

UTE NES060 A

Carry out routine work activities in an Electrotech environment

Descriptor: Undertake scheduled routine work activities in the Electrotechnology Industry in an agreed time, to a quality standard and with a minimum of waste.

Elements		Performance criteria	
060.1	Prepare to undertake routine work activities	060.1.1	Instructions for the preparation of the work activity are communicated and confirmed to ensure clear understanding
		060.1.2	<i>OH&S policies and procedures</i> are communicated and confirmed to ensure they are understood as to be applied in the carrying out of the work
		060.1.3	Tools, <i>equipment</i> and personnel protective equipment needed to do the work are identified, scheduled and checked to ensure they work correctly as intended and are safe to use in accordance with <i>established procedures</i>
		060.1.4	<i>Appropriate personnel</i> are consulted to ensure the work is coordinated effectively with others involved
		060.1.5	Resources and materials needed to do the work are confirmed, scheduled and obtained in accordance with <i>established procedures</i>
		060.1.6	Schedule of work including practices for working safely are confirmed as in accordance with instructions and <i>requirements</i>
060.2	Carry out work as instructed	060.2.1	<i>OH&S policies and procedures</i> and safe work practices are followed to eliminate or minimise incidents
		060.2.2	Schedule of work is followed to ensure work is completed in an agreed time, to a quality standard and with a minimum of waste
		060.2.3	Further instructions are sought from <i>appropriate personnel</i> in the event of unplanned events or conditions occurring
		060.2.4	On going checks of quality of the work are undertaken in accordance with instructions and <i>requirements</i>

Elements	Performance criteria
060.3 Check results of the completed work	<p>060.3.1 Final checks are made to ensure the work conforms with instructions and to <i>requirements</i></p> <p>060.3.2 <i>Appropriate personnel</i> are notified of completion of the work</p> <p>060.3.3 Tools, <i>equipment</i> and any surplus resources and materials are, where appropriate, cleaned, checked and returned to storage in accordance with <i>established procedures</i></p> <p>060.3.4 Work area is cleaned up and made safe and <i>sustainable energy practices</i> are followed</p> <p>060.3.5 Appropriate records are updated in accordance with instructions and <i>established procedures</i></p>

Range statement

General

Generic items in this unit are shown in italics, e.g. *established procedures*. The definition and intended scope covered by generic items is described in the Glossary that forms an integral part of this range statement.

Electrotechnology environment includes one or more the following *category* or allied industry areas:

Computer Systems

Data Communications

Electronics

Electrical

Instrumentation

Refrigeration and Air conditioning

Currency in unit of competence

In order to maintain currency in this unit on-going competency development is to occur. This would include keeping abreast of any changes in legislation, regulations, procedures, technology and the like related to the scope and application of this unit.

Evidence guide

This Evidence guide is intended to include components defined within the Range Statement, of which the Glossary is an integral part. Terms in italics, e.g. *consistent performance*, with respect to the Evidence guide are also contained in the Glossary.

Critical aspects of evidence

Achieving competence

Achievement of this unit of competence is based on each of the following conditions being met:

- demonstrating *consistent performance* for each element of the unit exhibited across a *representative range* of applications; independently under direct supervision and to *requirements*.
- meeting the performance criteria associated with each element of competence by employing the techniques, procedures, information, and resources available in the workplace within the context of the Range Statement.
- demonstrating an understanding of the Underpinning knowledge and skills identified in the section, of this unit titled 'Underpinning knowledge and Skills'.

Reporting requirements

The reporting of the judgements about competence must be in the context of the individual unit being assessed and the qualification to be issued. Where regulatory requirements in individual jurisdictions require recording of additional information such as underpinning knowledge and skills specified, as well as related work performance evidence relevant to this unit, it is to be reported in accordance with the Regulator's requirements. For such requirements knowledge and skills that underpin this competency are to be recorded and issued as a part of the transcript of achievement.

Maintaining competence

Consideration should be given to periodic evaluations of skills and knowledge within this unit that are critical to safety, operation of plant and equipment and the like, particularly where relevant skills and knowledge are not frequently practiced.

Context of assessment

Competency in this unit will be determined on evidence of having *consistently performed* across a *representative range* of activities in one or more of the following *category* areas: *Computer Systems; Data Communications; Electronics; Electrical; Instrumentation; Refrigeration and Air conditioning* and/or allied industry areas.

Due regard must be given to Safety when developing assessment and delivery arrangements. Assessment is to be progressive reflecting an holistic approach. Competent performance with inherent safe working practices is expected in the Electrotechnology Industry. This requires that the specified underpinning knowledge and skills is developed and assessed in a structured environment which is primarily intended for learning and incorporates all necessary equipment and facilities for learners to develop the knowledge and skills described in this unit. Such environment must ensure appropriate controls, safety, and direct supervision is practiced.

The context must also embrace the requirements and characteristics for the applicable endorsed qualification, which references this unit, and, where required, support the outcomes of other units within the endorsed qualification structure.

Interdependent assessment of units

Assessment in this unit is related to the knowledge associated with other units within a qualification structure, where appropriate.

Underpinning knowledge and skills

This section provides the specification of underpinning knowledge and skills required to underpin the elements, performance criteria, and range statement of this unit. More detailed information related to the breadth and depth of underpinning knowledge and skills is included in the Knowledge and Skills Specification, which forms an integral part of this unit.

Note: The Electrotechnology Industry is a hazardous industry which is demonstrated by the need for regulation in respect of electrical safety and regulation, and therefore, due regard must be given to the environment in which the development of underpinning knowledge and skills and its application occurs. Thus development and assessment of underpinning knowledge and skills is to be arranged in manner, which ensures appropriate control measures of safety and regulatory requirements are in place and observed. In particular, special attention is to be given to the topic of *Electrotechnology Systems, Materials and Accessories* detailed below. Appropriate measures for this topic must be put in place to ensure a structured environment for learning and practice includes the use of equipment that is designed for instructional purposes, and which does not expose the learner to any voltages that exceed extra low voltage. Extra low voltage is defined in Standards Australia publications, eg. SA/NZ 3000:2001. However, the use of such equipment does not negate the duty of care in treating electricity other than as a hazard.

This, with other aspects of evidence, will ensure that an individual has the appropriate underpinning knowledge and skills that support the ability to undertake activities as a competent person.

Underpinning knowledge and skills topics pertaining to this unit – listed below are underpinning knowledge and skills topics, which are required to be exhibited by individuals for the purposes of attaining appropriate knowledge and skills underpinning performance in this unit. The relevant detail for each topic that must be exhibited by an individual is included under Knowledge and Skills Specification topics, which follows the list:

Topics:

- **Occupational Health and Safety**
- **Electrotechnology Calculations**
- **Applied Electrical Science**
- **Electrical Concepts and Applications**
- **Overview and Practices in the Electrotechnology Industry**
- **Carrying out routine work activities in an Electrotech environment – Work Performance**

In the Specialisation of: Engineering

- **Drawing Interpretation and Sketching**

- **Electrotechnology Systems, Materials and Accessories**
- **Workshop Practices**

In the Specialisation of: Renewable Energy

- **Introduction to Renewable Energy Technologies**

Knowledge and Skills Specification

This Knowledge and Skills Specification details the requisite knowledge and skills that is to be developed and achieved for each topic specified and listed within the Evidence Guide of this unit of competency under the heading Underpinning knowledge and skills. This section provides information regarding the depth and breadth of knowledge and skills to be developed and exhibited thus, forming an integral part of the respective Unit of Competency.

More detailed information regarding strategies for learning, development and assessment of content breadth and depth, delivery and resourcing issues is included in associated Training Package Support Materials and, where developed advice can be obtained from ANTA's website.

Occupational Health and Safety

Occupational Health and Safety Act: Aims; Acts; Representatives'; Inspectors; Offences

Personal safety: health at and at work; stress related illnesses; injuries and diseases in the workplace; repetitive strain injuries; manual handling procedures; handling of ladders; adequate lighting in the workplace; industrial radiation; chemical hazards; protective equipment; special situations (eg. Scaffolding); electrical hazards; thermal stress; exposure to excessive vibration; high level industrial noise; safety in the general workplace

Workplace hazards: - Safety checks within the workplace; Identification of potential workplace hazards; Preventative measures

Working with electrically operated tools and equipment: nature of electric shock; causes of electrical accidents; working safely with electricity; safety items used in electrical environments; protection; isolation

Rescue from a live electrical situation

Emergency first aid/resuscitation: procedures for performing emergency first aid and; resuscitation from an electric shock.

Electrotechnology Calculations

Basic operations and estimating the results of a calculation

Graphs and tables

Transposition

Trigonometry

Vectors/phasors

Systematic Problem Solving

Applied Electrical Science

Components: resistors - fixed (composition & wire wound), variable (rheostats, potentiometers & trimmers), non-linear (thermistors, VDRs, LDRs); capacitors -

fixed (ceramic, plastic & electrolytic), variable, trimmers; magnetic - transformers (AF, RF and power), chokes, relays, contactors

Basic physics: conductors - definition, common types, typical applications; insulators - definition, common types, typical applications; semiconductors - definition, common types, typical applications; current flow - direction (electron/conventional), unit, effects of current flow; voltage - (i) sources (electromagnetic, chemical, heat & pressure) - unit; resistance - (ii) factors effecting (material, length, CSA & temp) - effect on circuit, colour code, preferred values (mention only), power rating; Ohms law - electrical Units (include sub and multiple) - volt, ampere, Ohm & Watt; power in electrical circuits - $P = IV$ only; introductory circuit symbols

Effects of electric current: heating, light, magnetic, chemical, physiological

Circuits: series and parallel (three resistive elements max.), V,I,R & P relationships, use lab experiments to validate theory

Protection: purpose, fuses, circuit breaking, safety interlocks, earthing – personnel safety

Electrical Concepts and Applications

DC resistive circuits: series; parallel; series parallel; measurement of V, I and R; calculation of R, V, I; and P

Capacitance: concept; unit; time constant; capacitors – basic construction and types

Magnetism: magnetic and non magnetic materials; magnetic field patterns; force between magnetic fields; applications

Electromagnetism: magnetic field around a current-carrying conductor and solenoid; force between current-carrying conductors; applications

Electromagnetic Induction: induced EMF; inductance (concept, unit, time constant, applications)

AC Principles: sine waves; frequency; amplitude; peak voltage; peak to peak voltage; RMS voltage; single phase; three phase; generation of AC voltages; circuit measurement; earthing; electrical supply system

Transformers: construction; principles of operation; primary and secondary voltage and current; applications

Motors: motor action; generator action; DC motors; AC motors; applications

Electrical Safety Testing: Regulations

Overview & Practices in the Electrotechnology Industry

Electrotechnology Vocations: Electrical; Electronics – including communications; Computer Systems; Communications; Refrigeration and Air Conditioning; Instrumentation and Control; Lifts

Career Paths in Electrotechnology: Australian Qualification Framework (AQF); Qualifications/Classifications; Scope of work-installation, maintenance and servicing

Training in Electrotechnology Vocations: traineeships and apprenticeships; licensed Electrician minimum requirements; career advancements

Industry Organisations: employers; employee – trade union groups (eg. CEPU, ETU); Government - ITABs, TAFE, RTO, ERAC, NACs; private providers

Qualification Requirements: unit of competency; competency standards; training and assessment; national training packages; training models - on-job components and off-job components; qualification requirements and assessments

Policies and Practices in Electrotechnology Industry: licensing and/or registration requirements and/or codes of practices; OH&S requirements including roles and responsibilities of employers and employees; awards, industrial agreements and enterprise bargaining

Job Application: research – employer organisations, trade unions, career advisers, job agencies, newspapers/magazines, personal contacts, industry training advisory boards (ITABs); writing – formal, content, handwritten/word processor, presentation; method of application – mail, fax, telephone, internet

Job Interview: preparation – dress code, timekeeping, what to take to the interview; presentation – appearance, introduction, mannerisms, strategies, techniques (questions/responses); evaluation – performance (appraisal/improvements)

Carrying out routine work activities in an Electrotech environment – Work Performance

Carry out routine work activities in an Electrotech environment in any one or more of the above *categories* across a *representative range* of apparatus and associated systems must be appropriately demonstrated on-the-job in real work activities or equivalent simulated environment

In the Specialisation of: Engineering

Drawing Interpretation and Sketching

Technical drawing standards appropriate to the industry sector, conventions and specifications to AS 1100, with strong emphasis on interpretation: sheet types, title block information, materials parts list, revision table, grid referencing scales, line types – visible outlines, hidden outlines, dimensioning lines, centre lines; orthogonal projection of views – 3rd angle (detail and assembly drawings); mechanical conventions; fabrication conventions; three dimensional view drawings – axonometric, isometric, oblique; sectioning standards and conventions – whole, part; engineering drawing symbols, components and equipment – mechanical, electrical, electronic, computer, instrument, refrigeration; dimensioning – orthogonal, isometric; layout and plans; geometric tolerance interpretation (straightness, flatness, squareness, parallelism and concentricity only); engineering abbreviations; drawing interpretation techniques – detail drawings, orthogonal projection (3rd angle only) and three dimensional, assembly drawings and three dimensions exploded (e.g. as in equipment manuals)

Equipment and service manuals: flow charts; assembly/disassembly diagrams; schematic diagrams; block diagrams; trouble shooting guides

Freehand drawing skills appropriate to the industry sector: 3rd angle orthogonal projections; isometric; interpretation of drawing symbols; practical exercises

Electrotechnology Systems, Materials and Accessories

Overview of Electrical Power System: generation system – fossil fuel and renewable sources, co-generation and typical power station equipment; transmission system – types and equipment; distribution system – equipment; grid system

Overview of Telecommunication System: customer access network (CAN); customer premises equipment (CPE)

Statutory requirements and standards: scope of work permitted by various licences; legislated requirements; purpose of technical standards; role of standards bodies; use of technical standards

Cables: types – power, signal, communication; terms; colour coding; structure; identification; cable applications

Wiring systems: types; wiring looms; enclosures and supports

Terminating power, signal and communication cables: requirements; plugs/sockets and connectors types and applications; assembly/disassembly plugs/sockets and connectors

Accessories and fixings appropriate to industry sector: types of accessories and applications; fixing devices and methods

Workshop Practices

Identification and application of tools for: marking out a measuring; cutting; shaping; drilling; threading; tapping; finishing; dismantling/assembling

Tool use: hazards; safety procedures; techniques

Fabrication: materials, types, applications; techniques, marking out, cutting, bending, drilling/punching, soldering, cutting mitres

Assembly/disassembly techniques

In the Specialisation of: Renewable Energy

Introduction to Renewable Energy Technologies

General issues: current economic social; environmental and political issues; impact on a renewable energy technology

Energy services/demand: terminology; energy; temperature; power; symbols; units; energy conversion and efficiency; domestic dwelling - energy services, energy source, selection; primary energy and end use energy

Solar radiation resource: terminology; units - symbols, conversions; sun position, sun path diagrams; solar radiation on fixed and tracking collectors

Wind energy resource and technology: terminology, units, symbols; wind patterns (Australia); local terrain, wind speed, direction, turbulence, wind power; maps, data

sheets, measuring instruments; Wind Energy Conversion Systems (WECS) – terminology, characteristics, applications, specifications, sizing

Micro-hydro resource and technology: terminology, units, symbols; flow rates, heads, assessment; turbines, operating characteristics; control requirements; specifications, sizing

Biomass resource and technology: terminology; common biofuels - types, energy contents, production, applications; resource assessment

Solar thermal systems: terminology; components; applications; types of hot water systems; system features, orientation, tilt angles, placement; system selection, size, cost

Energy efficient building design: terminology; climate and thermal comfort; thermal conductivity of building elements; solar heat gain; ventilation; glazing; thermal mass; insulation; shading devices; siting of buildings; active solar systems

RAPS systems configuration: configuration; components - functions, efficiencies; regulators, inverters, battery chargers, generators

Photovoltaic arrays: terminology; modules - types, efficiency, applications; IV curve; irradiance and temperature effects; blocking and bypass diodes; wiring diagrams, configurations; specifications and sizing

Energy storage: terminology; types and methods; battery life, temperature effects, charge and discharge rates; precautions, maintenance, safety; stratification; boosting and equalising charges; specifications, capacity, configuration; operating characteristics; types, sizes