

Critical Utilities Infrastructure Revitalization

Electrical Hazards and LOTO Procedure

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Outline

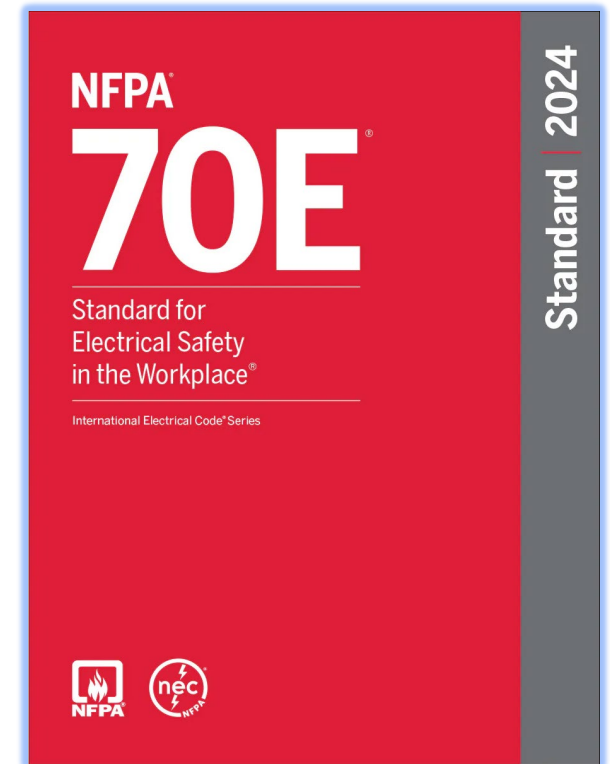
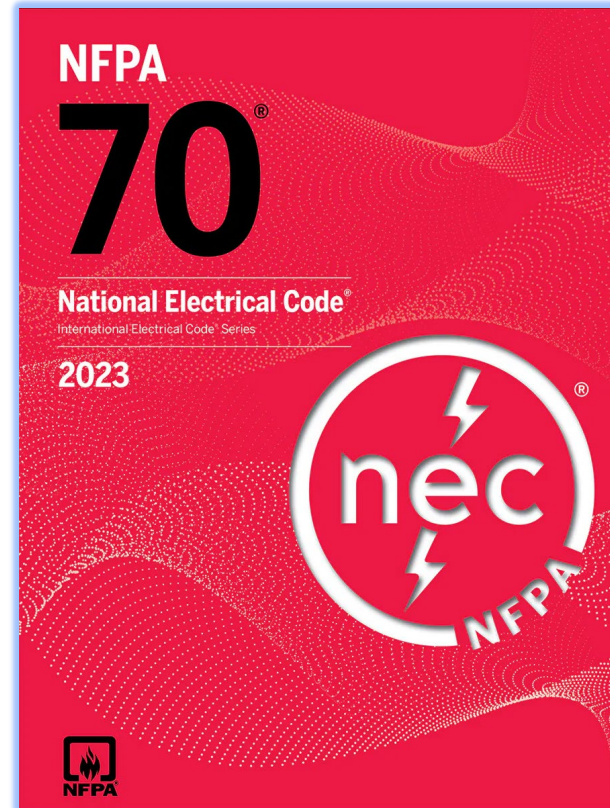
- Control of Hazardous Energy
- Electrical Hazard
- Protecting Existing Cable Ways

Electrical Codes

SLAC Policies

National Consensus Codes

- NFPA 70-2023 – National Electric Code (NEC)
- NFPA 70E-2024 – Standard for Electrical Safety in the Workplace



SLAC Policies

Building Inspection Office

- Construction Safety Manual

SLAC Environment Safety and Health

- Chapter 8 – Electrical Safety
- Chapter 51 – Control of Hazardous Energy

SLAC Construction Safety Requirements Manual



CONSTRUCTION SAFETY REQUIREMENTS MANUAL

Part One: Introduction

Part Two: S&H Program Management

Part Three: S&H Functional Area Requirements

Appendix: S&H-Related Data Requirements (S&H Forms, Plans, Permits and other Data Requirements)

Revision Date: May 24, 2019 (updated October 15, 2019)

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This chapter was last reviewed for currency 6/15/2021.
The next thorough review is due 6/15/2024.

Chapter 8

Electrical Safety

Related Chapters

- 1 [General Policy and Responsibilities](#)
- 2 [Work Planning and Control](#)
- 19 [Personal Protective Equipment](#)
- 44 [Penetration Safety](#)
- 51 [Control of Hazardous Energy](#)

Chapter Outline

- 1 Policy
- 2 Responsibilities
 - 2.1 Electrical Safety Officer
 - 2.2 Electrical Safety Committee
 - 2.3 Environment, Safety, and Health Division
 - 2.4 Managers and Supervisors
 - 2.5 Personnel
 - 2.6 Safety Watch Person
- 3 Hazards
 - 3.1 Electrical Shock
 - 3.2 Burns
 - 3.3 Delayed Effects
 - 3.4 Other Hazards
- 4 Qualified and Authorized Personnel
 - 4.1 General Requirements for a Qualified Person
 - 4.2 Qualifications for Working on Energized Components

7/7/2005 (updated 7/5/2022)

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ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 51

Control of Hazardous Energy

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URL: <https://www-orcup.slac.stanford.edu/esh/manual/pdfs/ESHch51.pdf>

1 Purpose

The purpose of this program is to prevent worker exposure to *hazardous energy* (such as from unexpected energization, start-up, or release of stored energy). It covers controlling hazardous energy associated with the *service and maintenance* of machines, equipment, or systems. It also covers *administrative lock and tag control*, which may involve the lockout of equipment for configuration or operational purposes, but which may not be used alone to protect workers from hazardous energy. It applies to workers (as *authorized, lead authorized, affected, and zero voltage verification* workers and operations group members) and supervisors; equipment designers, custodians, and owners; LOTO inspectors; project managers, field construction and service managers, and points of contact; the CoHE program manager, related ESH program managers; and associate laboratory directors.

Note Control of hazardous energy is commonly referred to as CoHE, and lockout/tagout is commonly referred to as LOTO or lockout.

1.1 Exemptions

The following activities are exempt from CoHE requirements.

- Work on *cord-and-plug connected equipment*, in which all these conditions are met:
 - There is a single energy source.
 - All of the hazardous energy is controlled by unplugging the equipment and there is no potential for stored hazardous energy.
 - The plug remains under the exclusive control of the worker performing the servicing or maintenance.
- *Hot tap operations*, the use of specialized drilling equipment to tap into in-service, pressurized process piping for the purpose of attaching a mechanical or welded branch fitting, in which all these conditions are met:
 - Continuity of service is essential.
 - Shutdown of the system is impractical.
 - Documented procedures are followed.
 - Special equipment is used that will provide proven, effective protection for workers.

Permission to hot tap a process system is limited to situations in which system shutdown is impossible (such as a leaking tank or other non-isolable leak) or where hot tapping is shown to be less hazardous than shutting down and locking out the system and performing a cold tap. In other words, the decision

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Control of Hazardous Energy

Subcontractor Lockout/Tagout

ESH Chapter 51 - 2.2 Subcontractors The SLAC project manager, construction manager (CM), service manager (SM), or point of contact (POC) must ensure that the subcontractor's affected and authorized workers understand and follow the applicable provisions of SLAC's and the subcontractor's CoHE programs. **In all instances, any equipment that requires a lockout will first be locked and tagged by a SLAC authorized worker or operations group, then, when authorized by the subcontractor supervisor, the subcontractor's authorized workers will apply their personal LOTO locks.**

Note: If the SLAC authorized worker will not perform any work under the lockout and is not the lead authorized worker, then the SLAC worker should apply an administrative lock.

Note: Only SLAC qualified electrical workers are authorized to operate breakers and perform switching of electrical equipment.

Subcontractors must maintain up-to-date marked-up drawings at the job site for all construction projects. These marked-up drawings must be made available to all SLAC and subcontractor workers for their use planning lockouts in support of construction activities.

Control of Hazardous Energy

SLAC does not permit hazardous energized work

- All electrical work will be:
 - Air-gapped (not connected to energy sources) – Preferred
 - Under an approved hazard Control of Hazardous Energy Lockout/Tagout program

Hot taps of hydraulic or electrical systems are not permitted

- Contact SLAC for prior approval in the exceptional case that a hot tap may be warranted

Switchgear, Transformers, Electrical Equipment, etc.

- Work in switchgear or other equipment with energized or potentially energized circuits (e.g.: Pulling cables while systems are locked out) will be subject to enhanced rigor and oversight
- Contractor will be responsible for supplying and using PPE and rescue equipment in accordance with NFPA 70E requirements

Electrical Hazard

Arc Flash

Almost all energized electrical systems at SLAC can generate an arc flash or arc blast in the event of a failure.

No SLAC-owned electrical disconnect or circuit breaker may be operated by a subcontractor.

Subcontractor-provided equipment operating at SLAC-provided power 480-volt or above may be subject to arc flash protocols. The arc flash hazard will depend on the specific power source used. Contact SLAC for particular arc flash information.

Protecting Existing Equipment

Protection of Existing Equipment

Much of the contract work will be above existing cable trays

- Equipment is in service.
- Workers shall not use cable trays or installed equipment for support. Walking on trays is not permitted. Leaning ladders on cable trays or equipment is not permitted.
- Equipment, cable trays, and cables to equipment must be 100% protected. No chips, shavings, tools, or construction debris may be allowed to contact these elements.
- In some cases, the use of a cable tray to support a protective blanket or plywood may be allowed. Contact SLAC for approval prior to use of existing infrastructure to support protective equipment.

Protection of Existing Equipment



Existing Klystron Gallery Roof



Existing Klystron Gallery



Internal view of MSS B016



Internal view of MSS B016

*Thank
You*



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