Australian Government

Department of Education, Employment and Workplace Relations

UEENEEE119A Solve problems in multiple path extra low voltage (ELV) a.c. circuits

Release: 1

UEENEEE119A Solve problems in multiple path extra low voltage (ELV) a.c. circuits

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers determining correct operation of single source ELV a.c. parallel and series-parallel circuits and providing solutions as they apply to various electrotechnology work functions. It encompasses working safely, problem solving procedures, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in multiple path circuits.

Application of the Unit

Application of the Unit **2)**

This competency standard is suitable for employment-based programs under an approved contract of training at the AQF level of the qualification in which the unit is first packaged or higher.

The unit may be selected as an elective from the relevant schedule (see qualification packaging rules) provided that all prerequisite units are undertaken or addressed through recognition processes.

This unit may be included in a skill set provided that it is listed in the schedule of electives (see Qualification Framework) and all prerequisite units are undertaken or addressed through recognition processes.

Delivery and assessment of this unit should be undertaken within regard to the requirements of License

to Practice (1.2 above), Prerequisite Competencies and Literacy and Numeracy skills (2 above) and the recommendations for concurrent assessment and relationship with other units (9.5 below).

Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.
Note:
1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.
2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting, risk safety measures etc.

Licensing/Regulatory Information

License to practice **3)**

The skills and knowledge described in this unit require a license to practice in the workplace where plant and equipment operate at voltage above 50 V a.c. or 120 V a.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as 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

Prerequisite Unit(s) **4)**

confirmed.

UEENEEE101A	Apply Occupational Health Safety regulations, codes and practices in the workplace
UEENEEE104A	Solve problems in d.c. circuits

For the full prerequisite chain details for this unit please refer to Table 2 in Volume 1, Part 2

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	4	Writing	4	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 work on multiple path ELV a.c. electrical circuits.	1.1	OHS procedures for a given work area are identified, obtained and understood.
		1.2	OHS risk control work preparation measures and procedures are followed.
		1.3	The nature of the circuit(s) problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.
		1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.
		1.5	Sources of materials that may be required for the work are identified and accessed in accordance with established procedures.
		1.6	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.
2	Solve multiple path ELV a.c. circuit problems.	2.1	OHS risk control work measures and procedures are followed.
		2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.
		2.3	Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures.
		2.4	Established methods are used to solve a.c. circuit problems from measure and calculated

ELEMENT	PERFORMANCE CRITERIA	
		values as they apply to multiple path electrical circuit.
	2.5	Unexpected situations are dealt with safely and with the approval of an authorised person.
	2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.
3 Complete work and document problem solving activities.	3.1	OHS work completion risk control measures and procedures are followed.
	3.2	Work site is cleaned and made safe in accordance with established procedures.
	3.3	Justification for solutions used to solve circuit problems is documented.
	3.4	Work completion is documented and appropriate person(s) notified in accordance with established procedures.

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 solving problems in multiple path ELV a.c. circuits.
All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EE119A Alternating current principles – single phase

Evidence shall show an understanding of alternating currents principles used in power circuits to an extent indicated by the following aspects:

T1 Sinusoidal alternating voltage and current encompassing:

- Generation of a sinusoidal voltage with a single turn coil rotated in a uniform magnetic field.
- the terms ‘period’, ‘maximum value’, ‘peak-to-peak value’, ‘instantaneous value’, ‘average value’, ‘root-mean-square (r.m.s.) value’, ‘crest factor’ and ‘form factor’ in relation to a sinusoidal waveform.
- the instantaneous value of induced voltage of a generated sinusoidal waveform.
- measurement of the instantaneous, peak, peak-to-peak values and the period of a sinusoidal waveform.
- the root-mean-square (r.m.s.) value and frequency of a sinusoidal waveform .
- phase relationship between two or more sinusoidal waveforms.

T2 Phasors encompassing:

- the terms ‘in-phase’, ‘out-of-phase’, ‘phase angle’, ‘lead’, and ‘lag’.
- the phase angle between two or more alternating quantities from a given sinusoidal waveform diagram.
- convention for representing voltage, current and the reference quantity in a phasor diagram.
- phasor diagrams two or more a.c. values of voltage and/or current.

T3 Resistance in a.c. circuits encompassing:

- connection of a single-source a.c. circuit to take resistance, voltage and current measurements.
- the voltage, current, resistances or power dissipated from measured or given values of any two of these quantities.
- the relationship between voltage drops and current in a resistive a.c. circuit.

T4 Inductance in a.c. circuits encompassing:

- definition of ‘inductive reactance’.
- the inductive reactance of a given inductor and show the relationship between inductive reactance and frequency.
- equivalent inductive reactance in an a.c. circuit or any part of a circuit.
- application of Ohm’s Law to determine voltage, current or inductive reactance in a

REQUIRED SKILLS AND KNOWLEDGE

purely inductive a.c. circuit given any two of these quantities.

- examples of inductive components in power circuits and systems and describe their effect on the phase relationship between voltage and current.
- the comparative current limiting characteristics of inductors and resistors.

T5 Capacitance in a.c. circuits encompassing:

- definition of ‘capacitive reactance’.
- the capacitive reactance of a given capacitor and the relationship between capacitive reactance and frequency.
- equivalent capacitive reactance in an a.c. circuit or any part of a circuit.
- application of Ohm’s Law to determine voltage, current or capacitive reactance in a purely capacitive a.c. circuit given any two of these quantities.
- examples of capacitive components in power circuits and systems and describe their effect on the phase relationship between voltage and current.

T6 Impedance encompassing:

- definition of ‘impedance’.
- impedance of series, parallel and series-parallel circuits and diagrams showing the relationship between resistive, inductive and capacitive components (impedance triangle).
- connection of a single-source a.c. circuit and take resistance, voltage and current measurements.
- voltage, current or impedance values from measured or given values of any two of these quantities.
- phasor diagram usage to solve problems and show the relationship between voltages and currents in a.c. circuits.

T7 Resonance encompassing:

- conditions in a circuit that produce resonance.
- the relationship between resonance and frequency.
- the effect on the current of series resonance and parallel resonance conditions.
- applications where resonance is applied

T8 Power and power factor encompassing:

- difference between true power, apparent power and reactive power and the units.
- definition of the term ”power factor”.
- the effects of low power factor.
- local and AS/NZS 3000 requirements regarding the power factor of an installation and power factor improvement equipment.

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 the 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-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 everyday 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 must 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, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Solve problems in multiple path ELV a.c. circuits as described in 8) and including:

A Determining the operating parameters of an existing circuit.

B Altering an existing circuit to comply with specified operating parameters.

C Developing circuits to comply with a specified

		function and operating parameters.
	D	Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a 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 in this unit.

These should be used in the formal learning/assessment environment.
Note:
Where simulation is considered a suitable strategy for assessment, conditions for assessment 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 solving problems in multiple path ELV a.c. circuits.

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 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 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:

UEENEEE10 Solve problems in d.c. circuits 4A

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:

- Single source parallel and series-parallel a.c. circuits as they apply to problems related to installation, fault finding, maintenance or development work functions in any of the following disciplines:
  - Computers
  - Data Communications
  - Electrical
  - Electronics
  - Fire protection
  - Instrumentation
  - Refrigeration and Air Conditioning
- In relation to at least two of the following types of circuit problems and on at least two occasions
  - determining the operating parameters of an existing circuit
  - altering an existing circuit to comply with specified operating parameters
  - developing circuits to comply with a specified function and operating parameters

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

Competency Field **11)**

Electrotechnology