

General Information

The guidelines provided in this document apply to High Voltage (HV) batteries from Tesla vehicles, and are intended to be used by 3rd parties in Europe to evaluate if a Tesla HV battery is critically damaged prior to shipment defined by the European transport regulation by road (ADR).

This document describes steps to evaluate the HV battery prior to shipment and is not meant to support reuse or remanufacturing of HV batteries in any way.

Guidelines

Use this document when preparing Tesla HV batteries for transport including, but not limited to:

- HV battery return request in a vehicle end-of-life context
- After vehicle collision
- After vehicle flooding
- After improper handling or storage of the HV battery
- When there are suspicions that the HV battery is damaged due to its history or lack of history

As per ADR, critically damaged HV batteries are cells and/or HV batteries liable to rapidly disassemble, dangerously react, produce a flame or a dangerous evolution of heat, emit toxic, corrosive or flammable gases or vapors under normal conditions of carriage.

Further information is available at <https://adrbook.com/en/2017/UN/3480>.

If any of the inspection steps below do not pass their outlined criteria, or if for any reason any of the inspection steps cannot be assessed, the HV battery should be transported in line with critically damaged transport regulation unless a more detailed assessment deems the HV battery pack as “damaged”.

It is the responsibility of the personnel performing the assessment to follow all inspection steps and truthfully provide the result based on each step’s passing criteria.

Each inspection category has a corresponding appendix in this document. The appendices contain additional technical information to support each inspection.

⚠ WARNING: An HV battery poses a significant high voltage and electrocution risk if the outer enclosure or safety circuits have been compromised or significantly damaged. Only personnel who have been specifically trained in High Voltage Live Work - such as the Dutch NEN-9140 or equivalent - are permitted to perform the inspections described in this document.

⚠ WARNING: Store damaged or critically damaged HV batteries in a safe location at least 15 m (50 ft) away from flammable materials, structures, other vehicles, and other HV batteries, secured from access by the general public. For example, a fenced, open yard may be an appropriate safe location. Alternatively, a container specifically designed for the purpose of holding a damaged lithium-ion battery pack may be used. The battery should be monitored during storage for evidence of smoke, flame, leakage of electrolyte or coolant, or indications of heat. If full-time monitoring of the battery is not possible (for example during extended storage), the safe location should be capable of containing a fire.

⚠ WARNING: Because of the volatile nature of a suspected critically damaged HV battery, it is preferable that the inspection be conducted outdoors in an isolated. If performed indoors, the inspection area must be within easy access to the outdoors, cordoned off and identified as hazardous, clear of any obstructions, and must offer a route to quickly move the battery/vehicle outside.

⚠ WARNING: If at any point, the HV battery or vehicle display signs of escaping gases, smoke, flames, excessive heat, sparks, or arcing, contact the local emergency services department for immediate hazard management, and then refer to the Tesla's First Responder Guides, available at <https://www.tesla.com/firstresponders>. Gases or smoke exiting a lithium-ion HV battery are likely flammable and could ignite at any time. Report the incident to Tesla for further assistance.

⚠ WARNING: Avoid contact with gases escaping from the battery. Vented gases might irritate the eyes, skin, and throat. Vent gas temperatures can exceed 600 °C (1,110 °F). Contact with hot gases can cause burns.

⚠ WARNING: Proper Personal Protective Equipment (PPE) is required to perform this procedure. PPE must include, but is not limited to:

- High Voltage (HV) insulating gloves
- Leather glove protectors
- High voltage glove tester
- Safety glasses
- Electrical hazard rated safety shoes

Refer to [CD-21-92-001](#) for more details on Tesla-recommended PPE specifications.

⚠ WARNING: Remove all jewelry (watches, bracelets, rings, necklaces, earrings, ID tags, piercings, etc.) from your body, and all objects (keys, coins, pens, pencils, tools, fasteners, etc.) from your pockets before performing any procedure that might expose you to high voltage.

⚠ WARNING: If corrective eyewear is necessary to safely perform any procedure, make sure that the eyewear is securely restrained to the head and cannot fall off.

📄 NOTE: All HV batteries need to travel with the appropriate dangerous goods regulatory documents. Regulatory document requirements vary from country to country and by mode of transportation. This document does not fulfil any regulatory document requirements.

Tools Required

Description	Tesla Part Number
Infrared thermometer or equivalent tool that can make non-contact temperature measurements with an accuracy of at least ± 1.5 °C.	1080603-00-A
Parts needed for Retrieving HV Battery Vitals: refer to CD-21-16-003 for details.	--

Inspection Product Information

HV Battery Part Number	
HV Battery Serial Number	
VIN (if available)	
Date of Battery Damage (if available)	
Evaluation performed by	
Telephone number	
Company/Location	
Country	
Date of Inspection	
Inspector's Signature	

HV Battery Inspection

Make sure to take photographs of all inspection items to support the pass/fail decision.

HV Battery Enclosure Inspection

- **Inspection criteria:** Inspect the HV battery enclosure for rupture, dent, bend/warp, and heat discoloration as described in Appendix 1.
- **Pass Decision:** The entire HV battery does not exhibit any of the Fail criteria
- **Result:**
 - The HV battery does not exhibit any of the Fail criteria as described in Appendix 1. **Pass inspection.**
 - The HV battery exhibits Fail criteria as described in Appendix 1. **Does Not Pass Inspection.**
 - The HV battery could not be safely inspected, or Fail criteria could not be measured or verified as described in Appendix 1. **Does Not Pass Inspection.**

HV Battery Thermal Inspection

- **Inspection criteria:** Inspect the HV battery enclosure for temperature anomalies as described in Appendix 2.
- **Pass Decision:** The HV battery enclosure does not exhibit any of the Fail criteria as described in Appendix 2.
- **Result:**
 - The HV battery does not exhibit any of the Fail criteria as described in Appendix 2. **Pass inspection.**
 - The HV battery exhibits Fail criteria as described in Appendix 2. **Does Not Pass Inspection.**
 - The HV battery could not be safely inspected, or Fail criteria could not be measured or verified as described in Appendix 2. **Does Not Pass Inspection.**

Battery Management System (BMS) Vitals Inspection

- **Inspection criteria:** Retrieve the HV battery vitals as described in Appendix 3.
- **Pass criteria:** The HV battery does not exhibit any of the Fail criteria as described in Appendix 3. Attach Screenshot(s) of the following: Part number, Serial number, SOC and Isolation Resistance values populated.
- **Result:**
 - The HV battery does not exhibit any of the Fail criteria as described in Appendix 3. **Pass inspection.**
 - The HV battery exhibits Fail criteria as described in Appendix 3. **Does Not Pass Inspection.**
 - The HV battery could not be safely inspected, or Fail criteria could not be measured or verified as described in Appendix 3. **Does Not Pass Inspection.**

APPENDIX 1: HV Battery Enclosure Inspection

Inspection for Ruptures

A rupture is where a structural damage to the HV battery metal enclosure exposes internal components. The rupture damage can be anything from a small crack to part of the HV battery torn off.

The following examples are considered ruptures to the HV battery enclosure.



Figure 1 – Rupture of the enclosure exposing internal electronics



Figure 2 – Enclosure underside tear exposing internal cells



Figure 3 – Enclosure underside rupture exposing internal components



Figure 4 – Large enclosure crack breaking the enclosure sealing



Figure 5 – Large enclosure crack breaking the enclosure sealing



Figure 6 – Enclosure rupture exposing internal components



Figure 7 – Enclosure rupture exposing internal components



Figure 8 – Enclosure rupture exposing internal components

The following examples are not considered a rupture in the HV battery metal enclosure:



Figure 9 – Light plastic deformation of the front baffle cover



Figure 10 – Side ski plastic cover damage

Inspection for Dents on HV Battery Enclosure

A dent is where a structural damage to the HV battery metal enclosure does not expose internal components. A dent is quantified by measuring its depth in relation to the surrounding, undamaged surfaces using a ruler and depth gauge.

- Non-cosmetic dents on the top of HV battery are not allowed.
- Dents on the underside of HV battery (baseplate) have these maximum thresholds:

Model	Maximum threshold
Model S, Model X (2012-2020)	6 mm
Model S, Model X (2021+)	7 mm
Model 3, Model Y	8 mm
Model Y Structural Pack	5 mm

The following images are examples of dents deeper than the maximum threshold on the HV battery enclosure:



Figure 11 – Dent exceeding the maximum threshold



Figure 12 – Dent exceeding the maximum threshold



Figure 13 – Dent exceeding the maximum threshold

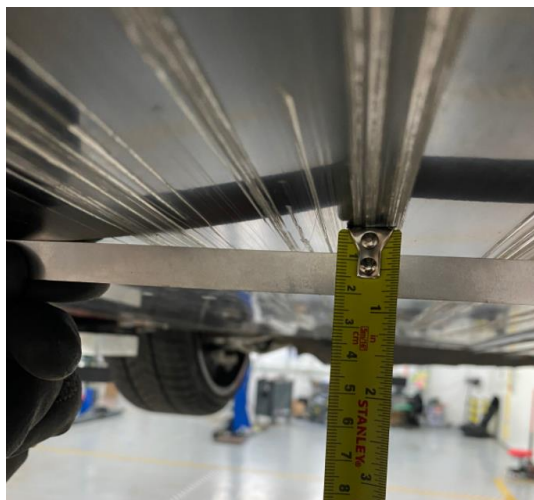


Figure 14 – Dent exceeding the maximum threshold

Bend/Twist/Warp

A bend, twist, or warp is where a structural damage to the HV battery metal enclosure causes the fundamental shape of the HV battery to be no longer visually straight or flat.

The following images are examples of bends, twists, or warps to an HV battery enclosure:



Figure 15 – Enclosure visually bent



Figure 16 – Enclosure top cover visually warped

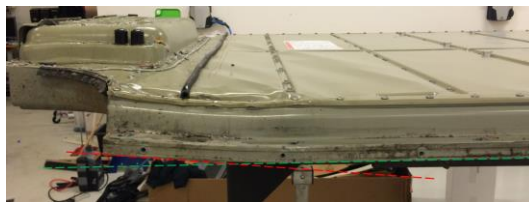


Figure 17 – Enclosure visually bent

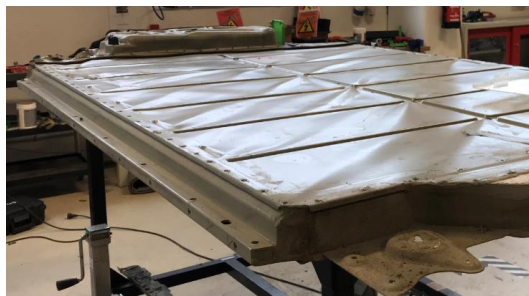


Figure 18 – Enclosure top cover visually warped

Discoloration / Heat Exposure

A soot-like, brown, or other discoloration to the HV battery metal enclosure can be indicative of internal or external heat exposure. Severe heat exposure can also cause enclosure rupture, exposing internal components.

The following images are examples of discoloration due to heat exposure to the HV battery enclosure:

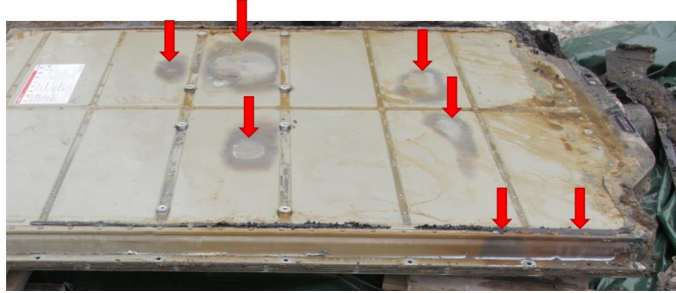


Figure 19 – Several heat discoloration spots on enclosure top cover



Figure 20 – Soot-like discoloration on enclosure




Figure 21 – Heat exposure causing enclosure rupture with internal components exposed

APPENDIX 2: Thermal Inspection

Thermal Inspection


Damaged or shorted cells can result in slow or rapid heating, release of flammable vapors, and thermal reactions to neighboring cells. Follow this procedure to determine if the HV battery is heating internally.

- Make sure that the HV battery is at ambient temperature, in a location with stable temperatures. For example, the battery should not be in direct sunlight or near a heating or air conditioning duct.
- If an insulating blanket is mounted on the top side of the HV battery, remove this blanket to be able to make a measurement on the HV battery metal enclosure.
- Use a non-contact infrared thermometer to measure the top or bottom surface of the battery enclosure at the indicated locations.

 **NOTE:** If the HV battery has any structural damage, also measure within 300 mm from the damaged area.

- Record the temperatures.

To pass the Thermal Inspection, all 16 measurements must be below 40 °C, with no more than 5 °C difference between 2 measurements.

 **CAUTION:** If there is a temperature difference of more than 5 °C between 2 measurement points, or if the maximum temperature exceeds 40 °C, the HV battery should be evaluated as critically damaged.

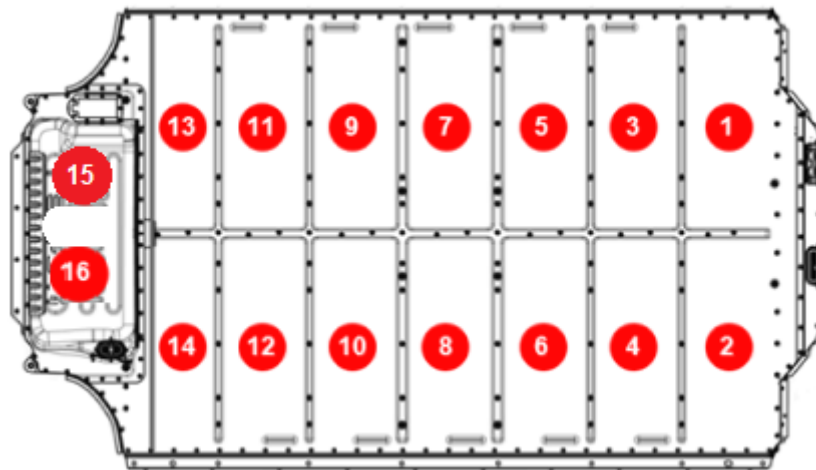


Figure 22 – Model S and Model X (20HV battery pack)

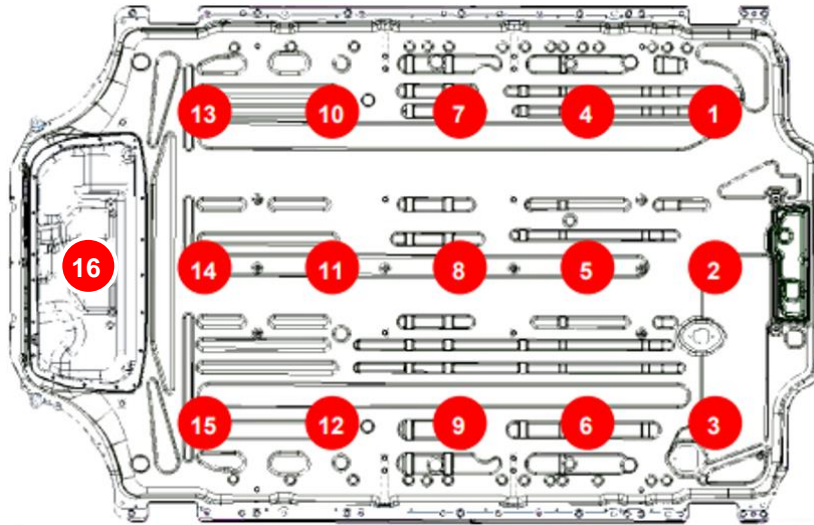


Figure 23 – Model S and Model X (2021+) HV battery pack

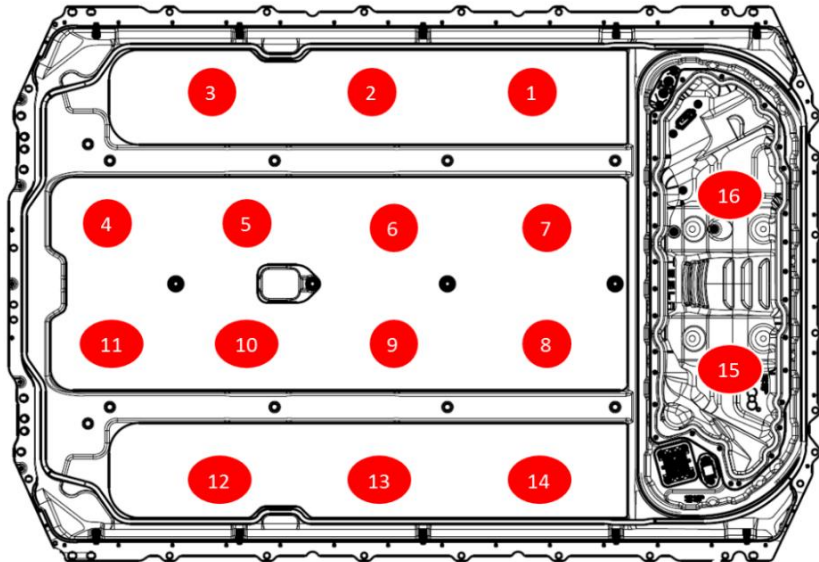


Figure 24 – Model 3 and Model Y HV battery pack

APPENDIX 3: Battery Management System (BMS) Vitals Inspection

Record the SOC and Isolation Resistance values as described in document [CD-21-16-003](#) - "Retrieving HV Battery Vitals Model S, Model X, Model 3 and Model Y".

Take a screenshot of the battery vitals and attach it to this document.

The HV battery vitals fail criteria are: Isolation Resistance value less than 200 k Ω and/or the SOC value over 50%.