

**1. Module details**

**Module name**

**Marine Electrical Systems**

**Suggested structured learning time**

A learner possessing the prerequisite skills and knowledge should achieve the module purpose in 36 to 40 hours.

**Module code**

NUE603

**Discipline code**

0703110

**2. Module purpose**

This module provides an introduction to, and an overview of, electrical systems in a marine environment. The module covers the safe generation, reticulation, control and protection systems related to electricity on ships and other marine installations. Back up supplies and system management is also considered. Corrosion protection systems are also surveyed.

**3. Learning pathway**

**Intended use in the structured learning program**

This module is intended to support supervised experience in installing and maintaining marine electrical systems. In particular it focuses on electrical equipment and arrangement significant in marine operation.

Therefore before undertaking this module a learner should have an understanding of general electrical system and safety requirements.

**Recommended prerequisites**

For the most effective learning this module should be undertaken only after module NUE057 have been completed.

**5. Content**

1. Marine electrical systems

- Switchboards
- Instrumentation
- Earthing

2. Alternators

- Construction
- Characteristics
- Synchronised operation

3. Switchboards and protection

- Purpose
- Testing and maintenance
- Equipment removal

4. Lighting systems
  - Purpose
  - Types
5. Power supplies
  - UPS systems
  - Batteries
  - Maintenance
  - Safety procedures - battery banks
6. Cathodic protection
  - Purpose
  - Operating parameters
  - Corrosion factors
7. Safety
  - Equipment
  - Codes and Regulations
8. System management
  - System evaluation
  - Commissioning new systems

**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**

Learning and assessment will take place in an environment that is conducive to a learner's development.

**7. Learning outcome details**

**Learning outcome 1**

Describe the electrical layout of marine vessels.

**Assessment criteria**

- 1.1 Describe the main features of a main switchboard/emergency switchboard of a marine vessel.

	1.2	Explain the features of a shore supply applicable to a marine vessel.
	1.3	Discuss the interconnections between switchboards in a marine installation.
	1.4	Describe the meters, instrumentation and indicating lights installed on switchboards in a marine installation.
	1.5	Describe a typical earthing system used on a marine vessel.
<b>Learning outcome 2</b>		Explain the operation of shipboard alternators.
<b>Assessment criteria</b>	2.1	Describe the types and construction methods of alternators used on a marine vessel.
	2.2	Explain the principles of operation of a marine type alternator.
	2.3	Show the relationship between voltage and speed in the regulation of the alternator.
	2.4	Describe the operational characteristics of a marine alternator.
	2.5	Describe the excitation and automatic voltage regulation systems used with marine alternators.
<b>Learning outcome 3</b>		Explain the need for and procedures for the paralleling of alternators.
<b>Assessment criteria</b>	3.1	Describe the automatic and manual procedures for synchronising and paralleling marine alternators, including machines of different capacities.
	3.2	Explain the operation of synchronising equipment used for paralleling alternators on marine vessels.
<b>Learning outcome 4</b>		Describe the principles associated with switchboards on marine vessels.
<b>Assessment criteria</b>	4.1	Explain the operation of a switchboard on a marine vessel.
	4.2	Describe testing and maintenance procedures for ACB, MCCB and MCB, including opening and closing systems.
	4.3	Outline the procedures for the control of arcing associated with marine switchboard equipment.

	4.4	Describe the procedures for the removal of equipment from a switchboard on a marine vessel.
<b>Learning outcome 5</b>		Describe marine lighting systems.
<b>Assessment criteria</b>	5.1	Describe the lighting systems in use on a marine vessel.
<b>Learning outcome 6</b>		Describe marine battery systems.
<b>Assessment criteria</b>	6.1	Describe typical layouts of battery systems on marine vessels.
	6.2	Explain the connections of banks of batteries on a marine vessel.
	6.3	Describe various types of batteries and charging systems in use on marine vessels.
	6.4	List maintenance and safety aspects applicable to battery installations on marine vessels.
<b>Learning outcome 7</b>		Explain the operation of un-interruptable power supplies (UPS).
<b>Assessment criteria</b>	7.1	Outline the operating principles of UPS systems on marine vessels.
	7.2	Describe the management of power and fault diagnosis of UPS systems.
<b>Learning outcome 8</b>		Explain the need for and operation of cathodic protection systems.
<b>Assessment criteria</b>	8.1	List various types of cathodic protection systems in use on marine vessels.
	8.2	Describe the operating parameters and corrosion factors to be considered in cathodic protection systems.
<b>Learning outcome 9</b>		Explain safety requirements for marine installations.
<b>Assessment criteria</b>	9.1	Demonstrate various safety components necessary for the safe operation of the electrical system of marine vessels.
	9.2	List the regulations and safe practices applicable to tankers with hazardous cargoes.
<b>Learning outcome 10</b>		Explain the management procedures for marine electrical installations.

<b>Assessment criteria</b>	10.1 Describe the evaluation procedures for plant performance in marine installations.  10.2 List the steps to be followed when commissioning new systems and conducting electrical surveys on marine vessels.
<b>8. Delivery of the module</b>	
<b>Delivery strategy</b>	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 students learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require learning outcome sequence other than that indicated in the module.
<b>Resource requirements</b>	Resources should be sufficient for students to carry-out learning activities on an individual basis. This could include: <ul style="list-style-type: none"><li>• Suitable workshops/laboratories</li><li>• Suitable tools and equipment.</li></ul>
<b>Occupational health and safety requirements</b>	Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EEQSBA <sup>1</sup> <i>User Guides (these outline in detail what training and work performance the Learner is required to undertake for the program)</i> .  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.

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<sup>1</sup> EEQSBA – ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd