

IALA World Wide Academy

Model Course for Aids to Navigation

LEVEL 2 Technician Training

Wind Generators Module 2 Element 2.4 (IALA WWA L2:2.4)

Edition 1

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DOCUMENT REVISIONS

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

| Date | Page / Section Revised | Requirement for Revision |
|------|------------------------|--------------------------|
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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.

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 aids to navigation. As such publications should include recommendations on the 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 wind generators 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 wind generators. 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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1 PART A - COURSE OVERVIEW

1.1 Scope

This course is intended to provide technicians with the theoretical and practical training necessary to install, set to work and maintain wind generators.

This course is intended to be supported by further training modules on energy storage systems, maintenance records and protection against damage to aids to navigation stations from lightning. Details of these supporting model courses can be found in the Level 2 Technician training overview document IALA WWA L2.0.

1.2 Objective

Upon successful completion of this course, participants will have acquired sufficient knowledge and skill to install, set to work and maintain wind generators within their organizations.

1.3 Course Outline

This mainly practical course is intended to cover the knowledge required for a technician to install, set to work and maintain wind generators used to power aids to navigation. The complete course comprises 1 classroom, 2 practical modules and a practical test of competence. Each of these deals with a specific subject covering the use of wind generators.

1.4 Table of Teaching Modules

| Module Title | Time in hours | Overview |
|------------------------------------|---------------|---|
| An introduction to wind generators | 2 | This module describes the background to, types and performance of wind generators |
| Wind generator installation | 3 | This module describes how to install and set to work a wind generator |
| Maintenance of wind generators | 1 | This module describes the maintenance procedures for wind generators |
| Evaluation | 1 | Practical assessment |
| Total Hours: | 7 | One day course |

1.5 Specific Course Related Teaching Aids

- 1 This course will be both classroom and workshop/site based. Classrooms should be equipped with blackboards, whiteboards, and overhead projectors to enable presentation of the subject matter.
- 2 A demonstration wind generator should be made available in a suitable workshop or open air environment

1.6 References

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

- IALA Navguide Chapter 7
- IALA Guideline 1067 on Selection of Power Systems for Aids to Navigation and Associated Equipment

- IALA Guideline 1067-2 on Power Sources
- Manufacturers of wind generators handbooks

2 PART B - TEACHING MODULES

2.1 Module 1 - An introduction to wind generators

2.1.1 Scope

This module describes the background to, types and performance of wind generators.

2.1.1 Learning Objective

To gain a **satisfactory** understanding of the types of wind generators used to power aids to navigation.

2.1.2 Syllabus

Lesson 1 General Information

- 1 The resource - wind
- 2 Wind generators in use world-wide
- 3 Operating principles – Betz's law

Lesson 2 Types of wind generators

- 1 Horizontal axis wind turbines
 - a. High speed wind generators
 - b. Low speed wind generators
- 2 Vertical axis wind turbines
 - a. Savonius wind turbines
 - b. Darrieus wind turbines
- 3 Ideal windmill efficiency

Lesson 2 Operational considerations

- 1 Environmental conditions - wind strength, storms and turbulent air flows
- 2 Environmental impact considerations – noise, flora and fauna (bird density), visual impact
- 3 Distance from ideal wind generator site to aid to navigation station
- 4 Planned maintenance visits
- 5 Health and safety issues for third parties

Lesson 3 Capacity and output

- 1 Generator outputs
- 2 Annual wind predictions and predicted outputs
- 3 Capacity assessment for AtoN autonomy

2.2 **Module 2 – Wind generator installation**

2.2.1 Scope

This module describes how to install and set to work a wind generator.

2.2.2 Learning Objective

To gain a **satisfactory** understanding of how to install and set to work a wind generator.

2.2.3 Syllabus

Lesson 1 Installation of a wind generator

- 1 Review of components
- 2 Health and Safety considerations
- 3 Assembly of the wind generator
- 4 Fitting the assembly to the tower or stand
- 5 Blade fitting and safety precautions
- 6 Power supply connection from tower to AtoN site

Lesson 2 Connection to battery pack

- 1 Electrical safety precautions
- 2 Connection to regulator and battery pack
- 3 Testing procedures

2.3 **Module 3 - Maintenance of Wind Generators**

2.3.1 Scope

This module describes the maintenance procedures for wind generators.

2.3.2 Learning Objective

To gain a **satisfactory** understanding of how to maintain a wind generator.

2.3.3 Syllabus

Lesson 1 Pre-maintenance procedures

- 1 Review of manufacturer's planned maintenance procedures
- 2 Health and Safety considerations
- 3 Review of spare part list and maintenance equipment
- 4 Maintenance records and forms

Lesson 2 Practical Maintenance

- 1 Initial examination and checks
- 2 Disconnection of electrical connections
- 3 Blade rotation considerations
- 4 Axis component maintenance
- 5 Turbine maintenance
- 6 Testing procedures

7 Reconnection procedures and tests

8 Maintenance records

Assessment. Participants will be assessed on their competency at the end of Module 2 and 3.