Australian Government

Department of Education, Employment and Workplace Relations

UETTDRIS32A Solve electrical problems in remote community network apparatus

Release: 1

UETTDRIS32A Solve electrical problems in remote community network apparatus

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers the underpinning skills and knowledge and the application of this skills and knowledge to provide solutions to predictable problems on remote community network apparatus. It encompasses working safely, diagnoses and problem solving procedures, including the use of voltage, current and resistance measuring devices to providing solutions derived from measurements and calculations to predictable circuit problems.

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.

Licensing/Regulatory Information

License to practice **3)**

The competency described in this unit does not directly require a license to practice but is subject to regulations for occupational health and safety and contracts of training where they apply.

Pre-Requisites

Prerequisite Unit(s) **4)**

Competencies **4.1)**

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

Where pre-requisite pathways have been identified. All competencies in the Common Unit Group must be have been completed.

Common Unit Group

Unit Code	Unit Title
UEENEEE103A	Solve problems in extra-low voltage single path circuits

Literacy and numeracy skills **4.2)**

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	3	Writing	3	Numeracy	3

Employability Skills Information

Employability Skills **5)**

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 solve electrical problems on remote community network apparatus.	1.1 Occupational Health and Safety procedures for a given work area are identified, obtained and understood.
	1.2 Occupational Health and Safety 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 electrical problems on remote community network apparatus.	2.1 Occupational Health and Safety risk control work measures and procedures are followed.
	2.2 The need to test or measure live is determined in strict accordance with Occupational Health and Safety requirements and when necessary conducted within established safety procedures.
	2.3 Circuits are checked as being isolated where necessary in strict accordance Occupational Health and Safety requirements and procedures.

ELEMENT	PERFORMANCE CRITERIA
	2.4 Established methods are used to solve electrical problems from measured and calculated values as they apply to remote community network apparatus
	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 Occupational Health and Safety 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 applying Occupational Health and Safety practices in the workplace.

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

KS01-TIS32A Remote area circuits and apparatus

Evidence shall show an understanding of remote area circuits and apparatus to an extent indicated by the following aspects:

T1 Parallel circuits encompassing:

- schematic diagram of a single-source d.c. ‘parallel’ circuit.
- major components of a ‘parallel’ circuit (power supply, loads, connecting leads and switch)
- applications where ‘parallel’ circuits are used in the Remote community ESI industry.
- characteristics of a ‘parallel’ circuit. (load connection, current paths, voltage drops, power dissipation, affects of an open circuit in a ‘parallel’ circuit).
- relationship between currents entering a junction and currents leaving a junction
- calculation of the total resistance of a ‘parallel’ circuit.
- calculation of the total current of a ‘parallel’ circuit.
- Calculation of the total voltage of a ‘parallel’ circuit.
- setting up and connecting a single-source d.c. parallel circuit
- resistance, voltage and current measurements in a single-source parallel circuit
- voltage, current, resistance or power dissipated from measured values of any of these quantities

T2 Series/parallel circuits encompassing:

- schematic diagram of a single-source d.c. ‘series/parallel’ circuit.
- major components of a ‘series/parallel’ circuit (power supply, loads, connecting leads and switch)
- applications where ‘series/parallel’ circuits are used in the Remote community ESI industry.
- characteristics of a ‘series/parallel’ circuit. (load connection, current paths, voltage drops, power dissipation, affects of an open circuit in a ‘series/parallel’ circuit).
- calculation of the total resistance of a ‘series/parallel’ circuit.
- calculation of the total current of a ‘series/parallel’ circuit.
- calculation of the total voltage and the individual voltage drops of a ‘series/parallel’ circuit.
- setting up and connecting a single-source d.c. series/ parallel circuit

REQUIRED SKILLS AND KNOWLEDGE

- resistance, voltage and current measurements in a single-source d.c. series / parallel circuit
- voltage, current, resistances or power dissipated from measured values of any two of these quantities

T3 Factors affecting resistance encompassing:

- four factors that affect the resistance of a conductor (type of material, length, cross-sectional area and temperature)
- affect the change in the type of material (resistivity) has on the resistance of a conductor.
- affect the change in 'length' has on the resistance of a conductor.
- affect the change in 'cross-sectional area' has on the resistance of a conductor.
- effects of temperature change on the resistance of various conducting materials
- effects of resistance on the current-carrying capacity and voltage drop in cables.
- using digital and analogue ohmmeter to measure the change in resistance of different types of conductive materials (copper, aluminium,) when those materials undergo a change in type of material length, cross-sectional area and temperature.

T4 Effects of meters in a circuit encompassing:

- selecting an appropriate meter in terms of units to be measured, range, loading effect, accuracy and safety category of meters for a given application.
- instruments used in the field to measure voltage and current, the typical circumstances in which they are used.
- hazards involved in using electrical instruments and the safety control measures that should be taken.
- operating characteristics of analogue and digital meters.
- correct techniques to read the scale of an analogue meters and how to reduce the 'parallax' error.
- types of voltmeters used in the ESI industry – bench type, clamp meter, Multimeter, etc.
- purpose and characteristics (internal resistance, range, loading effect and accuracy) of a voltmeter.
- types of voltage indicator testers. e.g. LED, neon, solenoid, volt-stick, series tester, etc. and explain the purpose of each voltage indicator tester.
- operation of various voltage indicator testers.
- Explain the advantages and disadvantages of each voltage indicator tester.
- List the various types of ammeters used in the ESI industry – bench, clamp meter, multimeter, etc.
- Explain the purpose of an ammeter and the correct connection (series) of an ammeter into a circuit.
- Explain the reasons why the internal resistance of an ammeter must be extremely low and the dangers and consequences of connecting an ammeter in parallel and/or wrong polarity.
- Connect an analogue/digital voltmeter into a circuit ensuring the polarities are

REQUIRED SKILLS AND KNOWLEDGE

correct and take various voltage readings.

- Demonstrate the loading effect of various voltmeters when measuring voltage across various loads.
- Use a variety of voltage indicator testers to detect the presence of various voltage levels.
- Connect an analogue/digital ammeter into a circuit ensuring the polarities are correct and take various current readings.
- steps and procedures for the safe use, care and storage of electrical instruments.

T5 Resistance Measurement encompassing:

- Identification of instruments used in the field to measure resistance (including insulation resistance) and the typical circumstances in which they are used.
- the purpose of an Insulation Resistance (IR) Tester.
- the parts and functions of various analogue and digital IR Tester (selector range switch, zero ohms adjustment, battery check function, scale and connecting leads).
- reasons why the supply must be isolated prior to using the IR tester.
- where and why the continuity test would be used in an ESI systems.
- where and why the insulation resistance test would be used in an ESI system.
- the voltage ranges of an IR tester and where each range may be used. e.g. 250 V d.c, 500 V d.c & 1000 V d.c
- the AS/NZS3000 Wiring Rules requirements – continuity test and insulation resistance test.
- the purpose of regular IR tester calibration.
- the correct methods of storing the IR tester after use
- carry out a calibration check on a IR Tester
- measurement of low values of resistance using an IR tester continuity functions.
- measurement of high values of resistance using an IR tester insulation resistance function.
- the volt-ammeter (short shunt and long shunt) methods of measuring resistance.
- calculation of resistance values using voltmeter and ammeter reading (long and short shunt connections)
- measurement of resistance using volt-ammeter methods

T6 Capacitors and Capacitance encompassing:

- basic construction of standard capacitor, highlighting the: plates, dielectric and connecting leads
- different types of dielectric material and each dielectric's relative permittivity.
- identification of various types of capacitors commonly used in the ESI industry (Fixed value capacitors -Stacked plate, Rolled, Electrolytic, Ceramic, Mica and Variable value capacitors – tuning and trimmer)
- circuit symbol of various types of capacitors: standard; variable, trimmer and polarised
- terms: Capacitance (C), Electric charge (Q) and Energy (W)

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- unit of: Capacitance (Farad), Electric charge (Coulomb) and Energy (Joule)
- factors affecting capacitance (the effective area of the plates, the distance between the plates and the type of dielectric) and explain how these factors are present in all circuits to some extent.
- how a capacitor is charged in a d.c. circuit.
- behaviour of a series d.c. circuit containing resistance and capacitance components. - charge and discharge curves
- the term 'Time Constant' and its relationship to the charging and discharging of a capacitor.
- calculation of quantities from given information: Capacitance (Q = VC); Energy (W =½CV2); Voltage (V = Q/C)
- connection of a series d.c. circuit containing capacitance and resistor to determine the time constant of the circuit

T7 Handling and testing capacitors encompassing:

- hazards involved in working with capacitance effects and the safety control measures that should be taken.
- safe handling and the correct methods of discharging various size capacitors
- dangers of a charged capacitor and the consequences of discharging a capacitor through a person
- effects of capacitors connected in parallel.
- effects on the total capacitance of capacitors connected in series.
- common faults in capacitors.
- testing of capacitors to determine serviceability.
- application of capacitors in the ESI industry.

T8 Magnetism encompassing:

- magnetic field pattern of bar and horse-shoe magnets.
- magnets attraction and repulsion when brought in contact with each other.
- common magnetic and non-magnetic materials and groupings (diamagnetic, paramagnetic and ferromagnetic materials).
- principle of magnetic screening (shielding) and its applications.
- practical applications of magnets

T9 Electromagnetism encompassing:

- conventions representing direction of current flow in a conductor.
- magnetic field pattern around a single conductor and two adjacent conductors carrying current.
- Using the "right hand rule" to determine the direction of magnetic field around a current carrying conductor.
- direction of force between adjacent current carrying conductors.
- effect of current, length and distance apart on the force between conductors (including forces on bus bars during fault conditions).

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- magnetic field around an electromagnet.
- Using the "right hand rule" to determine the direction of magnetic field around a current carrying coil.
- magnetomotive force (m.m.f.) and its relationship to the number of turns in a coil and the current flowing in the coil.
- practical applications of electromagnets.

T10 Electromagnetic induction encompassing:

- principle of electromagnetic induction (Faraday's law of electromagnetic induction).
- applying "Fleming's right hand rule" to a current a carrying conductor under the influence of a magnetic field.
- calculation of induced e.m.f. in a conductor given the conductor length, flux density and velocity of the conductor.
- calculation of induced e.m.f. in a coil given the number of turns in a coil and the rate of change of flux.
- calculation of force on a conductor given the flux density of the magnetic field, length of the conductor and the current being carried by the conductor.
- Lenz's law
- applications of electromagnetic induction

T11 Inductance encompassing:

- construction of an inductor, including a bifilar winding inductor.
- Australian Standard circuit diagram symbol for the four types of inductor.
- effect of physical parameters on the inductance of an inductor.
- common types of inductor cores.
- applications of the different types of inductors.
- definition of terms self induction, inductance and mutual inductance.
- calculation of value of self induced e.m.f. in a coil.
- mutual induction occurs between two coils.
- practical applications for the effects of self and mutual induction.
- undesirable effects of self and mutual induction.

T12 Magnetic devices encompassing:

- construction, operation and applications of relays.
- construction, operation and applications of contactors.
- magnetic methods used to extinguish the arc between opening contacts.
- construction, operation and applications of Hall Effect devices.
- construction, operation and application of magnetic sensing devices.

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit of competency and must be read in conjunction with the Performance Criteria and the range statement of the unit of competency 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.

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;
  - Apply sustainable energy principles and practices as specified in the Performance Criteria and range;
  - 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;
  - 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:
    - Apply Occupational Health and Safety practices in the workplace as described in 8) and including:
    - Applying work procedures and instructions as they apply to risk control measures

    A Participation in consultation processes, identifying hazards and implementing and

monitoring control measures.

B Applying work procedures and instructions as they apply to risk control measures.

- Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.
- Show evidence that all aspects of the range statement are demonstrated on two occasions
- Dealing with accidents and emergencies within the scope of responsibility.
- 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.

Note:

Ability to implement these Occupation Health and Safety measures shall be demonstrated on all occasions safety issues arise.

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:

- Occupational Health and Safety policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual installation of poles and or structures and their associated hardware.

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.

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 Industry to which this Competency Standard 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 associated skills described in this unit.

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

This unit shall be assessed concurrently, as it relates to other units undertaken in a possible skill clusters or qualification.

Components of this unit are included in the critical aspects of evidence of all units to help ensure the appropriate level of responsibility for safety has been acquired

Range Statement

RANGE STATEMENT

10) This relates to the unit of competency 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 solving electrical problems in remote community network apparatus:

(a) Relevant Occupational Health and Safety legislation, regulations and codes of practice related to hazards present in remote communities are followed.

(b) Accepted industry workplace procedures and instructions for remote communities are followed.

(c) Determine the correct operation of remote community network apparatus.

(d) Diagnose and provide solutions as they apply to remote community network apparatus.

Predictable problems within remote community network apparatus may include the following:

(a) Hi/Low volts

(b) High resistance

(c) Low resistance

(d) Fault Current (Fuses)

(e) Kilowatt hour meter faults (No supply, reverse polarity, etc)

(f) Streetlight faults

In relation to the following remote community electrical problems on at least two occasions:

(a) Using voltage, current and resistance measuring devices.

(b) Providing solutions derived from measurements and calculations to electrical problem in remote communities.

(c) Altering an existing circuit to comply with specified 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)**

Industry Specific Cross-Discipline Units