



**Australian Government**

# **UEENEEJ186A Install and commission carbon dioxide refrigeration systems, components and associated equipment**

**Release 4**

## **UEENEEJ186A Install and commission carbon dioxide refrigeration systems, components and associated equipment**

### **Modification History**

Release	Action	Core/Elective	Details	Points
4	Update		Update pre-requisite UEENEEE103A - Solve problems in ELV single path circuits	

### **Unit Descriptor**

#### **Unit Descriptor**

1)

#### **1.1) Descriptor**

This unit covers specialised procedures for the installation and commissioning to achieve effective and efficient operation of refrigeration equipment using carbon dioxide (CO<sub>2</sub>) as a refrigerant excluding self contained systems. It reinforces safe working practice and encompasses applying specialised knowledge of refrigeration principles that apply to carbon dioxide, following design specifications, testing, locating and rectifying faults and defective components and completing the necessary installation and commissioning documentation.

### **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

## **Application of the Unit 4)**

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 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 may, in some jurisdictions, require a licence to practise in the workplace subject to regulations for undertaking refrigeration and air conditioning work. Practice in 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, 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 and risk safety measures.

## 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.

UEENEEJ184A	Apply safety awareness and legal requirements for carbon dioxide refrigerant
UEENEEJ185A	Repair and service carbon dioxide refrigeration systems
UEENEEJ111A	Diagnose and rectify faults in air conditioning and refrigeration systems and components
UEENEEJ113A	Commission air conditioning and refrigeration systems

<b>Prerequisite Unit(s)</b>	<b>2)</b>
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 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
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

**Prerequisite Unit(s)**      2)

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

## **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 install major components and associated equipment.	1.1 OHS procedures for a given work area are identified, obtained and understood through established routines and procedures
	1.2 Established OHS risk control measures and procedures are followed in preparation for the work.
	1.3 Safety hazards which have not previously been identified are reported and advice on risk control measures is sought from the work supervisor.
	1.4 The nature of work is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.
	1.5 Component and equipment installation is appropriately sequenced in accordance with job schedule.
	1.6 Sources of materials that may be required for the work are accessed in accordance with established routines and procedures.
	1.7 Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety
2 Install major components and associated equipment.	2.1 Established OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Circuits / machines/plant are checked as being isolated where necessary in strict accordance with OHS requirements and procedures
	2.3 Components and equipment are installed to comply with technical standards, job specifications and requirements with sufficient access to affect electrical and pipe work connections and maintenance.
	2.4 Components and equipment are installed straight and square in the required locations and within acceptable tolerances

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
	2.5 Pressure testing is conducted at a pressure compatible with carbon dioxide and in accordance with standards
	2.6 Leaks are located and rectified using testing methods appropriate to the system and in accordance with industry practices
	2.7 System is evacuated to the required level and cleaned of all moisture and other contaminants in accordance with industry practices
	2.8 System is charged safely with refrigerant grade carbon dioxide and compatible lubricants in accordance with industry practices
	2.9 Established procedures are used to determine actual and specified range of operating conditions from measured and calculated values as they apply to carbon dioxide vapour compression and volatile secondary (liquid recirculation/cascade) systems.
	2.10 Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.
	2.11 Unexpected situations are dealt with safely and with the approval of an authorised person.
	2.12 Operating conditions are determined without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.
3 Complete Installation and commissioning work and document performance data	3.1 OHS work completion risk control measures and procedures are followed.
	3.2 Final check of the installed components and equipment is made to verify that it complies to all requirements.
	3.3 "As - installed' components and equipment is documented and an appropriate person or persons notified in accordance with established procedures.



## **ELEMENT**

## **PERFORMANCE CRITERIA**

- 3.4 Commissioning work is appropriately sequenced in accordance with job specification
- 3.5 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.
- 3.6 The extent of the system and location of system components is determined from site inspection and/ or job specifications and diagrams
- 3.7 System control settings and operating parameters are determined from job specifications and requirements
- 3.8 Tools equipment and testing devices needed to commission a carbon dioxide refrigerant system are obtained and checked for correct operation and safety
- 3.9 Pre commissioning checks are undertaken to ensure all components are in place and secure
- 3.10 The need to test or measure a live operating CO<sub>2</sub> system is determined in strict accordance with OH&S requirements and when necessary conducted within established safety procedures.
- 3.11 Carbon Dioxide refrigeration system pressure controls, valves, pumps and regulators are adjusted to their required settings.
- 3.12 Testing /measuring devices are used to observe the operation of refrigeration system and fine adjustments of controls are made as necessary.
- 3.13 Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.
- 3.14 Unexpected situations are dealt with safely and with the approval of an authorised person.
- 3.15 Commissioning is conducted efficiently without waste of materials or damage to apparatus and the surrounding environment or services and using sustainable energy practices

**ELEMENT**

**PERFORMANCE CRITERIA**

- 3.16 Work site is cleaned and made safe in accordance with established procedures
- 3.17 Results of commissioning are documented, including final operating parameters of the system.

## 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 determining the operating conditions of both vapour compression and liquid recirculating carbon dioxide refrigerating systems.

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

#### **KS01-EJ186 Installation and commissioning procedures for Carbon Dioxide refrigeration systems**

Evidence shall show an understanding of installation and commissioning procedures for sub-critical carbon dioxide refrigeration systems, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

##### T1 Materials and Installation procedures

- Material selection
- Copper pipe standards
- Pipe connections
- Pipe supports hangers and connections
- Arrangement of isolation valves
- Location of relief valves

##### T2 Commissioning

- Pressure testing
- Evacuation and dehydration
- Charging refrigerant and lubricant
- System testing and adjustment
- Documentation

## Evidence Guide

### 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 shall 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:
  - Install CO<sub>2</sub> refrigeration system components pipe work and associated equipment including :
    - A Reading and interpreting drawings to pipe work layouts and apparatus locations.
    - B Installing, connecting , securing and aligning components and equipment and ensuring that all equipment and pipe work is compliant with codes and regulations
    - C Pressure testing entire system at the appropriate design test pressures using dry nitrogen
    - D Removing system contaminants and evacuating

## EVIDENCE GUIDE

- E Selecting and using appropriate measuring devices correctly
- F Recording measurements
- G Using calculation methods accurately
- H Discharging / charging refrigerant / lubricants and pressure testing the system without damage to components
- I Locating and rectifying leaks
- J Using methodical and efficient commissioning techniques
- K Optimizing system performance and efficiency
- L Identifying the conditions of the refrigerant (R744) at various locations in the vapour compression and volatile secondary (liquid recirculation) system
- M Documenting operating conditions correctly (commissioning)
- N 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

## 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.

Evidence should show demonstrated competency in installation techniques as well as Commissioning skills and a clear understanding of operating conditions of Carbon Dioxide vapour compression and volatile secondary (liquid recirculation/cascade) system/s.

### 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 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)

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 determining operating conditions using measurement and basic calculation methods of carbon dioxide vapour compression and volatile secondary (liquid recirculation) system.

Furthermore, this unit must be demonstrated in relation to installing, connecting and commissioning the following Carbon Dioxide refrigeration system and components and associated equipment.

Major components shall include compressors, cascade condensers, evaporators, liquid recirculation pump/s. Associated equipment shall include refrigerant piping, refrigerant flow controls, cycling controls, safety controls, relief valves, isolation valves, monitoring and inspection accessories. Note: Steel pipe welding competency is not covered by this unit.

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            4                    Writing            4                    Numeracy            4

## Custom Content Section

Competency Field            5)

Refrigeration and Air Conditioning