

SUB-COMMITTEE ON HUMAN ELEMENT,  
TRAINING AND WATCHKEEPING  
5th session  
Agenda item 3

HTW 5/3/1/Add.1  
13 April 2018  
Original: ENGLISH

## **VALIDATED MODEL TRAINING COURSES**

### **Draft new model course on Electro-technical rating**

#### **Note by the Secretariat**

##### **SUMMARY**

*Executive summary:* This document provides the draft new model course on Electro-technical rating

*Strategic direction, if applicable:* 1

*Output:* 1.3

*Action to be taken:* Paragraph 2

*Related document:* HTW 5/3/1

#### **General**

1 The draft new model course on Electro-technical rating referred to in document HTW 5/3/1 is set out in the annex.

#### **Action requested of the Sub-Committee**

2 The Sub-Committee is invited to consider the draft new model course on Electro-technical rating, as set out in the annex, together with the report of the Review Group, as set out in document HTW 5/3/1, and take action, as appropriate.

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**ANNEX**

**DRAFT NEW MODEL COURSE ON ELECTRO-TECHNICAL RATING**

**Model  
Course  
X.XX**

**ELECTRO-TECHNICAL RATING**

2018 Edition



London, 2018

## **ACKNOWLEDGEMENTS**

The International Maritime Organization (IMO) wishes to express its sincere appreciation to Republic of the Philippines and the Maritime Industry Authority (MARINA) of the Philippines for the valuable assistance and cooperation in the development of this model course.

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## Foreword

[To be inserted by the Secretariat]

KITACK LIM  
*Secretary-General*

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## Introduction

### ■ Purpose of the model courses

The purpose of the IMO model courses is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved.

It is not the intention of the model course programme to present instructors with a rigid "teaching package" which they are expected to "follow blindly". Nor is it the intention to substitute audio-visual or "programmed" material for instructors' presence. As in all training endeavours, the knowledge, skills and dedication of instructors are the key components in the transfer of knowledge and skills to those being trained through IMO model course material.

Because educational systems and the cultural backgrounds of trainees in maritime subjects vary considerably from country to country, the model course material has been designed to identify the basic entry requirements and trainee target group for each course in universally applicable terms, and to specify clearly the technical content and levels of knowledge and skill necessary to meet the intent of IMO conventions and related recommendations.

### ■ Use of the model course

To use the model course, instructors should review the general outline and detailed outline, taking into account the information provided under the entry standards specified in the course framework. The actual level of knowledge and skills and the prior technical education of the trainees should be kept in mind during this review, and any areas within the detailed syllabus which may cause difficulties because of differences between the actual trainee entry level and that assumed by the course designer should be identified. To compensate for such differences, instructors are expected to delete from the course, or reduce the emphasis on, items dealing with knowledge or skills already attained by the trainees. Instructors should also identify any academic knowledge, skills or technical training which they may not have acquired. By analysing the general outline and the academic knowledge required to allow training in the technical area to proceed, instructors can design an appropriate pre-entry course or, alternatively, insert the elements of academic knowledge required to support the technical training elements concerned at appropriate points within the technical course.

Adjustment of the course objectives, scope and content may also be necessary if in the national maritime industry the trainees completing the course are to undertake duties which differ from the course objectives specified in the model course. Within the general outline, the course designers have indicated their assessment of the time that should be allotted to each learning area. However, it must be appreciated that these allocations assume that the trainees have fully met all entry requirements of the course. Instructors should therefore review these assessments and may need to re-allocate the time required to achieve each specific learning objective.

### ■ Lesson plans

Having adjusted the course content to suit the trainee intake and any revision of the course objectives, instructors should draw up lesson plans based on the detailed syllabus. The detailed syllabus contains specific references to the textbooks or teaching material proposed for use in the course. Where no adjustment has been found necessary in the learning objectives of the detailed syllabus, the lesson plans may simply consist of the detailed syllabus with keywords or other reminders added to assist instructors in the presentation of the material.

## ■ Presentation

The presentation of concepts and methodologies must be repeated in various ways until instructors are satisfied that the trainee has attained each specified learning objective. The detailed outline is laid out in learning-objective format and each objective specifies what the trainee must be able to do as the learning outcome.

## ■ Implementation

For the course to run smoothly and to be effective, considerable attention must be paid to the availability and use of:

- properly qualified instructors;
- relevant support staff;
- teaching and other spaces;
- appropriate equipment and teaching aids;
- videos and multi-media presentations;
- textbooks, appropriate technical papers, etc.; and
- other relevant reference material.

Thorough preparation is the key to successful implementation of the course. IMO has produced "*Guidance on the Implementation of IMO Model Courses*," which deals with this aspect in greater detail.

## ■ Training and the STCW Convention

The standards of competence that have to be met by seafarers are defined in Part A of the STCW Code in the International Convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW Convention), 1978, as amended. This IMO model course addresses the competences and the training that is required to achieve the standards for the knowledge, understanding and proficiency (KUPs) set out in table A-III/7 of the STCW Code.

**Part A** provides the framework for the course with its aims and objectives and notes on the suggested teaching facilities and equipment. A list of useful teaching aids, IMO references and textbooks is also included.

**Part B** provides an outline of lectures, demonstrations and exercises for the course. A suggested timetable is included, but from the teaching and learning point of view, it is more important that the trainee achieves the minimum standard of competence defined in the STCW Code than that a strict timetable is followed. Depending on their experience and ability, some trainees will naturally take longer to become proficient in some topics than in others. Also included in this section are guidance notes and additional explanations.

A separate IMO model course addresses Assessment of Competence. This course explains the use of various methods for demonstrating competence and criteria for evaluating competence as tabulated in the STCW Code.

**Part C** gives the Detailed Teaching Syllabus. This is based on the theoretical and practical knowledge specified in the STCW Code. It is written as a series of learning objectives, in other words what the trainee is expected to be able to do as a result of the learning experience. Each of the objectives is expanded to define a required performance of knowledge, understanding and proficiency. IMO references, textbook references and suggested teaching aids are included to assist instructors in designing lessons.

The new training requirements for these competences are addressed in the appropriate parts of the detailed teaching syllabus.

**Part D** gives guidance notes and additional explanations to instructors on the topics and learning outcomes listed in Part C. For the various topics, this part presents subject matter details, activities and recommended presentation and assessment techniques.

**Part E** presents a generic guide for effective evaluation/assessment of trainees. Parts C and D of this model course address the generic subject matter of Part E in greater detail.

## ■ Validation

The guidance contained in this document has been validated by the Sub-Committee on Human Element, Training and Watchkeeping for use by Administrations and training providers in developing relevant training programmes for the effective implementation of uniform minimum standards for training and certification of seafarers. Validation in this context means that the Sub-Committee has found no grounds to object to the contents of this model course, but has not granted its approval to the document, as the Sub-Committee does not consider any model course to be an official interpretation of IMO Instruments.

## Part A: Course Framework

### ■ Aim

The aim of this model course is to meet the mandatory minimum standards of competence for seafarers as Electro-Technical Ratings, for the Functions: electrical, electronic and control engineering; maintenance and repair; and controlling the operation of the ship and care for persons on board, at the support level specified in table A-III/7 of the STCW Code.

### ■ Objectives

The objective is to provide trainees with guidance and information to gain knowledge, understanding and proficiency (KUP) required to achieve the objectives of the learning outcomes to demonstrate the standard of competence for Electro-Technical Rating set out in table A-III/7 of the STCW Code.

Specifically at the end of the course, the trainees should be able to successfully demonstrate their competence at the Support Level in the following functions:

#### ***Function 1: Electrical, electronic and control engineering***

- safe use of electrical equipment;
- contribute to monitoring the operation of electrical systems and machinery; and
- use hand tools, electrical and electronic measurement equipment for fault finding, maintenance and repair operations.

#### ***Function 2: Maintenance and repair***

- contribute to shipboard maintenance and repair; and
- contribute to the maintenance and repair of electrical systems and machinery on board.

#### ***Function 3: Controlling the operation of the ship and care for persons on board contribute to the handling of stores***

- apply precautions and contribute to the prevention of pollution of the marine environment; and
- apply occupational health and safety precautions.

### ■ Entry standard

Entry to the course is open to trainees, who have completed the Basic training as per section A-VI/1 of the STCW Code, and are medically fit in accordance with section A-I/9, that intend to obtain certification in accordance with the provisions of STCW Convention, regulation III/7 and section A-III/7 of the STCW Code as Electro-Technical Rating (ETR) on a seagoing ship powered by a main propulsion machinery of 750 kW power or more.

## ■ Course certificate

On successful completion of the requirements of the course, a certificate of completion may be issued as evidence of achieving the mandatory minimum requirements in accordance with STCW regulation III/7 and the standard of competence in section A-III/7 of the STCW Code, for the issuance by the Administration of the appropriate certificate.

## ■ Course intake limitation

The course intake would be limited by the number of instructors that may be available to conduct the course effectively. The maximum trainee - instructor ratio may be up to 24 to 1 for classroom lectures, and 8 to 1 for practical sessions and simulations. Teaching staff should note that the ratios are suggestions only and should be adapted to suit individual groups of trainees depending on their experience, ability and equipment available.

## ■ Staff requirements

Instructors should be appropriately qualified in accordance with the provisions of section A-I/6 of the STCW Code.

All training and assessments carried out, and instructions given, should be by qualified personnel who understand the specific objectives of the training relating to the competences of Electro-Technical Rating.

## ■ Teaching facilities and equipment

For the theoretical part of the course, lectures and exercises should be held in spaces suitable for the class intake, and equipped with the relevant facilities including relevant multi-media equipment, to facilitate the delivery of the training through lectures, group exercises and discussions, as appropriate.

In order to conduct effective practical training, it would be advantageous to the trainees if training providers could ensure the availability of relevant actual and simulation equipment, as deemed necessary, that would facilitate the achievement of the learning objectives for the KUPs in table III/7 of the STCW Code.

## ■ Teaching aids (A)

A1 Visual presentations

A2 Equipment Manufacturers' Operations, Service Manuals, and Technical Diagrams for relevant shipboard machinery and equipment

**Note:** Multi-media training aids such as Videos, Computer Based Training (CBT), etc. may be used as deemed fit by instructors when presenting this course.

## ■ IMO references (R)

R1 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 as amended

R2 International Convention for the Safety of Life at Sea, (SOLAS), 1974, as amended

R3 International Electro-Technical Commission (IEC) – 60092 Series: Electrical Installations in Ships

■ **Bibliography (B)**

- B1 Boyd, G & Jackson, L (2013). *Instrumentation and Control Systems*, Allard n Cole Nautical, London.
- B2 Cadick J. et al, (2005). *Electrical safety handbook*, 3<sup>rd</sup> Ed., Mc Graw Hill.
- B3 Dalton, D. A (2005). *Introduction to Marine Engineering*, 2<sup>nd</sup> Ed., Butterworth-Heinemann Publication, Oxford.
- B4 Fardo S.W, Patric D. R (2009). *Electrical power systems technology*, TheFairmont Press, Lilburn.
- B5 Fernandez, E. (2010). *Marine Electrical Technology*, 5<sup>th</sup> Ed., Mumbai: Shroff Publishers & Distributors Pvt. Ltd.
- B6 Hall, D. T (2014). *Practical Marine Electrical Knowledge*, 3<sup>rd</sup> Ed., Witherby Seamanship International, Edinburgh, Scotland, UK.
- B7 Horovitz P., Hill W (1989). *The art of electronics*, Cambridge University Press.
- B8 Lavers, C., Kraal, E. G., & Buyers, S. (2013). *Basic Electrotechnology for Marine Engineers*, Allard Cole Nautical, London.
- B9 McGoerge, H. D (2008). *Marine Auxiliary Machinery*, 7<sup>th</sup> Ed., Butterworth-Heinemann Publication, Oxford.
- B10 McGeorge, H. D (1993). *Marine Electrical Equipment and Practice*, 2<sup>nd</sup> Ed., Butterworth-Heinemann Publication, Oxford.
- B11 Parr, A. A *Hydraulics and Pneumatics: A Technician's and Engineer's Guide*, 3<sup>rd</sup> Ed. Oxford: Elsevier Butterworth-Heinemann.
- B12 Patel, M (2012). *Shipboard Electrical Power Systems*. CRC Press, FL.
- B13 Patel, M (2012). *Shipboard Propulsion, Power Electronics and Ocean Energy*.CRC Press, FL.
- B14 Payne, J. C (2007). *The Marine Electrical and Electronics Bible*, 3<sup>rd</sup> Ed., Sheridan House, NY.
- B15 Richards, S (2013). *Electronics, Navigational Aids and Radio Theory for Electrotechnical Officer*, Allard Cole Nautical, London.
- B16 Roy, G. J (1994). *Instrumentation and Control*. Butterworth-Heinemann Publication, Oxford.
- B17 Russel, P. A, Morton, T. D & Jackson, L (2013). *General Engineering Knowledge for Marine Engineers*, 5<sup>th</sup> Ed., Allard Cole Nautical, London.
- B18 Russel, P. A, Morton, T. D, Jackson, L. & Prince, A. S (2013). *Motor Engineering Knowledge for Marine Engineers*, Bloomsbury Publishing, London.
- B19 Watson, G. O (1990). *Marine Electrical Practice*, 6<sup>th</sup> Ed., Butterworth-Heinemann Publication, Oxford.

## **Part B: General Outline**

### **■ Lectures**

As far as possible, lectures should be presented within a familiar context and should make use of practical examples. They should be well illustrated with diagrams, pictures and videos where appropriate, and must be related to those skills that will be necessary for the performance of duties on board ships.

An effective manner of presentation would be to develop techniques to transfer information and then reinforce the information. For example, share with the trainees briefly what instructors are about to present to them; then cover the topic in detail; and, finally, summarize what instructors have shared with them. The use of audio-visual aids, hand-outs and notes will all contribute to the effectiveness of the learning process.

### **■ Course timetable**

Teaching staff should note that the suggested hours for lectures, demonstrations and practical work, and length of time allocated to each objective within the sequence is for indicative purposes only. These factors may be adapted by instructors to suit individual groups of trainees depending on their experience, ability, equipment and the number of instructors available for teaching.

Development of a detailed timetable depends on the level of skills of the trainees entering the course, and any revision that may be required of basic principles.

Instructors must develop their own timetable depending on:

- the level of skills of trainees;
- the numbers to be trained; and
- the number of instructors,

and normal practices at the training establishment.

Preparation and planning constitute an important factor which makes a major contribution to the effective presentation of any course of instruction.

Care should be taken when indicating the total hours for the model course and each subject presented in a model course. The approval of a detailed timetable is best left to Administrations due to their understanding of the candidates' knowledge and skills, the class size and the resources available to each training provider.

### **■ General Outline**

The tables below list the competences and the knowledge, understanding and proficiency (KUPs) for this course in the sequence they are listed in table A-III/7 of the STCW Code, together with a suggested total hours required for lectures and any practical exercises. Teaching staff should note that the suggested timings are for indicative purposes only, and session timing should be adapted to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.

## General Outline

### Function 1: Electrical, electronic and control engineering at the support level

| Subject Area                                                                                  | Time Allocation |                                  |
|-----------------------------------------------------------------------------------------------|-----------------|----------------------------------|
|                                                                                               | Theoretical     | Demonstration/<br>Practical Work |
| <b>1.Course Introduction</b>                                                                  | 0.5             | -                                |
| <b>2.Safe use of electrical equipment</b>                                                     |                 |                                  |
| 2.1 Safe Use and operation of electrical equipment                                            |                 |                                  |
| 2.1.2 Safety precautions                                                                      | 1.5             | -                                |
| 2.1.2 Isolation procedures                                                                    | 2.0             | 4.0                              |
| 2.1.3 Emergency procedures                                                                    | 2.0             | -                                |
| 2.1.4 Voltage levels                                                                          | 2.0             | -                                |
| 2.2 Knowledge of the causes of Electric shock and precautions to be observed to prevent shock |                 |                                  |
| 2.2.1 Causes of electric shock                                                                | 2.0             | -                                |
| 2.2.2 Precautions to prevent electric shock                                                   | 2.0             | -                                |
| <b>3. Contribute to monitoring the operation of electrical systems and machinery</b>          |                 |                                  |
| 3.1 Basic knowledge of the operation of Mechanical engineering systems:                       |                 |                                  |
| 3.1.1 Prime movers, including main propulsion plant                                           | 8.0             | 8.0                              |
| 3.1.2 Engine-room auxiliary machinery                                                         | 8.0             | 8.0                              |
| 3.1.3 Steering systems                                                                        | 4.0             | 4.0                              |
| 3.1.4 Cargo-handling systems                                                                  | 4.0             | 4.0                              |
| 3.1.5 Deck machineries                                                                        | 4.0             | 4.0                              |
| 3.1.6 Hotel systems                                                                           | 4.0             | 4.0                              |

| Subject Area                                                                                                            | Time Allocation  |                                  |
|-------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------|
|                                                                                                                         | Theoretical      | Demonstration/<br>Practical Work |
| 3.2 Basic knowledge of:                                                                                                 |                  |                                  |
| 3.2.1 Electro-technology and electrical machines theory                                                                 | 12.0             | 12.0                             |
| 3.2.2 Electrical power distribution boards and electrical equipment                                                     | 12.0             | 12.0                             |
| 3.2.3 Fundamentals of automation, automatic control systems and technology                                              | 8.0              | 22.0                             |
| 3.2.4 Instrumentation, alarm and monitoring systems                                                                     | 8.0              | 12.0                             |
| 3.2.5 Electrical drives                                                                                                 | 8.0              | 12.0                             |
| 3.2.6 Electro-hydraulic and electro-pneumatic control systems                                                           | 12.0             | 12.0                             |
| 3.2.7 Coupling, load sharing and changes in electrical configuration                                                    | 8.0              | 12.0                             |
| 4. Use hand tools, electrical and electronic measurement equipment for fault finding, maintenance and repair operations |                  |                                  |
| 4.1 Safety requirements for working on shipboard electrical systems                                                     | 2.0              | 2.0                              |
| 4.2 Application of safe working practices<br>Basic knowledge of:                                                        | 2.0              | 2.0                              |
| 4.3 Construction and operational characteristics of shipboard AC and DC systems and equipment                           | 4.0              | 4.0                              |
| 4.4 Use of measuring instruments, machine tools, and hand and power tools                                               | 8.0              | 24.0                             |
| <b>Sub-total</b>                                                                                                        | <b>128.0</b>     | <b>162.0</b>                     |
| <b>Total training hours</b>                                                                                             | <b>290 hours</b> |                                  |

**Function 2: Maintenance and repair at the support level**

| Subject Area                                                                                                                                                                        | Time Allocation |                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------------|
|                                                                                                                                                                                     | Theoretical     | Demonstration/<br>Practical Work |
| <b>1. Course Introduction</b>                                                                                                                                                       | 0.5             | -                                |
| <b>2. Contribute to shipboard maintenance and repair</b>                                                                                                                            |                 |                                  |
| 2.1 Ability to use lubrication and cleaning materials and equipment                                                                                                                 | 1.0             | 1.0                              |
| 2.2 Knowledge of safe disposal of waste materials                                                                                                                                   | 1.0             | 1.0                              |
| 2.3 Ability to understand and execute routine maintenance and repair procedures                                                                                                     | 1.0             | 2.0                              |
| 2.4 Understanding manufacturer's safety guidelines and shipboard instructions                                                                                                       | 1.5             | 2.0                              |
| <b>3. Contribute to the maintenance and repair of electrical systems and machinery on board</b><br><i>Safety and emergency procedures</i>                                           |                 |                                  |
| 3.1 Basic knowledge of electro-technical drawings and safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment | 2.0             | 4.0                              |
| 3.2 Test, detect faults and maintain and restore electrical control equipment and machinery to operating conditions                                                                 | 4.0             | 6.0                              |
| 3.3 Electrical and electronic equipment operating in flammable areas                                                                                                                | 2.0             | 4.0                              |
| 3.4 Basics of ship's fire-detection system                                                                                                                                          | 1.0             | 2.0                              |
| 3.5 Carrying out safe maintenance and repair procedures                                                                                                                             | 1.0             | 4.0                              |
| 3.6 Detection of machinery malfunction, location of faults and action to prevent damage                                                                                             | 2.0             | 2.0                              |
| 3.7 Maintenance and repair of lighting fixtures and supply systems                                                                                                                  | 1.0             | 2.0                              |
| <b>Sub-total</b>                                                                                                                                                                    | <b>18</b>       | <b>30</b>                        |
| <b>Total training hours</b>                                                                                                                                                         | <b>48 hours</b> |                                  |

**Function 3: Controlling the operation of the ship and care for persons on board at the support level**

| Subject Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Time Allocation                                                       |                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Theoretical                                                           | Demonstration/<br>Practical Work                                                 |
| <b>1. Course Introduction</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.5                                                                   | -                                                                                |
| <b>2. Contribute to the handling, stowing and securing of stores</b><br>2.1 Knowledge of procedures for safe handling, stowage and securing of stores                                                                                                                                                                                                                                                                                                                             | 2.5                                                                   | 2.0                                                                              |
| <b>3. Apply precautions and contribute to the prevention of pollution of the marine environment</b><br><br>3.1 Knowledge of the precautions to be taken to prevent pollution of the marine environment<br><br>3.2 Knowledge of use and operation of anti-pollution equipment/agent<br><br>3.3 Knowledge of approved methods for disposal of marine pollutants                                                                                                                     | 4.0<br><br>4.0<br><br>2.0                                             | -<br><br>4.0<br><br>2.0                                                          |
| <b>4. Apply occupational health and safety procedures</b><br><br>4.1 Working knowledge of safe working practices and personal shipboard safety, including:<br>4.1.1 Electrical safety<br>4.1.2 Lockout/tag-out<br>4.1.3 Mechanical safety<br>4.1.4 Permit to work systems<br>4.1.5 Working aloft<br>4.1.6 Working in enclosed spaces<br>4.1.7 Lifting techniques and methods of preventing back injury<br>4.1.8 Chemical and bio-hazard safety<br>4.1.9 Personal safety equipment | 1.0<br><br>1.0<br><br>1.0<br><br>1.0<br><br>1.0<br><br>1.0<br><br>1.0 | 1.0<br><br>1.0<br><br>1.0<br><br>1.0<br><br>2.0<br><br>2.0<br><br>1.0<br><br>2.0 |
| <b>Sub-total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>22</b>                                                             | <b>20</b>                                                                        |
| <b>Total training hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>42 hours</b>                                                       |                                                                                  |

**Summary:**

| Function                                                                                    | Time Allocation |                                  |
|---------------------------------------------------------------------------------------------|-----------------|----------------------------------|
|                                                                                             | Theoretical     | Demonstration/<br>Practical Work |
| 1. Electrical, Electronic and Control Engineering at the Support Level                      | 128             | 162                              |
| 2. Maintenance and Repair at the Support Level                                              | 18              | 30                               |
| 3. Controlling the Operation of the Ship and Care for Persons on board at the support level | 22              | 20                               |
| Total training hours                                                                        | 168             | 212                              |
|                                                                                             | 380             |                                  |

## Part C: Detailed Outline

The detailed outline has been written in learning outcomes format in which the outcome describes what the trainee must do to demonstrate that the specified knowledge or skill has been acquired and the proper attitude has been developed. All the outcomes are understood to be prefixed by the words, "At the end of the session, the trainees should be able to ....."

### Function 1: Electrical, electronic and control engineering at the support level

| Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                       | IMO Reference | Other References                              | Teaching Aid |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------|--------------|
| <b>1. Course Introduction</b><br><br>.1 explain the importance of acquiring the competences for an effective and safe performance of duties and functions as electro-technical rating<br>.2 identify the competences in table A-III/7 for the function electrical, electronic and control engineering at the support level                                                                                             | R1            | B2                                            | A1           |
| <b>2. Safe use of electrical equipment</b><br><br><b>2.1 Safe use and operation of electrical equipment</b><br><br><b>2.1.1 Safety precautions</b><br><br>.1 explain safety instructions before commencing work or repair with electrical equipment and machinery<br><br>.2 observe safety procedures prior to commencing work on shipboard electrical systems, machinery and equipment in a given laboratory exercise | R1, R2, R3,   | B2, B4, B5, B6, B7, B8, B10, B12 B14, B18 B19 | A1, A2       |

| Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | IMO Reference | Other References | Teaching Aid |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|--------------|
| <p><b>2.1.2 Isolation procedures</b></p> <ul style="list-style-type: none"> <li>.1 explain isolation procedure of various electrical systems, machinery and equipment</li> <li>.2 isolate electrical systems, machinery and equipment from a power source in accordance with appropriate procedures</li> <li>.3 observe proper communications in the execution of isolation task</li> </ul> <p><b>2.1.3 Emergency procedures</b></p> <ul style="list-style-type: none"> <li>.1 explain the emergency procedures applicable to a given emergency situation</li> <li>.2 recognize potential electrical hazards and unsafe equipment in a given scenario</li> <li>.3 apply the emergency procedures in a given a scenario involving electrical shock</li> <li>.4 make a report on an observed electrical hazard and unsafe equipment in accordance with prescribe procedure</li> </ul> <p><b>2.1.4 Voltage levels</b></p> <ul style="list-style-type: none"> <li>.1 describe the procedures and precautionary measures associated with various voltage levels and sources on board ship</li> <li>.2 explain safe voltages for hand-held equipment</li> <li>.3 explain the risks associated with high voltages</li> </ul> |               |                  |              |