



MODEL COURSE

C2001-4

MARINE AIDS TO NAVIGATION - TECHNICIAN TRAINING BUOY MOORINGS

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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 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 the theoretical and practical training necessary to have a satisfactory understanding of the components and maintenance of moorings used in floating Marine Aids to Navigation (AtoN).

This course is intended to be supported by further theoretical and practical training modules on aspects on buoy handling, cleaning and maintenance records. Details of these supporting model courses can be found in C2000 on the Level 2 Technician training overview.

2. OBJECTIVE

Upon successful completion of this course, participants will have acquired sufficient knowledge to service and maintain the moorings fitted to floating AtoN.

3. COURSE OUTLINE

This practical, job-centred course covers the knowledge and competence required for a technician to properly service and maintain the moorings for floating AtoN. It is designed to provide trainees with a realistic, hands-on educational experience. The complete course comprises five modules, each of which deals with a specific subject representing an aspect of mooring systems and their maintenance. Each module begins by stating its scope and aims, and then provides a teaching syllabus.

4. TABLE OF TEACHING MODULES

Table 1 *Table of Teaching Modules*

Module Title	Time in hours	Overview
Design of mooring lines	2	This module describes the various sections of a mooring, its swinging radius and the ideal length and size of buoy moorings
Mooring components	1	This module describes the function, size and proportions of mooring components including shackles, swivels and sinkers and the use of synthetic mooring lines
The manufacture of moorings	0.5	This module describes the materials used and industrial process involved in mooring manufacture
Servicing ashore	0.5	This module describes the reception, welding, storage or disposal of moorings
Servicing afloat	1	This module describes the servicing procedure for moorings, the performance of an inspection including the measurement of wear and/or corrosion, troubleshooting, best practices and maintenance records
Site visit and evaluation ashore	1	Practical test
Total Hours:	6	1 day course



5. SPECIFIC COURSE RELATED TEACHING AIDS

- 1 This course involves both classroom instruction and practical experience in a work area. Classrooms should be equipped with blackboards, whiteboards, and overhead projectors to enable presentation of the subject matter.
- 2 An alternative to classroom instruction would be to provide the lecture material to participants via distance-learning via the Internet (i.e. 'e-learning'). In that case, participants would need access to computers and related equipment and should be provided with a means of interacting with instructors for discussion and to answer questions.
- 3 Participants should have access to the types of equipment that they will be expected to work with on the job. This would include such things as chain links, swivels, shackles, sinkers, callipers and an appropriate maintenance register.

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
L	Level
MBS	IALA Maritime Buoyage System
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 Guideline 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 G1066 on the Design of Floating Aid to Navigation Moorings
- 2 IALA Guideline G1077 on Developing maintenance strategy for Aids to Navigation
- 3 Technical documentation from mooring manufacturers would be another useful source of information



PART 2 – TEACHING MODULES

9. MODULE 1 – DESIGN OF MOORING LINES

9.1. SCOPE

This module describes the various sections of a mooring, its swinging radius and the ideal length and size of buoy moorings.

9.2. LEARNING OBJECTIVE

To gain a **satisfactory** understanding of the behaviour of mooring lines (chains) so that a participant will be able to name its various parts and will be able to design a theoretical mooring.

9.3. SYLLABUS

9.3.1. LESSON 1 – PRESENTATION OF MOORINGS

- 1 Basic buoy design
- 2 Behaviour of mooring lines
- 3 Parts of a mooring
 - a Tail chain/Bridle
 - b Riding chain
 - c Thrash chain
 - d Ground chain
 - e Sinker
- 4 Swinging radius
- 5 Reserve buoyancy
- 6 Site conditions
 - a Wind
 - b Currents
 - c Depth (+ tide)
 - d Waves
 - e Nature of seabed

9.3.2. LESSON 2 – DESIGN OF MOORINGS

- 1 Types of moorings:
 - a Transitional moorings
 - b Slack moorings
 - c Taut moorings
 - d Special moorings



- 2 Design:
 - a “3 times depth” design
 - b Transitional moorings design
 - c Principles of slack and taut moorings design

10. MODULE 2 – MOORING COMPONENTS

10.1. SCOPE

This module describes the function, size, and proportions of mooring components, including shackles, swivels, and sinkers, and the use of synthetic mooring lines.

10.2. LEARNING OBJECTIVE

To gain a **satisfactory** understanding of how to identify and place the correct components in a mooring system.

10.3. SYLLABUS

10.3.1. LESSON 1 MOORING CHAIN

- 1 Size
- 2 Proportions
- 3 Stud link chain

10.3.2. LESSON 2 SHACKLES AND SWIVELS

- 1 Forelock shackles
- 2 Clenching shackles
- 3 Bolt shackles
- 4 Screw-pin shackles
- 5 Kenter shackles
- 6 Swivels

10.3.3. LESSON 3 SINKERS OR ANCHORS

- 1 Sinkers:
 - a Concrete sinkers
 - b Rock sinkers
 - c Cast iron sinkers
 - d Fixed moorings
- 2 Anchors

10.3.4. LESSON 4 SYNTHETIC MOORING LINES

- 1 Rope mooring lines
- 2 Elastic mooring lines
- 3 Terminations



11. MODULE 3 – THE MANUFACTURE OF MOORINGS

11.1. SCOPE

This module describes the materials used and the industrial process involved in mooring manufacture.

11.2. LEARNING OBJECTIVE

To gain a basic understanding of steel and the principles of manufacturing a steel mooring.

11.3. SYLLABUS

11.3.1. LESSON 1 THE PROPERTIES OF STEEL

- 1 Material:
 - a Composition
 - b Chemical properties
 - c Mechanical properties
 - d Heat treatments
 - e Coating
 - f Cost
- 2 Manufacturing:
 - a Forming
 - b Machining
 - c Welding
 - d Quality assurance / component testing and certification

11.3.2. LESSON 2 SYNTHETIC MATERIALS

- 1 Material:
 - a Composition
 - b Mechanical properties
 - c Cost
- 2 Manufacturing synthetic lines

12. MODULE 4 – SERVICING ASHORE

12.1. SCOPE

This module describes the reception, welding, storage or disposal of moorings.

12.2. LEARNING OBJECTIVE

To gain a satisfactory understanding of how to service moorings on shore and a good understanding of health and safety issues.

12.3. SYLLABUS

12.3.1. LESSON 1 HANDLING OF MOORINGS

- 1 Reception and inspection
- 2 Storage



- 3 Handling and stevedoring
- 4 Disposal

12.3.2. LESSON 2 OPERATIONS

- 1 Cutting
- 2 Splicing
- 3 Manufacture of sinkers

12.3.3. LESSON 3 HEALTH AND SAFETY

- 1 Potential hazards
- 2 Personal protection
- 3 Safe handling procedures

13. MODULE 5 – SERVICING AFLOAT

13.1. SCOPE

This module describes the servicing procedure for moorings, including the performance of an inspection, including the measurement of wear and/or corrosion, troubleshooting, best practices, and maintenance records.

13.2. LEARNING OBJECTIVE

To gain a satisfactory understanding of how to service moorings afloat and a good understanding of health and safety issues.

13.3. SYLLABUS

13.3.1. LESSON 1 WEAR AND CORROSION

- 1 Definitions of wear and corrosion
- 2 Causes of wear
- 3 Causes of corrosion
- 4 Prevention of corrosion

13.3.2. LESSON 2 MOORING INSPECTIONS

- 1 Frequency
- 2 Measurements and how they should be taken
- 3 Record keeping
- 4 Factors affecting the decision to replace mooring components

13.3.3. LESSON 3 MOORING INSPECTIONS

- 1 Lifting a mooring
- 2 Changing the components of a mooring: Cutting



13.3.4. LESSON 4 IMPROVEMENTS TO EXISTING MOORINGS

- 1 Troubleshooting.
- 2 Best practices:
 - a Downgrading
 - b End-for-ending (turning over)
 - c Adjusting inspection intervals
 - d Components to retain

13.3.5. LESSON 5 HEALTH AND SAFETY

- 1 Potential hazards
- 2 Personal protections
- 3 Safe handling procedures

14. MODULE 6 – SITE VISITS

14.1. SCOPE

Practical visits to a buoy yard and a buoy tender on station.

14.2. LEARNING OBJECTIVE

To consolidate a satisfactory understanding of theoretical knowledge gained in the classroom modules.

14.3. SYLLABUS

View mooring components both ashore and afloat before conducting mooring measurement and change-over operation procedures under strict supervision.