

# **Practical Maintenance NFPA 70B & 70E**

**Chris Myers**

# Who am I?

- | Electrical Engineer focused on power design and electrical safety studies
- | Lead of the Studies Team
- | Subject Matter Expert (SME) for NFPA 70E within Interstates
- | Primary Support for our maintenance support team on NFPA 70B

# Goals

- | Provide understandable explanations of the expectations of NFPA 70B
- | Give reasonable definition of “well-maintained”
- | Provide practical approach for creating a comprehensive safety and maintenance plan
- | Avoid just listing tables and data
- | Presentation functions as a stand-alone document

# What is NFPA 70B?

- | In brief, codifies of the NETA standards
  - | Maintenance and Testing of electrical equipment
  - | Maintenance and Testing schedules
  - | Maintenance and Testing documentation
  - | Annex – Example forms
- | What it doesn't cover:
  - | A hard definition of “well-maintained”

[NFPA.org](https://www.nfpa.org) has all NFPA codes free to view online

# Goals of NFPA 70B

- | Maintenance procedures can vary by site so a common standard was deemed necessary as NETA standards are not mandated
- | Anecdotes from my travels (no pics since they're from various clients)
  - | Car filter to help keep rooftop panels clean and cool
  - | MCC as a PPE storage closet
  - | Rigging an MCC door to access a broken reset
  - | Ancient electric room identified as high risk burned down (no one was hurt)

# “It Works Fine”

What do we mean by “works?”

- | Bad Definition
  - | If the system can operate with the currently installed components then it “works.”
    - | This doesn't consider:
      - | Safety
      - | Maintainability
      - | Reliability
  
- | Good Definition
  - | The system will operate within the manufacturer's parameters and the design intent of the installation.

# Well-maintained - Code

## Core Concept

- | NFPA 70B & 70E center around the idea of “well-maintained” to determine how the equipment is to be approached from a safety perspective.

## Definition?

- | That’s the problem, “well-maintained” is NOT well defined within the code

## What definition do we have?

- | NFPA 70E-13: Maintenance, Condition of
  - | “The state of the electrical equipment considering the manufacturers’ instructions, manufacturers’ recommendations, and applicable codes, standards, and recommended practices”

# Well-maintained - Implications

What happens if gear is not “well-maintained?”

- | Gear is to be considered open while operating live
- | General risks include (but are not limited to)
  - | Fire hazard from overheating equipment
  - | Damage to gear shortening lifespan or leading to catastrophic failure
  - | Downtime
- | Inaccuracy of safety inspections if they’re assuming the gear has been properly maintained

# Well-maintained - Application

What is the code trying to say?

- | “The manufactures’ instructions and recommendations”
  - | Manufacturers’ will provide maintenance guidelines as part of documentation.
- | “Applicable codes, standards, and recommended practices”
  - | This is where NFPA 70B is here to help

How does NFPA 70B help?

- | It provides the list of the expected maintenance and frequency.

# NFPA 70B – Organization and Contents

NFPA 70B is broken down into chapters relating to each equipment type and the requirements.

- | Chapters 3-10 cover the general requirements and methodology which are referenced frequently
- | Chapter 4 includes the general requirements
- | Chapter 6 includes common studies
- | Chapter 9 has the maintenance and testing frequency

# NFPA 70B – Organization and Contents

Chapters 11-38 provide breakdowns of the requirements on each type of equipment to be maintained.

What's in each section?

- | Frequency of Maintenance
- | Visual Inspection
- | Cleaning
- | Lubrication
- | Mechanical Servicing
- | Electrical Testing

# EMP – General Requirements

## Electrical Maintenance Program (EMP)

- | Equipment owner SHALL implement and document EMP that directs activity to appropriate personnel.
- | EMP Equipment condition SHALL be considered in determining safety risks.
- | EMP SHALL identify the principles upon which it is based and goals to be achieved.

# EMP – General Requirements

EMP must include the following elements

- | Condition of gear
- | Identification of responsible personnel
- | Survey and analysis of equipment and priorities
- | Documentation of procedure
- | Plan for inspection, testing, and servicing
- | Records of EMP for equipment, maintenance and personnel
- | Written process to prescribe, implement, and document corrective measures
- | Written process for incorporating design for maintainability
- | Written process for program review and revision

# EMP – Meeting Requirements

Frequency of Maintenance based on condition of gear and maintenance results.

- | Condition 1: Looks like new, clean, no active recommendations, and maintenance performed per EMP
- | Condition 2: Maintenance results deviate from previous results, previous maintenance revealed issues, modifications since prior assessment, or has active recommendations
- | Condition 3: Missed two successive maintenance cycles, previous two cycles revealed issues, or urgent actions have been identified

# EMP – Meeting Requirements

## Visual Inspection

- | Detailed visual check for any signs of wear or damage

## Cleaning

- | Frequency of cleaning based on environmental considerations and condition of gear.

## Lubrication (some exclusions)

- | Lubrication to be performed per manufacturer standards

# EMP – Meeting Requirements

## Mechanical Servicing

- | Varies by gear type, full tables in code.
- | Everything is torqued/tight
- | Filters are clean
- | Mechanical supports are in good condition

## Electrical Testing

- | Passes grounding and resistance tests
- | IR scanning
- | Operational Testing
- | HI-Pot (dielectric withstand)
- | Communications

# EMP – Written Process

## Key Requirements

- | Prescribe, implement, and document corrective measures
- | Incorporate design for maintainability
- | Program Review and revision

## Written Process:

- | 1/3<sup>rd</sup> of the requirements of an EMP center around the written process.
- | Does this mean you need a written process for each piece of gear like with lock out tag out (LOTO)?
  - | No, this is a generalized process.

# EMP – Written Process

## Written Process:

- | Is there a template to get started?
  - | Annex A – Explanatory Material contains clarifying statements and implementation
  - | Annex E – Large selection of standard testing forms
- | What does a good written process look like?
  - | Uses definitions consistent with code
  - | Clear step-by-step process
  - | Examples of expected documentation and requirements
  - | Clear revision cycle

# EMP – Common Studies

- | One-Lines
  - | Requirement: Keep them up to date and legible
- | System Studies
  - | General Requirement: Shall be created and reviewed for accuracy at intervals not to exceed 5 years
  - | Short Circuit Studies
  - | Coordination Studies
  - | Arc Flash Study
  - | Load-Flow Studies
    - | Only required if needed to allow maintenance.
  - | Reliability Studies
    - | Only required if needed to allow maintenance.

# EMP – Best Practices

- | Create a preventative maintenance plan for electrical equipment with an emphasis on gear that may need to be operated live.
- | Include any critical vendor maintenance recommendations in the plan.
- | Written procedure for reviewing maintenance work to ensure proper hardware is used.
- | Label equipment that is not to be opened live due to physical damage or concerns the gear is not well-maintained.
- | Create a list of equipment within the EMP, including its testing records and tracked maintenance cycles.

# 70E – Overview

- | NFPA 70E is concerned with the safe performance of electrical work. Focuses on proper gear ratings, maintenance, and labeling.
  - | Proper ratings for short circuit, voltage, and environmental conditions
  - | Proper maintenance so there is confidence that the system will work as intended
  - | Proper labeling so personnel are aware of hazards and proper PPE

# 70E – Practical Focus

- | Pre-Job Hazard Assessment (PJHA)
  - | Core to how to approach safe work.
- | Arc Flash Study
  - | A good arc flash study determines the amount of risk associated with an electrical explosions as well as the short circuit and coordination (requirements of 70B).
- | Labeling
  - | Labeling requirements sound extensive but need to be taken in the context of a full site safety program.

# 70E – Understanding PPE

- | Incident Energy
  - | Cal/cm<sup>2</sup>
    - | Calorie (unit of energy)
    - | Cm<sup>2</sup> (unit of area)
- | PPE Ratings
  - | PPE for arc flash has a cal rating. If the cal rating of the PPE is higher than the calculated incident energy it's appropriate for use
  - | If using PPE levels it's basically the same thing
    - | Level 0 < 1.2; Level 1 < 4 cal; Level 2 < 8 cal; Level 3 < 25 cal; Level 4 < 40 cal
  - | PPE Components and why they're needed:
    - | Coveralls/Jacket/Pants/Balaclava – Protects against debris, flame and heat

# 70E – Understanding PPE

PPE Components and why they're needed:

- | Coveralls/Jacket/Pants & Balaclava
  - | Protects against debris, flame and heat
- | Earplugs
  - | Protect against the sound generated by an arc flash
- | Insulated gloves
  - | Protect from shock hazard
- | Face shield or hood
  - | Protects against debris, flame and heat
  - | Vision protection from the light generated by an arc flash

# 70E – Arc Flash Studies

## Parts of an arc flash study

- | Short Circuit
  - | How much current when there's a catastrophic failure
- | Coordination
  - | How the protective devices are set up so everything trips in order and quickly
- | Arc Flash Incident Energy
  - | How large is the explosion in the event of an arc flash
- | Arc Flash labels
  - | Provide the shock (voltage) risk and incident energy for determining PPE

# 70E – Bus Configurations

- | There are three main configurations that matter for most sites
  - | VCB – Vertical Conductors in Box
  - | VCBB – Vertical Conductors in Box with a Barrier
  - | HCB – Horizontal Conductors in Box
- | Why is this confusing?
  - | There are often multiple configurations in a single enclosure and determining which one to use can be challenging
- | Which should be used then?
  - | For almost all gear worst case between VCB and VCBB is sufficient
  - | HCB should be used for draw-out switchgear and some oddball cases such as needing to work on an MCC from side access.

# 70E – Best Practices

- | Include updates to arc flash in the scope for any expansion or major upgrade work performed
- | Track changes to the system on site one-lines
- | Note any changes that could invalidate the arc flash report findings and label gear that should no longer be considered accurately modeled.
  - | Breaker setting changes and equipment replacement
  - | Addition of large (>50HP) motors
  - | Change of feed locations

# Tying It Together

- | Get the process started on a written program for meeting NFPA 70B
- | Tie the EMP to your safety program since the requirements have a lot of overlap
- | Make sure the PJHA and live work procedures consider gear condition
- | Treat the EMP records like safety data sheets (SDS) with availability to maintenance/contractors to assist with the PJHA
- | Ensure site labeling and studies are in line with NFPA 70E

# To Do List – Some Minimums

- | Gear labeling and One-lines
  - | Up to date (no timeframes, simply the expectation of accuracy)
- | Arc flash, short circuit, and coordination studies
  - | Five-year cycle
- | Breaker testing
  - | Three-year cycle
- | Grounding and electrostatic testing
  - | Three-year cycle
- | Infrared scanning & visual inspections of gear with reporting
  - | Yearly
- | Gear cleaning
  - | Five-year cycle or as needed
- | Mechanical Servicing and Lubrication
  - | Five-year cycle



## Kansas Safety & Health Conference

Decades of Safety

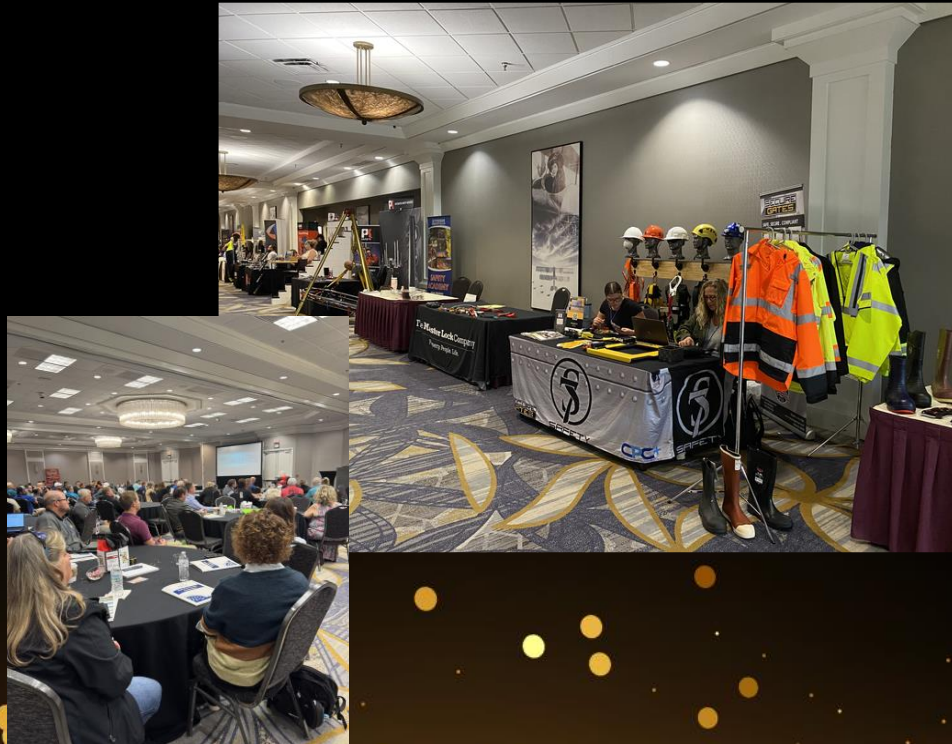
OCT. 14-17, 2025  
MANHATTAN, KS

- Two-day conference featuring the latest regulations, changes in laws and upcoming rules.
- Exhibitors that display the latest in safety and health equipment and technology.
- Two days of Professional Development Classes (PDC) in the 10-Hour OSHA Outreach Training for General Industry and Construction.



For more information,  
please visit our website:  
[dol.ks.gov/ishconference](http://dol.ks.gov/ishconference)

To be added to our conference email list,  
please email: [dena.ackors@ks.gov](mailto:dena.ackors@ks.gov)





## Feedback Survey



Your feedback is important to me!