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## Shipboard Electrical Grounding Training

Contact us Today for a FREE quotation to deliver this course at your company's location.

<https://www.electricityforum.com/onsite-training-rfq>

The increased use of electrical and electronic equipment aboard Naval ships introduces risk of electromagnetic interference (EMI) problems to ship operation and performance.

As systems are added, they all contribute and could become susceptible to an intense electromagnetic environment (EME). Considering the corrosive salt water environment in which ships must operate and the interaction of a ship's electrically conductive metallic superstructure, topside hardware, antenna systems, etc., the potential for interoperability problems is significantly increased.

Potential EMI and personnel safety problems related to electronic equipment operating in these environments are magnified because of:

- The need to establish and maintain a low impedance (Z)
- Common reference ground for all electrical/electronic equipment
- The detrimental effects of: Natural and manmade electromagnetic (EM) energy  
Spurious and intentional EM energy Off-ship and own-ship, EM energy

### **After Attending, You Will Learn:**

- How to ground the ships' electrical service
- To establish the ships Common Ground Point
- To evaluate and assess the grounding & bonding system
- Procedures for the connection between ship and shore safety grounds.
- About protection against shock hazards
- The fundamental characteristics of lightning and how to protect against it
- How power line disturbances can impact communications
- How to control corrosion through grounding
- The role of DOD specifications, commercial and Military/Navy standards
- The grounding of the engine block
- The concepts of Grounded and Ungrounded systems.
- Guidelines for Grounding in maritime installations
- Shipboard Bonding ,Grounding & Electromagnetic Compatibility
- Shipboard Electromagnetic Shielding practices

### **WHO SHOULD ATTEND**

Grounding And Bonding For Marine Applications Course. This advanced course is designed for those who are required to design, plan, install, maintain and/or supervise contractors who are providing grounding and lightning protection systems for shipboard systems, such as: Naval Engineers, Base Civil Engineers, Electrical Engineers, Project Engineers, Design Engineers, foremen & crew members, electrical workers in the marine industry, electronic technicians, site Engineers or those who are responsible for the engineering, design, construction, installation, inspection, operation, or maintenance of electrical grounding systems in shipboard and marine facilities.

### **STUDENTS RECEIVE**

- **FREE** 100-Page Digital Electrical Grounding Handbook (Value \$20)
- **\$100** Coupon Toward any Future Electricity Forum Event (Restrictions Apply)

- 1.4 Continuing Education Unit (CEU) Credits
- **FREE** Magazine Subscription (Value \$25.00)
- Course Materials in Paper Format

## **COURSE OUTLINE**

### **DAY ONE**

#### **SESSION 1: ELECTRICAL GROUNDING – SCOPE**

- Definitions
- Applications
- Grounding methods
- Ground Faults
- Why Ground Circuits and Systems
- Grounding Systems

#### **SESSION 2: CLASSIFICATION OF VARIOUS GROUNDING STANDARDS. CODES AND RULES**

- FEDERAL SPECIFICATIONS
- DEPARTMENT OF DEFENSE SPECIFICATIONS
- DEPARTMENT OF DEFENSE STANDARDS
- MIL-STD-464 Electromagnetic Environmental Effects, Requirements for Systems
- MIL-STD-2003-5 Electric Plant Installation, Standard Methods for Surface Ship and Submarines
- MIL-STD-2169 High-Altitude Electromagnetic Pulse (HEMP) Environment
- NON-GOVERNMENT PUBLICATIONS
- AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI/IEEE

### **SESSION 3: ELECTRICAL GROUNDING ELECTRODE SYSTEM**

- Grounding Theory
- Parameters, Measurements and Calculations
- Electrical Grounding and Corrosion
- Installation and Protection
- Sizing the Grounding Electrode Conductor
- General requirements for:
  - Shipboard Grounding, Bonding, & other techniques for EMC, EMP & Safety
  - Ground potential and ships ground plane
  - Ground potential for metallic hull ships
  - Ground potential for nonmetallic hull ships
  - Electrical safety
  - Bonding and grounding of composite structures
  - Hull-generated EMI prevention.

### **SESSION 4: CIRCUIT GROUNDING**

- Ships source of electrical power
- Grounded Conductor
- Direct-Current Systems
- Alternating-Current System
- Rigging Shore Power
- External source through shore power cables
- Unrigging Shore Power

### **SESSION 5: EQUIPMENT BONDING & GROUNDING**

- Major Requirements:

- Identification of the Bonding Conductor
- Bonding/Grounding and electric Shock
- Ship's Bonding installation
- Hardware for C bonding
- Bonding straps, Type I,II, III, IV & V
- Equipment cabinets and hardware items
- Shock-mounted
- Bond strap and grounding wire routing
- Joiner/false/honeycomb bulkhead mounted equipment

### **SESSION 6: EMERGENCY POWER SYSTEMS**

- Main Bonding Jumper
- Portable generators
- Vehicle Mounted Generators

### **DAY TWO**

### **SESSION 7: OFF-SHORE & SHIP'S GROUNDING SYSTEM**

- System Reference Zero
- Detection of a Faulty Neutral-Ground
- System Sizing Wiring to Meet Computer Industry Standards
- Grounding Line Treatment Devices
- Transient Overvoltage Protector Grounding
- Gas Tubes Metal Oxide Varistors Silicon Avalanche Diodes
- Ship's Computer Grounding System
- Ship's Ground plane(s)/Elements of the ground plane
- Superstructure, equipment foundations and racks

- Shielded room(s)

### **SESSION 8: HULL-GENERATED EMI PREVENTION**

- Portable and removable metallic deck hardware
- Nonmetallic topside material
- Bond topside metal-to-metal contact junctions
- Cable and hull penetration EMI control
- Topside cable installations
- Shielded cable
- Unshielded cable

### **SESSION 9: LIGHTNING PROTECTION**

- Electrical Grounding Lightning
- Characteristics Protection Systems
- Electrogeometric & Rolling Sphere Concept
- Ship's main ground connection point
- Metal Mast

### **SESSION 10: ELECTRONIC EQUIPMENT GROUNDING**

- Introduction and Definitions
- Computer and Electronic Equipment Grounding
- Telecommunication Rooms and Closets
- Data Processing Equipment
- Grounding Electronic Security Equipment Grounding
- RF tuned receiver front-end stages
- LF-MF receiver(s), but no in-band transmitters

## **SESSION 11: TELECOMMUNICATION SITE GROUNDING**

- Grounding Subsystems
- Exterior Ground Ring
- Interior Ground Ring –
- Halo Ground
- Low-Frequency Networks
- High frequency Networks

## **SESSION 12: EMI ON ELECTRONIC CIRCUITS**

- Susceptibility - Immunity
- Cable Shielding and Grounding
- Losses by Absorption and reflection
- Grounding Low- and High-Frequency Shielding
- Grounding High-frequency Shielding
- Coaxial Cables
- Superficial Resistivity
- Resonance and Skin Effect

**Review of expectations  
Questions and Answers**

## **COURSE TIMETABLE**

**Both days:**

Start: 8:00 a.m.

Coffee break: 10:00 a.m.

Lunch: 12:00 noon

Finish: 4:30 p.m.

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