Australian Government

Department of Education, Employment and Workplace Relations

AURETH4007 Diagnose and repair system instrumentation and safety interlocks in battery electric vehicles

Release: 1

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Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes required to repair high voltage (HV) system instrumentation and safety interlocks in battery electric vehicles (BEVs). It includes testing the instrumentation data communication system and safety interlocks for correct operation. It involves working with HV automotive electrical components as well as low voltage (LV) alternating current (AC) and direct current (DC) automotive electrical components and battery systems. Importance is placed on the application of HV safety procedures. Licensing, legislative, regulatory or certification requirements may apply to this unit in some jurisdictions. Users are advised to check with the relevant regulatory authority.

Application of the Unit

Application of the unit	Work applies to the repair of HV system instrumentation and safety interlocks in BEVs in the automotive industry.

Licensing/Regulatory Information

Refer to Unit Descriptor.

Pre-Requisites

Prerequisite units	AURETH3001 Depower battery electric vehicles

Employability Skills Information

Employability skills	This unit contains employability skills.

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.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for repair operations	1.1. ***Procedures and information*** relevant to the task are sourced and work requirements confirmed 1.2. ***Occupational health and safety (OHS) requirements*** and ***appropriate precautions*** are identified and applied 1.3. Repair methods for the specific work requirement are 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 diagnosis and repair of the HV system instrumentation and safety interlocks are established
2. Perform diagnosis	2.1. ***Tests and checks*** on instrumentation data communication system are carried out using manufacturer specifications and test procedures 2.2. Vehicle ***safety interlocks*** are tested for correct operation 2.3. Motor controller is checked for safe and correct operation 2.4. Audible warning system (if applicable) is checked for operation 2.5. Battery gauge state of charge (SOC) indicator is tested 2.6. Tests and checks on HV contactor are carried out (if applicable) using diagnostic scanner or computer interface 2.7. Test results are recorded
3. Repair instrumentation and safety interlocks	3.1. Test results are compared with manufacturer specifications to decide on appropriate ***corrective actions*** 3.2. Components are replaced, repaired and adjusted as required 3.3. Repaired and replaced components are re-tested for correct operation 3.4. Replacement, repair or adjustment procedures carried out are recorded
4. Complete repair operations	4.1. Work area is tidied, and tools and equipment replaced according to ***workplace requirements*** 4.2. Job card or repair order is completed according to workplace requirements

ELEMENT	PERFORMANCE CRITERIA
	4.3. Client report is prepared on the outcomes of the diagnosis and repair 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 the diagnosis and repair of HV system instrumentation and safety interlocks in BEVs
  - use specialist tools and equipment
  - use computerised measuring equipment
- 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
  - report and record actions
- 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 BEV electrical systems and components
  - optimise workflow and productivity

Required knowledge

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

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: • comply with OHS requirements and safe work practices • ensure electrical and mechanical integrity of the auxiliary motor/component is maintained when performing tests • check the operation of the HV system instrumentation and safety interlocks against manufacturer specifications • diagnose and replace, repair or adjust system components as required to correct deficiencies • complete relevant documentation for the diagnosis and repair of HV system instrumentation and safety interlocks.
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. 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

Evidence Guide	
	simulation. The following resources must be made available for the assessment of this unit: • appropriate PPE • a BEV • manufacturer specifications for the BEV • testing equipment • full range of essential tools and equipment • workplace documentation.
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, 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.	
Procedures and information may include:	• Australian standards • diagrams and sketches • engineer or manufacturer design specifications and instructions • industry codes of practice • material safety data sheets (MSDS) • parts catalogues • verbal, written and graphical instructions issued by authorised internal and external persons • workplace instructions and requirements.
OHS requirements may include:	• elimination of hazardous materials and substances • first aid equipment • following emergency procedures • hazard and risk control • personal protective equipment (PPE) and clothing • safety equipment • techniques for manual handling, including shifting, lifting and carrying.

Appropriate precautions may include:	• analysing task to define risk
	• applying electrical safety precautions, such as:
	  • "one hand rule"
	  • live system warning tags or signs
	• isolating the HV battery electrical supply
	• depowering the vehicle
	• using PPE, such as:
	  • electrical safety gloves 1000V
	  • HV insulating mats (Australian standards rated).

Testing equipment may include:	• AC/DC current clamp • battery management system (BMS) diagnostic equipment • diagnostic scanner or computer interface device

	• multimeter CAT 3 1000V • oscilloscope • thermal imaging equipment or non-contact thermometer.

Tests and checks may include:	• battery state of charge
	• operational tests of safety interlocks
	• testing instrumentation data communication system using scan tool, such as:
	  • CANBUS
	  • Controller Area Network
	  • diagnosis trouble codes (DTC).

Safety interlocks may include:	• battery charger, including charge cable sensor • fault signals from controller • gear selector inhibitor switch • ignition or power key • inertia or impact sensor • isolation componentry, including HV contactor • motor over temperature control • under voltage protection.
Corrective actions may include:	• balancing state of charge • replacing or adjusting system components or sensors • replacing or repairing cable connections • tightening connections.
Workplace requirements may include:	• 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.