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Shipboard Electrical Grounding Training

View Course Details

COURSE DATES AND TIMES

Shipboard Electrical Grounding Training Overview

Modern Naval and marine vessels carry dense concentrations of power, communication, navigation, and weapons systems. As new electrical and electronic systems are added, they contribute to a complex electromagnetic environment and can become susceptible to EMI. In parallel, ships operate in a harsh, corrosive saltwater environment, where the metallic hull, superstructure, topside hardware, and antenna systems interact electrically.

These factors significantly increase the potential for interoperability problems, nuisance upsets, data corruption, shock hazards, and accelerated corrosion. Effective shipboard grounding and bonding practices are essential for controlling ground potential, managing return currents, reducing electromagnetic coupling, and maintaining the safe operation of shipboard power systems and electronics.

This course explains how to establish and maintain a low-impedance common reference ground for shipboard electrical and electronic equipment. It examines the effects of natural and man-made electromagnetic energy, both on-ship and off-ship, and shows how proper grounding, bonding, and shielding practices can mitigate EMI, improve electromagnetic compatibility (EMC), and enhance personnel safety. The training also addresses the impact of power line disturbances on communications, the fundamentals of lightning and surge protection, and the role of grounding in corrosion control.

Why This Shipboard Grounding Course Matters

- Reduce EMI with effective grounding and bonding.
- Improve safety by limiting shock and fault hazards

- Protect critical equipment from damage and downtime.
- Reduce corrosion and extend system lifespan.
- Meet Navy, DOD, and industry grounding standards.
- Assess grounding integrity and apply corrective actions.

Key Learning Outcomes

After completing this course, participants will be able to:

Grounding and power distribution

- Understand how to ground the ship’s electrical service and establish an effective common ground point for shipboard power systems.
- Explain the concepts of grounded and ungrounded systems and when each approach is used in marine applications.
- Describe procedures for safe connection between the ship and the shore safety grounds.

Bonding, EMC, and EMI control

- Evaluate and assess shipboard grounding and bonding systems for both power and electronic equipment.
- Apply shipboard bonding, grounding, and electromagnetic compatibility practices to control EMI and maintain EMC.
- Understand shipboard electromagnetic shielding practices and how they complement grounding and bonding to reduce interference.
- Explain how power line disturbances can impact communications and control systems and how grounding strategies help mitigate these effects.

Lightning, surge, and shock protection

- Describe lightning and protect shipboard systems from its effects.
- Identify measures that prevent shock hazards near energized equipment.
- Apply maritime grounding rules, including lightning and surge protection.

Corrosion and structural considerations

- Understand how grounding and bonding affect shipboard corrosion and how to control it.
- Recognize how the hull and metallic structures interact electrically and manage these paths.

Standards, specifications, and compliance

- Identify how DOD, commercial, and Navy standards define grounding and bonding requirements.
- Apply these standards to design, install, inspect, and maintain grounding systems.
- Plan ongoing inspection, testing, and documentation to ensure compliance.

WHO SHOULD ATTEND

Grounding and Bonding for Shipboard Marine Applications is an advanced course designed for professionals who must design, plan, install, maintain, or supervise contractors providing grounding and lightning protection systems for shipboard and marine facilities, including:

• Naval engineers and base civil engineers
• Electrical, project, and design engineers working on shipboard or marine installations
• Foremen, crew leaders, and electrical workers in the marine industry
• Electronic technicians and site engineers dealing with shipboard power and electronic systems

• Personnel responsible for the engineering, design, construction, installation, inspection, operation, or maintenance of electrical grounding systems in shipboard and marine facilities

STUDENTS RECEIVE

- Shipboard Grounding Training Course Certificate
- 1.2 Continuing Education Unit (CEU) Credits (12 Professional Development Hours)
- $100 Coupon Toward any Future Electricity Forum Event (Restrictions Apply)
- FREE 100-Page Digital Electrical Grounding Handbook (Value $20)
- FREE Magazine Subscription (Value $25.00)
- Course Materials in PDF Format

COURSE OUTLINE

Shipboard Electrical Grounding Training 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.