**AURETH016 Diagnose and repair complex faults in battery electric vehicle powertrains – FOR PUBLIC REVIEW (Friday 30th April 2021 – Monday 31st May 2021)**

# Application

This unit describes the skills and knowledge required to diagnose and repair complex faults in battery electric vehicle (BEV) powertrains. It involves confirming the existence of a fault, developing a diagnostic testing strategy, diagnosing the cause of fault, carrying out the repair, performing post-repair testing and completing workplace processes and documentation. This unit covers the skills and knowledge required of those who work in the automotive service and repair industry and apply battery electric vehicle safety procedures.

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

# Unit Sector

Electric Technical – Hybrid Vehicle and Battery Electric Vehicle

# Elements and Performance Criteria

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| --- | --- |
| **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 complex faults in battery electric vehicle powertrains | 1.1 Identify job requirements from workplace instructions  1.2 Identify information required for diagnosis activity  1.3 Analyse diagnostic options, source testing strategy and identify cause of fault 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 complex faults in battery electric vehicle powertrains | 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 complex faults in battery electric vehicle powertrains | 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 Carry out repairs according to workplace and manufacturer procedures, manufacturer specifications, workplace health and safety and environmental requirements  3.4 Carry out post-repair testing according to workplace and manufacturer 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.*

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| **Skill** | **Description** |
| Learning | * efficiently locates required sources of information * develops sequenced plans for specific tasks |
| Numeracy | * matches electrical components and part identification numbers to workplace instructions, vehicle, machinery and component part lists, and manufacturer specifications * interprets vehicle electrical measurements and readings * measures voltage, current and resistance and uses mathematical operations * calculates deviations from manufacturer specifications |
| Reading | * organises and interprets technical information from workplace procedures, manufacturer procedures and manufacturer specifications * interprets text, symbols and wiring diagrams in information relating to electrical system testing and repair equipment from manufacturer specifications and workplace instructions and procedures |
| Oral communication | * clarifies instructions * obtains information from customers and supervisors |
| Planning and organising | * plans own work requirements * prioritises actions to achieve required outcomes * ensures tasks are completed within workplace timeframes |
| Technology | * uses specialised diagnostic equipment |

# 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 AURETH016 Diagnose and repair complex faults in battery electric vehicle powertrains –FOR PUBLIC REVIEW (Friday 30th April 2021 – 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 at least one complex fault in a powertrain in each of the different charging systems:
  + battery electric vehicle (BEV) with an AC charging system
  + BEV with a DC charging system
* carry out diagnostic tests during the above for at least one of the following faults:
  + insulation faults
  + component faults.

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# 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 vehicle complex faults in BEV powertrains, including:
* information provided by customers and supervisors
* manufacturer specific procedures
* workplace procedures and work health and safety (WHS) requirements relating to diagnosing and repairing BEV powertrains, including:
* establishing the 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
* safe disposal of materials
* recycling procedures
* using specialised tools and equipment
* using personal protective equipment (PPE)
* using of fire safety equipment
* identifying hazards and controlling risks associated with:
* working on vehicle high voltages on vehicle electrical systems
* wearing jewellery while working around high current wiring systems
* safe manual handling techniques, including those for lifting and moving high voltage (HV) rechargeable energy storage systems
* understanding workplace first aid equipment 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
* operating principles of BEV components, including:
* AC power
* induction motors
* driver invertors
* AC/DC and DC/DC power conversion
* AC and DC charging systems
* electric braking systems
* HV battery components and architecture, including state of charge (SOC) and internal component monitoring
* HV battery management systems
* HV battery discharge procedures
* HV system precharge concepts
* driver assist systems for BEVs
* infotainment systems in BEV
* diagnostic testing procedures for high voltage traction motors in BEVs, including procedures for:
* accessing and interpreting scan tool system data, including:
* diagnostic trouble codes (DTCs)
* live data
* freeze frame data
* using diagnostic flow charts
* testing the electrical system, including:
* accessing electrical terminals and using test probes without damaging connectors, fuse holders or wiring
* determining damage to traction motor
* windings
* checking insulation resistance of traction motor windings
* checking routing and damage to HV cabling
* conducting vehicle dynamic and static tests
* analysing abnormal noise
* analysing component failure
* repair procedures for battery electric vehicle powertrains, including:
* removing and replacing damaged components
* removing and replacing the powertrain
* post repair procedures for battery electric vehicle powertrains, including:
* DTC clearing procedures
* checking for electrical connector mating

static and dynamic performance tests of powertrains.

# 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 diagnosis and repair of complex faults in battery electric vehicle powertrains, 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:

* workplace instructions
* AS 5732 Electric vehicle operations: Maintenance and repair
* manufacturer battery electric vehicle powertrain specifications
* one BEVs with one complex powertrain fault in each BEV
* battery electric vehicle powertrain diagnostic equipment, including:
* digital multimeter with CAT III 1000 volt rating
* insulation tester
* scan tool
* oscilloscope
* residual voltage tester, if specified in original equipment manufacturer (OEM) test requirements
* tools, equipment and materials appropriate for diagnosing complex faults in battery electric vehicle powertrains.

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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