



**Australian Government**

# **UEENEEG130A Design switchboards rated for high fault levels (greater than 400 A)**

**Release: 2**

## **UEENEEG130A Design switchboards rated for high fault levels (greater than 400 A)**

### **Modification History**

Not applicable.

### **Unit Descriptor**

**Unit Descriptor**                    **1) Scope:**

#### **1.1) Descriptor**

This unit covers the design of supply and distribution arrangements, control, protection and selection of equipment for switchboards with low voltage demand greater than 400 amperes per phase. This encompasses designing schemes for protection of persons and property and correct functioning, compatibility with the supply, and arrangement of circuits, determination of fault levels, effective switchgear, control gear, and protection against over current, over and under voltage and wiring based on calculations to meet required safety and performance standards and functional requirements.

### **Application of the Unit**

**Application of the Unit**    **2)**

This unit is intended for competency development entry-level employment based programs incorporated in approved contracts of training. It applies to any formal recognition for this standard at the aligned AQF 6 level.

### **Licensing/Regulatory Information**

**License to practice**            **3)**

The skills and knowledge described in this unit do not require a license to practice in the work place. However practice in this unit is subject to regulations directly

**License to practice**

3)

related to occupational health and safe and contracts of training such as new apprenticeships.

**Pre-Requisites**

**Prerequisite Unit(s)**

4)

**Competencies**

4.1)

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEG128 A	Plan low voltage switchboard and control panel layouts
UEENEEE101 A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102 A	Fabricate, dismantle, assemble of utilities components
UEENEEE104 A	Solve problems in d.c circuits
UEENEEE105 A	Fix and secure electrotechnology equipment
UEENEEE107 A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEG006 A	Solve problems in single and three phase low voltage machines
UEENEEG033 A	Solve problems in single and three phase electrical apparatus and circuits
UEENEEG063 A	Arrange circuits, control and protection for general electrical installations
UEENEEG101 A	Solve problems in electromagnetic devices and related circuits
UEENEEG102	Solve problems in low voltage a.c. circuit

<b>Prerequisite Unit(s)</b>	<b>4)</b>
	A
UEENEEG106	Terminate cables, cords and accessories for low voltage circuits
A	
UEENEEG107	Select wiring systems and cables for low voltage general electrical installations
A	
	AND
UEENEEG149	Provide engineering solutions to problems in complex polyphase power circuits
A	
UEENEEE125	Provide engineering solutions for problems in complex multiple path circuit
A	
UEENEEE126	Provide solutions to basic engineering computational problems
A	
	AND
UEENEEE129	Solve electrotechnical engineering problems
A	
	OR
UEENEEE101	Apply Occupational Health and Safety regulations, codes and practices in the workplace
A	
UEENEEE104	Solve problems in d.c. circuits
A	
UEENEEG101	Solve problems in electromagnetic devices and related circuits
A	
	OR
UEENEEH114	Troubleshoot resonance circuits in an electronic apparatus
A	
UEENEEE101	Apply Occupational Health and Safety regulations, codes and practices in the workplace
A	
	AND
UEENEEE104	Solve problems in d.c. circuits

**Prerequisite Unit(s) 4)**

A

OR

UEENEEH169 Solve problems in basic electronic circuits

A

**Literacy and numeracy skills 4.2)**

Participants are best equipped to achieve competency in 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 5      Writing 5      Numeracy 5

## **Employability Skills Information**

**Employability Skills 5)**

This unit contains Employability Skills

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 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 to design switchboards.	<p>1.1 OHS processes and procedures for a given work area are identified, obtained and understood.</p> <p>1.2 The extent and nature of the switchboard is determined from design brief.</p> <p>1.3 Safety and other regulatory requirements to which the switchboard shall comply are identified, obtained and understood.</p> <p>1.4 Design development work is planned to meet scheduled timelines in consultation with others persons involved in the installation or associated work.</p>
2 Develop installation design.	<p>2.1 Knowledge of switchboard performance standards, compliance methods and electrical equipment and is applied to designing the installation.</p> <p>2.2 Alternative arrangements for the switchboard design are considered based on the requirements outlined in the design brief.</p> <p>2.3 Safety, functional and budgetary considerations are incorporated in the installation design.</p> <p>2.4 Switchboard design draft is checked for compliance with the design brief and regulatory requirements.</p> <p>2.5 Switchboard design is documented for submission to appropriate person(s) for acceptance and approval.</p> <p>2.6 Solutions to unplanned situation are provided consistent with organisation's policy.</p>
3 Obtain approval for installation design.	<p>3.1 Switchboard design is presented and explained to client representative and/or other relevant person(s).</p> <p>3.2 Requests for alterations to the design are negotiated with relevant person(s) within the</p>

**ELEMENT**

**PERFORMANCE CRITERIA**

constraints of organisation's policy.

- 3.3 Final design is documented and approval obtained from appropriate person(s).
- 3.4 Quality of work is monitored against personal performance agreement and/or established organisational or professional standards.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and designing switchboards rated for high fault levels.

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

#### KS01-EG130A

#### Switchboard design

Evidence shall show an understanding of the design of low voltage switchboards rated for high fault currents to an extent indicated by the following aspects:

T1 Trade calculations encompassing:

- mathematical techniques
- relevant calculations
- linear measurement, areas, volumes, ratios

T2 Engineering mechanics encompassing:

- base physical quantities
- concepts, principles, S.I. units, their applications in
- engineering calculations in relation to physical quantities and
- associated formulae
- mass, velocity, acceleration, force, weight, density, angles
- energy/work/power
- moments/torque
- centre of gravity
- mechanical advantage
- levers
- pulley blocks
- efficiency
- friction
- vectors
- resolution of forces
- forces in strung conductors
- forces on poles and towers
- determination of sag
- pressure/stress
- elementary fluid mechanics

T3 Engineering materials encompassing:

- classification
- ferrous and non-ferrous metals



## REQUIRED SKILLS AND KNOWLEDGE

- steels, alloys,
- properties
- tensile strength
- temperature and expansion in metals
- stress and strain
- ductility
- applications
- corrosion
- galvanic corrosion
- hardwoods and soft woods

T4 Fault current calculations encompassing:

- Calculation of fault currents
- Calculation/Determination of positive, negative and zero sequence impedances
- Determination of fault current breaking and let-through energy capacities of protection devices
- The influence of fault/arc impedances
- Impedances operative for phase-to-phase and phase-to-earth faults
- Calculation of fault currents for phase-to-phase and phase-to-earth faults
- Approximation calculations by selecting the components with the major impedance

## Evidence Guide

### EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all 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 accordance with industry and regulatory policy.

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. Sources of evidence need to be 'rich' in nature 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 practised. 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.

**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 – UEE11'. Evidence shall also comprise:

- A representative body of work performance 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 statement
- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Design switchboards rated for high fault levels as described in 8) and including:
    - A Developing outlines of alternative designs.
    - B Developing the design within the safety and functional requirements and budget limitations.
    - C Documenting and presenting design effectively.
    - D Successfully negotiating design alteration requests.
    - E Obtaining approval for final design.
    - F Dealing with unplanned events by drawing on essential knowledge and 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 work as prescribed by this unit.

These should be part of the formal learning/assessment

environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to designing switchboards rated for high fault levels.

**Method of  
assessment**

**9.4)**

This 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 industry to which this unit applies. This requires assessment 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 skills described in this unit.

**Concurrent  
assessment and  
relationship with  
other units**

**9.5)**

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

UEENEEED10 Use engineering applications software on personal  
4A computers

## Range Statement

### RANGE STATEMENT

**10)** This relates to the 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 unit shall be demonstrated in relation to designing switchboards rated for fault levels in excess of 20 kA. The switchboard shall comprise control for essential and general supply, metering, sub-main controls, local final sub-circuit distribution board and fault monitoring.

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

## Unit Sector(s)

Not applicable.

## Competency Field

<b>Competency Field</b>	<b>11)</b>
	Electrical