

## Tech Note: Rapid Mate Inspection

Tech Notes are internal announcements that help to communicate and track new information about Tesla Service concerns.

Improper sealing of the HV Rapid Mate (Figures 1 and 2) can allow water ingress. This can result in isolation faults and, in extreme cases, damage to the Rapid Mate connection points. Any time the HV battery pack is removed, follow the care points in this tech note.

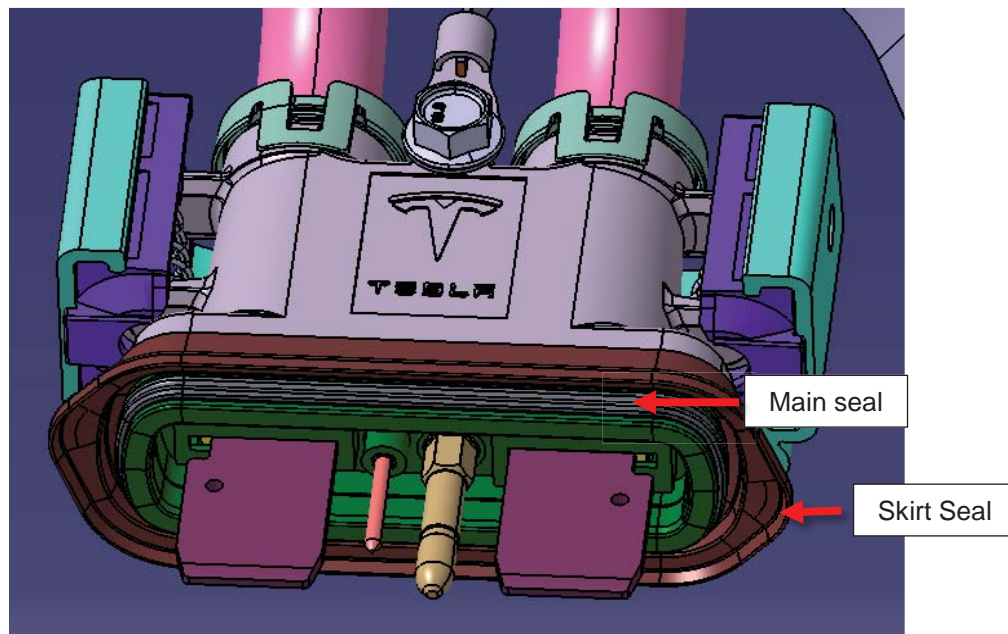


Figure 1 (Vehicle-side Rapid Mate connection)

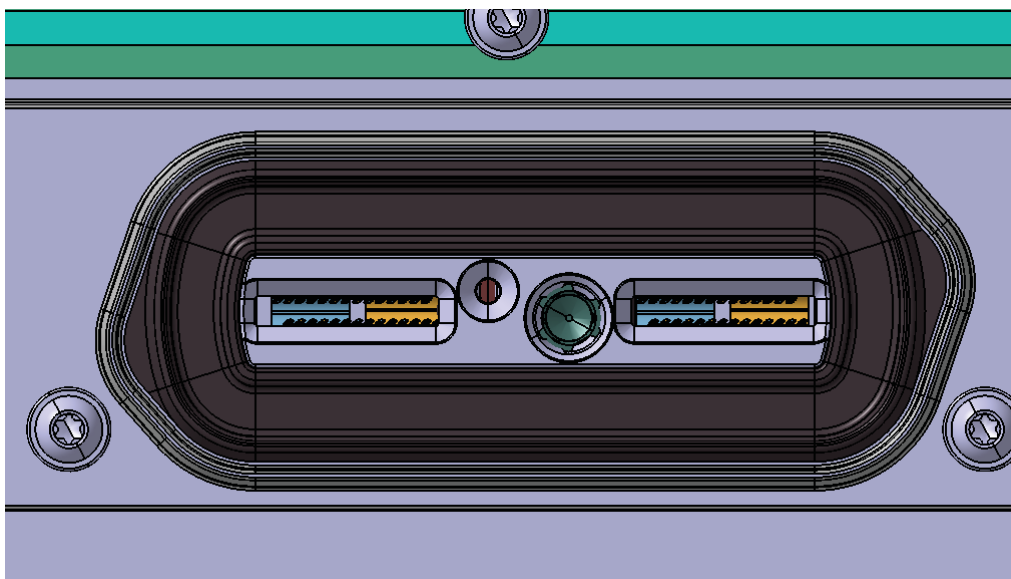


Figure 2 (Battery-side Rapid Mate connection)

## Before Removing the HV Battery Pack

Use a boroscope to take a picture of the Rapid Mate seating (Figure 3) and attach it to a new ATTAC case. Other care points in this bulletin will require pictures to attach to the ATTAC case. Submit the ATTAC case after completing all care points in this document.



**Figure 3 (Boroscope picture of Rapid Mate connection)**

## When Removing the HV Battery Pack

When removing the HV battery, note whether any water was present in the Rapid Mate connection. Minor water ingress is acceptable, but if water flows out, which might indicate that there was a large amount of standing water in the connection, then there is a high probability of damage. Take high resolution pictures of both the vehicle-side and battery-side Rapid Mate connectors and attach them to the ATTAC case. The pictures should be taken from the same orientation and show the same details as shown in Figures 1 and 2.

## After Removing the Pack

### Inspect the Skirt Seal

Inspect the skirt seal on the vehicle-side HV Rapid Mate. The seal is pliable, but can become permanently deformed (Figures 4 and 5) during removal and reinstallation of the HV battery pack. In the “After Securing the Battery Pack” section, it is necessary to confirm proper seating with a boroscope. Therefore:

- If the long, straight section of the seal on the front side of the vehicle is deformed, replace the vehicle-side HV Rapid Mate, because this area is not visible with a boroscope once the battery is reattached.
- If the long, straight section of the skirt seal on the rear side of the vehicle is deformed, mold it back into place, if possible. Follow the steps in the “After Securing the Battery Pack” section to ensure proper seating. If the seal is permanently deformed, replace the vehicle-side HV Rapid Mate.



Figure 4 (Seal deformed outwards)



Figure 5 (Seal deformed inwards)

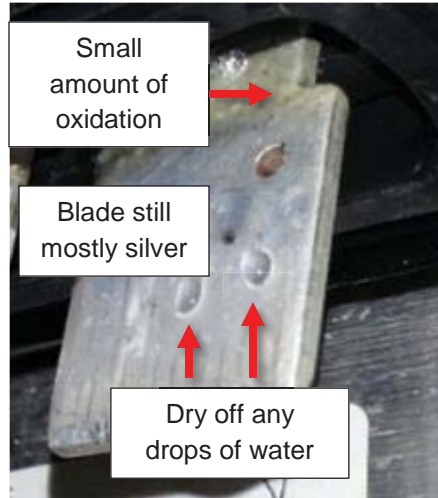
## Inspect the Vehicle-side HV Rapid Mate

1. Clean the vehicle-side HV blades, pins, and plastic insulator plate with isopropyl alcohol and a non-abrasive cloth. Thoroughly dry all parts.

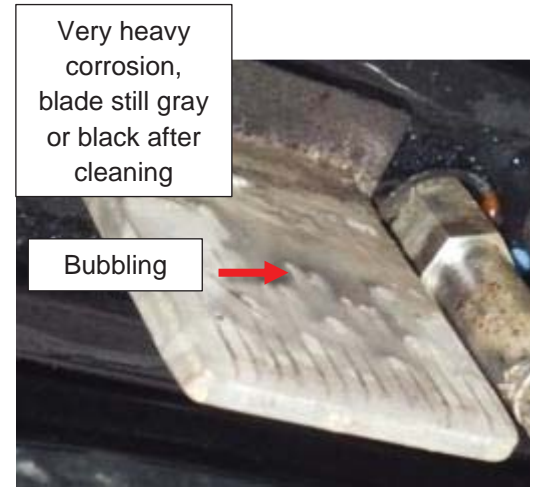
2. Inspect the blades and pins for signs of corrosion (Figures 6-8). A small amount of discoloration is acceptable, but if any silver is flaking off, or is bubbled or cracked, replace the vehicle-side HV Rapid Mate. If there is any doubt whether there is corrosion, take high resolution pictures and attach them to the ATTAC case.



✓ Ideal  
Figure 6



✓ Acceptable  
Figure 7



✗ Unacceptable  
Figure 8

3. Inspect the blades, pins, and plastic insulator plate for signs of arc-tracking (Figures 9 and 10). If the plastic insulator plate is deformed, cracked, or melted, or if the metal on the blades or pins is discolored or deformed, replace the vehicle-side HV Rapid Mate. If there is any doubt whether there is arc-tracking, take high resolution pictures and attach them to the ATTAC case.



Figure 9

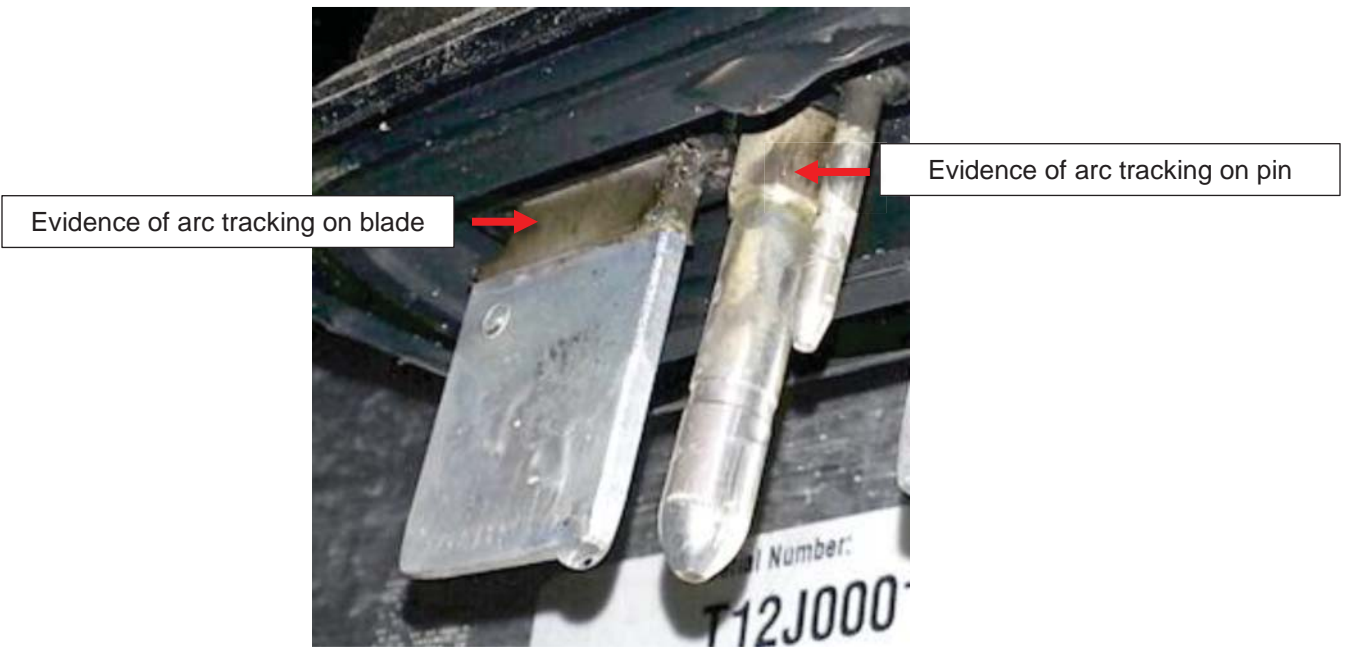


Figure 10

## Inspect the Battery-side HV Rapid Mate

1. Clean the plastic insulator with isopropyl alcohol and a non-abrasive cloth.
2. Inspect the battery-side HV Rapid Mate for signs of arc-tracking (Figure 11).



**Figure 11**

3. Use shop air to clean dirt and other foreign debris out the connectors, even if there is no visible debris. Take high resolution pictures of the connectors and attach them to the ATTAC case.

## Blade Alignment

Examine the blades on the vehicle-side of the HV Rapid Mate (Figures 12 and 13). If the blades are far out of alignment, gently use nylon-tipped pliers to position the blades back into place. If the blades cannot be corrected, replace the vehicle-side HV Rapid Mate.



✓ Acceptable  
Figure 12



✗ Unacceptable  
Figure 13

## Before Attaching the HV Battery Pack

Use a Q-tip to gently apply P-80 emulsion (1028374-00-A) on the inside of the skirt seal and the outside of the main seal (Figure 14).

**⚠ CAUTION:** Do not get any emulsion on the blades, pins, or plastic insulator plate.

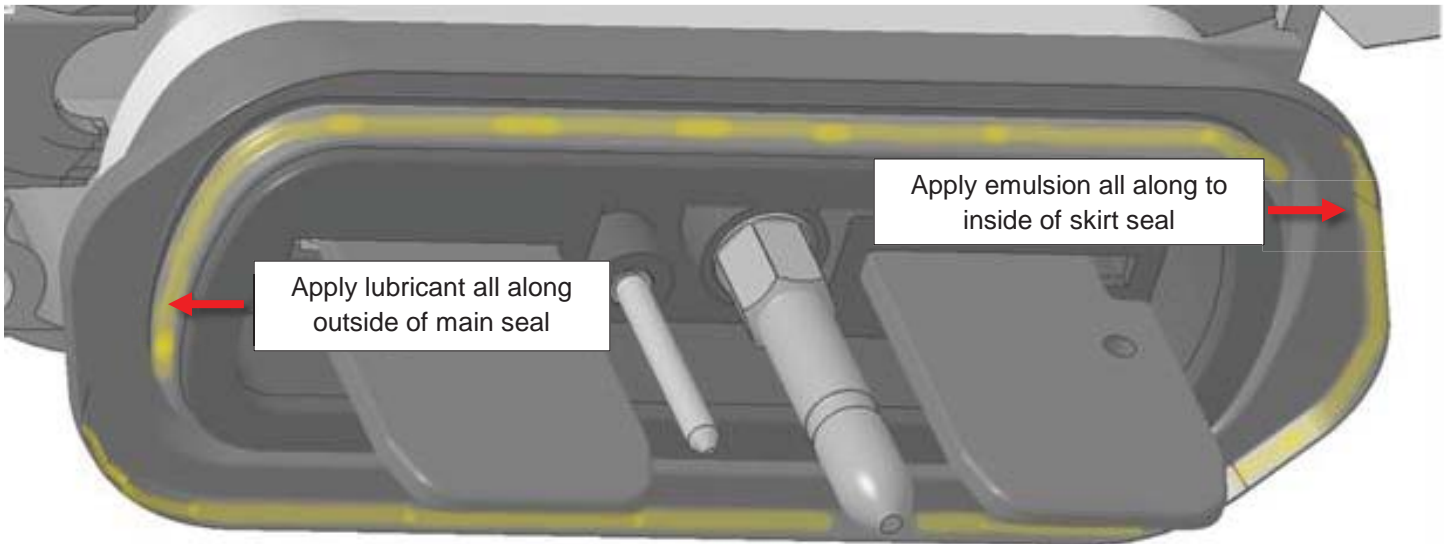


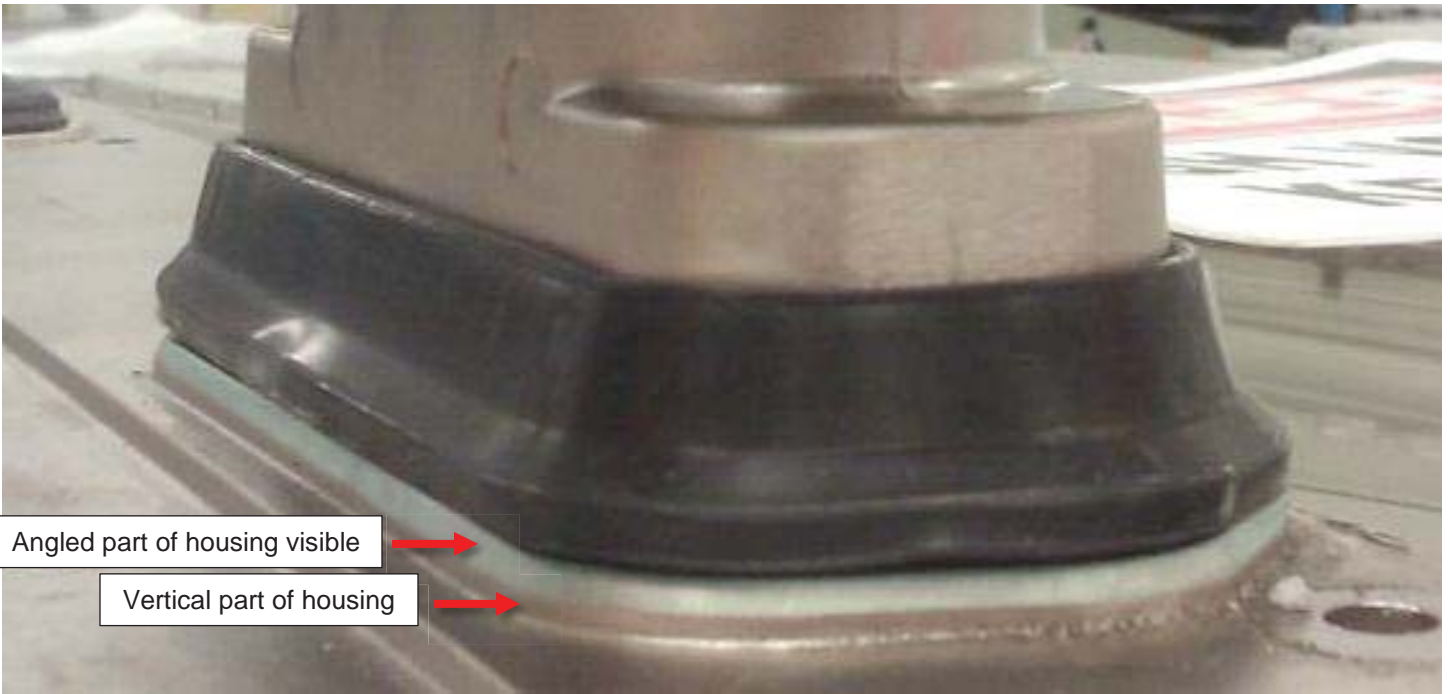
Figure 14

## After Securing the Battery Pack

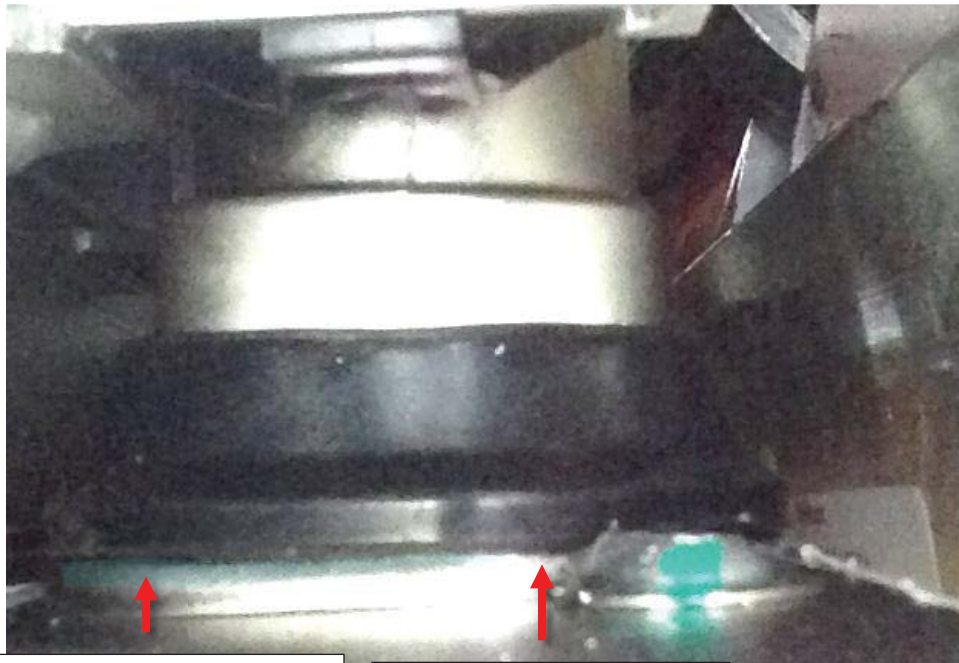
**NOTE:** Do not install the rear undershield yet.

1. Reach in front of the rear subframe and pull down hard on the vehicle-side HV Rapid Mate to make sure that it is fully mated to the battery-side Rapid Mate.
2. Use a mirror or boroscope to check the HV Rapid Mate connection. Check whether the skirt seal is fully seated on the battery. The battery-side Rapid Mate housing is vertical at the bottom, then angles inward. The skirt seal must completely cover the angled part of the housing (Figures 15-18). If the skirt seal cannot fully seat, use a boroscope to take a picture of the seal, and attach it to the ATTAC case.

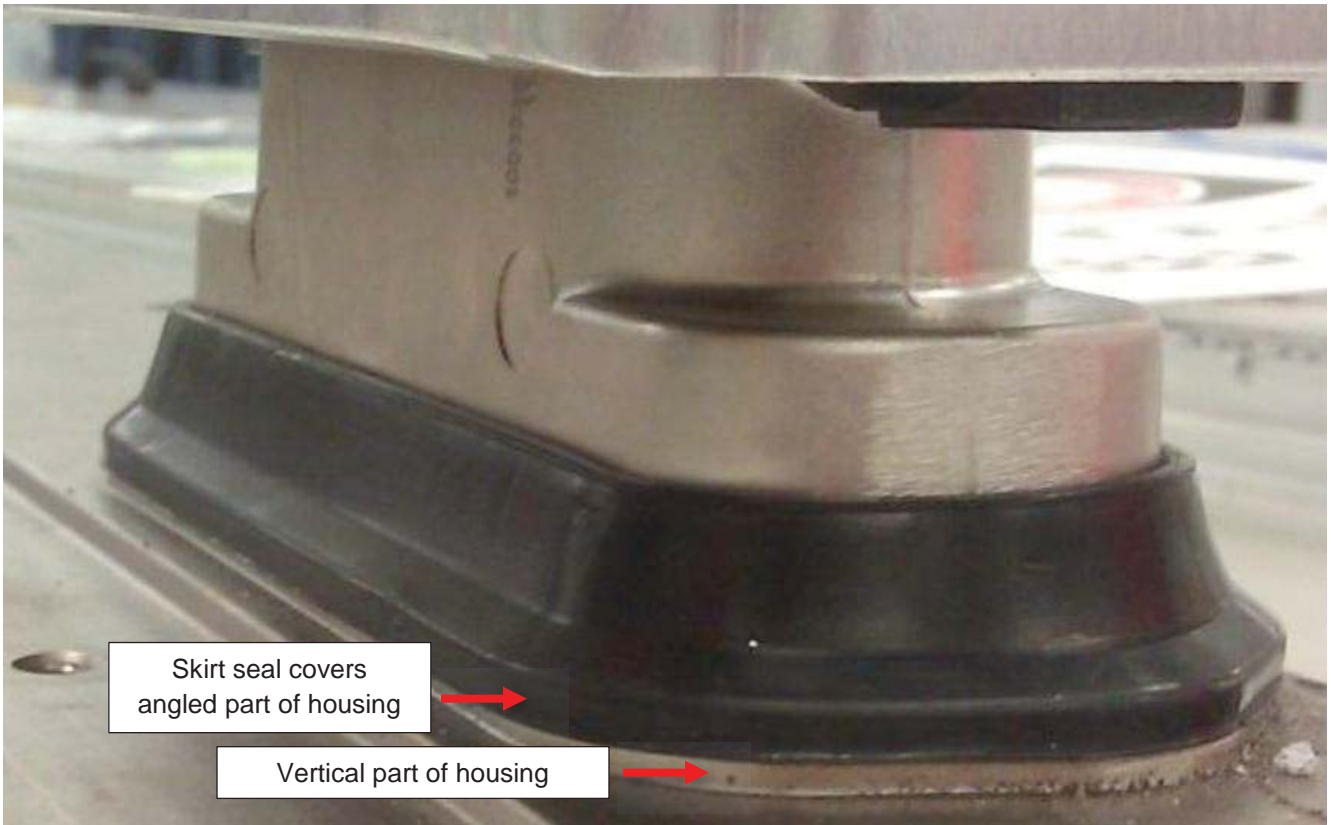




**✘ Incorrect – Skirt seal not fully seated**  
**Figure 15**



**✘ Incorrect – Skirt seal not fully seated**  
**Figure 16**



✓ Correct – Skirt fully seated  
Figure 17



✗ Incorrect – Skirt seal caught on base  
Figure 18

## Tech Note: Troubleshooting Isolation Faults

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As part of the Model S high voltage safety philosophy, the high voltage electrical system is isolated from the vehicle. This means that there is no electrical current carrying path between the vehicle and any high voltage conductor. To ensure that this isolation is always met, a monitor is installed in the battery, which periodically measures the resistance between the high voltage conductors and the chassis.

Three different conditions can introduce a conduction path to the chassis: a physical defect of the insulation material, contamination (of any size, e.g. dust, bolts, etc.), or moisture. When debugging isolation, look for signs of moisture or physical damage to HV cables, bus bars, and connectors.

This procedure aids in investigation of loss of isolation by separating the High Voltage system until the suspect component is found. The HV distribution network needs to be separated further and further apart until the isolation loss is found. To correct degradation or loss of isolation, the component with isolation breakdown needs to be localized and faulty component/components replaced.

This document contains quick reference flow charts for intermittent faults, and for when faults are present. It also includes detailed, step by step instructions to be used when faults are present. After repairing a fault, a final quality inspection always needs to be performed. A quick reference flow chart and detailed instructions are included for the final inspection procedure.

**⚠ WARNING:** Only technicians who have been trained in High Voltage Awareness are permitted to perform this procedure. Proper personal protective equipment (PPE) and insulating HV gloves with a minimum rating of class 00 (500V) must be worn any time a high voltage cable is handled. Refer to service bulletin SB-13-92-003, High Voltage Awareness Care Points for additional safety information.

### General Electrical Definitions

- **Electrical isolation:** Separating two conductive materials from electrical contact. In our case, isolating the HV electrical system from the vehicle ground.
- **Electrical insulation:** A non-conducting material that provides electric isolation of two parts at different voltages. It prevents the flow of electric current through it. In Tesla vehicles in particular it isolates HV systems to chassis ground, HV systems to LV systems and between HV conductors. Different materials have different dielectric ratings.
- **Isolation resistance:** The electrical resistance between two conductors separated by an insulating material.
- **Electrical continuity:** The state of being a whole, unbroken circuit. A continuity test is done to determine whether a circuit is open or closed. An open circuit cannot conduct electricity. A closed circuit has continuity. A simpler way to understand continuity is if there is a conductive path between two test points.
- **Electrical shielding:** A conductor shielding that is at chassis potential (“ground”), whose purpose is to reduce or eliminate electro-magnetic interference, or radio frequency interference.
- **Electrical isolation test:** A direct current (DC) resistance test that is performed between subcircuit common and subsystem chassis ground to verify that a specified level of isolation resistance is met. The BMS performs this measurement.