



Australian Government

**UEENEEJ146A Design complex control
systems for refrigeration or heating,
ventilation, air conditioning systems**

Release 3

UEENEEJ146A Design complex control systems for refrigeration or heating, ventilation, air conditioning systems

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers the design of complex control systems for heating, ventilation, air conditioning or refrigeration system. It encompasses applying knowledge of complex control systems for a heating, ventilation, air conditioning or refrigeration system, safety and regulatory requirements, developing alternative design schemes based on a design brief and customer requirements and documenting system designs.

Application of the Unit

Application of the Unit

4)

This unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training or institutional based delivery. It applies to any formal recognition for this standard at the aligned AQF 6 level.

Licensing/Regulatory Information

1.2) License to practice

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) 2)

2.1) Competencies

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

UEENEEJ135A Design control systems for refrigeration or heating, ventilation and air conditioning systems

UEENEEJ130A Produce HVAC/R control system diagrams

UEENEEJ164A Analyse the operation of HVAC air and hydronic systems

UEENEEJ192A Analyse the psychrometric performance of HVAC/R systems

and

UEENEEJ193A Analyse the thermodynamic performance of HVAC/R systems

or

UEENEEJ109A Verify functionality and compliance of refrigeration and air conditioning installations

UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace

UEENEEE102A Fabricate, assemble and dismantle utilities industry components

UEENEEE003B Solve problems in extra-low voltage

Prerequisite Unit(s)

2)

single path circuits

UEENEEE105A Fix and secure electrotechnology equipment

UEENEEE107A Use drawings, diagrams, schedules, standards, codes and specifications

UEENEEE137A Document and apply measures to control OHS risks associated with electrotechnology work

UEENEEJ102A Prepare and connect refrigerant tubing and fittings

UEENEEJ103A Establish the basic operating conditions of vapour compression systems

UEENEEJ104A Establish the basic operating conditions of air conditioning systems

UEENEEJ106A Install refrigerant pipe work, flow controls and accessories

UEENEEJ107A Install air conditioning and refrigeration systems, major components and associated equipment

UEENEEJ108A Recover, pressure test, evacuate, charge and leak test refrigerants

UEENEEJ110A Select refrigerant piping, accessories and associated controls

UEENEEJ111A Diagnose and rectify faults in air conditioning and refrigeration systems and components

UEENEEJ113A Commission air conditioning and refrigeration systems

UEENEEJ153A Find and rectify faults motors and associated controls in refrigeration and air conditioning systems

UEENEEJ170A Diagnose and rectify faults in air conditioning and refrigeration control systems

UEENEEJ194A Solve problems in low voltage refrigeration circuits

UEENEEP012A Disconnect /reconnect composite appliances connected to low voltage installation wiring

UEENEEP017A Locate and rectify faults in low voltage composite appliances using set procedures

UEENEEP024A Attach cords and plugs to electrical equipment for connection to a single phase 230 Volt

Prerequisite Unit(s) 2)
supply
UEENEEP025A Attach cords, cables and plugs to electrical equipment for connection to 1000 Va.c. or 1500 Vd.c. supply

Employability Skills Information

Employability Skills 3)
This unit contains Employability Skills
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 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 design complex refrigeration/HVAC control systems	1.1 OHS processes and procedures for a given work area are identified, obtained and understood
	1.2 Established OHS risk control measures and procedures are followed in preparation for the work.
	1.3 The extent of the proposed refrigeration/HVAC system is determined from the design brief or in consultations with appropriate person(s).

ELEMENT	PERFORMANCE CRITERIA
	1.4 Design development work is planned to meet scheduled timelines in consultation with others involved on the work site.
2 Design complex refrigeration/H VAC control systems	2.1 Knowledge of complex control processes and methods are applied to the design.
	2.2 Alternative concepts for the design are evaluated based on the requirements outlined in the design brief. (See Note)
	2.3 Safety, functional and budget considerations are incorporated in the design.
	2.4 System design draft is checked for compliance with the design brief and regulatory requirements.
	2.5 System design is documented for submission to appropriate person(s) for approval.
	2.6 Solutions to unplanned situation are provided consistent with organisation's policy.
3 Obtain approval for complex refrigeration/H VAC control systems design	3.1 System design is presented and explained to client representative and/or other relevant person(s).
	3.2 Requests for alterations to the design are negotiated with relevant person(s) within the constraints of organisation's policy.
	3.3 Final design is documented and approval obtained from appropriate person(s).
	3.4 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards.

Note.

Design concepts should be evaluated by real or virtual prototyping where it cannot be shown easily by other means that particular aspects of the design met specified requirements.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) 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 designing complex control systems for heating, ventilation, air conditioning or refrigeration systems.

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

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Complex HVAC/R control system design

Evidence shall show an understanding of complex HVAC/R control system design, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1 Advanced HVAC/R control system design

- Control diagrams
 - Australian Standard and nonstandard symbols as used in a variety of typical HVAC/R
 - control diagrams.
 - electric/electronic control diagrams
 - electrical installation documents
 - pneumatic diagrams
 - DDC diagrams
 - controls/electrical power circuit interface
 - nomographs
 - extraction of specific information relating to the operation and control of plant from a variety of typical HVAC/R control diagrams.
 - development of control diagrams to required standards given specific system operating parameters.
- Control design requirements
 - standard and statutory requirements
 - economy of operation (energy management)
 - the desired or most appropriate system operating logic for a specified HVAC/R system.
 - appropriate mode of control for a specified HVAC/R system.
 - control system type selection for specific applications with due regard to plant size, application, operating environment, available control power supply options, economy and computability to existing or proposed plant and control system.
 - components required to assemble and operate the control system of a specified HVAC/R system.

T2 HVAC/R system energy conservation methods

REQUIRED SKILLS AND KNOWLEDGE

- HVAC system control
 - night cycle
 - optimum stop/start
 - purge cycles
 - chiller/boiler/cooling tower sequencing
 - economy cycles (based on temperature or enthalpy).
 - supply air reset
 - condenser water temperature reset
- electrical load control
 - power demand control
 - load limiting
 - load shedding
 - set point relaxation
 - ventilation cycles

T3 Building Management Systems

- Functions of a BMS:
 - autonomous Functions
 - input
 - output
 - general I/O
 - installation management items
 - energy management
 - risk management
 - information processing
 - objectives
 - building running costs
 - smoke control as per AS 1668 part 1
- BMS hardware:
 - system architecture
 - communication devices
 - substations
 - PC's
 - interfaces with other systems
- Input and output functions:
 - digital - inputs/outputs
 - digital output with status feedback
 - analogue input/output
 - sensors

REQUIRED SKILLS AND KNOWLEDGE

- alarms

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package. .

The Evidence Guide forms an integral part of this Unit. It must be used in conjunction with all parts of this 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. 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 influence decisions about how/how much 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

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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 - UEE07'. 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:
 - Design complex control systems for heating, ventilation, air conditioning or refrigeration systems as described in 8) and including:
 - A Developing outlines of alternative designs
 - B Developing the design within the safety, regulatory,

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functional requirements and budget limitations

- C Documenting and presenting design effectively
- D Successfully negotiating design alteration requests
- E Obtaining approval for final design
- F Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

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 by this unit.

These should be part of the formal learning/assessment environment.

Note:

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

Evidence should show demonstrated competency in designing complex control systems for heating, ventilation, air conditioning or refrigeration systems.

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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 assessment in a structured environment which is intended primarily 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 unit:

UEENEEJ135A Design control systems for refrigeration or heating, ventilation, air conditioning or systems

Range Statement

RANGE STATEMENT

8) 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 must be demonstrated in relation to designing at least two different complex control systems.

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

2.2) Literacy and numeracy skills

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 5 Writing 5 Numeracy 5

2.2) Literacy and numeracy skills

Competency Field 5)

Refrigeration and Air Conditioning