



Australian Government

AURETH015 Diagnose, remove and replace heavy electric vehicle rechargeable energy storage systems

Release: 1

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Modification History

Release	Comments
Release 1	This version first released with the Automotive Retail, Service and Repair Training Package Version 7.0. Newly created unit.

Application

This unit describes the skills and knowledge required to diagnose, remove and replace 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 removal and replacement and post-replacement testing, and completing workplace processes and documentation.

It applies to individuals who work in the automotive service and repair industry and apply battery electric safety procedures according to Australian Standards (AS) 5732 Electric vehicle operations - Maintenance and repair.

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
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Prepare to diagnose, remove and replace heavy electric vehicle rechargeable energy storage systems	1.1 Identify job requirements from workplace instructions 1.2 Identify information required for diagnostic activity from customers and supervisors 1.3 Assess diagnostic options and source testing strategy according to workplace and manufacturer specifications 1.4 Identify hazards and environmental issues associated with diagnostic, removal and replacement 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 removal and replacement according to workplace procedures
3. Remove and replace heavy electric vehicle rechargeable energy storage systems	3.1 Identify information required for removal and replacement activity 3.2 Identify tools, equipment and materials required for removal and replacement 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 Identify potential stored energy sources and implement control measures 3.5 Carry out removal and replacement of HV RESS according to workplace manufacturer specifications, workplace health and safety and environmental requirements 3.6 Reconnect RESS service plug or manual service disconnect and repower vehicle HV RESS according to manufacturer specifications 3.7 Carry out post-removal and replacement 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 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
Reading	interprets symbols and wiring diagrams
Writing	legibly and accurately fills out workplace documentation
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 and equipment

Unit Mapping Information

Newly created 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, remove and replace heavy electric vehicle rechargeable energy storage systems

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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, remove and replace high voltage (HV) rechargeable energy storage systems (RESS) in at least two different heavy battery electric vehicles (BEVs).

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, remove and replace HV RESS in heavy vehicle BEVs including information from:
 - customers and supervisors
 - Australian Standards (AS) 5732 Electric vehicle operations - Maintenance and repair
 - manufacturer specifications and procedures
- workplace procedures required to diagnose, remove and replace HV RESS in BEVs, including:
 - documentation procedures
 - housekeeping procedures, including those for:
 - examining and storing tools and equipment
 - identifying, tagging and isolating faulty equipment
 - disposing and recycling of excess materials
- workplace health and safety requirements relating to diagnosing, removing and replacing 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, removing and replacing HV RESS in BEVs, including procedures for trapping, storing and disposing of waste produced during activity
- safe operating procedures for tools and equipment, including:
 - digital multimeter with minimum Cat III 1000volt 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.

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 removed and replaced.

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 heavy BEVs with RESS and associated components accessible for diagnosis, removal and replacement activities
- electrical diagnostic equipment appropriate to the BEVs being diagnosed, removed and replaced, 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 required for removing and replacing 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.

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