



**Australian Government**

# **UEERA0068 Repair and service self-contained carbon dioxide refrigeration and heat pump systems**

**Release: 1**

# **UEERA0068 Repair and service self-contained carbon dioxide refrigeration and heat pump systems**

## **Modification History**

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

## **Application**

This unit involves the skills and knowledge required to repair and service self-contained carbon dioxide (CO<sup>2</sup>) refrigeration and heat pump system.

It includes specialised procedures for servicing and repairing of self-contained refrigeration and heat pump equipment using CO<sup>2</sup> as a refrigerant. It also includes applying safe working practices and refrigeration principles that apply to CO<sup>2</sup>; following service manuals; testing, locating and rectifying faults and defective components; and completing the necessary service documentation.

The skills and knowledge in this unit will be applied by refrigeration and air conditioning technicians during the service and repair of self-contained refrigeration systems using CO<sup>2</sup> refrigerant.

The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c).

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, skills and knowledge described in this unit require a relevant contract of training, such as an Australian Apprenticeship.

Additional and/or other conditions may apply in some jurisdictions subject to regulations related to refrigeration, air conditioning or electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

Permits may also be required for some work environments, such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.

## **Pre-requisite Unit**

UEERA0053 Install, commission, service and maintain medium temperature systems

UEERA0006 Apply safety awareness and legal requirements for carbon dioxide refrigerant

Or

UEERA0089 Service refrigeration appliances

UEERA0006 Apply safety awareness and legal requirements for carbon dioxide refrigerant

## Competency Field

Refrigeration and air-conditioning

## Unit Sector

Electrotechnology

## Elements and Performance Criteria

### ELEMENTS

Elements describe the essential outcomes.

#### **1 Prepare to service self-contained CO<sup>2</sup> refrigeration and heat pump system**

#### **2 Service and repair self-contained CO<sup>2</sup> refrigeration and heat pump system**

### PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

- 1.1** WHS/OHS hazards, risk control methods, relevant standards, codes and legislation are obtained and applied
- 1.2** Safety hazards not previously identified are reported, risk assessed and advice on risk control measures sought from work supervisor
- 1.3** Nature of work is obtained from documentation or from work supervisor to determine the scope of work to be undertaken
- 1.4** Advice is sought from work supervisor to ensure the work is coordinated effectively with others
- 1.5** Sources of materials required for the refrigeration work are accessed in accordance with workplace and procedures
- 1.6** Tools, equipment and testing devices needed to carry out refrigeration work are obtained and checked for correct operation and safety
- 2.1** Measuring system operating parameters are conducted in accordance with WHS/OHS requirements and workplace safety procedures
- 2.2** Refrigeration inspection and checks are carried out to ensure the system or component parts are isolated in accordance with WHS/OHS requirements and

- workplace procedures
- 2.3** Refrigerant is removed from system safely in accordance with regulatory requirements, industry standards and practices
- 2.4** Precautions are taken to prevent damage to components while pressure testing the refrigeration and heat pump system
- 2.5** Pressure testing is conducted at a pressure compatible with CO<sup>2</sup> and in accordance with industry standards and practices
- 2.6** Refrigerant leaks are located and rectified using testing methods appropriate to the system and in accordance with industry standards and practices
- 2.7** Refrigeration and heat pump system is evacuated to the required level and cleaned of all moisture and other contaminants in accordance with industry standards and practices
- 2.8** Refrigeration and heat pump system is charged safely with refrigerant grade CO<sup>2</sup> and compatible lubricants in accordance with industry standards and practices
- 2.9** Actual and specified range of operating conditions are determined from measured and calculated values as they apply to CO<sup>2</sup> vapour compression systems in accordance with workplace procedures and industry standards
- 2.10** Unplanned situations are dealt with safely and in accordance with workplace procedures and approval of authorised person/s in a manner that minimises risk to personnel and equipment
- 2.11** Operating conditions are determined without damage to apparatus, circuits, the surrounding environment or services using sustainable energy practices
- 3 Complete and report servicing and repair of self-contained CO<sup>2</sup> refrigeration and heat pump system work activities**
  - 3.1** Worksite is cleaned and made safe in accordance with workplace procedures
  - 3.2** Contaminated refrigerant and lubricant are dealt with in accordance with legislative/regulatory and industry

standard requirements

- 3.3 Operation conditions are documented and include identification of any parameter that is not within the specified range for the system
- 3.4 Work supervisor is notified of the completion of work in accordance with workplace procedures

## Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

## Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Servicing and repairing self-contained CO<sup>2</sup> vapour compression systems must include at least the following:

- domestic refrigerators and freezers
- refrigerated cabinets
- heat pumps
- water heaters
- checking:
  - suction and discharge pressures
  - ambient, evaporator and condensed/gas cooler temperatures
  - evaporator and gas cooler temperature difference
  - critical point, triple point and trans-critical and sub-critical refrigerant conditions of CO<sup>2</sup>
- charging and discharging trans-critical CO<sup>2</sup> system with refrigerant and lubricant in a safe and environmentally responsible manner

## Unit Mapping Information

This unit replaces and is equivalent to UEENEEJ188A Repair and service self contained carbon dioxide refrigeration and heat pump systems.

## Links

Companion Volume implementation guides are found in VETNet - -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

# **Assessment Requirements for UEERA0068 Repair and service self-contained carbon dioxide refrigeration and heat pump systems**

## **Modification History**

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

## **Performance Evidence**

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:

- applying relevant legislation, industry standards and practices
- applying relevant work health and safety (WHS)/occupational health and safety (WHS/OHS) requirements and workplace procedures and practices, including using risk control measures
- applying sustainable energy principles and practices
- dealing with unplanned events/situations in accordance with workplace procedures in a manner that minimises risk to personnel and equipment
- discharging/charging refrigerant/lubricants and pressure testing the system without damage to components
- documenting operating conditions correctly
- identifying the conditions of the carbon dioxide (CO<sup>2</sup>) refrigerant at various locations in the vapour compression system in a trans-critical and sub-critical state
- locating and rectifying leaks
- pressure testing, evacuating, charging/discharging refrigerant/lubricants and determining the operating conditions of CO<sup>2</sup> vapour compression systems
- recording measurements
- selecting and using appropriate measuring devices correctly
- using calculation methods accurately.

## **Knowledge Evidence**

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- CO<sup>2</sup> refrigeration compressors and lubricants, including:
  - types, construction and their applications
  - types of compatible compressor oil (Polyolester (POE) and Polyaphalefin (PAO))
  - safe handling of lubricants for CO<sup>2</sup> applications using safety data sheets (SDS)/material

safety data sheets (MSDS)

- cylinder regulators
- moisture problems with CO<sup>2</sup> systems
- refrigerant CO<sup>2</sup> cylinders and regulators
- refrigerant conditions
- refrigeration principles
- relevant industry standards, codes and practices
- relevant job safety assessments or risk mitigation processes, including hazards associated with CO<sup>2</sup>
- relevant manufacturer specifications
- relevant WHS/OHS legislated requirements
- relevant workplace documentation, including service manuals and service documentation
- relevant workplace policies and procedures
- self-contained systems employing CO<sup>2</sup> refrigerant at trans-critical condition, including:
  - basic operation
  - domestic refrigerators and freezers
  - heat pumps
  - water heaters
  - refrigerated cabinets
  - systems and major components
  - typical applications
- service gauges
- service procedures
- CO<sup>2</sup> refrigerant, including:
  - benefits of using CO<sup>2</sup> as a refrigerant
  - thermophysical properties
- servicing tools, equipment and safe working procedures, including:
  - cylinder regulators
  - moisture problems with CO<sup>2</sup> systems
  - refrigerant CO<sup>2</sup> cylinders and regulators
  - refrigerant conditions
  - service gauges
  - service procedures
  - system standing pressure as a result of power loss
- system components, construction and operation, including:
  - capillary tubes and accurators
  - CO<sup>2</sup> evaporator design features
  - CO<sup>2</sup> sub-cooler design features
  - electronic expansion valves
  - liquid-suction heat exchangers

- pressure relief devices
- refrigerant flow controls
- system standing pressure as a result of power loss.
- trans-critical CO<sup>2</sup> refrigeration and heat pump systems.

## Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in suitable simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, facilities, equipment and personal protective equipment (PPE) currently used in industry
- resources that reflect current industry practices in relation to servicing, repairing and determining the operating conditions of CO<sup>2</sup> vapour compression and liquid recirculation/cascade systems
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

## Links

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