



Australian Government

AURETH013 Analyse and evaluate electrical and electronic faults in HEV and BEV management systems

Release: 1

AURETH013 Analyse and evaluate electrical and electronic faults in HEV and BEV management systems

Modification History

Release	Comment
Release 1	New unit of competency.

Application

This unit describes the performance outcomes required to analyse and evaluate electrical and electronic faults in the embedded network management systems of hybrid, plug-in hybrid and battery electric vehicles (HEV, PHEV and BEV) in order to initiate action to sustain, vary or enhance performance. It involves identifying, evaluating, selecting, justifying and documenting the most appropriate rectification method or variation to the rectification method. The unit includes the analysis of multi-system and intermittent faults which may be caused by operating in adverse conditions. Importance is placed in the unit on applying electrical safety procedures when working on high voltage (HV) rechargeable energy storage systems (RESS).

It applies to those working in the automotive service and repair industry on HEV, PHEV or BEV embedded network management systems.

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

Competency Field

Electrical

Unit Sector

Technical - Hybrid Vehicle and Battery Electric Vehicle

Elements and Performance Criteria

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.

Elements Elements describe the essential outcomes.	Performance Criteria Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.
1. Identify and confirm the work requirement	1.1 Objective of the analysis and evaluation is determined from workplace instructions 1.2 Specifications for HEV, PHEV or BEV management system are sourced and interpreted 1.3 System faults, deficiencies or discrepancies are identified and confirmed 1.4 Hazards associated with the work are identified, appropriate precautions are taken, and risks are managed according to workplace procedures, safety requirements , and requirements of Australian Design Rules (ADRs) and AS 5732 Electric vehicle operations: Maintenance and repair
2. Prepare for analysis and evaluation	2.1 Evaluation criteria are developed or adopted to meet the objective of the analysis and evaluation 2.2 Analytical and evaluative methodology is developed or identified from technical information 2.3 Testing equipment is prepared according to manufacturer specifications and workplace procedures 2.4 Tools and materials required to support the diagnostic procedure are identified, selected, checked and prepared for use 2.5 HEV, PHEV or BEV management system and components are prepared for the diagnostic process
3. Carry out failure analysis	3.1 Selected analytical and evaluative methodology is followed according to manufacturer specifications and workplace procedures 3.2 Tests are carried out according to manufacturer specifications, workplace procedures, and safety and environmental requirements 3.3 Analytical and other diagnostic findings are verified, as required, by using reliable alternative or optional processes 3.4 Analytical findings and results are assessed against evaluation criteria 3.5 Valid conclusions are drawn from available evidence and documented according to workplace requirements
4. Make recommendations	4.1 Options for responding to the objective are determined from further research of technical support information 4.2 Rectification method is selected from an analysis of the options, operating conditions, requirements of ADRs and AS 5732 4.3 Report is prepared specifying analysis and evaluation process,

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.
	and detailing and justifying rectification method or variation to the rectification method
5. Complete work processes	5.1 Final inspection is made to ensure work is to workplace expectations 5.2 Work area is cleaned, waste and non-recyclable materials are disposed of, and recyclable material is collected 5.3 Tools and equipment are checked and stored, and any faulty electrical equipment is identified, tagged and isolated according to workplace procedures 5.4 Workplace documentation is processed according to workplace procedures

Foundation Skills

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

Skills	Description
Learning skills to:	• apply learning and processes to different situations.
Reading skills to:	• research, organise and interpret technical information relating to HEV, PHEV and BEV management systems.
Writing skills to:	• legibly and accurately fill out workplace documentation when reporting failure analysis findings • document and complete reports.
Numeracy skills to:	• use mathematical ideas and techniques to complete measurements, calibrate testing equipment and present analytical results.
Planning and organising skills to:	• plan own work requirements and prioritise actions to achieve required outcomes and ensure tasks are completed within workplace timeframes.
Technology skills to:	• use specialised HEV, PHEV and BEV management system diagnostic equipment.

Range of Conditions

This section specifies work environments and conditions that may affect performance.

Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included. Bold italicised wording, if used in the performance criteria, is detailed below.

<i>Safety requirements</i> must include:	• work health and safety (WHS) and occupational health and safety (OHS) requirements, including procedures for: • identifying hazards and controlling risks associated with: • working with high voltages on vehicle electrical systems • working with hazardous materials and toxic substances • wearing jewellery while working around high electrical currents • minimising risk, including: • analysing task to define risk • applying electrical safety precautions, including ‘one hand’ rule, live system warning tags and signs, depowering the vehicle, isolating the HV RESS electrical supply, and stabilising the vehicle HV electrical systems • using personal protective equipment, including electrical safety gloves with 1000 volt rating and Australian standards rated HV insulating mat • identifying fire safety equipment.
<i>Analytical and evaluative methodology</i> must include:	• diagnostic process, sequence, tests and testing equipment.

Unit Mapping Information

Equivalent to AURETH5013 Analyse and evaluate electrical and electronic faults in electric and hybrid vehicle systems

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b4278d82-d487-4070-a8c4-78045ec695b1>

Assessment Requirements for AURETH013 Analyse and evaluate electrical and electronic faults in HEV and BEV management systems

Modification History

Release	Comment
Release 1	New unit of competency.

Performance Evidence

Before competency can be determined, individuals must demonstrate they can perform the following according to the standard defined in this unit's elements, performance criteria, range of conditions and foundation skills:

- analyse and evaluate an electrical or electronic fault in the network management systems of one hybrid electric vehicle (HEV) and one battery electric vehicle (BEV)
- the above faults must involve two of the following:
 - battery management system (BMS)
 - rechargeable energy storage system (RESS)
 - power distribution unit (PDU)
 - high voltage traction motor drive assembly
 - direct current (DC) to DC converter assembly
 - RESS cooling system.

Knowledge Evidence

Individuals must be able to demonstrate knowledge of:

- work health and safety (WHS) and occupational health and safety (OHS) requirements relating to analysing and evaluating electrical and electronic faults in HEV and BEV management systems, including procedures for:
 - identifying hazards and controlling risks associated with:
 - working with high voltages on vehicle electrical systems
 - working with hazardous materials and toxic substances
 - wearing jewellery while working around high electrical currents
 - minimising risk, including:
 - analysing task to define risk

- applying electrical safety precautions, including ‘one hand’ rule, live system warning tags and signs, depowering the vehicle, isolating the HV RESS electrical supply, and stabilising the vehicle HV electrical systems
- using personal protective equipment (PPE), including electrical safety gloves with 1000 volt rating and Australian standards rated HV insulating mat
- identifying and using fire safety equipment
- methods for locating and content of manufacturer specifications, workplace procedures, Australian standards and Australian Design Rules (ADRs) relating to embedded network management systems of HEV, plug-in hybrid electric vehicle (PHEV) and BEV
- principles and processes involved in planning and implementing analysis and evaluation of electrical and electronic faults in HEV, PHEV and BEV embedded network management systems
- design and planning of diagnostic procedures for electrical and electronic faults in HEV and BEV management systems, including procedures for diagnosing:
 - mechanical faults
 - electrical faults
 - electronics faults
- types, function and operation of hybrid and battery electric vehicle systems, including:
 - DC electric motor types, including:
 - separately excited motors
 - permanent magnet motors
 - alternating current (AC) electric motor types, including:
 - induction motors
 - brushless motors
 - HV traction motor drive assembly and motor controllers, including:
 - variable pulse width DC types
 - variable frequency and variable amplitude AC motor types
 - on-board RESS system and batteries, including:
 - lead acid
 - nickel metal hydride
 - lithium ion
 - ultra capacitors and super capacitors
 - key features of associated components and systems, including:
 - BMS
 - PDU
 - DC to DC converter assembly
 - RESS cooling system, including the vehicle HVAC system
 - parallel HEVs and PHEVs
 - series HEVs and PHEVs
 - power split HEVs and PHEVs
- testing procedures for HEV and BEV management systems, including:

- vehicle dynamic and static testing procedures
- abnormal noise analysis
- component failure analysis
- types, functions, operation and limitations of diagnostic testing equipment required to analyse and evaluate electrical and electronic faults in HEV, PHEV and BEV management systems
- procedures for accessing and interpreting scan tool system data, including:
 - diagnostic trouble codes (DTCs), including:
 - conditions that set the DTCs
 - conditions for running DTCs
 - live data
 - freeze frame data
 - waveforms
- procedures for documenting and reporting the analysis and evaluation process
- requirements of AS 5732 Electric vehicle operations: Maintenance and repair relating to HEV, PHEV and BEV management systems.
- requirements of Australian Design Rules (ADRs) relating to HEV, PHEV and BEV management systems.

Assessment Conditions

Assessors must satisfy NVR/AQTF assessor requirements.

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 HEV, PHEV and BEV management systems that they have worked on, 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
- workplace instructions
- PPE, including electrical safety gloves with 1000 volt rating and Australian standards rated HV insulating mat
- AS 5732 Electric vehicle operations: Maintenance and repair
- manufacturer HEV, PHEV or BEV management system specifications
- one HEV with a network management system fault
- diagnostic equipment for HEV and BEV management systems, including:
 - digital multimeter
 - scan tool

- oscilloscope
- tools, equipment and materials appropriate for analysing and evaluating electrical and electronic faults in HEV and BEV management systems.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b4278d82-d487-4070-a8c4-78045ec695b1>

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b4278d82-d487-4070-a8c4-78045ec695b1>