

1. Module details

Module name

Electrical installations - design and equipment selection 2

Module duration

It is expected that students with the appropriate entry skills will successfully complete this module in 40 hours.

Module code

NUE 402 (Together with NUE 400 and 401, this module replaces NE 168, 169 & 170)

Discipline code

0703

2. Module purpose

This module provides an understanding of the design and equipment selection steps in the process of installing electrical systems and the underlying principle of safety and protection. Students will develop skills in designing/planning electrical installations up to 400 A¹ per phase that meet the performance standards required by AS/NZS 3000. Students will learn to apply design considerations for the selection of compatible protection devices, switchgear and controlgear for a particular purpose and application, and which will comply with safety requirements of AS/NZS 3000. Students will gain and apply knowledge of tariffs, metering and local electricity distributors service rules, requirements for damp areas, ELV installations and an overview of special installations. Also, students will develop skills in completing mandatory documentation and an understanding for the need to record design and equipment selection decisions.

3. Prerequisites

NUE 401 Electrical installations – design and equipment selection 1

NUE 057 Applied Electricity 5

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills identified in the 'Evidence Guide' of specific units in the National Electrotechnology Industry Competency Standard and Lift Industry Competency Standard. The module provides similar support for equivalent units in the National Metals and Engineering Competency Standards.

5. Content

1. Selecting devices for protection against indirect contact
 - acceptable methods
 - AS/NZS3000 requirements

¹ Based on the electricity distributors (local service rules) design arrangement and installation for maximum size service fuses.

2. Selecting devices for overload and short-circuit protection
 - coordination between conductors and protection devices
 - short-circuit hazards
 - selecting overload protection devices
 - selecting short-circuit protection devices
3. Selecting devices for isolation and switching
 - requirements for provision of isolation
 - need for protection against mechanical movement
 - selecting devices
4. Switchboard layout design
 - AS/NZS and local requirements
 - tariff structures
 - main switchboard equipment
 - layout for whole current metering
 - layout for CT metering (up to 400 A per phase)
5. Selecting equipment for damp situations
 - delineation of damp areas
 - selecting equipment
6. Selecting equipment for ELV installations
 - voltage range
 - SELV and PELV
 - selecting equipment
7. Special installations
 - other requirements and standards that apply
 - defining hazardous areas
8. Documenting installation design and equipment used
 - responsibilities
 - mandatory documentation
 - documenting design

6. Assessment strategy

Assessment methods

Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.

Conditions of assessment

Normally learning and assessment will take place in a classroom / laboratory environment.

7. Learning outcome details

Learning outcome 1

Select methods and devices for protecting person and livestock against the dangers that may arise from contact with exposed conductive parts which may become live under fault conditions for a given installation.

- 1.1 Outline acceptable methods of protection against indirect contact.
- 1.2 Apply the AS/NZS 3000 requirements for selecting methods and devices to protect against indirect contact for a range of installation types and conditions.

Learning outcome 2

Select overload and short circuit protection devices in compliance with coordination requirements of AS/NZS 3000 and load characteristics.

Assessment criteria

- 2.1 Explain how the coordination between conductors and protection devices ensures the protection of cables from over-heating due to over-current.
- 2.2 Describe the possible injuries to persons or livestock from a short circuit.
- 2.3 Apply the AS/NZS 3000 requirements for selecting devices to protect against overload current for a range of circuits and loads.
- 2.4 Apply the AS/NZS 3000 requirements for selecting devices to protect against short-circuit current for a range of installations and conditions.

Learning outcome 3

Select devices for isolation and switching in an electrical installation in compliance with AS/NZS 3000.

Assessment criteria

- 3.1 Explain the requirements for the provision of the isolation of every circuit in an electrical installation
- 3.2 Explain the need for protection against mechanical movement of electrically activated equipment.
- 3.3 Apply the AS/NZS 3000 requirements for selecting devices for isolation and switching for a range of installations and conditions.

Learning outcome 4

Design the layout for main switchboards with capacities up to 400 A per phase to comply with the requirements of AS/NZS 3000 and local electricity distributor's service rules.

Assessment criteria

- 4.1 State the AS/NZS 3000 and local requirement for switchboards.
- 4.2 Explain the typical tariff structures for the supply of electricity.
- 4.3 List the equipment installed at main switchboards with capacities up to 400 A per phase.
- 4.4 Sketch the layout of a main switchboard for an installation supplied with single phase multiple tariff and with whole current metering.
- 4.5 Sketch the layout of a main switchboard and including metering arrangement for an installation supplied with three phases and with CT metering.

Learning outcome 5

Select equipment for installation in a damp situation to comply with the requirements of AS/NZS 3000.

Assessment criteria

- 5.1 Delineate the restricted zones around baths, showers, fixed water containers pools, sauna heaters and fountains/water features for given installations.
- 5.2 Select equipment suitable for installation in given damp situations.

Learning outcome 6

Select equipment for extra-low voltage installations to comply with the requirements of AS/NZS 3000.

Assessment criteria

- 6.1 Describe the voltage range that defines extra-low voltage.
- 6.2 Describe a 'Separated extra-low voltage system' (SELV) and a 'Protected extra-low voltage system' (PELV).
- 6.3 Apply the AS/NZS 3000 requirements for selecting extra-low voltage systems and devices for a range of installations and conditions.

Learning outcome 7

Demonstrate knowledge of special installations and locations that shall comply with additional requirement of AS/NZS 3000 and/or other standards.

Assessment criteria

- 7.1 List the standards that apply to specific electrical installations.
- 7.2 Define a hazardous area and outline the reasons for the need for special requirements for electrical wiring and equipment associated with these areas.

Learning outcome 8

Explain the need for documenting the reasons for a particular installation design and the equipment selected and installed.

Assessment criteria

- 8.1 Outline the responsibilities of those engaged in working with fixed wiring and equipment (electrical installations).
- 8.2 Apply the requirements to complete mandatory documentation in relation to work on electrical installations.
- 8.3 Explain the need to record the reasons for a particular installation design and equipment used.
- 8.4 Document the design and equipment selected for a given installation.

8. Delivery of the module

Delivery strategy

Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective way to achieve this is by the integration of theory and practice where students learn by experimentation and through research and assignment reports. It is recommended that learning and assessment be facilitated in a holistic manner, which may require learning outcome sequence other than that indicated in the module.

Resource requirements

Resources should be sufficient for students to carry out exercises on an individual basis.
Useful references include:
Standards Australia, Standards New Zealand, Australian/ New Zealand Wiring rules AS/NZS 3000:2000

**Occupational health
and safety requirements**

*Standards Australia, Standards New Zealand*²

AS/NZS3008.1.1, Electrical installations - Selection of cables.
Part 1.1 Cables for alternating voltages up to and including
0.6/1 kV Typical Australian installation conditions.

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

Local Service & Installation Rules

Building code of Australia.

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

² *Standards Australia, Standards New Zealand* AS/NZS3008.1.2, Electrical installations - Selection of cables. Part
1.2 Cables for alternating voltages up to and including 0.6/1 kV Typical New Zealand installation conditions.