REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
MARITIME INDUSTRY AUTHORITY

MARINA Circular No. 2014 - 01

ANNEX IV

UPDATING COURSE FOR MANAGEMENT LEVEL MARINE ENGINEER OFFICERS

(Chief Engineer Officer and Second Engineer Officer)

Certified Under STCW '78 Convention As Amended in 1995

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FOREWORD

This "Updating Course for Management Level Marine Engineer Officers", who were certificated under the STCW '78 Convention, as amended in 1995, was developed in order for the said merchant marine engineer officers to update themselves and comply with the new requirements under Regulation III/2 of the 2010 Manila Amendments to the 1978 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention), without need for re-taking the whole management level engine course.

The curriculum was designed based on the gap analysis of the minimum standards of competence provided in Table A-III/2 of STCW '78, as amended in 1995 vis-à-vis Table A-III/2 of the 2010 STCW Manila Amendments and guided by the revised IMO Model Course 7.02 (Chief Engineer Officer and Second Engineer Officer), which was validated during the 44th session of the IMO's Sub-Committee on Standards of Training and Watchkeeping (STW 44) held from 29 April to 3 May 2013.

The specific gaps identified were referred to the revised IMO Model Course 7.02 and the topics relevant to the said gaps together now comprise the curriculum for this updating course.

Upon completion of this updating course and passing the assessment thereof, successful management level Marine Engineer Officers shall be qualified to upgrade/renew their existing Certificates of Competency (COC) in accordance with Regulation III/2 of the 2010 STCW Manila Amendments.

MAXIMO Q MEJIA JR, PhD
Administrator

FUNCTION 1

MARINE ENGINEERING AT THE MANAGEMENT LEVEL

FUNCTION CONTENTS

Function 1 (F1): Marine Engineering at the Mangement Level

FUNCTION 1

PART A
COURSE FRAMEWORK

SCOPE
Function 1 of this updating course covers the topics relating to the gaps that were identified in order for Management Level Marine Engineer Officers who were certified under the STCW'78 Convention, as amended in 1995 to meet the additional knowledge, understanding and proficiencies (KUPs) under the 2010 STCW Manila Amendments for *"Marine Engineering at the Management Level"*.
LEARNING OBJECTIVES
Upon successful completion of the training under this Function, trainees shall be expected to have gained additional KUPs needed to meet the requirements of the 2010 STCW Manila Amendments for *"Marine Engineering at the Management Level"* on ships powered by main propulsion machinery of 3,000 kW propulsion power or more.
ENTRY STANDARD
Entrants to this course must be Management Level Marine Deck Officers who are holders of COC under Regulation III/2 of the STCW '78 Convention, as amended in 1995.
COURSE INTAKE LIMITATION
• Trainees shall not exceed 24 students per class. • Practical training using a full mission engine simulator shall follow a man-machine ratio of 4:1.
STAFF REQUIREMENTS
Every METI offering this Management Level Course shall have a Training Supervisor, a minimum of two (2) instructors and an assessor for the course; subject the approval by the Administration in accordance with MARINA Circular (MC) No. 2013-03, as amended by MC 2013-12, series of 2013. The qualification requirements shall be as follows:

STAFF REQUIREMENTS *(Continued…)*

Training Supervisor

- Holder of at least a Bachelor of Science Degree;
- Have not less than one (1) year experience in maritime education and training;
- Have an understanding of the training course and the specific objectives of the training being conducted under his supervision; and
- Holder of a Certificate of Completion of Instructor's Training Course (IMO Model Course 6.09) or 18 earned units in teacher education covering teaching methodologies, test and measurement.

Instructors

- Management Level Engineering Officer with not less than one (1) year seagoing service in that capacity on board a ship powered by main propulsion machinery of 3,000 kW propulsion power or more;
- Holder of a Certificate of Completion of Instructor's Training Course (IMO Model Course 6.09) or 18 earned units in teacher education covering teaching methodologies, test and measurement;
- Holder of a Certificate of Completion of the Management Level Course for Marine Engineer Officers;
- Holder of a COC as Management Level Marine Engineer Officer;
- Holder of a valid Professional Regulation Commission (PRC) License as Management Level Marine Engineer Officer;
- If conducting training using simulator:
  - Must be holder of a Certificate of Completion of the "Train the Simulator Trainer and Assessor" (IMO Model Course 6.10), or approved Training Course for Simulator Instructors and Assessors; and
  - Have gained practical operational experience on the particular type of simulator being used.

STAFF REQUIREMENTS *(Continued…)*

Assessors

- Management Level Engineer Officer with not less than one (1) year seagoing service in that capacity on board a ship powered by main propulsion machinery of 3,000 kW propulsion power or more;
- Holder of a Certificate of Completion of the Management Level Course for Marine Engineer Officers;
- Holder of a valid PRC License as Management Level Engineer Officer;
- Holder of a Certificate of Completion of the Training Course in Assessment, Examination and Certification of Seafarers (IMO Model Course 3.12);
- Have gained practical assessment experience as understudy for not less than three (3) times;
- If conducting assessment involving the use of simulators:
  - Must be holder of a Certificate of Completion of the Train the Simulator Trainer and Assessor (IMO Model Course 6.10), or approved Training Course for Simulator Instructors and Assessors; and
  - Has gained practical assessment experience on the particular type of simulator being used under the supervision and to the satisfaction of an experienced Assessor for a minimum of for not less than three (3) times.

Resource Person

The METI may be allowed to engage the services of other persons with established expertise on particular topics, provided that the Administration shall be duly informed at least five (5) working days prior to engagement.

NOTE TO METIs:

The foregoing are the qualification standards that must be met by the Instructors, Assessors and Supervisor. In addition, METIs shall exercise utmost diligence and responsibility in the selection of such Staff and ensure that they are appropriately qualified to carry out effective teaching, assessment and supervision of the course, respectively.

TRAINING FACILITIES
For the theoretical part, a classroom with multi-media over-head projector, with a computer set, and a white board with eraser will be utilized, among others. This does not however preclude METIs from utilizing additional teaching aids to facilitate learning.
TRAINING EQUIPMENT
A Full Mission Engine Room Simulator certified as Class "A" or similar category showing reference to STCW Table A-III/2, by an internationally recognized Classification Society, capable of simulating the required KUPs for marine engineering at the management level in the aforesaid Table, with briefing and debriefing room.
EXEMPTION
There is no particular exemption from any part of this Function. However, since topics about *Steam and Gas Turbines relating to marine propulsion plant machinery* were not covered by this updating course, a *"limitation on Steam and Gas Turbines"* shall be indicated in the COCs of successful candidates for certification.
CERTIFICATE OF COURSE COMPLETION
Trainees, who successfully completed this Function and passed the assessment thereof, shall be issued a Certificate of Completion in accordance with the format prescribed by the Administration.
SUGGESTED TEXT BOOKS AND REFERENCES
For the textbooks and reference materials, METIs should refer to the list of Teaching Aids, Videos, References, Textbooks and Bibliographies indicated in the revised IMO Model Course 7.02 validated during the 44th Session of the IMO Sub-Committee on Standards of Training and Watchkeeping. This does not however preclude METIs from utilizing other relevant and more updated books and references that may be available or prescribed by the Administration. METIs shall exercise prudence and utmost responsibility in selecting the textbooks and references for this Function to ensure that only relevant and up-to-date ones shall be used.

FUNCTION 1

PART B
COURSE OUTLINE

MAIN TOPICS	**NO. OF HOURS**
Competence	
F1 - Module 1: Manage the operation of propulsion plant machinery	
1. Marine diesel engine	8
2. Marine steam boiler	4
3. Propeller shaft and associated ancillaries	4
F1 - Module 2: Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	
1. Operating limits of propulsion plant	8
2. The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	40
3. Functions and mechanism of automatic control for main engine	4
4. Functions and mechanism of automatic control for auxiliary machinery:	
Generator distribution systems	4
Steam boilers	5
TOTAL FOR FUNCTION 1:	**77**

General Rule on Time Allocation:

METIs must note that the number of hours allocated for the topics in this Function are the minimum and can be increased as may be necessary to cover new requirements, laws, rules and regulations, new developments, trends and practices in the maritime industry.

FUNCTION 1

PART C
COURSE SYLLABUS

F1 - Module 1: Manage the operation of propulsion plant machinery

1. Design features and operative mechanism of Marine Diesel Engines and associated auxiliaries

1.1 Describes with the aid of sketches/computer aided drawing, material selection, and design features of the structure of diesel engine:

- 1.1.1 Structure of the bedplate
- 1.1.2 Bedplate connection to the tank top
- 1.1.3 Arrangement of holding down bolts
- 1.1.4 Structure of A-frames and columns
- 1.1.5 Arrangement of tie bolts
- 1.1.6 Cylinder block and entablature
- 1.1.7 Arrangement of main bearing caps
- 1.1.8 Arrangement of piston rod gland assembly
- 1.1.9 Arrangement of turbochargers and air coolers
- 1.1.10 Arrangement of turbochargers and air coolers

1.2 Describes with the aid of sketches/computer aided drawing, material selection, and design features of the running gear of diesel engine:

- 1.2.1 Crankshaft
- 1.2.2 Main bearing
- 1.2.3 Thrust block and bearing
- 1.2.4 Bottom end bearing
- 1.2.5 Connecting rod
- 1.2.6 Cross head and bearing
- 1.2.7 Guides and guide shoes
- 1.2.8 Lubrication of main bearing, bottom end bearing and cross head bearing
- 1.2.9 Cam shaft drive arrangement
- 1.2.10 Gear wheel transmission
- 1.2.11 Chain wheel transmission
- 1.2.12 Cam shaft bearing arrangement

1.3 Describes with the aid of sketches/computer aided drawing, material selection, and design features of the fuel injection equipment of diesel engine:

- 1.3.1 Fuel injection pumps including fuel pumps for common rail system
- 1.3.2 Fuel injectors
- 1.3.3 Arrangement of fuel injectors
- 1.3.4 Variable injection timing

1.4 Describes with the aid of sketches/computer aided drawing, material selection, and design features of the combustion chamber components of diesel engine:

1.4.1 Cylinder cover and mountings / excess pressure release method
1.4.2 Cooling of cylinder cover
1.4.3 Cylinder Liner and cooling arrangements
1.4.4 Piston crown
1.4.5 Piston assembly
1.4.6 Geometry of combustion chamber
1.4.7 Exhaust valve and cooling arrangement

1.5 Describes with the aid of sketches/computer aided drawing, material selection, and design features of piston rings, compatibility to cylinder liner and cylinder lubrication employed in a diesel engine:

1.5.1 Cylinder liner material
1.5.2 Piston rings material
1.5.3 Manufacturing methods of cylinder liner
1.5.4 Manufacturing methods of piston rings
1.5.5 Selection of cylinder lubrication oil

1.6 Describes with the aid of sketches the operative mechanism of diesel engine system

1.6.1 Starting and Reversing system
1.6.2 Cooling water system
1.6.3 Lubrication oil system
1.6.4 Fuel oil system
1.6.5 Scavenging, supercharging and exhausting.
1.6.6 Engine safety system
1.6.7 Engine emergency operating system

2. Design features and operative mechanism of Marine Steam Boiler and associated auxiliaries

2.1 Describes with the aid of sketches/computer aided drawing, material selection and design features of marine steam boilers:

2.1.1 Types of main steam boilers
2.1.2 Methods of construction
2.1.3 Boiler fittings and drum internals
2.1.4 Water circulation
2.1.5 Gas circulation
2.1.6 Operating parameters
2.1.7 Support and expansion
2.1.8 Superheaters and their temperature control.
2.1.9 Soot blower
2.1.10 Economizers

2.1.11 Air heaters
1.6.8 Steam to steam generation
1.6.9 Chemistry of combustion
1.6.10 Burners and burner registers
1.6.11 Local and remote water level indicators
1.6.12 Safety valves.

2.2 Describes with the aid of sketches/computer aided drawing, material selection and design features of marine steam boiler feed water systems:

1.6.13 Main feed systems
1.6.14 Condenser types, level control, construction, materials, support, expansion, operating parameters, loss of vacuum and leak testing
1.6.15 Air ejectors
1.6.16 Vacuum pumps
1.6.17 Extraction pumps
1.6.18 Gland condensers
1.6.19 Low pressure heaters
1.6.20 Drain coolers
1.6.21 High pressure heaters
1.6.22 Turbo feed pumps, hydraulic balance
1.6.23 De-aerators

3. Describes with the aid of sketches/computer aided drawing, material selection and design features of propeller shaft and associated ancillaries:

3.1 Establishing the shaft centre line
3.2 Deviation while building
3.3 Alignment deviation in service
3.4 Fair curve alignment
3.5 Shaft checks
3.6 Shaft bearings
3.7 Plain bearings
3.8 Tilting pad bearings
3.9 Roller bearings
3.10 Coupling bolts
3.11 Stern tubes
3.12 Stern tube sealing arrangements
3.13 Fixed pitch propellers
3.14 Methods of mounting fixed pitch propellers
3.15 Keyed propellers
3.16 Keyless propellers
3.17 Controllable pitch propellers
3.18 Gears and clutches
3.19 Reverse reduction gearbox
3.20 Flexible couplings
3.21 Air operated clutches

F1 - Module 2

Competence: Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery

1. Operating Limits of Propulsion Plants

1.1 Describe the parameters concerning operating limits of main diesel engine such as mean indicated pressure, maximum indicated pressure, shaft revolution, torque, scavenging air pressure, exhaust gas temperature, cooling water temperature, lubricating oil temperature, turbocharger revolution and others

1.2 Describe the parameters concerning operating limits of main steam turbine such as steam inlet pressure and temperature, torque, revolution, vibration, and others

1.3 Describe the parameters concerning operating limits of main gas turbine such as exhaust gas temperature, torque, revolution, vibration and others

1.4 Describe the parameters concerning operating limits of main/auxiliary steam boiler such as properties of boiler water, air/fuel ratio and others

1.5 Describe the parameters concerning operating limits of diesel, shaft and steam turbine generator

1.6 Describe the design standards of propulsion plants concerning operating limits of plant machinery such as sea water temperature, ambient temperature and fluid velocity

2. The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery

2.1 Diesel engines

2.2 Engine components

2.3 Fuel Injection

2.4 Scavenging and Supercharging

2.5 Starting and Reversing

2.6 Cooling systems

2.7 Diesel Engine Control and Safety

2.8 Diesel Engine Emergency operation

2.9 Multi-engine Propulsion Arrangement

2.10 Air compressors and compressed air systems

2.11 Hydraulic power system

2.12 Types of auxiliary boilers

2.13 Auxiliary steam system

2.14 Safety valves

2.15 Boiler water levels

2.16 Use of “Sea water in Boilers”

2.17 Use of Fresh Water in Boilers

2.18 Auxiliary Steam turbines

2.19 Boiler defects

2.20 Boiler survey and repairs

2.21 Evaporators

2.22 Thermal fluid heating system

3. Functions and Mechanism of Automatic Control for Main Engine

3.1 Diesel Engines

3.1.1 Describe system components and configuration for main engine automatic control

3.1.2 Describe the meaning of the following functions used for main engine automatic control including operations/control mechanism

- Automatic changeover from air running to fuel running
- Start failure
- Start impossible
- Wrong way
- Speed run-up program by revolution, load and /or combination control, including bypass program for critical speed

- Crash/Emergency astern program
- Speed control under rough/calm sea condition
- Variable injection timing
- Variable exhaust valve timing
- Safety (automatic shutdown, automatic slowdown) system

4.4.3 Describe the function and mechanism, of the lector governing system for revolution control

4. Functions and Mechanism of Automatic Control for Auxiliary Machinery

4.1 Generator and Distribution system

4.1.1 Describe system components and configuration for main engine automatic control

4.1.2 Describe the following functions used for generator and distribution system automatic control, including operation/control mechanisms

– Full automatic control for generator distribution system, including automatic starting and stopping prime mover
– Automatic synchronizing
– Automatic load sharing
– Optimum load sharing
– Large motor start blocking
– Preference trip
– Protective/Safety functions built in Automatic/Main Circuit Breaker (ACB and VCB)
– Automatic voltage (AVR) and frequency control

4.2 Steam boiler

4.2.1 Describe system components and configuration for main engine automatic control

4.2.2 Describe the following functions used for steam boiler automatic control including operation/control mechanisms

- Automatic Combustion Control (ACC), including steam pressure control, fuel oil flow control and air flow control
- Automatic feed water control
- Automatic steam temperature control
- Protective/Safety functions for steam boiler

FUNCTION 2

ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE MANAGEMENT LEVEL

FUNCTION CONTENTS

Function 2 (F2): Electrical, Electronic and Control Engineering at the Management Level

Part A: Course Framework

Part B: Course Outline

Part C: Course Syllabus

FUNCTION 2

PART A
COURSE FRAMEWORK

SCOPE
Function 2 of this updating course covers the topics relating to the gaps that were identified in order for Management Level Marine Engineer Officers who were certified under the STCW'78 Convention, as amended in 1995 to meet the additional knowledge, understanding and proficiencies (KUPs) under the 2010 STCW Manila Amendments for *"Electrical, Electronic and Control Engineering at the Management Level"*.
LEARNING OBJECTIVES
Upon successful completion of the training under this Function, trainees shall be expected to have gained additional KUPs needed to meet the requirements of the 2010 STCW Manila Amendments for *"Electrical, Electronic and Control Engineering at the Management Level"* on ships powered by main propulsion machinery of 3,000 kW propulsion power or more.
ENTRY STANDARD
Entrants to this course must be Management Level Marine Deck Officers who are holders of COC under Regulation III/2 of the STCW '78 Convention, as amended in 1995.
COURSE INTAKE LIMITATION
• Trainees shall not exceed 24 students per class. • Practical training using a full mission engine simulators shall follow a man-machine ration of 4:1
STAFF REQUIREMENTS
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STAFF REQUIREMENTS *(Continued…)*

Training Supervisor

- Holder of at least a Bachelor of Science Degree;
- Have not less than one (1) year experience in maritime education and training;
- Have an understanding of the training course and the specific objectives of the training being conducted under his supervision; and
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- Holder of a Certificate of Completion of Instructor's Training Course (IMO Model Course 6.09) or 18 earned units in teacher education covering teaching methodologies, test and measurement;
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- If conducting training using simulator:
  - Must be holder of a Certificate of Completion of the "Train the Simulator Trainer and Assessor" (IMO Model Course 6.10), or approved Training Course for Simulator Instructors and Assessors; and
  - Have gained practical operational experience on the particular type of simulator being used

STAFF REQUIREMENTS *(Continued…)*

Assessors

- Management Level Engineer Officer with not less than one (1) year seagoing service in that capacity on board a ship powered by main propulsion machinery of 3,000 kW propulsion power or more;
- Holder of a Certificate of Completion of the Management Level Course for Marine Engineer Officers;
- Holder of a valid PRC License as Management Level Engineer Officer;
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- Have gained practical assessment experience as understudy for not less than three (3) times;
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Resource Person

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NOTE TO METIs:

The foregoing are the qualification standards that must be met by the Instructors, Assessors and Supervisor. In addition, METIs shall exercise utmost diligence and responsibility in the selection of such Staff and ensure that they are appropriately qualified to carry out effective teaching, assessment and supervision of the course, respectively.

TRAINING FACILITIES
For the theoretical part, a classroom with multi-media over-head projector, with a computer set, and a white board with eraser will be utilized, among others. This does not however preclude METIs from utilizing additional teaching aids to facilitate learning.
TRAINING EQUIPMENT
Electrical laboratory equipment and training materials for analyzing and testing.
CERTIFICATE OF COURSE COMPLETION
Trainees, who successfully completed this Function and passed the assessment thereof, shall be issued a Certificate of Completion. The format of such certificate shall be in accordance with the format prescribed by the Administration.
SUGGESTED TEXT BOOKS AND REFERENCES
For the textbooks and reference materials, METIs should refer to the list of Teaching Aids, Videos, References, Textbooks and Bibliographies indicated in the revised IMO Model Course 7.02 validated during the 44th Session of the IMO Sub-Committee on Standards of Training and Watchkeeping. This does not however preclude METIs from utilizing other relevant and more updated books and references that may be available or prescribed by the Administration. METIs shall exercise prudence and utmost responsibility in selecting the textbooks and references for this Function to ensure that only relevant and up-to-date ones shall be used.

FUNCTION 2

PART B
COURSE OUTLINE

MAIN TOPICS	**NO. OF HOURS**
Competence	
F2 - Module 1: Manage operation of electrical and electronic control equipment	
1. Electronics, power electronics	8
2. Automatic control engineering and safety devices	8
3. Design features and system configurations of automatic control equipment and safety devices:	
General Requirements	2
Main engine	12
Generator and distribution system	2
Steam boiler	2
Design features and system configuration of operational control equipment for electrical motors	16
Design features of high-voltage installations	22
Features of hydraulic and pneumatic control equipment	8
F2 - Module 2: Manage trouble shooting restoration of electrical and electronic control equipment to operating condition (Practical Knowledge)	
1. Trouble shooting of electrical and electronic control equipment	24
2. Function test of electrical, electronic control equipment and safety devices	8
3. Trouble shooting of monitoring systems	8
4. Software version control	16
TOTAL FOR FUNCTION 2:	**136**

General Rule on Time Allocation:

METIs must note that the number of hours allocated for the topics in this Function are the minimum and can be increased as may be necessary to cover new requirements, laws, rules and regulations, new developments, trends and practices in the maritime industry.

FUNCTION 2

PART C
COURSE SYLLABUS

F2 - Module 1

Competence: Manage Operation of Electrical and Electronic Control Equipment

1. Marine Electronics, Power Electronics, Automatic Control Engineering and Safety Devices

1.1 Electronics, Power Electronics

1.1.1 Discusses the operation of semiconductor devices

1.1.2 Explains Integrated Circuits

1.1.3 Explains electronic fault diagnosis on board ship

1.2 Automatic Control Engineering and safety devices

1.2.1 Explains the basic concepts of:

- Open and closed control loops
- Process control.
- Essential components in process control loops

1.2.2 Explains the operation and use of sensors and transmitters in shipboard systems

1.2.3 Discusses Controllers and Basic Control Theory

1.2.4 Identifies the operation and use of Final Control Elements

1.2.5 Control Loop Analysis

1.2.6 Explains the operation and use of governors

2. Design Features and Systems Configurations of Automatic Control Equipment and Safety Devices for the following:

2.1 General Requirements

2.2 Main Engine

2.2.1 Control Theory

2.2.2 Tuning

2.2.3 Signal Transmission Systems

2.2.4 Final Control Elements

2.2.5 Electronic PID Controllers

2.2.6 Monitoring & Control Systems

2.2.7 General requirements of automatic control equipment and safety devices

2.2.8 Remote control – Diesel propulsion

2.2.9 UMS Systems

2.3 Generator and distribution system

2.3.1 Instrumentation and Safety in Generator and Distribution system

2.3.2 Auxiliary Diesel Generator Alarm and Shut Down

2.3.3 Automatic Starting of Propulsion Auxiliaries

2.4 Steam Boiler

2.4.1 Following failures will have alarms and display - feedwater high salinity, high water level, boiler pressure high and low, superheater outlet temperature high, fuel pump low outlet pressure, heavy fuel temperature high and low (or high and low viscosity), uptake high gas temperature, control system power failure, atomization steam / air pressure low

2.4.2 Following failures will have alarms, display and automatic shutdown of boiler - low water level, supply air pressure failure, ignition or flame failure.

3. Design Features and System Configuration of Operational Control Equipment for Electrical Motors

3.1 Three Phase A.C. Motors

3.2 Three Phase Synchronous Motors

3.3 Effect of varying frequency and voltage of A.C. Motors

3.4 Motor control and protection

3.5 Motor control and protection

3.6 Insulated Gate Bipolar Transistor (IGBT) motor speed control

3.7 Motor speed control by Thyristors

3.8 Three Phase Generators

3.9 Three Phase Transformers

3.10 Distribution

3.11 Emergency Power

4. Design Features of High-Voltage Installations

4.1 Generation and distribution of high voltage on ships

4.2 Electric propulsion system

4.3 Synchro-convertors and cyclo-convertors

4.4 Functional, operational and safety requirements for a marine high-voltage system

4.4.1 Assigning qualified personnel to carry out maintenance and repair of high-voltage switchgear of various types

4.4.2 High voltage system advantages

4.4.3 Advantages of an insulated system

4.4.4 High voltage circuit breakers

4.4.5 High voltage cable

4.4.6 High voltage fuses

4.4.7 Remedial action necessary during faults in a high-voltage system

4.4.8 Switching strategy for isolating components of a high- voltage system

4.4.9 Selection of suitable apparatus for isolation and testing of high-voltage equipment

4.4.10 Switching and isolation procedure on a marine high-voltage system, complete with safety documentation

4.4.11 Performance of insulation resistance and polarization index on high-voltage equipment

4.5 Safe Operation and Maintenance of High Voltage Systems

4.5.1 Knows how to use HV personal protection equipment (PPE): insulated gloves, goggles, insulating bars, insulating footwear, mates earthing cables, HV testers

4.5.2 Knows terms of certification of personal equipment

4.5.3 Explains HV safety procedures:

- Permission and co-ordination of HV works
- Information, warnings and protection against unauthorized influence on safety
- Assistance during HV work
- Checking for voltage presence before any work starts

5. Features of Hydraulic and Pneumatic Control Equipment

5.1 Hydraulic Control Equipments

- System components, Hydraulic Circuits, Hydraulic System Fitting & Maintenance.

5.2 Pneumatic Control Equipment

- Fluids, Pneumatic Circuits, Pneumatic System Fitting & Maintenance Components and Trouble shooting

F2 - Module 2

Competence: Manage Trouble Shooting Restoration of Electrical and Electronic Control Equipment to Operating Condition (Practical Knowledge)

1. Trouble Shooting of Electrical and Electronic Equipment

1.1 Electrical Safety

1.2 Test Equipment

1.3 Interpretation of Circuit Symbols

1.4 Logical six step troubleshooting procedure

1.5 Generation

1.6 Prime Mover Electrical Controls

1.7 Main Circuit Breaker

1.8 Protection of Generators

1.9 Electrical Distribution Systems

1.10 Motors

1.11 Electrical Survey Requirements

1.12 Caliber & Adjust Transmitters & Controllers

1.13 Control System Fault Finding

2. Function Test of Electrical, Electronic Control Equipment and Safety Devices

2.1 Function test of Electrical, Electronic Control Equipment and Safety Devices But Not Limited To

2.1.1 Function test Over Current Relay (OCR)
2.1.2 Function test Relays and magnetic contactors
2.1.3 Function test Timers
2.1.4 Function test Fuses
2.1.5 Function test MCCB
2.1.6 Function test ACB
2.1.7 Function test Diodes
2.1.8 Function test Silicon Controlled Rectifier (SCR)
2.1.9 Function test Temperature, Pressure and Level transmitters:
2.1.10 Function test Overspeed Protection Devices
2.1.11 Function test Flame Scanners
2.1.12 Function test Fire Detecting System

3. Trouble Shooting of Monitoring Systems

3.1 Test and Calibrations of Sensors and Transducers of Monitoring Systems But Not Limited To

1.1.1 Testing and calibration of pressure sensor and transducer

1.1.2 Testing and calibration of temperature sensor and transducer

1.1.3 Testing and calibration of flow sensor and transducer

1.1.4 Testing and calibration of level sensor and transducer

1.1.5 Testing and calibration of tachometer sensor and transducer

1.1.6 Testing and calibration of viscometer sensor and transducer

4. Software Version Control

4.1 Programmable logic controllers (PLC)

4.1.1 Basics of PLC operation

4.1.2 Comparison between hard-wired and programmable control operation

4.1.3 Advantages of PLCs

4.1.4 Binary number conversion

4.1.5 Digital logic gates and its practical application

4.1.6 Inputs and output modules and configuration of PLCs

4.1.7 Understanding of ladder logic and PLCs programming

4.1.8 Human Machine Interface (HMI) and alteration of parameters in the program

4.1.9 Basic software version and control of access.

4.1.10 Maintenance of Electronic Control Equipment and PLC Controlled processes

4.1.11 Checking the program validity and faultfinding and restoration of process with the help of PLCs

4.2 Microcontrollers

4.2.1 Introduction to microcontroller

4.2.2 Basics of microcontroller

4.2.3 Analog to digital convertor

4.2.4 Digital interfaces

4.2.5 Serial peripheral interface

4.2.6 Communication with PC

4.2.7 Code integration

4.3 Digital Techniques

4.3.1 Basic Logic gates and derived Logic gates. Boolean algebra.

4.3.2 Principles and operation of digital integrated circuits (TTL and CMOS), adders, flip flops, registers, counters, multiplexers, encoders and decoders.

4.3.3 Memories, RAM, ROM, PROM, EPROM,UVPROM

4.3.4 Microprocessors, principles of operation, input/output functions, application in marine control systems, programs, alteration of values

4.3.5 Single integrated circuit containing a processor core, memory, and programmable input/output peripherals.

4.3.6 Program memory in the form of NOR flash or OTP ROM is also often included on chip and RAM.

4.3.7 Microcontrollers- designed for embedded applications and real time response to events

4.3.8 Typical input and output devices- switches, relays, solenoids, LEDs, radio frequency devices, and sensors for data such as temperature, humidity, light level etc.

4.3.9 Description and use of General Purpose Input / Output pins (GPIO).

4.3.10 Analog-to-digital converter (ADC)

4.3.11 Digital-to-analog converter (DAC)

FUNCTION 3

MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL

FUNCTION CONTENTS

Function 3 (F3): Maitenance and Repair at the Manegemnt Level

FUNCTION 3

PART A
COURSE FRAMEWORK

SCOPE
Function 3 of this updating course covers the topics relating to the gaps that were identified in order for Management Level Marine Engineer Officers who were certified under the STCW'78 Convention, as amended in 1995 to meet the additional knowledge, understanding and proficiencies (KUPs) under the 2010 STCW Manila Amendments for *"Maintenance and Repair at the Management Level"*.
LEARNING OBJECTIVES
Upon successful completion of the training under this Function, trainees shall be expected to have gained additional KUPs needed to meet the requirements of the 2010 STCW Manila Amendments for *"Maintenance and Repair at the Management Level"* on ships powered by main propulsion machinery of 3,000 kW propulsion power or more.
ENTRY STANDARD
Entrants to this course must be Management Level Marine Deck Officers who are holders of COC under Regulation III/2 of the STCW '78 Convention, as amended in 1995.
COURSE INTAKE LIMITATION
• Trainees shall not exceed 24 students per class. • Practical training using a full mission engine simulators shall follow a man-machine ration of 4:1
STAFF REQUIREMENTS
Every METI offering this Management Level Course shall have a Training Supervisor, a minimum of two (2) instructors and an assessor for the course; subject the approval by the Administration in accordance with MARINA Circular (MC) No. 2013-03, as amended by MC 2013-12, series of 2013. The qualification requirements shall be as follows:

STAFF REQUIREMENTS *(Continued…)*

Training Supervisor

- Holder of at least a Bachelor of Science Degree;
- Have not less than one (1) year experience in maritime education and training;
- Have an understanding of the training course and the specific objectives of the training being conducted under his supervision; and
- Holder of a Certificate of Completion of Instructor's Training Course (IMO Model Course 6.09) or 18 earned units in teacher education covering teaching methodologies, test and measurement.

Instructors

- Management Level Engineering Officer with not less than one (1) year seagoing service in that capacity on board a ship powered by main propulsion machinery of 3,000 kW propulsion power or more;
- Holder of a Certificate of Completion of Instructor's Training Course (IMO Model Course 6.09) or 18 earned units in teacher education covering teaching methodologies, test and measurement;
- Holder of a Certificate of Completion of the Management Level Course for Marine Engineer Officers;
- Holder of a COC as Management Level Marine Engineer Officer;
- Holder of a valid Professional Regulation Commission (PRC) License as Management Level Marine Engineer Officer;
- If conducting training using simulator:
  - Must be holder of a Certificate of Completion of the "Train the Simulator Trainer and Assessor" (IMO Model Course 6.10), or approved Training Course for Simulator Instructors and Assessors; and
  - Have gained practical operational experience on the particular type of simulator being used

STAFF REQUIREMENTS *(Continued…)*

Assessors

- Management Level Engineer Officer with not less than one (1) year seagoing service in that capacity on board a ship powered by main propulsion machinery of 3,000 kW propulsion power or more;
- Holder of a Certificate of Completion of the Management Level Course for Marine Engineer Officers;
- Holder of a valid PRC License as Management Level Engineer Officer;
- Holder of a Certificate of Completion of the Training Course in Assessment, Examination and Certification of Seafarers (IMO Model Course 3.12);
- Have gained practical assessment experience as understudy for not less than three (3) times;
- If conducting assessment involving the use of simulators:
  - Must be holder of a Certificate of Completion of the Train the Simulator Trainer and Assessor (IMO Model Course 6.10), or approved Training Course for Simulator Instructors and Assessors; and
  - Has gained practical assessment experience on the particular type of simulator being used under the supervision and to the satisfaction of an experienced Assessor for a minimum of for not less than three (3) times.

Resource Person

The METI may be allowed to engage the services of other persons with established expertise on particular topics, provided that the Administration shall be duly informed at least five (5) working days prior to engagement.

NOTE TO METIs:

The foregoing are the qualification standards that must be met by the Instructors, Assessors and Supervisor. In addition, METIs shall exercise utmost diligence and responsibility in the selection of such Staff and ensure that they are appropriately qualified to carry out effective teaching, assessment and supervision of the course, respectively.

TRAINING FACILITIES
For the theoretical part, a classroom with multi-media over-head projector, with a computer set, and a white board with eraser will be utilized, among others. This does not however preclude METIs from utilizing additional teaching aids to facilitate learning.
TRAINING EQUIPMENT
A Full Mission Engine Simulator certified as Class "A" or similar category showing reference to STCW Table A-III/2, by an internationally recognized Classification Society, capable of simulating a total shipboard engine operations; or Practical laboratory equipment for maintenance and repair.
CERTIFICATE OF COURSE COMPLETION
Trainees, who successfully completed this Function and passed the assessment thereof, shall be issued a Certificate of Completion. The format of such certificate shall be in accordance with the format prescribed by the Administration.
SUGGESTED TEXT BOOKS AND REFERENCES
For the textbooks and reference materials, METIs should refer to the list of Teaching Aids, Videos, References, Textbooks and Bibliographies indicated in the revised IMO Model Course 7.02 validated during the 44th Session of the IMO Sub-Committee on Standards of Training and Watchkeeping. This does not however preclude METIs from utilizing other relevant and more updated books and references that may be available or prescribed by the Administration. METIs shall exercise prudence and utmost responsibility in selecting the textbooks and references for this Function to ensure that only relevant and up-to-date ones shall be used.

FUNCTION 3

PART B
COURSE OUTLINE

MAIN TOPICS	**NO. OF HOURS**
Competence	
F3 - Module 1: Manage Safe and Effective Maintenance and Repair Procedures	
1. Manage Safe and Effective Maintenance and Repair Procedures	10
2. Planning Maintenance, Including Statutory and Class Verifications	5
3. Planning Repairs	5
F3 - Module 2: Detect and Identify the Cause of Machinery Malfunctions and Correct Faults	
1. Inspection and Adjustment of Equipment	5
2. Non-Destructive Examination	10
TOTAL FOR FUNCTION 3:	**35**

General Rule on Time Allocation:

METIs must note that the number of hours allocated for the topics in this Function are the minimum and can be increased as may be necessary to cover new requirements, laws, rules and regulations, new developments, trends and practices in the maritime industry.

FUNCTION 3

PART C
COURSE SYLLABUS

F3 - Module 1

Competence: Manage Safe and Effective Maintenance and Repair Procedures

1 Manage Safe and Effective Maintenance and Repair Procedures

1.1 Discusses the preparation and practice of Dry-docking, In-Water survey and lay up

- Dry-dock repair file
- Preparation of dry-dock repair specification
- Dry-docking and in-water survey
- Initial and final dry-dock inspection
- Supporting the vessel in dry-dock
- Preparations for dry-docking and undocking
- Survey work and maintenance during dry-dock
- Typical arrangement for the supply of electrical power, fresh water and sanitation facilities while the vessel is in dry-dock
- Special arrangements during dry-dock for the prevention of fires and explosions
- The management of oil and water tanks during dry-docks. Testing of tanks by hydrostatic and pneumatic means
- Describe the preparations, inspections, records, planning, maintenance and events which occur with dry docking and in-water hull surveys
- Lay ups. Plan aspects of dry-docking, in water hull cleaning, and vessel layup/reactivation.

2 Manage Safe and Effective Maintenance and Repair Procedures Practical Knowledge

2.1 Planning maintenance, including statutory and class verifications

- Dismantled in sequential order as per manufacturer's instruction manual
- Cleaned prior to inspection
- Inspected and/or calibrated as appropriate
- Items are assessed to determine whether can be reused or need to be replace/repaired/reconditioned
- Above information recorded in maintenance record of equipment/machines
- Entry completed in spare parts inventory

3 Planning Repairs

3.1 Conducts planned maintenance that involves assembly and testing

- Individual parts are tested as per manufacturer's instruction manual
- Parts are assembled in sequential order as per manufacturer's instruction manual

- Pre-start checks are carried out in accordance with manufacturer's instruction manual
- Equipment / machinery is run up and relevant performance criteria are compared and recorded
- Updating of maintenance schedule records

F3 - Module 2

Competence: Detect and Identify the Cause of Machinery Malfunctions and Correct Faults

1. Inspection and Adjustment of Equipment

1.1 Inspection and adjustment of equipment

1.1.1 Discusses daily, weekly, monthly and routine inspection as per manufacturer's instruction manual

1.1.2 Identifies inspection of equipment as per class and statutory requirements

1.1.3 Completes adjustment of equipment as per manufacturer's instruction manual

1.1.4 Identifies the special tools for adjustment of equipment

2. Non-destructive Examination

2.1 Different types of non-destructive examination

2.1.1 Discusses the practice and limitations of Visual Inspection

- Unaided visual inspection
- Use of optical aids
- Application of visual inspection on board ship

2.1.2 Discusses the use of dye penetrant testing

- Use of cleaner, penetrant and developer
- Inspection and evaluation

2.1.3 Discusses the use of Magnetic Particle Testing

- Principles of magnetic particle testing
- Magnetizing using electromagnetic
- Use of premixed aerosol cans of wet fluorescent iron oxide visible in ultraviolet rays
- Use of cracked detection of tail end shat taper

2.1.4 Discusses the use of Radiography

- Use of radiography in testing welds

2.1.5 Discusses the use of portable hardness measurement
- Measurement of hardness by portable instrument
- Used on board to check harness of turbocharges compressor impeller

2.1.6 Discusses the use of Thermography
- Use of thermographic camera using infrared imaging
- Used on board for measurement of temperature variations

FUNCTION 4

CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

FUNCTION CONTENTS

Function 4 (F4): Maitenance and Repair at the Manegement Level

Part A: Course Framework

Part B: Course Outline

Part C: Course Syllabus

FUNCTION 4

PART A
COURSE FRAMEWORK

SCOPE
Function 4 of this updating course covers the topics relating to the gaps that were identified in order for Management Level Marine Engineer Officers who were certified under the STCW'78 Convention, as amended in 1995 to meet the additional knowledge, understanding and proficiencies (KUPs) under the 2010 STCW Manila Amendments for *"Controlling the Operation of the Ship and Care of Persons On Board at the Management Level"*.
LEARNING OBJECTIVES
Upon successful completion of the training under this Function, trainees shall be expected to have gained additional KUPs needed to meet the requirements of the 2010 STCW Manila Amendments for *"Controlling the Operation of the Ship and Care of Persons On Board at the Management Level"* on ships powered by main propulsion machinery of 3,000 kW propulsion power or more.
ENTRY STANDARD
Entrants to this course must be Management Level Marine Deck Officers who are holders of COC under Regulation III/2 of the STCW '78 Convention, as amended in 1995.
COURSE INTAKE LIMITATION
• Trainees shall not exceed 24 students per class. • Practical training using a full mission engine simulators shall follow a man-machine ration of 4:1
STAFF REQUIREMENTS
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STAFF REQUIREMENTS *(Continued…)*

Training Supervisor

- Holder of at least a Bachelor of Science Degree;
- Have not less than one (1) year experience in maritime education and training;
- Have an understanding of the training course and the specific objectives of the training being conducted under his supervision; and
- Holder of a Certificate of Completion of Instructor's Training Course (IMO Model Course 6.09) or 18 earned units in teacher education covering teaching methodologies, test and measurement.

Instructors

- Management Level Engineering Officer with not less than one (1) year seagoing service in that capacity on board a ship powered by main propulsion machinery of 3,000 kW propulsion power or more;
- Holder of a Certificate of Completion of Instructor's Training Course (IMO Model Course 6.09) or 18 earned units in teacher education covering teaching methodologies, test and measurement;
- Holder of a Certificate of Completion of the Management Level Course for Marine Engineer Officers;
- Holder of a COC as Management Level Marine Engineer Officer;
- Holder of a valid Professional Regulation Commission (PRC) License as Management Level Marine Engineer Officer;
- If conducting training using simulator:
  - Must be holder of a Certificate of Completion of the "Train the Simulator Trainer and Assessor" (IMO Model Course 6.10), or approved Training Course for Simulator Instructors and Assessors; and
  - Have gained practical operational experience on the particular type of simulator being used

STAFF REQUIREMENTS *(Continued…)*

Assessors

- Management Level Engineer Officer with not less than one (1) year seagoing service in that capacity on board a ship powered by main propulsion machinery of 3,000 kW propulsion power or more;
- Holder of a Certificate of Completion of the Management Level Course for Marine Engineer Officers;
- Holder of a valid PRC License as Management Level Engineer Officer;
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TRAINING FACILITIES
For the theoretical part, a classroom with multi-media over-head projector, with a computer set, and a white board with eraser will be utilized, among others. This does not however preclude METIs from utilizing additional teaching aids to facilitate learning.
TRAINING EQUIPMENT
A Full Mission Engine Room Simulator certified as Class "A" or similar category showing reference to STCW Table A-III/2, by an internationally recognized Classification Society, capable of simulating the required knowledge, understanding and proficiencies (KUPs) for controlling the operation of the ship and care of persons on board at the management level in the aforesaid Table, with briefing and debriefing room.
CERTIFICATE OF COURSE COMPLETION
Trainees, who successfully completed this Function and passed the assessment thereof, shall be issued a Certificate of Completion. The format of such certificate shall be in accordance with the format prescribed by the Administration.
SUGGESTED TEXT BOOKS AND REFERENCES
For the textbooks and reference materials, METIs should refer to the list of Teaching Aids, Videos, References, Textbooks and Bibliographies indicated in the revised IMO Model Course 7.02 validated during the 44th Session of the IMO Sub-Committee on Standards of Training and Watchkeeping. This does not however preclude METIs from utilizing other relevant and more updated books and references that may be available or prescribed by the Administration. METIs shall exercise prudence and utmost responsibility in selecting the textbooks and references for this Function to ensure that only relevant and up-to-date ones shall be used.

FUNCTION 4

PART B
COURSE OUTLINE

MAIN TOPICS	**NO. OF HOURS**
Competence	
F4 - Module 4: Use of leadership and managerial skills	
1. Application of task and workload management	8
2. Effective resource management	8
3. Decision-making techniques	7
4. Development, implementation and oversight of standard operating procedures	1
TOTAL FOR FUNCTION 4:	**24**

General Rule on Time Allocation:

METIs must note that the number of hours allocated for the topics in this Function are the minimum and can be increased as may be necessary to cover new requirements, laws, rules and regulations, new developments, trends and practices in the maritime industry.

FUNCTION 4

PART C
COURSE SYLLABUS

F4 - Module 1

Competence: Use of Leadership and Managerial Skill

1. Application of Task and Workload Management

1.1 Task and Workload Management

1.1.1 reviews theories on applying task and workload management from IMO Model Course 1.39, Leadership and Teamwork
1.1.2 explains that the scope of activity and conflict between activities managed by management level officers is broader than for operational level officers and requires greater task and workload management ability
1.1.3 plans the task and workload allocation for significant shipboard activities so that the following are considered:
- human limitations
- personal abilities
- time and resource constraints
- Prioritization
- workload, rest and fatigue

1.1.4 discusses strategies to monitor the effectiveness of task and workload management during an activity and to adjust the plan as necessary
1.1.5 discusses strategies to ensure that all personnel understand the activity to be undertaken and their tasks in this
1.1.6 discusses whether the encouragement of a challenge and response environment is appropriate to the task and workload management of particular shipboard tasks
1.1.7 discusses the importance of debriefs and reflection after activities have been conducted to identify opportunities for improving task and workload management

2. Effective Resource Management

1.1 Application of effective resource management at the management level

1.1.1 reviews theories on effective communication
1.1.2 demonstrates effective communication in simulated or real situations involving communications on board ship and between ship and shore
1.1.3 discusses how management level officers can encourage other personnel to use effective communications
1.1.4 reviews theories on effective resource allocation, assignment and prioritization

1.1.5 demonstrates the effective allocation, assignment and prioritization of resources when managing simulated or real shipboard activities
1.1.6 reviews theories on decision making that considers team experience
1.1.7 demonstrates the ability to involve team member effectively in decision making when managing simulated or real shipboard activities
1.1.8 reviews theories on assertiveness and leadership
1.1.9 discusses appropriate leadership styles and levels of assertiveness for management level officers in a range of shipboard activities
1.1.10 demonstrates the ability to apply appropriate leadership styles and levels of assertiveness when managing simulated or real shipboard activities
1.1.11 reviews theories on obtaining and maintaining situational awareness
1.1.12 demonstrates the ability to obtain and maintain situational awareness when managing complex simulated or real shipboard activities
1.1.13 reviews theories on the use of short and long term strategies
1.1.14 demonstrates the ability to apply short and long term strategies when managing simulated or real shipboard activities

3. Decision Making Techniques

4.1 Situation and risk assessment

4.1.1 reviews theories of situation and risk assessment
4.1.2 discusses formal and informal approaches to risk assessment
4.1.3 identifies typical risks that management level officers may have to assess
4.1.4 demonstrates the ability to effectively assess risk in the planning and conduct of simulated or real shipboard activities

4.2 Identify and generate options

5.1.1 review theories on identifying and generating options
5.1.2 demonstrate the ability to identify and generate options when making decisions as a management level officer in simulated or real shipboard activity

4.3 Selecting Course of Action

4.3.1 reviews theories on selecting the course of action in making decisions
4.3.2 demonstrate the ability to select appropriate courses of action when making decisions as a management level officer in simulated or real shipboard activity

4.4 Evaluation of outcome effectiveness

4.4.1 explains how to carry out the evaluation of outcome effectiveness and the importance of doing it

4. Development, Implementation and Oversight of Standard Operating Procedures

4.1 discusses approaches to developing standard operating procedures (SOP's)

4.2 explains the methods to implement the SOP's

4.3 explains why it may be desirable for there to be oversight and approval of many SOPs

(End of the Course)