



Australian Government

UEECD0043 Solve problems in direct current circuits

Release: 1

UEECD0043 Solve problems in direct current circuits

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Application

This unit involves the skills and knowledge required to determine correct operation of single source direct current (d.c.) series, parallel and series-parallel circuits and provide solutions to various electrotechnology work functions.

It includes working safely; using voltage, current and resistance measuring devices; and providing solutions to measurement and calculation problems derived from single and multiple path circuits.

The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V d.c.

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an apprenticeship, may be required.

Additional and/or 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 work health and safety (WHS)/occupational health and safety (OHS) regulations.

Pre-requisite Unit

UEECD0007 Apply work health and safety regulations, codes and practices in the workplace

Competency Field

Cross Discipline

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

PERFORMANCE CRITERIA

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

1 Identify d.c. electrical circuits

- 1.1** Nature of the circuit problem is obtained from relevant documentation, electrical drawings or personnel to determine the scope of work to be undertaken
- 1.2** Work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures for a given work area are identified and applied
- 1.3** Tools, equipment and circuit measuring devices required for the electrical work are obtained and checked for correct operation and safety in accordance with workplace procedures
- 1.4** Electrical apparatus is visually inspected, and components and circuits are identified

2 Determine electrical d.c. circuit problem

- 2.1** Electrical hazards are identified, risks are assessed and control measures are implemented
- 2.2** Need to test or measure live electrical work is conducted in accordance with WHS/OHS workplace safety procedures and regulatory requirements
- 2.3** Circuits are checked and isolated in accordance with workplace procedures and regulatory requirements
- 2.4** Expected circuit parameters are calculated from relevant component ratings/specifications
- 2.5** Circuit parameters are measured in accordance with industry standards and checked against expected values
- 2.6** D.c. circuit problems are assessed from measured and calculated values using established methodologies as they apply to circuits
- 2.7** Circuit solutions are determined from measured and calculated values of resistance, voltage, current and power in series, parallel, and series-parallel circuits in accordance with industry standards
- 2.8** Solutions are tested in accordance with workplace procedures and industry standards
- 2.9** Problems are resolved without damage to apparatus, circuits, the surrounding environment or services using

		sustainable energy practices
	2.10	Unplanned situations are responded to in accordance with workplace procedures in a manner that minimises risk to personnel and equipment
3 Complete work and document problem-solving activities	3.1	WHS/OHS work completion risk control measures and procedures are followed
	3.2	Worksite is cleaned and made safe in accordance with workplace procedures
	3.3	Justification for solutions used to resolve circuit problems is documented
	3.4	Work completion is documented, electrical drawings are updated, and relevant person/s notified in accordance with workplace procedures

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Unit Mapping Information

This unit replaces and is equivalent to UEENEEE104A Solve problems in d.c. circuits.

Links

Companion Volume implementation guides are found in VETNet - -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEECD0043 Solve problems in direct current circuits

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:

- altering an existing circuit to comply with specified operating parameters
- applying Ohm's Law to solve problems in direct current (d.c.) single path circuits
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including identifying risks and applying risk control measures
- calculating resistance of a conductor from factors such as conductor length, cross-sectional area, resistivity and changes in temperature and material
- connecting analogue/digital ammeter into a circuit ensuring the polarities are correct to take current readings
- connecting a series d.c. circuit containing capacitor and resistor to determine the time constant of the circuit
- calculating quantities from given information to determine capacitance, energy and voltage
- calculating one time constant as well as the time taken to fully charge and discharge a given capacitor
- calculating equivalent capacitance of capacitors connected in series and parallel circuits
- dealing with unplanned events in accordance with workplace procedures in a manner that minimises risk to personnel and equipment
- demonstrating graphical relationships of voltage, current and resistance
- calibrating and using measuring device in accordance with manufacturer specifications
- determining the operating parameters of an existing circuit
- developing circuits to comply with a specified function and operating parameters
- identifying and applying electrical industry standard symbols to represent electrical components in circuit diagram
- identifying fixed and variable resistors, including:
 - determining resistance of a colour coded resistor from colour code tables and confirming the value by measurement
 - measuring resistance of variable resistors under varying conditions of light, voltage and/or temperature
 - selecting a resistor for an application
- solving problems in series and series-parallel circuits, including:

- developing, setting up and connecting a single source d.c. series-parallel circuit
- measuring voltage and current
- calculating resistance, voltage, current and power from measured and/or given values of any two of these quantities in a single source series-parallel circuit
- using test equipment to confirm the effect of material length, cross-sectional area and temperature on the resistance of conductive materials
- selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application
- using measuring devices to Solve problems in direct current circuits
- using meters for problem solving, including measuring resistance using direct, volt-ammeter and/or bridge methods
- using methodical techniques to solve d.c. circuit problems from measured and calculated values.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- electrical concepts, including:
 - calculations involving quantity of electricity, velocity and speed
 - distribution of electricity from the source to the load via the transmission systems
 - principle of conservation of energy
 - production of electricity, including:
 - renewable and non-renewable energy sources
 - static and current electricity
 - utilisation of electricity by the various loads
- electrical circuit, including:
 - industry standard symbols used to represent components in an electrical circuit diagram
 - multiple and sub-multiple units
 - purpose of each component in the electrical circuit
- Ohm's Law, including:
 - d.c. single path circuit
 - determining voltage, current and resistance in a circuit
 - effects of an open circuit, a closed circuit and a short circuit on a d.c. single path
 - relationship between voltage and current from measured values in a circuit
 - graphical relationships of voltage, current and resistance
 - relationship between voltage, current and resistance
 - voltage and current levels in a d.c. single path circuit
- electrical power, including:
 - effects of power rating of various resistors
 - methods for measuring of electrical power in a d.c. circuit

- power dissipated in circuit from voltage, current and resistance values
- power ratings of electrical devices
- relationship between force, power, work and energy
- effects of electrical current, including:
 - relevant industry standards relating to fundamental principles for protection against the damaging effects of current
 - mechanisms by which metals corrode
 - principles by which electric current can result in the production of:
 - heat
 - magnetic fields
 - a chemical reaction
 - typical uses of electrical current
 - physiological effects of current
- electromotive force (EMF) sources and conversion of electrical energy, including:
 - input, output, efficiency and losses of electrical systems and machines
 - principles of generating an EMF, including:
 - when a mechanical force is applied to a crystal
 - when moving a conductor in a magnetic field
 - by the application of light falling on the surface of photovoltaic (PV) cells
 - from the heating of one junction of a thermocouple
 - principles of producing an electrical current from primary, secondary and fuel cells
- resistors, including:
 - types and applications of fixed and variable resistors used in the electrotechnology industry
 - characteristics of variable resistors used in the electrotechnology industry, including:
 - adjustable resistors: potentiometer and rheostat
 - light dependent resistor (LDR)
 - voltage dependent resistor (VDR)
 - temperature dependent resistor
 - power ratings of a resistor
 - power loss (heat) occurring in a conductor
 - resistor colour code tables
- series, parallel, and series-parallel circuits, including:
 - applications where these circuits are used in the electrotechnology industry
 - characteristics of series, parallel, and series-parallel circuits, including:
 - connection of loads
 - current path
 - voltage drops
 - power dissipation
 - effects of an open circuit

- diagrams of single source d.c. series, parallel, and series-parallel circuits
- identification of the components of series, parallel, and series-parallel circuits, including power supply, loads, connecting leads and switch
- relationship between voltage drops and resistance in a simple voltage divider network
- techniques for determining voltage, current, resistances or power dissipated from measured or given values (of any two of these quantities)
- relationship between branch currents and resistances in a two-branch parallel and series-parallel current divider network
- factors affecting the resistance of a conductor, including:
 - conductor length
 - cross-sectional area
 - resistivity
 - changes in temperature and material
 - effect the change in cross-sectional area, length and type of material has on the resistance of a conductor
 - effects of resistance on the current-carrying capacity and voltage drop in cables
 - effects of temperature change on the resistance of various conducting materials
- effects of measuring devices in a circuit, including:
 - advantages and disadvantages of each voltage indicator tester
 - calibration and use of the measuring device
 - methods for connecting an analogue/digital voltmeter into a circuit ensuring the polarities are correct and taking various voltage readings
 - correct techniques to read the scale of an analogue meters and how to reduce the 'parallax' error
 - hazards associated with the use of measuring devices, including polarity
 - hazards involved in using electrical instruments and the safety control measures that should be taken
 - instruments used in the field to measure voltage, current, resistance and insulation resistance and the typical circumstances in which they are used
 - methods for using insulation resistance measuring devices to relevant industry standards
 - loading effect of various voltmeters when measuring voltage across various loads
 - methods for measuring resistance using direct, volt-ammeter and bridge methods
 - non-contact voltage indicator types and use
 - operating characteristics of analogue and digital meters
 - connecting an analogue/digital voltmeter into a circuit ensuring the polarities are correct and taking various voltage readings
 - operation of various voltage indicator testers
 - purpose and characteristics of a voltmeter
 - purpose of an ammeter and the correct connection (series) of an ammeter into a circuit
 - reasons 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

- methods for selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application
- types of voltage indicator testers, including light-emitting diode (LED), neon, solenoid, volt-stick and series tester and the purpose of each voltage indicator tester
- methods for using voltage indicator testers to detect the presence of various voltage levels
- capacitors and capacitance, including:
 - construction of a standard capacitor
 - different types of dielectric material and each dielectric's relative permittivity
 - types of capacitors commonly used in the electrotechnology industry
 - industry standard symbol of various types of capacitors, including standard, variable, trimmer and polarised
 - terms and units for capacitance, electric charge and energy
 - factors affecting capacitance
 - behaviour of a series d.c. circuit containing resistance and capacitance components. - charge and discharge curves
 - arrangement of a series d.c. circuit containing capacitance and resistor to determine the time constant of the circuit
- capacitors in series and parallel, including:
 - application of capacitors in the electrotechnology industry
 - common faults in capacitors
 - arrangement of capacitors in series and/or parallel configurations to achieve various capacitance values
 - equivalent capacitance of capacitors connected in series and parallel
 - effects of capacitors connected in parallel by calculating their equivalent capacitance
 - effects on the total capacitance of capacitors connected in series by calculating their equivalent capacitance
 - hazards involved in working with capacitance effects and the safety control measures that should be taken, including 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
 - testing of capacitors to determine serviceability.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, equipment (including single source series, parallel and series-parallel d.c. circuits) and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, manufacturer instructions, regulations, codes of practice and operation manuals.

Links

Companion Volume implementation guides are found in VETNet - -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>