Australian Government

Assessment Requirements for UEERE0025 Carry out basic repairs to renewable energy (RE) apparatus

Release: 1

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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, performance criteria and range of conditions on at least one occasion and include:

- following manufacturer service instructions for access to components
- removing at least three different types of components specified in the work instructions
- replacing components to manufacturer requirements
- reassembling the apparatus correctly
- testing apparatus operation
- dealing with unplanned events
- applying relevant risk identification, assessment, reporting and control requirements
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including the use of risk control measures
- applying sustainable energy principles and practices
- carrying out repairs to renewable energy (RE) apparatus, including:
  - completing and reporting on repair work
  - determining scope of repair work
- checking isolation of circuits/machines/systems
- coordinating work with relevant person/s
- determining live testing/measurement requirements
- identifying and accessing materials, tools, equipment and testing devices.

Knowledge Evidence

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

- RE technologies, including:
  - major non-technical issues encompassing:
    - impact of economic, social, environmental and political issues on the use of RE technologies
    - how each of the non-technical issues impact on the application of a selected RE

technology

- energy services and demand encompassing:
  - definition of the terms: energy, power, energy efficiency, end-use energy, primary energy and embodied energy
  - calculation relating to energy, power and time with the appropriate number and time with the appropriate number of significant figures
  - units and symbols for energy, power, time and temperature using standard International System of Units (SI) and prefixes
  - conversion of energy and power quantities from one unit to another using conversion tables
  - the two laws that apply to any energy conversion process
  - efficiency of a simple energy conversion process
  - energy services required by a domestic dwelling
  - power and energy consumption of individual appliances and systems using appropriate meters or other methods
  - calculation of the end use and primary energy required for these energy services
  - selection of the most appropriate energy source for each of these services
  - justification in terms of environmental, economic, social and political constraints
  - selection of appropriate energy efficient appliances and technologies
- solar resource encompassing:
  - definition of the terms: irradiation, latitude, solar constant, direct and diffuse radiation, azimuth and altitude angles, irradiance, solar window, tilt angle, solstice and equinox
  - units and symbols for irradiation and irradiance and the conversion of one unit to another using conversion tables
  - measurement of solar irradiance with a solarimeter
  - solar radiation data tables and contour maps
  - position of the sun for a given date, time and latitude using a sun path diagram
  - times when an obstacle will shade a given collector
  - how radiation varies throughout the year on the surface of a collector which is either fixed, single-axis tracking or double-axis tracking
  - appropriate tilt angles for fixed and seasonally-adjustable collectors at a given latitude and given application
  - calculation of the effect of single-axis tracking and double-axis tracking on collected radiation using radiation data tables
- solar thermal systems encompassing:
  - definition of terms: conduction, convection, radiation, collector heat loss co-efficient, conductivity, specific heat and solar fraction
  - components for a solar thermal system, including collector, storage, reticulation and control
  - solar collector types suitable for low, medium and high temperature applications
  - different types of domestic solar hot water (SHW) systems
  - how the components of thermosiphon and pumped storage systems operate

- heat loss mechanisms in collectors
- stratification in storage tanks
- backup energy systems
- control and protection strategies
- solar fraction of a domestic SHW system with the use of table or nomograms

- energy efficient building design encompassing:
  - definition of terms: thermal comfort, passive system, active system, aspect of the site, orientation of the building and thermal mass
  - the climate factors which affect building design
  - relationship between thermal comfort and climate
  - relationship between the seasonal variation of the sun's path and the heat gain of the building elements (roof, walls, windows and floor)
  - effect of the thermal conductivity of building materials on heat flows to and from the building
  - use of thermal mass in reducing temperature variations within the building
  - use of ventilation
  - thermal performance of a dwelling using both indoor and outdoor hourly temperature measurements over the period of at least one day
  - effect of insulation, glazing, orientation, shading devices, thermal mass and ventilation on the thermal performance of a building
  - an active solar system which could be used in a dwelling to complement passive design features in extreme climates
  - aspects of an existing dwelling that contribute to or detract from thermal performance
- photovoltaic (PV) arrays encompassing:
  - definition of terms: PV cell, module, series, parallel, array, maximum power point (MPP), nominal operating cell temperature (NOCT), short circuit current (ISC), open circuit voltage (VOC), I-V curve, current at maximum power point (IMP) and voltage at maximum power point (VMP)
  - calculations relating to voltage, current and power with the appropriate number of significant figures and using standard SI units and prefixes
  - types of commercially available PV modules, their efficiency and typical applications
  - I-V curve for a typical PV module and label the approximate position of MPP and values of ISC, VOC, IMP and VMP
  - effect of irradiance and temperature on ISC, VOC, IMP and VMP
  - function of blocking and bypass diodes
  - current and voltage of a single module to produce the I-V characteristic curve
  - major specification criteria for a PV module
  - size and configuration of a PV array for a given load and system voltage using tables or nomograms
- wind energy resources encompassing:
  - definition of terms: kinetic energy, specific wind power, vertical wind speed profile, surface roughness, temperature inversion layer, cut in (vC), rated (vR) and furling

(vF) wind

- speeds, rated power (PR), power co-efficient (cP), output co-efficient (cO and tip speed ratio
  - units and symbols for wind speed, specific wind power and air density
  - large scale wind patterns over the Australian continent, their causes and the effect of local terrain on wind speed, direction and turbulence
  - specific wind power for given wind speeds
  - wind speed at different heights above ground level
  - the mean wind speed based on wind speed frequency distribution data in the form of a histogram
  - suitable minimum tower height for a wind energy conversion system (WECS) sited downwind from an obstacle
  - isovent maps
  - types of wind-measuring instruments and the minimum requirements for assessing wind energy at a given site
  - measurement of wind speed and direction
  - characteristics of horizontal axis and vertical axis, upwind and downwind, lift and drag propelled wind turbines
  - power vs. wind speed curve for a typical WECS showing vC, vR, vF, and PR
  - major specification criteria for a WECS
  - sizing a WECS for a given load, efficiency and annual mean wind speed using tables or a nomogram
- micro-hydro system basis encompassing:
  - definition of terms: flow rate, gross or static head, potential energy, net or dynamic head, hydraulic efficiency, micro-hydro system efficiency, equivalent pipe length, reaction turbine and impulse turbine
  - units and symbols for flow rate, head and gravitational constant
  - methods each assessing flow rate and head
  - measurement of stream flow rate and head
  - assessment from contour maps
  - different micro-hydro systems in terms of their physical and operating characteristics
  - major specification criteria for a micro-hydro system for electricity generation
  - suitable type and size of micro-hydro-system for a given load, efficiency, available flow rate and net head using tables or a nomogram
- energy storage encompassing:
  - methods of energy storage
  - energy density of the energy storage methods above by mass and volume
  - definition of the following terms in relation to batteries: nominal voltage, cell, primary and secondary cells, battery, charge and discharge rate, amp hour capacity, watt hour capacity, state of charge (SOC), depth of discharge (DOD), specific gravity (SG), watt hour and amp hour efficiency, and cycle life
  - major features of common types of batteries suitable for stand-alone power systems

    - state of charge of a lead-acid battery through measurement of specific gravity or battery voltage using safe working practices
- stand-alone power system basis encompassing:
    - direct current (d.c.) sub-system efficiency
    - block diagram of a typical stand-alone power system
    - function of each stand-alone power system component
    - typical efficiencies of each component
    - major characteristics of different types of commercially available regulators, inverters and battery chargers
- biomass encompassing:
    - definition of terms: biogas, producer gas, biofuels, feedstock, gross and net calorific values
    - biofuels and their specific energy contents
    - method of production of one of these five biofuels, including source of raw material/feedstock, conversion process and yield
    - applications for each of the biofuels
    - assessment of the biomass resource required to meet a particular energy service, e.g. cooking, hot water, space heat, transport, process heat and electricity
    - social, political and economic impact of large-scale use of selected biomass resources
- relevant manufacturer specifications
- relevant job safety assessments or risk mitigation processes
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace policies and procedures.

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 carrying out repairs to RE apparatus by replacement of components
- applicable documentation, including workplace procedures, equipment specifications, 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