



**Australian Government**

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

# **ICTTEN2007A Use electrical skills in telecommunications work**

**Release: 1**

## ICTTEN2007A Use electrical skills in telecommunications work

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required for an entry-level worker to use electrical skills working with analog and digital, cabling and wireless networking in telecommunications.</p> <p>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.</p>
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### Application of the Unit

<b>Application of the unit</b>	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.
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### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

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.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Build and test DC and AC circuits	<p>1.1. Identify any hazards and occupational health and safety (OHS) issues for a safe worksite and notify appropriate personnel</p> <p>1.2. Connect a series and a parallel <b><i>DC and AC circuit configuration</i></b> following <b><i>safe work practices</i></b></p> <p>1.3. Choose the appropriate <b><i>test equipment</i></b> and measure the values of electrical quantities of the circuits</p> <p>1.4. Use <b><i>calculations</i></b> to verify the measured values of the <b><i>electrical quantities</i></b> in a series and in a parallel circuit configuration</p> <p>1.5. Compare the measured values to the calculated values and determine the reasons for any variations</p> <p>1.6. Evaluate the results and determine the <b><i>probable faults</i></b> if relevant</p>
2. Evaluate analog and digital signals	<p>2.1. Compare the <b><i>characteristics of an analog signal and a digital signal</i></b></p> <p>2.2. Produce a layout using the <b><i>building blocks</i></b> to represent a typical analog and a digital circuit showing the different characteristics between of an analog signal and a digital signal</p> <p>2.3. Produce 4-bit binary codes with their decimal equivalent to represent output voltages of a digital to analog converter</p> <p>2.4. Choose the appropriate test equipment and measure the output voltage of a digital device for 'high' and 'low' logic states</p>
3. Perform cable selection	<p>3.1. Compare the basic <b><i>transmission characteristics</i></b> of different <b><i>types of cables</i></b> used in telecommunications and select the most appropriate cable type to suit the <b><i>application characteristics</i></b></p> <p>3.2. Connect two devices with a patch cable and test the connection</p>
4. Test a wireless link	<p>4.1. Select the types of <b><i>wireless connections</i></b> used in telecommunications</p> <p>4.2. Set up a wireless link to connect two wireless devices following safe work practices</p> <p>4.3. Transmit data over the link and verify the accuracy of the received data</p>

## Required Skills and Knowledge

### 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 and demonstrate knowledge by incorporating 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 OHS 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

#### Required knowledge

- AC and DC electrical quantities encompassing SI units, OHS issues and the application of Ohm's law
- AC and DC fault finding techniques and use of testing equipment
- application of binary to decimal conversion and vice versa
- distinction between analog and digital signals and devices
- typical electronic devices, cable types and their applications
- wireless technologies and basic applications

## Evidence Guide

### 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
- test wireless link.

#### 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
- direct observation of the candidate setting up wireless link and transmitting data
- 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:

- ICTTEN2140A 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.

**EVIDENCE GUIDE**

	<p>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.</p> <p>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.</p> <p>Where applicable, physical resources should include equipment modified for people with special needs.</p>
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**Range Statement****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:

- DC circuit:
  - resistances
  - single DC voltage source:
    - battery
    - DC voltage supply
    - solar panel
- AC circuit:
  - inductors, capacitors and resistances
  - single AC voltage source:
    - AC generator
    - AC voltage supply
    - alternator

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• low voltage AC source.</li> </ul>
<i>Safe work practices</i> may relate to:	<ul style="list-style-type: none"> <li>• component tolerances not exceeded - fire risk</li> <li>• correct use of power supply and test equipment</li> <li>• identifying any electrical safety hazards</li> <li>• isolation from main supply</li> <li>• overdrawing of current</li> <li>• power down during set up procedure</li> <li>• well laid out circuitry:               <ul style="list-style-type: none"> <li>• avoid contact with external sources</li> <li>• avoid shorting of components.</li> </ul> </li> </ul>
<i>Test equipment</i> may include:	<ul style="list-style-type: none"> <li>• digital multimeter</li> <li>• multimeter</li> <li>• ohmmeter</li> <li>• voltmeter.</li> </ul>
<i>Calculations</i> may include:	<ul style="list-style-type: none"> <li>• application of Ohm's law</li> <li>• engineering notation</li> <li>• power calculations</li> <li>• power consumption and efficiencies</li> <li>• voltage dividers</li> <li>• voltage, resistance and current calculations.</li> </ul>
<i>Electrical quantities</i> may include:	<ul style="list-style-type: none"> <li>• current</li> <li>• power</li> <li>• voltage.</li> </ul>
<i>Probable faults</i> may include:	<ul style="list-style-type: none"> <li>• blown fuse</li> <li>• cracked circuit board</li> <li>• failed components</li> <li>• faulty power supply</li> <li>• foreign battery</li> <li>• intermittent faults</li> <li>• loose connections</li> <li>• open circuit</li> <li>• short circuit</li> <li>• short to ground</li> <li>• split pairs</li> <li>• water damage.</li> </ul>
<i>Characteristics of an analog signal and a digital signal</i> may include:	<ul style="list-style-type: none"> <li>• analog signal characteristics:               <ul style="list-style-type: none"> <li>• continuously variable, infinite number of states</li> <li>• intelligence based on recreating exact</li> </ul> </li> </ul>



<b>RANGE STATEMENT</b>	
	<p>waveshape</p> <ul style="list-style-type: none"> <li>• signal to noise ratio increase with amplification</li> <li>• digital signal characteristics: <ul style="list-style-type: none"> <li>• encryption</li> <li>• error detection and correction</li> <li>• finite number of discrete states</li> <li>• high noise immunity</li> <li>• intelligence based on ability to discern only 2 states</li> <li>• regeneration</li> <li>• type of square wave (complex waveform).</li> </ul> </li> </ul>
<b><i>Building blocks</i></b> may include:	<ul style="list-style-type: none"> <li>• analog: <ul style="list-style-type: none"> <li>• amplifiers</li> <li>• attenuators</li> <li>• displays</li> <li>• filters</li> <li>• oscillators</li> <li>• transducers</li> </ul> </li> <li>• digital: <ul style="list-style-type: none"> <li>• ADC and DAC</li> <li>• computers</li> <li>• counter</li> <li>• data routers, switches and bridges</li> <li>• digital amplifier</li> <li>• digital display</li> <li>• input and output transducers</li> <li>• multiplexer.</li> </ul> </li> </ul>
<b><i>Transmission characteristics</i></b> may include:	<ul style="list-style-type: none"> <li>• attenuation</li> <li>• balanced</li> <li>• characteristic impedance (<math>Z_0</math>)</li> <li>• crosstalk</li> <li>• frequency range</li> <li>• transmission windows for glass optical fibre</li> <li>• unbalanced</li> <li>• waveguide cut-off frequency.</li> </ul>
<b><i>Types of cable</i></b> may include:	<ul style="list-style-type: none"> <li>• aluminium and copper DC busbars</li> <li>• coaxial cable</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• multi-pair communications cable</li> <li>• optical fibre</li> <li>• performance data cable CAT 5 and higher</li> <li>• rack and sub-rack alarm and power distribution cables</li> <li>• shielded twisted pair (STP) communications cable</li> <li>• unshielded twisted pair (UTP) communications cable.</li> </ul>
<i>Application characteristics</i> may include:	<ul style="list-style-type: none"> <li>• audio</li> <li>• data</li> <li>• digital subscriber line (DSL)</li> <li>• Ethernet</li> <li>• microwave</li> <li>• optical/laser</li> <li>• power</li> <li>• radio frequency (RF)</li> <li>• satellite</li> <li>• video.</li> </ul>
<i>Wireless connections</i> may include:	<ul style="list-style-type: none"> <li>• 2-way radio</li> <li>• AM, FM</li> <li>• Bluetooth</li> <li>• cellular</li> <li>• infra-red</li> <li>• microwave</li> <li>• optical/laser</li> <li>• satellite</li> <li>• wireless fidelity (WiFi)</li> <li>• worldwide interoperability for microwave access (WiMAX).</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Telecommunications
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Telecommunications networks engineering
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