



Australian Government

AURETHX07 Diagnose and repair driver interface and safety interlocks in battery electric vehicles

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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 diagnose and repair faults in the driver interface and safety interlocks of battery electric vehicles (BEVs).

The unit involves preparing for the task, sourcing a diagnostic testing strategy, diagnosing the cause of the fault, depowering the high voltage (HV) rechargeable energy storage system (RESS), carrying out the repair, reinitialising the vehicle, performing post-repair testing, and completing workplace processes and documentation.

The unit emphasises the safe application of electrical safety procedures when working on the high voltage RESS. This 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.

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)

N/A

Unit sector(s)

Electrical Technical - Hybrid Vehicle and Battery 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 and repair driver interface and safety interlocks	1.1 Determine job requirements from workplace instructions 1.2 Access and interpret manufacturer procedures, workplace procedures and applicable standards required for the diagnosis activity 1.3 Analyse diagnostic options and source testing strategy to identify cause of fault using workplace and manufacturer procedures 1.4 Identify hazards and environmental issues associated with the diagnosis and repair activity, assess risks and implement control measures according to safety requirements, workplace policies and procedures, and AS 5732 1.5 Select tools and equipment required for the testing strategy and establish serviceability according to workplace procedures
2. Diagnose driver interface and safety interlocks	2.1 Implement diagnostic tests set out in testing strategy according to manufacturer and workplace procedures, and workplace health and safety requirements 2.2 Identify cause of fault through analysis of diagnostic test results 2.3 Confirm and report cause of fault according to workplace procedures 2.4 Identify any faults requiring work outside of job role or scope, and escalate according to workplace and manufacturer procedures 2.5 Develop and report recommendations for necessary repairs according to workplace procedures
3. Repair driver interface and safety interlocks	3.1 Access and interpret manufacturer procedures, workplace procedures and applicable standards required for the repair activity 3.2 Select tools, equipment and materials required for the repair activity and establish serviceability according to workplace procedures 3.3 Depower vehicle high voltage system and secure the isolation according to manufacturer procedures

	3.4 Carry out repairs according to workplace and manufacturer procedures, manufacturer specifications, work health and safety and environmental requirements 3.5 Reinitialise vehicle according to manufacturer procedures 3.6 Carry out manufacturer required coding, pairing or initialisation procedures following replacement of instrumentation or interlock components 3.7 Carry out post-repair testing according to workplace procedures, work 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

Range of conditions

N/A

Assessment Requirements for AURETHX07 Diagnose and repair driver interface and safety interlocks in 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:

- diagnose and repair driver interface and safety interlocks and their associated components on at least two battery electric vehicles, which may be of the same or of different vehicle types, to correct at least one of the following performance deficiencies in each:
 - high resistance in an input system
 - faulty driver interface or safety interlocks
 - damaged or loose connectors, fuse holders or wiring.

In the course of the above work, the candidate must:

- depower and reinitialise each vehicle according to manufacturer procedures
- retrieve and interpret safety interlock status and logged faults
- select and use diagnostic and test equipment appropriate to the work and to the vehicle type
- carry out any coding, pairing or initialisation required after component replacement, according to manufacturer procedures
- confirm correct operation through post-repair testing
- complete workplace documentation.

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:

- methods to locate and interpret information required to diagnose and repair driver interface and safety interlocks in battery electric vehicles, including:
 - 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 driver interface and safety interlocks in battery electric vehicles, 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
- limits of own job role and scope of work, and workplace procedures for escalating work outside that scope, including who to notify and the information to provide
- workplace health and safety (WHS) requirements relating to diagnosing and repairing driver interface and safety interlocks in battery electric vehicles, including procedures for:
 - determining appropriate procedures for minimising risk associated with hazards, including applying electrical safety precautions when:
 - establishing and controlling a high voltage isolation zone, including exclusion zones and arc flash boundaries
 - responding to the indicators of a battery thermal management event or thermal runaway according to workplace emergency procedures, including evacuation and exclusion zone control
- environmental requirements relating to diagnosing and repairing driver interface and safety interlocks in battery electric vehicles, including procedures for trapping, storing and disposing of waste produced during repair.
- safe operating procedures for tools and equipment, including:
 - digital multimeter and other test equipment rated in accordance with manufacturer specifications and the applicable standard
 - insulation tester
 - residual voltage tester
 - scan tool
 - oscilloscope
- operating principles of driver interface and safety interlocks in battery electric vehicles, including reasons for safety interlocks in BEVs
 - the distinction between low-voltage driver interface work and high-voltage safety interlock work, and the different risk controls applicable to each
- purpose and operation of BEV driver interface and safety interlocks, including:
 - battery charger, including charge cable sensor
 - controller signals
 - gear selector inhibitor switch

- ignition or power key
 - inertia or impact sensor
 - isolation componentry, including HV contactor
 - motor over temperature control
 - under voltage protection
 - software-monitored safety states, including how the vehicle control system responds to a detected interlock fault
 - fault logging and network-based interlocks, including communication between interlock circuits and vehicle control systems
- diagnostic testing procedures for driver interface and safety interlocks in battery electric vehicles, including procedures for:
 - accessing and interpreting scan tool system data, including:
 - diagnostic trouble codes (DTCs)
 - live data
 - using diagnostic flow charts
 - electrical system testing, including procedures for:
 - accessing electrical terminals and using test probes without damaging connectors, fuse holders or wiring
 - determining battery state of charge
 - operational tests of safety interlocks
 - testing driver interface data communication systems using scan tool and oscilloscope
 - undertaking vehicle dynamic and static tests
- repair procedures for driver interface and safety interlocks in battery electric vehicles, including procedures for:
 - tightening connections
 - replacing faulty or damaged cable connections
 - removing and replacing faulty or damaged components
 - removing and replacing driver interface
- post-repair testing procedures for driver interface and safety interlocks in battery electric vehicles, including procedures for:
 - DTC clearing procedures
 - manufacturer-required coding, pairing or initialisation procedures following replacement of driver interface clusters or interlock modules
 - checking for electrical connector mating.

Assessment Conditions

Assessment must include direct observation of tasks.

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 driver interface and safety interlocks were safe to work on before diagnosis and repair commenced, and be verified by a workplace supervisor competent in diagnosing and replacing high voltage RESS in electric vehicles. Assessors must confirm its authenticity with the third party.

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 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 for BEV system instrumentation and safety interlocks
- AS 5732 Electric vehicle operations: Maintenance and repair
- two different BEVs with driver interface and safety interlocks accessible for diagnosis and repair or replacement activities
- electrical diagnostic equipment appropriate to the BEV being diagnosed and repaired, including:
 - digital multimeter with Cat III 1000 volt rating
 - insulation tester
 - scan tool
 - oscilloscope
 - residual voltage tester, if specified in OEM requirements
- tools, equipment and materials appropriate for repairing system instrumentation and safety interlocks in 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
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AURETH107 Diagnose and repair system instrumentation and safety interlocks in battery electric vehicles	Equivalent	
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Links

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

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