**AURETH015 Diagnose and repair heavy electric vehicle rechargeable energy storage systems – FOR PUBLIC REVIEW (Friday 30th April – Monday 31st May 2021)**

# Application

This unit describes the skills and knowledge required to diagnose and repair faults in high voltage (HV) rechargeable energy storage systems (RESS) in heavy electric vehicles. The unit involves preparing for the task, sourcing a diagnostic testing strategy, diagnosing the cause of the fault, carrying out the repair and post-repair testing, and completing workplace processes and documentation. This unit covers the skills and knowledge required for those who work in the automotive service and repair industry and apply battery electric safety procedures.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

# Unit Sector

Electrical technical – Hybrid Vehicle and Battery Electric Vehicle

# Elements and Performance Criteria

|  |  |
| --- | --- |
| **ELEMENT** | **PERFORMANCE CRITERIA** |
| *Elements describe the essential outcomes.* | *Performance criteria describe the performance needed to demonstrate achievement of the element.* |
| 1. Prepare to diagnose and repair heavy electric vehicle rechargeable energy storage systems | 1.1 Identify job requirements from workplace instructions  1.2 Identify information required for diagnosis activity  1.3 Analyse diagnostic options and source testing strategy according to workplace and manufacturer procedures  1.4 Identify hazards and environmental issues associated with diagnose and repair activity, assess potential risks and implement control measures according to workplace policies and procedures  1.5 Identify tools and equipment required for testing strategy and establish serviceability according to workplace procedures |
| 2. Diagnose heavy electric vehicle rechargeable energy storage systems | 2.1 Implement diagnostic tests according to testing strategy, manufacturer and workplace procedures, and workplace health and safety requirements  2.2 Analyse diagnostic test results and identify cause of fault  2.3 Confirm and report cause of fault according to workplace procedures  2.4 Develop and report recommendations for necessary repairs according to workplace procedures |
| 3. Repair heavy electric vehicle rechargeable energy storage systems | 3.1 Identify information required for repair activity  3.2 Identify tools, equipment and materials required for repair activity and establish serviceability according to workplace procedures  3.3 Isolate RESS service plug or manual service disconnect and depower vehicle HV RESS according to manufacturer specifications  3.4 Carry out repairs according to workplace and manufacturer procedures, manufacturer specifications, workplace health and safety and environmental requirements  3.5 Reconnect RESS service plug or manual service disconnect and repower vehicle HV RESS  3.6 Carry out post-repair testing according to workplace procedures, workplace health and safety and environmental requirements |
| 4. Complete work processes | 4.1 Conduct final inspection according to workplace procedures and confirm vehicle is ready for use  4.2 Clear work area and dispose of or recycle materials according to workplace procedures  4.3 Complete documentation according to workplace procedures |

# Foundation Skills

*This section describes those language, literacy, numeracy and employment skills that are essential to performance but not explicit in the performance criteria.*

|  |  |
| --- | --- |
| **Skill** | **Description** |
| Learning | * efficiently locates required sources of information * develops sequenced plans for specific tasks |
| Reading | * interprets symbols and wiring diagrams |
| Oral communication | * clarifies instructions * obtains information from customers and supervisors |
| Numeracy | * matches electrical components and part identification numbers to workplace instructions, vehicle and component part lists, and manufacturer specifications * interprets vehicle electrical measurements and readings on digital and analogue gauges * measures voltage, current and resistance * uses mathematical operations * calculates deviations from manufacturer specifications |
| Planning and organising | * prioritises actions to achieve required outcomes * ensures tasks are completed within workplace timeframes |
| Technology | * uses specialised tools |

# Unit Mapping Information

No equivalent unit. New unit.

# Links

Companion Volume Implementation Guide is found on VETNet: https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b4278d82-d487-4070-a8c4-78045ec695b1

**Assessment Requirements for AURETH015 Diagnose and repair heavy electric vehicle rechargeable energy storage systems – FOR PUBLIC REVIEW (Friday 30th April – Monday 31st May 2021)**

# Performance Evidence

The candidate must demonstrate the ability to complete the tasks outlined in the elements, performance criteria and foundation skills of this unit, including evidence of the ability to:

* diagnose and repair high voltage (HV) rechargeable energy storage systems (RESS) in at least two different heavy battery electric vehicles (BEVs) to correct at least one of the following performance deficiencies in each:
  + high resistance
  + component
  + abnormal noises
  + open circuits.

# Knowledge Evidence

# The candidate must be able to demonstrate knowledge to complete the tasks outlined in the elements, performance criteria and foundation skills of this unit, including knowledge of:

* methods to locate and interpret information required to diagnose and repair HV RESS in heavy vehicle BEVs including information from:
* information provided by customers and supervisors
* Australian Standards (AS) 5732 Electric vehicle operations - Maintenance and repair
* manufacturer specifications and procedures
* workplace procedures required to diagnose and repair HV RESS in BEVs, including:
* establishing serviceability of tools and equipment
* documentation procedures
* housekeeping procedures, including:
* examination of tools and equipment
* storage of equipment
* identification, tagging and isolation of faulty equipment
* disposal of excess materials
* recycling procedures
* workplace health and safety (WHS) requirements relating to diagnosing and repairing HV RESS in BEVs, including procedures for:
* identifying hazards and controlling risks associated with:
* working with high voltages in BEV electrical systems
* wearing jewellery while working around high electrical currents
* procedures for minimising risk associated with hazards, including applying electrical safety precautions when:
* using personal protective equipment (PPE), including electrical safety gloves with 1000 volt rating and Australian standards rated HV insulating mat
* identifying and using firefighting equipment
* using the one hand rule
* following live system warning tags and signs
* depowering vehicle
* isolating HV RESS electrical supply
* stabilising vehicle electrical system
* environmental requirements relating to diagnosing and repairing HV RESS in BEVs, including procedures for trapping, storing and disposing of waste produced during repair
* safe operating procedures for tools and equipment, including:
* digital multimeter with minimum Cat III 1000 volt rating or CAT IV 600 volt rating
* insulation tester
* residual voltage tester
* scan tool
* oscilloscope
* operating principles of HV RESS in BEVs, including:
* battery pack construction, including:
* battery types
* battery internal resistance
* battery pack system, including:
* charging characteristics
* open circuit cells
* short circuit cells
* reverse polarisation
* series cell configuration
* strapping and layout
* purpose and operation of HV RESS in BEVs and components, including:
* HV battery charger and direct current (DC) to DC converter
* battery management system (BMS)
* power distribution unit (PDU)
* diagnostic testing procedures for HV RESS in BEVs, including procedures for:
* accessing and interpreting scan tool system data, including:
* diagnostic trouble codes (DTCs)
* live data
* freeze frame data
* waveforms
* using diagnostic flow charts
* repair procedures for HV RESS in BEVs, including procedures for:
  + battery cell replacement
  + charging and discharging procedures
  + sensor replacement
  + battery management system or power distribution replacement
* electrical system testing, including procedures for:
* accessing electrical terminals and using test probes without damaging connectors, fuse holders or wiring
* testing controller input and output signals and waveforms
* vehicle dynamic and static testing procedures
* analysing abnormal noise
* analysing component failure
* testing RESS cooling system
* tightening connections
* replacing faulty or damaged cable connections
* removing and replacing faulty or damaged components
* removing and replacing motor controller
* post-repair testing procedures for HV RESS in BEVs, including procedures for:
* DTC clearing procedures
* checking for electrical connector mating
* performance testing RESS.

# Assessment Conditions

Competency is to be assessed in the workplace or a simulated environment that accurately reflects performance in a real workplace setting.

Assessment must include direct observation of tasks.

Where assessment of competency includes third-party evidence, individuals must provide evidence that links them to the RESS in BEVs that they have repaired, e.g. repair orders.

Assessors must verify performance evidence through questioning on skills and knowledge to ensure correct interpretation and application.

The following resources must be made available:

* automotive repair workplace or simulated workplace
* PPE, including electrical safety gloves with 1000 volt rating and Australian standards rated HV insulating mat
* manufacturer specifications for BEV and RESS
* AS 5732 Electric vehicle operations - Maintenance and repair
* two different BEVs with RESS and associated components accessible for diagnosis and repair or replacement activities
* electrical diagnostic equipment appropriate to the BEVs being diagnosed and repaired, including:
* digital multimeter with minimum Cat III 1000 volt rating or Cat IV 600 volt rating
* insulation tester
* residual voltage tester, if specified in original equipment manufacturer (OEM) specifications
* scan tool
* oscilloscope
* tools, equipment and materials appropriate for repairing BEV RESS and their components.

Assessors of this unit must satisfy the requirements for assessors in applicable vocational education and training legislation, frameworks and/or standards.

# Links

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