

# NFPA 70B: RECOMMENDED PRACTICE FOR ELECTRICAL EQUIPMENT MAINTENANCE®

NFPA® 70B, Recommended Practice for Electrical Equipment Maintenance is the American National Standard for electrical maintenance activities designed to reduce hazard to life and property that results from the failure or malfunction of electrical systems and equipment.

Both the National Electrical Code® (NEC®) and the NFPA 70E® Standard for Electrical Safety in the Workplace® address the need for electrical equipment maintenance.

The NEC states that compliance with the NEC and “proper maintenance” will result in an installation that is essentially free from hazard. The NFPA 70E® electrical safety standard requires, (along with four other items), that electrical equipment be “properly maintained” to permit normal operation. The standard explains the requirement as, “...maintained in accordance with the manufacturer’s recommendations and applicable industry codes and standards.” Thus, following manufactures’ instructions and applying the industry best practices found in NFPA 70B are necessary for safe plant operation.

Participants in this course take away practical knowledge and technical expertise that can be immediately applied to reduce downtime, extend equipment life and improve safety.

## CLASS FORMAT:

Lecture

## STANDARD CLASS SIZE:

NTT recommends a class of no more than 35 participants to obtain the best results.

## NTT TO PROVIDE:

- Two days (16 contact hours) of on-site instruction
- Textbooks
  - NFPA 70B, Recommended Practice for Electrical Equipment Maintenance, 2016 edition
  - NTT Workbook, NFPA 70B
- Classroom consumables
- Completion certificates
- Course syllabus, outline, table of contents, or training objectives
- Shipping and instructor travel logistics

## CLIENT PROVIDES:

- Classroom of 500 square feet or greater
- Projection screen, white board and/or flip chart(s)

## WHO SHOULD ATTEND:

- People who will benefit from this training include:
  - Warehouse employees
  - Safety directors
  - Electrical contractors
  - Electricians
  - Maintenance electricians
  - Linemen & Utility workers
  - Owners & managers
  - Supervisors working on or who oversee employees working on 50V or greater equipment
  - HVAC maintenance and Repair Technicians
  - Plant & facility maintenance technicians
  - Building engineers
  - Building managers & superintendents



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## COURSE AGENDA

### Fundamental Requirements for Electrical Maintenance

#### 1. THE ELECTRICAL PREVENTIVE MAINTENANCE PROGRAM

- Why electrical equipment maintenance?
- The Electrical Safety Triangle
- Developing and improving an Electrical Preventive Maintenance Program (EPM)
- The Electrical Safety Program and Maintenance Activities
- Reliability Centered Maintenance
- Electrical Disaster Recovery
- Case studies

#### 2 FUNDAMENTALS OF ELECTRICAL EQUIPMENT MAINTENANCE

- NEC® requirements for safe maintenance
- Safe electrical equipment and NFPA® 79 Electrical Standard for Industrial Machinery
- Protective scheme – understanding and applying system studies
- Acceptance testing objectives and procedures
- Maintenance testing specifications
- Equipment retrofits
- Equipment cleaning
- Special handling and disposal
- The SCADA System as part of maintenance
- Lubrication basics and proper lubrication
- Threaded connections and wiring terminations

#### 3. ELECTRICAL TESTING AND TEST METHODS

- Determining electrical tests to be conducted, frequency and specifications
- Testing issues: technician qualifications, equipment, safety and documentation
- Insulation resistance testing methods and procedures

- Distribution equipment testing: Circuit Breakers, switchgear, protective relays, cables, fuses, switches, rotating equipment, transformers, drives
- Grounding system tests
- Battery testing
- Predictive maintenance techniques: Infrared thermography, vibration analysis, Ultrasonic testing
- Emergency and Standby Power Systems

#### 4. GROUNDING SYSTEM MAINTENANCE

- Ground Fault Protective devices
- Isolating grounding system issues
- Inspection, testing and monitoring earth connections
- Solutions for grounding issues

#### 5. POWER QUALITY AND ELECTRICAL MAINTENANCE

- Introduction to power quality and its effects on electrical equipment and systems
- Why maintaining power quality must be considered a fundamental requirement of electrical maintenance
- Test equipment for measuring power quality
- Interpreting power quality measurements and providing corrective solutions:
  - Harmonics
  - Transients (Surges)
  - Voltage Sags and Swells
  - Voltage Interruptions
  - Unbalance
  - Grounding issues
  - Electrical noise
  - Interharmonics
  - Flicker
- Power quality audits and additional references

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## Specific Equipment Topics

### 6. SUBSTATIONS AND SWITCHGEAR ASSEMBLIES

- Substations components inspection and maintenance:
- Circuit Interrupters
- Air Circuit Breakers
- Vacuum Circuit Breakers
- Oil Circuit Breakers
- Interrupter Switches
- Gas-Insulated Substations and Gas-Insulated Equipment
- Auxiliary Equipment.
- Switchgear Assemblies:
- Inspection criteria
- Testing

### 7. MOTOR CONTROL COMPONENTS

- Motor control components
- Visual inspections and maintenance of:
- Enclosures
- Disconnect switches
- Terminations
- Overcurrent protection
- Pilot devices and associated wiring
- Relays
- Contactors and overloads
- Testing and troubleshooting motor controls

### 8. OVERCURRENT PROTECTIVE DEVICE MAINTENANCE – CIRCUIT BREAKERS AND FUSES

- Fuse classifications and maintenance:
- Maintaining fuses rated 1000 volts or less
- Maintaining fuses rated over 1000 volts
- Circuit Breaker maintenance
- Types, ratings and construction of circuit breakers
- Application considerations

- Inspecting for common circuit breaker faults
- Routine inspection and cleaning
- Periodic electrical and mechanical maintenance activities
- Circuit breaker overhaul
- Electrical testing

### 9. POWER CABLES, CABLE TRAY AND BUSWAY MAINTENANCE AND TESTING

- Installation applications for cables, cable tray and 600 volt busway
- Visual and mechanical inspections
- Aerial cable installations
- Raceway installations of cable
- Cable testing
- Busway rated 5kV to 15 kV specific maintenance activities
- Electrical testing of busway and associated equipment

### 10. ROTATING EQUIPMENT

- Classifications of rotating equipment and components
- Special safety precautions
- Visual and mechanical inspections
- Cleaning and drying methods
- Bearings and lubrication
- General overhaul of rotating equipment
- Electrical testing
- Using testing documentation for troubleshooting and predictive maintenance

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## 11. POWER AND DISTRIBUTION TRANSFORMERS

- Dry-type transformers
- Construction and operation
- Visual and mechanical inspections
- Electrical testing
- Liquid-filled transformers
- Construction and operation
- Auxiliary equipment and cooling systems
- Liquids and gas system maintenance
- Visual and mechanical inspections
- Electrical testing

## 12. HAZARDOUS (CLASSIFIED) LOCATIONS EQUIPMENT MAINTENANCE

- Determining hazardous locations for maintenance
- Special precautions and test equipment for work in hazardous locations
- Visual and mechanical inspections
- Maintaining equipment for use in hazardous locations

## 13. MISCELLANEOUS ELECTRICAL MAINTENANCE ITEMS – LIGHTING, WIRING DEVICES, ELECTRONIC EQUIPMENT, PORTABLE TOOLS AND EXTENSION CORDS, EQUIPMENT SUBJECT TO LONG TIME BETWEEN SHUTDOWNS

- Lighting system maintenance in facilities
- Types of lighting and unique maintenance characteristics
- Cleaning, relamping, lamp disposal
- Switch and receptacle inspection and maintenance
- Electronic equipment special precautions and preventive maintenance techniques
- Maintenance programs for portable tools and extension cords
- Methods for maintaining electrical systems and equipment in continuous process operations

## 14. ELECTRICAL MAINTENANCE FOR SPECIFIC SYSTEMS

- Uninterruptible Power Supply (UPS) systems
- Photovoltaic (PV) systems
- Electrical Vehicle Charging Systems
- Wind Power systems and associated equipment