



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **UETTDRSB07B Maintain high current DC switchgear and equipment**

**Release: 1**

## **UETTDRSB07B Maintain high current DC switchgear and equipment**

### **Modification History**

Not Applicable

### **Unit Descriptor**

#### **Unit Descriptor**

1)

#### **1.1) Descriptor**

This Competency Standard Unit covers the maintenance of DC switchgear and other equipment which may include rectifier transformers, rectifiers, invertors, isolators and links, harmonic filters, negative reactors and EDRs. It encompasses the maintenance, including the diagnosing of faults and replacement and repair to ensure correct maintenance to prescribed procedures and standards. It also encompasses the isolation of systems and/or circuits for safe working according to work plans and the visual inspection and necessary checks to ensure safe energisation, as well as updating of maintenance data and relevant quality assurance documentation.

### **Application of the Unit**

#### **Application of the Unit 4)**

This Competency Standard Unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training.

## **Licensing/Regulatory Information**

### **1.2) License to practice**

The skills and knowledge described in this unit requires a licence/registration to practice in the work place subject to regulations for undertaking of electrical work. Practice in workplace and during training is also subject to regulations directly related to Occupational Health and Safety, electricity/telecommunications/gas/water industry safety and compliance, industrial relations, environmental protection, anti discrimination and training. Commonwealth, State/Territory or Local Government legislation and regulations may exist that limits the age of operating certain equipment.

## **Pre-Requisites**

**Prerequisite Unit(s)**      2)

### **2.1) Competencies**

Entry into this unit requires a current 'Unrestricted Electrician's Licence' or equivalent issued in an Australian State or Territory or satisfaction of the ERAC requirements for the issue of an unrestricted electrician's licence.

## Employability Skills Information

### Employability Skills 3)

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

## Elements and Performance Criteria Pre-Content

**6) Elements:** Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

| ELEMENT                                                             | PERFORMANCE CRITERIA                                                                                                                                                                                                                      |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 Prepare/plan to maintain high current DC switchgear and equipment | 1.1 Work schedules including drawings, plans, requirements procedures and material lists are acquired, analysed and the extent of work determined.                                                                                        |
|                                                                     | 1.2 Relevant requirements and established procedures for the work are communicated to all personnel and identified for all work sites.                                                                                                    |
|                                                                     | 1.3 Hazards are identified, OHS risks assessed and control measures are prioritised, implemented and monitored including emergency exits kept clear, to ensure safe systems of work are followed and according to established procedures. |
|                                                                     | 1.4 Work is prioritised and sequenced for the most                                                                                                                                                                                        |

| ELEMENT                                                                 | PERFORMANCE CRITERIA                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                         | efficient and effective outcome following consultation with others for completion within acceptable timeframes, to agreed quality standards and in accordance with established policies and procedures.                                           |
|                                                                         | 1.5 Risk control measures are identified, prioritised, implemented and evaluated against the work schedule.                                                                                                                                       |
|                                                                         | 1.6 Resources including personnel, equipment, tools and personal protective equipment required for the job are identified, acquired and confirmed in safe/technical working order.                                                                |
|                                                                         | 1.7 Liaison issues with other personnel and/or authorities are resolved and activities coordinated to facilitate the work.                                                                                                                        |
|                                                                         | 1.8 Personnel participating in the work including plant operators and contractors are fully briefed, their respective responsibilities explained and coordinated and appropriate authorisation checked in accordance with established procedures. |
|                                                                         | 1.9 Work site is prepared according to the work schedule and to minimise risk and damage to property and personnel in accordance with established procedures.                                                                                     |
| 2 Carry out the maintenance of high current DC switchgear and equipment | 2.1 OHS and sustainable energy principles and practices to reduce the incidence of accidents and minimise waste are implemented and monitored in accordance with established procedures.                                                          |
|                                                                         | 2.2 CPR, Rescue from live electrical apparatus and other related safety procedures are in place according to requirements and established procedures.                                                                                             |
|                                                                         | 2.3 Safe working documentation is acquired and requirements completed in accordance with established procedures.                                                                                                                                  |
|                                                                         | 2.4 Lifting, climbing and working aloft, use of                                                                                                                                                                                                   |

| ELEMENT                                                                | PERFORMANCE CRITERIA                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                        | power tools/equipment techniques and practices are safely exercised in accordance with established procedures.                                                                                                                                         |
|                                                                        | 2.5 Hazard warnings and safety signs are recognised and hazards and assessed OHS risks are reported to the immediate authorised persons for directions according to established procedures.                                                            |
|                                                                        | 2.6 Maintenance and repair of high current DC switchgear and equipment is carried out, in accordance with the work schedule and requirements and/or established procedures.                                                                            |
|                                                                        | 2.7 Essential knowledge and associated skills are applied for the safe maintenance of high current DC switchgear and equipment to ensure completion in an agreed timeframe and to quality standards with a minimum of waste according to requirements. |
|                                                                        | 2.8 Unplanned events or conditions are responded to in accordance with established procedures.                                                                                                                                                         |
| 3 Complete the maintenance of high current DC switchgear and equipment | 3.1 Work undertaken is checked against work schedule for conformance with requirements, anomalies reported and solutions identified in accordance with established procedures.                                                                         |
|                                                                        | 3.2 Safe working documentation is surrendered and equipment made ready for service.                                                                                                                                                                    |
|                                                                        | 3.3 Work site is rehabilitated, cleaned up and confirmed safe in accordance with established procedures.                                                                                                                                               |
|                                                                        | 3.4 Tools, equipment and any surplus resources and materials are cleaned, checked and returned to storage in accordance with established procedures.                                                                                                   |
|                                                                        | 3.5 Required works completion records, reports and/or documentation and information are completed, processed and appropriate personnel notified in accordance with established procedures.                                                             |

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**7) Essential Knowledge and Associated Skills (EKAS):** This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of maintaining high current DC switchgear and equipment.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

The extent of the essential knowledge and associated skills (EKAS) required is given in Volume 2 - Part 2.2 EKAS. It forms an integral part of this unit.

|         |                                                              |
|---------|--------------------------------------------------------------|
| E2.18.1 | Occupational Health and Safety principles                    |
| E2.18.2 | Electrical safe working practice                             |
| T2.2.13 | Low Voltage - energised work practices for substations       |
| T2.8.1  | Enterprise specific - policy and procedures and instructions |
| T2.8.2  | Enterprise specific - OHS instruction                        |
| T2.8.3  | Enterprise specific - technical drawing and documents        |
| T2.8.4  | Enterprise specific - switching diagrams                     |
| T2.8.6  | Enterprise specific - specialised tools                      |
| T2.8.7  | Enterprise specific - equipment installation procedures      |
| T2.8.8  | Enterprise specific data management processes                |
| T2.10.4 | Substation DC circuit breaker principles                     |
| T2.10.5 | Substation DC circuit breaker maintenance                    |
| T2.10.6 | Substation DC circuit breaker installation                   |
| T2.10.7 | Substation tools and equipment                               |

## Evidence Guide

### EVIDENCE GUIDE

9) This provides essential advice for assessment of the competency standard unit and must be read in conjunction with the Performance Criteria and the Range Statement of the competency standard unit and the Training Package Assessment Guidelines.

The Evidence Guide forms an integral part of this Competency Standard Unit and shall be used in conjunction with all component parts of this unit and, performed in accordance with the Assessment Guidelines of this Training Package.

#### Overview of Assessment

##### 9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accord with Industry and, Regulatory policy in this regard.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Hence, sources of evidence need to be 'rich' in nature so as to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practiced. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

## EVIDENCE GUIDE

### Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated Performance Criteria shall be demonstrated on at least two occasions in accordance with the "Assessment Guidelines - UET09". Evidence shall also comprise:

- A representative body of Performance Criteria demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the Performance Criteria and range; and
  - Apply sustainable energy principles and practices as specified in the Performance Criteria and range; and
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit to such an extent that the learner's performance outcome is reported in accordance with the preferred approach; namely a percentile graded result, where required by the regulated environment; and
  - Demonstrate an appropriate level of employability skills; and
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures; and
- Demonstrated performance across a representative range of contexts from the prescribed items below:

| <b>Range of tools/equipment/materials/procedures/workplaces/other variables</b> |                                                                         |                  |
|---------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------|
| <b>Group No</b>                                                                 | <b>The minimum number of items on which skill is to be demonstrated</b> | <b>Item List</b> |
|                                                                                 |                                                                         |                  |

**EVIDENCE GUIDE**

|   |                                |                                                                                                                                                                                                                                             |
|---|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A | All of the following:          | Multimeters<br>Ductor<br>Megger tester<br>Ammeter<br>Voltmeter<br>1500 V drop out tester<br>Wiring diagrams<br>Schematic drawings<br>Operating and substation arrangement diagrams<br>Building layouts<br>Cable block and schedule diagrams |
| B | At least six of the following: | Direct current circuit breakers<br>Rectifier transformers<br>Rectifiers<br>Isolators and links<br>Harmonic filters<br>Negative reactors<br>Energy dissipation resistors                                                                     |
| C | At least ten of the following: | DC feeders<br>Surge arresters<br>Isolating links<br>Busbar<br>Cables<br>Cable supports<br>Pits and enclosures<br>Protection/alarm systems<br>Control wiring<br>Metering<br>Supervisory interface<br>Cabinets                                |

**EVIDENCE GUIDE**

|   |                       |                                                                                                                                                                                               |
|---|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                       | REC                                                                                                                                                                                           |
| D | All of the following: | Cable terminations<br>Busbar termination/joint<br>Alignment of electrical contacts of withdrawable equipment                                                                                  |
| E | At least one occasion | Dealing with an unplanned event by drawing on essential knowledge and associated skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items. |

**Context of and specific resources for assessment****9.3)**

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual maintenance of high current DC switchgear and equipment.

In addition to the resources listed above, in Context of and specific resources for assessment, evidence should show demonstrated competency working:

Below ground, in limited spaces, with different structural/construction types and method and in a variety of environments.

## EVIDENCE GUIDE

**Method of  
assessment****9.4)**

This Competency Standard Unit shall be assessed by methods given in Volume 1, Part 3 "Assessment Guidelines".

**Note:**

Competent performance with inherent safe working practices is expected in the Transmission, Distribution and Rail Traction Industry. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and associated skills described in this unit.

**Concurrent  
assessment and  
relationship with  
other units****9.5)**

There are no concurrent assessment recommendations for this unit.

## Range Statement

### RANGE STATEMENT

8) This relates to the competency standard unit as a whole providing the range of contexts and conditions to which the Performance Criteria apply. It allows for different work environments and situations that will affect performance.

This Competency Standard Unit shall/may be demonstrated in relation to the maintenance of high current DC switchgear and equipment.

DC switchgear and other equipment includes but is not limited to Direct Current Circuit Breakers, rectifier transformers, rectifiers, invertors, isolators and links, harmonic filters, negative reactors and energy dissipating resistors (EDR's) and rail earth contactor.

Associated equipment may include DC feeders, surge arresters, isolating links, busbar, cables, cable supports, pits and enclosures, protection/alarm systems, control wiring, metering, supervisory interface, cabinets,

Associated components may include main and auxiliary contacts, holding coils, contractors, busbar fingers, diodes, heatsinks, capacitors, fuses, metering, shunts, resistors banks, resistor bank housing.

Test and measurement equipments may include multimeters, ductor, megger tester, ammeter, voltmeter, 1500V drop out test set, feeler gauge.

Drawings can refer to wiring, schematic, operating and substation arrangement diagrams, cable block and schedule diagrams and building layouts.

Confined Spaces may apply to pits, cable tunnels, false floors, and cable basements.

The following constants and variables included in the element/Performance Criteria in this unit are fully described in the Definitions Section 1 of this volume and form an integral part of the Range Statement of this unit:

- Appropriate and relevant persons (see Personnel)
- Appropriate authorities
- Appropriate work platform
- Assessing risk
- Assessment
- Authorisation
- Confined space
- Diagnostic, testing and restoration
- Documenting detail work events, record keeping and or storage of information
- Drawings and specifications
- Emergency

**RANGE STATEMENT**

- Environmental and sustainable energy procedures
- Environmental legislation
- Environmental management documentation
- Established procedures
- Fall prevention
- Hazards
- Identifying hazards
- Inspect
- Legislation
- MSDS
- Notification
- OHS practices
- OHS issues
- Permits and/or permits to work
- Personnel
- Quality assurance systems
- Requirements
- Testing procedures
- Work clearance systems

**Unit Sector(s)**

Not Applicable

## 2.2) Literacy and numeracy skills

### 2.2) Literacy and numeracy skills

Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"

|         |   |         |   |          |   |
|---------|---|---------|---|----------|---|
| Reading | 4 | Writing | 4 | Numeracy | 4 |
|---------|---|---------|---|----------|---|

## Competency Field

Competency Field 5)

Substation Units