



Australian Government

Department of Education, Employment and Workplace Relations

AURETH4003 Test and repair high voltage battery systems in battery electric vehicles

Release: 1

AURETH4003 Test and repair high voltage battery systems in battery electric vehicles

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	<p>This unit describes the performance outcomes required to test and repair high voltage (HV) battery systems in battery electric vehicles (BEVs). It involves working with HV and low voltage (LV) alternating current (AC) and direct current (DC) automotive battery systems and electrical components.</p> <p>Importance is placed on the application of HV electrical safety procedures.</p> <p>Licensing, legislative, regulatory or certification requirements may apply to this unit in some jurisdictions. Users are advised to check with the relevant regulatory authority.</p>
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Application of the Unit

Application of the unit	<p>Work involves testing and repairing HV battery systems in BEVs in the automotive industry.</p>
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Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units	AURETH3001 Depower battery electric vehicles AURE218676A Test, service and charge batteries
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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. Prepare for repair operations	1.1. HV battery repair information is accessed 1.2. Occupational health and safety (OHS) requirements and appropriate precautions are identified and applied 1.3. Repair method most appropriate for the specific circumstances is selected and prepared for 1.4. Tools and testing equipment necessary to conduct the work are assembled 1.5. Technical and/or calibration requirements for repair of the HV battery system are established
2. Test battery system	2.1. HV battery systems is tested for electrical efficiency using manufacturer specifications and test procedures 2.2. Diagnostic equipment is used to retrieve system parameters and information 2.3. Faults with the battery system are identified 2.4. Test results are recorded
3. Repair battery system	3.1. Test results are compared with equipment specifications to decide on appropriate corrective action 3.2. HV battery system components are replaced, repaired or adjusted as required 3.3. Repaired HV battery systems are re-tested for correct operation 3.4. Replacement, repair or adjustment procedures are recorded
4. Complete repair operations	4.1. Work area is tidied, and tools and equipment are replaced according to workplace requirements 4.2. Job card or repair order is completed according to workplace requirements 4.3. Client report is prepared on the outcomes of the repair of the HV battery system, according to workplace requirements 4.4. Vehicle is prepared for return to the client

Required Skills and Knowledge

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

Required skills

- technical skills to:
 - use workplace technology relating to testing and repairing BEV HV battery systems and components
 - use specialist tools and equipment
 - use computerised measuring equipment
 - report and record actions
- communication skills to:
 - confirm work requirements and specifications
 - communicate effectively regarding work requirements with supervisor, other workers and customers
 - report work outcomes and problems
- literacy skills to interpret technical information and specifications
- numeracy skills to complete tests and measurements to determine correct operation
- problem-solving skills to:
 - interpret test results
 - identify repair options
- self-management skills to:
 - manage risks and hazards associated with HV BEV battery systems and components
 - optimise workflow and productivity

Required knowledge

- components of HV battery systems and their functions
- battery management system (BMS) theory
- battery theory, including:
 - battery internal resistance
 - battery types
 - terminal corrosion
 - terminal resistance
- battery pack theory, including:
 - cell failure theory
 - charging characteristics
 - open circuit cells
 - reverse polarisation
 - series cell configuration

- strapping and layout
- HV battery charger and DC to DC converter characteristics
- OHS requirements relating to:
 - safe work practices
 - electrical safety
- power distribution unit (PDU) theory
- principles of electricity, including AC and DC
- principles of operation of HV battery systems
- applicable commonwealth, state or territory legislation, regulations, standards, codes of practice and environmental regulations relating to the repair of HV battery systems
- vehicle-specific electrical requirements
- workplace policies and procedures, including quality, recording and reporting procedures relating to the repair of HV BEV battery systems

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	<p>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.</p> <p>A person who demonstrates competency in this unit must be able to:</p> <ul style="list-style-type: none"> • comply with OHS requirements and safe work practices • ensure electrical and mechanical integrity of any component or system is maintained when performing tests • check HV battery system performance against manufacturer's specifications • replace, repair and adjust HV battery system components as required to correct deficiencies • complete relevant documentation for the repair of the HV battery system.
Context of, and specific resources for assessment	<p>Competency is to be assessed in the workplace or a simulated workplace environment that accurately reflects performance in a real workplace setting.</p> <p>Assessment is to occur:</p> <ul style="list-style-type: none"> • using standard workplace practices and procedures • following safety requirements • applying environmental constraints. <p>Assessment is to comply with relevant:</p> <ul style="list-style-type: none"> • regulatory requirements • Australian standards • industry codes of practice. <p>Competency is to be assessed using a BEV that uses HV and LV AC/DC electrical systems. Where simulation is used, an operational BEV must be included in the simulation.</p> <p>The following resources must be made available for the assessment of this unit:</p>

Evidence Guide	
	<ul style="list-style-type: none">• appropriate PPE• a BEV• manufacturer specifications for the BEV• testing equipment• full range of essential tools and equipment• workplace documentation.
Method of assessment	<p>Assessment must satisfy the endorsed Assessment Guidelines of this Training Package.</p> <p>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.</p> <p>Assessment methods must be by direct observation of tasks and include questioning on required skills and knowledge to ensure correct interpretation and application.</p> <p>Competence in this unit may be assessed in conjunction with other units which together form part of an holistic work role.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate the needs of diverse clients.</p> <p>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.</p>

Range Statement

Range Statement	
<p>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.</p>	
<p><i>Repair information</i> may include:</p>	<ul style="list-style-type: none"> • Australian standards • diagrams and sketches • engineer or manufacturer design specifications and instructions • industry codes of practice • parts catalogues • verbal, written and graphical instructions issued by authorised internal and external persons • workplace specifications and requirements.
<p><i>OHS requirements</i> may include:</p>	<ul style="list-style-type: none"> • elimination of hazardous materials and substances • first aid equipment • following emergency procedures • hazard and risk control • material safety data sheets (MSDS) • personal protective equipment (PPE) and clothing • safety equipment • techniques for manual handling, including shifting, lifting and carrying.
<p><i>Appropriate precautions</i> may include:</p>	<ul style="list-style-type: none"> • analysing task to define risk • applying electrical safety precautions, such as: <ul style="list-style-type: none"> • “one hand rule” • live system warning tags and signs • isolating the HV battery supply • depowering the vehicle • using PPE, such as: <ul style="list-style-type: none"> • electrical safety gloves 1000V • HV insulating mats (Australian standards rated).
<p><i>Testing equipment</i> may include:</p>	<ul style="list-style-type: none"> • AC/DC current clamp • BMS diagnostic equipment • diagnostic scanner • insulation or mega ohm tester

Range Statement	
	<ul style="list-style-type: none"> • multimeter CAT 3 1000V • oscilloscope • thermal imaging equipment or non-contact thermometer.
<i>Electrical efficiency</i> relates to:	<ul style="list-style-type: none"> • charging • discharge rate • holding capacity • temperature • voltage.
<i>Test procedures</i> may include:	<ul style="list-style-type: none"> • battery charging interlock • battery cooling system • BMS • HV contactors • HV current leakage to vehicle chassis • HV fuse • inertia safety cut-out switch • isolation/cut-off emergency device • leakage of electrolyte • loose cable connections • mounting of batteries • on-board battery charging system • PDU.
<i>Appropriate corrective action</i> may include:	<ul style="list-style-type: none"> • balancing state of charge • replacing cable connection • replacing system component • replacing the battery • tightening connection.
<i>Workplace requirements</i> may include:	<ul style="list-style-type: none"> • industry codes of practice • manufacturer specifications • quality policies and procedures • safe work procedures • sustainability, environment, equal opportunity and anti-discrimination policies and procedures • workplace recording and reporting procedures.

Unit Sector(s)

Competency field	Electrical
Sector	Technical – Hybrid and Battery Electric Vehicle

Custom Content Section

Not applicable.