UEERE9993Y Apply electrical principles to renewable energy design

Modification History

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

Application

This unit involves the skills and knowledge required apply electrical principles to renewable energy design.

It includes: working safely; determining the extent and nature of the installation: applying regulation/legislation, industry standards, and codes; reading and interpreting drawings; identifying expertise required for design and installation; calculating cabling, isolation and protection devices; verifying compliance of equipment selected; and, completing necessary documentation and record keeping

This unit supports individuals other than electricians from other electrotechnology disciplines or education pathways to demonstrate the skills and knowledge required to undertake the design of renewable energy systems.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Not applicable

Competency Field

Renewable Energy

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	**Prepare to contribute to renewable energy installation design**	**1.1** WHS/OHS processes and procedures are identified and applied in accordance with workplace procedures
		1.2 Renewable energy system designs are reviewed to check compliance with industry standards, guidelines and codes
		1.3 Drawings and diagrams are interpreted to determine the apparatus, cables and isolation device sizes and types
		1.4 Renewable energy system regulations / legislation, industry standards, and codes are identified, interpreted and applied
		1.5 Calculated component sizes are checked against verified designs
		1.6 Additional expertise or approval required for execution of design is identified
2	**Apply electrical principles to development of renewable energy design**	**2.1** Energy production is calculated in accordance with industry standards
		2.2 Cable sizes are calculated in accordance with job requirements and industry standards
		2.3 Isolator sizes are calculated in accordance with job requirements and industry standards
		2.4 Protection device sizes are calculated in accordance with job requirements and industry standards
		2.5 Documentation and record keeping is completed in accordance with workplace procedures and regulatory requirements

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 Electrotechnology Training Package Companion Volume Implementation Guide.

Unit Mapping Information

This is a new unit

Links

UEE - Electrotechnology Training Package Companion Volume Implementation Guide at: [sector webpage link here]

Assessment Requirements for UEERE9993Y Apply electrical principles to renewable energy design

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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:

- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures and practices
- applying safety principles for electrical systems in buildings and premises
- reviewing renewable energy system designs for compliance with industry standards, guidelines and codes
- interpreting drawings and diagrams to determine the apparatus, cables and isolation device sizes and types
- identifying, interpreting, and applying relevant renewable energy system regulations / legislation, industry standards, and codes
- calculating:
  - cable sizes
  - isolator sizes
  - protection device sizes
  - energy production
- drawing block diagrams incorporating apparatus, cables, isolators and overcurrent protection
- identifying any additional expertise or approval required for execution of design
- verifying equipment and cable selected complies with standards and job specifications
- completing necessary documentation and record keeping.

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:

- safety and compliance including:
  - hierarchy of Acts, Regulation, Standards and Codes
  - Licensing restrictions

- alternating current (AC) and direct current (DC), what each is, and dangers posed by each
- electrical isolation requirements and processes

- electrical theory including:
  - definitions of and units of measurement for:
    - voltage
    - current
    - resistance including conductors versus insulators
    - power
    - energy
  - relationship between voltage, current and resistance
  - difference between power and energy, and when is each used
  - simple calculations including:
    - appliance loads
    - energy ratings

- the grid including:
  - high voltage (HV) and low voltage (LV)
  - distribution network service provider (DNSP)
  - electricity bills, tariff structures and demand charges
  - single, two and three phase
  - main switchboard and distribution boards
  - fault currents

- drawings including:
  - drawing types including:
    - single line diagram (SLD)
    - wiring
    - architectural
    - block
  - interpreting site plans
  - interpreting drawing symbols used for renewable energy designs/installations

- basic electrical circuits including:
  - elements of a simple electric circuit (supply, control switch, protection device and load)
  - purpose of each component in the circuit
  - effects of an open circuit, a closed circuit and a short circuit

- types of loads including:
  - resistive
  - inductive

- alternating current (AC - both single and three phase) and direct current (DC), what each is, and dangers posed by each
- need for devices to afford electrical protection and the mechanisms used in protection devices including resetting
- symbols used to represent an electrical energy source, a load, a switch and a circuit protection device in a circuit diagram
- Ohm's law, including:
    - relationship between Voltage, Current and Resistance
    - basic direct current (d.c.) single path circuit
    - voltage and current levels in a basic d.c. single path circuit
    - effects of an open circuit, a closed circuit and a short circuit on a basic d.c. single path relationship between voltage and current from measured values in a simple circuit
- electrical power, including:
    - power ratings of devices
    - power dissipated in circuit from voltage, current and resistance values
    - definition of 'power' in electrical terms (for d.c. or resistive a.c. circuits)
    - using circuit readings determine power using the appropriate equations, symbols and unit abbreviations including the use of multiples and sub multiples
- series circuits, including:
    - circuit diagram of a single source d.c. series circuit
    - identification of the major components of a series circuit: power supply, loads, connecting leads and switch
    - relationship between voltage drops and resistance in a simple voltage divider network
    - effect of an open circuit on a series connected circuit
- parallel circuits including:
    - schematic diagram of a single source d.c. parallel circuit
    - identification of the major components of a parallel circuit (power supply, protection device, switch and loads)
    - applications where parallel circuits are used in the electrotechnology industry
    - characteristics of a parallel circuit (load connection, current paths, voltage drops, power dissipation, and effects of an open circuit in a parallel circuit)
    - relationship between currents entering a junction and currents leaving a junction
    - relationship between branch currents and resistances in a two-branch current divider network
- series/parallel circuits including:
    - schematic diagram of a single source d.c. series/parallel circuit
    - identification of the major components of a series/parallel circuit (power supply, protection device, switch and loads)
    - applications where series/parallel circuits are used in the electrotechnology industry
    - characteristics of a series/parallel circuit (load connection, current paths, voltage drops, power dissipation, and effects of an open circuit in a series/parallel circuit)

- relationship between voltages, currents and resistances in a bridge network

- calculation of the total:
  - resistance of a series/parallel circuit
  - current of a series/parallel circuit
  - voltage and the individual voltage drops of a series/parallel circuit
  - techniques for setting up and connecting a single source d.c. series/parallel circuit
- factors affecting resistance, including:
  - 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
  - techniques for calculation of the resistance of a conductor from factors such as conductor length, cross-sectional area, resistivity and changes in temperature
- power factor
- basic measuring equipment including:
  - multi meter
  - AC/DC clamp meter
  - megohmmeter
- earthing systems including:
  - functional earthing
  - protective earthing and equipotential bonding
  - typical earthing arrangements for electrical installations, including installations with outbuildings
  - multiple earthed neutral (MEN) system including:
    - protective earth-neutral (PEN) conductor
    - main earthing conductor
    - MEN link
    - earth electrode
- switchboards and protection including:
  - switchboard types, application and construction
  - arrangement and identification of switchboard equipment
  - devices for functions of isolation, emergency, mechanical maintenance and functional control
  - circuit breakers including:
    - miniature circuit breaker (MCB)
    - molded case circuit breaker (MCCB)

        - residual current device (RCD)
        - residual current breaker with overcurrent (RCBO)
    - fuses
    - coordination of overload and short circuit protection devices
    - device requirements for protection against over-voltage and under-voltage
    - signage
    - alternate supplies
    - ingress protection (IP) ratings
    - relevant industry standard requirements for switchboards and protection
- cabling including:
    - purpose, types and construction of cables used in renewable energy installations
    - current carrying capacity of cables
    - cable installation methods including:
        - in air
        - open
        - on surface
        - partially surrounded
        - fully surrounded
    - typical cable routes through buildings, structures and premises
    - mechanical cable protection methods
    - cable and conductor terminations
    - maintaining fire integrity rating
    - voltage drop
    - voltage rise
    - earth fault-loop impedance
    - short circuit performance consideration
    - methods to calculate/select cable sizes including:
        - AC and DC cables
        - earthing cables
    - relevant industry standard requirements for cables
- relevant safe work method statements (SWMS)/job safety assessments or risk mitigation processes.

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 suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in suitable 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 and personal protective equipment (PPE) currently used in industry
- resources that reflect current industry practices in relation to applying electrical principles in renewable energy design
- applicable documentation, including workplace procedures, equipment specifications, regulations, relevant industry standards, codes of practice and operation manuals.

Links

UEE - Electrotechnology Training Package Companion Volume Implementation Guide at: [sector webpage link here]