

Overview

This standard is about testing, removing, and storing high voltage battery systems in electric vehicles. This may be relevant for vehicle dismantling or recycling operations. For the purposes of this standard, an electric vehicle is any vehicle that is in part or wholly electrically propelled. This would include

- Hybrid (HEV) - to include mild/micro hybrid vehicles where the voltage is considered dangerous.
- Plug-in Hybrid (PHEV)
- Extended Range Electric Vehicle (ER-EV) or Range Extended Electric Vehicle (RE-EV)
- Battery Electric Vehicle (BEV) or Pure Electric Vehicle (PEV)
- Fuel Cell Electric Vehicle (FCEV).

Warning: It has been recommended by industry experts that only those with suitable training and experience on working with electric vehicles should carry out the functions below.

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**Performance
criteria**

- You must be able to:
- P1 Collect and analyse relevant technical information prior to commencing work on the vehicle
 - P2 Carry out a dynamic risk assessment of the vehicle and the work to be carried out
 - P3 Wear **personal protective equipment** (PPE) and use vehicle protection equipment (VPE) appropriate to the work activities you are carrying out
 - P4 Carry out thorough inspection of the external and visible parts of the high voltage battery, connections and cables for signs of **damage**
 - P5 Follow your organisation's and manufacturer's instructions if **damage** to the high voltage battery, connections and cables is found
 - P6 Use diagnostic and test **equipment** in line with manufacturer's guidelines to ensure the integrity of the high voltage battery and the high voltage system prior to commencing removal
 - P7 Correctly interpret the results obtained from the diagnostic test **equipment**
 - P8 Ensure all work carried out takes place immediately following inspection where possible or carry out a re-inspection following timescales recommended by the manufacturer
 - P9 Isolate the high voltage system as per manufacturer's guidance
 - P10 Select, check and use appropriate tools/lifting **equipment** in line with manufacturer's guidelines and specification
 - P11 Remove the high voltage battery following manufacturer's guidelines and place in a suitable, isolated area with restricted access and appropriate signage
 - P12 Ensure records of work are accurate complete and passed to the relevant person in the format required.

**Knowledge and
understanding**

You need to know
and understand:

Use of technical information

- K1 The different types of electric vehicle and their electrical storage systems
- K2 The terminology used within electric vehicle systems
- K3 How and where to access relevant information on the specific electric vehicle systems
- K4 How to identify high voltage components and/or parts that are connected to the high voltage system within the battery

Legislative and organisational requirements and procedures

- K5 The authorisation procedures to allow an individual to work on high voltage systems
- K6 How to carry out a dynamic risk assessment of the vehicle and the work to be carried out
- K7 The current health and safety legislation, industry codes of practice or guidelines and specific vehicle manufacturer's safety procedures relevant to working with electric vehicles
- K8 How to inform and make others aware of the potential hazards prior to and when work is being carried out on high voltage systems
- K9 The importance of storing the high voltage battery in a safe, restricted area
- K10 The factors to consider when moving and storing high voltage batteries
- K11 How to work in a way that minimises the risk of:
 - K11.1 injury to yourself and others
 - K11.2 **damage** to your working environment
 - K11.3 **damage** to other vehicle systems, components and units
- K12 The hazards associated with electric high voltage vehicle batteries when exposed to extreme temperatures, impact and other adverse conditions
- K13 The implications of electrical conductivity through the human body
- K14 The implications of strong magnetic fields and the effects on medical devices
- K15 Workplace procedures that must be followed in the event of electric shock and other emergencies
- K16 How to safely dispose of or recycle battery components in line with legislation and organisational procedures

You need to know and understand:

K17 How to accurately report the work that has been carried out on the vehicle to relevant persons

Use of equipment

K18 How to select, check and use the **equipment** required to test, remove and move electric vehicle high voltage batteries

K19 How to calibrate electrical test **equipment** prior to use

Testing and removing high voltage batteries

K20 How to identify any **damage** to the battery and the high voltage connections and cables

K21 How to carry out tests and procedures to determine the condition of the battery cells or modules

K22 How to use diagnostic and test **equipment** and interpret the results to ensure the integrity of the high voltage system, the state of charge and state of health

K23 How to safely isolate the vehicle following manufacturer's guidelines

K24 The procedures for the safe removal and storage of the high voltage battery

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Scope/range

- 1. High voltage personal protective equipment** includes:
 - 1.1. insulated high voltage gloves
 - 1.2. face shield
 - 1.3. fire resistant clothing/apron
 - 1.4. insulated tools
- 2. Damage** includes:
 - 2.1. overheating
 - 2.2. physical impact damage
 - 2.3. chemical leakage
 - 2.4. smoke
 - 2.5. water damage
 - 2.6. different battery chemistries
 - 2.7. reduction in energy holding capacity
 - 2.8. overcharging due to internal electrical damage
- 3. Equipment** includes:
 - 3.1. Voltage detector
 - 3.2. Scan tools
 - 3.3. Lifting and moving equipment
 - 3.4. De-pollution station
 - 3.5. Neutraliser for spilt electrolyte

**Additional
Information****Glossary**

This section contains examples and explanations of some of the terms used but does not form part of the standard.

Dynamic risk assessment - the practice of mentally observing, assessing and analysing an environment while working, to identify and remove risk. The process allows individuals to identify a hazard on the spot and make quick decisions in regards to their own safety.

Hazards associated with high voltage electrical vehicle components – exist not only during work on high voltage systems, as specified above, but also on all other high-power electrical drive systems and high-pressure storage systems. Vehicle and equipment manufacturers' guidance should be followed at all times.

High voltage – Regulation No 100 of the Economic Commission for Europe of the United Nations (UNECE) — Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric power train, states that: 'High Voltage' means the classification of an electric component or circuit, if its working voltage is $> 60 \text{ V}$ and $\leq 1\,500 \text{ V DC}$ or $> 30 \text{ V}$ and $\leq 1\,000 \text{ V AC}$ root mean square (rms). Electricity at Work Regulations (1989), and associated HSE guidance should be followed at all times.

Sources of information applicable to electric vehicles

Examples include hard copy manuals, data on computer and data obtained from on-board diagnostic displays.

Vehicle – any vehicle that is in part or wholly electrically propelled. This would include:

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