Australian Government

Department of Education, Employment and Workplace Relations

UEENEEJ183A Design secondary refrigerant systems

Release: 2

UEENEEJ183A Design secondary refrigerant systems

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor **1**)

1.1) **Descriptor**

This unit covers the design of secondary refrigeration systems. It encompasses design skills including overall systems design, selection of components and definition of control logic.

Application of the Unit

Application of the Unit **4**)

This competency standard is suitable for employment-based programs under an approved contract of training at the AQF level of the qualification in which the unit is first packaged or higher.
The unit may be selected as an elective from the relevant schedule (see qualification packaging rules) provided that all prerequisite units are undertaken or addressed through recognition processes.
This unit may be included in a skill set provided that it is listed in the schedule of electives (see Qualification Framework) and all prerequisite units are undertaken or addressed through recognition processes.
Delivery and assessment of this unit should be undertaken within regard to the requirements of License to Practice (1.2 above), Prerequisite Competencies and Literacy and Numeracy skills (2 above) and the recommendations for concurrent assessment and relationship with other units (9.5 below).
Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.
Note:
1. Compliance with permits may be required in various

Application of the Unit **4)**

jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.
2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting, risk safety measures etc.

Licensing/Regulatory Information

1.2) License to practice

The skills and knowledge described in this unit do not require a licence to practise in the work place. However practice in this unit is subject to regulations directly related to occupational health and safety, codes of work practice and standard work procedures related to the characteristics and behaviour of material in an engineering environment.

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.
UEENEEJ132A Design commercial refrigeration systems and select components
UEENEEJ129A Establish heat loads for commercial refrigeration and/or air conditioning applications
UEENEEJ165A: Evaluate thermodynamic and fluid parameters of refrigeration systems
UEENEEJ127A Establish the thermodynamic parameters of refrigeration and air conditioning systems
UEENEEJ164A Analyse the operation of HVAC air and hydronic systems
UEENEEJ192A Analyse the psychrometric performance

Prerequisite Unit(s) **2)**

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 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

Prerequisite Unit(s) **2)**

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 supply
UEENEEP025A Attach cords, cables and plugs to electrical equipment for connection to 1000 Va.c. or 1500 Vd.c. supply

For the full prerequisite chain details for this unit please refer to Table 2 in Volume 1, Part 2

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 must be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to design secondary refrigeration systems	1.1 OHS processes and procedures for a given work area are identified, obtained and understood.
	1.2 The extent and nature of the refrigeration system is determined from design specifications.

ELEMENT		PERFORMANCE CRITERIA	
		1.3	Safety and other regulatory requirements to which the system shall comply are identified, obtained and understood.
		1.4	Work supervisor or customers are consulted to determine which functions of the system are to be used and the parameter of each and written confirmation sought.
		1.5	Design development work is planned to meet scheduled timelines in consultation with others involved on the work site.
2	Design secondary refrigeration systems	2.1	Established OHS risk control measures and procedures for carrying out the work are followed.
		2.2	Knowledge of secondary refrigeration system analysis, secondary refrigeration system components and piping, performance standards and compliance methods are applied to developing the system design.
		2.3	Safety, functional and budgetary considerations are incorporated in the installation designed.
		2.4	Equipment required for the system is selected in accordance with the design specifications and established requirements.
		2.5	Location of components of the system is documented to ensure correct operation of system functions.
		2.6	System design draft is checked for compliance with the design brief and regulatory requirements.
		2.7	System design is documented for submission to appropriate person(s) for approval.
		2.8	Solutions to unplanned situation are provided consistent with organisation's policy.

ELEMENT	PERFORMANCE CRITERIA
3 Obtain approval for engineering computer applications 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 organisational or professional standards.

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 multi-stage cascade and/or liquid recirculation secondary refrigeration systems. All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EJ183A Secondary refrigeration system design

Evidence shall show an understanding of secondary refrigeration system, components and piping design, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1 Technical standards, regulations and codes for secondary refrigeration systems

- Environmental and safety considerations in the use and disposal of secondary refrigerants
  - Toxicity and food compatibility
  - Flammability
  - Environmental effects
  - Safe disposal
  - MSDS samples
  - Registration requirements for transport and on-site use

T2 Secondary refrigeration systems design requirements

- Applications of secondary refrigeration systems in refrigeration
  - Introduction into Secondary Refrigeration
  - Applications in Industrial Refrigeration: Cold storage, food processing, climatic test chamber
  - Application in Commercial Refrigeration: Supermarkets, Small commercial systems
  - Advantages and disadvantages of secondary refrigerants over the direct use of primary refrigerants
- Properties, application and limitations of available secondary refrigerants
  - General classification of secondary refrigerant types – single phase, volatile, phase change
  - General types of single phase secondary refrigerants available: Glycols, Alcohols, Brines, Hydrocarbons, Silicone oils, Water

REQUIRED SKILLS AND KNOWLEDGE

- Common types of volatile and phase change secondary refrigerants available: CO2, Ice slurries
- Thermal and transport properties of most widely used single phase secondary refrigerants (MEG, PG, Ethyl Alcohol, CaCl2, Potassium brines)
- Pump selection for viscous fluids

- Application concepts and principles
  - Main and loop circuits, use of variable speed pumps and overflow valves
  - Buffer and storage tanks, benefits and disadvantages
  - Loop temperature control and loop pump selection
  - Control valve options: Regulating and on/off, 2-way and 3-way, mixing and diverting
  - Expansion and contraction of components, compensation for pipe expansion, effect of pipe pre-insulation
  - Expansion and contraction of secondary refrigerant, use of membrane expansion tanks versus open expansion tank
  - Air purging

T3 Secondary refrigeration system components and piping

- Corrosion and Material selection
  - Materials compatibility table
  - Thermal and other properties of materials in use
  - Pipe material and jointing methods/materials
  - Pumps, impellers and seals
  - Isolation and control valves
  - Heat exchangers
- Pipe and insulation materials
  - Metal pipe
  - Plastic pipe
  - Post-installation insulation (in situ foaming, formed insulation, closed cell flexible insulation)
  - Pre-insulated pipe material
  - Vapour barrier – importance and maintenance
- Heat exchangers
  - Plate heat exchangers, brazed, welded, semi-welded, gasketed. Design considerations in conjunction with primary refrigerant, flooded, direct expansion, pump circulated primary refrigerant
  - Shell & tube and Plate & shell heat exchangers
  - Fan coil units
- System control
  - Primary pump speed and staging control

REQUIRED SKILLS AND KNOWLEDGE

- Maintenance of minimum flow and control valve pressure head
- Overflow valves
- Secondary loop temperature control
- Room humidity and temperature control with fan-coil units

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 issues inherent in working with electricity, electrical equipment, gas or any other hazardous substance/material present a challenge for those determining competence. 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

EVIDENCE GUIDE

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 must be considered holistically. Each element and associated performance criteria must be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence must 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 must 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:
  - Design secondary refrigeration systems as described in 8) and including:

    A Understanding required operating functions and parameters from the design specification

EVIDENCE GUIDE

B Developing the design within the safety, regulatory and 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 a holistic assessment with the above listed items

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.

The resources used for assessment should reflect current industry practices in relation to designing secondary refrigeration systems.

EVIDENCE GUIDE

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. The critical aspects of occupational health and safety covered in unit UEENEEE001B and other discipline specific occupational health and safety units shall be incorporated in relation to 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 (2 multi-stage cascade or 2 liquid recirculation or 1 multi-stage and 1 liquid recirculation) secondary refrigeration systems encompassing major components (i.e. heat exchanger, condenser, compressor, accumulator, and pump), associated components and controls.

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