



Electrical Grounding In Mining Applications

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COURSE DATES AND TIMES

The mining industry uses a large amount of electric power. Their equipment is subject to extreme environmental conditions and mechanical shock. A significant number of electrical accidents are a result of improperly grounded electrical equipment.

Accident statistics compiled by MSHA's Health Safety Analysis Center indicate that approximately 14% of all electrical fatalities occur from improper or inadequate grounding.

Once a reliable system ground has been established that connects all the metallic frames of electrical equipment together, then the grounding system must be placed at some reference potential.

Improper frame grounding is the cause of many electrical accidents in metal/nonmetal mines. It is therefore important that the frame grounding system be periodically tested to determine if the grounding conductor is continuous throughout the mine power system. This course will provide the information on how to conduct this test.

Grounding conductors in trailing cables, power cables, and cords, which supply power to portable electrical equipment require testing more frequently than the annual testing required of grounding conductors which are exposed or subjected to vibration, flexing, corrosive environments or frequent lightning hazards. This course will provide procedures and methods for these tests.

After Attending, You Will Learn:

- Understand Classification Of Various Mining Grounding Standards. Codes And Rules
- Resistance Grounding in mining Installations
- High voltage trail cable
- Purpose of Ground Monitor/Ground monitor operation
- Neutral current and potential Relaying
- About ground faults

- Be able to comply with Mining Specifications
- Comply with U.S. Department of Labor Mine Safety and Health Administration Specifications
- Understand Mining Emergency Power Systems
- Understand how to design, construct and test lighting protection systems adjacent to Mining facilities
- Lightning Protection of Mining Shovels/Excavators
- Portable substation grounding

WHO SHOULD ATTEND

- Mining Electrical Engineers and Engineering Technicians
- Mining Project Engineers and Supervisors
- Design Engineers, Field Technicians, Mining Electrical Technicians
- Mining Engineers responsible for the engineering, design, construction, installation, inspection, operation, or maintenance of electrical grounding systems in mining applications

STUDENTS RECEIVE

- **FREE** 130-Page 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

Electrical Grounding and Bonding for Mining Applications

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

- CFR 30 Parts 55, 56 and 57, 12-25, 12-26, 12-27 and 12-28.
- In Parts 55, 56 and 57, section 12-25 requires frame grounding of all electrical equipment. Section 12-26 requires grounding of substation enclosures. Frame grounding of portable equipment is required by 12-27 and 12-28 requires testing of all the grounding components at a mine.
- U.S. Department of Labor Mine Safety and Health Administration
- U.S. Department of the Interior
- Pittsburgh Safety and Health Technology Center
- ANSI/IEEE

SESSION 3: ELECTRICAL GROUNDING ELECTRODE SYSTEM

- Grounding Theory
- Grounding Theory
- Parameters, Measurements and Calculations
- Types of ground
- Stationary equipment grounding importance of grounding the metallic portions of buildings.
- Wrong practice of grounding the equipment through local grounds or “peg grounds”.
- Installation and Protection
- Sizing the Grounding Electrode Conductor
- Portable equipment grounding
- Equipment powered through trailing cables
- Frame grounding or equivalent protection
- Noncurrent carrying metallic conductor

SESSION 4: SAFETY GROUNDING

- Sources of electrical power
- Grounded Conductor
- Direct-Current Systems
- Alternating-Current System
- Power systems at metal/nonmetal mines
- Solidly Grounding system
- Resistance Grounding
- MCC's-Motors grounding
- Rigging Shore Power
- External source through shore power cables
- Performance grounding

SESSION 5: EQUIPMENT BONDING & GROUNDING

- Major Requirements:
- Identification of the Bonding Conductor

- Bonding/Grounding and electric Shock
- Equipment cabinets and hardware items
- Ground returns & machine grounding
- Frame grounding

SESSION 6: EMERGENCY POWER SYSTEMS

- Proper grounding of emergency power systems (generators)
- Three Pole emergency generator grounding
- Four Pole emergency generator grounding.
- Main Bonding Jumper
- Portable generators
- Vehicle Mounted Generators

DAY TWO

SESSION 7: GROUND CHECK MONITORS FOR UNDERGROUND POWER SYSTEMS

- The pilot wire to the equipment frame
- Phase to ground fault while the ground wire is broken.
- Basic approaches to monitoring
- Face equipment monitoring
- Problems associated with monitoring
- Intermachine Arcing
- Stray Currents
- Voltage Regulation
- Parallel Paths
- High Voltage Monitoring Systems
- Low Voltage Monitoring Systems

SESSION 8: GROUND RESISTANCE TESTING IN THE MINING INDUSTRY

- Substation with Substation Ground Bed and Three Parallel Ground Paths
- Measurement of earth resistance
- 62% Method
- Fall of Potential Method.
- Universal Ground Resistance Curve
- Guidelines to insure a safe testing procedure.
- Grounding Electrode accident

SESSION 9: LIGHTNING PROTECTION

- Electrical Grounding & Lightning
- Characteristics Protection Systems
- Electrogeometric & Rolling Sphere Concept
- NAVFAC Design Guides
- Ordnance Facilities Protection
- Storage and Handling Facilities Above Ground
- Earth-Covered Magazines
- Cranes on Piers and Wharves
- Marshalling Yards (Truck and Railroad)
- Explosives safety requirements
- Transient Overvoltage Protector Grounding
- Gas Tubes Metal Oxide Varistors Silicon Avalanche Diodes

SESSION 10: SAFE MEASUREMENT OF GROUND RESISTANCE

- Ground beds
- Ground bed resistance measurement
- Substation with Substation Ground Bed and Three Parallel Ground Paths
- Evaluation of specific instruments
- Three and four terminal instruments
- Clamp meter type
- Mine Safety Ground Bed
- Operation of Continuous
- Ground Bed Monitor
- Location of Ground Bed Monitor
- and Blocking Inductor

SESSION 11: CONSTRUCTION OF DRIVEN ROD GROUND BEDS

- Ground Bed design & construction
- Construction of a prototype ground bed
- Interconnection of rods
- Ground bed design tables
- Ground bed conducting fault current
- Ground bed conducting lightning stroke
- Soil Resistivity
- Soil Resistivity measurements
- Resistivity surveys for the Bureau of Mine ground Beds
- Soil resistivity measurement
- Wenner Method for soil resistivity measurement
- Arrangement for resistivity tables
- Interpretation of results

SESSION 12: SUBSTATION GROUNDING & BONDING FOR MINE POWER SYSTEMS

- Substation Ground Mat
- Grid design

- Surge arresters
- Grounding distribution system arresters
- Safety ground bed
- Wiring of ground system
- Grounding the borehole casing
- Ground check monitoring
- Ground bed corrosion
- CASE HISTORIES

Review of expectations

Questions and Answers

COURSE SCHEDULE:

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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