Last Modified: 12-04-2024	6.11:8.1.0	**Doc ID:** RM1000000029A4L
Model Year Start: 2023	**Model:** Prius Prime	**Prod Date Range:** [12/2022 -]
Title: HYBRID / BATTERY CONTROL: HYBRID BATTERY SYSTEM (for M20A-FXS): P33EC16,P33ED16; (Extreme) Hybrid/EV Battery Stack 1 Cell Circuit Voltage Below Threshold; 2023 - 2024 MY Prius Prius Prime [12/2022 -]		

DTC	**P33EC16**	**(Extreme) Hybrid/EV Battery Stack 1 Cell Circuit Voltage Below Threshold**

DTC	**P33ED16**	**(Extreme) Hybrid/EV Battery Stack 2 Cell Circuit Voltage Below Threshold**

DESCRIPTION

If the voltage of an HV battery cell is lower than the threshold for a certain amount of time, the battery ECU assembly will interpret this as a malfunction.

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
P33EC16	(Extreme) Hybrid/EV Battery Stack 1 Cell Circuit Voltage Below Threshold	The voltage of any cell of the No. 1 HV supply stack sub-assembly has decreased excessively. (1 trip detection logic)	• HV battery • Battery ECU assembly	Comes on	Master Warning: Comes on	HV Battery	A	SAE Code: P33EC
P33ED16	(Extreme) Hybrid/EV Battery Stack 2 Cell Circuit Voltage Below Threshold	The voltage of any cell of the No. 2 HV supply stack sub-assembly has decreased excessively. (1 trip detection logic)	• HV battery • Battery ECU assembly	Comes on	Master Warning: Comes on	HV Battery	A	SAE Code: P33ED

CAUTION:

Do not charge the HV battery using the THS charger if DTC P33EC16 or P33ED16 is output.

MONITOR DESCRIPTION

If the battery ECU assembly detects voltage drop in the battery cells, the battery ECU assembly will illuminate the MIL and store a DTC.

MONITOR STRATEGY

Related DTCs	P33EC (INF P33EC16), P33ED (INF P33ED16): Cell voltage too low
Required sensors/components	Battery ECU assembly
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 stored	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Battery ECU assembly	DTC P33EC (INF P33EC16) is not detected DTC P33ED (INF P33ED16) is not detected

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
- When clearing the permanent DTCs, refer to the "CLEAR PERMANENT DTC" 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 2 minutes or more.
3. Drive the vehicle on urban roads for approximately 10 minutes.[*1]

   HINT:

   [*1]: Normal judgment procedure.

   The normal judgment procedure is used to complete DTC judgment and also used when clearing permanent DTCs.
4. Enter the following menus: Powertrain / HV Battery / Utility / All Readiness.
5. 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 the normal judgment procedure again.

WIRING DIAGRAM

Refer to the wiring diagram for DTC P1A001C.

Click here INFO

CAUTION / NOTICE / HINT

CAUTION:

Refer to the precautions before inspecting high voltage circuit.

Click here INFO

NOTICE:

- 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

PROCEDURE

1.	**CHECK DTC OUTPUT (HV BATTERY, HYBRID CONTROL)**

Pre-procedure1

(a) None

Procedure1

(b) Check for DTCs.

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

RESULT	PROCEED TO
"P33EC16 or P33ED16" only is output, or DTCs except the ones in the table below are also output.	A
DTCs of hybrid battery system in the table below are output.	B
DTCs of hybrid control system in the table below are output.	C

SYSTEM	RELEVANT DTC	
Hybrid battery system	P060A47	Hybrid/EV Battery Energy Control Module Monitoring Processor Watchdog / Safety MCU Failure
	P060B49	Hybrid/EV Battery Energy Control Module A/D Processing Internal Electronic Failure

SYSTEM	RELEVANT DTC	
	P060687	Hybrid/EV Battery Energy Control Module Processor to Monitoring Processor Missing Message
	P0E2D00	Hybrid/EV Battery Energy Control Module Hybrid/EV Battery Monitor Performance
Hybrid control system	P0A1F94	Hybrid/EV Battery Energy Control Module Unexpected Operation

Post-procedure1

(c) Turn the ignition switch off.

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

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

A

2.	**CHECK DTC**

(a) Check the DTCs that were output when the vehicle was brought to the workshop.

RESULT	PROCEED TO
"P33EC16" is also output.	A
"P33ED16" is also output.	B

B ▶ **GO TO STEP 8**

A

3.	**CHECK CONNECTOR CONNECTION CONDITION (BATTERY ECU ASSEMBLY CONNECTOR)**

Click here INFO

RESULT	PROCEED TO
OK	A

RESULT		PROCEED TO
Not connected securely	The terminals are not damaged or corroded	B
Not connected securely	The terminals are damaged or corroded	C

B ▶ **CONNECT SECURELY**

C ▶ **REPLACE HV BATTERY**

A

4.	CHECK FREEZE FRAME DATA (HYBRID/EV BATTERY CELL VOLTAGE)

Pre-procedure1

(a) None

Procedure1

(b) Read the value of freeze frame data items "Hybrid/EV battery cell 1 voltage" through "Hybrid/EV battery cell 30 voltage" for DTC P33EC16 and make a note if the value of any is 1.2 V or less.

Powertrain > HV Battery > Trouble Codes

Post-procedure1

(c) Turn the ignition switch off.

NEXT

5.	CHECK HV BATTERY (HV BATTERY CELL VOLTAGE 1 - 30)

CAUTION:

- Be sure to wear insulated gloves and protective goggles.
- Disconnect only the connector corresponding to the HV battery cell to be checked. Do not disconnect the other connectors.

NOTICE:

Make sure to use tester probes with a diameter of approximately 0.5 mm (0.0197 in.) when measuring the voltage of each HV battery cell.

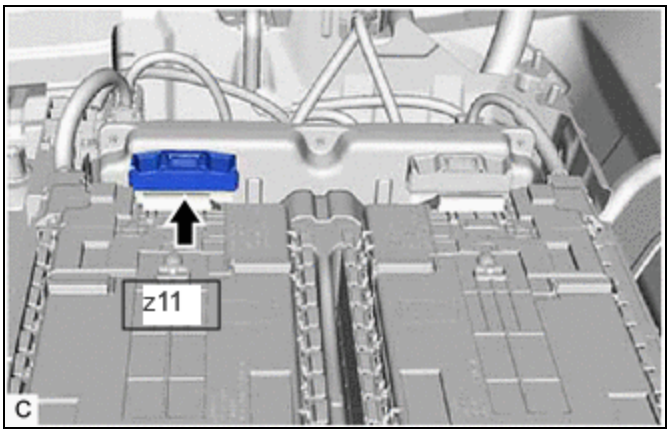
Pre-procedure1

(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 battery ECU assembly connector.



Procedure1

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

HINT:

Measure the voltage of the HV battery cells whose value in the freeze frame data was 1.2 V or less only.

HV BATTERY CELL	TESTER CONNECTION	CONDITION
1	z11-19 (GA0) - z11-41 (VA1)	Always
2	z11-41 (VA1) - z11-18 (VA2)	Always
3	z11-18 (VA2) - z11-40 (VA3)	Always
4	z11-40 (VA3) - z11-17 (VA4)	Always
5	z11-17 (VA4) - z11-39 (VA5)	Always
6	z11-39 (VA5) - z11-16 (VA6)	Always
7	z11-16 (VA6) - z11-38 (VA7)	Always
8	z11-38 (VA7) - z11-15 (VA8)	Always
9	z11-15 (VA8) - z11-37 (VA9)	Always
10	z11-37 (VA9) - z11-14 (VA10)	Always
11	z11-14 (VA10) - z11-36 (VA11)	Always
12	z11-36 (VA11) - z11-13 (VA12)	Always
13	z11-13 (VA12) - z11-35 (VA13)	Always
14	z11-35 (VA13) - z11-12 (VA14)	Always
15	z11-12 (VA14) - z11-34 (VA15)	Always
16	z11-34 (VA15) - z11-11 (VA16)	Always
17	z11-11 (VA16) - z11-33 (VA17)	Always
18	z11-33 (VA17) - z11-10 (VA18)	Always

HV BATTERY CELL	TESTER CONNECTION	CONDITION
19	z11-10 (VA18) - z11-32 (VA19)	Always
20	z11-32 (VA19) - z11-9 (VA20)	Always
21	z11-9 (VA20) - z11-31 (VA21)	Always
22	z11-31 (VA21) - z11-7 (VA22)	Always
23	z11-29 (GA1) - z11-6 (VA23)	Always
24	z11-6 (VA23) - z11-28 (VA24)	Always
25	z11-28 (VA24) - z11-5 (VA25)	Always
26	z11-5 (VA25) - z11-27 (VA26)	Always
27	z11-27 (VA26) - z11-4 (VA27)	Always
28	z11-4 (VA27) - z11-26 (VA28)	Always
29	z11-26 (VA28) - z11-3 (VA29)	Always
30	z11-3 (VA29) - z11-23 (VA30)	Always

CAUTION:

Make sure not to cross the electrodes of an electrical tester measurement terminals.

NOTICE:

Make sure to check the polarity of each terminal (positive (+) or negative (-)) before connecting a tester.

RESULT	PROCEED TO
The voltage between the terminals is 1.2 V or less.	A
Other than above	B

Post-procedure1

(d) Reconnect the battery ECU assembly connector.

B ▶ **REPLACE BATTERY ECU ASSEMBLY**

A ▼

6.	**CHECK BATTERY ECU ASSEMBLY (GA0 - VA30)**

NOTICE:

Make sure to use tester probes with a diameter of approximately 0.5 mm (0.0197 in.) when measuring the resistance.

Pre-procedure1

(a) Remove the battery ECU assembly.

HINT:

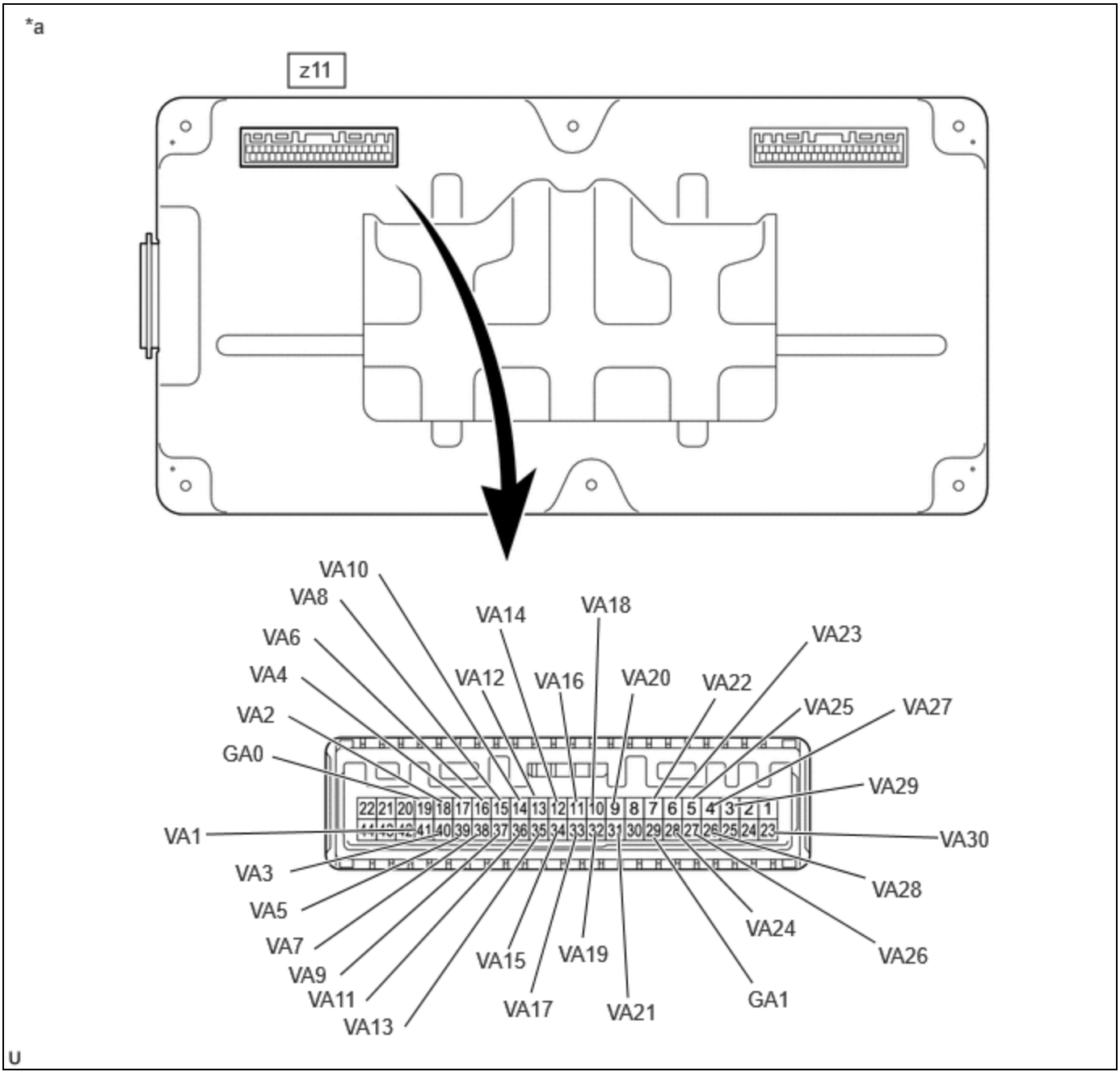
Click here INFO

Procedure1

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

HINT:

Only inspect the terminals of the battery ECU assembly which correspond to the HV battery cells which measured 1.2 V or less in the previous step.



*a	Component without harness connected (Battery ECU Assembly)	-	-

Standard Resistance:

HV BATTERY CELL	TESTER CONNECTION (TESTER PROBE POLARITY)	CONDITION	SPECIFIED CONDITION
1	z11-19 (GA0) (-) - z11-41 (VA1) (+)	Always	50 kΩ or more
2	z11-41 (VA1) (-) - z11-18 (VA2) (+)	Always	50 kΩ or more
3	z11-18 (VA2) (-) - z11-40 (VA3) (+)	Always	50 kΩ or more
4	z11-40 (VA3) (-) - z11-17 (VA4) (+)	Always	50 kΩ or more
5	z11-17 (VA4) (-) - z11-39 (VA5) (+)	Always	50 kΩ or more
6	z11-39 (VA5) (-) - z11-16 (VA6) (+)	Always	50 kΩ or more
7	z11-16 (VA6) (-) - z11-38 (VA7) (+)	Always	50 kΩ or more
8	z11-38 (VA7) (-) - z11-15 (VA8) (+)	Always	50 kΩ or more
9	z11-15 (VA8) (-) - z11-37 (VA9) (+)	Always	50 kΩ or more
10	z11-37 (VA9) (-) - z11-14 (VA10) (+)	Always	50 kΩ or more
11	z11-14 (VA10) (-) - z11-36 (VA11) (+)	Always	50 kΩ or more
12	z11-36 (VA11) (-) - z11-13 (VA12) (+)	Always	50 kΩ or more
13	z11-13 (VA12) (-) - z11-35 (VA13) (+)	Always	50 kΩ or more
14	z11-35 (VA13) (-) - z11-12 (VA14) (+)	Always	50 kΩ or more
15	z11-12 (VA14) (-) - z11-34 (VA15) (+)	Always	50 kΩ or more
16	z11-34 (VA15) (-) - z11-11 (VA16) (+)	Always	50 kΩ or more
17	z11-11 (VA16) (-) - z11-33 (VA17) (+)	Always	50 kΩ or more
18	z11-33 (VA17) (-) - z11-10 (VA18) (+)	Always	50 kΩ or more
19	z11-10 (VA18) (-) - z11-32 (VA19) (+)	Always	50 kΩ or more
20	z11-32 (VA19) (-) - z11-9 (VA20) (+)	Always	50 kΩ or more
21	z11-9 (VA20) (-) - z11-31 (VA21) (+)	Always	50 kΩ or more
22	z11-31 (VA21) (-) - z11-7 (VA22) (+)	Always	50 kΩ or more
23	z11-29 (GA1) (-) - z11-6 (VA23) (+)	Always	50 kΩ or more
24	z11-6 (VA23) (-) - z11-28 (VA24) (+)	Always	50 kΩ or more
25	z11-28 (VA24) (-) - z11-5 (VA25) (+)	Always	50 kΩ or more
26	z11-5 (VA25) (-) - z11-27 (VA26) (+)	Always	50 kΩ or more
27	z11-27 (VA26) (-) - z11-4 (VA27) (+)	Always	50 kΩ or more
28	z11-4 (VA27) (-) - z11-26 (VA28) (+)	Always	50 kΩ or more
29	z11-26 (VA28) (-) - z11-3 (VA29) (+)	Always	50 kΩ or more
30	z11-3 (VA29) (-) - z11-23 (VA30) (+)	Always	50 kΩ or more

NOTICE:

- Make sure to check the polarity of each terminal (positive (+) or negative (-)) before connecting a tester.
- Read the resistance after the value has stabilized.
- In order to avoid damaging the terminals of the battery ECU assembly, make sure to use tester probes with a diameter of approximately 0.5 mm (0.0197 in.) when measuring the resistance of the battery ECU assembly.

RESULT	PROCEED TO
The voltage between the terminals is 50 kΩ or more.	A
Other than above	B

Post-procedure1

(c) Install the battery ECU assembly.

A ▶ **REPLACE HV BATTERY**

B ▼

7.	**REPLACE HV BATTERY**

HINT:

Click here INFO

NEXT ▶ **REPLACE BATTERY ECU ASSEMBLY**

8.	**CHECK CONNECTOR CONNECTION CONDITION (BATTERY ECU ASSEMBLY CONNECTOR)**

Click here INFO

RESULT		PROCEED TO
OK		A
Not connected securely	The terminals are not damaged or corroded	B
Not connected securely	The terminals are damaged or corroded	C

B ▶ **CONNECT SECURELY**

C ▶ **REPLACE HV BATTERY**

A ▼

9.	CHECK FREEZE FRAME DATA (HYBRID/EV BATTERY CELL VOLTAGE)

Pre-procedure1

(a) None

Procedure1

(b) Read the value of freeze frame data items "Hybrid/EV battery cell 31 voltage" through "Hybrid/EV battery cell 60 voltage" for DTC P33ED16 and make a note if the value of any is 1.2 V or less.

Powertrain > HV Battery > Trouble Codes

Post-procedure1

(c) Turn the ignition switch off.

NEXT

10.	CHECK HV BATTERY (HV BATTERY CELL VOLTAGE 31 - 60)

CAUTION:

- Be sure to wear insulated gloves and protective goggles.
- Disconnect only the connector corresponding to the HV battery cell to be checked. Do not disconnect the other connectors.

NOTICE:

Make sure to use tester probes with a diameter of approximately 0.5 mm (0.0197 in.) when measuring the voltage of each HV battery cell.

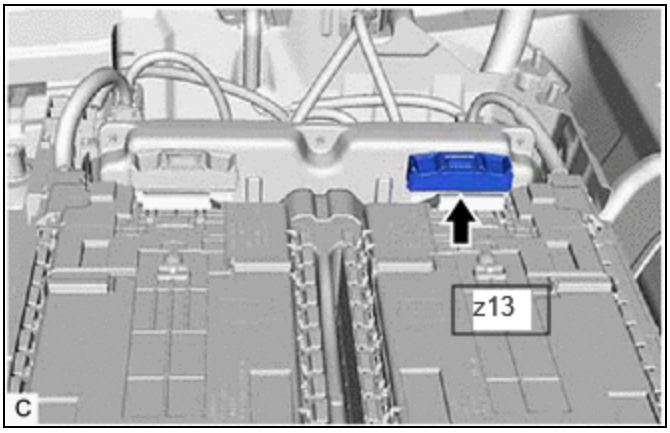
Pre-procedure1

(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 battery ECU assembly connector.



Procedure1

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

HINT:

Measure the voltage of the HV battery cells whose value in the freeze frame data was 1.2 V or less only.

HV BATTERY CELL	TESTER CONNECTION	CONDITION
31	z13-22 (VAD) - z13-44 (VA31)	Always
32	z13-44 (VA31) - z13-21 (VA32)	Always
33	z13-21 (VA32) - z13-43 (VA33)	Always
34	z13-43 (VA33) - z13-20 (VA34)	Always
35	z13-20 (VA34) - z13-42 (VA35)	Always
36	z13-42 (VA35) - z13-19 (VA36)	Always
37	z13-19 (VA36) - z13-16 (VA37)	Always
38	z13-35 (GA2) - z13-12 (VA38)	Always
39	z13-12 (VA38) - z13-34 (VA39)	Always
40	z13-34 (VA39) - z13-11 (VA40)	Always
41	z13-11 (VA40) - z13-33 (VA41)	Always
42	z13-33 (VA41) - z13-10 (VA42)	Always
43	z13-10 (VA42) - z13-32 (VA43)	Always
44	z13-32 (VA43) - z13-9 (VA44)	Always
45	z13-9 (VA44) - z13-31 (VA45)	Always
46	z13-31 (VA45) - z13-8 (VA46)	Always
47	z13-8 (VA46) - z13-30 (VA47)	Always
48	z13-30 (VA47) - z13-7 (VA48)	Always
49	z13-7 (VA48) - z13-29 (VA49)	Always
50	z13-29 (VA49) - z13-6 (VA50)	Always
51	z13-6 (VA50) - z13-28 (VA51)	Always

HV BATTERY CELL	TESTER CONNECTION	CONDITION
52	z13-28 (VA51) - z13-5 (VA52)	Always
53	z13-5 (VA52) - z13-27 (VA53)	Always
54	z13-27 (VA53) - z13-4 (VA54)	Always
55	z13-4 (VA54) - z13-26 (VA55)	Always
56	z13-26 (VA55) - z13-3 (VA56)	Always
57	z13-3 (VA56) - z13-25 (VA57)	Always
58	z13-25 (VA57) - z13-2 (VA58)	Always
59	z13-2 (VA58) - z13-24 (VA59)	Always
60	z13-24 (VA59) - z13-23 (VA60)	Always

CAUTION:

Make sure not to cross the electrodes of an electrical tester measurement terminals.

NOTICE:

Make sure to check the polarity of each terminal (positive (+) or negative (-)) before connecting a tester.

RESULT	PROCEED TO
The voltage between the terminals is 1.2 V or less.	A
Other than above	B

Post-procedure1

(d) Reconnect the battery ECU assembly connector.

B ▶ **REPLACE BATTERY ECU ASSEMBLY**

A ▼

11.	**CHECK BATTERY ECU ASSEMBLY (VAD - VA60)**

NOTICE:

Make sure to use tester probes with a diameter of approximately 0.5 mm (0.0197 in.) when measuring the resistance.

Pre-procedure1

(a) Remove the battery ECU assembly.

HINT:

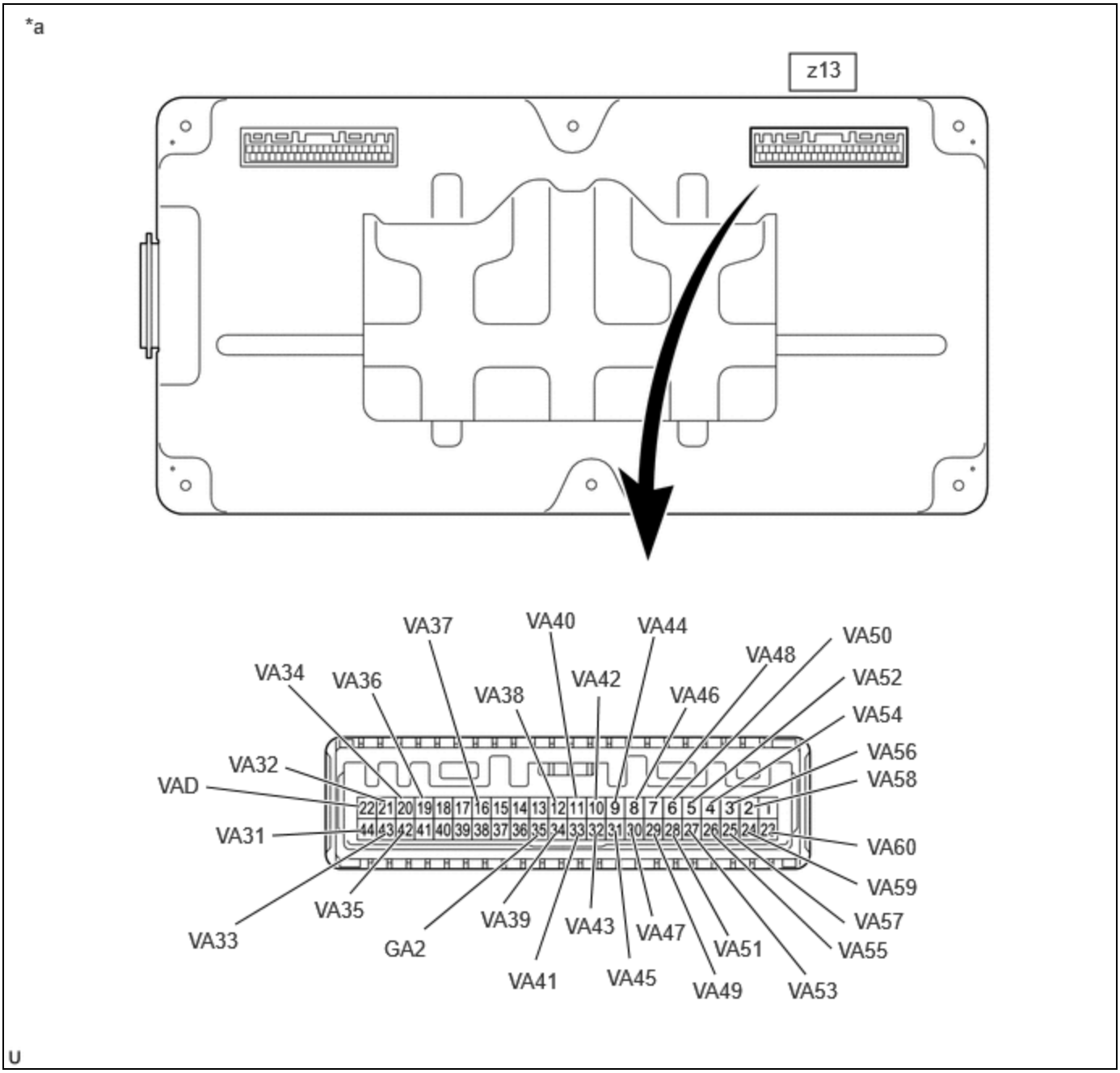
Click here INFO

Procedure1

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

HINT:

Only inspect the terminals of the battery ECU assembly which correspond to the HV battery cells which measured 1.2 V or less in the previous step.



*a	Component without harness connected (Battery ECU Assembly)	-	-

Standard Resistance:

HV BATTERY CELL	TESTER CONNECTION (TESTER PROBE POLARITY)	CONDITION	SPECIFIED CONDITION
31	z13-22 (VAD) (-) - z13-44 (VA31) (+)	Always	50 kΩ or more
32	z13-44 (VA31) (-) - z13-21 (VA32) (+)	Always	50 kΩ or more

HV BATTERY CELL	TESTER CONNECTION (TESTER PROBE POLARITY)	CONDITION	SPECIFIED CONDITION
33	z13-21 (VA32) (-) - z13-43 (VA33) (+)	Always	50 kΩ or more
34	z13-43 (VA33) (-) - z13-20 (VA34) (+)	Always	50 kΩ or more
35	z13-20 (VA34) (-) - z13-42 (VA35) (+)	Always	50 kΩ or more
36	z13-42 (VA35) (-) - z13-19 (VA36) (+)	Always	50 kΩ or more
37	z13-19 (VA36) (-) - z13-16 (VA37) (+)	Always	50 kΩ or more
38	z13-35 (GA2) (-) - z13-12 (VA38) (+)	Always	50 kΩ or more
39	z13-12 (VA38) (-) - z13-34 (VA39) (+)	Always	50 kΩ or more
40	z13-34 (VA39) (-) - z13-11 (VA40) (+)	Always	50 kΩ or more
41	z13-11 (VA40) (-) - z13-33 (VA41) (+)	Always	50 kΩ or more
42	z13-33 (VA41) (-) - z13-10 (VA42) (+)	Always	50 kΩ or more
43	z13-10 (VA42) (-) - z13-32 (VA43) (+)	Always	50 kΩ or more
44	z13-32 (VA43) (-) - z13-9 (VA44) (+)	Always	50 kΩ or more
45	z13-9 (VA44) (-) - z13-31 (VA45) (+)	Always	50 kΩ or more
46	z13-31 (VA45) (-) - z13-8 (VA46) (+)	Always	50 kΩ or more
47	z13-8 (VA46) (-) - z13-30 (VA47) (+)	Always	50 kΩ or more
48	z13-30 (VA47) (-) - z13-7 (VA48) (+)	Always	50 kΩ or more
49	z13-7 (VA48) (-) - z13-29 (VA49) (+)	Always	50 kΩ or more
50	z13-29 (VA49) (-) - z13-6 (VA50) (+)	Always	50 kΩ or more
51	z13-6 (VA50) (-) - z13-28 (VA51) (+)	Always	50 kΩ or more
52	z13-28 (VA51) (-) - z13-5 (VA52) (+)	Always	50 kΩ or more
53	z13-5 (VA52) (-) - z13-27 (VA53) (+)	Always	50 kΩ or more
54	z13-27 (VA53) (-) - z13-4 (VA54) (+)	Always	50 kΩ or more
55	z13-4 (VA54) (-) - z13-26 (VA55) (+)	Always	50 kΩ or more
56	z13-26 (VA55) (-) - z13-3 (VA56) (+)	Always	50 kΩ or more
57	z13-3 (VA56) (-) - z13-25 (VA57) (+)	Always	50 kΩ or more
58	z13-25 (VA57) (-) - z13-2 (VA58) (+)	Always	50 kΩ or more
59	z13-2 (VA58) (-) - z13-24 (VA59) (+)	Always	50 kΩ or more
60	z13-24 (VA59) (-) - z13-23 (VA60) (+)	Always	50 kΩ or more

NOTICE:

- Make sure to check the polarity of each terminal (positive (+) or negative (-)) before connecting a tester.
- Read the resistance after the value has stabilized.
- In order to avoid damaging the terminals of the battery ECU assembly, make sure to use tester probes with a diameter of approximately 0.5 mm (0.0197 in.) when measuring the resistance of the battery ECU assembly.

RESULT	PROCEED TO
The voltage between the terminals is 50 kΩ or more.	A

RESULT	PROCEED TO
Other than above	B

Post-procedure1

(c) Install the battery ECU assembly.

A ▶ **REPLACE HV BATTERY**

B ▼

12.	**REPLACE HV BATTERY**

HINT:

Click here INFO

NEXT ▶ **REPLACE BATTERY ECU ASSEMBLY**