



**Australian Government**

# **AURETH4005 Diagnose and repair high voltage traction motors in battery electric vehicles**

**Release 2**

## **AURETH4005 Diagnose and repair high voltage traction motors in battery electric vehicles**

### **Modification History**

<b>Release</b>	<b>Comment</b>
<b>Release 2</b>	Replaces AURETH4005 Diagnose and repair high voltage traction motors in battery electric vehicles (Release 1)  Reference to OHS legislation replaced with new WHS legislation

### **Unit Descriptor**

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes required to diagnose and repair high voltage (HV) traction motors in battery electric vehicles (BEVs).</p> <p>Importance is placed on the application of HV 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**

<b>Application of the unit</b>	<p>Work applies to the diagnosis and repair of HV traction motors in BEVs in the automotive industry.</p> <p>It involves working with HV alternating current (AC) and direct current (DC) automotive electrical components.</p>
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### **Licensing/Regulatory Information**

Refer to Unit Descriptor.

## Pre-Requisites

<b>Prerequisite units</b>	AURETH3001 Depower battery electric vehicles
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## Employability Skills Information

<b>Employability skills</b>	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	<p>1.1.<i>Procedures and information</i> relevant to the task are sourced and work requirements confirmed</p> <p>1.2.<i>Workplace health and safety (WHS) requirements</i> and <i>appropriate precautions</i> are identified and applied</p> <p>1.3.Repair methods for the specific work requirement are selected and prepared for</p> <p>1.4.Tools and testing equipment necessary to conduct the work are assembled</p> <p>1.5.Technical and/or calibration requirements for diagnosis and repair of the traction motor are established</p>
2. Diagnose traction motor operation	<p>2.1.Traction motor operational <i>tests and checks</i> are carried out using manufacturer specifications and test procedures</p> <p>2.2.Faults with the traction motor are diagnosed and identified</p> <p>2.3.Test results are recorded</p>
3. Repair traction motor	<p>3.1.Traction motor repair information is accessed</p> <p>3.2.Test results are compared with manufacturer specifications to decide on <i>corrective actions</i></p> <p>3.3.Traction motor and components are removed, replaced, repaired and adjusted as required</p> <p>3.4.Traction motor is re-tested for correct operation once repaired</p> <p>3.5.Replacement, repair or adjustment procedures are recorded</p>
4. Complete repair operations	<p>4.1.Work area is tidied, and tools and equipment replaced according to <i>workplace requirements</i></p> <p>4.2.Job card or repair order is completed according to workplace requirements</p> <p>4.3.Client report is prepared on the outcomes of the diagnosis and repair of the traction motor according to workplace requirements</p> <p>4.4.Vehicle is prepared for return to the client</p>

## 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 the repair of BEV traction motors and components
  - use specialist tools and equipment
  - use computerised measuring and diagnostic 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 electrical systems and components
  - optimise workflow and productivity

### Required knowledge

- components of HV BEVs and their functions
- principles of electricity, including AC and DC
- principles of operation of traction motors
- relevant WHS requirements relating to:
  - safe work practices
  - electrical safety
- applicable commonwealth, state or territory legislation, regulations, standards and codes of practice and environmental regulations relating to the diagnosis and repair of BEV traction motors
- vehicle-specific electrical requirements
- workplace policies and procedures, including quality, recording and reporting procedures relating to the diagnosis and repair of BEV traction motors

## Evidence Guide

<b>Evidence Guide</b>	
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.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<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"> <li>• comply with WHS requirements and safe work practices</li> <li>• ensure electrical and mechanical integrity of components and system is maintained when performing tests</li> <li>• check traction motor performance against manufacturer specifications</li> <li>• diagnose and replace, repair or adjust traction motor as required to correct deficiencies</li> <li>• complete relevant documentation for the diagnosis and repair of the traction motor.</li> </ul>
<b>Context of, and specific resources for assessment</b>	<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"> <li>• using standard workplace practices and procedures</li> <li>• following safety requirements</li> <li>• applying environmental constraints.</li> </ul> <p>Assessment is to comply with relevant:</p> <ul style="list-style-type: none"> <li>• regulatory requirements</li> <li>• Australian standards</li> <li>• industry codes of practice.</li> </ul> <p>Competency is to be assessed using a BEV that uses HV and low voltage (LV) AC/DC electrical systems. Where simulation is used, an operational BEV must be included in the simulation.</p>

**Evidence Guide**

	<p>The following resources must be made available for the assessment of this unit:</p> <ul style="list-style-type: none"> <li>• appropriate PPE</li> <li>• a BEV</li> <li>• manufacturer specifications for the BEV</li> <li>• testing equipment</li> <li>• full range of essential tools and equipment</li> <li>• workplace documentation.</li> </ul>
<b>Method of assessment</b>	<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 a 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, 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>	
<b><i>Procedures and information</i></b> may include:	<ul style="list-style-type: none"> <li>• Australian standards</li> <li>• diagrams and sketches</li> <li>• engineer or manufacturer design specifications and instructions</li> <li>• industry codes of practice</li> <li>• verbal, written and graphical instructions issued by authorised internal and external persons</li> <li>• workplace specifications and requirements.</li> </ul>
<b><i>WHS requirements</i></b> may include:	<ul style="list-style-type: none"> <li>• elimination of hazardous materials and substances</li> <li>• first aid equipment</li> <li>• following emergency procedures</li> <li>• hazard and risk control</li> <li>• material safety data sheets (MSDS)</li> <li>• personal protective equipment (PPE) and clothing</li> <li>• safety equipment</li> <li>• techniques for manual handling, including shifting, lifting and carrying.</li> </ul>
<b><i>Appropriate precautions</i></b> may include:	<ul style="list-style-type: none"> <li>• analysing task to define risk</li> <li>• applying electrical safety precautions, such as:               <ul style="list-style-type: none"> <li>• “one hand rule”</li> <li>• live system warning tags or signs</li> </ul> </li> <li>• isolating the HV battery electrical supply</li> <li>• depowering the vehicle</li> <li>• using PPE, such as:               <ul style="list-style-type: none"> <li>• electrical safety gloves 1000V</li> <li>• HV insulating mats (Australian standards rated).</li> </ul> </li> </ul>
<b><i>Tests and checks</i></b> may include:	<ul style="list-style-type: none"> <li>• damage to traction motor windings</li> <li>• insulation resistance of traction motor windings</li> <li>• routing and damage of HV cabling</li> <li>• traction motor operation.</li> </ul>
<b><i>Corrective actions</i></b> may	<ul style="list-style-type: none"> <li>• replacing cable connections</li> </ul>



<b>Range Statement</b>	
include:	<ul style="list-style-type: none"> <li>• replacing system components</li> <li>• replacing the traction motor</li> <li>• tightening connections.</li> </ul>
<b>Workplace requirements</b> may include:	<ul style="list-style-type: none"> <li>• industry codes of practice</li> <li>• manufacturer specifications</li> <li>• quality policies and procedures</li> <li>• safe work procedures</li> <li>• sustainability, environment, equal opportunity and anti-discrimination policies and procedures</li> <li>• workplace recording and reporting procedures.</li> </ul>

## Unit Sector(s)

<b>Competency field</b>	Electrical
<b>Sector</b>	Technical – Hybrid and Battery Electric Vehicle

## Custom Content Section

Not applicable.