



Australian Government

UEENEEJ187A Design carbon dioxide refrigerated systems

Release 4

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Modification History

Release	Action	Core/Elective	Details	Points
4	Update		Update pre-requisite UEENEE103A - Solve problems in ELV single path circuits	

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers the design of refrigeration systems using carbon dioxide as a refrigerant. It encompasses applying knowledge of complex refrigeration systems, safety and regulatory requirements, developing alternative design schemes based on a design brief and customer requirements and documenting system design.

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.

Application of the Unit 4)

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 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

Prerequisite Unit(s) **2)**

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

UEENEEJ184A Apply safety awareness and legal requirements for carbon dioxide refrigerant

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 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

UEENEEE103A Solve problems in ELV 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

Prerequisite Unit(s)**2)**

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 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 must be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to design carbon dioxide 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.
	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

ELEMENT	PERFORMANCE CRITERIA
	involved on the work site.
2 Design carbon dioxide refrigeration systems	<p>2.1 Established OHS risk control measures and procedures for carrying out the work are followed.</p> <p>2.2 Knowledge of carbon dioxide refrigeration system analysis, carbon dioxide refrigeration system components and piping, performance standards and compliance methods are applied to developing the system design.</p> <p>2.3 Safety, functional and budgetary considerations are incorporated in the installation designed.</p> <p>2.4 Equipment required for the system is selected in accordance with the design specifications and established requirements.</p> <p>2.5 Location of components of the system is documented to ensure correct operation of system functions.</p> <p>2.6 System design draft is checked for compliance with the design brief and regulatory requirements.</p> <p>2.7 System design is documented for submission to appropriate person(s) for approval.</p> <p>2.8 Solutions to unplanned situation are provided consistent with organisation's policy.</p>
3 Obtain approval for engineering computer applications design	<p>3.1 System design is presented and explained to client representative and/or other relevant person(s).</p> <p>3.2 Requests for alterations to the design are negotiated with relevant person(s) within the constraints of organisation's policy.</p> <p>3.3 Final design is documented and approval obtained from appropriate person(s).</p> <p>3.4 Quality of work is monitored against personal performance agreement and/or established organisational or professional standards.</p>

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 subcritical and/or trans-critical carbon dioxide refrigerating systems.

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

KS01-EJ187 Carbon dioxide refrigeration system design requirements

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Evidence shall show an understanding of Carbon Dioxide refrigeration systems, components and piping design requirements, 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 carbon dioxide refrigeration systems

- Standard philosophy and format
- Standards, regulations and codes that apply to CO₂ refrigeration systems
- Equipment manufactures specifications

T2 Carbon Dioxide refrigeration system design requirements

- Possible areas of applications of CO₂ refrigeration systems
 - Mobile air conditioner
 - Heat pump water heater
 - Commercial refrigeration
- Thermodynamic properties of CO₂
 - CO₂ phase diagram
 - CO₂ properties tables and chart
- Conventional refrigeration cycle versus CO₂ refrigeration cycle
 - T-s and p-h diagram representations
 - Isentropic efficiency
 - Volumetric efficiency
- Types of CO₂ refrigeration system configurations
 - Sub-critical operation
 - Trans-critical operation

REQUIRED SKILLS AND KNOWLEDGE

- Cascade systems
- Performance analysis of CO2 refrigeration systems
 - Sub-critical cycle
 - Trans-critical cycle
 - Cascade systems

T3 Carbon Dioxide refrigeration system components and piping

- Design preliminaries
 - System operating parameters
 - Project specifications
 - Equipment selection criteria
 - Selection tables, charts and catalogues
- Heat exchanger selection
 - Selection of evaporators
 - Selection of condensers
 - Selection of coolers
- Compressor selection
- Liquid expansion devices selection
- System load balance point
- Refrigeration line design and sizing
- Automatic controls
- Safety devices

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

EVIDENCE GUIDE

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 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:

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- 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 carbon dioxide refrigeration systems as described in 8) and including:
 - A Understanding required operating functions and parameters from the design specification
 - 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

EVIDENCE GUIDE

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 carbon dioxide refrigeration 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.

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 subcritical or 2 trans-critical or 1 subcritical and 1 trans-critical) carbon dioxide refrigeration systems encompassing major components (i.e. cooler, condenser, compressor and evaporator), 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
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2.2) Literacy and numeracy skills

Competency Field 5)

Refrigeration and Air Conditioning

