Australian Government

MARL034 Demonstrate advanced knowledge of marine electrical systems

Release: 1

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Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to supply shipboard electrical power on board a commercial vessel. It includes analysing electrical layout systems, alternators, marine motors, lighting systems, power management and uninterruptable power systems (UPS), shipboard electrical equipment and high voltage power systems.

This unit applies to the work of a Marine Engineer Class 1 on commercial vessels of unlimited propulsion power and forms part of the requirements for the Certificate of Competency Marine Engineer Class 1 issued by the Australian Maritime Safety Authority (AMSA).

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Not applicable.

Competency Field

L – Marine Engineering

Unit Sector

Not applicable.

Elements and Performance Criteria

Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1 Evaluate advanced electrical layout systems	1.1 Effects of power factor changes on prime mover, alternator and electrical system are analysed
	1.2 Methods of altering load power factor by means of capacitors or synchronous machines are explained
	1.3 Methods of obtaining constant frequency from a variable frequency output such as a main engine driven alternator and/or variable speed drives for a self discharging equipment

			are explained
		1.4	Protecting systems available for shaft driven alternators are evaluated
2	**Analyse construction and principles of operation of different types of marine alternators**	2.1	Construction and operating parameters of different types of marine alternators are compared and contrasted
		2.2	Cooling systems, leak detection, monitoring and protection systems in different types of marine alternators are compared and contrasted
		2.3	Procedures for drying out an alternator with a low insulation resistance are explained
		2.4	Excitation systems and methods of flashing alternator after loss of excitation are appraised
		2.5	Systems used for protecting against high winding temperatures, circulating currents, loss of excitation and internal short circuit are evaluated
3	**Analyse different types of direct current (DC) and alternating current (AC) marine motors**	3.1	Different types and applications of marine motors are compared and contrasted
		3.2	Difference between types of encapsulation is explained and where they should be used is justified
		3.3	Motor ratings and effect of overloading on different types of motor are assessed
		3.4	Possible operational problems associated with marine motors are analysed and appropriate remedial action is devised
		3.5	Procedure for drying out a motor that has become unserviceable due to either long-term storage or immersion in seawater is formulated
		3.6	Effects of operating star connected motors compared with delta connected motors are distinguished and when this may be required is suggested
		3.7	Different types and applications of special motors for deck and cargo operation are analysed
4	**Analyse requirements of motor starters for 3 phase and**	4.1	Differentiation is established between different types of motor starters
		4.2	Different types of starters are evaluated in terms of starting torque and current, and are compared to particular motor

	synchronous motors		applications
		4.3	Simple starter circuit diagrams are evaluated and operating principles of motor starters are explained
		4.4	Documentation and circuit and wiring diagrams are used for fault-finding in motor starters
		4.5	Routine maintenance program for monitoring vibration and insulation resistance levels of motors is designed
5	**Analyse lighting systems used on board ships**	5.1	Common types and applications of lighting systems are evaluated
		5.2	Distribution layout systems are explained
		5.3	Fault-finding method for lights and starter systems, including lighting in hazardous areas, is planned using circuit diagrams
6	**Evaluate alternator excitation system design**	6.1	Different types of excitation systems and impact of load changes are compared
		6.2	Type, location and function of components involved in excitation are examined
		6.3	Function, cooling, failure mode and procedures for testing and changing diodes are explained
		6.4	Functions of an Automatic Voltage Regulator (AVR) and how it may be incorporated into an excitation system are explained
		6.5	Process of fault-finding in an AVR and types, causes and remedies of common problems are explained
		6.6	The impact excitation systems have on output in normal and adverse circumstances is assessed
7	**Analyse power management and UPS fitted to vessels**	7.1	Operational functions of power management systems during high load, overload and short circuit conditions are analysed
		7.2	Functions and components of UPS systems are evaluated
		7.3	Limitations of power management and UPS fitted to vessels are analysed
		7.4	System response under possible fault conditions of vessel power management and UPS are determined
8	**Analyse vessel**	8.1	Cathodic protection systems and how they interact are

	cathodic protection system		analysed
		8.2	Components of cathodic protection systems are identified and life cycle maintenance program is prepared
		8.3	Modifications required for operating parameters of cathodic protection systems when operating alongside an active wharf or another vessel are determined
		8.4	Likely causes of corrosion in relation to size, location or distribution of anodes or current densities are assessed
		8.5	Other corrosion problems in shipboard environment that may be cause of electrical problems are appraised
9	**Assess requirements and components associated with electrical systems for hazardous spaces on board vessels**	9.1	Different types, limitation and nameplate identification of 'E' equipment are compared
		9.2	Requirements of classification societies are distinguished from administrations regarding electrical installations on board vessels
		9.3	Lighting and power supply requirements of pump rooms are identified
		9.4	Safety requirements for electrical equipment and safety practices on board vessels and how these are extended when alongside a berth are analysed
10	**Assess existing electrical shipboard equipment**	10.1	Existing and new shipboard electrical equipment and systems are compared to assess future requirements as well as potential problems and preventative measures
		10.2	Performance of existing shipboard electrical equipment and systems is analysed and cost effectiveness studies for modifications or improvements are prepared
		10.3	Factors involved in commissioning new electrical plant are evaluated
		10.4	Procedures involved in organising survey of existing plant are outlined
		10.5	Procedures involved in making recommendations for new systems consistent with modified new ship building requirements are outlined
11	**Appraise high voltage electrical**	11.1	Safety requirements for working with high voltage systems are identified

motor propulsion systems	11.2	Use of high voltage systems for propulsion and cargo handling is evaluated
	11.3	Safe maintenance methods for high voltage switchgear and machines are analysed

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Operating parameters include one or more of the following:	• excitation current • insulation grade • operating temperature • speed
Marine motors include one or more of the following:	• polyphase • reduced starting current motors • single • speed changing • synchronous • variable speed
Encapsulation includes one or more of the following:	• drip proof • submersible • TEFC
Motor ratings must include:	• continuous • short time
Operational problems include one or more of the following:	• loss of insulation resistance • open circuit • overheating • short circuit • wrong connections

Motor starters include one or more of the following:	• DOL • primary and secondary resistance • soft or electronic starters • star-Delta • transformer starter
Lighting systems include one or more of the following:	• fluorescent • halogen • incandescent • LED • mercury • sodium vapour
Distribution layout systems must include:	• emergency lights • safety lights
How excitation systems impact on output in normal and adverse circumstances must include:	• loss of excitation • short circuit
Safety requirements include one or more of the following:	• company requirements • manufacturer requirements • statutory requirements

Unit Mapping Information

This unit replaces and is equivalent to MARL6021A Demonstrate advanced knowledge of marine electrical systems

Links

Companion Volume implementation guides are found in VETNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2