Australian Government

ICTTEN2008A Use electrical skills in telecommunications work

Release 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

ICTTEN2008A Use electrical skills in telecommunications work

Modification History

Release	Comments
Release 1	This version first released with *ICT10 Integrated Telecommunications Training Package Version 3.0*.

Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required for an entry-level worker to use electrical skills working in telecommunications.

Application of the Unit

Technical staff who undertake basic testing, circuit building and evaluation of cable and wireless devices apply the skills and knowledge in this unit. They may work in domestic, commercial and industrial situations.

Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement but users should confirm requirements with the relevant federal, state or territory authority.

Pre-Requisites

Nil

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements	Performance Criteria
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

1. Connect up, test and verify DC and AC circuitry	1.1 Identify any hazards and work health and safety (WHS) issues for a safe work site, and notify appropriate personnel 1.2 Connect a series and a parallel ***DC and AC circuit configuration*** following ***safe work practices*** 1.3 Choose the appropriate ***test equipment*** and measure the values of electrical quantities of the circuits 1.4 Use ***calculations*** to verify the measured values of the ***electrical quantities*** in a series and in a parallel circuit configuration 1.5 Compare the measured values to the calculated values, and determine the reasons for any variations 1.6 Measure LV, ELV and TNV voltages to determine that the value is within equipment or power supply specifications 1.7 Use appropriate test equipment to measure AC voltage (multimeter) or AC current (clamp meter) in a safe manner that does not require an LV circuit to be disconnected 1.8 Test residual current devices (RCD) or earth leakage devices to ensure they are working prior to working with AC mains powered equipment, power supplies and tools 1.9 Evaluate results and determine ***probable faults if relevant***
2. Evaluate analog and digital signals	2.1 Compare ***characteristics of an analog signal and a digital signal*** 2.2 Produce a layout using the ***building blocks*** to represent a typical analog and a digital circuit showing the different characteristics between that of an analog signal and a digital signal 2.3 Produce 4-bit binary codes with their decimal equivalent to represent output voltages of a digital to analog converter 2.4 Choose appropriate test equipment and measure the output voltage of a digital device for 'high' and 'low' logic states
3. Perform cable selection	3.1 Compare basic ***transmission characteristics*** of different ***types of cables*** used in telecommunications and select the most appropriate cable type to suit ***application characteristics*** 3.2 ***Connect two devices with a patch cable and test the connection***

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

- communication skills to request technical information for activities
- literacy skills to:
  - interpret technical documentation
  - incorporate technical language into written tasks
- numeracy skills to:
  - interpret technical data, such as specifications of telecommunications networks
  - perform mathematical problem solving in AC and DC tasks and fault finding
- problem-solving skills to apply AC and DC fault-finding techniques to different situations
- safety awareness skills to:
  - apply precautions and required action to minimise, control or eliminate hazards that may exist during work activities
  - select and use required personal protective equipment, conforming to industry and WHS standards
  - work systematically with required attention to detail without injury to self or others, or damage to goods or equipment
- technical skills to select and use appropriate test equipment and practices to perform basic AC and DC testing and fault finding tasks.
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Required knowledge

- AC and DC electrical quantities, encompassing SI units, WHS issues and the application of Ohm's law
- AC and DC fault-finding techniques and use of testing equipment
- AC and DC theory
- analog and digital principles
- application of binary to decimal conversion and vice versa
- distinction between analog and digital signals and devices
- encoding techniques and their application in wired, wireless and optical communications systems
- features and applications of unshielded twisted pair (UTP), coaxial and fibre cables
- typical electronic devices, cable types and their applications
- modulation techniques used in wired, wireless and optical communications systems
- techniques to convert analog to digital and digital to analog.

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	Evidence of the ability to: • use Ohm's law and fundamental electrical principles to solve basic AC and DC electrical problems • connect and test an AC and DC circuit • evaluate cable and wireless devices.
Context of, and specific resources for assessment	Assessment must ensure: • appropriate AC and DC testing equipment • manufacturer's documentation and equipment • safety equipment.
Methods of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: • direct observation of the candidate undertaking AC and DC measurements and fault finding • oral or written questioning to assess knowledge of fundamental concepts of telecommunications networks.
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example: • ICTTEN2140B Use hand and power tools. Aboriginal people and other people from a non-English speaking background may have second language issues. Access must be provided to appropriate learning and assessment support when required.

	Assessment processes and techniques must be culturally appropriate, and appropriate to the oral communication skill level, and language and literacy capacity of the candidate and the work being performed. In all cases where practical assessment is used it will be combined with targeted questioning to assess required knowledge. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. Where applicable, physical resources should include equipment modified for people with special needs.

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, if used 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.

DC and AC circuit configuration may include:	• AC to DC supply
	• DC circuit:
	  • resistances
	  • single DC voltage source:
	  • battery
	  • DC voltage supply
	  • solar panel
	  • power loads
	• AC circuit:
	  • inductors, capacitors and resistances
	  • single AC voltage source:
	  • AC generator
	  • AC voltage supply
	  • alternator
	  • low voltage AC source.

Safe work practices may relate to:	• component tolerances not exceeded
	• correct use of power supply and test equipment
	• identifying electrical safety hazards
	• isolation from main supply
	• overdrawing of current
	• power down during set-up procedure
	• well laid out circuitry:
	  • avoid contact with external sources
	  • avoid shorting of components.

Test equipment may include:	• AC current clamp meters • multimeters, including digital multimeters • ohmmeters • voltmeters.
Calculations may include:	• application of Ohm's law • engineering notation • power calculations • power consumption and efficiencies • voltage dividers

	• voltage, resistance and current calculations.
Electrical quantities may include:	• current • power • voltage.
Probable faults may include:	• blown fuse • cracked circuit board • failed components • faulty power supply • foreign battery • intermittent faults • loose connections • open circuit • short circuit • short to ground • split pairs • water damage.

Characteristics of an analog signal and a digital signal may include:	• analog signal characteristics:
	  • continuously variable, infinite number of states
	  • intelligence based on recreating exact waveshape
	  • signal to noise ratio increase with amplification
	• digital signal characteristics:
	  • encryption
	  • error detection and correction
	  • finite number of discrete states
	  • high noise immunity
	  • intelligence based on ability to discern only two states
	  • regeneration
	  • type of square wave (complex waveform).

Building blocks may include:	• analog:
	  • amplifiers
	  • attenuators
	  • displays
	  • filters
	  • oscillators
	  • transducers
	• digital:
	  • ADC and DAC
	  • computers
	  • counter
	  • data routers, switches and bridges

	• digital amplifier • digital display • input and output transducers • multiplexer.
Transmission characteristics may include:	• attenuation • balanced • characteristic impedance (Zo) • crosstalk • frequency range • transmission windows for glass optical fibre • unbalanced • waveguide cut-off frequency.
Types of cable may include:	• aluminium and copper DC busbars • coaxial cable • multi-pair communications cable • optical fibre • performance data cable CAT 5 and higher • rack and sub-rack alarm and power distribution cables • shielded twisted pair (STP) communications cable • UTP communications cable.
Application characteristics may include:	• audio • data • digital subscriber line (DSL) • ethernet • microwave • optical/laser • power • radio frequency (RF) • satellite • video.

Unit Sector(s)

Telecommunications - Telecommunications networks engineering