Australian Government

UEENEEE192A Produce detailed electrotechnology /utilities drawings using computer aided design equipment and software

Release: 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

UEENEEE192A Produce detailed electrotechnology /utilities drawings using computer aided design equipment and software

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers the production of, and modification and maintenance of, detailed electrotechnology/utilities drawings and diagrams using computer-aided design (CAD) equipment and software from specifications, layouts, sketches or verbal instructions in conformance with Australian Standards, enterprise standards and/or design brief.

Application of the Unit

Application of the Unit **2)**

This unit is intended for competency development entry-level employment based programs incorporated in approved contracts of training.

Licensing/Regulatory Information

License to practice **3)**

The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

Pre-Requisites

Prerequisite Unit(s) **4)**

Competencies **4.1)**

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEED104A	Use software for engineering applications
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102A	Fabricate, dismantle, assemble of utilities industry components
UEENEEE104A	Solve problems in d.c. circuits
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEE190A	Prepare engineering drawings using manual drafting and CAD for electrotechnology/utilities applications
UEENEEE191A	Prepare electrotechnology/utilities drawings using manual drafting and CAD equipment and software

Literacy and numeracy skills **4.2)**

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading 4 Writing 4 Numeracy 4

Employability Skills Information

Employability Skills **5)**

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA	
1 Prepare to produce detailed electrotechnology /utilities drawings	1.1	OHS procedures for a given work area are identified, obtained and understood
	1.2	Established OHS risk control measures and procedures in preparation for the work are followed
	1.3	The extent of the work is determined from project specifications and discussion with appropriate personnel
	1.4	Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site
	1.5	Software tools and equipment a needed for the work are obtained in accordance with established procedures

ELEMENT	PERFORMANCE CRITERIA	
2 Produce detailed electrotechnology /utilities drawings.	2.1	OHS risk control measures and procedures for carrying out the work are followed
	2.2	The types of design detailed drawings and layouts required are determined from project specifications
	2.3	Technical data of system components is interpreted to determine parameters that are to be included in the detailed drawings
	2.4	Appropriate software tools are used to produce detailed drawings based on standard protocols
	2.5	Detailed drawings are checked for accuracy are compliance with project specifications
	2.6	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
3 Complete detailed electrotechnology /utilities drawings.	3.1	Completed detailed drawings are submitted to an appropriate person to be checked for accuracy and compliance with project specifications.
	3.2	Any alterations, additions or correction instructions are followed and detailed drawings are re-submitted for final approval
	3.3	Copies of completed detailed drawings are filed securely in accordance with established procedures

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and using drawings, diagrams, schedules and manuals.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EE192A Detailed electrotechnology /utilities drawings

Evidence shall show an understanding of detailed electrotechnology /utilities drawings to an extent indicated by the following aspects

T1 Detailed working drawings encompassing:

- definition of detailed working drawings
- usage and types of detailed working drawings
- composition and layout of detailed working drawings
- preparation of detailed working drawings

T2 Advanced (master) sketching techniques encompassing:

- lines and letters
- shapes
- solids
- axonometric views
- building sketch
- isometric views
- object sketch
- perspective; building interior perspective sketch
- detail labelled sketch
- complex surfaces with tangent and curvature continuities
- surfaces manipulation using editing tools
- surfaces analysis for quality and desired characteristics

T3 Drafting/modelling electrotechnology/ utilities encompassing:

- standard documentation practices for block diagrams
- wiring diagrams
- circuit schematics
- control circuits
- creating one-line diagrams
- standard PCB layouts
- printing wiring assemblies
- art masters

REQUIRED SKILLS AND KNOWLEDGE

T4 Electrotechnology/ utilities related drawings encompassing:

- charts and graphs; encompassing alternating current, frequency, electromagnetisms, signals, transmission
- measuring devices and gauges
- power sources, transformers, alternators, motors and related applications
- earthing
- conduits, boxes and fittings, harnesses, cable trays and ducts
- conductor terminations, splices, installations and wiring schedules
- busways
- electric services installations
- protection devices -over current and voltage, circuit breakers, and fuses
- switches, contactors and relays
- control systems and devices
- HV devices and apparatus
- cabinet and panel layouts
- plot and floor plans
- electric lighting
- analogue and digital systems, circuits, electronic components and devices - connections; resistors; capacitors; magnetic devices; piezoelectric devices, crystals and resonators; transducers, sensors and detectors; solid state components and semiconductors; display technologies – filament, LED, LCD, discharge devices, thermionic valves, vacuum tubes; assemblies, modules; prototyping aids; mechanical accessories
- data networks, communication and telecommunications equipment and devices
- pneumatic and hydraulic circuits, including related piping ware and components

T5 AutoCAD – functional for electrotechnology/ utilities encompassing:

- user coordinates systems
- Right-Hand Rule
- 2D geometry extrusion
- 2D views from 3D models and visa-versa
- user coordinate systems creation
- 3D wireframe geometry creation
- 3D faces on wireframe geometry placement
- 3D geometry viewing
- surfaces construction
- working drawings generation
- drawing set up using model space and paper space; encompassing printing and plotting
- plotting
- rendering

REQUIRED SKILLS AND KNOWLEDGE

- 3D models construction
- 3D surface models construction
- 3D models display from different vantage points
- orthographic drawings constructed from 3D models
- rendered images creation
- solid modelling construction using Boolean operations
- scripts writing and tool button macros application
- organisation of writing scripts and tool button macros commands
- advanced drawing, editing, and configuration procedures application
- basic user-level system customisation
- design environment
- basic workflow

T6 AutoCAD – project basics encompassing:

- project manager
- project drawing list
- projects progression/stages
- projects copy and activation

T7 AutoCAD – schematic wiring, editing, components and reporting encompassing:

- wiring and ladders
- wire types, wire numbers
- source and destination signal arrows
- multiple phase and multi wire circuits
- circuits
- connectors and point-2-point wiring
- basic editing utilities
- miscellaneous tools
- data tools
- re-sequence and retag drawings
- using the auditing tools
- schematic symbol annotation
- inserting schematic symbols
- swapping and updating blocks
- inserting schematic components from lists
- generating schematic reports

T8 AutoCAD – panel layouts encompassing:

- creating panel layouts from schematic lists
- din rail utility usage
- panel footprints

REQUIRED SKILLS AND KNOWLEDGE

- terminal strip editor usage
- panel layout annotation and reports

T9 AutoCAD – PLC modules encompassing:

- PLC I/O modules
- PLC modules builder
- PLC database file editor; encompassing insert and edit in parametric PLC modules, nonparametric PLC modules, and stand-alone PLC I/O points
- PLC I/O address-based tagging
- spreadsheet to PLC I/O utility

T10 AutoCAD - detailed settings and configurations – advanced commands encompassing:

- drawing properties
- project properties
- creating wire types
- reference files usage
- creating drawing templates
- installation and search paths

T11 AutoCAD – detailed customised components and customised detailed data encompassing:

- schematic symbols
- icon menu system
- panel footprints
- part catalogue databases usage
- pin list database editor
- title block update and attributes
- terminal properties editor
- reference files usage

T12 AutoCAD – advanced auditing tools, automation tools and integration encompassing:

- auditing tools
- trouble shooting tools
- updating schematics from spreadsheets
- generating automatic reports
- AutoCAD integration
- din rail editor
- footprint with wire annotation
- conduit tools
- cables management

REQUIRED SKILLS AND KNOWLEDGE

T13 AutoCAD – database management and productivity tools encompassing:

- title block attributes automation tools update
- schematics update spreadsheets
- adding wire data to footprints
- managing cables
- using the circuit builder
- working with peer-to-peer

T14 Drawings production using CAD application programs encompassing:

- principals, concepts and applications of drawings production using CAD application programs
- terms, conventions and codes related to drawings production using CAD application programs
- drawing production types using CAD application programs
- CAD advanced commands identification and application for drawings
- CAD advanced commands identification and application for editing drawings
- CAD advanced commands identification and application for hardcopy drawings
- techniques and applications in producing detailed architectural drawings of a floor plan, elevation, and exterior wall section for a residential structure related to electrotechnology/ utilities applications

T15 Utility programs disk and file management encompassing:

- principals, concepts and applications of disk and file management of utility programs
- terms, conventions and codes related to disk and file management of utility programs
- disk operating system commands identification and usage
- utility commands identification and usage
- commands for word processing identification and usage

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit. It must be read in conjunction with the performance criteria and the range statement of the unit and the Training Package Assessment Guidelines.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of the unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment **9.1)**

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit **9.2)**

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
  - Demonstrate an appropriate level of skills enabling employment
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Producing detailed electrotechnology /utilities drawings using computer aided design equipment and software as described in 8) Range and including:

A	Producing, modifying and maintaining detailed electrotechnology/ utilities drawings and diagrams using computer-aided design (CAD) equipment and software
B	Producing master sketches of complex electrotechnology/ utilities drawings using pictorial methods and scaling to

	generate relevant dimensional electrotechnology/ utilities images
C	Identifying, selecting and determining uses for a range of materials and equipment used in electrotechnology/ utilities engineering drafting applications
D	Drawing single and multi-part components and detailed electrotechnology/ utilities assemblies
E	Using advanced CAD equipment commands and drawing techniques and processes to produce detailed electrotechnology/utilities drawings
F	Using filing systems for managing, entering and/or retrieving technical information from computer related database programs
G	Applying safety precautions when working with CAD equipment

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed in this unit.

These should be used in the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to using drawings, diagrams, schedules and manuals.

Method of assessment **9.4)**

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units **9.5)**

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with units covering the production of detailed drawings using computer aided design equipment and software for other disciplines.

Range Statement

RANGE STATEMENT

10) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to producing detailed electrotechnology /utilities drawings using computer aided design equipment and software covering:

- Drawings include detailed circuit and wiring diagrams/schedules, block diagrams, schematics, printed circuit board layouts, assembly and installation drawings, modification drawings, and conversion between drawing types.
- Electrotechnology/ utilities specifications, layouts, sketches or verbal instructions in conformance with Australian Standards, enterprise standards and/or design brief.
- Master sketches methods, techniques, procedures and devices encompassing freehand sketching
- Type, form and size of materials from information, abbreviations and symbols supplied on electrotechnology/ utilities engineering drawings, briefs and/or specifications
- Specifications may be obtained from design information, customer requirements, sketches, preliminary layouts and/or field investigations
- Materials and equipment used in electrotechnology/ utilities engineering applications by selecting the correct type, form and size of materials and equipment from information, abbreviations and symbols supplied on detailed electrotechnology/ utilities engineering drawings, briefs and/or specifications
- Advanced computer-aided design (CAD) equipment commands and drawing techniques and processes
- CAD application programs and advanced tools
- Utility programs disk and file management
- Filing systems management including entering/retrieving technical information from computer related database programs for the production, modification and/or maintenance of detailed electrotechnology/ utilities drawings
- Safety precautions when working with CAD equipment
- Detailed working drawings
- Drafting/modelling electrotechnology/ utilities
- Detailed electrotechnology/ utilities drawings including a representative array of relevant 2D and 3D CAD drawings
- Single and multi-part components and detailed electrotechnology/ utilities assemblies for fabrication, assembly, installation and/or modification of products encompassing dimensions encompassing dimensions; fabrication,

RANGE STATEMENT

assembly, installation and/or modification notes, circuit/wiring layouts/schedules and parts lists from specified dimensions, associated tolerances and design specifications.

- Architectural drawings for electrotechnology/ utilities applications
- Organisational procedures for preparation and production of drawings, drawing sets, specifications, drafting documentation and operating and maintenance instructions/manuals for products and systems
- Organisational procedures for processing, filing and saving all graphics, specifications, instructions and related documentation in correct format and location in accordance with work site procedures
- Organisational procedures for collaborating with the client, key stakeholders and other staff in the selection of the preferred option

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field **11)**

Electrotechnology