

1. Module details**Module name****Refrigeration Systems Safety – Capstone assessment****Module duration**

It is expected that students with the appropriate entry skills will successfully complete this module in 6-8 hours.

Module code

NUE508A

Discipline code

0703110 & 0703320

2. Module purpose

This module provides the criteria for attributing competence to a learner through the assessment of knowledge and skills critical to work associated with refrigeration and air conditioning in the capacity of installing, maintaining, repairing, fault finding, testing and commissioning as required by National Electrotechnology Training Package. This includes “associated electrical work.”¹

3. Learning Pathways**Prerequisite**NUE508B Refrigeration Systems Safety– *Monitoring Competency Development***Intended use**

This module is intended to specify assessment criteria and methodologies for gathering and evaluating evidence and confirming that a learner has achieved the critical knowledge and skills necessary to:

- i.) Work safely with refrigerants, gases and electricity and in compliance with relevant standards, Acts and Regulations
- ii.) Ensure refrigeration and air conditioning installations are safe and tested in compliance with relevant standards, Acts and Regulations.
- iii.) Ensure refrigeration and air conditioning system protection devices and systems operate in compliance with relevant standards, Acts and Regulations.

This evidence together with evidence of sufficient workplace development and the attainment of all underpinning knowledge and skills is to be used in deeming the learner competent and is to be the trigger for issuing the industry approved qualification, and required transcript/report for licensing authorities.

This module is to be used as part of an industry approved competency development plan. This component is to be undertaken only when all other relevant evidence indicates that the learner is ready for a final assessment of competency.

¹ “associated electrical work” is all work required to service and maintain refrigeration and air conditioning plant such as; disconnect and reconnect electric motors, testing and fault finding on electrical power and control circuits, minor wiring alterations and repair and adjustment of electrical components.

4. Relationship to competency standards

This module provides a third source of evidence of competency related to the critical aspects underpinning knowledge and skills as detailed in the “Evidence Guide” of units in the National Electrotechnology Training Package UTE99 for Certificate III in Electrotechnology Refrigeration and Air Conditioning. The module provides similar support for equivalent units where they have formally mapped an agreed to by respective National ITABs in respective National Training Package qualifications.

5. Content

1. Work safely with refrigerants, gases and electricity and in compliance with relevant standards, Acts and Regulations
2. Ensure refrigeration and air conditioning installations are safe and tested in compliance with relevant standards, Acts and Regulations.
3. Ensure refrigeration and air conditioning system protection devices and systems operate in compliance with relevant standards, Acts and Regulations.

6. Assessment strategy

Assessment scope

Assessment shall reflect an holistic approach to ensure all the critical aspects of refrigeration and air conditioning work including associated electrical work, as specified in learning outcomes one to three are clearly demonstrated and achieved. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written oral and tests. These include:

- Multiple choice, short answers, graphical, diagrammatic, calculation and problem solving, and
- Installation, connection, measurement, data gathering, testing, repairing, commissioning, observation, interpretation and fault finding.

Conditions of assessment

Assessment shall be under supervision of a qualified assessor and will take place in a simulated or appropriate workplace environment.

Event structure of assessment

The assessment event shall be structured to integrate practical, written and oral test components based on real world scenarios in a simulated or appropriate workplace environment. A variety of assessment item types/approaches shall be included in the overall assessment.

Setting and evaluation

1. The assessment for competency may be set and evaluated by the RTO, and be in accordance with the industry approved competency development plan/training model. However, where a licensed assessment outcome is needed it is also required the assessment shall take into account point 2 below by integrating into the assessment requirements the criteria set by the regulator and industry. For example, where a:
 - Restricted Electrical license is needed to enable “associated electrical work”¹ to be carried out.
 - CFC/HCFC license is required to use and/or purchase CFC/HCFC refrigerants.
 - Refrigeration / Air Conditioning Mechanics license is required to install, maintain and service refrigeration and/or air conditioning systems.

2. As this module addresses the knowledge and skills critical to personal and public safety for work on refrigeration and air conditioning installations, it may be used by a state/territory licensing authority as the basis for a final assessment for the issuing licence/s. Under these circumstances the Authority will specify the conditions under which the assessment is to be set and conducted.

Conducting assessment

The assessment shall be conducted to ensure authenticity of candidates work and be independent of the training delivery.

Timing of the assessment event

The assessment shall be conducted no more than twice yearly. Special arrangements may apply for those who are unable to attend the scheduled assessment due to trauma affecting the learner’s or their significant others.

7. Learning outcome details

Learning outcome 1

Demonstrate knowledge and skills for working safely with refrigerants, gases and electricity.

Assessment criteria

- 1.1 State the safety procedures to work on refrigeration and air conditioning systems, circuits and/or apparatus. This includes:
 - relevant codes and regulations
 - handling and using of refrigerants
 - pressurise, evacuation, charging, leak detection, recovery.
 - handling and using gases, for example oxygen, acetylene, dry nitrogen.
 - handling and using refrigeration oils
 - electrical disconnect/reconnect and testing

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|-----------------------------------|--|
| | <p>1.2 Demonstrate safe working practices as a normal part of carrying out refrigeration and air conditioning installation, commissioning and service work (as listed above, integrated with other practical assessment activities)</p> |
| <p>Learning outcome 2</p> | <p>Demonstrate knowledge and skills for ensuring a refrigeration and air conditioning installation or portion of an installation is safe to use, including associated electrical equipment.</p> |
| <p>Assessment criteria</p> | <p>2.1 Demonstrate methods for ensuring refrigeration and air conditioning installations, circuits and apparatus are safe to use.</p> <p>This includes:</p> <ul style="list-style-type: none"> ▪ apply relevant codes, regulations, design conditions, specifications and drawings. ▪ conduct mandatory tests <ul style="list-style-type: none"> ▪ Refrigeration: pressure, vacuum, leak, refrigerant charge, operation, compressor efficiency, superheat, airflow, etc. ▪ Electrical: earth continuity, earth leakage, supply voltage and polarity, short circuit, operating current, etc. ▪ identify non-compliance from test results ▪ locate/identify non-compliance faults ▪ make recommendations to rectify non-compliant faults ▪ complete mandatory documentation <p>2.2</p> <ul style="list-style-type: none"> ▪ Apply the safety requirements when installing, commissioning or servicing refrigeration and air conditioning equipment/systems |
| <p>Learning outcome 3</p> | <p>Demonstrate knowledge and skills for ensuring refrigeration and air conditioning system fault protection devices will operate as intended.</p> |
| <p>Assessment criteria</p> | <p>3.1 Explain the features and characteristics of electrical overload and fault protection systems. This includes:</p> <ul style="list-style-type: none"> ▪ operating principles fuses, circuit breakers and RCDs ▪ characteristics of fuses, circuit breakers and RCDs ▪ suitability of protection devices for a given situation |

- 3.2 Describe the main features/components of an MEN system and the purpose of each. This includes:
- supply neutral
 - MEN link
 - protecting earth conductor
 - main earth
 - earth electrode
 - the need to ensure continuity of the main neutral
- 3.3 Explain the features and characteristics of refrigeration and air conditioning equipment overload and fault protection devices and systems. This includes:
- high side pressure controls
 - low side pressure controls
 - oil pressure controls
 - air flow controls
 - water flow controls
 - motor controls
- 3.4 Set and test the operation of refrigeration and air conditioning fault protection devices and systems. This includes:
- high side pressure controls
 - low side pressure controls
 - oil pressure controls
 - air flow controls
 - water flow controls
 - motor controls

8. Delivery of the module

Delivery scope

This module contains components related to ensuring a learner achieves the required level of competency as specified in the National Electrotechnology Training Package qualification Certificate III in Electrotechnology Refrigeration and Air Conditioning. That is, assessment of knowledge and skills critical to safety of work associated with refrigeration and air conditioning installations, including “associated electrical work”¹

Delivery strategies

- a) *Assessment component*: refer to item 6 Assessment Strategy
- b) *Guidance component*: Refer to NUE508B Refrigeration Systems Safety – *Monitoring Competency Development*

Resource requirements

RTO to provide:

- Resources and materials sufficient for students to carry out the assessment on an individual basis both for written and practical tests.
- Simulated installation for safety testing with mechanisms for incorporating non-compliant faults.
- A suitable range of tools and testing equipment.
- Relevant refrigeration and air conditioning equipment catalogues, specifications, technical manuals and the like.
- A range of refrigeration, air conditioning and electrical equipment for compliant identification.

Learner/candidate to provide:

- Relevant Australian Standards, which may include personal marginal notations
- Writing and free hand drawing instruments

In relation to restricted electrical licensing assessment transcripts/reports/tests to the independent evaluator(s) as designated by the electrical regulator and industry.

References include:

- Relevant standards Published by Standards Australia / Standards New Zealand including;
 - HB40: The Australian Refrigeration and Air-conditioning Code of Good Practice - Reduction of emissions of fluorocarbon refrigerants.
 - AS1677: Refrigerating systems
 - AS 1668.2: The use of mechanical ventilation and air-conditioning in buildings - Mechanical ventilation for acceptable indoor-air quality
 - AS3666: Air-handling and water systems of buildings - Microbial control - Design, installation and commissioning
- Relevant Commonwealth and State Acts and Regulations.

Occupational health and safety requirements

- Boyle, G. Australian Refrigeration and Air Conditioning, Volumes 1& 2, WA Trust Publications.
- Jenneson, J. R. 1995, *Electrical Principles for Electrical Trades*, McGraw Hill, Sydney

A safe and healthy environment will be provided for students and teachers as well as safety procedure with regard to learning/teaching activity