



Australian Government

AURETHX02 Inspect and maintain battery electric vehicles

AURETHX02 Inspect and maintain battery electric vehicles

Modification History

Release	Comments
1	This unit of competency was first released in AUR Automotive Retail, Service and Repair Training Package Release 11.0.

Application

This unit describes the skills and knowledge required to inspect and maintain battery electric vehicles (BEVs). It involves testing rechargeable energy storage systems (RESS) and electric drive motor system operation, depowering and securing high voltage (HV) system, inspecting high voltage components and thermal management systems for condition and integrity, reinitialising the vehicle, and identifying and reporting problems.

The unit emphasises the safe application of electrical safety procedures for the high voltage RESS and, where applicable, the separated extra low voltage (SELV) system. The unit applies the same voltage definitions as Australian Standards (AS) 5732 Electric vehicle operations - Maintenance and repair.

The unit applies to those who work in the automotive service and repair industry and applies to vehicles fitted with a RESS. Work is undertaken in line with manufacturer specifications and AS 5732. This unit does not cover vehicles or equipment that operate from an external electrical supply. It does not cover opening the RESS enclosure, or work on RESS modules or cells. It does not cover diagnosis and repair of faults in the high voltage system.

Licensing/Regulatory Information

Licensing, legislative and certification requirements that apply to this unit can vary between States, Territories and industry sectors, and must be sourced from state jurisdictions prior to applying the unit.

Pre-requisite unit(s)

AURETHX01 Depower and reinitialise electric vehicles

Competency field(s)

Electrical

Unit sector(s)

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 inspect and maintain vehicle	1.1 Determine job requirements from workplace instructions 1.2 Access and interpret manufacturer procedures, workplace procedures and applicable standards required to inspect and maintain vehicle 1.3 Identify hazards associated with the work, assess risks and implement control measures in line with workplace policies and procedures, and AS 5732 1.4 Select and inspect tools, PPE and equipment required for the work and establish serviceability according to workplace procedures 1.5 Apply warning tags and signage to vehicle to indicate potential hazards according to workplace procedures
2.Test RESS and drive motor system operation	2.1 Use diagnostic equipment to retrieve system parameters and information 2.2 Test RESS and vehicle drive motor system for correct operation according to manufacturer specifications 2.3 Identify any problems associated with performance of RESS or drive motor system according to workplace procedures
3.Depower vehicle high voltage system	3.1 Locate and disconnect SELV supply according to manufacturer specifications, if required 3.2 Isolate high voltage RESS using the isolation method specified in manufacturer procedures 3.3 Confirm high voltage system is depowered by verifying residual voltage is at or below the threshold according to manufacturer procedures and AS 5732 3.4 Secure isolation against accidental or unauthorised reactivation according to workplace and manufacturer procedures

4. Inspect high voltage system, drive motor, electrical subsystems and associated components	4.1 Inspect high voltage system components and confirm condition, security and integrity according to manufacturer specifications 4.2 Inspect electrical drive motor and electrical subsystems and confirm condition 4.3 Inspect thermal management system condition and operation according to manufacturer specifications 4.4 Identify any problems associated with performance or condition of high voltage system components, electrical drive motor, electrical subsystems and associated components 4.5 Report any corrective action according to workplace procedures
5. Reinitialise vehicle high voltage system	5.1 Reconnect high voltage RESS and, if required, SELV supply according to manufacturer procedures, and reinitialise vehicle 5.2 Carry out tests and confirm correct recalibration of subsystems affected by depower process according to manufacturer specifications 5.3 Check RESS and vehicle subsystems for correct operation according to manufacturer specifications 5.4 Report any post-reactivation faults according to workplace procedures
6. Complete work processes	6.1 Conduct final inspection according to workplace procedures and confirm vehicle is ready for use 6.2 Clear work area and dispose of or recycle materials according to workplace procedures 6.3 Check tools and equipment are stored, and any faulty equipment is identified, tagged and isolated according to workplace procedures 6.4 Complete documentation according to workplace procedures

Range of conditions

N/A

Assessment Requirements for AURETHX02 Inspect and maintain battery electric vehicles

Performance Evidence

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

- inspect and maintain at least two battery electric vehicles.

In the course of the above, the candidate must:

- identify and apply manufacturer-specific information and procedures, WHS and AS 5732 requirements
- inspect high voltage components, including RESS enclosure integrity, high voltage cabling and connections, and equipotential bonding
- identify all relevant energy sources
- compare measured values with expected values to confirm correct operation, and respond to abnormal conditions based on measured values
- report any faults outside scope of works to relevant persons

Knowledge Evidence

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

- requirements for inspecting and maintaining battery electric vehicles, including:
 - requirements of AS 5732 Electric vehicle operations - Maintenance and repair
 - vehicle manufacturer specifications and procedures
 - vehicle identification and high voltage system configuration information
- workplace procedures required to inspect and maintain battery electric vehicles, including:
 - documentation procedures
 - housekeeping procedures, including those for:
 - examining and storing tools and equipment
 - identifying, tagging and isolating faulty equipment
- work health and safety (WHS) relating to inspecting and maintaining BEVs, including procedures for:
 - identifying hazards and controlling risks associated with:
 - working with high voltages on vehicle electrical systems, including electric shock, arc flash and arc blast

- energy stored in the RESS, including energy retained after the RESS is isolated
 - wearing jewellery, watches and other conductive jewellery while working on or near high voltage systems
- determining appropriate procedures to minimise risk associated with hazards, including applying electrical safety precautions when:
 - using personal protective equipment (PPE), including electrical safety gloves and arc-rated (CAL-rated) protective clothing of an appropriate rating
 - responding to the indicators of a battery thermal management event or thermal runaway according to workplace emergency procedures, including evacuation and exclusion control
 - escalating a high voltage or thermal event to emergency services according to workplace emergency response procedures
 - following live system warning tags and signs
 - establishing and controlling a high voltage isolation zone, including exclusion zones and arc flash boundaries
- use of diagnostic equipment to retrieve and interpret RESS and drive motor system parameters
- key components of BEVs and their functions
- purpose and operation of equipotential bonding in a high voltage system, including bonding of high voltage components and enclosures to the vehicle and equipment chassis or frame, and the role of bonding in insulation monitoring and detection of high voltage leakage
- RESS battery construction, including:
 - battery internal resistance
 - battery types
 - terminal corrosion
 - terminal resistance
- principles of RESS operation, including:
 - cell failure theory
 - charging characteristics
 - open circuit cells
 - series and parallel cell configuration
 - methods of interconnecting cells and modules within a RESS pack, including busbars and welded or bolted straps
 - physical arrangement of cells and modules within a RESS pack and its effect on thermal management and structural integrity

- battery charger characteristics and operation, including battery cooling system and refrigerant flow through RESS
- battery management system (BMS) theory
- thermal management system operation, including:
 - coolant type and condition
 - coolant and refrigerant circuits serving the RESS and power electronics
 - thermal management fault indicators
- differences between inspection and maintenance practices for battery electric vehicles and internal combustion engine vehicles, including the effect of RESS mass on weight distribution, handling and braking, and the effect of regenerative braking on friction brake service requirements
- variation in RESS capacity, configuration, mounting location, access arrangements and cooling between vehicle and equipment types, and the effect of that variation on inspection and maintenance procedures
- high voltage power distribution unit (PDU) operation.

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 by the assessor of the individual, confirming the BEV is safe to work on, in accordance with manufacturer specifications, before inspecting high voltage components, and inspecting and maintaining the BEV. Third party evidence must not replace this observation.

Where assessment of competency includes third-party evidence, it must identify the individual and each BEV by VIN, include reference to the manufacturer procedure followed, include record confirming the BEV was safe to work on before high voltage components were inspected and be verified and signed by a workplace supervisor who is competent in inspecting and maintaining BEVs.

The following resources must be made available:

- workplace, or simulated workplace, appropriate to the vehicles being inspected and maintained
- PPE and safety equipment, including electrical safety gloves of an appropriate voltage rating in accordance with AS 5732, arc-rated clothing and face protection, and an insulating mat
- manufacturer specifications and inspection procedures for the BEVs being inspected and maintained
- AS 5732 Electric vehicle operations - Maintenance and repair
- two different BEVs as specified in the performance evidence
- electrical test equipment, including:

- digital multimeter with a category and voltage rating appropriate to the electrical system being tested
- insulation tester
- continuity tester, or equivalent equipment for verifying equipotential bonding
- residual voltage tester, if specified in original equipment manufacturer (OEM) test requirements
- scan tool
- tools, equipment and materials appropriate for servicing and maintaining BEVs.

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

Mandatory Workplace Requirements

Assessment of performance evidence may be in a workplace setting or an environment that accurately represents a real workplace.

Unit Mapping Information

Previous Code and Title	Equivalence	Comments
AURETH102 Inspect and maintain battery electric vehicles	Equivalent	

Links

Companion volumes, including implementation guides, are found on the national training register - <https://training.gov.au/training/details/AUR>.