IMIEV04
Isolate and re-energise high voltage systems in an electric vehicle

Overview

This standard is about assessing an electric vehicle and isolating it to make it safe to work on. It also covers re-energising the vehicle once the required work has been carried out.

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 Locate relevant information about the **vehicle** and use it to determine any potential hazards

P2 Identify any potential hazards by carrying out a dynamic risk assessment of the **vehicle**

P3 Identify high voltage **components** and cabling

P4 Notify all relevant persons of your intention to work on a high voltage **vehicle**

P5 Select and use correct personal protective equipment when isolating and re-energising the high voltage system

P6 Ensure the work area is clearly identified and made safe, following workplace procedures

P7 Follow the manufacturer's procedures to isolate and re-energise the high voltage system

P8 Work in a way which minimises the risk of:

P8.1 injury to yourself and others

P8.2 damage to your working environment

P8.3 damage to other vehicle systems, **components** and units

P9 Prepare, check and use all the appropriate test equipment following manufacturer's instructions

P10 Follow the manufacturer's recommendations to ensure residual voltage is within manufacturer's specification when isolating the high voltage system

P11 Use suitable **testing methods** to evaluate the performance of the re-energised high voltage system accurately, ensuring that it performs to the manufacturer's operating specifications and legal requirements

P12 Follow workplace procedures in case of emergency

P13 Refer any problems with the process to a relevant person in your workplace

P14 Ensure records are accurate, complete and passed to the relevant person(s) promptly 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 systems

K2 The terminology used within electric vehicle systems

K3 How to find, interpret and use sources of information applicable to isolating and re-energising an electric vehicle's high voltage systems

K4 The importance of knowing how and where to access relevant information on the specific electric vehicle systems

K5 How to determine the location and route of the high voltage **components** and cabling

K6 Specific high voltage vehicle safety systems relevant to your work

Legislative and organisational requirements and procedures

K7 The current health and safety legislation, industry codes of practice or guidelines and specific **vehicle** manufacturer's repair and safety procedures relevant to working with electric vehicles

K8 The hazards associated with working with electric vehicles and how to identify them

K9 How to select, check and use appropriate and correct personal protective equipment

K10 How to work in a way which minimises the risk of:

K10.1 injury to yourself and others

K10.2 damage to your working environment

K10.3 damage to other vehicle systems, **components** and units

K11 The implications and effects of electricity through the human body

K12 The signs and symptoms of electrocution

K13 The implications of strong magnetic fields and the effects on medical devices

K14 Workplace procedures that must be followed in the event of electric shock or other emergencies

K15 Your workplace procedures for the referral/reporting of problems when working with electric vehicles

K16 Your workplace procedures for documenting isolation and re-energisation activities and the importance of doing so

K17 How to make others aware that work is being carried out on electric vehicles

You need to know and understand:

K18 The specific manufacturer's guidelines and the precautions necessary when charging, connecting an auxiliary power source to or towing/lifting an electric vehicle

K19 The hazards associated with electric vehicles when exposed to extreme temperatures, impact and other adverse conditions

Use of testing equipment

K20 How to select and use the correct electrical testing equipment required

K21 How to check and test equipment prior to use

Isolating and re-energising vehicle high voltage systems

K22 How to isolate and re-energise an electric vehicle's high voltage system following manufacturer's instructions

K23 How to accurately test that the residual voltage is below manufacturer's specification following the isolation process

K24 How to interpret test results and make recommendations based on these results and the importance of basing recommendations on test results

K25 How to test and evaluate the performance of the system against manufacturers' operating specifications and legal requirements

K26 The importance of ensuring all high voltage vehicle systems are functioning correctly and safely before the **vehicle** is released to the customer

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. **Testing methods** include**:**
   - 2.1. sensory
   - 2.2. functional
   - 2.3. measurement

3. **Components** include, but are not limited to**:**
   - 3.1. batteries
   - 3.2. motors
   - 3.3. cables
   - 3.4. HVAC components
   - 3.5. contacters
   - 3.6. AC/DC onboard charger
   - 3.7. DC-DC converter
   - 3.8. HV service disconnect
   - 3.9. HV charge port

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 V and ≤ 1 500 V DC or > 30 V and ≤ 1 000 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.

Sensory testing methods - include looking, listening, smelling, touching for temperature or vibration.

Sources of information applicable to electric vehicles - examples include hard copy manuals, data on computer and data obtained from on- board diagnostic displays.

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