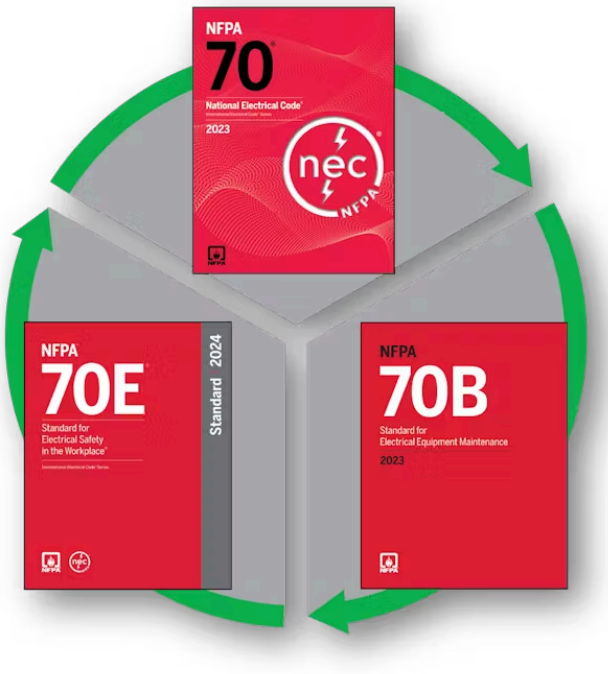
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SAFETY

Safety-Related Maintenance: The Evolving Standard

Now that NFPA 70B has been elevated to a standard, it's critical to understand how all of the electrical standards should work together.

Chuck Fox, CESCP



In managing any electrical system, the National Fire Protection Association (NFPA) publishes three related documents (NFPA 70, *National Electrical Code*; NFPA 70E, *Standard for Electrical Safety in the Workplace*; and NFPA 70B, *Standard for Electrical Equipment Maintenance*) that designers, installers, and maintenance professionals need to base their work on. As of January 2023, NFPA 70B has evolved from a "recommended practice" into an enforceable standard. With this elevation of NFPA 70B, electrical professionals (including facility and maintenance managers) now have some well-developed guidelines to keep people safe while ensuring a strong and reliable electrical system. With these guidelines, however, come some potential compliance challenges.

A combined study of these publications (their current and past editions) allows us to identify the trend to emphasize and develop standards for the safety-related

maintenance of electrical equipment. Let's take a closer look.

Historical highlights

Looking back, the 2009 edition of NFPA 70E was the first edition to specify a compliance requirement for device-specific equipment labeling. As per 70E 2009 Sec. 130.3(C), "Equipment Labeling. Equipment shall be field-marked with a label containing the available incident energy or required level of PPE."

Of course, to mark equipment in the field, an arc flash study was required. Within this same 2009 edition, the reference calling for the arc flash study contained the only reference to "condition of maintenance." As per NFPA 70E 2009 Sec. 130.3, "The arc flash hazard analysis shall take into consideration the design of the overcurrent protective device and its opening time, including its condition of maintenance."

The 2009 edition of NFPA 70E, Chapter 2, does reference safety-related maintenance but also includes text to narrow the focus to "only maintenance directly associated with employee safety" [Sec. 200.1(1)]. Specific elements of what is now defined in NFPA 70B, the Electrical Maintenance Program, were not yet part of the standard so without specific condition of maintenance requirements, many arc flash studies focused on the nameplate data of equipment required to calculate an arc flash label. Condition of maintenance elements were not included at this time nor were requirements for an electrical maintenance program beyond the arc flash study.

The 2015 edition of NFPA 70E was a major step forward in developing at least an awareness/need for a safety-related maintenance program. The scope of NFPA 70E was expanded to recognize that a component of employee safety begins with electrical equipment maintenance. The text expanded electric safety to now reference "safety-related maintenance and other administrative controls" [NFPA 70E 2015 Sec. 90.2, Scope]. Additionally, this new compliance requirement was further described by this new entry in the electrical safety plan. As per NFPA 70E 2015 Sec. 110.1(B) Maintenance, "The electrical safety program shall include elements that consider condition of maintenance of electrical equipment and systems."

The 2018 edition of NFPA 70E added equipment inspections as a new element of the electrical safety program. “The electrical safety program shall include elements to verify that newly installed or modified electrical equipment or systems have been inspected to comply with applicable installation codes and standards prior to being placed into service” [Sec. 110.5(B) Inspections]. While the scope of this inspection requirement focused on newly installed equipment, a well-developed electrical maintenance program should include a systematic inspection schedule for the site’s total inventory. For the first time, the 2018 standard also added a definition for maintenance. “Maintenance – Condition of” is the state of the electrical equipment considering the manufacturers’ instructions, manufacturers’ recommendations, and applicable industry codes, standards, and recommended practices [NFPA 70E 2018 Art.100 Definition]. But perhaps the compliance requirement with the most impact in NFPA 70E 2018 was Sec. 105.3 Responsibility, which placed a much stronger call to action to develop a written electrical safety program. The basic outline of the Electrical Safety Program (ESP) was outlined in Sec. 110.1. Efforts to develop the electrical safety plan included a broader capture of safety-related maintenance requirements throughout the 70E document.

The 2021 and 2024 editions of NFPA 70E did not define any new requirements of safety-related maintenance, but the important changes to the NFPA 70B publication were soon to be launched. NFPA 70E 2024 added Informative Annex S – Assessing the Condition of Maintenance. But remember, the descriptions provided in an Annex are noted as “Informational Only” and do not create direct compliance requirements. Most frequently, an Annex will provide additional details and approaches that contribute to compliance.



Crossreference resources

The references described thus far comprise a trend to evolve the metrics of electrical equipment maintenance as one of the foundational elements of employee safety and equipment safety. For further emphasis, many compliance topics are addressed in both the NFPA 70E and NFPA 70B standards as listed in the Table below. NFPA 70E 2024 includes the Electrical Safety Program, and NFPA 70B 2023 outlines the Electrical Maintenance Program requirements.

Topic	NFPA 70E 2024	NFPA 70B 2023
Inspection	Sec. 110.3(B)	Sec. 4.2.2
Condition of Maintenance	Sec. 110.3(C)	Sec. 4.2.3
Program Principles	Sec. 110.3(E)	Sec. 4.2.4
Program Controls	Sec. 110.3(F)	Sec. 4.2.5
Incident Investigations	Sec. 110.3(J)	Sec. 4.2.6
Program Audit	Sec. 110.3(K)	Sec. 4.2.7
Qualified Individual	Sec. 110.4	Sec. 5.1.1

Single line diagrams	Sec. 205.3	Sec. 6.2
Incident energy study	Sec. 130.5	Sec. 6.7
Short circuit study	Sec. 210.6	Sec. 6.3
Coordination Study	See NFPA 70 - NEC	Sec. 6.4

Key objectives of the Electrical Maintenance Program include:

- Preventing equipment failures that can also cause injury to employees.
- Establishing a program for compliance with NFPA 70E and now NFPA 70B standards.
- Increasing the lifespan of equipment with ongoing maintenance processes.

The general structure of the Electrical Maintenance Program and the Electrical Safety Program will include the following elements:

- Develop an electrical system device inventory.
- Complete a visual inspection and other tests to develop a baseline condition of maintenance.
- Complete an overall risk assessment.
- Develop a plan for electrical equipment maintenance.
- Document the maintenance tasking when completed.
- Audit the electrical maintenance program.

Electrical system inventory

When establishing an Electrical Maintenance Program, a detailed baseline inventory of the electrical components must first be developed. There can be significant latitude in how this device inventory is collected. For example, is a motor control center (MCC) line-up referenced as “one device,” or is each vertical section and each motor control “bucket” profiled separately? A best practice is to be as detailed as needed to properly document a one-line diagram and establish an incident energy/short circuit/and coordination result for each component.

Visual inspection and other tests to assess the condition of maintenance

As the electrical device profiles are being developed, the protocols of a full visual inspection as well as other condition of maintenance assessment can be completed concurrently. The result can be a problem report of all visual inspection issues and other test results, such as identified infrared problems. A best practice of the Electrical Maintenance Program is to implement the work sessions (frequently building or area-wide maintenance shutdowns) to complete repairs and document the resolution of the reported problems.

Additional risk assessment based on required engineering studies

Based on the data presented, NFPA 70B outlines the specific assessments of a short-circuit audit, a device coordination assessment, and the incident energy (arc flash) results. While these elements have generally been included with a comprehensive arc flash risk assessment, NFPA 70E does not have a specific requirement for these electrical system risk factors. For example, NFPA 70E 2024, Sec. 210.6 [Protective Devices] states that "protective devices shall be maintained to adequately withstand or interrupt available fault current." There is no specific compliance text that requires a short-circuit study. The EPM program requirements of NFPA 70B now fully describe this compliance challenge. See NFPA 70B Sec. 6.3 [Short Circuit Studies].

Based upon arc flash incident energy data, what should be considered for incident energy reduction? Based on NFPA 70E Sec. 110.2(A)(1) [Electrically Safety Work Condition], "Hazard elimination to be the first priority in the implementation of safety-related work practices. It remains the responsibility of management to determine what is a significant hazard and is the investment in its resolution a reasonable cost."

Getting started

Develop a plan for the frequency and content of maintenance procedures. NFPA 70B 2023 Chapter 9 presents an entire assessment protocol for establishing the frequency of recommended maintenance intervals. NFPA 70E Sec. 200.1(2) says "it is left to the employer to choose from the various maintenance methods available to satisfy the requirements of this (70E) Chapter 2." This is an additional example of the more

detailed Electrical Maintenance Program guidelines that in recent editions have created the additional emphasis safety related maintenance compared to the more generic descriptions of prior editions.

Document the test and inspection results.

If it is not documented, it did not happen. The proper documentation of electrical maintenance protocols is critical to the overall management of the Electrical Maintenance Program. What has been tested and what was bypassed within a maintenance cycle assures a well-managed program of electrical equipment maintenance and safety.

Audit

Audit the Electrical Maintenance Program to ensure maintenance activities remain on schedule/plan. The audit should also include a review of future editions of the NFPA standards to identify new compliance requirements.

Conclusion

The Electrical Maintenance Program can be viewed as a segment or chapter of the overall Electrical Safety Plan. Employee training, overall risk assessment, and definition of maintenance or troubleshooting procedures are also topics shared between the Electrical Maintenance Program and the Electrical Safety Plan. Safety related maintenance practices are now identified and recognized to be an essential elements of electrical system management. Employee safety is enhanced by reducing the risk of equipment failure along with the additional benefits of electrical system reliability.