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The symptoms of a failed Master Lithium Energy Control circuit board (MLEC) include flashing yellow “power limit” light on the instrument cluster, failure of the vehicle to ready-on/drive (green car light on center console does not illuminate), red battery warning light on the center console illuminates, failure of the vehicle to charge when connected to external power, and the sound of contactors closing upon key-on and then opening shortly thereafter. The battery management system (BMS) will store trouble codes for “Max number of precharge retries exceeded,” “Contactor precharge timeout fault,” and sometimes “Short circuit at contactor precharge.” This procedure explains how to remove and replace a failed MLEC, and requires a lift that can allow the battery to be lowered straight down from the vehicle and fixture capable of evenly supporting the 550 lb battery. It is very helpful if the battery support fixture is at or above waist height.

Because it’s easy to skip the re-assembly directions as you are working through the procedure in reverse, I want to call attention to (“pre-iterate”) the possibility of the parking brake cables and low voltage wire harness being pinched during traction battery re-installation.

In the passenger compartment:

- Verify a failed MLEC by retrieving fault codes using TechCentre.
- Record radio presets.

Under the car:

- Lift the vehicle such that the traction battery can be removed. The lift points in the rear need to be located far enough back and outboard that the battery can be dropped straight down. It is also important that the vehicle be lifted parallel to the floor, so that when the vehicle is lowered onto a support fixture for the battery, the fixture and the battery will be well aligned.
- Disconnect the 12V battery. (10mm)
- Remove the four bolts that mount the cable housing to the body of the car just forward of the battery. (8mm)
- Remove the cable housing by pulling the grommets for each of the high voltage frame wires and the low voltage harness out the top of the housing.

- Each of the three cable/harnesses is secured to the bottom of the car by plastic cable ties mounted on studs. Pull the cables ties down off of the studs to allow the cables more slack.

Some Think vehicles are equipped with an additional sheet metal shield under the traction battery. If there is a shield under the traction battery, it will look very similar to a battery without the shield except that vents will be cut in the center of the shield and the shield will be secured to the car by all but six of the bolts that secure the battery to the car—two on each side, the center bolt in front and the center bolt in back. Do not remove the four bolts (two on each side) that secure the battery to the car; the front and rear center bolts may be removed. Remove the shield by removing all but two of the bolts that secure it—one at each corner—and loosen the final two bolts. Pry the shield away from the vehicle until it hangs freely by the two remaining bolts. Ask an assistant to help support the shield while removing the final bolts. There is no need to re-install the shield unless the customer is likely to take the Think off-roading.

- With all but four bolts remaining, position the battery support fixture approximately beneath the battery.
- Lower the car until the battery is only a few inches above the support fixture.
- Precisely position the battery support fixture and lock its wheels.

The next 4 (or preferably 10) steps must be undertaken cautiously and without interruption. The car and battery will be in a very unstable configuration until the two are fully separated with the car supported fully by the lift and the battery (and only the battery) supported fully by the fixture.

- Slowly lower the car so the battery just barely contacts the fixture, but does not load it. Take measures to ensure that the lift will not be inadvertently lowered any further.
- Use shims to ensure that the battery is firmly in contact with the fixture at every corner.
- Remove the final four bolts that secure the battery to the car.
- Lift the car slightly while watching the battery to ensure that it is fully disengaged from the car. The low voltage and high voltage cables (and the ground strap) will not be disconnected from the car at this point. It takes a very specific tool to disconnect the high voltage cables from the battery with the battery fully installed in the car. This procedure assumes that you do not have such a tool.
- Lift the car approximately 6 inches so the connectors at the front of the battery are fully visible. There is very limited slack in the cables to lift much further.
- Disconnect the high voltage connector using a small screwdriver to pry out on the locking tab while pushing or pulling down on the connector. (The high voltage cables look like they have individual connectors (one positive, one negative) going into the battery, but in fact this is only a part of the connector assembly: Do not attempt to disconnect the cables from the bottom side of the connector assembly. The connector assembly (which you are disconnecting from the battery in this step) only has one locking tab to secure both cables to the battery. I use the tip of a small pry bar positioned above the connector assembly and give it a twist to push the connector down as I have the locking tab disengaged using a small screwdriver.)
- Disconnect the low voltage connector by twisting the locking ring counterclockwise.

- Hang the frame wires and low voltage harness to the side so they do not snag on the flange of the battery as the car is raised.
- Raise the car approximately another 12 inches so the ground strap on top of the battery is accessible, and disconnect the ground strap. (10mm)
- Raise the car to its maximum height.
- Inspect the low voltage wire harness loom and verify that it has not been pinched during previous battery installation. If the loom is pinched, cut away enough to inspect the wires inside for damage and make repairs as required. Install new loom and electrical tape.
- The following steps only apply if a new MLEC will be installed. If the MLEC will be repaired or is simply being inspected, skip to the step of cutting the Enerdel seal.
- Connect a computer to the traction battery through the PCAN adapter and a modified low voltage harness.
- Apply 12V to the B+, key-on, and Emergency Power Off (EPO) wires of the low voltage harness and ground to the B- wire.

Open EEPROM Data Tool v3.08:

- Click on “Select EEPROM Data Map File” and select “A306_Build_27_BMSEE.CFG”. (After selecting this program for the first time it will automatically be selected when re-opening the program in the future.)
- Click “Read EEPROM” and verify that values populate the boxes.
- Click “Save Values to File” and select a location and filename.

This file will be retrieved and written to the new MLEC once it has been installed. I have been using the following format: “[5-digit battery serial number][single character part number suffix, usually F]_[Owner’s last name]_[Date of MLEC replacement]”

For example: 00737E_Linn_02-18-2013.DVAL (The “.DVAL” extension will be added automatically.)

- Disconnect the modified low voltage harness from the battery.
- Cut the Enerdel seal on the panel on the left (port) side front of the battery and remove the bolts. (3mm hex)
- The panel will fold forward as if hinged along the bottom edge.

In the unlikely event that a contactor is stuck closed, there is the possibility of high voltage being present on the MLEC. The most likely place for a technician to be exposed to high voltage while working on the MLEC is the back side of the two white connectors. Avoid touching those areas.

- Carefully disconnect all of the connectors.
- Remove the 6 bolts that mount the MLEC to the panel. (Philips #2?)
- Inspect all wiring to the MLEC for damage that may have been caused by the precharge resistor catching on fire. Make repairs and install a ribbon cable repair kit as necessary.

Install the new MLEC in reverse order of removal with the following exceptions:

When the new MLEC has been installed in the battery and the panel is secure, connect the computer to the battery through the modified low voltage harness, and apply 12V power and ground. Ignore these programming steps if the same MLEC is reinstalled.

Open the EEPROM Data Tool v3.08:

- Click "Read EEPROM" and verify the fields populate.
- Click "Read Values from File" and select the file that was saved in previous steps.
- Click "Write EEPROM" and verify that the "Write EEPROM" button momentarily turns green and displays "Write OK".
- Close EEPROM Data Tool.
- Open Programming Tool V4.16 (ProgTool_4_16):
- Click the box next to "Use CAN" so that it is checked.
- Click "Browse..." and select "MLec_A306_427.s19"
- Click "Start" and verify that in the box labeled "Response:" the programming procedure is running.
- When the Response box reads "Application code is running. Flash operation is complete." click "Exit".
- Disconnect the modified low voltage harness from the battery and resume installation in reverse order of removal.

When lowering the car down onto the battery after the ground strap has been bolted on and the connectors connected, verify that the parking brake cables at the rear of the battery and the wire harnesses at the front of the battery (especially the black low voltage convoluted loom) do not get pinched between the battery and the car frame. When reinstalling the bolts that secure the battery to the car, an alignment punch may be required. I install the 4 bolts that were last to be removed (snug, but not tight so the battery can shift if bolt holes need to be aligned), raise the vehicle to a comfortable working height and then install the remaining bolts

After all bolts are installed, torque to 20Nm.

In the passenger compartment:

- Turn the key on and verify the contactors close, and the "power limit" light does not flash.
- Turn the key to the start position and verify that the green car light on the center console illuminates.
- Connect a computer through the PCAN adapter to the DLC, open CommTool and clear BMS fault codes.
- Connect a computer through the VIM to the DLC, open TechCentre and check for fault codes in all modules.
- Re-program radio settings, presets and clock.
- Test drive and put on charger.