SLAC
NATIONAL ACCELERATOR LABORATORY

Electrical Equipment Inspection Program

Electrical Safety
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Contents

Acronyms and Definitions

Authority having jurisdiction (AHJ) (electrical). A person who interprets the requirements of electrical codes and standards, approves electrical equipment for use, and coordinates the activities of staff. The SLAC electrical safety officer is the AHJ.

EEIP field report. 1) A written report verifying that a piece of electrical equipment or an installation is acceptable for use, or 2) a written report describing the reasons why electrical equipment does not comply with a mandatory standard. It may include recommendations to achieve equivalent safety criteria. The report consists of two documents, a field report record and a completed EEIP checklist; both are available at the Electrical Equipment Inspection Program site.

ESO. Electrical safety officer

Electrical equipment. Equipment that uses electrical energy for electronic, electromechanical, heating, lighting, or similar purposes. Electrical equipment includes equipment used in laboratory research and development (R&D) as well as utility, facility, and shop equipment.

Examination. A process performed by a person qualified to evaluate electrical equipment to determine if it is free from recognized hazards and meets code requirements

Labeled. A nationally recognized testing laboratory (NRTL) label, symbol, or other identifying mark that is affixed to equipment or materials

Listed. Electrical equipment and materials listed by an organization concerned with product evaluation that have been examined against designated standards and found to be suitable for use in specified operations. The means of identifying electrical equipment may vary among listing organizations, some of which do not recognize equipment as listed unless it is also labeled.

Nationally recognized testing laboratory (NRTL). An organization that is recognized by the federal Occupational Safety and Health Administration (OSHA as an acceptable laboratory for product evaluation and maintains records of periodic examinations of equipment and materials. The NRTL ensures that equipment and materials comply with designated standards or are tested to determine their suitability for use.

1 Introduction

1.1 Purpose

The purpose of the Electrical Equipment Inspection Program (EEIP) is to ensure that electrical equipment not listed or labeled by a nationally recognized testing laboratory (NRTL) meets federal Occupational Safety and Health Administration (OSHA) safety codes and the codes and standards listed in Section 1.4 below.

In addition, the EEIP process provides the following:

- Electrical safety resources to assist in mitigating potential hazards
- Guidance in code compliance and safety design standards
- Lower project costs by providing an ongoing review process

1.2 Scope

The program covers unlisted and unlabeled equipment, modifications to NRTL-listed or labeled equipment, and design, fabrication, installation, and inspection of custom electrical equipment.

Note *Legacy equipment at SLAC designed before the implementation of this program must be accepted for use subject to a future inspection and/or engineering safety analysis. Available spares for legacy equipment that currently exist and are maintained can be placed into service when required and will also be subject to future inspections and/or engineering safety analysis.*

1.3 Applicability

This program applies to SLAC management, project managers, EEIP field representatives, the EEIP program manager, electrical safety officer (ESO), and the Electrical Safety Committee (ESC).

1.4 Standards

This procedure is designed to meet the following directives and standards:

- National Fire Protection Association (NFPA) 70E, “Standard for Electrical Safety in the Workplace” (NFPA 70E)
- National Fire Protection Association (NFPA) National Electrical Code (NFPA 70)
- Department of Energy Handbook 1092, “Handbook for Electrical Safety” (DOE-HDBK-1092-2004)
- Title 29, *Code of Federal Regulations*, “Labor” , Chapter 17, “Occupational Safety and Health Administration, Department of Labor”, Part 1910, “Occupational Safety and Health Standards”, Subpart S, “Electrical”, Section 303, “General” (29 CFR 1910.303)

For more information see the *SLAC Environment Safety and Health Manual*, Chapter 8, "Electrical Safety" or the Electrical Equipment Inspection Program site.

2 Roles and Responsibilities

2.1 SLAC Management

Management must ensure the following:

- Electrical installations and work performed at SLAC are examined in accordance with the requirements in this document.
- Unlisted or unlabeled electrical equipment fabricated, manufactured, or installed after the implementation of this program are examined in accordance with the requirements in this document. Non-NRTL approved electrical equipment in storage or not in use must be examined before activation except for maintained spares for in-use legacy equipment. Safety issues identified during a review must be addressed and any potentially imminently dangerous situation must be corrected immediately.
- Adequate resources are allocated to mitigate electrically hazardous conditions and to ensure compliance with applicable codes and standards. Consideration should be given to the priorities of other hazardous conditions that might also have to be addressed.
- Deficiencies found during EEIP examinations are corrected before the electrical equipment is placed into operation
- Drawings of all electrical systems and equipment (including utility, facility, and programmatic systems; equipment single-line diagrams; and panel board, switchboard, control, ladder network, schematic, layout, and interconnection diagrams) are current.
- A program is developed to ensure legacy equipment and maintained spares are subjected to EEIP inspection and approval in a timely manner.

2.2 EEIP Manager

The EEIP manager

- Interprets NEC codes and other electrical standards, approving electrical equipment and materials for use. May permit alternate methods and work practices where it can be assured that equivalent safety objectives have been met.
- Has authority to accept for use, with respect to electrical safety, programmatic electrical equipment and installations
- Delegates to EEIP field representatives the authority to interpret NEC codes and other electrical standards and to examine and approve electrical equipment. Determinations made by EEIP personnel will stand unless overturned by the ESO or ESC.
- Develops protocol for EEIP personnel to
  - Interpret NEC codes and other electrical requirements in the field
  - Approve electrical equipment, wiring methods, electrical installations, and materials for use
  - Permit alternate methods if equivalent safety protection can be provided

- Ensures electrical equipment is in compliance with electrical codes and standards
- Reviews and validates EEIP field reports
- Reviews and validates NEC and OSHA permitted alternate methods
- Maintains all documentation of EEIP activities, including EEIP field reports, interpretations of NEC and OSHA codes, approvals of electrical equipment and materials, permitted alternate methods, and any other related documentation
- Establishes limits of authority for EEIP field representative
- Assesses overall program effectiveness on a periodic basis and makes improvements as appropriate

2.3 SLAC Electrical Safety Committee

The Electrical Safety Committee (ESC)

- Advises on electrical safety matters to promote electrical safety
- Works to resolve disputes between a user and the EEIP
- Review ESO interpretations on matters of code to ensure personnel safety, as needed

2.4 EEIP Field Representative

The EEIP field representative must be a SLAC employee and may be an engineer, senior electrician, or senior technician nominated by his or her organization or the ESC and approved by the EEIP manager. Approval will be based of the nominee's knowledge of electrical codes, training, education, and experience. The approval of the nominee will be made by the EEIP manager with input from the EEIP staff, the ESO, and the ESC when requested. Organizations that do not have a qualified person to serve as an EEIP field representative may have one assigned to them by the EEIP manager.

- Must be trained as an EEIP field inspector
- Interprets OSHA regulations, NEC codes, and other standards listed in this document
- Examines/inspects and approves/rejects for use
  - Electrical equipment (such as electronic panel boards, switchboards, shop-built extension cords, power supplies, and research and development [R&D] equipment) and installations
  - Recommend modifications to unapproved electrical equipment that, if implemented, will result in approval
- Permits, with EEIP manager approval, alternate methods from the NEC and other standards, if it can be assured that equivalent safety objectives are met
- Verifies that all modifications meet or exceed established codes and standards
- Participates in design reviews, as requested
- Labels approved electrical equipment
- Prepares EEIP field reports
- Performs EEIP inspections as requested by the EEIP manager

3 EEIP Training

The EEIP manager and the field representative must have the following training:

- Training requirements for electrical workers and electrical work performed at SLAC as described in ESH Manual Chapter 8, “Electrical Safety”
- Training in application of the NEC and NFPA 70E
- Site-specific electrical safety training
- EEIP-specific field representative training
- Training in the administration of the EEIP and database operation
- Other training as deemed appropriate to carry out requirements of the program

4 Approval Requirements

4.1 Equipment and Installations Subject to Review and Approval

This section describes requirements for approving unlisted or unlabeled electrical equipment, installation, and work. EEIP personnel must review and approve electrical equipment and installations at SLAC based on at least one of the following four criteria before placing the equipment into service:

1. Electrical equipment manufactured at another DOE laboratory must be approved as follows:
    a. By the originating laboratory's AHJ program
    b. If the originating laboratory does not provide such approval the equipment must be approved under the SLAC EEIP before the equipment is entered into service
2. Electrical equipment, including custom-made SLAC electrical equipment, that is not NRTL listed or labeled will be acceptable if examined by EEIP personnel in accordance with the provisions of this program. The equipment must either meet code requirements or it must be demonstrated that equivalent safety can be achieved. If the electrical equipment is not acceptable but can be modified, EEIP personnel may recommend the necessary modifications as described below.
3. All modifications to NRTL-listed electrical equipment must be examined and approved by EEIP personnel.
4. All electrical equipment installations and work must be examined and approved by EEIP personnel or be reviewed and approved by the ESC.

Section 4.2 describes the three methods for review and approval. For documentation requirements, see Section 4.2.3. In all instances EEIP personnel must prepare and maintain an EEIP report for review by the equipment supervisor. This report will be entered into the EEIP database.

4.2 Review and Approval Methods

The three options to achieve OSHA compliant electrical equipment (as defined in 29 CFR 1910.399) are listed below. The individual or project manager will chose the method appropriate to the project or program.

4.2.1 EEIP Representative Involvement in the Engineering Cycle from Project or Program Inception

This option requires that an EEIP representative be assigned to a project or program at its inception. The EEIP representative will attend all engineering and project reviews and conduct routine safety inspections during construction. A summary of the approved EEIP safety standards should be documented by the project management and EEIP field representative.

At the conclusion of this process the equipment or project will be certified as being compliant and accepted as AHJ approved. A minor inspection must be completed by the EEIP field representative or representative

of the SLAC AHJ prior to placing the equipment into service. Once the equipment passes inspection a label that certifies compliance will be affixed.

The ESC may also request a field inspection.

4.2.2 Engineering Safety Analysis Self Assessment

This option requires submitting a detailed equipment safety analysis for review to the EEIP manager once the project has reached design milestones. The safety analysis should be conducted by a registered professional engineer or senior SLAC staff electronic or electrical engineer. The report should address the elements in the acceptance criteria listed in Section 4.3.

At the conclusion of this process the equipment or project will be certified as compliant and accepted as AHJ approved. Prior to placing the equipment into service, a minor inspection must be completed by the EEIP representative or representative of the SLAC AHJ. Once the equipment passes inspection a label that certifies compliance will be affixed.

4.2.3 Equipment Inspection Program

The project manager may request a rigorous inspection prior to placing the equipment in service. The inspection must comprise all elements described below in Section 4.3, “Acceptance Criteria”. In addition, the EEIP inspector may make interpretations of the NEC codes and other electrical requirements and grant special permission contemplated in a number of the codes. The ESO may waive specific requirements in the NEC or permit alternate methods and work practices where it can be assured that equivalent safety objectives have been met.

At the conclusion of this process the equipment or project will be certified as being compliant and accepted as AHJ approved.

4.3 Acceptance Criteria

4.3.1 Equipment Acceptance: Areas of Consideration

Equipment is accepted for use if it meets the following requirements. Equipment should be examined for safety as extensively as possible. Areas of consideration include the following:

- Failure modes
- Heat effects
- Magnetic effects
- Grounding and bonding
- Guarding of live parts
- Leakage currents
- Dielectric testing
- Access to serviceable parts
- Over current and over temperature protection

- Clearances and spacing
- Interlocks
- Design and procedural documentation
- Signage, labels, and administrative controls
- Mechanical motion
- Stored energy

4.3.2 Documentation Requirements

Documentation should be developed to substantiate the acceptance of any equipment. Documentation should include the following:

- Tests performed
- Conditions of acceptability
- Applicable standards to which the equipment was evaluated
- Limitations of approved use, if any

The EEIP inspection forms may be used to capture this information. (See the Electrical Equipment Inspection Program site.)