

1. Module details

Module name

Electrical systems safety

Suggested structured learning time

A learner possessing the prerequisite skills and knowledge should achieve the module purpose in 6 to 8 hours.

Module code

NUE505.1A

Discipline code

0703110

2. Module purpose

This module provides the criteria for assessment of knowledge and skills critical to safety associated with electrical installations in the capacity of installing, maintaining, repairing, fault-finding, testing and commissioning as required by National Electrotechnology Training Package. It also incorporates the Critical aspects of Essential Performance Capability Requirements for Licensed Electricians” as recommended by ERAC/NULAC¹ to the respective State/Territory Electrical Regulators.

3. Learning Pathways

Intended use

This module is intended to be used as a third source of evidence in confirming that a learner has achieved the knowledge and skills critical to:

- Working safely with electricity
- Ensuring electrical installations are safe and comply with standards as do relevant installation tests
- Selecting equipment that complies with standards
- Ensuring electrical protection systems operate in compliance with standards

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.

¹ ERAC/NUELAC – Electrical Regulatory Authorities Council and National Uniform Electrical Licensing Advisory Council

Prerequisite	<p>This module is to be used as part of an industry approved competency development plan. It is to be undertaken only after all other evidence indicates that the learner has acquired the essential knowledge and skills and applied these in the workplace at a level specified in the National Electrotechnology Training Package UTE99 for Certificate III in Electrotechnology Systems Electrician.</p>
4. Relationship to competency standards	<p>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 Systems Electrician. 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, and as approved by the electrical regulator and industry.</p>
5. Content	<ol style="list-style-type: none">1. Working safely with electricity2. Ensuring electrical installations are safe and tests are conducted in accordance with safe working requirements3. Selecting equipment that complies with standards4. Ensuring electrical protection systems operate as intended <p>The module also covers the Critical aspects of the Essential Performance Capability Requirements for Licensed Electricians” as recommended by ERAC/NULAC</p>
6. Assessment strategy	<p>Assessment scope</p> <p>Assessment shall reflect an holistic approach to ensure all the critical aspects of electrical work as specified in learning outcomes one to four 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:</p> <ol style="list-style-type: none">1. Multiple choice, short answers, graphical, diagrammatic, calculation and problem solving, and2. Set-up, installation, connection, measurement, data gathering, testing, observation and interpretation.
Conditions of assessment	<p>Assessment shall be under supervision of a qualified assessor and will take place in a simulated or appropriate workplace environment.</p>

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	<ol style="list-style-type: none">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, such assessment shall also take into account point 2 below, which integrates the requirements of the Electrical Regulator and Industry for the purposes of the learner applying for an Electrical Licence.2. As this module addresses the knowledge and skills critical to personal and public safety for work on electrical installations it may be used by a state/territory licensing authority as the basis for a final assessment for the issuing of an electrical licence. 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 and as set out by the requirements of the electrical regulator and industry. 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	
Assessment outcome 1	Demonstrated knowledge and skills for working safely with electricity
Assessment criteria	<ol style="list-style-type: none">1.1 State the safety requirements and procedures to work on electrical systems, circuits and/or apparatus1.2 Demonstrate safe working practices as a normal part of carrying out electrical installation work such as effective isolation, connecting equipment, use of personal protective equipment and the like <p>NOTE: Safe working practices should be integral with other practical assessment activities</p>
Assessment outcome 2	Demonstrate knowledge and skills for ensuring an electrical installation or portion of an installation is safe to use.

Assessment criteria

2.1 Demonstrate methods for ensuring an electrical installation, circuits and apparatus are safe to use.

This includes:

- conduct mandatory tests
- determine compliance of fault-loop impedance
- identify non-compliance from test results
- locate/identify non-compliance faults
- make recommendations to rectify non-compliant faults
- complete mandatory documentation – eg. regulatory certificate of installation completion

NOTES: This encompasses:

1. *Section 6 Testing and verification of the Wiring Rules AS/NZS 3000*
2. Understanding of electrical circuits theory and measurement

2.2 Apply the safety requirements in the designing/planning of single and multiphase electrical installations. This includes:

- supply requirements
- maximum demand
- circuit arrangements
- external influence
- justification of design

Note: This encompasses

1. *Section 1... Fundamental Safety Principles of the Wiring Rules AS/NZS 3000*
2. Basic electrical calculations

Assessment outcome 3

Demonstrated knowledge and skills for selecting appropriate electrical apparatus, components, accessories and cables

Assessment criteria

3.1 Apply methods for selecting equipment for an electrical installation. This includes:

- wiring systems to suit given environments
- cable size based on current-carrying capacity, voltage drop and fault-loop impedance limitations
- protection methods and devices to protect against overload and short-circuit current
- switchgear and controlgear

NOTE: This encompasses;

1. The following parts of the *Wiring Rules AS/NZS 30001*.
Section 1... Fundamental Safety Principles,
Section 2 Selection and installation of switchgear and controlgear,
Section 3 Selection and installation of wiring systems
Section 5 Earthing arrangements and earthing conductors
Clauses 7.1 to 7.6
2. Using Cable selection standard *AS/NZS 3008.1*.
3. Specific installation standards such as *AS/NZS 3012* and *AS/NZS 3018*
3. Motor starters and starting current limitations and methods
4. Understanding of electrical circuits theory and measurement
5. Basic electrical calculations

3.2 Demonstrate ability to produce evidence that electrical equipment complies with safety requirement:

- source of evidence
- identification of compliant markings

NOTE: This requires knowledge of where evidence of compliance can be obtained and ability to identify compliant markings.

3.3 Identify actions/conditions that would void the compliant status of given item(s) of equipment

Note: This is particularly relevant to repairs to electrical equipment and installations

Assessment outcome 4

Demonstrated knowledge and skills for ensure electrical fault protection devices will operate as intended.

Assessment criteria

4.1 Explain the features and characteristics of systems and devices for protection against indirect contact and overload and fault current. This includes:

- operating principles fuses, circuit breakers and RCDs
- characteristics of fuses, circuit breakers and RCDs
- suitability of protection devices for a given situation

NOTE: This encompasses;

1. The following parts of the *Wiring Rules AS/NZS 30001*.
Section 1... Fundamental Safety Principles,
Section 2 Selection and installation of switchgear and controlgear,
Section 3 Selection and installation of wiring systems
Section 5 Earthing arrangements and earthing conductors
Clauses 7.1 to 7.7
2. Using Cable selection standard *AS/NZS 3008.1*
3. Specific installation standards such as *AS/NZS 3012* and *AS/NZS 3018*
4. Understanding of electrical circuits theory and measurement
5. Basic electrical calculations

4.2 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
- equipotential bonding
- the need to ensure continuity of the main neutral

NOTE: This requires a clear understanding of: *Section 5 Earthing arrangements and earthing conductors of the Wiring Rules AS/NZS 3000*

4.3 Show acceptable methods of providing MEN connection at separate buildings/structures within a single electrical installation

NOTE: This requires a clear understanding of: *Section 5 Earthing arrangements and earthing conductors of the Wiring Rules AS/NZS 3000*

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 Systems Electrician. It also relates to Critical aspects of the Essential Performance Capability Requirements for Licensed Electricians as set recommended by ERAC/NULAC and the industry for the issuance of an electrical licence.

Delivery strategies

- a) *Assessment component:* refer to item 6 Assessment Strategy
- b) *Guidance component:* Refer to NUE505B Electrical Safety Systems – Monitoring Competency Development

Resource requirements

RTO to provide:

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

Learner/candidate to provide:

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

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

Useful references include:

NUE 505A Module Resource Manual

Pethebridge, K., Neeson, I. 1998, *Electrical Wiring Practice*. 5th Ed. McGraw Hill, Sydney.

Jenneson, J. R. 1995, *Electrical Principles for Electrical Trades*, McGraw Hill, Sydney

The following Australia / Standards New Zealand

AS/NZS 3000:2000 *Wiring rules*

AS/NZS 3008: 1998 *Electrical installations —Selection of cables*. Part 1.1: Cables for alternating voltages up to and including 0/6/1kV – Typical Australian installation conditions.

HB 013:2001 *Electrical Equipment for hazardous area*

HB300:2001 *Electrical installations—A guide to using the wiring rules*

AS/NZS 3018:2001 *Electrical installation – Domestic installations*

AS/NZS 3001:2001 *Moveable premises and their site installation*

AS/NZS 3002:2001 *Electrical installation – shows and carnivals*

AS/NZS 3004:2001 *Boating Marinas– Electrical installations*

AS/NZS 3012:1995 *Electrical installation – Construction and demolition sites*

AS/NZS 3017:2001 *Electrical Installation Testing Guide*

AS/NZS 3018:2001 *Electrical Installations Domestic Installations*

AS/NZS 2381:1999 *Electrical equipment for explosive atmospheres 0 selection, installation and maintenance part1: General requirements*

AS/NZS 4836 *Safe working practice on low-voltage electrical installations*

HB3:1996 *Electrical and electronic drawing practice for student*

Local electricity distributor and authority regulations.

Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EEQSBA² **User Guides** (these outline in detail what training and work performance the Learner is required to undertake for the program).

Occupational health and safety requirements

A safe and healthy environment will be provided for learners and teachers. Safety procedures for the particular learning facilities shall be followed as part of the learning / teaching activity and assessment.

² EEQSBA – ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd