VERTIV.

UNDERSTANDING 2015 CHANGES TO NFPA 70E

Safety-related work practices and maintenance requirements mandate more robust electrical safety programs for commercial and industrial facilities

Executive Summary

Every three years, the National Fire Protection Association (NFPA) updates NFPA 70E: Standard for Electrical Safety in the Workplace®. In recent years, the standard has become increasingly stringent in response to the increased understanding of electrical accidents in industrial plants and facilities. Because of the severe and often devastating consequences of arc flash incidents—which claim one life every workday—NFPA, along with the Occupational Safety and Health Administration (OSHA), is mandating and enforcing safer electrical work practices.

Industrial facilities and plants are often challenged when it comes to making electrical safety policy changes in order to keep up with the new requirements. However, making every effort to comply is essential to avoiding costly fines, as well as protecting a facility's equipment and its greatest asset: its employees.

With the assistance of a well-qualified, professional electrical engineering or electrical testing service provider, facilities can efficiently and cost-effectively evaluate, update, and maintain their electrical safety programs to ensure compliance and a safe work environment for employees.

Understanding the Severity of Arc Flash Hazards

In the last 10 years, the U.S. Bureau of Labor Statistics reports 2,000 fatal and more than 24,000 non-fatal electrical injuries such as those sustained from an arc flash. Arcing from an electrical fault can produce temperatures hotter than the surface of the sun, creating an incredibly hot blast with force similar to an explosion—enough to throw a worker's body across the room. The National Safety Council reports that electrical hazards like this cause nearly one fatality every single workday.

Obviously, the consequences of arc flash are devastating. Beyond the risk of personal injury and death, arc flashes can also lead to business disruption, costly damage to equipment and facilities, legal liability, increased insurance premiums, and hefty regulatory fines.

The problem isn't going away. Rather, due in part to greater overall energy usage, as well as higher system voltages and available fault currents, the danger of exposure to arc flash hazards is on the rise and increasing steadily. To help reduce the risk and protect workers, NFPA develops and regularly updates its guidelines for creating a safe electrical work environment.

The Role of NFPA 70E

As the world's leading advocate of fire protection, NFPA has published more than 300 consensus codes and standards, including NFPA 70E: Standard for Electrical Safety in the Workplace. Designed at the request of OSHA, the intent of the standard is to reduce exposure to the hazards of shock, electrocution, arc flash, and arc blast while working on or near exposed electrical conductors or circuit parts that are or can become energized.

NFPA 70E undergoes updates and revisions every three years. Each edition introduces significant changes designed to help prevent the devastating effects of electrocution and arc flash incidents. Even more changes have appeared in the 2015 edition, including additional essential updates in the areas of safety, maintenance and training. NFPA 70E 2015 became effective in August 2014. While not yet an OSHA-enforceable document in its entirety, NFPA standards are used as part of electrical safety practices and are often referenced as part of an OSHA citation.

This paper provides an overview of the safety and maintenance changes in NFPA 70E 2015 that most impact the electrical safety programs in place at industrial facilities and among other major power users.

A Look Back at NFPA 70E 2012

Many facility managers have likely made changes to work practices and electrical safety programs based on the updates in NFPA 70E 2012, which became effective August 31, 2011. The most relevant changes impacted safety-related work practices, work involving arc flash hazards, and electrical distribution system maintenance.

Specifically, NFPA 70E stipulated the following:

Safety-Related Work Practices (Article 110)

- Employers must now document meetings with contract employees in which information about known hazards is communicated, thus enabling contractors to make proper hazard assessments. This stipulation also appears in OSHA's 29 CFR 1910.269 revisions, which require divulging incident energy levels for contractors.
- Employees who work around—not just on—energized electrical equipment must be safety trained, preferably via an instructor-led course as opposed to web-based training. Retraining must occur at least every three years, and all training must be documented.
- Facilities must conduct annual inspections to ensure each employee is complying with safety-related work practices. The annual audit requirement is extended to field work as well.
- At least once every three years, facilities must audit their own safety policy and training programs to ensure compliance with the standards. The audits need to be documented, and if deficiencies are identified, revisions must be made to bring all elements of the safety program into compliance.

Work Involving Arc Flash (Article 130)

- Facility managers must ensure that arc flash hazard labels include information such as nominal system voltage, arc flash boundary, and guidance on the required level of personal protective equipment (PPE).
- Facility managers must document the calculation method and the data that supports the information on the arc flash labels.
- Arc flash labeling is required for DC equipment in addition to AC equipment.

General Maintenance Requirements (Articles 200 through 250)

- Facility managers must now conduct maintenance on electrical equipment in accordance with manufacturers' instructions or industry consensus standards. Previously, maintenance was only specified for overcurrent protective devices.
- Facility managers must maintain a current single-line diagram in legible condition.
- Documentation is now required for overcurrent protective devices to show they have been properly maintained, tested and inspected.

New Changes for 2015

Building on the safety, training, and maintenance requirements outlined in the 2012 edition of NFPA 70E, the 2015 version of the standard introduces additional changes that facilitate an even greater understanding, awareness, and mitigation of electrical hazards. While some of the 2015 updates are editorial or informational in nature, others require facility managers to once again take action to revise and update safety policies to better protect workers and ensure regulatory compliance.

Specifically, facility managers need to be aware of the following updates to NFPA 70E 2015:

Terminology Changes—Risk vs. Hazard

In the 2015 version of NFPA 70E, the standard committee has attempted to separate and better define "risk" and "hazard." For the purposes of the standard, hazard identification primarily refers to the potential for harm from exposed energized electrical conductors and/or the condition of the equipment. Risk primarily refers to the chance or probability that the identified hazard could result in physical harm to the worker, or the unqualified or unprotected persons nearby.

The terms "risk" and "risk assessment" have also been clearly defined:

- Risk - "A combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard."
- Risk Assessment - "An overall process that identifies hazards, estimates the potential severity of injury or damage to health, estimates the likelihood of occurrence of injury or damage to health, and determines if protective measures are required."

Risk assessment is now the key to determining the necessity to use PPE.

As a result of these changes, the terms "arc flash hazard analysis," "shock hazard analysis," and "electrical hazard analysis" have all been removed from the language in the standard. These items are now referred to, respectively, as "arc flash risk assessment," "shock risk assessment," and "electrical risk assessment." Additionally, Hazard Risk Categories (HRC) have been eliminated and are now referred to as "Arc Flash PPE Categories." Finally, shock protection requirements are now assessed separately from arc flash protection requirements.

In line with the effort to better define risks to workers, the standard committee has also made attempts to more clearly indicate situations where additional or substantial risk is unlikely to exist. For example, the standard makes it clear that workers do not need to take special measures to protect themselves when performing routine operations on electrical equipment that is properly installed and maintained. Specifically, the standard states that normal operation, such as switching, is allowed without any special PPE if all the following exist:

- The equipment is properly installed
- The equipment is properly maintained in accordance with manufacturer's specifications or industry consensus standards
- Doors are closed and secured
- Covers are in place and secured
- There is no evidence of impending failure

Defining Qualified Workers

Both OSHA and NFPA recognize the importance of determining a worker's qualifications to work on or around electrical equipment. To help employers make this important designation, NFPA 70E 2012 states that a qualified person shall be trained and knowledgeable in the construction and operation of equipment or specific work methods, and be trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method. It is important to note that a person can be considered qualified with respect to certain equipment and methods, but still be unqualified in other situations.

The 2015 version of the standard adds the requirement that such a person shall demonstrate the ability to use—and not just be familiar with the proper use of—the following:

- Special precautionary techniques
- PPE including arc flash suits
- Insulating and shielding materials
- Insulated tools and test equipment

NFPA 70E 2015 also adds that qualified electrical workers permitted to work within the limited approach boundary of exposed energized electrical conductors and circuit parts operating at 50 volts or more must have additional training in minimum approach distances to exposed parts.

Employees who respond to medical emergencies must also participate in refresher training per the new standard.

SHOCK HAZARD BOUNDARY DEFINITIONS IN NFPA 70E

Limited Approach Boundary: A risk of shock exists within this boundary. Unqualified persons may enter this area if they are under the supervision of a qualified worker and using proper PPE.

Restricted Approach Boundary: Qualified personnel only. Requirements are the same as if working on or near energized circuits. Insulated gloves, tools, and equipment are required within this boundary.

Prohibited Approach Boundary: Removed from NFPA 70E 2015.

NFPA 70E 2015 Article 130.4(B) states: *"The shock protection boundaries identified as limited approach boundary and restricted approach boundary shall be applicable where approaching personnel are exposed to energized electrical conductors of circuit parts."*

Arc Flash Risk Assessments

A major revision in the 2012 NFPA 70E update stated that the arc flash boundary distance must now be determined for all locations where the voltage is greater than 50 volts and there is a possibility of performing energized work such as maintenance, diagnostics and testing. Previously, a number of locations could be excluded from the assessment and calculation based on system voltage and the limits of the supplying energy source. For example, a 208-volt distribution panel for lighting and convenience outlets may not have been assessed or labeled because the supplying transformer was less than 150 kilovolt-amperes. However, a second adjacent panel did need to be assessed and labeled because it was fed from a larger transformer. Such anomalies led to much confusion in the field. So while the new standard expands the scope of arc flash protection and the number of locations that need to be assessed, it also helps eliminate uncertainty that could lead to noncompliance, or worse, injury to a worker.

In years past, the standard was also vague and not well defined regarding whether the arc flash boundary distance would have to be manually calculated or if it could be assumed using tables supplied in the standard. While the "table method" of determining the boundaries costs nothing to use and is easier to implement than an analysis, the tables are often misused in the field, which can put workers at risk.

As a result, provisions in the new 70E make it clear that the intent of the standard committee is to encourage the use of engineering analyses over the "table method." Specifically, Article 130.5(C)(1) recommends performing an engineering analysis using one of the recognized means such as Institute of Electrical and Electronic Engineers' Guide for Performing Arc Flash Calculations (IEEE 1584). However, Article 130.5(C)(2) does allow the use of the tables at 130.7(C)(15), so long as the system parameters and task meet the table requirements.

In other words, the tables may only be used if:

- The specific task to be performed appears in the tables
- The system meets the listed criteria for short circuit current magnitude and speed of response of circuit protection

If the task does not appear in the table, or if the system does not meet the criteria found in the tables, then the tables cannot be used. Keep in mind that in many cases, facility managers do not have access to the data and information needed to use the tables correctly. In this case, an engineering analysis must be performed.

Although not new in 2012 or modified in 2015, it is important to emphasize that the arc flash risk assessment shall be updated when a major modification or renovation takes place and that it shall be reviewed periodically, not to exceed five years, to account for changes in the electrical distribution system (or regulatory guidance).

Arc Flash PPE

While proper PPE can be life-saving, far too often, employees have not selected or used the proper PPE in order to complete their jobs safely. IEEE reports that 2,000 workers are admitted to burn centers for extended injury treatment caused by arc flash every year.

As described above, there are clearly two separate methods for assessing arc flash risks and determining arc flash protection and PPE requirements. The first method is to perform an engineering analysis. The second "table method" can be used only where the system parameters defined in the tables are applicable to the specific tasks being performed.

Method 1—Engineering Analysis

The results of an engineering analysis are placed on the equipment label in the form of incident energy (in calories per square centimeter at working distance). The worker would then need to select PPE with an Arc Thermal Performance Value (ATPV) that meets or exceeds the available incident energy posted on the informational label. ATPV is also rated in calories per square centimeter to make this determination simple.

Notice there is no mention of PPE categories. In fact, the results of an incident energy analysis to specify an arc flash PPE category in Table 130.7(C)(16) is not permitted. Table 130.7(C)(16) was specifically created to complement the task tables and is applicable only if using the "table method."

Therefore, facilities that conduct an engineering analysis must use the results to create site-specific arc flash protection and PPE requirements. Reducing and managing incident energy exposure through engineering analysis can significantly impact and potentially reduce the required PPE for performing tasks on electrical equipment, a benefit that cannot be gained using the task tables and charts.

For example, if an engineering analysis determined an incident energy value of 8.4 calories, and that value was recorded on the label, then the worker would need to choose a garment with an ATPV that meets or exceeds the posted 8.4 calories. However, using the previous "table method," an 8.4 calorie hazard would be considered Category 3. Most employers do not provide Category 3 PPE, but they do offer Category 4 PPE. In such a case, the worker would be required to wear Category 4 protection for a calculated Category 3 hazard. Using the incorrect PPE or more PPE than required becomes cumbersome and could actually be more detrimental to worker safety. Using the engineering analysis to determine PPE requirements ensures the most appropriate PPE for the hazard, and thus, the greatest protection for the worker.

Method 2—Table Method

In the past, the NFPA 70E "table method" for choosing arc-rated (previously called flame resistant) clothing was somewhat cumbersome. This method could also be ineffective, as tasks in the old tables were often lumped together, regardless of system characteristics, ultimately leading to improper PPE requirements.

The 2015 version of the standard introduces a new multi-table format for choosing arc-rated clothing and PPE. Major revisions have been made to the table for determining risk, and additional tables have been added to determine proper PPE if a risk exists.

Workers first look to Table 130.7(C)(15)(A)(a) to determine if arc flash PPE is required. This task-based table covers both AC and DC applications and indicates if there is an arc flash hazard associated with each specific task—yes or no. If there is an arc flash hazard, workers move to Table 130.7(C)(15)(A)(b) or 130.7(C)(15)(B) to find the arc flash PPE category. They then refer to Table 130.7(C)(16) which lists the clothing and other PPE required for that category. Workers must wear all of the PPE listed.

The tables contained within NFPA 70E provide some basic guidelines for common tasks, but even the tables require system information that may not be known. As described above, if the task is not in the tables, or the system parameters defined in the tables are not met, then an engineering analysis must be performed to determine what level of arc flash protection will be required.

Arc Flash Labeling

Arc flash labeling became an NFPA 70E requirement in 2002, and the requirements were updated in 2004, 2009, 2012 and 2015. As recently as 2009, the standard stated only that electrical equipment had to be labeled, and listed a few of the types subject to marking, but was somewhat unclear in detail. In 2012 and 2015, NFPA clarified the intent of the requirement.

Specifically, NFPA 70E 2015 spells out the types of equipment that need to be labeled, including switchboards, switchgear, panel boards, industrial control panels, meter socket enclosures, and motor control panels. The new standard also makes it clear what information needs to be included on field labels:

- Nominal system voltage
- Arc flash boundary
- At least one of the following:
    - Available incident energy and the corresponding working distance, or the arc flash PPE category in Table 130.7(C)(15)(A)(b) or Table 130.7(C)(15)(B) for the equipment, but not both
    - Minimum arc rating of clothing
    - Site-specific level of PPE

Today's standards specify a number of exceptions to arc flash labeling requirements. They state that only electrical equipment that is likely to require examination, adjustment, servicing, or maintenance while energized needs to be field marked. For example, a fractional horsepower motor disconnect in a 3-phase motor control center would likely require PPE, yet a local wall-mounted disconnect for the same motor (that requires a label) may not call for arc flash PPE due to the location's inherently low level of incident energy. Only a risk assessment can determine the need and should be performed on a case-by-case basis.

Additionally, NFPA 70E section 130.5 includes an exception that permits labels applied prior to September 30, 2011, as long as those labels contain the available incident energy or required level of PPE. It is important to note that some existing labels may contain both incident energy at working distance and arc flash PPE category. This is acceptable only until the labels come due for review (the review period for arc flash labels is at least once every five years). At such time, new labels must be applied indicating one, but not both, pieces of information.

Clarification is also provided around the need to keep labels up to date. Language in 130.5 says that labels need to be updated if the arc flash hazard risk assessment shows that the labels are inaccurate. The standard clearly indicates that the owner of the electrical equipment is responsible for documentation, installation, and maintenance of the field-marked label.

Obviously, major changes to the electrical distribution system have the potential to impact the accuracy of arc flash labels, and thus, the risk to electrical workers. However, replacing a fuse, replacing a circuit breaker or protective relay, and even changes made by supplying utilities can affect arc flash analysis and the resulting field label information. To ensure compliance and worker safety, a qualified engineering company should ideally assist with an arc flash assessment and label review when any changes are made to the distribution system, or every five years at a minimum.

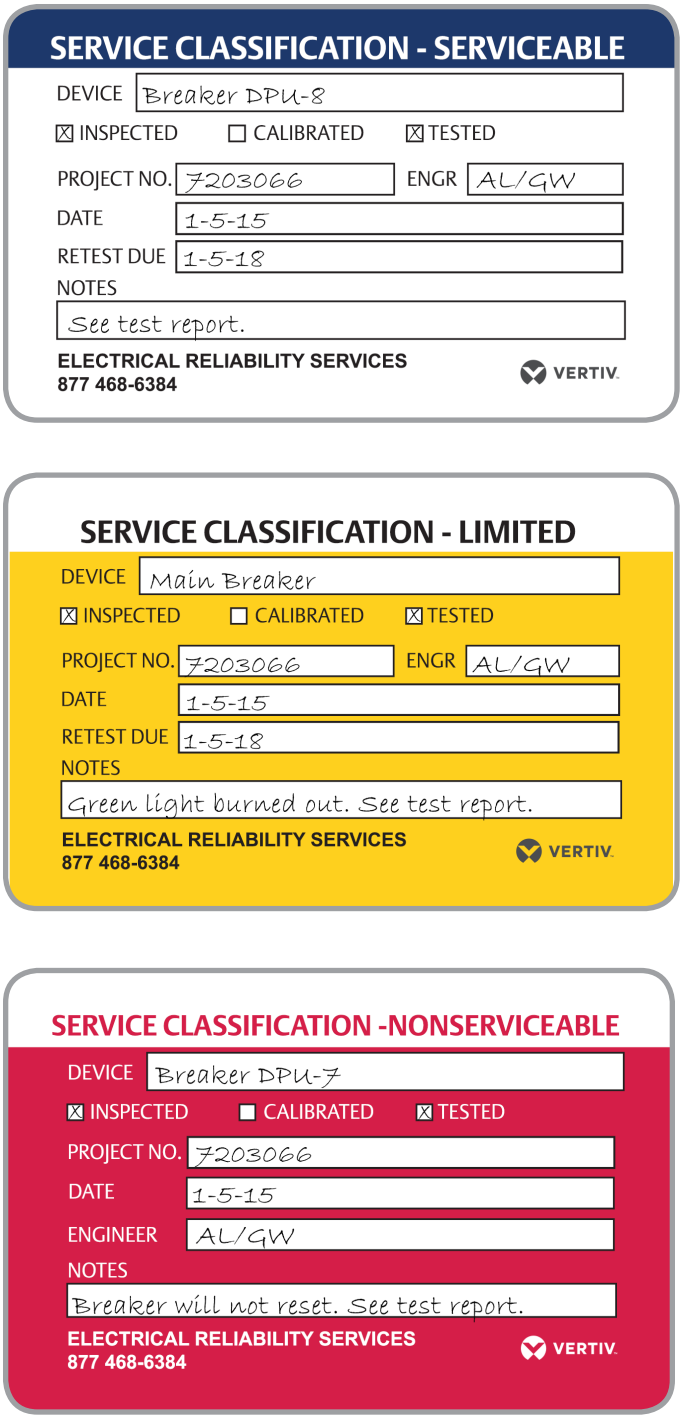

Figure 1: *Field testing labels help satisfy documentation requirements of NFPA 70E 2015.*

Energized Electrical Work Permit Requirements

Some facility managers contend that adopting NFPA 70E is a cumbersome and time-consuming process, especially the development of risk assessments and energized electrical work permits. It is important to note that newer versions of NFPA 70E limit areas where electrical work permits are required to those areas within the limited approach boundary or arc flash boundary.

Specifically, energized electrical work permits are required when:

- Work (repair or replacement of components) is planned within the limited approach boundary of exposed energized conductors or circuit parts
- An increased risk of an arc flash exists (even) with doors closed and covers on

Additionally, the recommendation to perform a risk assessment and develop a written energized electrical work permit plan for hazard mitigation applies to those tasks that are not routine in nature, or performed less frequently than once a year. If the task is performed frequently, an original risk assessment with successful mitigation techniques should already be in place. Thus, another assessment is not required.

Specifically, NFPA 70E 2015, Article 130.2(B)(3) Exemptions to Work Permit says that an energized work permit is not required for work performed on or near live parts when qualified persons are performing tasks such as testing, troubleshooting, or voltage measuring; thermography and visual inspection up to the restricted approach boundary (RAB); access/egress with no electrical work within the RAB; and general housekeeping up to the RAB, as long as appropriate safe work practices and PPE is provided and used.

General Maintenance Requirements

Building on the general maintenance requirements established in NFPA 70E 2012, the newest version of the standard reiterates that qualified persons who perform maintenance on electrical equipment and installations shall be trained and familiar with the specific maintenance and test procedures required. Additionally, the 2015 version requires maintenance for protective devices in order to adequately withstand or interrupt available fault current.

Specifically, Article 205.4 requires the inspection and testing of these devices in accordance with manufacturers' specifications or industry consensus standards, including American National Standards Institute/InterNational Electrical Testing Association Standard for Maintenance Testing Specifications (ANSI/NETA MTS), IEEE 3007.2, and NFPA 70B. Furthermore, the results of these maintenance activities must be documented and maintained. An informational note states: "Improper or inadequate maintenance can result in increased opening time of the overcurrent protective device, thus increasing the incident energy."

NFPA 70E 2015 now specifies that the equipment owner is responsible for electrical equipment maintenance and the documentation of such maintenance. The latest edition of the standard added IEEE 3007.2 Recommended Practice for the Maintenance of Industrial and Commercial Power Systems as a guideline for maintenance frequency, methods, and tests, along with NFPA70B and ANSI/NETA MTS.

Common industry practice is to provide date and overall condition of the specific devices that have been tested and maintained in the field via a test or calibration decal. This provides immediate indication of the last maintenance date and if it was found acceptable. This can assist the employee in the assessment of the overall electrical equipment maintenance status.

Battery Risk Assessment Requirements

NFPA 70E specifies that electrical safety programs should include risk assessment procedures to address employee exposure to electrical hazards. New in 2015, this stipulation also applies to battery work. Specifically, Article 320.3(A)(1) states: "Prior to any work on a battery system, a risk assessment shall be performed to identify the chemical, electrical shock, and arc flash hazards and assess the risks associated with the type of tasks to be performed."

Specific battery-related tasks are now included in the newly revised DC task-based tables, indicating if an arc flash hazard is associated with such tasks. The tables currently offer the best method for assessing and evaluating battery-related risks and selecting the appropriate PPE.

In conjunction with the assessment, it is important to review the warning signs or labels regarding shock hazard due to the battery voltage and the arc flash hazard due to the prospective short circuit current and thermal hazard.

Well-qualified, professional electrical engineering service providers who specialize in battery services can be instrumental in identifying battery-related risks; performing battery work in compliance with all industry standards; and mitigating risks to electrical workers.

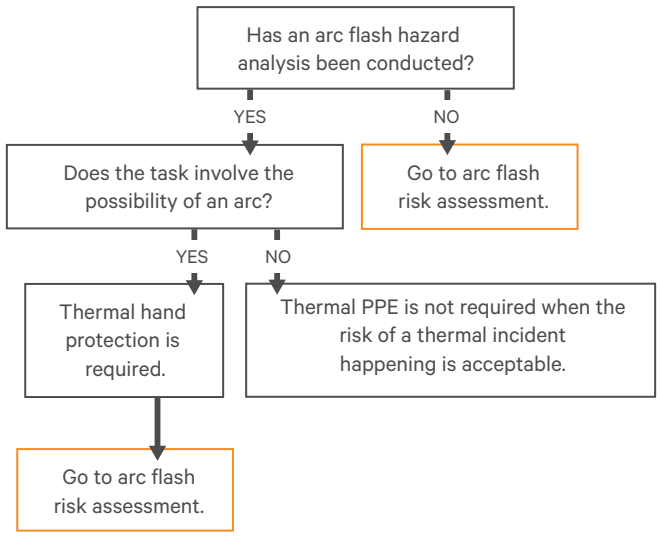

Figure 2: *The thermal risk assessment process for a battery system illustrates how the likely exposure depends on the type of task being performed.*

Additional Changes and Complete Details

For more information on the changes outlined in this white paper, please refer to the 2015 NFPA 70E Handbook available at NFPA.org. You can also refer to the most current edition of ANSI/NETA MTS.

A Note About OSHA

NFPA is not the only organization requiring facilities to upgrade their electrical safety practices. Due to increasing awareness of the frequency and the severity of the electrical arc flash hazard, OSHA updated standard CFR 1910.269 in the Federal Register on April 11, 2014, representing the first time OSHA is mandating and enforcing specific arc flash-related requirements (beyond general hazard awareness) for higher voltage facilities.

Effective October 31, 2014, the new revisions to OSHA CFR 1910.269 address the frequency and magnitude of arc flash hazards in high-voltage utilities and industrial facilities that operate power generation, transmission, and distribution equipment. The OSHA revisions are patterned after the latest consensus standards, including NFPA 70E, ANSI/IEEE C2 National Electrical Safety Code, and other improvements in electrical safety technology. They require utilities and industrial facilities to make significant changes to training, host employer requirements, fall protection, the requirements to estimate arc flash energy, minimum approach distances, PPE, and a number of other work practices.

For more details on the OSHA revisions, see the following white paper, published by Vertiv™: OSHA Publishes First-Ever Arc Flash Protection Requirements for the Electric Power Generation, Transmission, and Distribution Industry.

Implementing the New Electrical Safety Requirements

It can be challenging for major power users and industrial facilities to comply with the increasingly stringent electrical safety requirements outlined in NFPA 70E. However, establishing an effective safety program per the guidelines can promote system performance and efficiency and prevent costly OSHA fines. Even more important, it can reduce injuries and lost worker productivity. It could even save the life of an employee working at your business or facility.

Industry experts, including the NETA-certified engineers and field technicians at Vertiv's Electrical Reliability Services, strongly recommend partnering with professional electrical engineering or electrical testing service providers that are well trained and well versed in the new requirements. While there is no legal requirement for a Registered Professional Engineer to perform arc flash hazard analysis, such expertise not only ensures compliance with the standards, it can also save lives since improper calculations can put workers in grave danger.

As a first step toward compliance with safety requirements, Vertiv recommends performing a comprehensive professional site review and compliance assessment. It will evaluate current safety practices in your plant or facility and identify any areas of risk or non-compliance. Based on the results, your chosen service partner should offer capabilities to customize and implement a complete, cost-effective solution designed to bring your facility up to standards in the most efficient way possible, along with an ongoing plan to maintain compliance.

Best Practices Help Ensure Compliance

Vertiv recommends the following elements and best practices as part of a comprehensive, effective electrical safety program that complies with OSHA, NFPA, and other relevant industry guidelines.

10 BEST PRACTICES FOR COMPLYING WITH NFPA 70E

1. Preventive Maintenance
2. Arc Flash Risk Assessment
3. Labeling and Hazard Communication Plan
4. Design and Methods Review
5. Accurate Single-Line Diagrams
6. Short Circuit and Coordination Studies
7. Electrical Safety Program Review/Development
8. Arc Flash Training Program and PPE Plan Development
9. Documentation
10. Periodic Reviews

Preventive Maintenance

An optimized preventive maintenance strategy evaluates the condition of your equipment and determines the most cost-effective and manageable solution to ensure the equipment's overall performance, safety and reliability. By maintaining all electrical equipment, you can help ensure worker safety and prevent unplanned downtime. NFPA 70E specifically requires maintenance for electrical equipment and overcurrent protection devices to help mitigate arc flash hazards.

Such equipment would include:

- Substations, switchgear assemblies, panelboards, motor control centers, disconnect switches
- Insulated conductors, grounds and busduct
- Transfer switches and control equipment
- Circuit breakers
- Protective relays
- Motors and generators
- Equipment in hazardous locations
- Batteries and battery rooms
- Portable electric tools and equipment
- Personal safety and protective equipment including electrical gloves, hot sticks, and flash suits

Arc Flash Risk Assessment

NFPA 70E requires facility owners to perform an arc flash risk assessment prior to allowing a worker to perform tasks on energized equipment. The arc flash risk assessment determines the presence and location of any arc flash hazards, calculates incident energy, and determines appropriate safety-related work practices, arc flash boundary, and the correct PPE to be worn within the arc flash boundary.

To calculate incident energy, technical data is reviewed and additional data is collected such as equipment type, voltage, ratings, impedance, and other information. To provide accurate results, state-of-the-art software should be utilized to perform the arc flash calculations. The software enables users to evaluate alternatives quickly and easily in order to establish an optimal design.

Labeling and Hazard Communication Plan

Electrical equipment such as switchboards, panelboards, industrial control panels, and motor control centers that are likely to require maintenance while energized, must be field marked with a label, and the labels must be reviewed no less than once every five years. Specific requirements for what must be included on the labels are outlined in NFPA 70E Article 130.5.

The new requirement in NFPA 70E 2015 to analyze and label all equipment operating at greater than 50 volts may be somewhat costly due to the number of additional calculations required.

Design and Method Reviews

A protection scheme design review and operational assessment of your electrical distribution system should be conducted to identify and reduce potential electrical hazards. Several areas to evaluate include fault current levels, arc exposure times, operational procedures (such as remote breaker control and remote racking), and system grounding. Experts can assist with mitigation strategies to alter the current protection scheme, which can significantly reduce fault levels, arcing time, arc incident energy, and arc blast force.

Accurate Single-Line Diagrams

NFPA 70E requirements mandate accurate, up-to-date and legible single-line diagrams. These schematics are essential for documenting, troubleshooting, and communicating information about your power systems. A comprehensive site survey is essential to develop or update existing single-line diagrams or to complete electrical system drawings.

Short Circuit and Coordination Studies

To achieve accurate arc flash hazard results, it is essential that arc flash calculations be completed using accurate short circuit calculations and protective device coordination data. Short circuit and coordination studies calculate momentary, interrupting, and arcing current values; compare available fault currents to protective device ratings; and establish trip settings for all types of protective devices, which reduce unplanned downtime or outages. It's important to select an expert that specializes in conducting these studies to ensure compliance with NFPA and OSHA requirements.

Electrical Safety Program Review/Development

An effective electrical safety program should be designed to support and complement the facility's overall site safety program. It should provide training and awareness of the potential electrical hazards, and specifically arc flash, to all employees.

At a minimum, the program should identify hazard/risk evaluation procedures, electrically safe work procedures, tools and PPE, and risk mitigation strategies. The electrical safety program must be documented and audited at least every three years to verify the principles and procedures are in compliance with NFPA 70E.

Arc Flash Training Program and PPE Plan Development

Developing a specific arc flash training program and complementary PPE plan based on the findings of the arc flash analysis can ensure workers fully understand electrical and arc flash hazards and how to mitigate the risks. The PPE plan should provide specific protection requirements and recommendations based on findings of the arc flash analysis.

Documentation

Keeping comprehensive and proper documentation can ensure compliance with NFPA 70E and OSHA standards and can help facilitate an investigation should an arc flash-related injury occur.

Documentation should include the results of the arc flash analysis and any other studies, as well as a written recording of incident energy at working distances, flash protection boundary, hazard/risk category, and other pertinent information such as voltage, available fault current, protective device description and its trip time, arc gap, and arc current. Documentation of worker training is also required.

Periodic Reviews

The 2015 edition of NFPA 70E clarified the intent of and suggested frequency for periodic reviews/updates of arc flash assessment information and worker training programs. Such reviews can help maintain ongoing compliance with arc flash standards, practices and regulations, and ensure that any changes, modifications or expansions to an electrical distribution system meet the latest arc flash requirements.

Per the standard, the arc flash assessment must be reviewed whenever significant changes are made to the system, or at most, every five years. The corporate safety policy must be reviewed every three years to stay in compliance with the latest updates to NFPA 70E. Individual worker reviews, or audits, must be performed annually, and the results must be documented. If these audits find that the principles and procedures of the electrical safety program are not being followed, appropriate revisions to the training program or revisions to procedures must be made.

Conclusion

Electrical power has always come with risks, and potential hazards, including arc flash, are on the rise. Organizations such as OSHA and NFPA have become increasingly proactive about providing and enforcing guidelines and standards for mitigating the risk and ensuring worker safety. The most recent version of NFPA 70E requires facility owners and managers to revise and update safety policies, including performing power system studies to calculate and document arc flash risks.

Compliance with the revised standards can be a challenge for many major power users and industrial facilities. However, partnering with a qualified electrical service provider to evaluate, update, and maintain safe work practices can help industrial facilities and power users make great strides in implementing best practices for protecting their people, their businesses, and their bottom lines.

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