High Voltage (HV) Battery Rescue Charge (HEV Workstation / GRX-5100)

Introduction

This bulletin includes basic procedures for performing a rescue charge on Ni-MH high voltage (HV) batteries. This bulletin should be used in conjunction with the applicable model and model year Repair Manual while performing a rescue charge. The GRX-5100 should be used wherever the Repair Manual references the Toyota Hybrid System (THS) charger.

Warranty Information

<table>
<thead>
<tr>
<th>OP CODE</th>
<th>DESCRIPTION</th>
<th>TIME</th>
<th>OFP</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Not Applicable to Warranty</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
### Required Tools & Equipment

<table>
<thead>
<tr>
<th>SPECIAL SERVICETOOLS (SST)</th>
<th>PART NUMBER</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Voltage Battery Service Unit*</td>
<td>01413-00002</td>
<td>1</td>
</tr>
<tr>
<td>Interface ECU* – 64</td>
<td>01413-00017</td>
<td>1</td>
</tr>
<tr>
<td>High Voltage Cable* (A)</td>
<td>01413-00013</td>
<td>1</td>
</tr>
<tr>
<td>High Voltage Cable* (B)</td>
<td>01413-00014</td>
<td>1</td>
</tr>
<tr>
<td>High Voltage Cable* (C)</td>
<td>01413-00015</td>
<td>1</td>
</tr>
<tr>
<td>High Voltage Cable* (D)</td>
<td>01413-00016</td>
<td>1</td>
</tr>
<tr>
<td>High Voltage Cable* (E)</td>
<td>01413-00009</td>
<td>1</td>
</tr>
<tr>
<td>High Voltage Cable* (G)</td>
<td>01413-00018</td>
<td>1</td>
</tr>
<tr>
<td>Universal High Voltage Cable* (V)</td>
<td>01413-00007</td>
<td>1</td>
</tr>
<tr>
<td>Interlock Connector*</td>
<td>01413-00003</td>
<td>1</td>
</tr>
<tr>
<td>Stack Balance Cable* (I)</td>
<td>01413-00024</td>
<td>1</td>
</tr>
<tr>
<td>Low Voltage Cable* (P)</td>
<td>01413-00022</td>
<td>1</td>
</tr>
<tr>
<td>Low Voltage Cable* (Q)</td>
<td>01413-00023</td>
<td>1</td>
</tr>
<tr>
<td>Low Voltage Cable* (R)</td>
<td>01413-00004</td>
<td>1</td>
</tr>
<tr>
<td>Cell Voltage Cable* (J)</td>
<td>01413-00019</td>
<td>1</td>
</tr>
<tr>
<td>Cell Voltage Cable* (L)</td>
<td>01413-00021</td>
<td>1</td>
</tr>
<tr>
<td>Temperature Sensor Cable* (K)</td>
<td>01413-00020</td>
<td>1</td>
</tr>
<tr>
<td>Universal Fuse Box*</td>
<td>01413-00010</td>
<td>1</td>
</tr>
<tr>
<td>AC Power Cord* (S)</td>
<td>01413-00005</td>
<td>1</td>
</tr>
<tr>
<td>D/C Adapter Kit* (T&amp;U)</td>
<td>01413-00006</td>
<td>1</td>
</tr>
<tr>
<td>Banana Jack Extension Cable* (X)</td>
<td>01413-00031</td>
<td>1</td>
</tr>
<tr>
<td>AC Circuit Checker*</td>
<td>01413-00012</td>
<td>1</td>
</tr>
<tr>
<td>Battery Diagnostic Tool*</td>
<td>DCA-8000P T</td>
<td>1</td>
</tr>
</tbody>
</table>

*Essential SST.

**NOTE**

Additional SSTs may be ordered by calling 1-800-933-8335.
Required Tools & Equipment (continued)

<table>
<thead>
<tr>
<th>REQUIRED EQUIPMENT</th>
<th>SUPPLIER</th>
<th>PART NUMBER</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Techstream ADVi*</td>
<td>ADE</td>
<td>TSADVUNIT</td>
<td>1</td>
</tr>
<tr>
<td>Techstream 2.0</td>
<td>ADE</td>
<td>TS2UNIT</td>
<td></td>
</tr>
<tr>
<td>Techstream Lite</td>
<td>ADE</td>
<td>TSLITEPDLR01</td>
<td></td>
</tr>
<tr>
<td>Techstream Lite (Green Cable)</td>
<td>ADE</td>
<td>TSLP2DLR01</td>
<td></td>
</tr>
</tbody>
</table>

*Essential SST

**NOTE**
- Only ONE of the Techstream units listed above is required.
- Software version 15.00.028 or later is required.
- Additional Techstream units may be ordered by calling Approved Dealer Equipment (ADE) at 1-800-368-6787.

---

Rescue Charge Ni-MH

1. Inspect the vehicle.
   A. Inspect the auxiliary battery voltage.

   **NOTE**
   - Standard Voltage is approximately 11V or more.
   - If the voltage is less than 11V, charge the auxiliary battery or replace it with an auxiliary battery that is already charged.
Rescue Charge Ni-MH (continued)

2. Inspect the HV battery.

   **CAUTION**
   - ALWAYS wear the appropriate Personal Protective Equipment (PPE) provided in the HEV Workstation when working with high voltage. (Insulated gloves, insulated apron, and arc protective helmet w/ face shield.)
   - ALWAYS use insulated tools when working with high voltage.
   - ALWAYS use the cones, barriers and high voltage car toppers provided in the HEV Workstation to create a perimeter around the vehicle and work area.

   **HINT**
   - Removing the service plug grip interrupts the high voltage circuit.
   - High voltage wiring connectors are orange.

   A. Check the charge level of the HV battery.

   B. Check whether the HV battery warning message is shown in the vehicle’s multi-information display.

   C. Confirm whether the engine starts.

      Does the engine start?
      - YES — Go to step 6.
      - NO — Continue to step 3.

3. Connect the GRX-5100 for a rescue charge.

   **NOTE**
   - ALWAYS use Techstream to troubleshoot the hybrid system before attempting an HV battery charge.
   - Charging time while using the GRX-5100 is 10 minutes per charge cycle when the battery temperature is above 77°F (25°C).
   - If the battery temperature is below 32°F (0°C), then three 10-minute charge cycles may be required for putting the engine in a condition where it can be started (the system can enter the READY ON state).
   - The GRX-5100 will automatically stop 10 minutes AFTER charging starts.

   A. Disconnect the 12V auxiliary battery.
Rescue Charge Ni-MH (continued)

B. Use the table below to select the high voltage and low voltage cables for a specific model. Some vehicles may also require a high voltage accessory.

Table 1.

<table>
<thead>
<tr>
<th>MODEL NAME</th>
<th>MODEL YEAR</th>
<th>MODEL CODE</th>
<th>PART NUMBER/MODEL APPLICATION</th>
<th>HIGH VOLTAGE CABLES</th>
<th>LOW VOLTAGE CABLE/HV BONDING CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>01413-00010 UNIVERSAL FUSE BOX</td>
<td>01413-00007 HV* CABLE A</td>
<td>01413-00007 HV* CABLE E</td>
</tr>
<tr>
<td>Avalon HV</td>
<td>2013 – 2018</td>
<td>AVX40</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Camry HV</td>
<td>2007 – 2011</td>
<td>AVH40</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>2012 – 2017</td>
<td>AVV50</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Highlander HV</td>
<td>2006 – 2007</td>
<td>MHU23</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>2008 – 2010</td>
<td>MHU28</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>2011 – 2013</td>
<td>GVU48</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>2014 – 2019</td>
<td>GVU58</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Prius</td>
<td>2001 – 2003</td>
<td>NHW11</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>2004 – 2009</td>
<td>NHW20</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>2010 – 2015</td>
<td>ZVW30</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Prius C</td>
<td>2012 – 2019</td>
<td>NHF10</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Prius V</td>
<td>2012 – 2017</td>
<td>ZVW41</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RAV4 HV</td>
<td>2016 – 2018</td>
<td>AAV44</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*HV = High Voltage
**LV = Low Voltage

C. Connect the power input (Cable S) to the GRX-5100 and connect the cable into a grounded AC 100 to 240V receptacle.

NOTICE

ALWAYS confirm the AC 100 to 240V receptacle has a properly functioning ground by using the AC Circuit Checker provided in the HEV Workstation. The ground is designed to reduce the chance of electric shock if a malfunction occurs. Do NOT use the charger if ANY of the pins on the plug (Cable S) have been damaged or removed.

D. Turn the GRX-5100 ON.
Rescue Charge Ni-MH (continued)

E. Select RESCUE CHARGE by using the arrow key, then press SELECT.

F. Confirm you are wearing the appropriate PPE for high voltage service.

CAUTION
ALWAYS wear the appropriate PPE when working with high voltage: Insulated gloves, insulated apron, and arc protective helmet w/face shield.

G. Press YES.

H. Press NEXT.

NOTE
Refer to the applicable model and model year Repair Manual for vehicle specific instructions for disassembly and connector locations.
High Voltage (HV) Battery Rescue Charge (HEV Workstation / GRX-5100)

Rescue Charge Ni-MH (continued)

I. Remove the service plug grip.

NOTE
Refer to the applicable model and model year Repair Manual at TIS – Engine Hybrid System – Hybrid/Battery Control System – HV Battery Charging for the appropriate wait time AFTER the high voltage service plug grip is pulled.

J. Press YES.

K. Remove the inverter terminal cover.

L. Check the terminal voltage.

HINT
Standard voltage is 0V.

Figure 4.

WARNING
ENSURE THE HIGH VOLTAGE SERVICE PLUG IS REMOVED

Figure 5.
Rescue Charge Ni-MH (continued)

M. Disconnect the frame wire.

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

<table>
<thead>
<tr>
<th>TESTER CONNECTION</th>
<th>CONDITION</th>
<th>SPECIFIED CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Wire Connector Housing – Body Ground</td>
<td>Always</td>
<td>Below 1 Ω</td>
</tr>
</tbody>
</table>

**NOTE**
If the shielding of the frame wire is NOT securely connected to body ground, the GRX-5100 will NOT operate.

O. If the results are NOT as specified, inspect the connection according to the applicable model and model year Repair Manual at TIS – Engine Hybrid System – Hybrid/Battery Control System – HV Battery Charging for proper installation.
Rescue Charge Ni-MH (continued)

P. Connect the corresponding high voltage cable to the fuse box.

Q. Connect High Voltage Cable V to the fuse box.

R. Connect High Voltage Cable V to the GRX-5100.

S. Connect the corresponding low voltage cable to the GRX-5100.

T. Install the inverter terminal cover to the inverter assembly.

NOTICE

- Do NOT allow any foreign material or water to enter the inverter assembly.
- Make sure ALL connectors are securely connected.

CAUTION

- ALWAYS wear insulated gloves and the appropriate PPE provided in the HEV Workstation when working with high voltage.
- ALWAYS use insulated tools provided in the HEV Workstation when working with high voltage.

U. Connect the green high voltage bonding cable to a suitable chassis ground.

V. Press NEXT.
Rescue Charge Ni-MH (continued)

W. Connect the low voltage cable to inverter terminal cover.

X. Press NEXT.

Y. Connect the high voltage cable to the vehicle’s frame wire.

Z. Press NEXT.

NOTE
- Certain high voltage cables require a grounding bolt to complete the high voltage bonding test.
- High voltage cables requiring a grounding bolt have been labeled using a black sticker indicating bolt location, size, and torque.
Rescue Charge Ni-MH (continued)

AA. Install the interlock connector in the inverter.

NOTE
The battery charge active test will fail and a DTC will set if the interlock connector is NOT installed.

BB. Inspect the connection according to the applicable model and model year Repair Manual at TIS – Engine Hybrid System – Hybrid / Battery Control System – HV Battery Charging for proper installation.

NOTE
An overall view of connectors and their connections for the GRX-5100 during a high voltage battery rescue charge is shown in Figure 11.
High Voltage (HV) Battery Rescue Charge (HEV Workstation / GRX-5100)

Rescue Charge Ni-MH (continued)

CC. Wait for the internal test to complete.

Figure 12.

DD. Install the service plug grip.

EE. Press NEXT.

Figure 13.

FF. Connect the negative (–) terminal of the auxiliary battery.

NOTE
Using the power supply mode, connect the Battery Diagnostic Tool to the auxiliary battery.

GG. Wait for the high voltage bonding test to complete.

Figure 14.
4. HV battery rescue charging.
   A. Turn the vehicle power switch to the IG-ON position.
   B. Connect Techstream to DLC3.
   C. Refer to the following menus: Powertrain – Hybrid Control – Active Test – Battery Charge.

   **HINT**
   During the battery charge active test, check the System Main Relay Status – SMRB and the System Main Relay Status – SMRG on the data list.

   D. Open the battery charge active test and click the ON button on Techstream. Then press NEXT on the GRX-5100 to start HV battery charging within 30 seconds.

---

**NOTE**

- **AFTER** the battery charge active test has been turned ON, press the NEXT button on the GRX-5100 within 30 seconds. If the NEXT button is NOT pressed within the 30 seconds, the SMR will open and the GRX-5100 will NOT be able to charge the HV battery.
- **If** the shielding of the frame wire is NOT securely connected to body ground, the GRX-5100 will NOT operate.
- The GRX-5100 charging condition status will be displayed on the screen of the GRX-5100 while charging the HV battery.
- **During** the HV battery charge cycle, the voltage and charge current will be recorded on the flash drive.
- The GRX-5100 will automatically stop 10 minutes **AFTER** charging starts. SMRs will automatically open as soon as the GRX-5100 stops charging.
- **If** the data list values are NOT as specified in the table below, restart Techstream and cycle the vehicle’s power switch to the IG-ON/OFF positions, and then perform the HV battery rescue charging procedure again.

---

<table>
<thead>
<tr>
<th>STEP</th>
<th>ACTIVE TEST BATTERY CHARGE</th>
<th>GRX-5100 START SWITCH</th>
<th>DATA LIST SYSTEM MAIN RELAY STATUS – SMRB</th>
<th>DATA LIST SYSTEM MAIN RELAY STATUS – SMRG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>2</td>
<td>OFF → ON</td>
<td>OFF</td>
<td>OFF → ON</td>
<td>OFF → ON</td>
</tr>
<tr>
<td>3</td>
<td>ON</td>
<td>OFF → ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>
Rescue Charge Ni-MH (continued)

E. Wait for the HV battery rescue charge to start.

F. Repeat the charge cycle up to three times if required.

NOTE
- Charging time while using the GRX-5100 is 10 minutes per charge cycle when the battery temperature is above 77°F (25°C).
- If the battery temperature is below 32°F (0°C), then three 10-minute charge cycles may be required for putting the engine in a condition where it can be started (the system can enter the READY ON state).
- The GRX-5100 will automatically stop 10 minutes AFTER charging starts.
- There is VERY LITTLE chance of overcharging the HV battery during the second or third charging cycle. The SOC will not likely increase beyond the upper limit because it was low enough to prevent the engine from starting. Even if the SOC were to increase enough to exceed the limit, the hybrid vehicle control ECU will stop the Active Test to prevent overcharging.
- Cranking the engine once causes the SOC to drop approximately 1%.
- Charging the HV battery once (10 minutes) using the GRX-5100 restores the SOC approximately 2%.

Figure 16.

<table>
<thead>
<tr>
<th>CHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETTING UP RESCUE CHARGE</td>
</tr>
<tr>
<td>PLEASE WAIT............</td>
</tr>
</tbody>
</table>

Figure 17.

<table>
<thead>
<tr>
<th>CHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLTAGE: 216.9V</td>
</tr>
<tr>
<td>CURRENT: 1.5A</td>
</tr>
<tr>
<td>AMP HOURS: 0.31AH</td>
</tr>
<tr>
<td>TIME: 00:05:31</td>
</tr>
<tr>
<td>ELAPSED: 00:05:31</td>
</tr>
<tr>
<td>REMAINING: 00:05:29</td>
</tr>
<tr>
<td>STOP</td>
</tr>
</tbody>
</table>
5. Reassemble the vehicle.

**CAUTION**
- ALWAYS wear insulated gloves and the appropriate PPE provided in the HEV Workstation when working with high voltage.
- ALWAYS use insulated tools provided in the HEV Workstation when working with high voltage.

A. Turn the GRX-5100 power switch OFF.
B. Turn the vehicle power switch OFF.
C. Disconnect 12V auxiliary battery.
D. Remove the service plug grip.
E. Remove the GRX-5100 cables and interlock connector.
F. Reassemble the vehicle following the applicable model and model year Repair Manual at TIS – Engine Hybrid System – Hybrid/Battery Control System – HV Battery Charging.
G. Install the service plug grip.
H. Connect the 12V auxiliary battery.
I. Check for ANY DTCs.
J. Confirm whether the engine cranks.
   - Does the engine crank?
     - **YES** — Continue to sub step K.
     - **NO** — Repeat steps 3 – 5.
K. Confirm whether the engine starts.
   - Does the engine start?
     - **YES** — Continue to step 6.
     - **NO** — Continue diagnosis using the applicable Repair Manual.

6. Allow the vehicle to idle in park “P” until the engine stops. Once the engine stops, self-charge has been completed.