



Australian Government

Department of Education, Employment and Workplace Relations

UEENEEJ153A Find and rectify faults in motors and associated controls in refrigeration and air conditioning systems

Release: 2

UEENEEJ153A Find and rectify faults in motors and associated controls in refrigeration and air conditioning systems

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers finding and repairing faults in motors and associated controls in refrigeration and air conditioning systems. It encompasses working safely, applying knowledge of motor systems and their controls, reading circuit diagrams, sketching diagrams from traced circuits, applying logical fault finding procedures, conducting repairs and completing the necessary service documentation.

Application of the Unit

Application of the Unit 4)

This unit is intended for competency development entry-level employment-based programs incorporated in approved contracts of training. It may also be used to augment formally acquired competencies.

Licensing/Regulatory Information

1.2) License to practice

The skills and knowledge described in this unit require a license to practice in the workplace where appliances are connected to fixed wiring at voltage above 50 V a.c. or 120 V d.c. In some States/Territories a licence is required to practise this unit in the workplace subject to regulations for servicing refrigeration or air conditioning appliance in particular when working with refrigerants. 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 devices, 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.

UEENEEE107A Use drawings, diagrams, schedules, standards, codes and specifications

UEENEEJ108A Recover, pressure test, evacuate, charge and leak test refrigerants

UEENEEJ194A Solve problems in low voltage refrigeration circuits

UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace

UEENEEE003B Solve problems in extra-low voltage single path circuits

UEENEEJ103A Establish the basic operating conditions of vapour compression systems

For the full prerequisite chain details for this unit please

Prerequisite Unit(s) 2)
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 is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to find and rectify faults	1.1 OHS procedures for a given work area are identified, obtained and understood
	1.2 OHS risk control measures and procedures in preparation for the work are followed.
	1.3 The likely extent of work to be undertaken is envisaged from fault/breakdown reports and/or discussions with appropriate person(s).
	1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.
	1.5 Sources of materials that may be required for the work are accessed in accordance with established procedures.
	1.6 Tools, equipment and testing devices needed to locate

ELEMENT	PERFORMANCE CRITERIA
	faults are obtained in accordance with established procedures and checked for correct operation and safety.
2 Find and repair faults	2.1 OHS risk control measures and procedures for carrying out the work are followed.
	2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures
	2.3 Equipment is checked as being correctly isolated where necessary in strict accordance OHS requirements and procedures
	2.4 Safety hazards resulting from the fault or breakdown are documented and risk control measures devised and implemented in consultation with appropriate personnel.
	2.5 Fault finding is approached methodically drawing on knowledge of refrigeration and air conditioning motors and their controls using measured and calculated values of circuit/motor parameters.
	2.6 Equipment is dismantled where necessary and parts stored to protect them against loss or damage
	2.7 Suspected faulty motor, component or circuit is rechecked and its fault status confirmed.
	2.8 Replacement parts required to rectify faults are sourced and obtained in accordance with established procedures.
	2.9 Effectiveness of the repair is tested in accordance with established procedures.
	2.10 Apparatus is reassembled, finally tested and prepared for return to service.
	2.11 Unexpected situations are dealt with safely and with the approval of an authorised person.
	2.12 Fault finding and repair activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

ELEMENT	PERFORMANCE CRITERIA
3 Completion and report fault finding and repair activities	3.1 OHS work completion risk control measures and procedures are followed.
	3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares inventory.
	3.3 Maintenance work activities are documented in accordance with established procedures. (See Note)

Note.

Examples of documentation are component faults reports, test results, authorisations, permits, parts/component dispatch and stores records.

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 finding and rectifying faults in appliance motors and associated controls.

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

KS01-EJ153A Refrigeration and air conditioning motors and associated controls

Evidence shall show an understanding of refrigeration and air conditioning motors and associated controls, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1 Three phase induction motors

- Revise the principles of electromagnetism
- Phase sequence
- Three phase induction motor action
- Induction motor construction
 - stator construction
 - rotor construction
- Speed and slip
- Line and phase voltages
- Terminal block markings
- Motor nameplate details
- Motor rating

REQUIRED SKILLS AND KNOWLEDGE

- Star and Delta connections
- Electrical isolation
- Electrical testing and fault finding
- Rotation reversal
- Maintenance requirements

T2 Three phase motor starters

- Types of three phase induction motor starters
 - Direct-on-line motor starters
 - characteristics, applications and limitations
 - line and control voltages
 - connection, testing and fault finding
 - Other motor starters – characteristics, applications and limitations
 - Star-delta
 - Auto-transformer
 - Part winding
 - Solid State (soft start)

T3 Three phase motor protection devices

- Motor protection
- Motor protection devices
 - star point overloads
- Types of protection devices
 - fuses and circuit breakers
 - thermal overload
 - magnetic overload
 - under voltage and overvoltage relays
 - electronic motor protection
- Isolation devices
- Timers
- Environmental protection
- Fault finding in three phase motor installations
- Motor circuit faults

T4 Split phase, single phase motors and starters

- Split phase single phase motors
- Development of starting torque in split phase induction motors
- Winding characteristics
- Construction details
- Starting
 - centrifugal switch

REQUIRED SKILLS AND KNOWLEDGE

- current coil relay
- solid state relay
- Characteristics of a split phase motor
 - advantages
 - disadvantage
 - application
 - rating
 - speed
 - reversal
- Testing and fault finding

T5 Capacitor and shaded pole, single phase motor and starters

- Capacitor start motors
 - Characteristics
 - Switching mechanism
 - Applications
 - Motor reversal
- Capacitor start/capacitor run motors
 - Characteristics
 - Switching mechanism
 - Applications
 - Motor reversal
- Permanently split capacitor motors
 - Characteristics
 - Applications
 - Motor reversal
 - Capacitors
- Shaded pole induction motors
 - Advantages
 - Disadvantages
 - Reversal
 - Applications
- Motor faults and fault finding
 - Capacitor start types
 - Shaded pole motor type

T6 Series universal, single phase motors

- Basic motor principles
- Commutation

REQUIRED SKILLS AND KNOWLEDGE

- Electromagnet field system
- Reversal
- Supply types, a.c. /d.c.
- Construction
- Characteristics
- Applications
- Reversal
- Faults
- Synchronous motor

T7 Single phase motor protection devices

- Motor protection
 - Environmental
 - Overheating
 - Thermal overload relay
 - Thermal disc overload
 - Internal overload
 - Protection against open circuit, under voltage and automatic restarting
- Testing and fault finding

T8 Single phase motor speed control devices

- Speed control methods
 - Pole changing method
 - Voltage control method
 - Inverter

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.

EVIDENCE GUIDE

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 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:

EVIDENCE GUIDE

- 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:
 - Find and rectify faults in refrigeration and air conditioning system motors and associated controls as described in 8) and including:
 - A Envisaging the likely extent of work from fault/breakdown reports and discussion with appropriate person(s)
 - B Using methodical fault finding techniques
 - C Finding faults efficiently
 - D Rectifying faults effectively
 - E Completing documentation correctly
 - F 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 finding and rectifying faults in appliance motors and associated controls

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 finding and repairing the following faults, in single and/or three phase appliance motors and associated controls in each of three different types of refrigeration and air conditioning systems:

- Open-circuit
- Short-circuit
- Incorrect connections
- Insulation failure
- Unsafe condition
- Motor component failure
- Control circuit component failure
- Related mechanical failure

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	3	Writing	3	Numeracy	3
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Custom Content Section

Competency Field 5)

Refrigeration and Air Conditioning