



# MODEL COURSE

C2001-9

## MARINE AIDS TO NAVIGATION– TECHNICIAN TRAINING POWER SOURCES ON BUOYS

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# DOCUMENT REVISION

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Revisions to this document are to be noted in the table prior to the issue of a revised document. The latest edition of the Model Course is the only version in force unless the Model Course is explicitly revoked by the Council.

| Date          | Revision details                                                          | Approval          |
|---------------|---------------------------------------------------------------------------|-------------------|
| June 2016     | Edition 1.0<br>Entire document, minor textual changes                     |                   |
| December 2021 | Edition 2.0<br>Entire document, review of content                         | Review of content |
| June 2026     | Edition 3.0<br>Entire document, textual changes and time in hours changes | Council 04        |
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## FOREWORD

The International Organization for Marine Aids to Navigation (IALA) recognizes that training in all aspects of Marine Aids to Navigation (AtoN) service delivery, from inception through installation and maintenance to replacement or removal at the end of a planned life-cycle, is critical to the consistent provision of that AtoN service.

Under the SOLAS Convention, Chapter 5, Regulation 13, contracting governments should undertake to take into account existing international recommendations and guidelines when establishing aids to navigation. A footnote is included referencing inter alia recommendations and guidelines of IALA.

IALA has adopted the normative Recommendation R0141 on Training and Certification of AtoN Personnel. In order to help Members of the Organization, AtoN authorities and other stakeholders worldwide to conform with the provisions of the Recommendation a series of model courses covering elements of training for AtoN personnel have been developed by the Committees and the World-Wide Academy of the Organization (WWA).

It is intended that such courses shall be conducted by a training institute or an organization accredited by a competent authority in a Member State of the Organization or a Non-member State. This model course is intended to provide Members, AtoN authorities, and other appropriate stakeholders with specific guidance on the training of AtoN technicians in shore marks.

## PART 1 – COURSE OVERVIEW

### 1. SCOPE

This course is intended to provide technicians with an introduction to the installation, servicing, and maintenance of power sources on buoys in a safe and efficient manner.

This introductory course is intended to be supported by further training modules on theoretical and practical aspects of floating aids to navigation. Details of these supporting model courses can be found in the Model Course C2000 Level 2 Technician Training Model Course Overview.

All persons working on power sources on buoys should be deemed by the competent authority to be responsible individuals.

### 2. OBJECTIVE

Upon successful completion of this course, trainees will have acquired sufficient knowledge and skill to service and maintain AtoN power sources on buoys whilst working within their authorities, organizations or other stakeholders.

### 3. COURSE OUTLINE

This course is intended to cover the knowledge and practical competence required for a technician to properly install, service, and maintain power sources on buoys. The complete course comprises five modules, each of which deals with a specific subject representing an aspect of power sources on buoys servicing and maintenance. Each module begins by stating its scope and aims, and then provides a teaching syllabus. This is a practical, job-centered course designed to provide trainees with a realistic, hands-on educational experience.

The required standard of competence is considered to be the level of proficiency that should be achieved for the proper performance of the duties carried out by the technician in their organization.

This Model Course is focused on the basic level of competence.

***Table 1 Levels of Competence***

| Competence Level | Learning Outcome                                   | Instructional Objectives                      | Required skills                                                                                                      |
|------------------|----------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1                | The conduct of routine tasks with some supervision | A basic understanding of facts and principles | First stage in acquiring competency of a complex skill. Appropriate responses are identified through trial and error |

### 4. TEACHING MODULES

***Table 2 Table of Teaching Modules***

| Module Title  | Time in hours | Overview                                                                                          |
|---------------|---------------|---------------------------------------------------------------------------------------------------|
| Safety        | 1.0           | This module explains the potential hazards on buoy power systems and how to work safely with them |
| Battery types | 0.5           | This module covers the different types of energy storage types suitable for use on buoys          |

|                                       |            |                                                                                                                                                    |
|---------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| PV System Types                       | 0.5        | This module covers the different types of PV power types suitable for use on buoys                                                                 |
| Battery & PV system maintenance       | 1.0        | Explains how to maintain, operate and dispose of batteries & PV system for maximum life and safe disposal                                          |
| Charging                              | 0.5        | Covers different types of charging methods available and charge regulation                                                                         |
| General considerations and site visit | 1          | Covers general items of battery installation and operation before a site visit to consolidate knowledge gained on the course in a practical manner |
| Evaluation                            | 1.0        |                                                                                                                                                    |
| <b>Total Hours</b>                    | <b>6.0</b> | 1 day course                                                                                                                                       |

## 5. SPECIFIC COURSE RELATED TEACHING AIDS

This course involves both classroom instruction and a visit to a buoy refurbishment facility. Classrooms should be equipped with appropriate teaching aids to enable the presentation of the subject matter. Trainees should have access to the types of equipment that they will be expected to work with on the job.

## 6. ACRONYMS

To assist in the use of this model course, the following acronyms have been used:

|       |                                                                           |
|-------|---------------------------------------------------------------------------|
| AtoN  | Marine Aids to Navigation                                                 |
| IALA  | International Organization for Marine Aids to Navigation                  |
| NiCd  | Nickel Cadmium                                                            |
| NiMH  | Nickel Metal Hydride                                                      |
| PV    | Photovoltaic(s)                                                           |
| SOLAS | International Convention for the Safety of Life at Sea, 1974 (as amended) |
| WWA   | World-Wide Academy                                                        |

## 7. DEFINITIONS

The definition of terms used in this Model Course can be found in the International Dictionary of Marine Aids to Navigation.

## 8. REFERENCES

In addition to any specific references required by the Competent Authority, the following material is relevant to this course:

- 1 IALA Guideline G1067 on Selection of Power Systems for Marine Aids to Navigation and Associated Equipment
- 2 IALA Guideline G1067-1 on Total Electrical Loads of Marine Aids to Navigation
- 3 IALA Guideline G1067-2 on Power Sources
- 4 IALA Guideline G1067-3 on Electrical Energy Storage for Marine Aids to Navigation

- 5 IALA Guideline G1039 on Designing Solar Power Systems for Marine AtoN
- 6 Technical documentation from equipment manufacturers

## PART 2 – COURSE MODULES

### 1. MODULE 1 – SAFETY

#### 1.1. SCOPE

This module explains the potential hazards on buoy power systems and how to work safely with them.

#### 1.2. LEARNING OBJECTIVE

To gain a basic understanding of how to work on buoy power sources in a safe manner.

#### 1.3. SYLLABUS

##### 1.3.1. LESSON 1 - STORED ENERGY

- 1 Battery stored energy
- 2 Danger of exposed terminals
- 3 Solar PV voltages

##### 1.3.2. LESSON 2 - CHEMICAL HAZARDS

- 1 Acid electrolyte
- 2 Toxic chemicals in high-technology batteries
- 3 Hydrogen

##### 1.3.3. LESSON 3 - PERSONAL PROTECTIVE EQUIPMENT

Gloves, goggles, apron

##### 1.3.4. LESSON 4 - ELECTROLYTE SPILLAGE MANAGEMENT

Spillage of electrolyte and safe clean up

### 2. MODULE 2 – BATTERY TYPES

#### 2.1. SCOPE

This module covers the different types of energy storage types suitable for use on buoys.

#### 2.2. LEARNING OBJECTIVE

To gain a basic understanding of the different types of batteries suitable for use in power systems on buoys.

#### 2.3. SYLLABUS

##### 2.3.1. LESSON 1 - NON RECHARGEABLE BATTERIES

- 1 Alkaline, Lithium
- 2 Applications, including when a non-rechargeable would be selected
- 3 Safe disposal

##### 2.3.2. LESSON 2 - RECHARGEABLE BATTERIES

- 1 Gel/ liquid lead acid



- 2 NiMH/NiCad
- 3 Lithium
- 4 Applications, including when a rechargeable battery would be selected
- 5 Battery housing and ventilation

### **2.3.3. LESSON 3 - MATCHING LOADS TO BATTERIES**

Voltages in common use

## **3. MODULE 3 – PV SYSTEM TYPES**

### **3.1. SCOPE**

This module covers the different types of solar energy types suitable for use on buoys.

### **3.2. LEARNING OBJECTIVE**

To gain a basic understanding of the different types of solar panels suitable for use in power systems on buoys.

### **3.3. SYLLABUS**

#### **3.3.1. LESSON 1 - TYPES**

- 1 monocrystalline cell
- 2 polycrystalline cell
- 3 thin film cell or amorphous silicon

## **4. MODULE 4 – BATTERY & SOLAR PANEL MAINTENANCE**

### **4.1. SCOPE**

Explains how to maintain, operate, and dispose of batteries for maximum life and safe disposal.

### **4.2. LEARNING OBJECTIVE**

To gain a basic understanding of how to maintain batteries and how to optimize battery life.

### **4.3. SYLLABUS**

#### **4.3.1. LESSON 1 - BATTERY STORAGE**

- 1 Storage locations
- 2 Effects of complete discharge in storage
- 3 Maintaining charge during storage

#### **4.3.2. LESSON 2 - RECHARGEABLE BATTERIES**

- 1 Advantage of battery conditioning prior to use in service
- 2 Methods of battery conditioning
- 3 Frequency of battery conditioning

#### **4.3.3. LESSON 3 - ROUTINE MAINTENANCE**

Visual inspection:

- 1 Swelling of the casing & Swelling of the cells
- 2 Cleaning of solar panels
- 3 Terminal and connection integrity

- 4 Signs of electrolyte leakage on batteries
- 5 Corrosion
- 6 Corrosion prevention as per manufacturer's recommendations
- 7 Policy decision on when to replace

#### **4.3.4. LESSON 4 - TESTING**

- 1 Expected voltages
- 2 Discharge testing
- 3 Use of propriety condition monitors and test equipment

#### **4.3.5. LESSON 5 – DISPOSAL**

- 1 Safe disposal
- 2 Local regulation

## **5. MODULE 5 – BATTERY CHARGING**

### **5.1. SCOPE**

This module covers different types of charging methods available and charge regulation.

### **5.2. LEARNING OBJECTIVE**

To gain a basic understanding of the options for charging buoy batteries and how to maintain charging systems.

### **5.3. SYLLABUS**

#### **5.3.1. LESSON 1 - CHARGING SOURCES**

- 1 Solar PV
- 2 Wind generation
- 3 Other charging sources

#### **5.3.2. LESSON 2 - CHARGE REGULATION**

- 1 Regulation integral to the charging source
- 2 Regulation external to the charging source

#### **5.3.3. LESSON 3 - CHARGE SYSTEMS MAINTENANCE**

Charge output checks

## **6. MODULE 6 – GENERAL CONSIDERATIONS AND SITE VISIT**

### **6.1. SCOPE**

This module covers general items of battery installation and operation before a site visit to consolidate knowledge gained in the course in a practical manner.

### **6.2. LEARNING OBJECTIVE**

To gain a basic understanding of the overview of conditions and general issues pertinent to power systems on buoys.

## 6.3. SYLLABUS

### 6.3.1. LESSON 1 - ENVIRONMENTAL PROTECTION

- 1 Terminal covers:
  - a Open
  - b Sealed
- 2 Battery boxes:
  - a Sealed
  - b Vented
- 3 Location:
  - a Access
  - b Theft
  - c Wave protection

### 6.3.2. LESSON 2 - SITE VISIT

- 1 Visit to a buoy yard to view power system installations
- 2 Visit to battery conditioning installation