Before discussing the lost chapter of NFPA 70E, one must know a little of the history of the NFPA 70E. The Standard for Electrical Safety Requirements for Employee Workplaces, NFPA 70E, was first issued in 1979. Subsequent to the initial versions of NFPA 70E, the OSHA standard 29CFR1910.331-335, commonly referred to as Subpart S – Electrical Standards, was issued in 1990. This standard deals with requirements associated with electrical safety-related work practices for industrial facilities. In general, this OSHA standard only addresses the electrical shock hazard and does not specifically address electrical arc-flash or arc-blast hazards. In an effort to further define the requirements for electrical safety, the fifth edition of NFPA 70E was published in 1995. This standard introduced the concept of “limits of approach,” and the establishment of a “flash protection boundary” was introduced. In the sixth edition, published in 2000, further focus on flash protection and the use of personal protective equipment (PPE) was expanded with charts being added to assist the user in applying PPE for common tasks. With the most recent seventh edition, published in 2004, the standard was rearranged to be consistent with the NEC and was renamed Standard for Electrical Safety in the Workplace. With the 2004 edition, other safety precautions, such as job briefings and electrical work permits, were introduced and emphasized. The eighth edition of NFPA 70E is scheduled for issuance in 2009. We will have to wait on its issuance to know what the impact of this latest edition will be.

In general, utilities, industrials, and large commercial entities have gradually accepted and are implementing the requirements provided through NFPA 70E, Chapter 1, Safety-Related Work Practices. However, little attention is being paid to NFPA 70E, Chapter 2, Safety-Related Maintenance Requirements. This chapter of NFPA 70E provides safety-related maintenance requirements “…directly associated with employee safety.” It does not “prescribe specific maintenance methods or testing procedures” but does require that this maintenance preserve or restore “…the condition of electrical equipment and installations, or parts of either, for safety of employees who work on, near, or with such equipment.” Further, Chapter 2 references NFPA 70B, Recommended Practice for Electrical Equipment Maintenance, for the specific maintenance methods and tests to be used.

In reviewing NFPA 70E, Chapter 2, several sections are worthy of note:

“Article 205.1 Qualified Persons. Employees who perform maintenance on electrical equipment and installations shall be qualified persons as required in Chapter 1 and shall be trained in, and familiar with, the specific maintenance procedures and tests required.” Not all electrical workers are qualified to perform all electrical tasks. Electrical maintenance and testing activities have evolved into using more sophisticated equipment and techniques. Typically, additional training on the use of this testing equipment is required.

“Article 205.2 Single Line Diagram. A single line diagram, where provided, for the electrical system shall be maintained.”
This is an often overlooked component of any good maintenance program. Having up-to-date drawings is a requirement for performing maintenance in a safe and proper manner. It is also critical in determining and implementing proper lockout/tagout processes and procedures.

“**Article 205.4 Grounding and Bonding.** Equipment, raceway, cable tray, and enclosure bonding and grounding shall be maintained to ensure electrical continuity.

The only way to verify that a facility has maintained electrical continuity in the grounding system is to test and measure that continuity. This testing is typically performed in several steps. First, a fall-of-potential test is performed to verify that the grounding electrode or system is adequately connected to ground. Then many point-to-point tests are performed to verify adequate connection of equipment, raceway, etc. to the grounding electrode.

“**Article 205.11 Single and Multiple Conductors and Cables.** Electrical cables and single and multiple conductors shall be maintained free of damage, shorts, and ground that would present a hazard to employees.”

“**Article 210.3 Conductors.** Current-carrying conductors (buses, switches, disconnects, joints, and terminations) and bracing shall be maintained to:

1. Conduct rated current without over heating.
2. Withstand available fault current”

“**Article 210.4 Insulation Integrity.** Insulation integrity shall be maintained to support the voltage impressed.”

Per the IEEE Gold Book, insulation failure or breakdown is one of the more significant causes of failures for transformers, cables, cable terminations, cable splices, buses, and joints. Because of this, a range of tests has been developed to test and monitor insulation integrity (insulation resistance testing, ac and dc high-potential testing, power factor testing, polarization index testing, partial discharge testing, VLF tan delta, etc.). Combinations of these tests are typically performed in an effort to determine the overall health of insulation systems.

“**Article 210.5 Protective Devices.** Protective devices shall be maintained to adequately withstand or interrupt available fault current.”

Maintenance, which includes operability testing, must be performed on a periodic basis to ensure that protective devices operate as designed. With the recent requirements associated with arc-flash hazards analysis, proper protective device operation is critical to the accuracy of the arc-flash analysis and the minimizing and mitigating of arc-flash hazards.

“**Article 225.1 Fuses.** Fuses shall be maintained free of breaks or cracks in fuse cases, ferrules, and insulators. Fuse clips shall be maintained to provide adequate contact with fuses.”

Any good maintenance program for any low- and medium-voltage fused disconnect switches includes visual inspection, contact resistance testing, and fuse resistance testing.

“**Article 225.2 Molded-Case Circuit Breakers.** Molded-case circuit breakers shall be maintained free of cracks in cases and cracked or broken operating handles.”

“**Article 225.3 Circuit Breaker Testing.** Circuit breakers that interrupt faults approaching their ratings shall be inspected and tested in accordance with the manufacturer’s instructions.”

A good maintenance program for low- and medium-voltage breakers includes visual inspection, contact resistance testing, and insulation integrity testing. Additionally, primary or secondary injection testing and protective relay operability testing, as applicable, are performed periodically to ensure that these protective devices operate as designed. For other larger low- and medium-voltage draw-out breakers, lubrication and mechanical operability testing are performed periodically to ensure proper operation.

Much of the equipment required to accomplish the requirements of NFPA 70E, Chapter 2, is expensive and specialized; therefore, use of a qualified outside contractor, like a NETA Accredited Company, may be warranted. A big advantage in using a NETA Accredited Company as the outside contractor for these services is associated with having access to experienced and qualified, nationally-certified technicians and the calibrated, state-of-the-art testing equipment they utilize.

ANSI/NETA MTS-2007 is the most complete reference document in the electrical testing industry for identifying the recommended tests and developing the required maintenance procedures to accomplish the requirements of NFPA 70E, Chapter 2, and NFPA 70B recommendations. Therefore, when considering implementing the NFPA 70E requirements, consider your local NETA Accredited Company as a valuable resource in meeting those requirements.

As Operations Manager of ESCO Energy Services Company, Lynn brings over 25 years of working knowledge in design, permitting, construction, and startup of mechanical, electrical, and instrumentation and controls projects as well as experience in the operation and maintenance of facilities.

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