



IALA MODEL COURSE

L2.3.9

AIDS TO NAVIGATION - TECHNICIAN
TRAINING
MODULE 3 ELEMENT 9
LEVEL 2 - MAINTENANCE OF MERCURY
ROTATING OPTICS

Edition 2.0

June 2016



DOCUMENT REVISION

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

Date	Page / Section Revised	Requirement for Revision
June 2016	Pages 3 & 6	Minor text amendments and update of Teaching Modules



CONTENTS

PART 1 - COURSE OVERVIEW	6
1. SCOPE	6
2. OBJECTIVE	6
3. COURSE OUTLINE.....	6
4. TEACHING MODULES	6
5. SPECIFIC COURSE RELATED TEACHING AIDS	7
6. ACRONYMS	7
7. DEFINITIONS.....	7
8. REFERENCES	7
PART 2 – TEACHING MODULES	8
1. MODULE 1 – OVERVIEW AND HISTORY OF MERCURY FLOATING BATH OPTICS	8
1.1. Scope.....	8
1.2. Learning Objective	8
1.3. Syllabus	8
1.3.1. Lesson 1 – History of the Floating Optic	8
1.3.2. Lesson 2 – Where They Are Used	8
2. MODULE 2 – MERCURY THE SUBSTANCE	8
2.1. Scope.....	8
2.2. Learning Objective	8
2.3. Syllabus	8
2.3.1. Lesson 1 – Physical Properties.....	8
2.3.2. Lesson 2 - Hazards to Health	8
2.3.3. Lesson 3 – Environmental Hazards	9
3. MODULE 3 – LEGISLATION AND MERCURY.....	9
3.1. Scope.....	9
3.2. Learning Objective	9
3.3. Syllabus	9
3.3.1. Lesson 1 – Legislation	9
3.3.2. Lesson 2 - Internal Instructions.....	9
4. MODULE 4 – APPLICATION IN A FLOATING OPTIC BATH	9
4.1. Scope.....	9
4.2. Learning Objective	9
4.3. Syllabus	10
4.3.1. Lesson 1 – Overview	10
4.3.2. Lesson 2 - Routine Maintenance	10
4.3.3. Lesson 3 – Drive Systems.....	10
5. MODULE 5 – OTHER APPLICATIONS OF MERCURY IN ATON EQUIPMENT	10
5.1. Scope.....	10



CONTENTS

5.2.	Learning Objective	10
5.3.	Syllabus	10
5.3.1.	Lesson 1 – Overview	10
6.	MODULE 6 – MERCURY REMOVAL AND REPLACEMENT	11
6.1.	Scope.....	11
6.2.	Learning Objective	11
6.3.	Syllabus	11
6.3.1.	Lesson 1 – Equipment Required	11
6.3.2.	Lesson 2 - Safety Equipment.....	11
6.3.3.	Lesson 3 – Draining & Re-filling	11
7.	MODULE 7 – VISIT TO A MERCURY ROTATING OPTIC	12
7.1.	Scope.....	12
7.2.	Learning Objective	12
7.3.	Syllabus	12

List of Tables

<i>Table 1</i>	<i>Table of Teaching Modules.....</i>	<i>6</i>
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FOREWORD

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) recognises that training in all aspects of 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.

Taking into account that 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 the international recommendations and guidelines when establishing aids to navigation, including recommendations on training and qualification of AtoN technicians, IALA has adopted Recommendation E-141 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 E-141 Level 2 technician functions. This model course on AtoN Service Craft and Buoy Tenders 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 an introduction to service craft and buoy tenders. Assistance in implementing this and other model courses may be obtained from the IALA World Wide Academy at the following address:

The Secretary-General
IALA
10 rue des Gaudines
78100 Saint Germain-en-Laye
France

Tel: (+) 33 1 34 51 70 01
Fax: (+) 33 1 34 51 82 05
e-mail: academy@iala-aism.org
Internet: www.iala-aism.org

PART 1- COURSE OVERVIEW

1. SCOPE

This course is intended to provide technicians with the practical training necessary to become competent in the servicing and maintenance of mercury rotating optics in a safe and efficient manner.

Due to the hazardous nature of mercury, all persons engaged in mercury operations should be over the age of 18 and be deemed by the competent authority to be responsible individuals. This course does not recommend the specific handling of mercury as part of the course.

2. OBJECTIVE

Upon successful completion of this course, participants will have acquired sufficient knowledge and skill to service and maintain AtoN mercury rotating optics on the job within their organizations

3. COURSE OUTLINE

This course is intended to cover the knowledge and practical competence required for a technician to properly service and maintain mercury rotating optics used on lighthouses. The complete course comprises 7 modules, each of which deals with a specific subject representing an aspect of mercury rotating optics servicing and maintenance. Each module begins by stating its scope and aims, and then provides a teaching syllabus. This is a practical, job-centred course designed to provide trainees with a realistic, hands-on educational experience.

4. TEACHING MODULES

Table 1 *Table of Teaching Modules*

Module Title	Time in hours	Overview
Overview and history of mercury floating bath optics	1.5	This module describes the history behind the mercury bath rotating optic
Mercury the substance	1.5	This module describes mercury (Hg) its properties and its hazards
Legislation and Mercury	1.5	This module describes the legislative framework within which mercury must be used, handled and disposed of and will vary from one country to another
Application in a floating optic bath	2.0	This module describes how mercury is used, maintenance and general information on its application in a rotating optic
Other applications of mercury in AtoN equipment	0.5	This module considers other applications of mercury such as electrical slip rings and tilt switches in the lighthouse estate.
Mercury removal and replacement	2.0	This module describes the procedures and safety requirements for removing and draining mercury from a rotating optic
Site visit	7.0	To visit a mercury rotating optic for familiarisation

Evaluation	1.0	Practical competency test
Total Hours	17	3 day course

5. SPECIFIC COURSE RELATED TEACHING AIDS

- 1 This course involves both classroom instruction and practical visit in a work area. Classrooms should be equipped with blackboards, whiteboards, and overhead projectors to enable presentation of the subject matter.
- 2 Trainees should have access to the types of equipment that they will be expected to work with on the job.
- 3 Examples of equipment used such as mercury containers, personal protective equipment, air sampling equipment and photographs will all be required to enhance the students learning experience prior to the practical site visit.

6. ACRONYMS

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

AtoN	Aid(s) to Navigation
Hg	Mercury
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
L	Level
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 (IALA Dictionary) at <http://www.iala-aism.org/wiki/dictionary>

8. REFERENCES

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

- 1 IALA NAVGUIDE.
- 2 IALA Guideline 1036 Environmental Considerations in Aids to Navigation Engineering.
- 3 Technical documentation from equipment.
- 4 National legislative requirements regarding the use and handling of mercury.

PART 2 – TEACHING MODULES

1. MODULE 1 – OVERVIEW AND HISTORY OF MERCURY FLOATING BATH OPTICS

1.1. SCOPE

This module describes the history behind the mercury bath rotating optic.

1.2. LEARNING OBJECTIVE

To understand why mercury was used and where it is used now.

1.3. SYLLABUS

1.3.1. LESSON 1 – HISTORY OF THE FLOATING OPTIC

- 1 Developments in the rotating optic.
- 2 Why mercury is used.
- 3 The early mercury baths.

1.3.2. LESSON 2 – WHERE THEY ARE USED

- 1 Locations of mercury floating optics within the competent authority.
- 2 Other uses of mercury in the Lighthouse estate.
- 3 Future plans for mercury use.
- 4 Alternative bearings for rotating optics.

2. MODULE 2 – MERCURY THE SUBSTANCE

2.1. SCOPE

This module describes Mercury (Hg) its properties and its hazards.

2.2. LEARNING OBJECTIVE

To be aware of the properties and hazards of mercury.

2.3. SYLLABUS

2.3.1. LESSON 1 – PHYSICAL PROPERTIES

- 1 Mass.
- 2 Liquid state.
- 3 Boiling point.
- 4 Uses.
- 5 Long term storage.

2.3.2. LESSON 2 - HAZARDS TO HEALTH

- 1 Results of mercury poisoning.
- 2 Ingestion by mouth.
- 3 Inhalation by air.
- 4 Safe working limits.

- 5 Absorption through skin.
- 6 Air monitoring.
- 7 Treatment for those contaminated.
- 8 Blood & urine testing.

2.3.3. LESSON 3 – ENVIRONMENTAL HAZARDS

- 1 Pollution to land.
- 2 Marine pollution.

3. MODULE 3 – LEGISLATION AND MERCURY

3.1. SCOPE

This module describes the legislative framework within which mercury must be used, handled and disposed of and will vary from one country to another.

3.2. LEARNING OBJECTIVE

To understand the law and approved codes of practice for both the country of operation and the Competent Authority.

3.3. SYLLABUS

3.3.1. LESSON 1 – LEGISLATION

- 1 Legislation pertaining to Mercury.
- 2 Previous legislation and legislation developments.
- 3 Approved codes of practice for handling mercury.

3.3.2. LESSON 2 - INTERNAL INSTRUCTIONS

- 1 Competent Authority instructions.
- 2 Storage.
- 3 Handling.
- 4 Transport.
- 5 Disposal.

4. MODULE 4 – APPLICATION IN A FLOATING OPTIC BATH

4.1. SCOPE

This module describes how mercury is used, maintenance and general information on its application in a rotating optic.

4.2. LEARNING OBJECTIVE

To understand how to safely operate, maintain and fault find on a mercury bath optic.

4.3. SYLLABUS

4.3.1. LESSON 1 – OVERVIEW

- 1 Principles of operation.
- 2 Quantities in use.
- 3 Guide bearings.
- 4 Shims.
- 5 Balancing.

4.3.2. LESSON 2 - ROUTINE MAINTENANCE

- 1 Run down times & start-up times.
- 2 Longevity.
- 3 Overview of draining down & topping up.
- 4 Cleaning & varnishing of iron surfaces.
- 5 Gaskets on large annular baths.
- 6 Viscosity changes / dirt impregnation.
- 7 Lubrication.

4.3.3. LESSON 3 – DRIVE SYSTEMS

- 1 Stepper motor drives.
- 2 Geared variable speed drives.
- 3 Geared fixed speed drives.
- 4 Other drive mechanisms.

5. MODULE 5 – OTHER APPLICATIONS OF MERCURY IN ATON EQUIPMENT

5.1. SCOPE

This module describes other applications of mercury that may be in service within the competent authority.

5.2. LEARNING OBJECTIVE

To understand where mercury is used and its application.

5.3. SYLLABUS

5.3.1. LESSON 1 – OVERVIEW

- 1 Slip rings.
- 2 Tilt switches.
- 3 Other applications.

6. MODULE 6 – MERCURY REMOVAL AND REPLACEMENT

6.1. SCOPE

This module describes the procedures and safety requirements for removing and draining mercury from a rotating optic.

6.2. LEARNING OBJECTIVE

To understand where mercury is used and its application.

6.3. SYLLABUS

6.3.1. LESSON 1 – EQUIPMENT REQUIRED

- 1 Temporary storage containers & transfer pipes.
- 2 Jacks.
- 3 Paper & tape for masking.
- 4 Filtering gauze.
- 5 Ventilation fans & ducting.

6.3.2. LESSON 2 - SAFETY EQUIPMENT

- 1 Personal Protective Equipment – suitable for use with mercury:
 - a Breathing masks.
 - b Overalls.
 - c Overshoes.
 - d Gloves.
 - e Goggles.
- 2 Air monitoring.
- 3 Sheeting.
- 4 Clean / dirty areas.
- 5 Flowers of Sulphur
- 6 Written method statement.
- 7 Disposal method statements.
- 8 Personal hygiene.
- 9 Medical surveillance.

6.3.3. LESSON 3 – DRAINING & RE-FILLING

- 1 When to work e.g. ambient temperature and number of available daylight hours.
- 2 Sheeting up.
- 3 Filtering.
- 4 Re filling
- 5 Spillage procedures.
- 6 Cleaning up and disposal of contaminated items.

7. MODULE 7 – VISIT TO A MERCURY ROTATING OPTIC

7.1. SCOPE

To visit a mercury rotating optic for familiarisation.

7.2. LEARNING OBJECTIVE

To consolidate knowledge in the field.

7.3. SYLLABUS

Day visit to an operating mercury optic.