



Training Program:

Arc Flash Calculation And Analysis

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Introduction:

The inadequate electrical installation often resulted in fires, and standard installation methods did not exist. In recent years, the community has begun to recognize that in addition to fire and electrocution, arc-flash and arc-blast hazards also result in injury. The knowledge base about these hazards is expanding but is not yet complete. The community knows that as the distance between a worker and an electrical hazard decreases the degree of exposure increases.

Employees must understand that they are exposed to these hazards until an electrically safe work condition has been established, as explained in this workshop. Recently, the electrical community has begun to understand that workers are exposed to many different electrical hazards. Workers certainly should not be unnecessarily exposed to hazards. Workers should understand how and when they could be exposed to a hazard and how to assess the hazard and risk of injury. They must also understand how to select and use work practices that minimize or eliminate the risk of injury and how to select and wear protective equipment that will minimize or eliminate that risk.

Basic Arc Flash hazard course provides front-line electrical workers with the information they need to make safe decisions involving their work practices. From this training, they will receive the proper awareness and training needed in order to develop a personal arc flash safety strategy in the workplace. This 5 days seminar will go in-depth with arc flash hazard analysis using commercial worldwide software like ETAP power station from OTI.

Who Should Attend?

Electrical Design, Project and Maintenance Engineers, Managers & Safety Professionals.

Course Objectives:

This course is designed to enable participants to:

- Identify electrical safety training requirements for qualified workers.
- Identify best practice Regulations that address shock and arc flash hazards.
- List the steps to perform a shock hazard analysis and describe each step.
- List the personal protective equipment required for shock protection.
- List the steps to achieve an electrically safe work condition.
- List the steps to install and remove temporary protective grounding equipment.
- Explain what an arc flash is and the injuries that can result.
- Identify when an arc flash hazard exists.
- List the steps to perform an arc flash hazard analysis and describe each step
- Define the term "incident energy," identify the key electrical system variables that affect it.
- Define the term "arc flash protection boundary" and explain its application.
- Define the term "arc-rated" and explain the difference between "flame-resistant" clothing and "arc rated" clothing.
- Select appropriate personal protective equipment for arc flash hazards.
- Describe the Hazard/Risk Category method of selecting arc flash PPE.

- List the testing and maintenance requirements for personal protective equipment.
- Identify the key objectives of job safety planning.
- Some analysis typical cases using ETAP Software.

Course Outline

Understanding Electric Power Systems

- Basic Electrical Theory and Definitions
- Ohm's Law
- Types of Electrical Faults
- Overloads
- Short Circuits
- Overcurrent Protective Devices
- Earth Fault Systems
- Time-Current Curves & Power System Studies
- Circuit Breakers & Interrupting Rating
- Electrical Drawings & Switching programs
- Current Limitation
- Fuses

Recognizing Electrical Hazards associated with Electrical Elements

A detailed review of critical electrical safety hazards created by energized electrical equipment:

- Insulation
- Power Cables
- Power Transformers
- Instrument Transformers
- Dealing With Fault Currents
- Disconnect Switches
- Switchgear & Circuit Breakers
- Fuses & Electrical Relays
- Capacitors
- Emergency UPS Systems

Hazards of Electricity

- Electrical Safety Hazards
- Electric Shock
- Effects of current on human beings based on IEC 60479
- Shock Hazard Analysis
- Arc-Flash and Arc Blasts
- Electrical Arc Flash Characteristics
- Arc-Flash Metrics
- Arc-Blast Effect

- Light and Sound Effects
- Elements and characteristics of an Arc Flash Event
- Arc Flash Hazard Analysis

Preparing to Work Safely

- Hazard Risk Analysis/ Task Assessment
- Hazard/ Risk Evaluation/ Assessment
- Assessment to Lockout or Work Energized
- Overview of Lockout Fundamentals
- Working Energized defined
- Job Briefing and Planning Checklist
- Energized Electrical Work Permit Flow Chart
- Elements of an Energized Electrical Work Permit and preparing for

Establishing an Electrically Safe Work Condition

- Principles of Lockout Tagout Execution
- Hazardous Electrical Energy Control Procedures

Determining Safe Approach Distance

- Determining Safe Approach Distance
- Definitions of Boundaries and Spaces
- Limits of Approach
- Shock Hazard Analysis

- Shock Protection Boundaries
- Limited Approach Boundary
- Restricted Approach Boundary
- Prohibited Approach Boundary
- Hazard Boundary

Shock Hazard Assessment

- Limits of Approach
- Preparation for Approach
- Qualified Persons, Safe Approach Distance
- Basis for Distance Values - Approach Boundaries to Energized
- Electrical Conductors or Circuit Parts for Shock Protection

Basic Method for Determining Arc Flash Hazard Assessment

- Breakdown and characteristics of the 5 Hazard Risk Categories
- Selection of Personal Protective Equipment for Various Tasks
- Hazard/ Risk Category Classification
- Protective Clothing and Personal Protective Equipment (PPE)
- Protective Clothing Characteristics
- Factors in selection of Protective Clothing and Equipment

Electrical Hazard Analysis

- Shock Hazard Analysis

- Approach Boundaries
- Flash Hazard Analysis
- Arc-Flash Calculations
- Arc-Flash Hazard Calculation Examples
- IEEE 1584 Arc-Flash Hazard Calculation
- NFPA 70E Table Method
- Steps required to use the NFPA 70E Table Method

Electrical Hazard Labels, Arc Flash and Shock Labeling

- Shock and Arc Flash Warning Label
- Arc Flash Label Example
- Detailed Arc Flash Hazard Analysis Label

Minimizing Arc-Flash and Other Electrical Hazards

- Design a Safer System
- Implement an Electrical Safety Program including Arc Flash Study Analysis and Implementation
- Observe Safe Work Practices
- Use Personal Protective Equipment (PPE)
- The evolution of Flame Resistant (FR) fabrics
- Use Warning Labels
- Use an Energized Electrical Work Permit
- Avoid Hazards of Improperly Selected or Maintained Overcurrent Protective Devices

- Achieve or Increase Selective Coordination
- Arc Flash Study Analysis and Implementation
- Arc Resistant Switchgear
- Remote Breaker Racking
- Regular Maintenance and Testing

Some Relevant Video Tapes for Electrical Hazards & Cases

Arc Flash & Electricity Hazards Analysis using Software

- Basic Methods For Determining Arc Flash Hazard Assessment
- Breakdown and characteristics of the 5 Hazard Risk Categories
- Selection of Personal Protective Equipment for Various Tasks
- Hazard/ Risk Category Classification
- Protective Clothing and Personal Protective Equipment (PPE)
- Factors in selection of Protective Clothing and Equipment
- Short Circuit, Relay Co-ordination & Arc Flash Analysis using Computer simulations using ETAP 16.00 from OTI
- Calculations of incident Energy (Cal/cm²) using software's & manually (ETAP 16.00)

Accreditation:

BTS attendance certificate will be issued to all attendees completing a minimum of 80% of the total course duration.