Facility: DOE Complex

Best Practice Title: Use of Finger-Safe Components in Electrical Installations

Point(s) of Contact:

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Brief Description of Best Practice: Worker safety can be enhanced by the implementation of guarding and finger-safe devices. This best practice was developed by the Energy Facility Contractor Group - Electrical Safety Community of Practice (EFCOG-ESCoP) to provide recommendations and guidance for finger-safe design and additional safety practices regarding all workers.

Why the best practice was used: Guidance is needed to establish criteria to assess whether a piece of equipment is considered finger-safe and therefore not considered exposed per NFPA 70E for a qualified person (see NFPA 70E def.).

What are the benefits of the best practice: Provide guidance for the assessment and installation of electrical systems and assemblies that are subject to the NEC.

What problems/issues were associated with the best practice: N/A (New best practice)

How the success of the Best Practice was measured: N/A (New best practice)

Description of process experience using the Best Practice: N/A (New best practice)

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Best Practice # 269

Acronyms:

AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
IEC	International Electrotechnical Commission
NEC	National Electrical Code (NFPA 70)
NFPA 70E	Standard for Electrical Safety in the Workplace

Introduction:

Worker safety can be enhanced by the implementation of guarding and finger-safe devices. This document provides a recommendation to use the IP20 standard as a minimum for finger-safe design and provides recommendations for additional safety practices regarding all workers. Finger-safe standards may apply to commercially available, custom manufactured, or lab-fabricated equipment.

Scope:

This best practice was developed by the Energy Facility Contractor Group (EFCOG) Electrical Safety Community of Practice to establish criteria to assess whether a piece of equipment is considered finger-safe and therefore not considered exposed per NFPA 70E for a qualified person (see NFPA 70E def.). It is intended to provide guidance for the installation of electrical systems and assemblies that are subject to the NEC.

Discussion:

This document is intended to address the definition of finger-safe items with regard to qualified persons for equipment that is not enclosed, such as normally enclosed equipment with covers removed, open panels, or benchtop prototypes.

The framework defines finger-safe design as a suitable method to implement guarding as discussed in NFPA-2024 70E Article 130.4(G)(1).

Finger-safe design may be used to mitigate shock hazards from energized conductors for qualified persons. However, finger-safe design does not provide a safe work environment for unqualified persons. Qualified personnel who require access to the terminals should be trained to understand the limitations of finger-safe components and apply appropriate safe work practices to avoid contact. Unqualified personnel should be protected from exposure by an enclosure or other means to restrict access to the terminals and should not rely on the finger-safe rating of components.

"Finger-safe" components:

The term "finger-safe" refers to a level of ingress protection that guards against intrusion by objects roughly the size of an adult fingertip. Neither the NEC nor NFPA 70E define the term "finger-safe". The NEC refers to the practical safeguarding of persons and property from the hazards arising from the use of electricity, while NFPA 70E refers to energized electrical conductors and circuit parts being suitably insulated, isolated, or guarded, i.e., practical safeguarding.

For this document, finger-safe is characterized as guarding of energized conductors or circuit parts sufficient to prevent inadvertent contact by the hand or finger of a qualified person. Covers or guards that create a finger-safe condition should be secured to protect against inadvertent removal.

The recommended minimum criteria for guarding against inadvertent contact by hand or finger is to meet or exceed the IP20 rating defined in ANSI/IEC 60529. IP20 provides protection against solid foreign objects 12.5mm (about ½ inch) in diameter or greater. Articulated test fingers are commercially available for testing of devices not specifically designed to the IP20 standard.

The AHJ may specify an alternate standard such as found in the following references:

- NFPA 79, *Electrical Standard for Industrial Machinery* figure 6.2.3: Jointed Test Finger
- UL 498A, *Standard for Safety for Current Taps and Adapters* figure 11.1: articulated probe with web stop
- UL 61010-1 *Safety requirements for electrical equipment for measurement, control, and laboratory use* section 6.2: Determination of ACCESSIBLE parts
    - Note: UL 61010-1 includes standardized specifications for defining a safe enclosure for lab measurement equipment.

Engineering/Installation Guidance:

1. Whenever possible, the electrical installation requirements of the NEC should be followed for all electrical installations and assemblies and be inspected and approved by the NEC-AHJ or delegate.
2. Finger-safe components are preferred to be used in assemblies and should be installed within an enclosure whenever possible.
3. Supplemental controls may be required to prevent unqualified persons from exposure to electrical hazards.
    a. Supplemental controls may include barricade tape, signage, insulated sheeting, or other access controls.
4. Unqualified workers should not be allowed within the limited approach boundary of finger-safe components unless supervised by a qualified person.
5. Only insulated tools or instruments should be used within the restricted approach boundary of energized finger-safe components.
6. Electrical installations or assemblies should be verified finger-safe by the AHJ or their delegate during inspection for code compliance.

Conclusion:

The use of finger-safe components installed within enclosures is recommended for electrical assemblies and provides an additional layer of protection for qualified personnel. Unenclosed finger-safe components in an open environment do not provide sufficient protection for unqualified workers. Additional methods of protection may be needed, including attendance by a qualified person, the use of lockout tagout to control the source of energy, engineered barriers to prevent access or barricades erected that warn of the hazard and restrict access to the equipment.

REFERENCES:

NFPA 70 2020 "National Electrical Code"
NFPA 70E-2024 "The Standard for Electrical Safety in the Workplace"
NFPA 79 2021 "Electrical Standard for Industrial Machinery"
ANSI/IEC-60529-2013 "Degrees of Protection Provided by Enclosures" (IP Code)
UL 61010-1 2012 Third Ed. "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements"

DEFINITIONS:

Barricade – A physical obstruction such as tapes, cones, or A-frame wood or metal structures intended to provide a warning and to limit access. [NFPA 70E Article 100]

Barrier – A physical obstruction that is intended to prevent contact with equipment or energized electrical conductors and circuit parts to prevent unauthorized access to the work area. [NFPA 70E Article 100]

Exposed (as applied to energized electrical conductors or circuit parts). – Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors and circuit parts that are not suitably guarded, isolated, or insulated. [NFPA 70E Article 100]

Guarded – Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger. [NFPA 70 Article 100]

Qualified Person - An electrical qualified person with respect to definitions in NFPA 70E and NFPA 70.