



Australian Government

MARL026 Demonstrate intermediate knowledge of marine control systems and automation

Release: 1

MARL026 Demonstrate intermediate knowledge of marine control systems and automation

Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to operate control systems on board a commercial vessel.

This unit applies to the work of a Marine Engineer Class 2 on commercial vessels greater than 3000 kW and forms part of the requirements for the Certificate of Competency Marine Engineer Class 2 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.

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| 1 Analyse open and closed loop systems | 1.1 | Open loop systems are distinguished from closed loop systems |
| | 1.2 | Closed loop manual, time based automatic open loop and feed forward open loop are explained |
| 2 Explain principles and operation of pneumatic control element and systems | 2.1 | Operation of a nozzle flapper and pneumatic amplifier unit is analysed and applied to transmitters, basic controllers and valve positioners |
| | 2.2 | Control air supply system is defined |

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| | 2.3 | Principle of operation of direct and reverse acting pneumatic relays and application is clarified |
| | 2.4 | Application of computing relays is analysed |
| 3 Compare temperature transmitters | 3.1 | Pneumatic temperature transmitter is defined |
| | 3.2 | Effect of changes in ambient temperature on thermocouples and resistance temperature detectors (RTD) is explained |
| | 3.3 | Testing procedures and methods of simulation for both RTDs and thermocouples are explained |
| | 3.4 | Characteristics and application of thermistors are outlined |
| 4 Analyse application of differential pressure transmitters | 4.1 | Application of differential pressure transmitters on board ships is confirmed |
| | 4.2 | Arrangements of differential pressure transmitters for measurement of liquid levels in both closed and open tanks are explained |
| | 4.3 | Mechanics for viscosity measurement using a differential pressure transmitter are analysed |
| | 4.4 | Principle of using a differential pressure transmitter for flow measurement and the need for a square root extractor is explained |
| | 4.5 | Use of a differential pressure transmitter for flow measurement is compared and contrasted with other types of meters |
| 5 Explain engine room monitoring systems | 5.1 | Application of different speed sensing systems is analysed |
| | 5.2 | Operating principles of torque monitoring systems applied to propeller shafting are explained |
| | 5.3 | Arrangements of shaft power and indicated power monitoring are compared |
| | 5.4 | Horizontal and vertical float level systems are compared with other tank level monitoring system in common use |
| | 5.5 | Operating principle of oil-water interface sensor is explained |
| | 5.6 | Methods of bearing temperature monitoring applied to diesel engine rotating parts are outlined |
| | 5.7 | Machinery space monitoring and alarm system from a central |

		control room are outlined
6 Explain procedure for transmitter calibration	6.1	Procedure for transmitter calibration for both pneumatic and electronic transmitters is applied
	6.2	Test equipment is used for transmitter calibration
	6.3	Relationship between process variables and output signals is demonstrated in a graph
	6.4	Effects of transmitter dead band are defined
7 Explain operation of pneumatic 3 term controller and controller adjustment procedures	7.1	Common controller actions and applications are outlined
	7.2	Operating principle of pneumatic 3 term controllers is outlined
	7.3	Procedure for adjusting 3 term pneumatic controllers is applied and effects if incorrectly adjustment are explained
	7.4	Typical controller settings for a PID controller are detailed
	7.5	Integrated hand/auto station and 3 term controller are outlined and bumpless transfer is demonstrated
8 Explain actuators and control valves	8.1	Arrangements to provide fail safe requirements are outlined
	8.2	Control valve and actuator are explained
	8.3	Different types of actuators are identified
	8.4	Operating principle of pneumatic valve positioners is explained
9 Analyse operation of hydraulic governors	9.1	Operating principle of proportional action hydraulic governors is explained
	9.2	Importance of spring stiffness in relation to response is clarified
	9.3	Purpose of an isochronous governor is outlined
	9.4	Principle of operation of an isochronous hydraulic governor is outlined
	9.5	Governor droop and its requirements for stable load sharing and engine stability is explained
10 Interpret electronic systems circuit	10.1	Electrical symbols commonly used in electronic circuits and sub-circuits are defined

diagrams	10.2	Printed and colour codes used in electronic circuits are defined
	10.3	Operation and maintenance manuals commonly used in the fault finding electronic circuits are used correctly
11 Explain basic operation of programmable logic controllers	11.1	Principles and operation of integrated circuit gates are explained
	11.2	Operational function of input/output devices connected to a digital programmable logic controller is detailed
	11.3	Methods of operation of flip flops, adders, counters, multiplexers and decoders are outlined
	11.4	Methods employed when changing set point values in a digital programmable logic controller are outlined
12 Explain typical machinery space control loops and unmanned machinery spaces requirements	12.1	Fuel oil heating, LO cooling and JW cooling loop showing cascade and split range systems are outlined
	12.2	Fuel oil viscosity control loop is outlined
	12.3	Common methods of boiler water control and simple combustion control with burner management for an auxiliary boiler are outlined
	12.4	Requirements and system arrangements for bridge control of main propulsion machinery including change over from local to bridge are explained
	12.5	Common pressure control loops found in a ship's engine room are identified
	12.6	Unmanned machinery spaces (UMS) requirements are outlined
	12.7	Troubleshooting procedures associated with control systems are outlined
	12.8	Procedures for software version control are outlined

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.

Meters must include:

- area meter
- rotometer
- target meter

Types of actuators may include one or more of the following:

- electric
- hydraulic
- pneumatic

Unit Mapping Information

This unit replaces and is equivalent to MARL6013A Demonstrate intermediate knowledge of marine control systems and automation.

MARL6013A replaces and is equivalent to TDMMB4207A Test, detect faults and maintain and restore electronic control equipment to operating condition on vessels over 750 kW propulsion power.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2>

Assessment Requirements for MARL026 Demonstrate intermediate knowledge of marine control systems and automation

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least one occasion and include:

- accessing information and sketch diagrams to interpret and explain testing requirements related to control systems on commercial vessels
- applying relevant work health and safety/occupational health and safety (WHS/OHS) requirements and work practices
- assessing own work outcomes and maintaining knowledge of current codes, standards, regulations and industry practices
- explaining principles of marine automation and process control
- identifying and interpreting numerical and graphical information, including schematic diagrams, relevant to control systems on commercial vessels
- identifying and suggesting ways of rectifying faults and malfunctions in control systems on commercial vessels
- identifying methods, procedures and materials needed to operate and maintain control systems on commercial vessels
- imparting knowledge and ideas through verbal, written and visual means
- reading and interpreting written information related to operate control systems on commercial vessels.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- actuators and control valves
- Australian standards for drawing symbols/layouts for schematic diagrams
- bridge control systems
- concepts of unmanned machinery spaces (UMS), and automated monitoring and control of machinery
- control and monitoring of ship machinery
- differential pressure transmitters
- electronic systems circuit diagrams
- engine room monitoring systems
- machinery space control loops and UMS requirements
- mechanical and electrical sensors
- open and closed loop systems
- operation of hydraulic governors
- operation of pneumatic 3-term controller and controller adjustment procedures
- operation of programmable logic controllers
- pneumatic and electrical instrumentation transmitters
- principles and operation of pneumatic control element and systems
- principles of basic pneumatic systems and action of pneumatic instruments
- principles of process control
- temperature transmitters
- tests and procedures required to meet UMS requirements
- total bridge control
- transmitter calibration
- WHS/OHS legislation, policies and procedures.

Assessment Conditions

Assessors must satisfy National Vocational Education and Training Regulator (NVR)/Australian Quality Training Framework (AQTF) assessor requirements.

Assessment must satisfy the National Vocational Education and Training Regulator (NVR)/Australian Quality Training Framework (AQTF) standards.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Assessment must occur in workplace operational situations or where these are not available, in an industry-approved marine operations site where intermediate knowledge of marine control systems and automation can be demonstrated.

Resources for assessment include access to:

- applicable documentation including workplace procedures, regulations, codes of practice and operation manuals
- technical reference library with current publications on automation and process control

- tools, equipment, materials and personal protective equipment currently used in industry.

Performance should be demonstrated consistently over time and in a suitable range of contexts.

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