



IALA MODEL COURSE

L2.1.7

MARINE AIDS TO NAVIGATION - TECHNICIAN
TRAINING

LEVEL 2 MODULE 1 ELEMENT 1.7

BUOY MOORINGS

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FOREWORD

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) recognises 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, paragraph 2; Contracting Governments, mindful of their obligations published by the International Maritime Organisation, undertake to consider international recommendations and guidelines when establishing Marine Aids to Navigation. As such publications should include recommendations on the training and qualification of AtoN technicians, IALA has adopted Recommendation R0141 on Standards for Training and Certification of AtoN personnel.

IALA Committees working closely with the IALA World Wide Academy have developed a series of model courses for AtoN personnel having R0141 Level 2 technician functions. This model course on buoy moorings should be read in conjunction with the Training Overview Document IALA WWA.L2.0 which contains standard guidance for the conduct of all Level 2 model courses

This model course is intended to provide national members and other appropriate authorities charged with the provision of AtoN services with specific guidance on the training of AtoN technicians in buoy moorings. Assistance in implementing this and other model courses may be obtained from the IALA World Wide Academy at the following address:

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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 the Level 2 Technician training overview document IALA WWA L2.0.

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 5 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
Site visit and evaluation afloat	4	
Total Hours:	10	Total number of days 2



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. REFERENCES

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

- IALA Guideline No. 1066 on the Design of Floating Aid to Navigation Moorings;
- IALA Guideline No. 1077 on Maintenance of Aids to Navigation;
- Technical documentation from mooring manufacturers would be another useful source of information.



PART 2 – TEACHING MODULES

7. MODULE 1 – DESIGN OF MOORING LINES

7.1. SCOPE

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

7.2. 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.

7.3. SYLLABUS

7.3.1. 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.

7.3.2. 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.

8. MODULE 2 – MOORING COMPONENTS

8.1. SCOPE

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

8.2. LEARNING OBJECTIVE

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

8.3. SYLLABUS

8.3.1. LESSON 1 MOORING CHAIN

1. Size.
2. Proportions.
3. Stud link chain.

8.3.2. LESSON 2 SHACKLES AND SWIVELS

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

8.3.3. LESSON 3 SINKERS OR ANCHORS

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

8.3.4. LESSON 4 SYNTHETIC MOORING LINES

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

9. MODULE 3 – THE MANUFACTURE OF MOORINGS

9.1. SCOPE

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



9.2. LEARNING OBJECTIVE

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

9.3. SYLLABUS

9.3.1. 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.

9.3.2. LESSON 2 SYNTHETIC MATERIALS

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

10. MODULE 4 – SERVICING ASHORE

10.1. SCOPE

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

10.2. LEARNING OBJECTIVE

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

10.3. SYLLABUS

10.3.1. LESSON 1 HANDLING OF MOORINGS

1. Reception and inspection.
2. Storage.
3. Handling and stevedoring.
4. Disposal.



10.3.2. LESSON 2 OPERATIONS

1. Cutting.
2. Splicing.
3. Manufacture of sinkers.

10.3.3. LESSON 3 HEALTH AND SAFETY

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

11. MODULE 5 – SERVICING AFLOAT

11.1. SCOPE

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.

11.2. LEARNING OBJECTIVE

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

11.3. SYLLABUS

11.3.1. LESSON 1 WEAR AND CORROSION

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

11.3.2. 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.

11.3.3. LESSON 3 MOORING INSPECTIONS

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

11.3.4. 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.

11.3.5. LESSON 5 HEALTH AND SAFETY

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

12. MODULE 6 – SITE VISITS

12.1. SCOPE

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

12.2. LEARNING OBJECTIVE

To consolidate a **satisfactory** understanding of theoretical knowledge gained in the class room modules.

12.3. SYLLABUS

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