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Model Year Start: 2023	**Model:** Prius Prime	**Prod Date Range:** [03/2023 -]
Title: HYBRID / BATTERY CONTROL: HYBRID CONTROL SYSTEM (for PHEV Model): P0AA000; Hybrid/EV Battery Positive Contactor Circuit Stuck Closed; 2023 - 2024 MY Prius Prime [03/2023 -]		

DTC	**P0AA000**	**Hybrid/EV Battery Positive Contactor Circuit Stuck Closed**

DTC SUMMARY

MALFUNCTION DESCRIPTION

The hybrid vehicle control ECU detects a stuck closed malfunction of a system main relay on the HV battery positive (+) terminal side.

The cause of this malfunction may be one of the following:

Inverter voltage sensor (VH) internal circuit malfunction

- Voltage sensor (VH) malfunction
- Motor generator control ECU (MG ECU) malfunction
- Communication (wire harness) malfunction

High voltage system malfunction

- No. 1 traction battery device box assembly malfunction

Low-voltage circuit (12 V) malfunction

- Hybrid vehicle control ECU malfunction
- No. 1 traction battery device box assembly malfunction
- Low voltage wire harness malfunction
- Low voltage connector malfunction

DESCRIPTION

The SMRs (System Main Relays) are the relays that connect or disconnect the high-voltage system in accordance with commands from the hybrid vehicle control ECU.

There are 2 SMRs. SMRB and SMRG are located in the No. 1 traction battery device box assembly.

To shut off the high voltage power system, SMRB and SMRG are turned off.

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
P0AA000	Hybrid/EV Battery Positive Contactor Circuit Stuck Closed	Even the system main relay of HV battery positive (+) terminal side is turned off, the inverter voltage (VH) does not drop.	• No. 1 traction battery device box assembly • Inverter with converter assembly	Does not come on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P0AA1

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
		(1 trip detection logic)	• Hybrid vehicle control ECU • Wire harness or connector					

CONFIRMATION DRIVING PATTERN

HINT:

After repair has been completed, clear the DTC and then check that the vehicle has returned to normal by performing the following All Readiness check procedure.

Click here INFO

1. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
2. Turn the ignition switch off and wait for 30 seconds or more.
3. Turn the ignition switch to ON (READY).
4. Turn the ignition switch off and wait for 30 seconds or more.
5. Turn the ignition switch to ON (READY).

HINT:

According to the display on the GTS, read the Data List and monitor the values of "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" for 3 minutes. If the difference between "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" is always less than 100 V, the vehicle has returned to normal.

6. Enter the following menus: Powertrain / Hybrid Control / Utility / All Readiness.
7. Check the DTC judgment result.

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE, perform driving pattern again.

WIRING DIAGRAM

Refer to the wiring diagram for the HV Battery High-voltage Line Circuit.

Click here INFO

CAUTION / NOTICE / HINT

CAUTION:

Refer to the precautions before inspecting high voltage circuit.

Click here INFO

NOTICE:

- If the DTCs are cleared or the cable is disconnected and reconnected to the negative (-) auxiliary battery terminal before performing repairs, turning the ignition switch to ON (READY) may cause a malfunction. Do not turn the ignition switch to ON (READY).
- After the ignition switch is turned off, there may be a waiting time before disconnecting the negative (-) auxiliary battery terminal.

Click here INFO

- When disconnecting and reconnecting the auxiliary battery

HINT:

When disconnecting and reconnecting the auxiliary battery, there is an automatic learning function that completes learning when the respective system is used.

Click here INFO

HINT:

- If DTC P0AA000 is output, the ignition switch cannot be turned to ON (READY).
- P0AA000 may be output as a result of the malfunction indicated by the DTCs in table below.

a. The chart above is listed in inspection order of priority.
b. Check DTCs that are output at the same time by following the listed order. (The main cause of the malfunction can be determined without performing unnecessary inspections.)

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
Microcomputer malfunction	Hybrid Control System	P060647	Hybrid/EV Powertrain Control Module Processor Watchdog / Safety MCU Failure
		P060687	Hybrid/EV Powertrain Control Module Processor to Monitoring Processor Missing Message
		P060A47	Hybrid/EV Powertrain Control Module Monitoring Processor Watchdog / Safety MCU Failure
		P060A87	Hybrid/EV Powertrain Control Module Processor from Monitoring Processor Missing Message
		P0A1B49	Drive Motor "A" Control Module Internal Electronic Failure
		P1C9E9F	Hybrid/EV System Reset Stuck Off
	Motor Generator Control System	P0A1B1F	Generator Control Module Circuit Intermittent
		P0A1A47	Generator Control Module Watchdog / Safety MC Failure
		P0A1A49	Generator Control Module Internal Electronic Failure
		P1C2A1C	Generator A/D Converter Circuit Circuit Voltage Out of Range
		P1C2A49	Generator A/D Converter Circuit Internal Electronic Failure
		P1C2B1C	Drive Motor "A" Control Module A/D Converter Circuit Voltage Out of Range
		P1C2B49	Drive Motor "A" Control Module A/D Converter Circuit Internal Electronic Failure
		P1CAC49	Generator Position Sensor Internal Electronic Failure
		P1CAD49	Drive Motor "A" Position Sensor Internal Electronic Failure
		P1CAF38	Generator Position Sensor REF Signal Cycle Malfunction Signal Frequency Incorrect
		P1CB038	Drive Motor "A" Position Sensor REF Signal Frequency Incorrect

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
		P313383	Communication Error from Generator to Drive Motor "A" Value of Signal Protection Calculation Incorrect
		P313386	Communication Error from Generator to Drive Motor "A" Signal Invalid
Power source circuit malfunction	Motor Generator Control System	P06D61C	Generator Control Module Offset Power Circuit Voltage Out of Range
		P06B01C	Generator Control Module Position Sensor REF Power Source Circuit Voltage Out of Range
Communication system malfunction	Motor Generator Control System	P313387	Communication Error from Generator to Drive Motor "A" Missing Message
Sensor and actuator circuit malfunction	Hybrid Control System	P0AD911	Hybrid/EV Battery Positive Contactor Circuit Short to Ground
		P0AD915	Hybrid/EV Battery Positive Contactor Circuit Short to Auxiliary Battery or Open
		P0ADD11	Hybrid/EV Battery Negative Contactor Circuit Short to Ground
		P0ADD15	Hybrid/EV Battery Negative Contactor Circuit Short to Auxiliary Battery or Open
	Motor Generator Control System	P0A3F16	Drive Motor "A" Position Sensor Circuit Voltage Below Threshold
		P0A4B16	Generator Position Sensor Circuit Voltage Below Threshold
		P0A4B21	Generator Position Sensor Signal Amplitude < Minimum
		P0A4B22	Generator Position Sensor Signal Amplitude > Maximum
		P0C5013	Drive Motor "A" Position Sensor Circuit "A" Circuit Open
		P0C5016	Drive Motor "A" Position Sensor Circuit "A" Circuit Voltage Below Threshold
		P0C5017	Drive Motor "A" Position Sensor Circuit "A" Circuit Voltage Above Threshold
		P0C5A13	Drive Motor "A" Position Sensor Circuit "B" Circuit Open
		P0C5A16	Drive Motor "A" Position Sensor Circuit "B" Circuit Voltage Below Threshold
		P0C5A17	Drive Motor "A" Position Sensor Circuit "B" Circuit Voltage Above Threshold
		P0C6413	Generator Position Sensor Circuit "A" Circuit Open
		P0C6416	Generator Position Sensor Circuit "A" Circuit Voltage Below Threshold
		P0C6417	Generator Position Sensor Circuit "A" Circuit Voltage Above Threshold

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
		P0C6913	Generator Position Sensor Circuit "B" Circuit Open
		P0C6916	Generator Position Sensor Circuit "B" Circuit Voltage Below Threshold
		P0C6917	Generator Position Sensor Circuit "B" Circuit Voltage Above Threshold
System malfunction	Hybrid Control System	P0D2D1C	Drive Motor "A" Inverter Voltage Sensor Voltage Out of Range
		P1C8349	High Voltage Power Resource Circuit Voltage Sensor after Boosting Malfunction
		P0C7600	Hybrid/EV Battery System Discharge Time Too Long
	Motor Generator Control System	P0D2D16	Drive Motor "A" Inverter Voltage Sensor (VH) Circuit Voltage Below Threshold
		P0D2D17	Drive Motor "A" Inverter Voltage Sensor (VH) Circuit Voltage Above Threshold
		P1CB69E	Drive Motor "A" Inverter Voltage Sensor (VH) Stuck On

PROCEDURE

1.	**CHECK FREEZE FRAME DATA (HYBRID CONTROL)**

Pre-procedure1

(a) None.

Procedure1

(b) Read the Freeze Frame Data of DTC P0AA000.

Powertrain > Hybrid Control > DTC(P0AA000) > Freeze Frame Data

TESTER DISPLAY
VL-Voltage before Boosting
VH-Voltage after Boosting

NOTICE:

As freeze frame data is stored immediately before and after a DTC is stored, make sure to only read the values for the moment the DTC was stored ("0(s)").

RESULT	PROCEED TO
Difference between "VL-Voltage before Boosting" and "VH-Voltage after Boosting" is less than 90 V.	A
Difference between "VL-Voltage before Boosting" and "VH-Voltage after Boosting" is 90 V or more.	B

HINT:

If VH-Voltage after Boosting is output even when an off command is being sent to the system main relay (positive side), P0AA000 is output. If the difference between the "VL-Voltage before Boosting" and the "VH-Voltage after Boosting" is large, it is determined that there is an inverter (VH sensor) malfunction.

Post-procedure1

(c) Turn the ignition switch off.

B ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

A

▼

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

Click here INFO

OK ▶ **GO TO STEP 4**

NG

▼

3.	**CONNECT SECURELY**

NEXT

▼

4.	**CHECK CONNECTOR CONNECTION CONDITION (FLOOR WIRE CONNECTOR)**

(a) Check the connection condition of the floor wire connector and the contact pressure of each terminal. Check the terminals for deformation, and check the connector for water ingress and foreign matter.

HINT:

Click here INFO

OK:

- The connector is connected securely.
- The terminals are not deformed and are connected securely.
- No water or foreign matter in the connector.

RESULT	PROCEED TO
OK	A
NG (The connector is not connected securely.)	B
NG (The terminals are not making secure contact or are deformed, or water or foreign matter exists in the connector.)	C

A ▶ **GO TO STEP 7**

C ▶ **GO TO STEP 6**

B
▼

5.	**CONNECT SECURELY**

NEXT ▶ **GO TO STEP 7**

6.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT
▼

7.	**CHECK CONNECTOR CONNECTION CONDITION (FLOOR UNDER WIRE CONNECTOR)**

(a) Check the connection condition of the floor under wire connector and the contact pressure of each terminal. Check the terminals for deformation, and check the connector for water ingress and foreign matter.

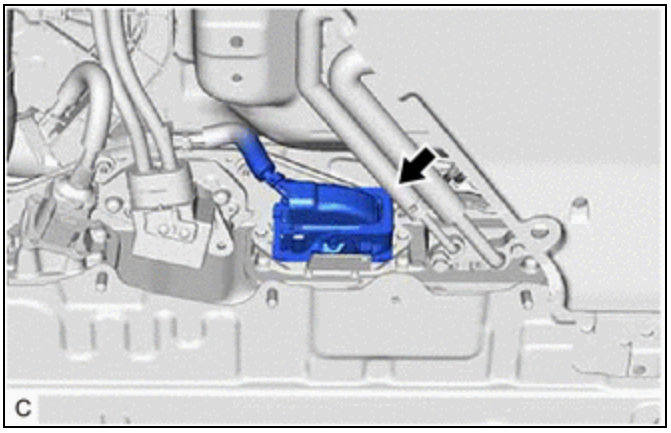
HINT:

Click here INFO

OK:

- The connector is connected securely.
- The terminals are not deformed and are connected securely.

- No water or foreign matter in the connector.



RESULT	PROCEED TO
OK	A
NG (The connector is not connected securely.)	B
NG (The terminals are not making secure contact or are deformed, or water or foreign matter exists in the connector.)	C

A ▶ **GO TO STEP 10**

C ▶ **GO TO STEP 9**

B
▼

8.	**CONNECT SECURELY**

NEXT ▶ **GO TO STEP 10**

9.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT
▼

10.	**CHECK CONNECTOR CONNECTION CONDITION (NO. 1 TRACTON BATTERY DEVICE BOX ASSEMBLY CONNECTOR)**

CAUTION:

Be sure to wear insulated gloves.

Pre-procedure1

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

NOTICE:

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

Procedure1

(b) Check the connector connections and contact pressure of the relevant terminals of the No. 1 traction battery device box assembly connector.

HINT:

Click here INFO

OK:

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

Result:

PROCEED TO
OK
NG

Post-procedure1

(c) None.

OK ▶ **GO TO STEP 12**

NG

▼

11.	**CONNECT SECURELY**

NEXT

12.	**CHECK GROUND WIRE CONNECTION CONDITION (SMR ACTIVATION LOW-VOLTAGE CIRCUIT)**

(a) Check the installation condition of the ground wire RD.

OK:

The ground wire RD is securely installed.

OK ▶ **GO TO STEP 14**

NG

13.	**CONNECT SECURELY**

NEXT

14.	**CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - NO. 1 TRACTON BATTERY DEVICE BOX ASSEMBLY)**

CAUTION:

Be sure to wear insulated gloves.

Pre-procedure1

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

NOTICE:

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

(b) Connect the SST.

HINT:

Click here INFO

(c) Disconnect the No. 1 traction battery device box assembly connector.

(d) Disconnect the hybrid vehicle control ECU connector.

Procedure1

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

Standard Resistance (Check for Open):

EWD INFO

Click Location & Routing(K11,x12)
Click Connector(K11)
Click Connector(x12)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
K11-3 (SMRB) - x12-1 (SMRB)	Ignition switch off	Below 1 Ω	Ω

Standard Resistance (Check for Short):

EWD INFO

Click Location & Routing(K11,x12)
Click Connector(K11)
Click Connector(x12)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
K11-3 (SMRB) or x12-1 (SMRB) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ

Post-procedure1

(f) Reconnect the hybrid vehicle control ECU connector.

(g) Reconnect the No. 1 traction battery device box assembly connector.

(h) Disconnect the SST.

OK ▶ **GO TO STEP 16**

NG

15.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT

16.	**CHECK HARNESS AND CONNECTOR (NO. 1 TRACTON BATTERY DEVICE BOX ASSEMBLY - BODY GROUND)**

CAUTION:

Be sure to wear insulated gloves.

Pre-procedure1

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

NOTICE:

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

(b) Connect the SST.

HINT:

Click here INFO

(c) Disconnect the No. 1 traction battery device box assembly connector.

Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(x12)
Click Connector(x12)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
x12-2 (GND) - Body ground	Ignition switch off	Below 1 Ω	Ω

Post-procedure1

(e) Reconnect the No. 1 traction battery device box assembly connector.

(f) Disconnect the SST.

OK ▶ **GO TO STEP 18**

NG

17.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT

18.	**INSPECT NO. 1 TRACTION BATTERY DEVICE BOX ASSEMBLY (SMRB)**

CAUTION:

Be sure to wear insulated gloves.

Pre-procedure1

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

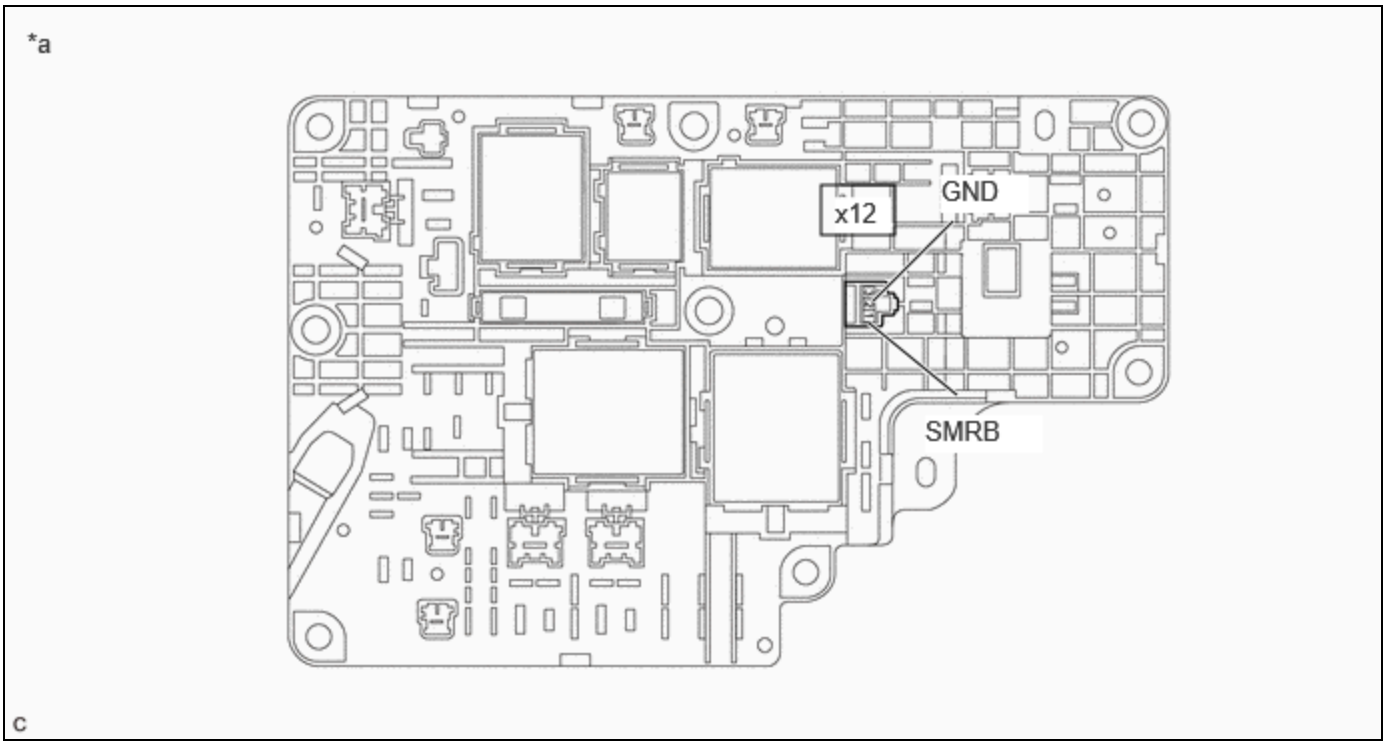
NOTICE:

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

(b) Disconnect the No. 1 traction battery device box assembly connector.

Procedure1

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



*a	Component without harness connected (No. 1 Traction Battery Device Box Assembly)	-	-

Standard Resistance:

EWD INFO

Click Location & Routing(x12)
Click Connector(x12)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
x12-1 (SMRB) - x12-2 (GND)	-40 to 80°C (-40 to 176°F)	20.6 to 40.8 Ω	Ω

Post-procedure1

(d) Reconnect the No. 1 traction battery device box assembly connector.

NG ▶ **GO TO STEP 21**

OK ▼

19.	CHECK NO.1 TRACTION BATTERY DEVICE BOX ASSEMBLY (SMRB)

CAUTION:

Be sure to wear insulated gloves.

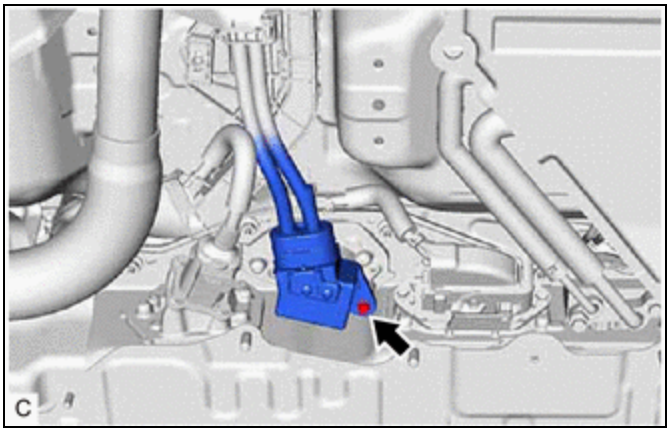
Pre-procedure1

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

NOTICE:

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

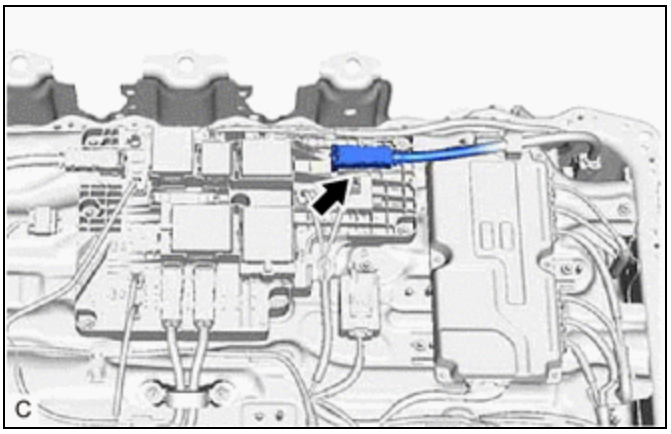
(b) Disconnect the floor under wire from the HV supply battery assembly.



(c) Disconnect the HV battery high voltage connectors from the No. 1 traction battery device box assembly.

NOTICE:

Insulate each disconnected high-voltage connector with insulating tape. Wrap the connector from the wire harness side to the end of the connector.



Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(z25,we1)
Click Connector(z25)
Click Connector(we1)

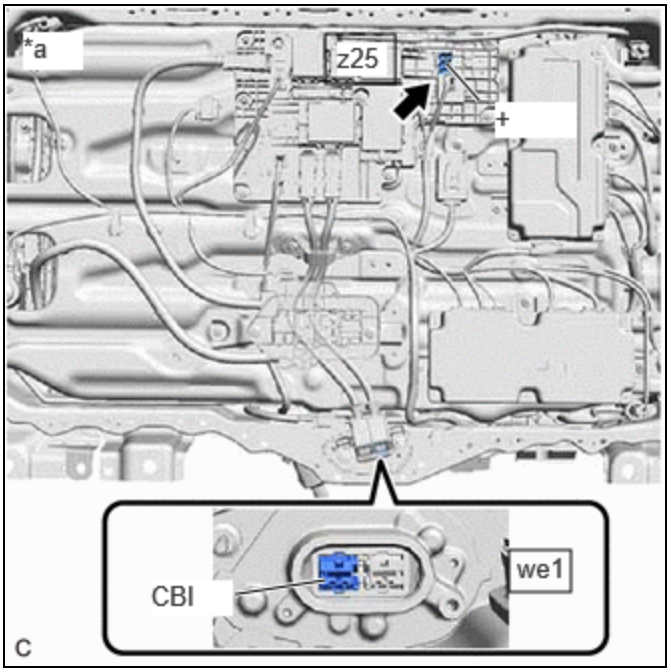
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
z25-1 (+) - we1-1 (CBI)	Ignition switch off	10 kΩ or higher

HINT:

- If a system main relay is stuck closed, inspect the No. 1 traction battery device box assembly without removing it from the vehicle, in order to keep the relay closed.
- If the result of reading the freeze frame data is A, the No. 1 traction battery device box assembly must be replaced. Measuring resistance can determine that this is either a present or past malfunction.

Result:

RESULT	JUDGMENT	PROCEED TO
OK	Past malfunction	A
NG	Present malfunction	B



*a	Component without harness connected (No. 1 Traction Battery Device Box Assembly)

Post-procedure1

(e) Reconnect the HV battery high voltage connectors.

B GO TO STEP 22

A

20.	**REPLACE NO. 1 TRACTION BATTERY DEVICE BOX ASSEMBLY**

HINT:

Click here INFO

NEXT **GO TO STEP 24**

21.	**REPLACE NO. 1 TRACTION BATTERY DEVICE BOX ASSEMBLY**

HINT:

Click here INFO

NEXT **GO TO STEP 24**

22.	**REPLACE NO. 1 TRACTION BATTERY DEVICE BOX ASSEMBLY**

HINT:

Click here INFO

NEXT

23.	**CHECK DTC OUTPUT (HYBRID CONTROL, MOTOR GENERATOR, HV BATTERY)**

CAUTION:

Be sure to wear insulated gloves.

Pre-procedure1

(a) Install the service plug grip.

(b) Clear the DTCs.

Powertrain > Hybrid Control > Clear DTCs

(c) Turn the ignition switch off and wait for 30 seconds or more.

(d) Turn the ignition switch to ON (READY).

(e) Turn the ignition switch off and wait for 30 seconds or more.

(f) Turn the ignition switch to ON (READY).

Procedure1

(g) Check for DTCs.

Powertrain > Hybrid Control > Trouble Codes
Powertrain > Motor Generator > Trouble Codes
Powertrain > HV Battery > Trouble Codes

RESULT	PROCEED TO
DTCs are not output	A

RESULT	PROCEED TO
DTCs of Hybrid Control System are output.	B
DTCs of Motor Generator Control System are output.	C
DTCs of Hybrid Battery System are output.	D

Post-procedure1

(h) Turn the ignition switch off.

B ▶ **GO TO DTC CHART (HYBRID CONTROL SYSTEM)**

C ▶ **GO TO DTC CHART (MOTOR GENERATOR CONTROL SYSTEM)**

D ▶ **GO TO DTC CHART (HYBRID BATTERY SYSTEM)**

A ▼

24.	CHECK HYBRID VEHICLE CONTROL ECU (CHECK FOR NORMAL OPERATION)

Pre-procedure1

(a) None.

Procedure1

(b) According to the display on the GTS, read the Data List and monitor the values of "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" for 3 minutes.

Powertrain > Hybrid Control > Data List

TESTER DISPLAY
VL-Voltage before Boosting
Hybrid/EV Battery Voltage

RESULT	PROCEED TO
Difference between "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" is always less than 100 V.	A

RESULT	PROCEED TO
Difference between "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" is 100 V or more.	B

Post-procedure1

(c) Turn the ignition switch off.

A ▶ **END**

B ▶ **REPLACE HYBRID VEHICLE CONTROL ECU AND NO. 1 TRACTION BATTERY DEVICE BOX ASSEMBLY**

HYBRID VEHICLE CONTROL ECU: Click here INFO

NO. 1 TRACTION BATTERY DEVICE BOX ASSEMBLY: Click here INFO