



Australian Government

UEENEEJ149A Develop heat exchanger design specifications

Release: 3

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Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers the analysis of refrigeration parameters and develop specification for heat exchanger design. It encompasses working safely, apply extensive knowledge of refrigeration parameters, gathering and analysing data, developing and documenting results and solutions for use in design work.

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, codes of work practice and standard work procedures related to the operation of automated machinery.

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.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to develop specifications for exchanger designs	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 analysis to develop specifications is determined from design brief and situation reports and in consultations with relevant persons 1.4 Activities are planned to meet scheduled timelines in

ELEMENT	PERFORMANCE CRITERIA
2 Develop specifications for exchanger designs.	consultation with others involved in the work.
	1.5 Effective strategies are formed to ensure analysis is carried out efficiently.
	2.1 OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Knowledge of refrigeration parameters are applied to developing heat exchanger specifications.
	2.3 Parameters and performance requirements in relation to refrigeration systems are obtained in accordance with established procedures.
	2.4 Approaches to analysing refrigeration parameters are carried out to provide the most effective solution.
3 Document specifications for exchanger design	2.5 Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.
	2.6 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards
	3.1 Analysis is documented including details of all findings, calculations and assumptions.
	3.2 Specification for heat exchanger are developed from analysis findings and in accordance with established procedures
	3.3 Developed specification and analysis is reported to appropriately person(s) for endorsement.
	3.4 Justification for findings and any actions to be undertaken in relation to the design is documented for inclusion in work/project or development records in accordance with 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 developing specifications for heat exchanger designs.

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

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Heat exchanger design

Evidence shall show an understanding of heat exchanger design, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1 Advanced thermodynamics

- Heat transfer
 - Modes of heat transfer
 - Conduction through a flat plate, series flat plates, thick and thin wall pipe, composite pipes (e.g. lagged pipes and drums)
 - Convection at a flat surface or tube
 - Radiation from a flat surface or tube for black or grey bodies
 - Combined conduction and convection through single or multiple flat plates or thin wall tubes
 - Combined convection and radiation
 - Combined conduction, convection and radiation such as fluid in a tank (convection to wall), through wall and/or insulation (conduction) to outside air (convection and radiation)
 - Heat exchangers - parallel, counter flow and cross flow
- Refrigeration/heat pump
 - Basic principles and terminology
 - Vapour compression cycle
 - Performance criteria
 - Types of refrigerant - designation, properties advantages and disadvantages
 - Refrigerant properties using the p-h diagram
 - Ideal vapour compression cycle on the p-h diagram
 - Energy balance and heat transfers in compressor, evaporator and condenser
 - Actual vapour compression cycle and variations from the ideal
 - pressure loss in lines and non-ideal compression
 - Superheating and subcooling with or without suction/liquid heat exchanger
 - Carnot principle applied to refrigerator and heat pump
 - Principles of evaporative refrigeration, absorption refrigeration, air cycle refrigeration and thermo-electric refrigeration

REQUIRED SKILLS AND KNOWLEDGE

T2 Heater exchanger design

- Concepts
- Design parameters and limitations
- Construction material and components
- Testing requirements

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

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'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 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:
 - Develop specifications for heat exchanger designs as described in 8) and including:
 - A Interpreting compliance documents
 - B Setting up and conducting appropriate examinations and tests

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- C Identifying non-compliance defects
- D Reporting examination and test results and non-compliance issues clearly and accurately

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 developing specifications for heat exchanger designs.

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 developing specifications for at least two different heat exchangers.

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