

1. Module details

Module name

Electrical Heating

Suggested structured learning time

A learner possessing the prerequisite skills and knowledge should achieve the module purpose in 18 to 20 hours.

Module code

NE163.1

Discipline code

0703125

2. Module purpose

This module provides Learners with a knowledge of the principles and practical applications of single and three phase electrical heating and the relevant safety requirements. Learners will gain some understanding and skills in the procedure of fault finding heating equipment.

3. Learning pathway

Intended use in the structured learning program

This module is intended to supplement exposure to electrical installation work. In particular it applies the installation, maintenance, testing, commissioning, fault finding and repair of electrical heating circuits and equipment.

Therefore before undertaking this module a Learner should have a clear understanding and experience of electrical installation in general and how the fundamental principles for safety apply.

Recommended prerequisites

For the most effective learning this module should be undertaken only after modules in three phase theory and electrical wiring and equipment have been completed.

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills in the 'Evidence Guide' of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from EEQSBA.

This module supports the development of essential capabilities required for electrical licensing.

5. Content

1. Heating and heat energy
 - temperature
 - heat energy
 - specific heat capacity
 - heat transfer
 - thermal conductivity
 - electrical equivalent (kWh) of heat energy
 - resistance heating
 - infra-red ovens
 - induction heating
 - dielectric heating
 - electric arc
2. Control of heating
 - manual
 - on/off
 - three heat switch
 - four heat control
 - automatic control
 - thermostatic
 - sensitivity
 - differential
 - simmerstats
 - electronic and other forms of heat control

- 3. Heating process
 - water heating
 - intrinsic safety (pressure relief valve, thermal cut-out)
 - instantaneous
 - storage
 - displacement
 - falling level
 - mains pressure
 - solar heating
 - tariffs
 - space heating
 - radiators, strip heaters, convection heaters
 - storage heaters
 - undercarpet heating
 - reverse cycle air conditioning
 - infra-red heating
 - cooking
 - resistance heating
 - induction heating
 - industrial process heating
- 4. Wiring rules requirement
 - clause
 - installation solution
- 5. Malfunction of heating equipment
 - causes
 - fault finding

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 formal learning environment.
7. Learning outcome details	
Learning outcome 1	Demonstrate knowledge of the concepts of heat and temperature, heat capacity and heat transfer.
Assessment criteria	<ul style="list-style-type: none">1.1 Describe the difference between heat and temperature and define the various units for each.1.2 Calculate the heat energy needed to cause a temperature rise in a simple process.1.3 Describe methods of heat transfer.1.4 Define thermal conductivity and its dependent factors.
Learning outcome 2	Demonstrate knowledge of the methods used to control heating in various situations.
Assessment criteria	<ul style="list-style-type: none">2.1 Describe the various manual methods of heat control.2.2 Describe the function of a thermostat with respect to its mechanical operation, sensitivity and differential.2.3 Test a thermostat for correct operation within its specification.2.4 State the applications of thermostats.2.5 Describe the operation and application of a simmerstat.2.6 Describe electronic techniques employed for heat control.
Learning outcome 3	Demonstrate knowledge of the processes and techniques used for water, space and industrial process heating.
Assessment criteria	<ul style="list-style-type: none">3.1 Describe the various types of domestic and industrial water heaters and their control.3.2 Describe intrinsic safety precautions employed with water heaters.3.3 Describe how solar heating can be used to supplement or replace electric heating.3.4 State the various tariff mechanisms that are employed with heating processes.

	<p>3.5 Describe the various types of space heaters and their control methods.</p> <p>3.6 Describe the various types of cooking appliances and their control method.</p> <p>3.7 Describe the various types of industrial process heating and their control.</p>
Learning outcome 4	Demonstrate an understanding of the Wiring Rules' requirements for the installation of electrical heating equipment.
Assessment criteria	<p>4.1 State the requirements for the installation of electrical heating equipment.</p> <p>4.2 Provide solution for the installation of electrical heating equipment that complies with the Wiring Rules.</p>
Learning outcome 5	Demonstrate knowledge of the possible causes of malfunction in electric heating equipment and skills the testing and fault finding
Assessment criteria	<p>5.1 List the possible causes of faults in a malfunctioning electric heating device/circuit.</p> <p>5.2 Conduct tests and locate a fault in a malfunctioning electric heating device/circuit.</p>
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 method to achieve this is by integration of theory and practice where Learners learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require a learning outcome sequence other than that indicated in the module.
Resource requirements	<p>Resources should be sufficient for Learners to carry out exercises on an individual basis.</p> <p>Useful references include:</p> <p>Jenneson, J. R. 1996, <i>Electrical Principles for Electrical Trades</i>, 4th Ed., McGraw Hill, Sydney</p> <p>Pethebridge, K., and Neeson, I., 2001, <i>Electrical Wiring Practice</i>, 6th Ed, Vol. 2., McGraw Hill, Sydney.</p>

**Occupational health
and safety requirements**

Standards Australia, Standards New Zealand

AS/NZS 3000:2000 Wiring Rules

HB300 Electrical installations — A guide to using the wiring rules

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

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 EEQSBA¹ **User Guides** (*these outline in detail what training and work performance the Learner is required to undertake for the program*)

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.

¹ EEQSBA – ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd