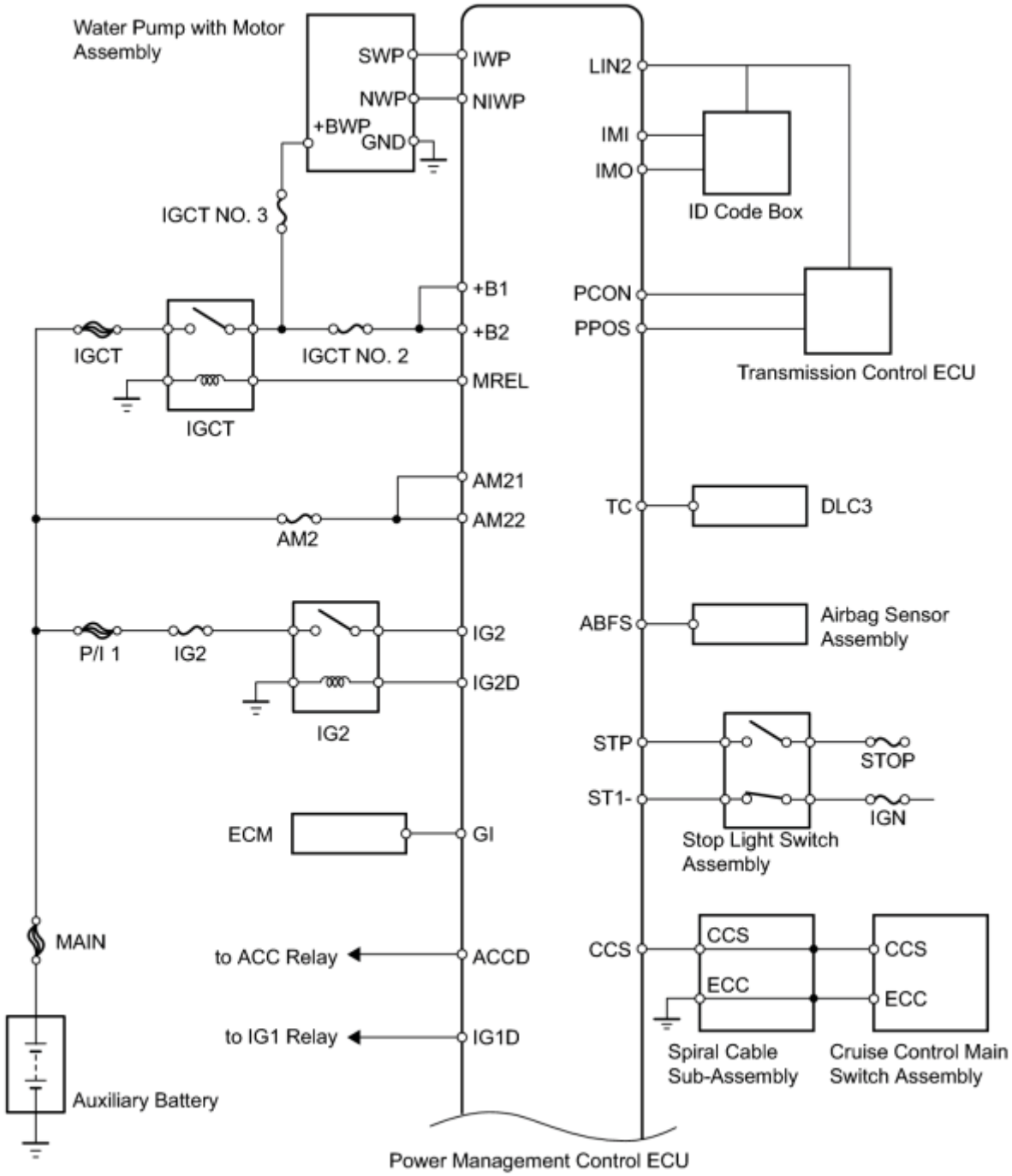
c

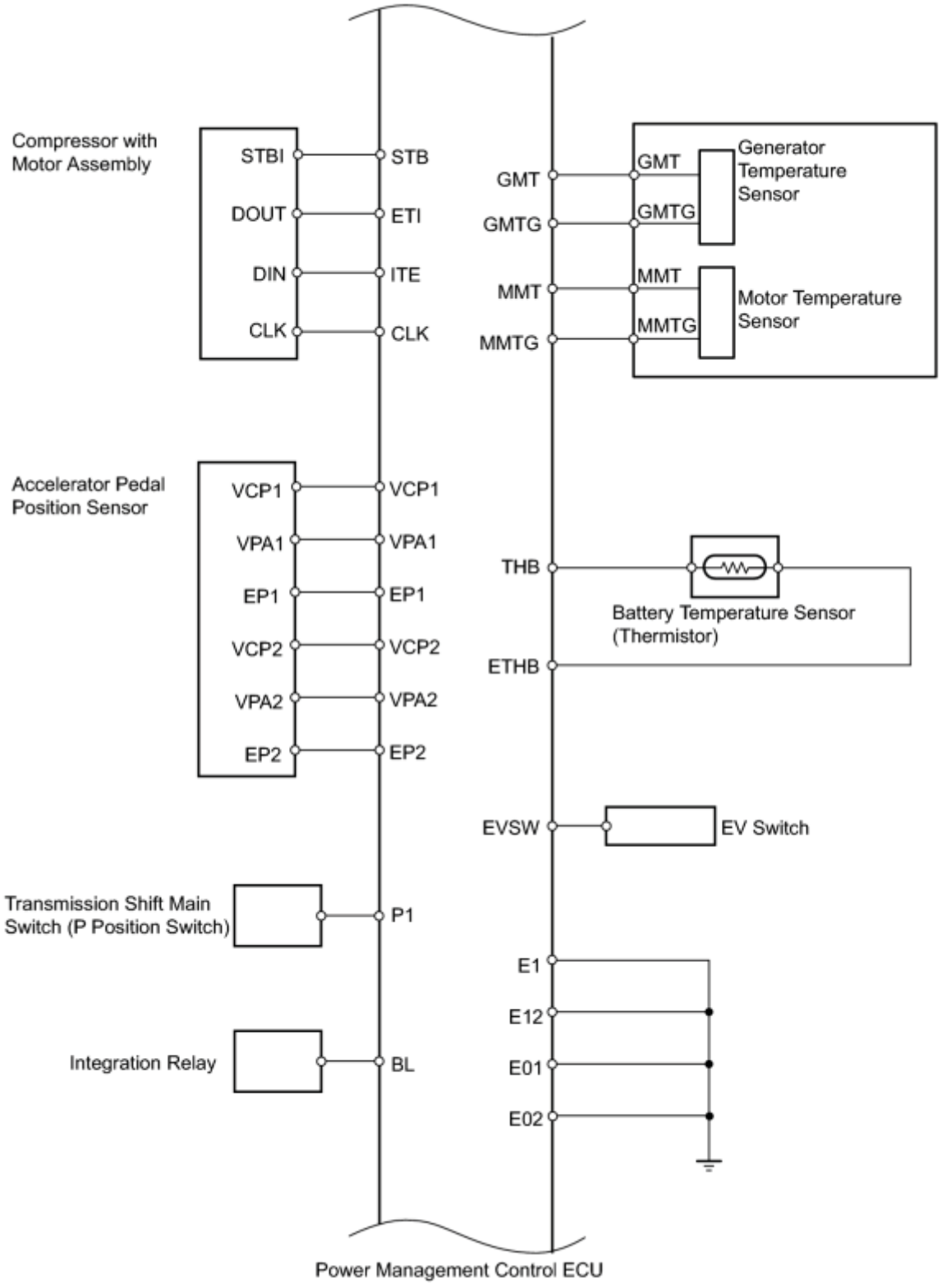
ILLUSTRATION

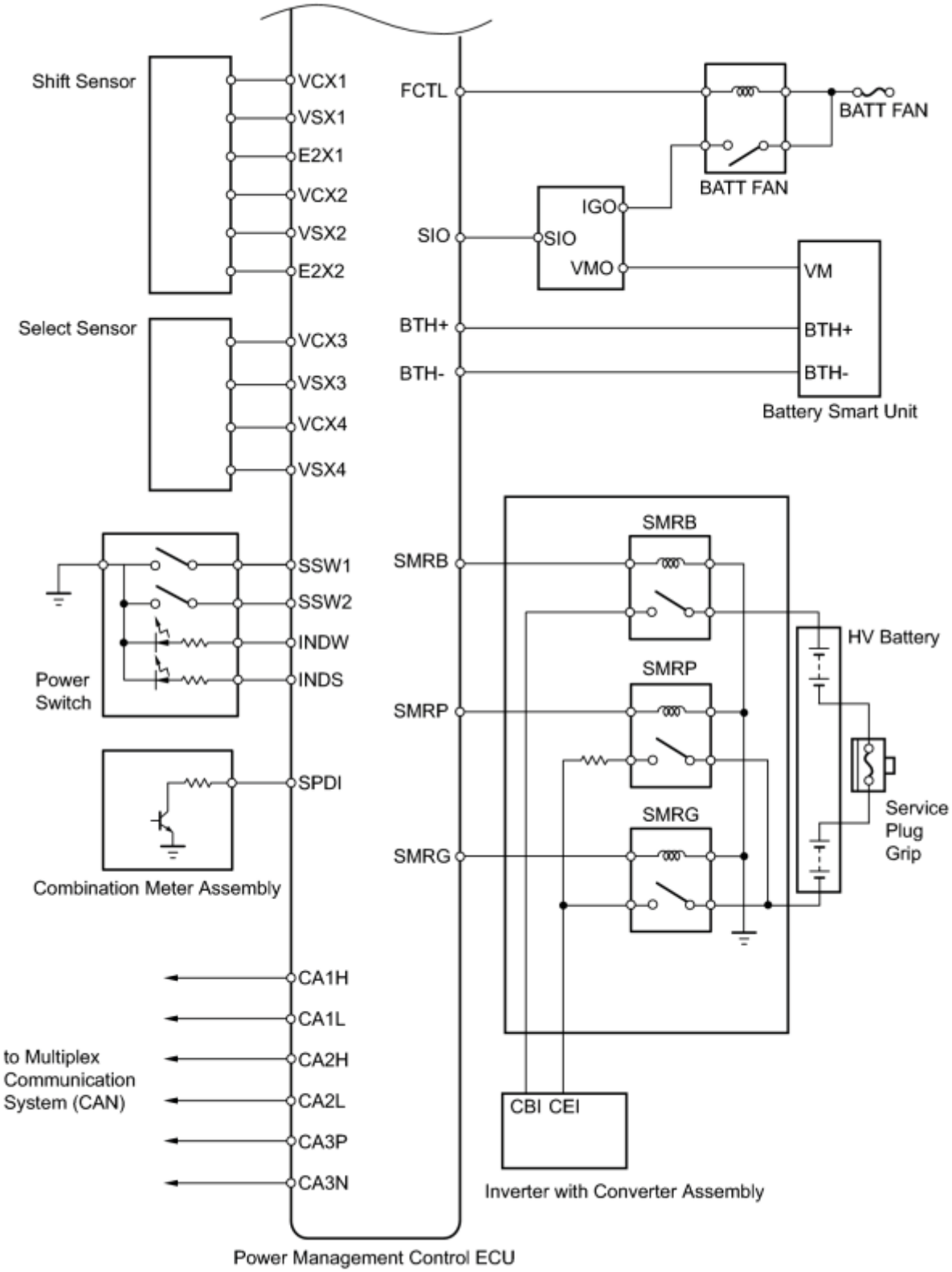

HYBRID BATTERY JUNCTION BLOCK
PRECHARGE RESISTOR
SMRB
SMRG
SMRP
BATTERY SMART UNIT
SERVICE PLUG GRIP

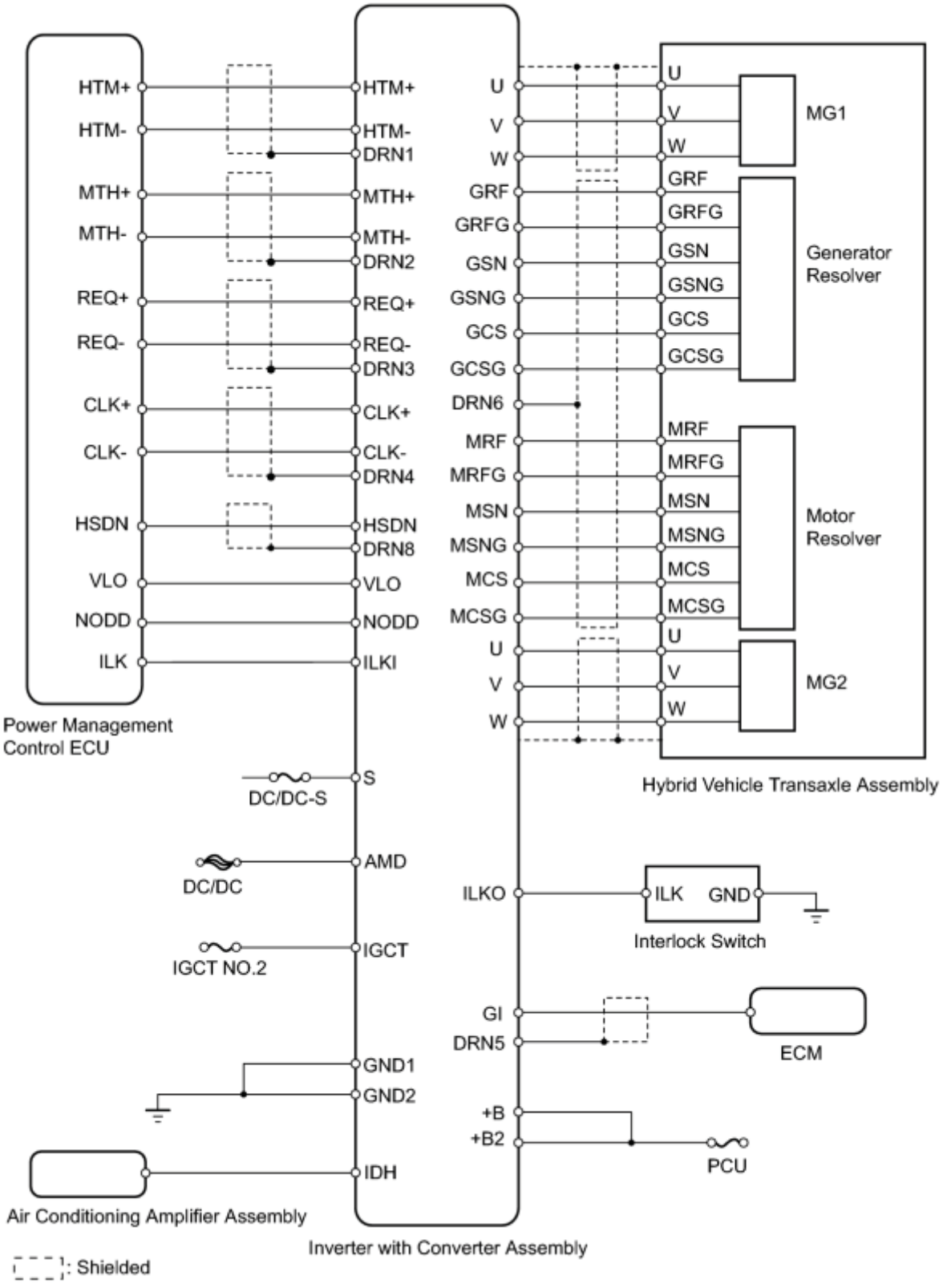
c

SYSTEM DIAGRAM




Compressor with Motor Assembly
STBI
DOUT
DIN
CLK
STB
ETI
ITE
CLK
GMT
GMTG
MMT
MMTG
GMT
GMTG
MMT
MMTG
Generator Temperature Sensor
Motor Temperature Sensor
Accelerator Pedal Position Sensor
VCP1
VPA1
EP1
VCP2
VPA2
EP2
VCP1
VPA1
EP1
VCP2
VPA2
EP2
THB
ETHB
Battery Temperature Sensor (Thermistor)
EVSW
EV Switch
Transmission Shift Main Switch (P Position Switch)
P1
Integration Relay
BL
E1
E12
E01
E02
Power Management Control ECU


Shift Sensor
VCX1
VSX1
E2X1
VCX2
VSX2
E2X2
Select Sensor
VCX3
VSX3
VCX4
VSX4
SSW1
SSW2
INDW
INDS
Power Switch
SPDI
Combination Meter Assembly
CA1H
CA1L
CA2H
CA2L
CA3P
CA3N
to Multiplex Communication System (CAN)
Power Management Control ECU
FCTL
SIO
BTH+
BTH-
SMRB
SMRP
SMRG
BATT FAN
BATT FAN
IGO
SIO
VMO
VM
BTH+
BTH-
Battery Smart Unit
SMRB
SMRP
SMRG
HV Battery
Service Plug Grip
CBI CEI
Inverter with Converter Assembly

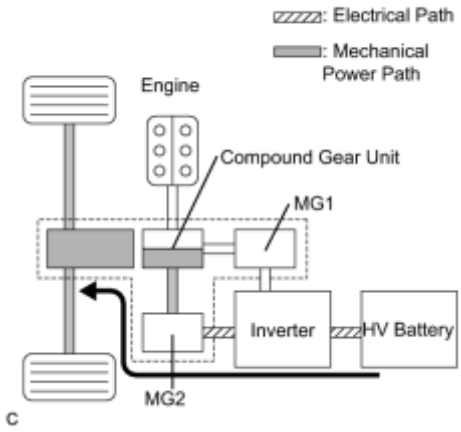

HTM+
HTM-
MTH+
MTH-
REQ+
REQ-
CLK+
CLK-
HSDN
VLO
NODD
ILK
Power Management Control ECU
HTM+
HTM-
DRN1
MTH+
MTH-
DRN2
REQ+
REQ-
DRN3
CLK+
CLK-
DRN4
HSDN
DRN8
VLO
NODD
ILKI
S
DC/DC-S
AMD
DC/DC
IGCT
IGCT NO.2
GND1
GND2
IDH
Air Conditioning Amplifier Assembly
: Shielded
U
V
W
GRF
GRFG
GSN
GSNG
GCS
GCSG
DRN6
MRF
MRFG
MSN
MSNG
MCS
MCSG
U
V
W
ILKO
GI
DRN5
+B
+B2
Inverter with Converter Assembly
U
V
W
MG1
GRF
GRFG
GSN
GSNG
GCS
GCSG
Generator Resolver
MRF
MRFG
MSN
MSNG
MCS
MCSG
Motor Resolver
U
V
W
MG2
Hybrid Vehicle Transaxle Assembly
ILK
GND
Interlock Switch
ECM
PCU

SYSTEM DESCRIPTION

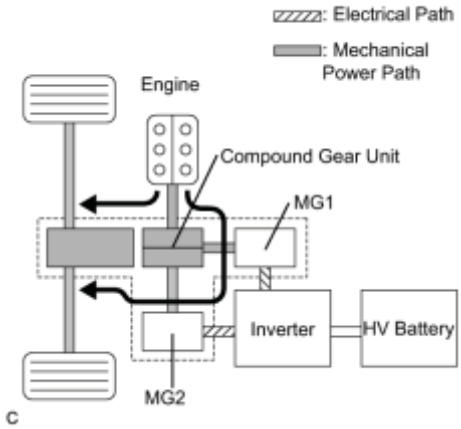
1. BASIC OPERATION

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

(b) Operation:

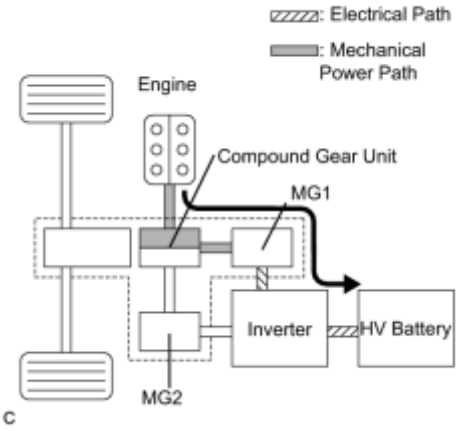


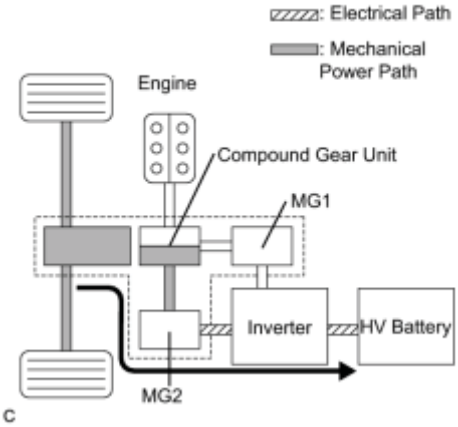
(1) Supply of electrical power from the HV battery to MG2 provides force to drive the front wheels.



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

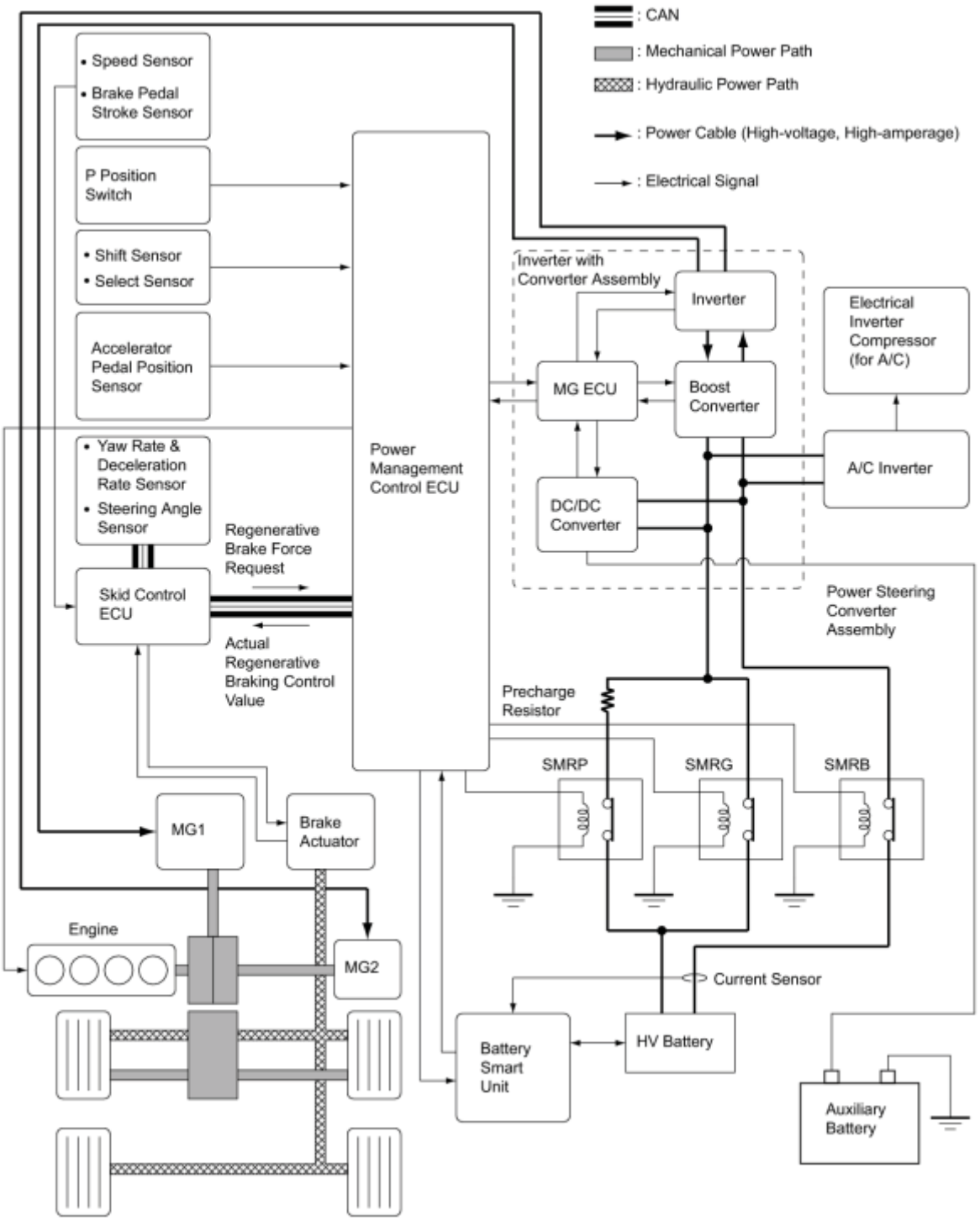
(3) MG1 is rotated by the engine via the planetary gears, in order to charge the HV battery.





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

2. SYSTEM DIAGRAM



3. FUNCTION OF MAIN COMPONENTS

Component	Function
Power Management Control ECU (HV CPU)	• Performs comprehensive control of the hybrid system. • Information from various sensors as well as from ECUs

Component			Function
			(ECM, MG ECU, battery smart unit and skid control ECU) is received, and based on this the required torque and output power is calculated. The power management control ECU (HV CPU) transmits the calculated result to the ECM, MG ECU and skid control ECU. • Monitors the SOC of the HV battery. • Controls the DC-DC converter. • Controls the HV water pump with motor. • Controls the HV battery cooling blower.
Hybrid Vehicle Transaxle Assembly	Motor Generator 1 (MG1)		MG1, which is driven by the engine, generates high-voltage electricity in order to operate MG2 and charge the HV battery. Also, it functions as a starter to start the engine.
	Motor Generator 2 (MG2)		• MG2, which is driven by electrical power from MG1 and the HV battery, generates motive force for the drive wheels. • During braking, or when the accelerator pedal is not depressed, it generates high-voltage electricity to recharge the HV battery.
	Resolver (for MG1/for MG2)		Detects the rotor position, rotational speed and direction of MG1 and MG2.
	Temperature Sensor (for MG1/for MG2)		Detects the temperature of MG1 and MG2.
	Compound Gear Unit	Power Split Planetary Gear Unit	Distributes the engine motive force as appropriate to directly drive the vehicle as well as MG1.
		Motor Speed Reduction Planetary Gear Unit	Reduces the rotational speed of MG2 in accordance with the characteristics of the planetary gear, in order to increase torque.
Inverter with Converter Assembly	Inverter		Converts the direct current from the boost converter into the alternating current for MG1 and MG 2, and vice versa (from AC to DC).
	Boost Converter		Boosts the HV battery nominal voltage of DC 201.6 V up to a maximum voltage of DC 650 V and vice versa (drops DC 650 V to DC 201.6 V).
	DC-DC Converter		Drops the HV battery nominal voltage of DC 201.6 V to approximately DC 14 V in order to supply electricity to the electrical components, as well as to recharge the auxiliary battery.
	MG ECU		Controls the inverter and boost converter in accordance with the signals received from the power management control ECU (HV CPU), thus operating MG1 and MG2 as either a generator or motor.
	Atmospheric Pressure Sensor		Detects the atmospheric pressure.

Component		Function
	Temperature Sensor (for Inverter with Converter Assembly)	Detects temperatures in the parts of the inverter with converter assembly as well as the HV coolant temperature.
	Inverter Current Sensor	Detects the current of MG1 and MG2.
HV Battery Assembly	HV Battery (Battery Modules)	• 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.
	HV Battery Temperature Sensor	Detects temperatures in the parts of the HV battery and the Intake air temperature from the HV battery cooling blower.
HV Junction Block Assembly	System Main Relays	Connects and disconnects the high-voltage circuit between the HV battery and the inverter with converter assembly, through the use of the signals from the power management control ECU (HV CPU).
	HV Battery Current Sensor	Detects the input and output current of the HV battery.
Battery Smart Unit		• Monitors the conditions of the HV battery such as voltage, current and temperature, and transmits this information to the power management control ECU (HV CPU). • Monitors the high-voltage system for breakdown of the electrical insulation.
Service Plug Grip		Shuts off the high-voltage circuit of the HV battery when the service plug grip is removed for vehicle inspection or maintenance.
Interlock Switch (for Service Plug Grip/for Inverter Terminal Cover/for Power Cable Connector)		Verifies that the service plug grip, inverter terminal cover and inverter power cable connector are installed.
Power Cable		Connects the HV battery, inverter with converter assembly, hybrid vehicle transaxle assembly and cooler compressor with motor assembly.
Water Pump with Motor Assembly		Operates by the signal from the power management control ECU (HV CPU) in order to cool the inverter with converter assembly and MG1.
HV Battery Cooling Blower		Operates by the signal from the power management control ECU (HV CPU) in order to cool the HV battery.
Auxiliary Battery Temperature Sensor		Detects the temperature of the auxiliary battery.
Accelerator Pedal Position Sensor		Converts the accelerator pedal position into an electrical signal and outputs it to the power management control ECU (HV CPU).
Selector Lever Position Sensor		Converts the selector lever operation into an electrical signal and outputs it to the power management control ECU (HV CPU).
P Position Switch		Outputs the P position switch signal to the power management control ECU (HV CPU) when operated by the driver.
EV Drive Mode Switch		Outputs the EV drive mode switch signal to the power management control ECU (HV CPU) when operated by the driver.
PWR MODE Switch		Outputs the PWR MODE switch signal to the power management

Component	Function
	control ECU (HV CPU) via the ECM when operated by the driver.
ECO MODE Switch	Outputs the ECO MODE switch signal to the power management control ECU (HV CPU) via the air conditioning amplifier when operated by the driver.
Air Conditioning Amplifier	Transmits various A/C state signals to the power management control ECU (HV CPU).

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- *: Use the Techstream
- Use the following procedure to troubleshoot the hybrid control system.

1.	VEHICLE BROUGHT TO WORKSHOP

NEXT

2.	CUSTOMER PROBLEM ANALYSIS

NEXT

3.	CONNECT TECHSTREAM 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* INFO

HINT:

- Make sure to save freeze frame data because the data is necessary for a simulation test.
- For the hybrid vehicle control system, there are many DTCs, many of which can be stored due to a single malfunction. As a result, in some of the diagnosis procedures an instruction is provided to check for other DTCs and their corresponding INF codes. By following the diagnosis path based on the combination of output DTCs and INF codes, it is possible to narrow down the problem early and avoid unnecessary diagnosis.

NEXT

5.	CLEAR DTC AND FREEZE FRAME DATA* INFO

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* INFO

Result:

Result	Proceed to
DTC is output	A
DTC is not output	B

B ▶ GO TO STEP 11

A ▼

10.	REFER TO DTC CHART INFO

NEXT ▶ **GO TO STEP 13**

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 INFO

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 INFO.

(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 (state of charge), engine coolant temperature, engine rpm, and MG1/MG2 rpm and torque.

(b) Check the connector(s) and terminal(s) INFO.

(c) Wiggle the harness and connector(s) INFO.

(d) Heat or cool suspected parts INFO.

REGISTRATION

NOTICE:

The Vehicle Identification Number (VIN) must be input into the replacement power management control ECU.

HINT:

The VIN is in a 17-digit alphanumeric vehicle identification number. The Techstream is required to register the VIN.

1. DESCRIPTION

(a) Read VIN: This process allows the VIN stored in the power management control ECU to be read, in order to confirm that the two VINs, provided with the vehicle and stored in the power management control ECU, are the same.

(b) Write VIN: This process allows the VIN to be input into the power management control ECU. If the power management control ECU is changed, or the power management control ECU VIN and the vehicle VIN do not match, the VIN can be registered, or overwritten in the power management control ECU by following this procedure.

2. READ VIN

(a) Confirm the vehicle VIN.

(b) Connect the Techstream to the DLC3.

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

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Hybrid Control / Utility / VIN / VIN Read.

3. WRITE VIN

(a) Confirm the vehicle VIN.

(b) Connect the Techstream to the DLC3.

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

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Hybrid Control / Utility / VIN / VIN Write.

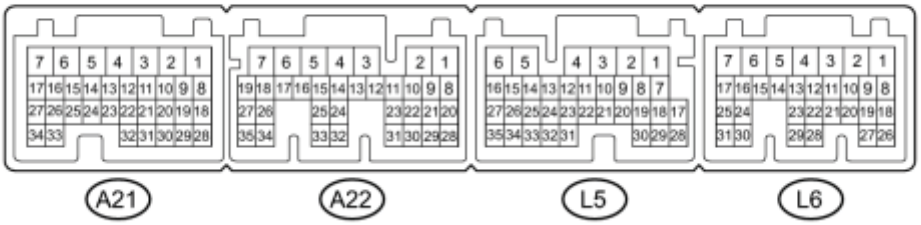
PROBLEM SYMPTOMS TABLE

Hybrid Vehicle Control System

Symptom	Suspected Area	See page
Cannot enter EV mode	CAN communication system	INFO
	Combination meter	INFO
	Pattern select switch (EV switch)	-
	EV drive mode switch circuit	INFO
EV mode indicator light does not illuminate	Combination meter	INFO
	Pattern select switch (EV switch)	-
EV mode indicator light does not turn off	Combination meter	INFO
	Pattern select switch (EV switch)	-
Cannot enter POWER mode	CAN communication system	INFO
	Combination meter	-
	Pattern select switch (POWER switch)	-
	Pattern select switch POWER mode circuit	INFO
POWER mode indicator light does not illuminate	Combination meter	INFO
	Pattern select switch (POWER switch)	-
POWER mode indicator light does not turn off	Combination meter	INFO
	Pattern select switch (POWER switch)	-
Cannot enter ECO mode	CAN communication system	INFO
	Combination meter	INFO
	Pattern select switch (ECO switch)	-
	Pattern select switch ECO mode circuit	INFO
ECO mode indicator light does not illuminate	Combination meter	INFO
	Pattern select switch (ECO switch)	-
ECO mode indicator light does not turn off	Combination meter	INFO
	Pattern select switch (ECO switch)	-
Loud rattle from hybrid vehicle transaxle	Loud Rattle from Hybrid Vehicle Transmission	INFO
	Transmission input damper	INFO
	Hybrid vehicle transaxle assembly	INFO

TERMINALS OF ECU

Power Management Control ECU



Y

Power management control ECU

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A21-2 (+B2) - L5-6 (E1)	L - BR	Power Source	Power switch on (IG)	11 to 14 V
A21-4 (FCTL) - L5-5 (E01)	BR - W-B	Cooling fan relay signal	Power switch on (IG)	Below 2 V
A21-11 (VLO) - L5-6 (E1)	R - BR	DC/DC operation monitor / voltage change signal	Power switch on (IG)	Pulse generation (Waveform 1)
A21-13 (IWP) - L5-6 (E1)	G - BR	Water pump with motor assembly signal	Power switch on (READY)	Pulse generation (Waveform 2)
A21-14 (NIWP) - L5-6 (E1)	P - BR	Water pump with motor assembly signal	Power switch on (READY)	Pulse generation (Waveform 2)
A21-15 (BL) - L5-6 (E1)	R - BR	Back up light	Power switch on (IG), selector lever in R	11 to 14 V
A21-16 (GI) - L5-6 (E1)	Y - BR	Camshaft position sensor signal	Power switch on (READY), with engine running	Pulse generation (Waveform 3)
A21-19 (CLK) - L5-6 (E1)	G - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
				(Waveform 4)
A21-20 (STB) - L5-6 (E1)	W - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 4)
A21-21 (NODD) - L5-6 (E1)	W - BR	DC/DC operation	Converter operating normally	5 to 7 V
A21-21 (NODD) - L5-6 (E1)	W - BR	DC/DC operation	Converter not operating normally	2 to 4 V
A21-21 (NODD) - L5-6 (E1)	W - BR	DC/DC operation	Converter operating prohibited	0.1 to 0.5 V
A21-24 (MMT) - A21-25 (MMTG)	L - BR	Motor temperature sensor	Power switch on (IG), temperature 77°F (25°C)	3.6 to 4.6 V
A21-24 (MMT) - A21-25 (MMTG)	L - BR	Motor temperature sensor	Power switch on (IG), temperature 140°F (60°C)	2.2 to 3.2 V
A21-26 (GMT) - A21-27 (GMTG)	B - R	Generator temperature sensor	Power switch on (IG), temperature 77°F (25°C)	3.6 to 4.6 V
A21-26 (GMT) - A21-27 (GMTG)	B - R	Generator temperature sensor	Power switch on (IG), temperature 140°F (60°C)	2.2 to 3.2 V
A21-29 (SI0) - L5-6 (E1)	Y - BR	HV battery blower fan	Power switch on (IG), during Active Test	Pulse generation (Waveform 5)
A21-30 (ETI) - L5-6 (E1)	R - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 4)
A21-31 (ITE) - L5-6 (E1)	Y - BR	A/C communication signal	Power switch on (READY), air conditioning system stopped	Pulse generation (Waveform 4)

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A21-32 (ILK) - L5-6 (E1)	V - BR	Interlock switch	Power switch on (IG), inverter terminal cover, high-voltage input cables and service plug grip installed correctly	0 to 1.5 V
A21-32 (ILK) - L5-6 (E1)	V - BR	Interlock switch	Power switch on (IG), inverter terminal cover, high-voltage input cables or service plug grip not installed	11 to 14 V
A22-1 (IG2) - L5-6 (E1)	R - BR	Power source	Power switch on (IG)	11 to 14 V
A22-2 (IG2D) - L5-6 (E1)	V - BR	IG2 relay	Power switch on (IG)	11 to 14 V
A22-5 (+B1) - L5-6 (E1)	L - BR	Power source	Power switch on (IG)	11 to 14 V
A22-6 (MREL) - L5-6 (E1)	BE - BR	Main relay	Power switch on (IG)	11 to 14 V
A22-7 (ST1-) - L5-6 (E1)	R - BR	Brake cancel switch	Power switch on (IG), brake pedal depressed	0 to 1.5 V
A22-7 (ST1-) - L5-6 (E1)	R - BR	Brake cancel switch	Power switch on (IG), brake pedal released	11 to 14 V
A22-18 (VCP1) - A22-34 (EP1)	Y - B	Accelerator pedal position sensor power source (for VPA1)	Power switch on (IG)	4.5 to 5.5 V
A22-19 (VCP2) - A22-35 (EP2)	G - R	Accelerator pedal position sensor power source (for VPA2)	Power switch on (IG)	4.5 to 5.5 V
A22-20 (CLK-) - L5-6 (E1)	W - BR	MG communication clock signal	Power switch on (IG)	Pulse generation (Waveform 6)
A22-21 (CLK+) - L5-6 (E1)	B - BR	MG communication clock signal	Power switch on (IG)	Pulse generation (Waveform 6)
A22-22 (PCON) - L5-6 (E1)	LG - BR	P position switch signal	Power switch on (IG), park (P) selected	Pulse generation (Waveform 7)
A22-23 (STP) - L5-6 (E1)	L - BR	Stop light switch	Brake pedal depressed	11 to 14 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A22-23 (STP) - L5-6 (E1)	L - BR	Stop light switch	Brake pedal released	0 to 1.5 V
A22-24 (HTM+) - L5-6 (E1)	B - BR	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (IG)	Pulse generation (Waveform 8)
A22-25 (HTM-) - L5-6 (E1)	W - BR	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (IG)	Pulse generation (Waveform 8)
A22-26 (VPA1) - A22-34 (EP1)	L - B	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), accelerator pedal released	0.4 to 1.4 V
A22-26 (VPA1) - A22-34 (EP1)	L - B	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG) engine stopped, park (P) selected, accelerator pedal fully depressed	2.6 to 4.5 V
A22-27 (VPA2) - A22-35 (EP2)	W - R	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG), accelerator pedal released	1.0 to 2.2 V
A22-27 (VPA2) - A22-35 (EP2)	W - R	Accelerator pedal position sensor (for accelerator pedal position detection)	Power switch on (IG) engine stopped, park (P) selected, accelerator pedal fully depressed	3.4 to 5.3 V
A22-28 (PPOS) - L5-6 (E1)	W - BR	P position switch signal	Power switch on (IG), park (P) selected	Pulse generation (Waveform 7)
A22-29 (MTH-) - L5-6 (E1)	W - BR	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (IG)	Pulse generation (Waveform 9)
A22-30 (MTH+) - L5-6 (E1)	B - BR	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (IG)	Pulse generation (Waveform 9)
A22-31 (HSDN) - L5-6 (E1)	B - BR	MG ECU shutdown signal	Power switch on (READY)	0 to 1.5 V
A22-32 (REQ-) - L5-6 (E1)	W - BR	MG ECU communication request signal	Power switch on (IG)	Pulse

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
				generation (Waveform 10)
A22-33 (REQ+) - L5-6 (E1)	B - BR	MG ECU communication request signal	Power switch on (IG)	Pulse generation (Waveform 10)
L5-1 (AM22) - L5-6 (E1)	W - BR	Constant power source	Power switch on (IG)	11 to 14 V
L5-1 (AM22) - L5-6 (E1)	W - BR	Constant power source	Power switch on (READY)	11 to 15.5 V
L5-2 (SMRG) - L5-5 (E01)	Y - W-B	System main relay	Power switch on (IG)→Power switch on (READY)	Pulse generation (Waveform 11)
L5-3 (SMRP) - L5-5 (E01)	W - W-B	System main relay	Power switch on (IG)→Power switch on (READY)	Pulse generation (Waveform 11)
L5-4 (SMRB) - L5-5 (E01)	SB - W-B	System main relay	Power switch on (IG)→Power switch on (READY)	Pulse generation (Waveform 11)
L5-7 (SSW1) - L5-6 (E1)	B - BR	Power switch	Power switch pressed and held	0 to 1.5 V
L5-11 (TC) - L5-6 (E1)	P - BR	Diagnosis terminal	Power switch on (IG)	11 to 14 V
L5-13 (EVSW) - L5-6 (E1)	B - BR	EV switch signal	Power switch on (IG), EV switch off	11 to 14 V
L5-13 (EVSW) - L5-6 (E1)	B - BR	EV switch signal	Power switch on (IG), EV switch off	0 to 1.5 V
L5-14 (SPDI) - L5-6 (E1)	V - BR	Vehicle speed signal	Approximately 12 mph (20 km/h)	Pulse generation (Waveform 12)
L5-16 (P1) - L5-6 (E1)	Y - BR	P position switch signal	Power switch on (IG), P position switch off	7 to 12 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
L5-16 (P1) - L5-6 (E1)	Y - BR	P position switch signal	Power switch on (IG), P position switch on	3 to 5 V
L5-17 (VCX4) - L5-6 (E1)	P - BR	Select position sensor power source (VCX4)	Power switch on (IG)	11 to 14 V
L5-18 (VSX4) - L5-6 (E1)	LG - BR	Select position sensor (Sub)	Power switch on (IG), selector lever in home position	0.5 to 0.2 V
L5-18 (VSX4) - L5-6 (E1)	LG - BR	Select position sensor (Sub)	Power switch on (IG), selector lever in R, N or D	3.0 to 4.85 V
L5-19 (VCX3) - L5-6 (E1)	W - BR	Select position sensor power source (VSX3)	Power switch on (IG)	11 to 14 V
L5-20 (VSX3) - L5-6 (E1)	BR - BR	Select position sensor (Main)	Power switch on (IG), selector lever in home position	0.5 to 0.2 V
L5-20 (VSX3) - L5-6 (E1)	BR - BR	Select position sensor (Main)	Power switch on (IG), selector lever in R, N or D	3.0 to 4.85 V
L5-21 (VCX2) - L5-23 (E2X2)	G - Y	Shift position sensor power source (VSX2)	Power switch on (IG)	4.5 to 5.5 V
L5-22 (VSX2) - L5-23 (E2X2)	L - Y	Shift position sensor (Sub)	Power switch on (IG), shift lever in home position	2.0 to 3.0 V
L5-22 (VSX2) - L5-23 (E2X2)	L - Y	Shift position sensor (Sub)	Power switch on (IG), selector lever in R	0.2 to 1.0 V
L5-22 (VSX2) - L5-23 (E2X2)	L - Y	Shift position sensor (Sub)	Power switch on (IG), selector lever in B or D	4.0 to 4.8 V
L5-25 (VSX1) - L5-24 (E2X1)	B - R	Shift position sensor (Main)	Power switch on (IG), selector lever in home position	2.0 to 3.0 V
L5-25 (VSX1) - L5-24 (E2X1)	B - R	Shift position sensor (Main)	Power switch on (IG), selector lever in R	0.2 to 1.0 V
L5-25 (VSX1) - L5-24 (E2X1)	B - R	Shift position sensor (Main)	Power switch on (IG), selector lever in B or D	4.0 to 4.8 V
L5-26 (VCX1) - L5-24 (E2X1)	W - R	Shift position sensor power source (VSX1)	Power switch on (IG)	4.5 to 5.5 V
L5-28 (THB) - L5-30 (ETHB)	L - V	Auxiliary battery temperature	Power switch on (IG), auxiliary battery temperature 77°F (25°C)	1.7 to 2.3 V
L5-28 (THB) - L5-30 (ETHB)	L - V	Auxiliary battery temperature	Power switch on (IG), auxiliary battery temperature 140°F (60°C)	0.6 to 0.9 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
L5-29 (ABFS) - L5-6 (E1)	B - BR	Airbag activation signal	Power switch on (READY) (2 seconds after power switch on (ACC))	Pulse generation (Waveform 13)
L5-32 (BTH+) - L5-6 (E1)	R - BR	Communication signal from battery smart unit to power management control ECU (HV CPU)	Power switch on (IG)	Pulse generation (Waveform 14)
L5-33 (BTH-) - L5-6 (E1)	G - BR	Communication signal from battery smart unit to power management control ECU (HV CPU)	Power switch on (IG)	Pulse generation (Waveform 14)
L5-34 (CA2H) - L5-6 (E1)	P - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 15)
L5-35 (CA2L) - L5-6 (E1)	V - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 15)
L6-1 (ACCD) - L5-6 (E1)	G - BR	ACC relay	Power switch on (ACC)	11 to 14 V
L6-2 (IG1D) - L5-6 (E1)	B - BR	IG1 relay	Power switch on (IG)	11 to 14 V
L6-7 (AM21) - L5-6 (E1)	W - BR	Constant power source	Power switch on (IG)	11 to 14 V
L6-7 (AM21) - L5-6 (E1)	W - BR	Constant power source	Power switch on (READY)	11 to 15.5 V
L6-11 (LIN2) - L5-6 (E1)	L - BR	LIN communication system	Power switch on (IG), brake pedal depressed	Pulse generation
L6-17 (SSW2) - L5-6 (E1)	Y - BR	Power switch	Power switch pressed and held	0 to 1.5 V
L6-20 (IMO) - L5-6 (E1)	L - BR	Immobiliser communication	Immobiliser communicating	Pulse generation (Waveform 16)
L6-21 (IMI) -	R - BR	Immobiliser communication	Immobiliser communicating	Pulse

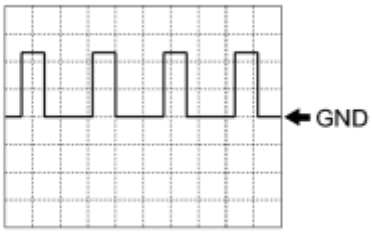
Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
L5-6 (E1)				generation (Waveform 16)
L6-24 (CA1L) - L5-6 (E1)	W - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 17)
L6-25 (CA1H) - L5-6 (E1)	B - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 17)
L6-30 (CA3N) - L5-6 (E1)	L - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 18)
L6-31 (CA3P) - L5-6 (E1)	LG - BR	CAN communication system	Power switch on (IG)	Pulse generation (Waveform 18)

1. Oscilloscope waveforms

HINT:

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

(a) Waveform 1 (DC/DC operation monitor / voltage change signal)

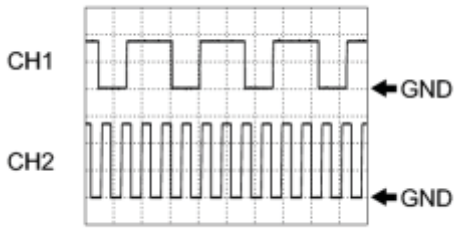


Item	Content
Terminal	A21-11 (VLO) - L5-6 (E1)
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Power switch on (IG)

HINT:

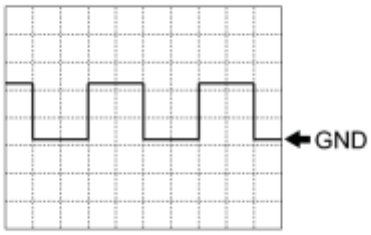
The cycle will vary depending on the specified voltage of the hybrid vehicle converter.

(b) Waveform 2 (HV water pump signal)



Item	Content
Terminal	CH1: A21-13 (IWP) - L5-6 (E1) CH2: A21-14 (NIWP) - L5-6 (E1)
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Power switch on (READY)

(c) Waveform 3 (GI signal)

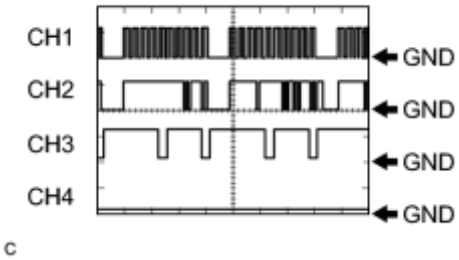


Item	Content
Terminal	A21-16 (GI) - L5-6 (E1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Power switch on (READY) with engine running

HINT:

The pulse cycle becomes shorter as the engine speed increases.

(d) Waveform 4 (A/C communication signal)



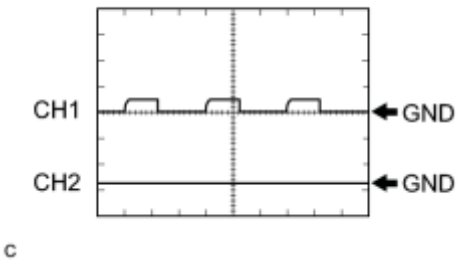
Item	Content
Terminal	CH1: A21-19 (CLK) - L5-6 (E1) CH2: A21-31 (ITE) - L5-6 (E1) CH3: A21-30 (ETI) - L5-6 (E1) CH4: A21-20 (STB) - L5-6 (E1)
Equipment Setting	10 V/DIV., 100 ms./DIV.
Condition	Power switch on (READY) with air conditioning system stopped

HINT:

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

(e) Waveform 5 (HV battery blower fan operation signal)

Item	Content
Terminal	CH1: A21-29 (SI0) - L5-6 (E1) CH2: A21-4 (FCTL) - L5-5 (E01)



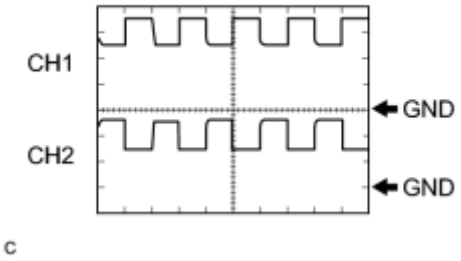
c

Equipment Setting	10 V/DIV., 1 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).

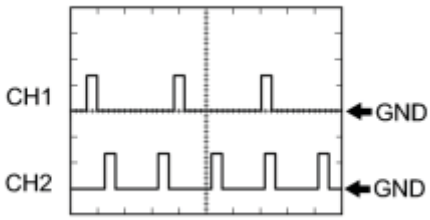
(f) Waveform 6 (MG communication clock signal)



c

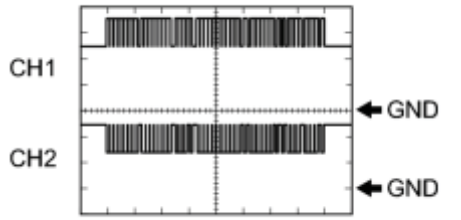
Item	Content
Terminal	CH1: A22-21 (CLK+) - L5-6 (E1) CH2: A22-20 (CLK-) - L5-6 (E1)
Equipment Setting	1 V/DIV., 1 µs./DIV.
Condition	Power switch on (READY)

(g) Waveform 7 (P position signal)



Item	Content
Terminal	CH1: A22-22 (PCON) - L5-6 (E1) CH2: A22-28 (PPOS) - L5-6 (E1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Power switch on (IG)

(h) Waveform 8 (communication signal from power management control ECU (HV CPU) to MG ECU)

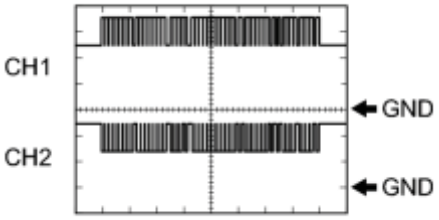


Item	Content
Terminal	CH1: A22-24 (HTM+) - L5-6 (E1) CH2: A22-25 (HTM-) - L5-6 (E1)
Equipment Setting	1 V/DIV., 200 µs./DIV.
Condition	Power switch on (READY)

HINT:

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

(i) Waveform 9 (communication signal from MG ECU to power management control ECU (HV CPU))

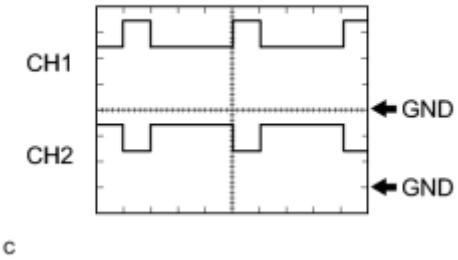


Item	Content
Terminal	CH1: A22-30 (MTH+) - L5-6 (E1) CH2: A22-29 (MTH-) - L5-6 (E1)
Equipment Setting	1 V/DIV., 200 µs./DIV.
Condition	Power switch on (READY)

HINT:

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

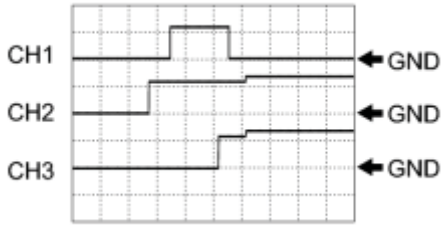
(j) Waveform 10 (MG ECU communication request signal)



c

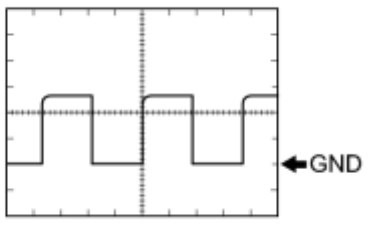
Item	Content
Terminal	CH1: A22-33 (REQ+) - L5-6 (E1) CH2: A22-32 (REQ-) - L5-6 (E1)
Equipment Setting	1 V/DIV., 1 ms./DIV.
Condition	Power switch on (READY)

(k) Waveform 11 (system main relay operation signal)



Item	Content
Terminal	CH1: L5-3 (SMRP) - L5-5 (E01) CH2: L5-4 (SMRB) - L5-5 (E01) CH3: L5-2 (SMRG) - L5-5 (E01)
Equipment Setting	10 V/DIV., 200 ms./DIV.
Condition	Power switch on (IG) → Power switch on (READY)

(l) Waveform 12 (vehicle speed signal)



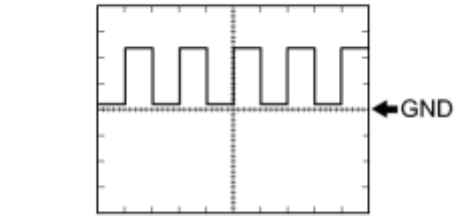
c

Item	Content
Terminal	L5-14 (SPDI) - L5-6 (E1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Driving at approximately 12 mph (20 km/h) with power switch on (READY)

HINT:

The higher the vehicle speed, the shorter the cycle.

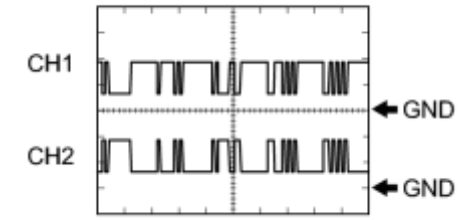
(m) Waveform 13 (airbag deployment signal)



c

Item	Content
Terminal	L5-29 (ABFS) - L5-6 (E1)
Equipment Setting	5 V/DIV., 500 ms./DIV.
Condition	Power switch on (READY)

(n) Waveform 14 (communication signal from battery smart unit to power management control ECU (HV CPU))



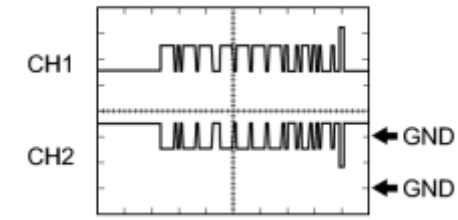
c

Item	Content
Terminal	CH1: L5-32 (BTH+) - L5-6 (E1) CH2: L5-33 (BTH-) - L5-6 (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).

(o) Waveform 15 (CAN communication signal)



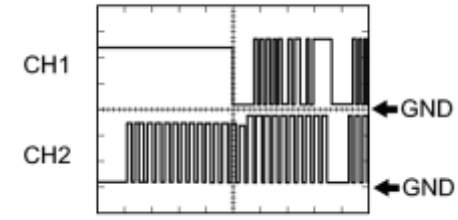
c

Item	Content
Terminal	CH1: L5-34 (CA2H) - L5-6 (E1) CH2: L5-35 (CA2L) - L5-6 (E1)
Equipment Setting	1 V/DIV., 50 µs./DIV.
Condition	Power switch on (IG)

HINT:

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

(p) Waveform 16 (immobilizer communication signal)

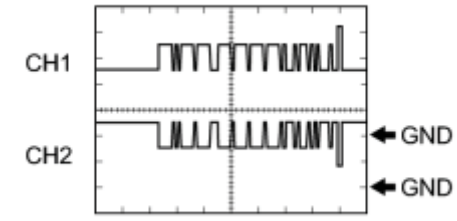


c

Item	Content
Terminal	CH1: L6-20 (IMO) - L5-6 (E1) CH2: L6-21 (IMI) - L5-6 (E1)
Equipment Setting	5 V/DIV., 200 ms./DIV.
Condition	Power switch off → Power switch on (IG) → Power

	switch on (READY)

(q) Waveform 17 (CAN communication signal)



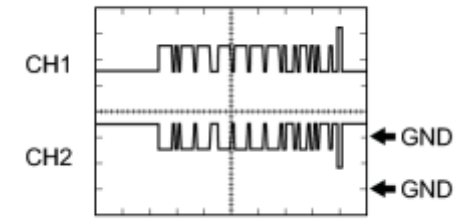
c

Item	Content
Terminal	CH1: L6-25 (CA1H) - L5-6 (E1) CH2: L6-24 (CA1L) - L5-6 (E1)
Equipment Setting	1 V/DIV., 50 µs./DIV.
Condition	Power switch on (IG)

HINT:

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

(r) Waveform 18 (CAN communication signal)



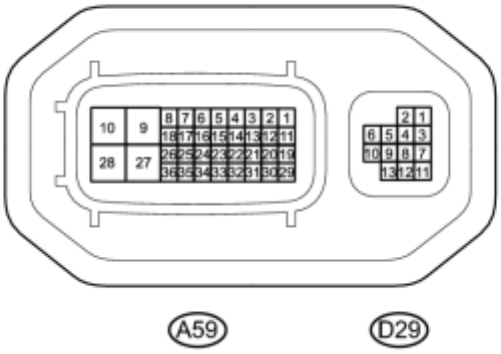
c

Item	Content
Terminal	CH1: L6-31 (CA3P) - L5-6 (E1) CH2: L6-30 (CA3N) - L5-6 (E1)
Equipment Setting	1 V/DIV., 50 µs./DIV.
Condition	Power switch on (IG)

HINT:

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

Inverter with Converter Assembly



c

HINT:

Since the inverter with converter assembly uses waterproof connectors, the voltage and waveform cannot be inspected directly. Standard voltage readings and waveforms are indicated for reference only.

Inverter with converter assembly

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
A59-1 (IGCT) - A59-28 (GND1)	B - W-B	MG ECU power source	Power switch on (IG)	11 to 14 V
A59-2 (IDH) - A59-28 (GND1)	L - W-B	PTC heater prohibit signal	Power switch on (IG)	4 to 6 V
A59-3 (VLO) - A59-28 (GND1)	R - W-B	DC/DC operation monitor / voltage change signal	Power switch on (IG)	Pulse generation (Waveform 1)
A59-5 (CLK+) - A59-28 (GND1)	B - W-B	Communication clock signal	Power switch on (READY)	Pulse generation (Waveform 2)
A59-6 (REQ+) - A59-28 (GND1)	B - W-B	Communication request signal	Power switch on (READY)	Pulse generation (Waveform 3)
A59-7 (MTH+) - A59-28 (GND1)	B - W-B	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (READY)	Pulse generation (Waveform 4)
A59-8 (HTM+) - A59-28 (GND1)	B - W-B	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (READY)	Pulse generation (Waveform 5)
A59-11 (S) - A59-28 (GND1)	W - W-B	Auxiliary battery voltage monitor	Power switch on (IG)	11 to 14 V
A59-12 (NODD) - A59-28 (GND1)	W - W-B	DC/DC operation	Converter operating normally	5 to 7 V
A59-12 (NODD) - A59-	W - W-B	DC/DC operation	Converter not operating normally	2 to 4 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
28 (GND1)				
A59-12 (NODD) - A59-28 (GND1)	W - W-B	DC/DC operation	Converter operation prohibited	0.1 to 0.5 V
A59-15 (CLK-) - A59-28 (GND1)	W - W-B	Communication clock signal	Power switch on (READY)	Pulse generation (Waveform 2)
A59-16 (REQ-) - A59-28 (GND1)	W - W-B	Communication request signal	Power switch on (READY)	Pulse generation (Waveform 3)
A59-17 (MTH-) - A59-28 (GND1)	W - W-B	Communication signal from MG ECU to power management control ECU (HV CPU)	Power switch on (READY)	Pulse generation (Waveform 4)
A59-18 (HTM-) - A59-28 (GND1)	W - W-B	Communication signal from power management control ECU (HV CPU) to MG ECU	Power switch on (READY)	Pulse generation (Waveform 5)
A59-29 (GI) - A59-28 (GND1)	B - W-B	GI signal	Power switch on (READY), with engine running	Pulse generation (Waveform 6)
A59-31 (HSDN) - A59-28 (GND1)	B - W-B	MG shutdown signal	Power switch on (READY)	0 to 1 V
A59-35 (ILKI) - A59-28 (GND1)	V - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables and service plug grip installed correctly	Below 1 V
A59-35 (ILKI) - A59-28 (GND1)	V - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables or service plug grip not installed	11 to 14
A59-36 (ILKO) - A59-28 (GND1)	LG - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables and service plug grip installed correctly	Below 1 V

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Standard Condition
A59-36 (ILKO) - A59-28 (GND1)	LG - W-B	Interlock switch signal	Power switch on (IG), inverter terminal cover, high-voltage input cables or service plug grip not installed	11 to 14
A59-9 (+B2) - A59-28 (GND1)	G - W-B	MG ECU power source	Power switch on (IG)	11 to 14 V
A59-10 (+B) - A59-28 (GND1)	G - W-B	MG ECU power source	Power switch on (IG)	11 to 14 V
D29-1 (MRF) - D29-2 (MRFG)	Y - L	Motor resolver signal	Motor resolver stopped or running	Pulse generation (Waveform 7)
D29-3 (MSN) - D29-4 (MSNG)	G - W	Motor resolver signal	Motor resolver stopped or running	Pulse generation (Waveform 7)
D29-6 (MCS) - D29-5 (MCSG)	R - BR	Motor resolver signal	Motor resolver stopped or running	Pulse generation (Waveform 7)
D29-7 (GSN) - D29-8 (GSNG)	G - W	Generator resolver signal	Generator resolver stopped or running	Pulse generation (Waveform 8)
D29-10 (GCS) - D29-9 (GCSG)	R - B	Generator resolver signal	Generator resolver stopped or running	Pulse generation (Waveform 8)
D29-11 (GRF) - D29-12 (GRFG)	Y - L	Generator resolver signal	Generator resolver stopped or running	Pulse generation (Waveform 8)

NOTICE:

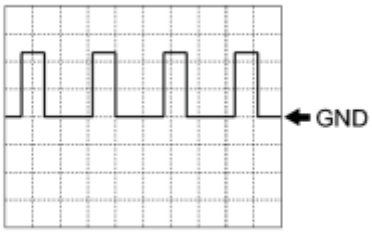
Do not measure the voltage or waveform directly at the sealed side of the inverter with converter assembly connector. Doing so may damage the connector because the connector is waterproof.

2. Oscilloscope waveforms

HINT:

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

(a) Waveform 1 (DC/DC operation monitor / voltage change signal)

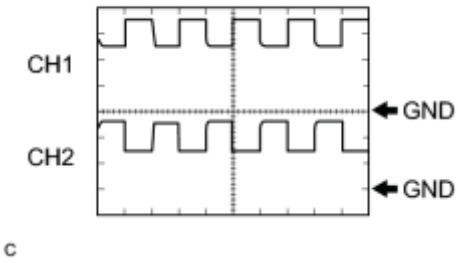


Item	Content
Terminal	A59-3 (VLO) - A59-28 (GND1)
Equipment Setting	5 V/DIV., 50 ms./DIV.
Condition	Power switch on (IG)

HINT:

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

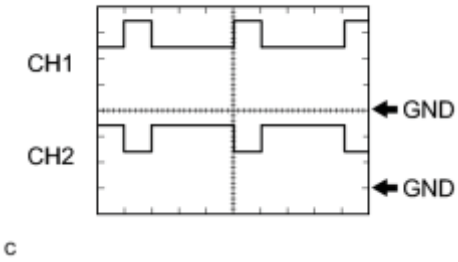
(b) Waveform 2 (MG ECU communication clock signal)



c

Item	Content
Terminal	CH1: A59-5 (CLK+) - A59-28 (GND1) CH2: A59-15 (CLK-) - A59-28 (GND1)
Equipment Setting	1 V/DIV., 1 µs./DIV.
Condition	Power switch on (READY)

(c) Waveform 3 (MG ECU communication request signal)

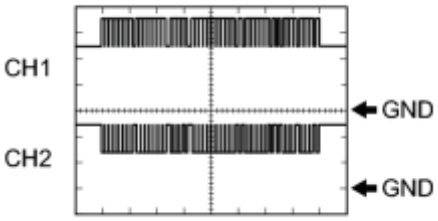


c

Item	Content
Terminal	CH1: A59-6 (REQ+) - A59-28 (GND1) CH2: A59-16 (REQ-) - A59-28 (GND1)
Equipment Setting	1 V/DIV., 1 ms./DIV.
Condition	Power switch on (READY)

(d) Waveform 4 (communication signal from MG ECU to power management control ECU (HV CPU))

Item	Content
Terminal	CH1: A59-7 (MTH+) - A59-28 (GND1)

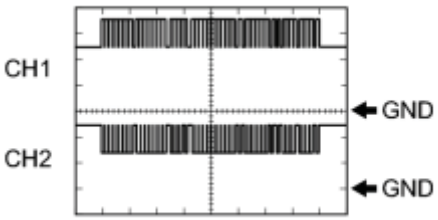


	CH2: A59-17 (MTH-) - A59-28 (GND1)
Equipment Setting	1 V/DIV., 200 µs./DIV.
Condition	Power switch on (READY)

HINT:

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

(e) Waveform 5 (communication signal from power management control ECU (HV CPU) to MG ECU)

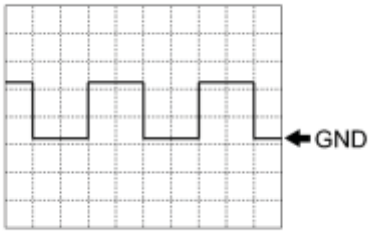


Item	Content
Terminal	CH1: A59-8 (HTM+) - A59-28 (GND1) CH2: A59-18 (HTM-) - A59-28 (GND1)
Equipment Setting	1 V/DIV., 200 µs./DIV.
Condition	Power switch on (READY)

HINT:

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

(f) Waveform 6 (GI signal)

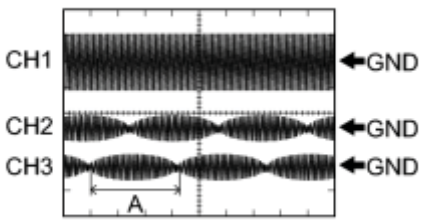


Item	Content
Terminal	A59-29 (GI) - A59-28 (GND1)
Equipment Setting	5 V/DIV., 20 ms./DIV.
Condition	Power switch on (READY) with engine running

HINT:

The pulse cycle becomes shorter as the engine speed increases.

(g) Waveform 7 (motor resolver signal)



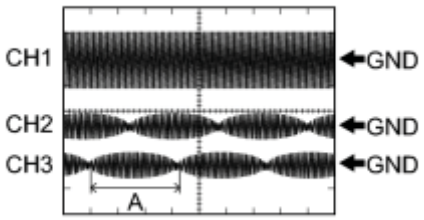
c

Item	Content
Terminal	CH1: D29-1 (MRF) - D29-2 (MRFG) CH2: D29-3 (MSN) - D29-4 (MSNG) CH3: D29-6 (MCS) - D29-5 (MCSG)
Equipment Setting	CH1: 10 V/DIV., 1 ms./DIV. CH2, 3: 5 V/DIV., 1 ms./DIV.
Condition	Resolver running

HINT:

Pulse cycle A becomes shorter as the rotor speed increases.

(h) Waveform 8 (generator resolver signal)



c

Item	Content
Terminal	CH1: D29-11 (GRF) - D29-12 (GRFG) CH2: D29-7 (GSN) - D29-8 (GSNG) CH3: D29-10 (GCS) - D29-9 (GCSG)
Equipment Setting	CH1: 10 V/DIV., 1 ms./DIV. CH2, 3: 5 V/DIV., 1 ms./DIV.
Condition	Resolver running

HINT:

Pulse cycle A becomes shorter as the rotor speed increases.

DIAGNOSIS SYSTEM

1. DESCRIPTION

(a) The power management control ECU (HV CPU) has a self-diagnosis system. If the computer, power management control ECU (HV CPU), 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 in the combination meter and provides other appropriate messages on the multi-information display, such as the HV system warning message, the HV battery warning message, on the discharge warning message.

HINT:

The master warning light will illuminate when the hybrid control system malfunctions and the light will blink when in inspection mode.

- When troubleshooting OBD II (On-Board Diagnostics) vehicles, the Techstream (complying with SAE J1987) must be connected to the DLC3 (Data Link Connector 3) of the vehicle. Various data in the vehicle ECM (Engine Control Module) can then be read.
- OBD II regulations require that the vehicle's on-board computer illuminate the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in:

a. The emission control system components.
b. The powertrain control components (which affect vehicle emissions).
c. The computer itself.

In addition, the applicable DTCs prescribed by SAE J2012 are recorded in the power management control ECU (HV CPU) memory. If the malfunction does not recur in 3 consecutive

trips, the MIL turns off automatically but the DTCs remain recorded in the power management control ECU (HV CPU) memory.

- To check for DTCs, connect the Techstream to the DLC3. The Techstream displays DTCs, freeze frame data, and a variety of hybrid control system data. The DTCs and freeze frame data can be cleared with the Techstream. In order to enhance the OBD function on vehicles and develop the Off-Board diagnosis system, Controller Area Network (CAN) communication is used in this system. CAN is a network which uses a pair of data transmission lines spanning multiple computers and sensors. It allows for high speed communications between the systems and simplification of the wire harness connections.

2. 2 TRIP DETECTION LOGIC

- When a malfunction is first detected, the malfunction is temporarily stored in the power management control ECU (HV CPU) memory (1st trip). If the same malfunction is detected during the next drive cycle, the MIL is illuminated (2nd trip).

3. FREEZE FRAME DATA

- The power management control ECU (HV CPU) records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, as well as other data recorded at the time of a malfunction.

4. AUXILIARY BATTERY VOLTAGE

Standard Voltage:

Switch Condition	Specified Condition
Power switch on (IG)	11 to 14 V

- If voltage is below 11 V, replace or recharge the battery.

5. MIL (Malfunction Indicator Lamp)

(a) The MIL is illuminated when the power switch is first turned on (IG), before the READY indicator comes on.

(b) When the READY indicator turns on, the MIL should turn off. If the MIL remains illuminated, the diagnosis system has detected a malfunction or abnormality in the system.

HINT:

If the MIL is not illuminated when the power switch is first turned on (IG), check the MIL circuit INFO.

DTC CHECK / CLEAR

1. CHECK FOR DTCS

(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check the DTCs and freeze frame data, and then write them down.

(f) Check the details of the DTCs 

.

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:

A 3-digit information code (INF code) will be displayed as the value for one of the Information 1 to Information 5 lines.

(c) Read the information for the information code.

(1) Select the item from among Information 1 to Information 5 that has an information code and click the engine icon to view the additional information.

3. CHECK FOR DTCS (SYSTEMS OTHER THAN POWER MANAGEMENT CONTROL ECU (HV CPU))

HINT:

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

(a) 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 INFO, and operation history data INFO.

(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on.

(d) Check that park (P) is selected.

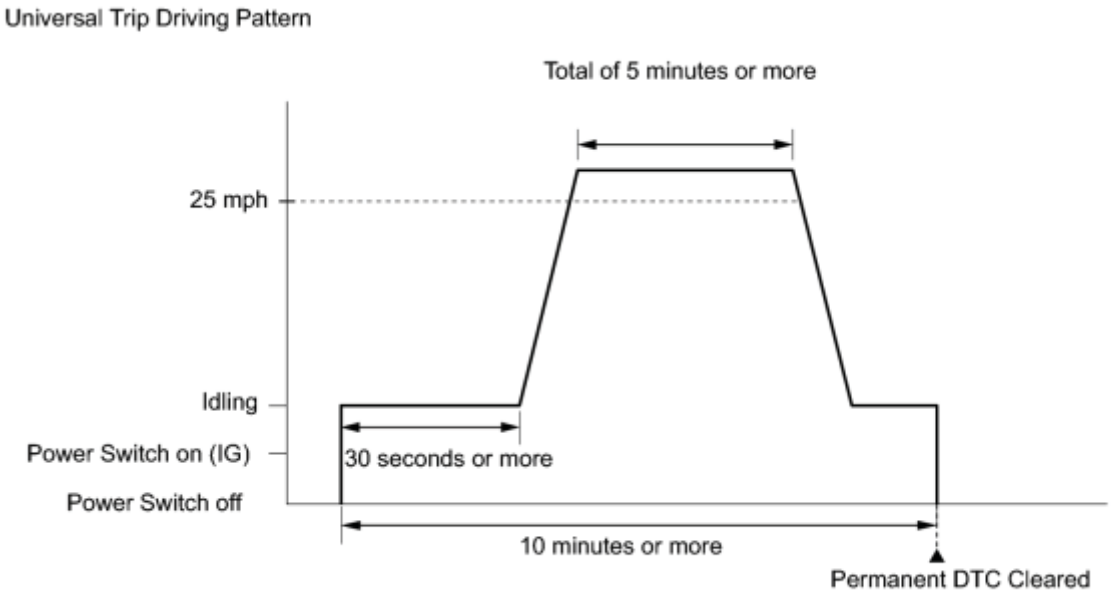
(e) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(f) Clear DTCs and freeze frame data.

5. CLEAR PERMANENT DTC

HINT:

Even if the following procedure is not performed, permanent DTCs are cleared by obtaining a normal judgment during 3 consecutive driving cycles.



(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Check if permanent DTCs are stored.

HINT:

If permanent DTCs are not output, it is not necessary to continue this procedure.

(f) Clear the DTCs.

(g) Perform the respective confirmation driving patterns in order to obtain a normal judgment for the output DTCs.

HINT:

- Confirmation driving patterns do not need to be performed for misfire and fuel system DTCs.
- For the confirmation driving pattern, refer to the procedures for the relevant DTC INFO.

(h) Perform the universal trip.

HINT:

The driving pattern to obtain a normal judgment and the universal trip driving can be performed consecutively in the same driving cycle.

1. Put the engine in inspection mode INFO.
2. Idle the engine for 30 seconds or more.
3. Drive the vehicle at 25 mph (40 km/h) or more for a total of 5 minutes or more.

   HINT:

   It is possible to complete the drive pattern even if the vehicle decelerates to less than 25 mph (40 km/h) during the driving cycle provided that the vehicle is driven at 25 mph (40 km/h) or more for a total of 5 minutes.

4. Allow 10 minutes or more to elapse from the time the engine is started.

(i) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(j) Check that the permanent DTCs have been cleared.

HINT:

The permanent DTCs are cleared when the universal trip is completed.

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.

(a) Connect the Techstream to the DLC3.

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

(c) Enter the following menus: Powertrain / Hybrid Control / Data List.

(d) Check the results by referring to the following table.

HINT:

- When reviewing Data List information, try to select only the specific Data List items related to the inspection being performed. If all items are selected when checking the Data List, the interval between updates for each item will be longer, resulting in delayed or incorrect data.
- Using a custom list makes it possible to easily select smaller groups of related Data List items.
- The following custom lists are available:
  - Electric Leakage
  - Boost/Lower Converter
  - High Voltage Charge
  - HV Transmission
  - Thermo Sensor
  - Auxiliary Battery
  - Drive Performance
  - Elec Shift Lever System

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Engine Coolant Temp	Engine coolant temperature/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	Cold start→Fully warmed up Gradually rises: After warming up: 176 to 212°F (80 to 100°C):	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Engine Revolution	Engine speed/ Min.: 0 r/min, Max.: 16383.75 r/min	While idling after the engine is warmed up and inspection mode: Approximately 900 rpm While driving at a constant speed: No significant fluctuation	-
Vehicle Spd	Vehicle speed/ Min.: 0 mph (0 km/h), Max.: 158 mph (255 km/h)	Vehicle stopped: 0 mph (0 km/h) While driving at a constant speed: No significant fluctuation	-
Engine Run Time	Elapsed time after starting engine/ Min.: 0 s, Max.: 65535 s	-	-
+B	Auxiliary battery voltage/ Min.: 0 V, Max.: 65.535 V	Constant: Auxiliary battery voltage +/-3 V	Auxiliary battery
Accel Pedal Pos #1	Accelerator pedal position sensor No.1/ Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	Accelerator pedal position sensor
Accel Pedal Pos #2	Accelerator pedal position sensor No.2/ Min.: 0%, Max.: 100%	Accelerator pedal depressed: Changes with accelerator pedal pressure	Accelerator pedal position sensor
Ambient Temperature	Ambient air temperature/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	Power switch on (IG): Same as ambient air	Ambient temperature sensor

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		temperature	
Intake Air Temperature	Intake air temperature/ Min.: -40°F (-40°C), Max.: 284°F (140°C)	Constant: Same as ambient air temperature	-
DTC Clear Warm Up	The number of times the engine is warmed up after clearing DTCs/ Min.: 0, Max.: 255	MIL OFF, engine coolant temperature increases from below 71.6°F (22°C) before starting the engine to above 158°F (70°C) after starting the engine: Increases once	-
DTC Clear Run Distance	Drive distance after clearing DTCs/ Min.: 0 mile (0 km), Max.: 40723 mile (65535 km)	-	-
DTC Clear Min	Elapsed time after clearing DTCs/ Min.: 0, Min, Max.: 65535 Min	-	-
MIL on Engine Run Time	Driving time after a malfunction occurs/ Min.: 0 Min, Max.: 65535 Min	-	-
MIL Status	MIL status/ ON or OFF	MIL ON: ON	Constant ON: Repair in accordance with detected DTCs
MIL on Run Distance	Travel distance after a malfunction occurs/ Min.: 0 mile (0 km), Max.: 40723 mile (65535 km)	-	-
Model Code	Model code	ZVW3#	-
Engine Code	Engine code	P410	-
ECU Code	ECU code	-	-
Destination	Destination	A	-
OBD Requirements	OBD requirements	OBD	-
MAP	Intake manifold vacuum/ Min.: 0 kPa, Max.: 255 kPa	Power switch on (IG) or engine stopped: Atmosphere pressure	Valued less than atmospheric pressure are indicated while the engine is running

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Atmosphere Pressure	Atmosphere pressure/ Min.: 0 kPa, Max.: 255 kPa	Constant: Atmosphere pressure	-
Number of Emission DTC	The number of emission DTCs	-	-
Motor(MG2) Revolution	MG2 revolution/ Min.: -32768 r/min, Max.: 32767 r/min	While driving: Varies depending on vehicle operating conditions	• Hybrid vehicle transaxle assembly • Inverter with converter assembly
Motor(MG2) Torq	MG2 torque/ Min.: -4096 Nm, Max.: 4095.875 Nm	While driving: Varies depending on vehicle operating conditions	• Power management control ECU • Hybrid vehicle transaxle assembly • Inverter with converter assembly
M(MG2) Trq Exec Val	MG2 torque execution value/ Min.: -4096 Nm, Max.: 4095.875 Nm	After full-load acceleration with power switch on (READY) and engine stopped: Less than +/- 20% of MG2 torque	• Power management control ECU • Hybrid vehicle transaxle assembly • Inverter with converter assembly
Generator(MG 1) Rev	MG1 revolution/ Min.: -32768 r/min, Max.: 32767 r/min	During charge or discharge: Varies depending on vehicle operating conditions	• Hybrid vehicle transaxle assembly • Inverter with converter assembly
Generator(MG 1) Torq	MG1 torque/	During charge or discharge:	• Power management

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: -4096 Nm, Max.: 4095.875 Nm	Varies depending on vehicle operating conditions	control ECU • Hybrid vehicle transaxle assembly • Inverter with converter assembly
G(MG1) Trq Exec Val	MG1 torque execution value/ Min.: -4096 Nm, Max.: 4095.875 Nm	One second after engine automatically starts with park (P) selected (Condition before engine start: Power switch on (READY), engine stopped, A/C fan speed high and headlights on) Less than +/- 20% of MG1 torque	• Power management control ECU • Hybrid vehicle transaxle assembly • Inverter with converter assembly
Regenerative Brake Torq	MG1 regenerative braking execution torque/ Min.: -4096 Nm, Max.: 4095 Nm	While braking: Varies depending on vehicle operation conditions	• Power management control ECU • Hybrid vehicle transaxle assembly • Inverter with converter assembly
Rqst Regen Brake Torq	Requested MG2 regenerative braking torque/ Min.: -4096 Nm, Max.: 4095 Nm	While braking: Varies depending on vehicle operation conditions	• Power management control ECU • Hybrid vehicle transaxle assembly • Inverter with converter

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
			assembly
Inverter Temp-(MG1)	Generator inverter temperature/ Min.: 59°F (15°C), Max.: 302°F (150°C)	• Vehicle left for 1 day at an ambient temperature of 77°F (25°C): 59°F (15°C) to 95°F (35°C) • While driving at an ambient temperature of 77°F (25°C): 59°F (15°C) to 230°F (110°C)	Inverter with converter assembly
Inverter Temp-(MG2)	Motor inverter temperature/ Min.: 59°F (15°C), Max.: 302°F (150°C)	• Vehicle left for 1 day at an ambient temperature of 77°F (25°C): 59°F (15°C) to 95°F (35°C) • While driving at an ambient temperature of 77°F (25°C): 59°F	Inverter with converter assembly

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		(15°C) to 230°F (110°C)	
Motor Temp No2	MG1 temperature/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	• Vehicle left for 1 day at an ambient temperature of 77°F (25°C): 77°F (25°C) • While driving at an ambient temperature of 77°F (25°C): 77°F (25°C) to 212°F (100°C)	GMT terminal
Motor Temp No1	MG2 temperature/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	• Vehicle left for 1 day at an ambient temperature of 77°F (25°C): 77°F (25°C) • While driving at an ambient temperature of 77°F (25°C): 77°F (25°C) to 194°F	MMT terminal

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		(90°C)	
Accelerator Degree	Accelerator pedal depressed angle/ Min.: 0%, Max.: 127.5%	Accelerator pedal depressed: Changes with accelerator pedal pressure	Accelerator pedal position sensor
Request Power	Request engine power/ Min.: 0 W, Max.: 655350 W	While driving with the engine running: Varies depending on vehicle operating conditions	• Power management control ECU • ECM • Engine
Target Engine Rev	Target engine speed/ Min.: 0 r/min, Max.: 65535 r/min	While driving with the engine running: Varies depending on vehicle operating conditions	• Power management control ECU • ECM • Engine
Engine Rev (Sensor)	Engine speed/ Min.: 0 r/min, Max.: 16383.75 r/min	While idling after the engine is warmed up: Approximately 1000 rpm While driving at a constant speed: No significant fluctuation	-
State of Charge (All Bat)	Battery state of charge/ Min.: 0%, Max.: 100%	Constant: 0 to 100%	• HV battery • Battery smart unit • Power management control ECU

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Master Cylinder Ctrl Trq	Master cylinder control torque/ Min.: -4096 Nm, Max.: 4095 Nm	Brake pedal depressed: Changes with the brake pedal pressure	Master cylinder pressure sensor
Power Resource VB	HV battery voltage/ Min.: 0 V, Max.: 6553.5 V	Power switch on (READY): 150 to 300:	• HV battery • Battery smart unit • Power management control ECU
Power Resource IB	HV battery current/ Min.: -327.68 A, Max.: 327.67 A	Power switch on (READY): -200 to 200 A	• HV battery • Power cable • Inverter with converter assembly • Battery current sensor • Air conditioning system
VL-Voltage before Boosting	High voltage before it is boosted/ Min.: 0 V, Max.: 450 V	Power switch on (READY): Practically the same as the HV battery voltage	• HV battery • Inverter with converter assembly
VH-Voltage after Boosting	High voltage after it is boosted/ Min.: 0 V, Max.: 765 V	Engine revving up with park (P) selected: After boosted voltage to below 650 V	Inverter with converter assembly
Boost Ratio	Boost ratio/ Min.: 0%, Max.: 127.5%	The pre-boost and the post boost voltages are equal: 0 to 10%	Inverter with converter assembly
Drive Condition ID	Drive condition ID	• Engine stopped: 0 • Engine about to be stopped: 1 • Engine about	• Power management control ECU • ECM • Hybrid

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		to be started: 2 • Engine operated or operating: 3 • While generating or driving under load: 4 • Engine racing with park (P) selected: 6	vehicle transaxle assembly
Shift Sensor Main	Shift position sensor (Main) voltage/ Min.: 0 V, Max.: 4.98 V	Selector lever in home position or N: 2.0 to 3.0 V Selector lever in R: 0.2 to 1.0 V Selector lever in D or B: 4.0 to 4.8 V	-
Shift Sensor Sub	Shift position sensor (Sub) voltage/ Min.: 0 V, Max.: 4.98 V	Selector lever in home position or N: 2.0 to 3.0 V Selector lever in R: 0.2 to 1.0 V Selector lever in D or B: 4.0 to 4.8 V	-
Shift Sensor Select Main	Select position sensor (Main) voltage/ Min.: 0 V, Max.: 4.98 V	Selector lever in home position or B: 10. to 1.6 V	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		Selector lever in R, N or D: 2.9 to 4.3 V	
Shift Sensor Select Sub	Select position sensor (Sub) voltage/ Min.: 0 V, Max.: 4.98 V	Selector lever in home position or B: 10. to 1.6 V Selector lever in R, N or D: 2.9 to 4.3 V	-
Shift Sensor Shift Pos	Selector lever position/ P/D/N/R/B	Selector lever remains in one position: P, R, N, D or B	Selector lever position sensor
Crank Position	Crankshaft position/ Min.: -128 °CA, Max.: 127 °CA	-	-
A/C Consumption Pwr	A/C consumption power/ Min.: 0 W, Max.: 12750 W	While the Air conditioning system is operating: 0.001 kW to 5000 W	• Air conditioning system • Battery smart unit
Short Wave Highest Val	Waveform voltage in leak detection circuit in battery ECU/ Min.: 0 V, Max.: 4.98 V	Left for 2 minutes in power switch on (READY), and pre-boost and post boost voltages are equal: 4 V or more	High voltage circuit
MG1 Control Mode	MG1 control mode/ Min.: 0, Max.: 2	PWM: 0 Variable PWM: 1 Rectangular wave: 2	-
MG1 Carrier Frequency	MG1 carrier frequency/	-	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	0.75kHz/1.25kHz/2.5kHz/ 3.75kHz/5kHz/10kHz		
MG2 Control Mode	MG2 control mode/ Min.: 0, Max.: 2	PWM: 0 Variable PWM: 1 Rectangular wave: 2	-
MG2 Carrier Frequency	MG2 carrier frequency/ 0.75kHz/1.25kHz/2.5kHz/ 3.75kHz/5kHz/10kHz	-	-
Num of Current Code	The number of current DTCs/ Min.: 0, Max.: 255	-	-
Num of History Code	The number of history DTCs/ Min.: 0, Max.: 255	-	-
Check Mode	Check Mode/ ON or OFF	-	-
Calculate Load	Calculated load/ Min.: 0%, Max.: 100%	• Engine idling with warm engine, air conditioner off, park (P) and inspection mode selected: 20 to 40% • Engine speed of 2500 rpm, air conditioner off, park (P) and inspection mode selected:	• Air cleaner condition • Throttle valve status

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		15 to 35%	
Throttle Position	Throttle position sensor/ Min.: 0%, Max.: 100%	Throttle valve fully closed: 10 to 24%	Throttle valve status
DCDC Cnv Tar Pulse Duty	Target auxiliary battery voltage/ Min.: 0%, Max.: 399.9%	-	-
Inverter Coolant Water Temperature	Inverter coolant temperature/ Min.: -58°F (-50°C), Max.: 230°F (110°C)	Cold start→Fully warmed up: Gradually rises System operating normally: Controlled at 149°F (65°C) or less	• Inverter with converter assembly • Water pump with motor assembly • Cooling fan system • Inverter cooling system • IGCT No.3 fuse
Cooling Fan 0	Battery cooling fan operating mode/ Min.: 0%, Max.: 127.5%	-	-
Cooling Fan Relay	BATT FAN relay on or off/ ON or OFF	While the battery cooling fan is operating: ON	-
Inverter W/P Revolution	Water pump with motor assembly speed/ Min.: 0 rpm, Max.: 15000 rpm	Power switch on (READY): 1375 to 5500 rpm	• Power management control ECU • Water pump with motor assembly
Prohibit DC/DC conv sig	Hybrid vehicle converter prohibition signal/ ON or OFF	• Power switch on (IG): ON (Prohibited) • Power	• Power management control ECU • Hybrid vehicle converter

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		switch on (READY): OFF (Permitted)	
EV Request	EV mode transition availability/ ON or OFF	In EV mode: ON	-
TRC OFF Switch	VSC condition/ OFF / TRC / TRC/VSC	-	-
Starter Switch	ST ON signal/ ON or OFF	-	-
Inv-T (MG1) aftr IG-ON	Generator inverter temperature soon after power switch on (IG)/ Min.: 59°F (15°C), Max.: 302°F (150°C)	-	-
Inv-T (MG2) aftr IG-ON	Motor temperature soon after power switch on (IG)/ Min.: 59°F (15°C), Max.: 302°F (150°C)	-	-
Mtr-T (MG2) aftr IG-ON	MG2 temperature soon after power switch on (IG)/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	-	-
Conv-Tmp after IG-ON	Boost converter temperature soon after power switch on (IG)/ Min.: 59°F (15°C), Max.: 302°F (150°C)	-	-
SOC after IG-ON	SOC soon after power switch on (IG)/ Min.: 0%, Max.: 127.5%	-	-
Inv-Temp (MG1) Max	Generator inverter maximum temperature/ Min.: 59°F (15°C), Max.: 302°F (150°C)	-	-
Inv-Temp (MG2) Max	Motor inverter maximum temperature/ Min.: 59°F (15°C), Max.: 302°F (150°C)	-	-
Mtr-Temp (MG2) Max	MG2 maximum temperature/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	-	-
Converter Temp Max	Boost converter maximum temperature/	-	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: 59°F (15°C), Max.: 302°F (150°C)		
Status of Charge Max	Maximum status of charge/ Min.: 0%, Max.: 127.5%	-	-
Status of Charge Min	Minimum status of charge/ Min.: 0%, Max.: 127.5%	-	-
Stop Light Switch	Stop light switch condition/ ON or OFF	Brake pedal depressed: ON	-
Auxiliary Batt Temperature	Auxiliary battery temperature/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	Auxiliary battery temperature is 68°F (20°C): 68°F (20°C)	-
Collision Signal (Airbag)	Airbag sensor assembly collision detection/ ON or OFF	Collision detection by the airbag sensor assembly: ON	-
TC Terminal	TC terminal state/ ON or OFF	TC terminal connected: ON	-
Inter Lock Switch	Interlock switch condition/ ON or OFF	Power switch on (IG), inverter terminal cover, high voltage input cables and service plug grip installed detached ON	-
EV SW2	EV switch condition/ ON or OFF	EV switch on: ON	-
Back Up Lamp Relay	Back up light switch condition/ ON or OFF	Selector lever in R ON	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
ECO Mode	ECO mode signal/ ON or OFF	ECO mode being selected OFF→ON: OFF→ON	• Combination meter assembly • Power management control ECU
Generate Torque	Currently generated drive torque/ Min.: -4096 Nm, Max.: 4095.875 Nm	While driving: Varies depending on vehicle operating conditions	-
Prohibit Charge for P Pos	HV battery charge in park (P) selected prohibition state/ ON or OFF	HV battery charge in park (P) selected prohibition: ON	-
Vehicle Parking (T/M Ctrl)	Indicates whether vehicle being driven or stopped./ ON or OFF	-	-
Shift Pos Status (T/M Ctrl)	Indicates whether park (P) is selected/ Not P / Run / P	-	-
Shift P Permission Signal	Indicates whether selection of park (P) is permitted./ ON or OFF	-	-
DC/DC Cnv Tmp (Upper)	Boost converter temperature (upper)/ Min.: 59°F (15°C), Max.: 302°F (150°C)	• Vehicle left for 1 day at an ambient temperature of 77°F (25°C): 59°F (15°C) to 95°F (35°C) • While driving at an ambient temperature of	Inverter with converter assembly

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		77°F (25°C): 59°F (15°C) to 230°F (110°C)	
Safing Signal (Airbag)	Safing state of the airbag sensor assembly/ ON or OFF	When safing state of the airbag sensor assembly: ON	-
DC/DC Cnv Temp (Lower)	Boost converter temperature (lower)/ Min.: 59°F (15°C), Max.: 302°F (150°C)	• Vehicle left for 1 day at an ambient temperature of 77°F (25°C): 59°F (15°C) to 95°F (35°C) • While driving at an ambient temperature of 77°F (25°C): 59°F (15°C) to 250°F (121°C)	Inverter with converter assembly
Normal Signal for A/B ECU	Control state of airbag sensor assembly/ ON or OFF	When the airbag sensor assembly is operating normally: ON	-
Mtr-T (MG1) aftr IG-ON	MG1 temperature soon after power switch on (IG)/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	-	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Mtr-Temp (MG1) Max	MG1 maximum temperature/ Min.: -40°F (-40°C), Max.: 419°F (215°C)	-	-
Overvoltage Input to Conv	Boost converter overvoltage detection/ ON or OFF	Overvoltage is received by the boost converter: ON	-
Overvoltage Input to Inv	Inverter overvoltage detection/ ON or OFF	Overvoltage is received by the inverter: ON	-
Emergency Shutdown	Inverter emergency shutdown/ ON or OFF	Inverter emergency shutdown: ON	-
MG1 Inverter Shutdown	Generator inverter shutdown/ ON or OFF	Generator inverter shutdown: ON	-
MG1 Inverter Fail	Generator inverter failure/ ON or OFF	Generator inverter faulty: ON	-
MG2 Inverter Shutdown	Motor inverter shutdown/ ON or OFF	Motor inverter shutdown: ON	-
MG2 Inverter Fail	Motor inverter failure/ ON or OFF	Motor inverter faulty: ON	-
Conv Shutdown	Boost converter shutdown/ ON or OFF	Boost converter shutdown: ON	-
Converter Fail	Boost converter failure/ ON or OFF	Boost converter faulty: ON	-
P Pos SW Terminal Vol	Indicates voltage at the P position switch terminals/	P position	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: 0 V, Max.: 79.9987793 V	switch ON: 0 to 1.5 V	
Internal Shift Position	ECU internal shift condition/ P/R/N/D/B	Matches currently selected condition: P, R, N, D or B	-
P Rq Malfunction (T/M Ctrl)	Indicates whether park (P) selection request is normal/ Normal or Abnormal	-	-
P Request (T/M Ctrl)	Indicates whether selection of park (P) is requested./ ON or OFF	-	-
T/M Control ECU Status	Indicates the control condition of the transmission control ECU/ Normal or Abnormal	-	-
T/M ECU Pulse Consec Err	Indicates consecutive communication errors with the transmission control ECU/ Normal or Abnormal	-	-
T/M ECU Pulse Single Err	Indicates a single communication error with the transmission control ECU/ Normal or Abnormal	-	-
HV Start Condition	Indicates the hybrid start condition/ Norml /Pr A/C / Remote	-	-
W/P Run Control Duty	Water pump motor driver request duty/ Min.: 0%, Max.: 100%	Power switch on (READY): 62.5 to 81.25%	Power management control ECU
Engine Stop Request	Engine stop request/ ON or OFF	Requesting engine stop: ON	• ECM • Power management control ECU
Engine Idling Request	Engine idling request/ ON or OFF	Requesting idle: ON	• ECM • Power management control ECU

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Main Batt Charging Rqst	HV battery charging request/ ON or OFF	Requesting HV battery charging: ON	• Battery smart unit • HV battery
Aircon Request	Engine starting request from A/C amplifier/ ON or OFF	While an engine start is requested from the A/C amplifier: ON	Air conditioning amplifier
Engine Warming Up Rqst	Engine warm-up request/ ON or OFF	While an engine warm-up is requested: ON After the engine is warmed up: OFF	• Power management control ECU • ECM
SMRP Status	Operating state of SMRP/ ON or OFF	Immediately after the power switch on (ST-ON) state occurred: ON After the above timing: OFF	• Hybrid battery junction block • Wire harness
SMRB Status	Operating state of SMRB/ ON or OFF	Power switch on (READY): ON	• Hybrid battery junction block • Wire harness
SMRG Status	Operating state of SMRG/ ON or OFF	Power switch on (READY): ON	• Hybrid battery junction block • Wire harness

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
MG1 Gate Status	MG1 gate status/ ON or OFF	Shutting down generator inverter: ON	• Power management control ECU • Inverter with converter assembly
MG2 Gate Status	MG2 gate status/ ON or OFF	Shutting down motor inverter: ON	• Power management control ECU • Inverter with converter assembly
Converter Gate Status	Boost converter gate status/ ON or OFF	Shutting down boost converter: ON	• Power management control ECU • Inverter with converter assembly
Aircon Gate Status	While A/C inverter is being shut off/ ON or OFF	While A/C inverter is being shut off: ON	• Air conditioning amplifier • Power management control ECU
Converter Carrier Freq	Converter signal carrier frequency/ 9.55kHz/9.13kHz/8.71kHz/8.29kHz/7.87kHz/7.45kHz/4.8kHz	-	-
Delta SOC	Difference between maximum and minimum values of SOC/ Min.: 0%, Max.: 127.5%	READY indicator on, engine stopped and no electrical load: 0 to 60%	-
Batt Pack Current Val	HV battery current/ Min.: -327.68 A, Max.: 327.67 A	Immediately after a full-load acceleration with the engine stopped: Maximum 190	HV battery current sensor circuit

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		A Immediately after engine start with park (P) selected: 100 A or more	
Inhaling Air Temp	HV battery intake air temperature/ Min.: -58°F (-50°C), Max.: 402.6°F (205.9°C)	-	-
VMF Fan Motor Voltage1	Battery blower motor monitoring voltage/ Min.: 0 V, Max.: 25.5 V	Fan mode 1 with READY indicator ON and park (P) selected: 1.0 to 1.4 V	Battery cooling fan circuit
Auxiliary Battery Vol	Auxiliary battery voltage/ Min.: -40 V, Max.: 39.9 V	Same as auxiliary battery voltage	• Auxiliary battery • Hybrid vehicle converter
Charge Control Value	Charge control wattage sent from battery smart unit to power management control ECU/ Min.: -64 kW, Max.: 63.5 kW	-33 kW or more	-
Discharge Control Value	Discharge control wattage sent from battery smart unit to power management control ECU/ Min.: -64 kW, Max.: 63.5 kW	30 kW or less	-
Cooling Fan Mode1	Battery cooling fan operation mode/ Min.: 0, Max.: 255	Power switch on (IG) or on (READY), and cooling fan stopped: 0 Power switch on (IG) or on (READY), and cooling fan low speed to high	Battery cooling fan circuit

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		speed: 1→6	
ECU Control Mode	Battery control mode/ Min.: 1, Max.: 5	Driving control mode: 1 Current sensor offset mode: 2 External charge control mode: 3 Power supply end mode: 4	-
Standby Blower Request	Battery blower motor stop control request (standby blower)/ ON or OFF	Constant: ON or OFF	Air conditioning system
Temp of Batt TB1	Temperature of HV battery/ Min.: -58°F (-50°C), Max.: 402.6°F (205.9°C)	Undisturbed for 1 day: Same as ambient air temperature	• Battery temperature sensor • Battery smart unit
Temp of Batt TB2	Temperature of HV battery/ Min.: -58°F (-50°C), Max.: 402.6°F (205.9°C)	Undisturbed for 1 day: Same as ambient air temperature	• Battery temperature sensor • Battery smart unit
Temp of Batt TB3	Temperature of HV battery/ Min.: -58°F (-50°C), Max.: 402.6°F (205.9°C)	Undisturbed for 1 day: Same as ambient air temperature	• Battery temperature sensor • Battery smart unit
Temp of Batt TB4	Temperature of HV battery/	Undisturbed for	• Battery temperature

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: -58°F (-50°C), Max.: 402.6°F (205.9°C)	1 day: Same as ambient air temperature	sensor • Battery smart unit
Battery Block Num	The number of battery blocks	Always: 14	HV battery
Batt Block Minimum Vol	Battery block minimum voltage/ Min.: 0 V, Max.: 79.99 V	SOC 55 to 60%: 12 V or more	-
Minimum Batt Block No	Battery block number with minimum voltage/ Min.: 0, Max.: 14	Any of block number 0 to 14	-
Batt Block Max Vol	Battery block maximum voltage/ Min.: 0 V, Max.: 79.99 V	SOC 55 to 60%: 23 V or less	-
Max Battery Block No	Battery block number with maximum voltage/ Min.: 0, Max.: 14	Any of block number 0 to 14	-
Battery Block Vol -V01	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V02	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V03	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V04	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V05	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V06	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V07	Battery block voltage/	SOC 60% : 12 to 20 V	• HV battery • Battery smart

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: 0 V, Max.: 79.99 V		unit
Battery Block Vol -V08	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V09	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V10	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V11	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V12	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V13	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Battery Block Vol -V14	Battery block voltage/ Min.: 0 V, Max.: 79.99 V	SOC 60% : 12 to 20 V	• HV battery • Battery smart unit
Internal Resistance R01	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R02	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R03	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R04	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance	Internal resistance of each battery block/	Always:	HV battery

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
R05	Min.: 0 Ω, Max.: 0.255 Ω	0.01 to 0.1 Ω	
Internal Resistance R06	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R07	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R08	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R09	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R10	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R11	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R12	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R13	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Internal Resistance R14	Internal resistance of each battery block/ Min.: 0 Ω, Max.: 0.255 Ω	Always: 0.01 to 0.1 Ω	HV battery
Battery Low Time	Cumulative total of extremely low battery charge level (engine not startable)/ Min.: 0, Max.: 65535	-	-
DC Inhibit Time	Cumulative total of extremely low battery charge level (engine startable)/ Min.: 0, Max.: 65535	-	-
Battery too High Time	Cumulative total of charging during charge prohibition state/ Min.: 0, Max.: 65535	-	-
Hot Temperature Time	Cumulative total of rapid battery temperature increase/ Min.: 0, Max.: 65535	-	-

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Pattern Switch (PWR/M)	POWER mode switch signal/ ON or OFF	POWER mode switch on: ON	-

2. ACTIVE TEST

Using the Techstream 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 tester DLC connector becomes disconnected or if a communication error occurs during an Active Test, the vehicle could become inoperative (the READY indicator may go off).

(a) Connect the Techstream to the DLC3.

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

(c) Turn the Techstream on.

Enter the following menus: Powertrain / Hybrid Control / Active Test.

(d) According to the display on the Techstream perform the appropriate Active Test.

Tester Display	Test Part	Control Range	Test Details	Test Condition
Inspection Mode - 2WD Inspection*1	-	-	-	-
Inspection Mode - 2WD Chassis-Dynamo*1	-	-	-	-
Compression Test*2	To crank the engine continuously in order to measure the compression	ON / OFF	Allows the engine to continue cranking by activating MG1 continuously	Power switch on (IG), HV system normal, not in cranking mode, and other Active Tests not being done
Activate the Water Pump	To activate the water pump with motor assembly continuously	ON / OFF	Activates the water pump with motor assembly continuously	Power switch on (IG), HV system normal, not in inspection mode, and other Active Tests not being done
Driving the Battery Cooling Fan	To check operation of the cooling fan check if there is sufficient air	1 to 6	Stops the cooling fan or changes air volume mode	-

Tester Display	Test Part	Control Range	Test Details	Test Condition
	flow			
Connect the TC and TE1	Batch display of warnings on combination meter	ON / OFF	TC terminal can be switched ON/OFF	Power switch on (IG), system is normal

NOTICE:

- *1: Enter inspection mode INFO.
- *2: The Techstream will display a communication error and the vehicle's READY indicator will turn off when the Active Test is completed. If the Techstream will be used on the vehicle again, turn the power switch off and then on (READY) again to restart the Techstream.

DIAGNOSTIC TROUBLE CODE CHART

Hybrid Vehicle Control System

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
P0069-273	Manifold Absolute Pressure - Barometric Pressure Correlation	- Inverter with converter assembly - Manifold absolute pressure sensor - ECM - Wire harness or connector	Comes on	-	INFO
P0340-886	Camshaft Position Sensor "A" Circuit	- Wire harness or connector - Camshaft position sensor - Inverter with converter assembly - ECM - Power management control ECU	Comes on	-	INFO
P0343-747	Camshaft Position Sensor "A" Circuit High Input	- SFI system - Inverter with converter assembly - ECM - Power management control ECU - Wire harness or connector	Comes on	-	INFO
P0516-769	Battery Temperature Sensor Circuit Low	- Thermistor assembly - Wire harness or connector - Power management control ECU	-	-	INFO
P0517-770	Battery Temperature Sensor Circuit High	- Thermistor assembly - Wire harness or connector - Power management control	-	-	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
		ECU			
P060B-134	Internal Control Module A/D Processing Performance	Power management control ECU	Comes on	Comes on	INFO
P060B-135	Internal Control Module A/D Processing Performance	Power management control ECU	Comes on	Comes on	INFO
P060B-570	Internal Control Module A/D Processing Performance	Power management control ECU	Comes on	Comes on	INFO
P062F-143	EEPROM Malfunction	Power management control ECU	Comes on	Comes on	INFO
P062F-165	EEPROM Malfunction	Power management control ECU	Comes on	Comes on	INFO
P0630-804	VIN not Programmed or Mismatch-ECM / PCM	Power management control ECU	Comes on	-	INFO
P06A4-209	Sensor Reference Voltage "D" Circuit Low	Power management control ECU	Comes on	-	INFO
P06A5-210	Sensor Reference Voltage "D" Circuit High	Power management control ECU	Comes on	-	INFO
P082B-575	Gear Lever X Position Circuit Low	- Wire harness or connector - Shift lock control unit assembly - Power management control ECU	Comes on	-	INFO
P082C-576	Gear Lever X Position Circuit High	- Wire harness or connector - Shift lock control unit assembly - Power management control ECU	Comes on	-	INFO
P082E-571	Gear Lever Y Position Circuit Low	- Wire harness or connector - Shift lock control unit assembly - Power management control ECU	Comes on	-	INFO
P082F-572	Gear Lever Y Position Circuit High	- Wire harness or connector - Shift lock control unit assembly - Power management control	Comes on	-	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
		ECU			
P0851-579	Park / Neutral Switch Input Circuit Low	- Wire harness or connector - Transmission shift main switch (P position switch) - Power management control ECU	Comes on	-	INFO
P0852-580	Park / Neutral Switch Input Circuit High	- Wire harness or connector - Transmission shift main switch (P position switch) - Power management control ECU	Comes on	-	INFO
P085D-582	Gear Shift Control Module "A" Performance	- Wire harness or connector - Transmission control ECU assembly - Power management control ECU	Comes on	-	INFO
P085D-599	Gear Shift Control Module "A" Performance	- Wire harness or connector - Transmission control ECU assembly - Power management control ECU	Comes on	-	INFO
P0861-597	Gear Shift Control Module "A" Communication Circuit Low	- Wire harness or connector - Transmission control ECU assembly - Power management control ECU	Comes on	-	INFO
P0862-598	Gear Shift Control Module "A" Communication Circuit High	- Wire harness or connector - Transmission control ECU assembly - Power management control ECU	Comes on	-	INFO
P0A01-726	Motor Electronics Coolant Temperature Sensor Circuit Range / Performance	- Inverter cooling system	Comes on	-	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
		- Cooling fan system - Power management control ECU - Inverter with converter assembly - Water pump with motor assembly - Wire harness or connector - IGCT No. 3 fuse			
P0A02-719	Motor Electronics Coolant Temperature Sensor Circuit Low	Inverter with converter assembly	Comes on	-	INFO
P0A03-720	Motor Electronics Coolant Temperature Sensor Circuit High	Inverter with converter assembly	Comes on	-	INFO
P0A04-725	Motor Electronics Coolant Temperature Sensor Circuit Intermittent	- Inverter cooling system - Cooling fan system - Power management control ECU - Inverter with converter assembly - Water pump with motor assembly - Wire harness or connector - IGCT No. 3 fuse	Comes on	-	INFO
P0A08-264	DC / DC Converter Status Circuit	- Wire harness or connector - Water pump with motor assembly - Inverter cooling system - Hybrid vehicle transaxle assembly - Generator cable	Comes on	-	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
		- Motor cable - Frame wire - Inverter with converter assembly - Fusible link block assembly (MAIN) - Fuse (DC/DC-S, IGCT, IGCT No. 2, IGCT No. 3) - Fusible link block assembly (DC/DC)			
P0A09-265	DC / DC Converter Status Circuit Low Input	- Wire harness or connector - Inverter with converter assembly - Power management control ECU	Comes on	-	INFO
P0A09-591	DC / DC Converter Status Circuit Low Input	- Wire harness or connector - Inverter with converter assembly - Power management control ECU	Comes on	-	INFO
P0A0D-350	High Voltage System Inter-Lock Circuit High	- Wire harness or connector - Service plug grip - Power management control ECU - Inverter with converter assembly - Frame wire - Inverter terminal cover	Comes on	-	INFO
P0A0D-351	High Voltage System Inter-Lock Circuit High	- Wire harness or connector - Service plug grip - Power management control	Comes on	-	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
		ECU - Inverter with converter assembly - Frame wire - Inverter terminal cover			
P0A0F-204	Engine Failed to Start	- SFI system - Power management control ECU	Comes on	-	INFO
P0A0F-205	Engine Failed to Start	- SFI system - Power management control ECU	Comes on	-	INFO
P0A0F-206	Engine Failed to Start	- SFI system - Power management control ECU	Comes on	-	INFO
P0A0F-238	Engine Failed to Start	- Hybrid vehicle transaxle assembly - Transmission input damper assembly - Power management control ECU - Engine	Comes on	-	INFO
P0A0F-524	Engine Failed to Start	- SFI system - Power management control ECU	Comes on	-	INFO
P0A0F-525	Engine Failed to Start	- SFI system - Power management control ECU	Comes on	-	INFO
P0A10-263	DC / DC Converter Status Circuit High Input	- Wire harness or connector - Inverter with converter assembly - Power management control ECU	Comes on	-	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
P0A10-592	DC / DC Converter Status Circuit High Input	- Wire harness or connector - Inverter with converter assembly - Power management control ECU	Comes on	-	INFO
P0A1A-151	Generator Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1A-155	Generator Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1A-156	Generator Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1A-166	Generator Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1A-200	Generator Control Module	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A1A-658	Generator Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1A-659	Generator Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1A-791	Generator Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1A-792	Generator Control Module	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A1A-793	Generator Control Module	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A1B-163	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
P0A1B-164	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-168	Drive Motor "A" Control Module	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A1B-192	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-193	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-198	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-511	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-512	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-661	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-786	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-794	Drive Motor "A" Control Module	Inverter with converter assembly	Comes on	Comes on	INFO
P0A1B-795	Drive Motor "A" Control Module	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A1B-796	Drive Motor "A" Control Module	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A1D-144	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-148	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-	Hybrid Powertrain Control	Power management control	Comes on	Comes	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
162	Module	ECU		on	
P0A1D-187	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-721	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-722	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-723	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-787	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-818	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-821	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-822	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A1D-823	Hybrid Powertrain Control Module	Power management control ECU	Comes on	Comes on	INFO
P0A2B-250	Drive Motor "A" Temperature Sensor Circuit Range / Performance	Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	INFO
P0A2C-247	Drive Motor "A" Temperature Sensor Circuit Low	- Wire harness or connector - Power management control ECU - Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	INFO
P0A2D-249	Drive Motor "A" Temperature Sensor Circuit High	- Wire harness or connector - Power management control ECU - Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	INFO
P0A2E-248	Drive Motor "A" Temperature Sensor Circuit Intermittent	Hybrid vehicle transaxle assembly (Motor temperature sensor)	Comes on	-	INFO
P0A37-260	Generator Temperature Sensor Circuit Range / Performance	Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	INFO

DTC Code	Detection Item	Trouble Area	Master Warning Light	MIL	See page
P0A38-257	Generator Temperature Sensor Circuit Low	- Wire harness or connector - Power management control ECU - Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	INFO
P0A39-259	Generator Temperature Sensor Circuit High	- Wire harness or connector - Power management control ECU - Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	INFO
P0A3A-258	Generator Temperature Sensor Circuit Intermittent	Hybrid vehicle transaxle assembly (Generator temperature sensor)	Comes on	-	INFO
P0A3F-243	Drive Motor "A" Position Sensor Circuit	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A40-500	Drive Motor "A" Position Sensor Circuit Range / Performance	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A41-245	Drive Motor "A" Position Sensor Circuit Low	- Inverter with converter assembly - Hybrid vehicle transaxle assembly - Wire harness or connector	Comes on	Comes on	INFO
P0A4B-253	Generator Position Sensor Circuit	- Inverter with converter assembly - Hybrid vehicle transaxle assembly	Comes on	Comes on	INFO