**COURSE MAPPING**
**RATINGS FORMING PART OF ENGINEERING WATCH**

***Function:*MARINE ENGINEERING AT THE SUPPORT LEVEL**

| Competence | Knowledge, Understanding and Proficiency | Performance Outcome | Performance Criteria | Topics | Intended Learning Outcome | Teaching Learning Activity | Assessment Activity |
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| **Understand orders and be understood in matters relevant to watchkeeping duties** | 1. Terms used in machinery spaces and names of machinery and equipment | *Relieve a watch*<br><br>On a simulator or laboratory, the trainee relieves a watch. | The trainee should:<br>1. report to duty at least 15 minutes before the time<br>2. determine from the out-going watch:<br>▪ *operational status of the plant*<br>▪ *unusual alarms or conditions occurring during previous watch*<br>▪ *standing orders*<br>▪ *maintenance performed during previous watch*<br>▪ *on-going repairs affecting plant operations; and*<br>▪ *outstanding safety conditions*<br>3. seek clarification from the out-going watch or engineer if information was not clearly understood | | | | |
| | | *Hand over watch*<br><br>On a simulator or laboratory, the trainee hands over the watch. | The trainee should:<br>1. in preparation for relief, ensure that all assigned routine duties are completed before the conclusion of the watch<br>2. communicate the following information to the incoming watch:<br>▪ *operational status of the plant* | | | | |

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| **Understand orders and be understood in matters relevant to watchkeeping duties *(continuation)*** | Terms used in machinery spaces and names of machinery and equipment*(continuation)* | | ▪ *unusual alarms or conditions occurring during previous watch*<br>▪ *standing orders*<br>▪ *maintenance performed during previous watch*<br>▪ *on-going repairs affecting plant operations; and*<br>▪ *outstanding safety conditions*<br>3. ensures that the watch relief is fully aware of the operational status of the plant | | | | |
| | | *Pre-start checking of diesel engine*<br><br>On a simulator or laboratory, the trainee assist in a pre-start check of a diesel engine. | The trainee should:<br>1. check the general exterior of the engine for debris, leaks, or unsafe conditions<br>2. check the lube oil level of the engine sump, governor and any other ancillary lube oil tanks such as cylinder oil tank, rocker lube tank, cam lube oil tank, as applicable.<br>3. Check the jacket water expansion tank level and any other ancillary treated fresh water expansion or collecting tanks such as injector cooling water tank and piston cooling water tank, as applicable<br>4. check fuel oil day tank level<br>5. check starting air receiver pressure, starting hydraulic | | | | |

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| **Understand orders and be understood in matters relevant to watchkeeping duties *(continuation)*** | Terms used in machinery spaces and names of machinery and equipment*(continuation)* | | accumulator pressure, or starting battery charge status, as applicable<br>6. drain air boxes, scavenging air receiver, and start air bottles, as appropriate<br>7. perform any manual pre-lubrication functions, as required<br>8. open indicators cocks and stand by for engine rollover and recloses indicator cocks, as applicable<br>9. check other associated equipment fitted to the specific vessel<br>10. take proper action to prevent safety and pollution violations. | | | | |
| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** | 2. Engine-room watchkeeping procedures | *<u>Electrical generating plant</u>*<br><br>On a simulator, or in a laboratory, the trainee monitors the electrical generating plant. | The trainee shall:<br>1. check plant's operational status<br>2. check diesel generator's:<br>▪ *rpm*<br>▪ *frequency*<br>▪ *output voltage*<br>▪ *output current*<br>▪ *kilowatt output*<br>▪ *kilovolt-amp reactive output, or power factor*<br>▪ *bearing's temperatureandoil flow*<br>▪ *governor turbocharger, and diesel engine sump lube-oil levels* | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | ▪ *physical condition of pipes, tubing and hoses for wear or leaks*<br>3. observe the following:<br>▪ *diesel engine lube-oil and cooling water temperatures and pressures*<br>▪ *diesel engine air intake and exhaust temperatures and pressures, including air intake filter pressure drop, as appropriate*<br>4. check start air pressure<br>5. read fuel oil meters, day tank levels, and observe operation of viscometer, if installed<br>6. check for any unusual conditions or noises<br>7. notify the watch engineer of any unusual or unsafe conditions | | | | |
| | | *Lube-oil and fuel oil purification systems*<br><br>On a simulator or in a laboratory, the trainee monitor lube-oil and fuel oil purification systems. | The trainee shall:<br>1. check the following:<br>▪ *plant's operational status*<br>▪ *dirty-oil inlet temperature and pressure*<br>▪ *clean-oil discharge pressure*<br>▪ *purifier-gear drive oil sump level*<br>▪ *level in sealing-water head tanks*<br>▪ *inlet and outlet sight glasses for flow*<br>▪ *heater steam supply pressure*<br>2. feels machine for vibration<br>3. check speed indicator for proper bowl speed | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | 4. for lube oil purification plant determine the point of:<br>▪ *suction to include engine sump, settling/renovating tanks, or other tanks*<br>▪ *discharge to include engine sump, settling/ renovating tanks, or other tanks*<br>5. for fuel oil purification plant determine the point of:<br>▪ *suction, including settling or other tanks*<br>▪ *discharge to include day/ service or other tanks*<br>6. Check the following:<br>▪ *priming- and wash-water pressure*<br>▪ *operating-water pressure*<br>▪ *control-air pressure*<br>▪ *any unusual conditions or noises*<br>7. notify the watch engineer of unusual or unsafe conditions | | | | |
| | | *Compressed air plant*<br><br>On a simulator or in a laboratory, the trainee monitor the compressed air plant. | The trainee:<br>1. check plant operational status<br>2. check applicable start, service and control air compressor:<br>▪ *oil levels and add oil as necessary*<br>▪ *oil pressure*<br>▪ *suction pressure or air-inlet filter pressure differential* | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | *indications, as appropriate*<br>▪ *discharge pressure and compressed-air receiver pressure*<br>3. check for any unusual conditions or noises<br>4. blow down intercoolers, after coolers and receivers, check associated refrigerated filter system and look for clogged cooling fins<br>5. notify the watch engineer for any unusual or unsafe condition<br>6. identify emergency or cross- connect between ship's service air and control air systems<br>7. identify valves to direct "air on deck"<br>8. identify settings of standby equipment | | | | |
| | | *<u>Refrigeration and air-conditioning plants</u>*<br><br>On a simulator or in a laboratory, the trainee monitor the refrigeration and air-conditioning plants. | The trainee:<br>1. check plant operational status<br>2. check the following:<br>▪ *compressor suction and discharge pressure and temperature*<br>▪ *compressor-oil level*<br>▪ *compressor-oil pressure and control-oil pressures*<br>▪ *receiver level*<br>▪ *liquid-line sight glass condition*<br>▪ *related cooling water* | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | *supply strainers and filters, and clean or blow down, when necessary*<br>3. for refrigeration plants:<br>▪ *check refrigerated box temperature and condition of evaporator coils and drain for icing*<br>▪ *note the condition of the box door gasket and operation of circulating fans*<br>4. for air-conditioning plant:<br>▪ *check return and supply air temperature*<br>▪ *check chilled-water pump suction and discharge pressures*<br>▪ *check chilled-water inlet and outlet temperatures*<br>▪ *check chilled-water expansion-tank level*<br>5. check condenser sea-water inlet and outlet temperature<br>6. notify the watch engineer for any unusual or unsafe conditions | | | | |
| | | *Tank and pressure-vessel levels*<br><br>In a laboratory, the trainee determines the tank and pressure-vessel levels. | The trainee determine the:<br>1. liquid level of vented tanks and low-pressure pressure vessels fitted with tubular sight-glasses<br>2. liquid level of a high-pressure pressure vessel fitted with a high-pressure gauge glass or a remote | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | level indicator<br>3. liquid level of a vented tank fitted with petcocks<br>4. liquid level of two vented tanks (1 fuel- or lube-oil, and 1 water), fitted with sounding tubes, using a sounding tape, using innage or ullage method<br>5. fuel level of a lube-oil sump fitted with a dipstick<br>6. oil/water-interface of the slop tank<br>7. level of a vented tank or pressure vessel fitted with remote reading-level gauges | | | | |
| | | *Charging a "water-logged" portable water pressure tank with compressed air*<br><br>On a simulator or in a laboratory, the trainee charges a "water-logged" portable water pressure tank with compressed air | The trainee :<br>1. correctly connect the compressed air hose from the service air header to the pressure tank<br>2. open the appropriate valves, charge air into the pressure tank, while observing the water level and allowing the potable water pump to cycle on and off<br>3. close the appropriate valves, secure from charging air into the pressure tank when the potable water pump no longer shortcycles and the pressure tank level cycles | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | between normal parameters<br>4. disconnect and stow the compressed air hose from the service air header to the pressure tank | | | | |
| | | *Propulsion shafting and bearings*<br><br>On a simulator or in a laboratory, the trainee monitors the propulsion shafting and bearings | The trainee:<br>1. check the following:<br>▪ *all line shaft-bearing sump-oil levels*<br>▪ *all line shaft-bearing-oil temperatures*<br>▪ *all line shaft-bearing oiler rings, where appropriate*<br>▪ *the independent thrust-bearing sump level, where appropriate*<br>▪ *the independent thrust-bearing lube-oil sump temperature, where appropriate*<br>▪ *the independent thrust-bearing lube-oil cooler inlet and outlet temperatures, where appropriate*<br>▪ *the independent thrust-bearing lube-oil supply pressure, where appropriate*<br>▪ *the independent thrust-bearing gravity- head tank level, where appropriate*<br>▪ *the water-lubricated stern-tube stuffing box for proper leak-off, where appropriate*<br>▪ *the oil-lubricated stern-* | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | *tube lube sump tank level where appropriate*<br>▪ *the oil-lubricated stern-tube lube-oil pressure where appropriate*<br>▪ *the oil-lubricated stern-tube oil temperatures where appropriate*<br>▪ *the oil-lubricated stern-tube inboard shaft seal for leakage if appropriate*<br>2. notify the watch engineer of any unusual or unsafe conditions; | | | | |
| | | *Steering gear*<br><br>On a simulator or in a laboratory, the trainee monitors the steering gear | The trainee:<br>1. compare the rudder-angle mechanical- sliding scale with the electrical indicator, if fitted<br>2. monitor the steering gear hydraulic oil reservoir levels and temperatures<br>3. monitor system hydraulic oil pressure and any applicable filter pressure drops<br>4. check steering hydraulic system power units, piping, and actuators for leaks<br>5. assist in testing the communication devices;<br>6. observe various linkages for wear, loosening, or lost motion<br>7. note glands on main rams and rudderpost for | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Engine-room watchkeeping procedures *(continuation)* | | leakage<br>8. assists in adding oil to hydraulic oil reservoirs as required<br>9. check for unusual noises, erratic motions and other indications of air in the system<br>10. notify the watch engineer of all unusual or unsafe conditions; | | | | |
| | 3. Safe working practices as related to engine-room operations | *Adding clean oil*<br><br>In a laboratory, the trainee adds clean oil to the vented lube-oil sump of an auxiliary engine, reduction gear, or piece of deck machinery. | The trainee:<br>1. determine the need to add oil;<br>2. obtain an adequate amount of clean oil of proper grade and type;<br>3. remove the filler cap or plug;<br>4. pour oil through the filler cap or oil filler plug opening;<br>5. check the oil level and verifies that it stands at the specified level;<br>6. replace the filler cap or plug and leaves the area clean | | | | |
| | | *Lubricating grease-lubricated bearing*<br><br>In a laboratory, the trainee lubricates a grease-lubricated bearing. | The trainee:<br>1. determine from the appropriate lubrication chart the type and grade of grease to use;<br>2. remove the fitting protective covering if fitted, drain plug, if fitted, and | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Safe working practices as related to engine-room operations *(continuation)* | | wipes the fitting free of grease and dirt with a rag;<br>3. remove air from the grease-gun hose by slowly squeezing the handle until grease starts to leave the fitting, and attaches the hose fitting to the bearing of the fitting;<br>4. slowly pump in grease until a small amount of clean grease appears but, if the grease meets undue resistance, the candidate notifies the watch engineer; and<br>5. replace drain plug and protective cover on grease fitting. | | | | |
| | | *Lifting heavy equipment, handling chemicals, and work with delicate equipment*<br><br>In a laboratory and workshop, the trainee assists in cleaning a lube-oil or a fuel-oil purifier to demonstrate safe working practices for the following:<br>▪ *lifting heavy equipment;*<br>▪ *handling chemicals;* | The trainee:<br>1. Perform all tasks safely using all required safety equipment (safety shoes, safety glasses, explosion-proof lighting and electrical devices, hearing protection, gloves, hard hat, respirator mask, etc) and adheres to all safety procedures (verifies tag-out procedures, notifications, safe lifting techniques, etc.);<br>2. Assist in disassembly of purifier using appropriate tools as provided; | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Safe working practices as related to engine-room operations *(continuation)* | ▪ *work w/delicate equipment* | 3. Clean all sludge deposits from individual disks, bowl top and bowl;<br>4. Assist in reassembling purifier, reinstalling all disks and in numerical order;<br>5. Leave the area safe and secure;<br>6. Report all unusual findings or unsafe conditions;<br>7. Ensure that all operations are in accordance with equipment manufacturer's recommended procedures and supervisor's instructions; | | | | |
| | 4. Basic environmental protection procedures | *Oily-water separator*<br><br>On a simulator or in a laboratory, the trainee monitors an oily-water separator. | The trainee:<br>1. check the following:<br>▪ *plant's operational status;*<br>▪ *bilge-water tank level;*<br>▪ *oily-water-separator chamber pressure or vacuum;*<br>▪ *filling related pressure/vacuum;*<br>▪ *overboard-discharge water-pump pressure;*<br>2. monitor oil-content monitor:<br>▪ *ensures that equipment is not bypassed, sampling line is open, and flushing water is not being supplied to sensor;*<br>▪ *automatic valves are not* | | | | |

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| **Carry out a watch routine appropriate to the duties of a rating forming part of an engine-room watch** *(continuation)* | Basic environmental protection procedures*(continuation)* | | *operated in manual mode or disconnected from controlling devices; and*<br>▪ *no temporary hoses are used during operation;*<br>3. check for any unusual conditions or noises; 8. Notifies the watch engineer of any unusual or unsafe conditions | | | | |
| | | *<u>Sewage treatment plant</u>*<br><br>On a simulator or in a laboratory, the trainee monitors a sewage- treatment plant. | The trainee:<br>1. checks the following:<br>▪ *plant's operational status;*<br>▪ *destination of "black water" sewage;*<br>▪ *sewage-circulating and overboard-discharge pump pressures;*<br>▪ *sewage-circulating and overboard-discharge pump mechanical seals for leakage;*<br>▪ *air-compressor discharge pressure;*<br>▪ *the chemical-batch tank level;*<br>▪ *any unusual conditions or noises;* | | | | |
| **Understand orders and be understood in matters relevant to watchkeeping duties** | 5. Use of appropriate internal communication system | *<u>Operate internal communication system</u>*<br><br>On a simulator or in a laboratory, the trainee operates internal communication system | The trainee:<br>1. answer the phone stating his or her location, name, and rank;<br>2. operate and communicate with remote stations by ship's phone;<br>3. operate and communicate with remote stations by | | | | |

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| **Understand orders and be understood in matters relevant to watchkeeping duties** *(continuation)* | Use of appropriate internal communication system*(continuation)* | | sound-powered phone;<br>4. operate and communicate with remote stations by two-way radio;<br>5. conduct all operations in accordance with ship's procedures. | | | | |
| | | *Engine-order telegraph signals*<br><br>On a simulator or in a laboratory, the trainee logs engine-order telegraph signals. | The trainee:<br>1. obtain correct "counter" and "fuel oil meter" readings at standby or departure or arrival;<br>2. acknowledge main engine direction and speed by matching engine order telegraph with order from the bridge;<br>3. enter appropriate graphic bell signal symbol and logs with correct time; from full ahead to full astern including stop and finished with engines; and<br>4. make legible entries. | | | | |
| | 6. Engine-room alarm systems and ability to distinguish between the various alarms, with special reference to fire-extinguishing gas alarms | *Responding to alarm*<br><br>On a simulator or in a laboratory, the trainee responds to the following alarms:<br>• $CO_2$ discharge<br>• fire or smoke<br>• engine operational alarms, including:<br>▪ lube-oil alarms | For each alarm response, the trainee:<br>1. silence the alarm;<br>2. describe the system involved;<br>3. describe the system's purpose;<br>4. describe the seriousness of the alarm; and<br>5. notify the officer-in-charge of the engine watch of the alarm and | | | | |

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| | | (temperature and pressure),<br>▪ boiler alarms,<br>▪ fueloil tank high-level alarm,<br>▪ oilywater separator alarm,<br>▪ high-bilgewater alarm<br>• vessel emergency signal or alarm. | his/her actions. | | | | |
| **For keeping a boiler watch:**<br><br>**Maintain the correct water levels and steam pressure** | 1. Safe operation of boilers | *Boiler operation*<br><br>On a simulator or in a laboratory, the trainee monitors the operation of boiler. | The trainee:<br>1. monitor the steam drum pressure and water level;<br>2. monitor the feed water pressure;<br>3. monitor the fuel oil service pump suction and discharge pressures and fuel-oil supply pressure and temperature to the supply header and applicable fuel oil strainer pressure drops;<br>4. monitor the fuel oil settling/service tank levels and temperatures;<br>5. strip fuel oil settling tanks of moisture as appropriate;<br>6. monitor the stack temperature;<br>7. monitor the atomizing steam pressure as applicable;<br>8. observe condition of | | | | |

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| | | | flame through peephole;<br>9. inspect boiler casing, hand holes, manholes, and piping for leaks;<br>10. wipe up any oil accumulations presenting a fire hazard. | | | | |
| **Operate emergency equipment and apply emergency procedures** | 1. Escape routes from machinery spaces | *Machinery spaces escape routes*<br><br>In a laboratory, the trainees all engine-room escape routes, describe emergency escape procedure, and perform escape using the shortest open route. | The trainee:<br>1. locate all emergency-escape routes;<br>2. describe the operations and procedures appropriate to each means of escape (including the use of emergency-escape breathing devices);<br>3. demonstrate the correct means of escape via:<br>a. the shortest open route;<br>b. an escape trunk, if so equipped. | | | | |
| | 2. Familiarity with the location and use of fire-fighting equipment in the machinery spaces | *Fire-fighting equipment in machinery spaces*<br><br>Given a set of a ship's fire plan, the trainee locates each piece of fire- fighting and emergency equipment in the machinery spaces, starting with the nearest, states its purpose, and describes its use or | The trainee:<br>1. locate the nearest piece of each item named from the firecontrol plan; and<br>2. state the purpose and describe the use or operation of the item of equipment named. | | | | |

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| | | operation. | | | | | |