

EFCOG Best Practice #47

Controlling Energized Electrical Work Hazards

02/22/07

Background:

The DOE/EFCOG Electrical Safety Improvement Project developed seven distinct project areas for improving electrical safety. The task team for Project Area #6, "Controlling Energized Work Hazards," committed to submit a recommended best practice to the EFCOG Integrated Safety Management Working Group for posting on the EFCOG Best Practices website addressing minimization or elimination of energized electrical work (to the extent practical) to prevent injury and ensure worker safety.

Discussion:

To adequately address minimization or elimination of energized electrical work, the terms "Live Parts" and "Exposed" must be applied as they are defined in NFPA 70E, Article 100, "Definitions," and used in NFPA 70E, Article 110, "General Requirements for Electrical Safety-Related Work Practices" as follows:

Live Parts. Energized conductive components.

Exposed (as applied to live parts). Capable of being inadvertently touched if approached nearer than a safe distance by a person. It is applied to parts that are not suitably guarded, isolated, or insulated.

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.

Isolated (as applied to location). Not readily accessible to persons unless special means for access are used.

Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

The question of whether the worker is exposed is addressed in the Job Hazard Analysis (JHA) as part of the Integrated Environment Safety and Health Management System (ISMS) evaluation. At the "Identify Hazards" phase of ISMS, the workers and management consider, in the JHA, how to establish an electrically safe work condition as described in NFPA 70E, Article 120, and identify what controls must be put in place to work on or near live parts, if necessary, as described in NFPA 70E, Article 130.

Process Description:

After careful study of the requirements in NFPA 70E and application of the principles of ISMS, the Project Area #6 team developed the following approach to minimize or eliminate energized electrical work (to the extent practical) to prevent injury and ensure worker safety:

(1) Any work within the Limited Approach Boundary (LAB) or Arc Flash Protection Boundary (FPB) is considered Energized Electrical Work.

(2) The following cases do not require an Energized Electrical Work Permit (EEWP):

- (a) Achieving an Electrically Safe Work Condition
- (b) Testing and Measurement
- (c) Working within the LAB (minimal risk of shock or arc flash injury)

(3) As a result of the conclusions in (1) and (2) above, the team defined 5 work conditions referred to as Modes:

Mode 0 - Electrically Safe Work Condition

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- Mode 1 - Achieving Electrically Safe Work Condition
- Mode 2 - Testing and Measurement
- Mode 3 - Work within LAB, not exposed to shock
- Mode 4 - Work within LAB, exposed to shock, or
Work within FPB, or
Work within Restricted Approach Boundary (RAB)

(4) Work control processes, hazardous energy analysis, worker qualification considerations and some form of work authorization are required for Modes 1, 2, 3 and 4 involving hazardous electrical energy.

(5) An EEWP is only required for Mode 4. Mode 4 work is highly discouraged and requires a formal hazard evaluation and approval prior to commencing work, except on battery banks, where it is unavoidable.

(6) Special precautions must be applied when working with grounded conductors in a multi-wire branch circuit. There are times when establishing an electrically isolated work condition on a multi-wire branch circuit grounded conductor is not feasible. It is not practical in most multi-wire branch circuits to assure the grounded conductor will not become inadvertently energized if the continuity to ground is interrupted; therefore, electrical work involving multi-wire branch circuits must be treated as energized work whenever it is necessary to break the continuity of the grounded conductor. The decision as to whether or not an EEWP is required when working with grounded conductors is made by the interpretive authority for NFPA 70E.

Process Basis:

For facility work, the arc flash boundary is almost always greater than the RAB. For direct current, especially high voltage, the shock boundaries are usually much greater than the arc flash boundaries. There is often a need, in R&D, to work within the LAB. Work within the LAB can be done safely by qualified persons, as long as qualified persons stay outside the RAB, use voltage rated tools, wear proper PPE, and control access to unqualified persons.