IMIEV05L

Diagnose and rectify faults in an electric vehicle powertrain and ancillary systems Legacy

Overview

This standard covers the competence and knowledge technicians need to safely diagnose and rectify electrical, mechanical and fluid component faults in an electric vehicle powertrain and high voltage ancillary systems. The unit also ensures that the technician is aware of the effect that high voltage component technology has on other vehicle systems.

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.

Performance criteria

You must be able to:

P1 Use suitable personal and vehicle protective equipment appropriate to the diagnosis and rectification activities carried out
P2 Support the identification of **faults**, by reviewing vehicle:

P2.1 technical data
P2.2 diagnostic test procedures
P3 Prepare the vehicle systems and work area for safe working procedures as appropriate to the vehicle and the nature of the **fault**

P4 Prepare, check and use all the required **equipment** following manufacturer's instructions
P5 Use **diagnostic methods** which are relevant to the symptoms presented
P6 Collect sufficient diagnostic information in a logical and systematic way to enable an accurate diagnosis of the high voltage system **faults**
P7 Identify and record any system deviation from manufacturer’s specifications accurately
P8 Ensure your assessment of components and units identifies their condition and suitability for repair or replacement
P9 Inform the relevant person(s) promptly where repairs are uneconomic or unsatisfactory to the customer
P10 Carry out all diagnostic and rectification activities following:

P10.1 manufacturer's instructions
P10.2 recognised repair methods
P10.3 your workplace procedures
P10.4 health, safety and environmental requirements
P11 Work in a way which minimises the risk of:

P11.1 **damage** to other vehicle systems
P11.2 **damage** to other components and units
P11.3 injury to self and others
P12 Ensure all repaired and replacement components and units conform to the vehicle operating specification and any legal requirements

P13 Adjust components and units, when necessary, correctly to ensure that they operate to system requirements
P14 Record and report any additional **faults** you notice during the course of work promptly
P15 Use testing methods which are suitable for assessing the performance of the rectified system
P16 Ensure the rectified system performs to the vehicle operating specification and any legal requirements prior to return to the customer
P17 Ensure your records are accurate, complete and passed to the relevant person(s) within the agreed timescale and in the format required
P18 Complete all activities within the agreed timescale
P19 Report any anticipated delays in completion to the relevant person(s) promptly

Knowledge and understanding

You need to know and understand:

Use of technical information

K1 The different types of electric vehicle
K2 How to find, interpret and use sources of information on high and low voltage electrical and electronic, mechanical and fluid system operating specifications, diagnostic test procedures, repair procedures and legal requirements
K3 Vehicle operating specifications relating to high and low voltage electrical, electronic, mechanical and fluid systems for the vehicle(s) on which you work
K4 The importance of using the correct sources of technical information for electric vehicle system diagnosis and rectification
**Legislative and organisational requirements and procedures **
K5 the legislation, industry codes of practice or guidelines and workplace procedures relevant to

K5.1 health and safety
K5.2 the environment (including waste disposal)
K5.3 appropriate personal and vehicle protective equipment
K5.4 legal requirements relating to the vehicle (including road safety requirements)
K6 Your workplace procedures for:

K6.1 recording fault location and correction activities
K6.2 reporting the results of tests
K6.3 the referral of problems
K6.4 reporting delays to the completion of work
K7 How to confirm an electric vehicle is safe to work on and the precautions you should take to ensure the high voltage system cannot be re-energised without your knowledge and agreement
K8 The hazards associated with electric vehicle high voltage systems and batteries
K9 How to reduce the risk of high voltage hazards when working on and around electric vehicles
K10 The implications of electrical conductivity through the human body
K11 The implications of strong magnetic fields and the effects on medical devices
K12 Workplace procedures that must be followed in the event of electric shock and other emergencies

K13 The hazards associated with electric vehicles when exposed to extreme temperatures, impact and other adverse conditions
K14 How to store, dispose of, recycle and return any removed high voltage components in line with legislative and organisational requirements
K15 How to work safely avoiding **damage** to other vehicle systems, components and units and contact with leakage and hazardous substances
K16 The hazards associated with alternative fuel sources and systems, including hydrogen fuel cells
K17 The importance of working to agreed timescales and keeping others informed of progress
K18 The relationship between time, costs and productivity
K19 The importance of reporting anticipated delays to the relevant person(s) promptly

High and low voltage component faults, their diagnosis and rectification

K20 How high and low voltage electrical, electronic, mechanical and fluid systems are constructed and operate
K21 How high and low voltage electrical, electronic, mechanical and fluid systems are dismantled, reassembled and adjusted to manufacturer's specifications
K22 The types and causes of high and low voltage electrical, electronic, mechanical and fluid system, component and unit **faults** and failures
K23 High and low voltage electrical, electronic, mechanical and fluid component unit and replacement procedures, the circumstances which will necessitate replacement and other possible courses of action
K24 The importance of working to recognised diagnostic and rectification procedures and processes and obtaining the correct information for diagnostic and rectification activities to proceed
K25 The importance of recording diagnostic and rectification information
K26 How to select the most appropriate **diagnostic testing** method for the symptoms presented
K27 How to carry out systematic **diagnostic testing** of high and low voltage electrical, electronic, mechanical and fluid systems using prescribed processes or formats
K28 How to assess the condition of high and low voltage electrical, electronic, mechanical and fluid components and units
K29 How to interpret test results and vehicle data in order to identify the location and cause of high and low voltage system **faults**
K30 How to carry out the rectification activities in order to correct **faults** in the high and low voltage electrical, electronic, mechanical and fluid systems

K31 The relationship between test methodology and the **faults** repaired – the use of appropriate testing methods
K32 How to make cost effective recommendations for rectification
K33 The components of alternative fuel sources and systems on electric vehicles, including hydrogen fuel cells

Electrical and electronic principles

K34 Electrical and electronic principles, including ohms law, voltage, power, current (ac/dc), resistance, magnetism, electromagnetism and electromagnetic induction
K35 Electrical symbols, unit and terms
K36 Electrical and electronic principles associated with high voltage systems, including types of sensors and actuators, their application and operation
K37 The operating principles of electric vehicle components
K38 How electrical and electronic high and low voltage systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles
K39 How electrical and electronic systems interlink and interact, including multiplexing
K40 The interaction between electrical, electronic, magnetic, chemical and mechanical components within electric vehicle systems
K41 The principles of chassis and insulated earth return systems as appropriate to electric vehicles
K42 Specific high voltage circuit protection

Use of diagnostic and rectification equipment

K43 How to prepare and check the accuracy of **diagnostic testing equipment**
K44 How to use diagnostic and rectification equipment for highand low voltage electrical, mechanical, electronic, and fluid systems, specialist repair tools and general workshop equipment

Vehicle system operation

K45 The main differences between an electric vehicle and a non-electric vehicle and its basic operation, including regeneration
K46 How to safely operate an electric vehicle
K47 The specific manufacturer's guidelines and the precautions necessary when charging, connecting an auxiliary power source to or towing/lifting an electric vehicle
K48 How to mobilise an electric vehicle safely
K49 The charging systems (types and modes) associated with electric vehicles and how to charge electric vehicles safely

Scope/range