



**Australian Government**

# **UEENEEE191A Prepare electrotechnology/utilities drawings using manual drafting and CAD equipment and software**

**Release: 1**

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### **Modification History**

Not applicable.

### **Unit Descriptor**

#### **Unit Descriptor**

#### **1) Scope:**

##### **1.1) Descriptor**

This unit covers the preparation of, and modification of, preliminary electrotechnology/utilities drawings and diagrams using manual drafting methods, techniques, procedures and devices and computer-aided design equipment and software from specifications, layouts, sketches or verbal instructions in conformance with Australian Standards and enterprise standards.

### **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.

UEENEEED1 04A Use software for engineering applications

UEENEE1 01A Apply Occupational Health and Safety regulations, codes and practices in the workplace

UEENEE1 02A Fabricate, dismantle, assemble of utilities industry components

UEENEE1 04A Solve problems in d.c. circuits

UEENEE1 07A Use drawings, diagrams, schedules, standards, codes and specifications

UEENEE1 90A Prepare engineering drawings using manual drafting and CAD for electrotechnology/utilities applications

**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 3      Writing 3      Numeracy 3

## 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 electrotechnology/utilities drawings using manual drafting and CAD equipment and software | 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               |
| 2       | Prepare electrotechnology/utilities drawings using manual drafting and                            | 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                                                                       |

| ELEMENT                                                                                              | PERFORMANCE CRITERIA                                                                                                                 |
|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| CAD equipment and software.                                                                          | 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 electrotechnology/utilities drawings using manual drafting and CAD equipment and software | 3.1 Completed 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 drawings are re-submitted for final approval              |
|                                                                                                      | 3.3 Copies of completed 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 the preparation of electrotechnology/utilities drawings using manual drafting and CAD equipment and software.

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

#### **KS01-EE191A**

#### **Electrotechnology/ utilities drawings and diagrams**

Evidence shall show an understanding of electrotech/utilities drawings and diagrams to an extent indicated by the following aspects

**T1** Electrotechnology/ utilities drafting fundamentals encompassing:

- principles, concepts and purpose of electrotechnology/ utilities drafting
- terms, conventions and codes related to electrotechnology/ utilities drafting
- rules and symbols used in electrotechnology/ utilities drafting
- types and usage techniques of electrotechnology/ utilities drawings
- techniques and applications for creating graphic symbols charts
- techniques and applications in composing block diagram drawings

**T2** Standard drawing sheets and drawing sheet layout encompassing

- standard drawing sheet borders
- standard drawing sheet scale
- standard drawing sheet editing - routine
- standard drawing sheet editing - title block
- standard drawing sheet editing - revision blocks
- drawing sheet layout for small electrotechnology/ utilities projects
- drawing sheet layout for large electrotechnology/ utilities projects
- drawing sheet layout for signing and markings projects
- key plan sheets
- drawing layers
- line types

**T3** Electrotechnology/ utilities drawings line work, symbols, lettering and techniques production to Australian/New Zealand and industry standards encompassing:

- principles of correct drafting technique
- principles, concepts and purpose of electrotechnology/ utilities drawings
- terms, symbols (including sectional symbols), conventions and codes related to electrotechnology/ utilities drawings

## REQUIRED SKILLS AND KNOWLEDGE

- rules for drafting electrotechnology/ utilities drawings
- types and usage techniques of electrotechnology/ utilities drawings
- relationship between components and symbols used in drafting applications
- techniques and applications for production of electrotechnology/ utilities drawings

T4 Sketching techniques for electrotechnology/ utilities applications encompassing:

- lines and letters
- shapes
- solids
- axonometric views
- building sketch
- isometric views
- object sketch
- perspective; building interior perspective sketch
- detail labelled sketch

T5 Pole and structure elevations encompassing:

- elevation sheet layout
- elevation labeling
- concrete bases
- luminaire pole elevations
- signal pole elevations
- service pole elevations
- sign pole elevations
- sign bridge and cantilever elevations
- breakaway sign structures
- wood post sign structures

T6 Survey base plan drawings encompassing:

- survey base plan scale
- survey base plan
- survey base plan contents
- model space and paper space
- external reference (xref) drawings
- viewports

T7 Auxiliary Views and Revolutions encompassing:

- principles, concepts and purpose of auxiliary views and revolutions
- terms, conventions and codes related to auxiliary views and revolutions
- rules of revolutions
- types and usage techniques of auxiliary views, auxiliary reference planes and revolutions

## REQUIRED SKILLS AND KNOWLEDGE

- techniques and applications in finding the true size of an oblique surface
- secondary auxiliary view drawing techniques and applications
- applications of revolutions
- usage of the axis of revolution to draw the true shape of an oblique view

### T8 Map Drafting encompassing:

- types and usage techniques of map drafting and illustrated maps
- techniques and applications of plat surveys and set plans
- techniques and applications of contour maps using profile coordinates
- map reading techniques and applications
- map drawing techniques and applications

### T9 Civil/GIS (Geographic Information Systems) drawings basics encompassing:

- principles, terms and conventions usage in civil GIS drawings
- land surveying techniques (e.g. property line, corners, symbols, coordinates, base line, and typical sections)
- GIS and Global Positioning Systems (GPS) uses and applications
- land survey plot production from a written description
- manual and computer methods calculation of area
- contour plans
- profile drawings

### T10 Architectural and site plan drawings for electrotechnology/ utilities applications encompassing:

- principles, purpose, terms and conventions usage in basic architectural drawings
- typical scales
- base plan symbols and labels
- electrotechnology/ utilities site plan symbols and labels
- signing and markings site plan symbols and labels
- architectural design and planning principles
- elevation drawings
- architectural symbols and abbreviations usage
- floor plans layout and production
- basic construction terminology and materials
- perspectives and pictorials
- typical wall and building sections with necessary details
- applicable building codes
- as-built floor plan measurement, sketching, and drafting
- usage of schedules in freehand architectural style lettering
- styles of architecture
- fundamentals and design function in residential design
- site plans production

## REQUIRED SKILLS AND KNOWLEDGE

- foundation plan production

T11 AutoCAD basics for electrotechnology/ utilities applications encompassing:

- operating system fundamentals encompassing: principals, concepts and applications of CAD hardware; terms, conventions and codes related to CAD hardware; CAD hardware type and variation; system specifications interpretation and usage; I/O devices identification; computer components installation and configuration arrangements and application
- CAD filing and naming conventions
- opening program/closing and saving drawings
- basic drafting commands encompassing: line; circle; spline; rectangle
- basic modification commands encompassing: erasing; copy; mirror; block; trim; extend
- layout and plotting
- design centre encompassing: electrical symbols; electronic symbols
- AutoCAD and lists
- components and symbols in CAD
- mass storage and file compression
- network operating systems, protocols, and cabling systems
- researching hardware and software
- installation and configuration of operating systems
- plotting solutions
- security issues
- system maintenance
- user interface
- object creation and modification
- editing
- layers
- properties
- paper space and model space concepts
- dimensioning and dimensioning variables
- blocks
- attributes
- three dimensional construction
- solid modelling and scripts
- library construction
- database manipulation
- data extraction
- circuit simulation
- wiring symbols - motor and generator, AC and DC; wiring junctions; grounds; distinguishing power and control conductors; normally open and normally closed contacts; series and shunt coils; circuit protection devices - overload relay

## REQUIRED SKILLS AND KNOWLEDGE

w/thermal element, fuse, circuit breakers; push button - disconnect switches, momentary contact, maintained contact; meters; resistors; transformers - power, current, potential, auto-transformers

T12 Drawing numbering, file names and digital file storage encompassing:

- drawing series and version control
- drawing sheet numbering
- drawing file names
- drawing storage
- drawing file

## 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, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Preparation of electrotechnology/utilities drawings using manual drafting and CAD equipment and software as described in 8) Range and including:

A

Carrying out freehand sketching of simple electrotechnology/ utilities products, circuits and components using pictorial methods to generate two and three dimensional electrotechnology/ utilities images encompassing a range of standard components, such as devices, components, parts, equipment and structures,

- sketched together with other solid and hollow items.
- B Preparing and modifying preliminary electrotechnology/utilities drawings and diagrams using manual drafting methods, techniques, procedures and devices
- C Preparing and modifying preliminary electrotechnology/utilities drawings and diagrams using computer-aided design equipment and software
- D Notating type, form and size of materials from information, abbreviations and symbols supplied on electrotechnology/ utilities drawings, briefs and/or specifications.
- E Obtaining specifications from design information, customer requirements, sketches, preliminary layouts and/or field investigations.
- F Drawing single part components, simple electrotechnology/ utilities assemblies and circuits for fabrication, assembly or installation of products encompassing dimensions, fabrication and/or installation notes, wiring schedules and parts lists from predetermined dimensions, associated tolerances and design specifications
- G Using CAD equipment and related commands and drawing environments to produce setting out details; drawing template for a range of paper sizes, the drawing title and scale used, date of drawing and other relevant information; and/or working drawings
- H Stating the purpose and usage of a variety of typical electrotechnology/utilities drawings for electrotechnology/ utilities industry applications
- I Generating a variety of CAD drawings from 2D components to 3D models by applying relevant techniques and processes, extracting properties, applying basic rendering techniques and incorporating pre-prepared symbols to construct electrotechnology /utilities diagrams and assembly drawings to produce section, surface modelling, solid modelling, and wireframe modelling views
- J 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 preparation of electrotechnology/utilities drawings using manual drafting and CAD equipment and software

**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 development of electrotechnology/utilities drawings is required.

## 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 the preparation of electrotechnology/utilities drawings using manual drafting and CAD equipment and software:

- Drawings include layouts, assembly and installation drawings, and modifications (version control), and conversion between drawing types
- Electrotechnology drafting specifications, layouts, sketches or verbal instructions in conformance with Australian Standards and enterprise standards
- Manual drafting methods, techniques, procedures and devices
- Type, form and size of materials from information, abbreviations and symbols supplied on electrotechnology drawings, briefs and/or specifications
- Sketching methods, techniques, procedures and devices encompassing freehand sketching
- Specifications may be obtained from design information, customer requirements, sketches, preliminary layouts and/or field investigations
- Electrotechnology drawings line work, symbols, lettering and techniques
- Sketching techniques
- Technical drawing equipment including computer-aided drawing design (CAD) applications, peripherals and devices including AutoCAD basics for electrotechnology applications and related commands
- Safety precautions when working with CAD equipment
- Pole and structure elevations
- Survey base plan drawings
- Auxiliary Views and Revolutions
- Map Drafting
- Civil/GIS (Geographic Information Systems) drawings basics
- Architectural and site plan drawings
- 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 |