

Overview

This standard is designed for those who provide a first response to an accident damaged electric vehicle, for example, those working in the fire service or roadside recovery operators; the standard would also be appropriate for those involved in the dismantling and disposal of electric vehicles. It covers the working practices and knowledge needed to continually monitor and work safely around an electric vehicle that has damage to its high voltage system and is showing signs of being unstable or potentially becoming unstable and requiring emergency response.

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).

This standard does not deem someone competent to maintain, service or repair an electric vehicle's high voltage systems and their components.

Performance criteria

- You must be able to:
- P1 Identify the electric vehicle type and the location of the high voltage battery
 - P2 Wear personal protective equipment (**PPE**) and use **safety equipment** in line with your working procedures and appropriate to the work activities you are carrying out
 - P3 Carry out a dynamic risk assessment to identify the **hazards** presented by the unstable electric vehicle high voltage system, assess the risks and formulate an agile mitigation plan
 - P4 Follow the correct procedures to make the **vehicle** safe prior to starting any work activities, including where necessary and safe to do so, isolating high voltage electrical systems, within your level of training, competence and authority
 - P5 Recognise and continually monitor the **indicators** of instability within an electric vehicle's high voltage system
 - P6 Apply **control measures** appropriate to the **indicators** presented by the **vehicle**
 - P7 Quickly respond to changes/escalation within the emergency situation
 - P8 Carry out work activities in a way that minimises risks to yourself, other people and the environment
 - P9 Refer any problems with the **vehicle** that you cannot deal with yourself to a relevant person and follow their instructions
 - P10 Record and report the detail of work activities you have carried out on or near the **vehicle** to relevant personnel.
 - P11 Follow a robust, documented/logged handover procedure

Knowledge and understanding

You need to know and understand:

Use of technical information

- K1 How to identify an electric vehicle and the location of its high voltage battery
- K2 How to find, interpret and use sources of information applicable to unstable electric vehicle high voltage systems
- K3 The importance of using up-to-date data and emergency response and recovery guidance

Legislative and organisational requirements and procedures

- K4 The health and safety legislation, industry codes of practice or guidelines and workplace procedures relevant to working on, near or with unstable electric vehicles, including the appropriate personal protective equipment and its use, and the safety of the working environment
- K5 How to carry out a dynamic risk assessment on unstable electric vehicles and formulate an agile plan to mitigate escalating risks
- K6 The manufacturer's and your workplace procedures for:
 - K6.1 assessing and managing the risks associated with unstable electric vehicle high voltage systems
 - K6.2 identifying the **indicators** associated with unstable electric vehicles
 - K6.3 ensuring that the **vehicle** condition is monitored for signs of deterioration or escalation in severity
 - K6.4 referring/reporting problems when working with unstable electric vehicles
 - K6.5 recording and reporting work carried out on unstable electric vehicles
- K7 The workplace specified information that must be included in an incident handover record for an unstable electric vehicle
- K8 The importance of adhering to a robust, documented handover procedure

Hazard indicators and control measures

- K9 The standard operating temperature of an electric vehicle high voltage battery
- K10 The **indicators**, causes and consequences of thermal runaway
- K11 Why actively smelling for **indicators** of an unstable EV system must be

- avoided
- K12 How emergency response actions (relocation of the **vehicle**, extrication etc.) may initiate thermal runaway
 - K13 The **control measures** available to deal with thermal runaway and the benefits and implications of their use
 - K14 How to use different **control measures** and when it is appropriate for them to be applied
 - K15 How to determine the hot zone and safe working zone around an EV incident
 - K16 The actions to take where electrolyte leakage has occurred
 - K17 The considerations to be made regarding the recovery of an unstable electric vehicle
 - K18 The importance of keeping up to date with new electric vehicle technologies and **control measures**

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Scope/range

1. **Vehicle** - any vehicle that is in part or wholly electrically propelled. This would include
 - 1.1. Hybrid (HEV) - to include mild/micro hybrid vehicles where the voltage is considered dangerous.
 - 1.2. Plug-in Hybrid (PHEV)
 - 1.3. Extended Range Electric Vehicle (ER-EV) or Range Extended Electric Vehicle (RE-EV)
 - 1.4. Battery Electric Vehicle (BEV) or Pure Electric Vehicle (PEV)
 - 1.5. Fuel Cell Electric Vehicle (FCEV)
2. **PPE and safety equipment** may include:
 - 2.1. High voltage gloves
 - 2.2. Full face protection
 - 2.3. Respiratory protective equipment
 - 2.4. Protective clothing
 - 2.5. PPE as specified by workplace
 - 2.6. Electrolyte neutraliser
 - 2.7. Safety equipment as specified by workplace
 - 2.8. Casualty respiratory protection
3. **Hazards** may include:
 - 3.1. High voltage
 - 3.2. Unpredictable vehicle movements
 - 3.3. Gases
 - 3.4. High-voltage system residual charge
 - 3.5. Highly magnetic components
 - 3.6. Fuel explosion
 - 3.7. Hazardous materials
 - 3.8. Leaking electrolytes
 - 3.9. Pressurised systems
4. **Indicators** may include:
 - 4.1. Visual vehicle warning alerts
 - 4.2. Audible vehicle warning alerts

- 4.3. Smoke or vapour emission
- 4.4. 'Popping', 'crackling' or 'hissing' sound
- 4.5. Burning smell
- 4.6. Strong odour
- 4.7. Physical impact damage

5. Monitoring equipment may include:

- 5.1. Thermal imaging/monitoring equipment
- 5.2. Gas detector/monitor

6. Control measures may include:

- 6.1. Water
- 6.2. Chemicals
- 6.3. Extinguishers
- 6.4. Extinguishing devices e.g. lance
- 6.5. Leave to burn out
- 6.6. EV fire blanket
- 6.7. Water tank/pool
- 6.8. Electrolyte neutraliser

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**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 continually 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 regard to their own safety.

Handover procedure – to include mark up of vehicle and detailed incident record, including hazards encountered and actions taken

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.

N.B. Some electric vehicles may operate at voltages below or above industry recognised standards.

Recovery considerations - to include safe transportation route, whether a chaperone would be advisable and the suitability of the final destination.

Relevant person - May be someone within your organisation, or other authority.

Sources of information applicable to unstable electric vehicles - Examples include government emergency response and recovery guidance, manufacturer

guidance, hard copy manuals, online data and data obtained from on-board diagnostic displays. It may also include control room or other personnel, the vehicle driver or passengers.

Unstable - being unstable or having the potential to become unstable

Work activities – recovering, collecting or dealing with unstable electric vehicles as part of a first response.

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