



Australian Government

UEENEEJ145A Design hydronic systems and select equipment

Release 3

UEENEEJ145A Design hydronic systems and select equipment

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers the design of hydronic systems. It encompasses applying knowledge of hydronic systems, 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.

UEENEEJ138A Analyse vibration and noise in refrigeration and air conditioning systems

UEENEEJ165A Evaluate thermodynamic and fluid parameters of refrigeration systems

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 hydronic systems and select equipment	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 hydronic system is determined from the design brief or in consultations with appropriate person(s).
	1.4 Design development work is planned to meet

ELEMENT	PERFORMANCE CRITERIA
	scheduled timelines in consultation with others involved on the work site.
2 Design hydronic systems and select equipment	2.1 Knowledge of hydronic systems, 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 hydronic system design and equipment selection	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

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 hydronic systems.

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

KS01-EJ145A

HVAC/R hydronic system design

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

T1 Hydronic system design fundamentals

- Principles of fluid flow
 - properties of fluids
 - flow of ideal fluids
 - fluid flow equipment
 - Bernoulli Theorem
 - fluid flow in pipes
- Pressure loss and static head - calculation
 - flow throughout system
 - pressure throughout system
 - friction losses
 - pressure loss charts for: copper, steel, UPVC
 - dynamic losses
 - fitting pressure losses
 - fitting interaction
 - total losses
 - calculating system (static and dynamic) head
- Pump performance and selection
 - pump classification and types
 - pump performance terminology, discharge, head, power, efficiency, speed, net positive suction head required
 - pump performance curves
 - pump laws
 - system head and 'K' factor
 - balance points
 - energy considerations
 - pump cavitation

REQUIRED SKILLS AND KNOWLEDGE

- calculation of net positive suction head available
- Series and parallel operation
- Pipe sizing
 - maximum friction rate
 - erosion and equipment life
 - industry standards
 - recommended system water velocities
 - economic balance - first cost and operating cost

T2 Hot water systems

- boilers
- coils
- expansion tanks
- pumps, characteristics curves
- control valves, types, flow diagrams,
- air purge points
- water treatment
- pipe anchors and expansion joints

T3 Chilled water systems

- Chillers
- Coils
- expansion tanks
- pumps, characteristics curves
- control valves, types, flow diagrams,
- air purge points
- water treatment
- pipe anchors and expansion joints

T4 HVAC/R hydronic systems

- Systems operation
 - closed/open systems
 - pump head/lift, static head (high rise building)
 - system friction losses
 - nett positive suction head
 - system curves
- Pumps
 - types
 - selection criteria
 - performance characteristics
 - bladder tanks

REQUIRED SKILLS AND KNOWLEDGE

- coil characteristics
- heat exchangers: plate, shell and tube, tube in tube
- flow measurements: types
- flow switchers
- builders: types and performance characteristics
- cooling towers: elementary cooling thermodynamics and types
- Valves - flow control devices
 - types and applications
 - throttling characteristics
 - flow measurements
 - selection and applications
- Hydronic system configuration and design
 - piping configurations
 - single pipe closed circuit
 - two pipe closed circuit
 - direct return
 - three pipe closed circuit with reversed return
 - three way diverting valves
 - risers and headers
 - component location
 - evaluation of piping configurations
 - capital cost
 - owning and operating costs
 - noise vibration
 - maintenance
 - future expansion
 - commissioning and balancing
 - operating characteristics
 - cavitation
- System pipe sizes
 - pipe dynamic and friction losses for different materials
 - fitting pressure losses for different materials
 - thermal heat losses
 - bare, insulated and underground pipes

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 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

9.2)

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

EVIDENCE GUIDE

competency in this unit

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 hydronic systems as described in 8) and including:
 - A Developing outlines of alternative designs
 - B Developing the design within the safety, regulatory, 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

EVIDENCE GUIDE

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 hydronic systems.

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)

There are no concurrent assessment recommendations for this unit.

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 hydronic 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
---------	---	---------	---	----------	---

Custom Content Section

Competency Field 5)

Refrigeration and Air Conditioning