



Australian Government

AURETH4014 Diagnose complex faults in battery electric and hybrid electric vehicle systems

Release 1

AURETH4014 Diagnose complex faults in battery electric and hybrid electric vehicle systems

Modification History

Release	Comment
Release 1	New unit of competency

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes required to diagnose complex faults in battery electric and hybrid electric vehicle systems in order to initiate action to service, repair, replace or improve performance. The unit involves evaluating system performance and identifying possible operational anomalies. Faults may be electrical or electronic by nature, requiring the application of complex diagnostic processes to resolve. Licensing, legislative, regulatory or certification requirements may apply to this unit in some jurisdictions. Users are advised to check with the relevant regulatory authority.
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Application of the Unit

Application of the unit	Work applies to and includes system fault and failure diagnosis of battery electric and hybrid electric vehicle systems of light vehicles, heavy commercial vehicles, and vehicles in the mining, construction and agricultural environments. The unit relates to an automotive technologist, master technician or subject matter specialist. It encompasses and builds on trade level competencies.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify and confirm work requirement	1.1. Workplace instructions and reports are used to determine the nature and objective of system diagnosis requirements 1.2. Specifications for correctly functioning battery electric and hybrid electric vehicle systems are accessed and interpreted 1.3. Workplace health and safety (WHS) requirements, equipment and system isolation requirements, and personal protection needs are observed and applied throughout the work 1.4. Effects of systemic deficiencies, discrepancies or faults with battery electric and hybrid electric vehicle systems are identified and confirmed from direct and/or indirect evidence 1.5. Possible safety impacts of the work are considered and responded to according to regulatory and workplace requirements and practices
2. Prepare to perform diagnosis	2.1. Criteria for diagnosis are developed and adopted to meet the objective of the work 2.2. System performance achievements or discrepancies are identified from scrutiny of technical support information and available on-board diagnostic systems 2.3. Diagnostic methods, including complexity of diagnostic process, sequence, tests and testing process are identified and selected from the range of available options 2.4. Testing equipment is obtained and prepared for application according to manufacturer, component supplier and workplace requirements 2.5. Tools and materials required to support the diagnostic process are identified, selected and prepared for use
3. Apply complex diagnostic process	3.1. Selected diagnostic processes are followed according to specifications and workplace procedures 3.2. Testing is carried out according to workplace procedures and manufacturer and component supplier specifications 3.3. Findings are verified, if necessary, by using reliable alternate or optional processes 3.4. Conclusions are drawn from findings and documented according to workplace requirements 3.5. Information and detail related to the evaluation of diagnosis is provided to the appropriate person or customer to confirm further action to be taken

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

- communication skills to communicate ideas and information to enable confirmation of work requirements and specifications, coordination of work with site supervisor, other workers and customers, reporting of work outcomes and completion of regulatory, commercial and vehicle information systems inputs
- numeracy skills to use mathematical ideas and techniques to complete measurements, calculate requirements, and present results of diagnosis
- planning and organising skills to conclude complex diagnostic processes which anticipate and allow for risks, cater for both direct and indirect evidence and avoid or minimise reworking and avoid wastage
- problem-solving skills to use available information to contribute to decision making strategies for solving complex problems as they relate to battery electric and hybrid electric vehicle systems
- self-management skills to plan and organise activities, including the planning of analytical processes, preparation of the worksite and the obtaining of testing equipment and materials to avoid backtracking, workflow interruptions or wastage
- technical skills to use workplace tools relating to the complex diagnosis of battery electric and hybrid electric vehicle systems, including the use of:
 - specialised tools and equipment
 - measuring equipment
- technology skills to use workplace technology related to systems diagnosis, information research and management systems.

Required knowledge

- concepts and principles of battery electric and hybrid electric vehicle systems
- types, functions and operations of electrical and electronic systems in battery electric and hybrid electric vehicles
- theory of diagnosis, including concept, design and planning
- electrical theory and operation covering automotive digital computers, networked vehicles, voltage, current, resistance, power, capacitance, electrostatics, magnetics, inductance, discrete electronic components, logic families and radio frequency
- types, functions, operations and limitations of diagnostic testing equipment related to battery electric and hybrid electric vehicle systems
- testing procedures of battery electric and hybrid electric vehicle systems
- methods and processes for documenting and reporting diagnostic findings and recommendations

Evidence Guide

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

Critical aspects for assessment and evidence required to demonstrate competency in this unit

The evidence required to demonstrate competency in this unit must be relevant to workplace operations and satisfy all of the requirements of the performance criteria and required skills and knowledge.

A person who demonstrates competency in this unit must be able to:

- interpret workplace instructions and locate and apply information
- apply safety requirements, including the use of personal protective equipment
- identify and select appropriate diagnosis processes to be performed
- complete diagnosis of complex faults on a minimum of three different battery electric and hybrid electric vehicle systems with real or simulated faults
- document and report outcomes and required actions of diagnosis of complex faults in battery electric and hybrid electric vehicle systems.

Context of, and specific resources for assessment

Competency is to be assessed in the workplace or a simulated workplace environment that accurately reflects performance in a real workplace setting.

Assessment is to occur:

- using standard workplace practices and procedures
- following safety requirements
- applying environmental constraints.

Assessment is to comply with relevant:

- regulatory requirements
- Australian standards
- industry codes of practice.

The following resources must be made available for the assessment of this unit:

- workplace location or simulated workplace
- vehicles with real or simulated battery electric and hybrid

EVIDENCE GUIDE

	electric vehicle systems faults • tools and equipment appropriate for the diagnosis of complex faults in battery electric and hybrid electric vehicle systems • technical reference information and workplace instructions.
Method of assessment	Assessment must satisfy the endorsed Assessment Guidelines of this Training Package. Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with the application of required skills and knowledge. Assessment methods must be by direct observation of tasks and include questioning on required skills and knowledge to ensure correct interpretation and application. Competence in this unit may be assessed in conjunction with other units which together form part of a holistic work role. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate the needs of diverse clients. Assessment processes and techniques must be culturally sensitive and appropriate to the language, literacy and numeracy capacity of the candidate and the work being performed.

Range Statement

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Battery electric and hybrid electric vehicle systems may include:

- traction control systems
- steering and braking systems
- electronic stability systems
- electric traction motors and control systems
- high voltage/low voltage charging systems
- heating, ventilation, air conditioning and cooling (HVAC) systems
- vehicle dynamic control
- closed loop electronic and multi-class bi-directional universal switch (BUS) systems.

Workplace health and safety (WHS) requirements:

- are those prescribed under legislation, regulations, codes of practice, and workplace policies and procedures
- may include:
 - protective clothing and equipment
 - use of tools and equipment
 - handling of material
 - use of fire-fighting equipment
 - first aid equipment
 - safety management systems, including equipment and system isolation requirements
- hazard control, including control of hazardous materials and toxic substances

Faults may include:

- electrical and electronic failures in battery electric and hybrid electric vehicle systems
- direct faults in input sensors, output actuators, wiring harnesses or computer systems
- calibration and adjustment specifications, component specifications, and component assembly
- component damage and system modifications
- indirect faults caused by the influence of external electrical and electronic systems, which may or may not be faulty in their primary operations.

Tests may include:

- wiring and connector integrity
- operator and specification of input and output devices

RANGE STATEMENT

	- controlling electronic components and computers - data interpretation - readings relating to direct, indirect and intermittent causes.
Testing equipment may include:	- analogue and digital multimeters - lab oscilloscopes - scan tools - on-board diagnostic systems - test lights and test LEDs - pulse generators - manufacturer and component supplier testing equipment.
Diagnostic processes may include:	- analysing manufacturer and component supplier specifications, schematics and operational procedures relating to battery electric and hybrid electric vehicle systems - six-step troubleshooting plan - discover-investigate-fix methodology.

Unit Sector(s)

Competency field	Electrical
Unit sector	Technical – Hybrid Vehicle and Battery Electric Vehicle

Custom Content Section

Not applicable.