

MARINE ELECTRICAL SYSTEMS HANDBOOK

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INTRODUCTION

While sailing the Pacific Coast, Mexico, Central America, and the Caribbean, I conducted several hands-on seminars for cruising sailors to learn about and improve their electrical systems. Over that time, the seminar developed into an effective means to help others understand their needs, their systems, and increase the level of safety relating to marine electrical systems. The seminar was popular, well received and resulted in many new friendships.

The material contained in this handbook aims to help you understand and troubleshoot your boat's electrical system without a prior background in electronics. You will be better able to make necessary repairs, increase overall electrical system efficiency, add a little to safety, and enjoy your boat more.

The complete, 8-part handbook will help you:

- Learn how to decrease your charging time and increase your battery efficiency with simple, do-it-yourself wiring changes.
- Learn about your batteries. What types are best suited to your application? Gel-cell verses liquid electrolyte. Learn about Ni-Cad and alkaline batteries. How to care for each of these.
- Learn about battery charging devices. Which are good or bad? How do they differ? Includes alternators, generators, shore power chargers, wind power, and solar power.
- Learn about regulators and other charge controllers including internal and external, multi-state, by-pass, and shunt types.
- Learn about "electrolysis", its causes and cures.
- Learn how to trouble shoot electrical problems with your multimeter.
- Learn preventive maintenance for your electrical system.

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Part 1: ELECTRICAL CONNECTIONS **1**

This part examines proper wire size for amp loads, use of ring terminals, connections, resistance, and losses in the wiring system. This is some of the most important material in this handbook. Concentrate on learning this part as it sets up the understanding for all the following material.

Part 2: GROUNDS **8**

Discussion on Alternator Ground, Protective Ground, Neutral Conductor, and Bonding. What are their differences? Similarities? Proper uses? The effectiveness of these can be measured and simple improvements made to decrease charge time, and reduce electrolysis.

Part 3: BATTERIES **15**

There are many types of batteries used on a boat, Lead Acid (liquid electrolyte), Gel Cell (immobilized electrolyte), Ni-Cad, and Alkaline. In this part, we discuss the application, usefulness, storage, and charging characteristics of each.

Part 4: BATTERY CHARGING DEVICES **22**

What types of battery charging devices are used on boats? A thorough discussion of Alternators & Generators, AC Transformers & Solid State "Automatic" Chargers, Wind/Tow Generators, and Solar (Photo Voltaic) Panels is presented. How are they different? Which are effective? What precautions must be taken for each?

Part 5: REGULATORS **27**

Regulators control the amount of charge entering a battery, preventing an overcharge condition. Here we learn about Internal vs. external types, remote sense options, Multi-state regulators, Bypass, and Shunt type regulators.

Part 6: ELECTROLYSIS **33**

This part examines the destroying effects of Galvanic Action, Hot Grounds, Hot Marinas (including at anchor with generator), and Ground Loops. Learn how to measure and safeguard against these.

Part 7: POWER SOURCES and DISTRIBUTION **36**

Somewhat different from Battery Charging devices, alternative power sources discussion covers AC Shore Power, AC/DC Generators, Outlets, and Isolation Transformers.

Part 8: QUESTIONS and ANSWERS **39**

Questions or specific problems raised during the seminar are be presented, along with discussion and possible solutions for all readers to review and benefit from.