Dartmouth College
Facilities Operations and Management
Environmental Health and Safety
Occupational Health and Safety Program (2001)

Energy Control (Lockout/Tagout) Program
•LOTO•

Prepared in compliance with 29 CFR 1910.147 and .333

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Purpose

To help protect Dartmouth College employees from the hazards associated with the unexpected/uncontrolled release of hazardous energy during maintenance or repair. This policy outlines procedures that must be followed when working with potentially hazardous energies to safely isolate its source(s).

Regulatory Requirements

This program was developed to meet the Occupational Safety and Health Administration's (OSHA) requirements found in 29 CFR 1910.147, The Control of Hazardous Energy (LOTO), and 29 CFR 1910.333, Selection and Use of Work Practices (Electrical Safety-Related Work Practices). For complex systems, OSHA requires that specific written procedures be developed.

Scope and Application

Applies to all Dartmouth College employees considered to be "authorized" to work on electrical circuits, steam lines or other sources of hazardous energy by virtue of having been trained on the tenants of the College's LOTO program. In particular, this includes the following job classifications that are considered "qualified" to work on energy systems[1].

- Electricians and high voltage electricians
- Troubleshooters
- Equipment Maintenance (EM)
- Maintenance Workers
- CEC Operators
- Electronics Technicians
- Welders
- Oil Burner Technicians
- Mechanical Shop (steam systems)

[1] Specific definitions and requirements apply to the Power Plant.

The Role of Employees

Employees are required to comply with the restrictions and limitations imposed upon them during the use of lockout/tagout.

An **Affected Employee** is anyone whose job requires him/her to operate or use a machine, equipment or system on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

An **Authorized Employee** is anyone who locks out or tags out machines, equipment or system in order to perform servicing or maintenance on that machine or piece of equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance. All authorized employees must be trained in the provisions and safe work practices of this policy before being allowed to lock out or tag out.

Only authorized employees may lockout or tagout equipment. Affected employees (those work activities are affected by the lockout/tagout procedure) must be notified by an authorized employee before the procedure is used and when the machine or equipment is returned to service.

Outside Personnel or Contractors

Outside personnel or contractors involved in service or maintenance, operations covered by this program must submit their LOTO procedures to the Project Supervisor. All affected employees must be notified of the provisions of the outside contractor’s LOTO procedures and must comply with its restrictions and prohibitions.

Employee Training and Retraining

All authorized and affected employees must receive initial training, as required. Retraining must be given for employees whenever there is a change in job assignment, a change in machines, equipment or process that presents a new hazard or a change in this lockout/tagout program. Retraining must also be given whenever the annual inspection identifies a deficiency in the procedures.

Selected Definitions:

"Capable of being locked out." An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild or replace the energy-isolating device or permanently alter its energy control capability.

"Energized." Connected to an energy source or containing residual or stored energy.

"Energy isolating device." A mechanical device that physically prevents the transmission or release of energy.

These devices may include (but are not limited to) the following: A manually operated electrical circuit breaker, a disconnect switch, a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and--in addition--no pole can be operated independently. Other examples include a valve cover, a blocking or line-blanking device and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

"Energy source." Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

"Hot tap." A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, and steam and petrochemical distribution systems.

"Lockout." The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

"Lockout device." A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

“Mechanical Lock.” A keyed-alike yellow padlock that is to be used for locking out a piece of equipment or system. It is not to be used for personal protection and may only be used by an authorized employee. See Appendix 1.

"Normal production operations." The utilization of a machine or equipment to perform its intended production function.

“Personal Lock.” A uniquely keyed lock that is color-coded by shop to be used by an authorized employee for personal protection only. See Appendix 1.
“Qualified person.” An employee who has knowledge, skills, ability and training in avoiding the hazards associated with the energy systems they work with.

"Servicing and/or maintenance." Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines

or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

"Setting up." Any work performed to prepare a machine or equipment to perform its normal production operation.

"Tagout." The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

"Tagout device." A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

At Dartmouth, only approved tags may be used (See Attachment 2).

"Zero Energy State." A system condition in which power or other forms of energy have been demonstrated to be safely isolated--by verification--and therefore removed from the system rendering it safe to work on.

Responsibilities:

Director of Facilities, Operations and Management (FO&M)

The Director of FO&M is responsible for ensuring that all supervisors and employees within FO&M adhere to and follow the work practice requirements set forth in this policy.

The Director of FO&M delegates the necessary authority to each supervisor to ensure that all affected employees follow the LOTO policy. As required, the Director of FO&M takes steps to help ensure compliance.

Supervisor

Each supervisor is responsible for ensuring that each employee is aware of and follows the electrical safety related work practices outlined in this policy. In their own electrical work, each supervisor is expected to set a positive example by modeling safe work practices and considering safety in the assignment and planning of tasks requiring LOTO.

Each supervisor is responsible for reporting problems with implementing this program in their shop to their supervisor and EHS to help ensure continual program improvement.

Employee

At all times each employee must use care, consideration and respect for hazardous energies for their safety and that of others.

Each employee covered under this policy is responsible for following the LOTO practices outlined here.

Each employee should report problems with implementation of this program to their supervisor and EHS to help ensure continual program improvement.

Director of Environmental Health and Safety (EHS)

The Director of EHS is responsible for ensuring institutional compliance with this policy and the overall effectiveness of adherence to the LOTO requirements set forth by OSHA. On behalf of the College, the Director of EHS evaluates and makes recommendations for improvements based on observed and reported discrepancies between actual practice and the intent of OSHA requirements.

Consequences for Noncompliance:

Failure to use LOTO can have serious repercussions. Tampering with locks and tags will not be tolerated and may be grounds for immediate discharge.
Each problem/event will be evaluated and handled on a case-by-case basis.

Locks and Tags:

Only College supplied locks, tags and isolation devices may be used. Locks and tags have been standardized[2]. Every effort has been made to obtain a wide range of isolation devices such as switch covers, valve covers and hasps to meet our maintenance needs. Employees and supervisors are actively encouraged to help identify, purchase and use new devices and products that best meet their needs, as they become aware of them.

General LOTO Principles:

The following are the basic principles that need to be used when locking out any piece of equipment or system. While circumstances may vary, the general principles to follow will not. Only trained, authorized employees are permitted to conduct LOTO activities.

- Notify affected employees that a piece of equipment or system must be shutdown or taken off line for servicing/maintenance.
- Identify the types of energy present, its hazards and the methods to control the energy safely.

[2] For other areas, such as DMS, DCAD, Thayer School, etc. slightly different--yet standardized -- procedures may be used provided they are as protective than the requirements set forth in this policy.

- Identifying the type(s) and location(s) of the control points (switches, valves, gates, etc.). Labeling these locations using approved, standardized labels (Attachment 3).
- Locking out/Tagging out the hazardous energies at their respective control point(s) according to established College procedures.
- Verifying that the system is in a "Zero Energy State".
- Doing the task needed.
- Safely returning the equipment or system to service.

Electrical LOTO:

Please refer to the Electrical Safety-Related Work Practices Program for specific information on electrical safety and electrical LOTO. These two policies are meant to compliment one another.

LockOut/Tag Out Program (LOTO)

Only qualified, authorized persons are permitted to conduct Lockout/ Tagout.

This procedure does not apply to electrical equipment that is exclusively plug and cord supplied.

Whenever an employee is exposed to a potential electrical hazard, the equipment or circuit must be de-energized and locked out/ tagged out in accordance with the requirements of Dartmouth's Energy Control (Lockout/Tagout) Program[3].

Guiding Principles in Electrical LOTO

1. Safe procedures for de-energizing circuits and equipment must be planned for in advance. *For example*, consideration is given to the number and location(s) of electrical supply to a system or piece of equipment.

2. The circuits and equipment to be serviced must be disconnected or otherwise isolated from **all** electrical energy sources supplying the system. *For example,* shutting off the supply at a breaker box.

3. Control circuit devices, such as push buttons, switches and interlocks, must not be used as the sole means for de-energizing circuits or equipment. Interlocks for electric equipment may not be used as a substitute for lockout / tagout procedures.

4. Stored electric energy that might endanger personnel must be released. Capacitors shall be discharged and high capacitance elements must be short-circuited and grounded, as needed.

[3] Specific LOTO Procedures are required for the Power Plant. Please refer to these procedures.

5. Stored non-electrical energy in devices that could re-energize electrical circuits must be blocked or relieved.

6. A lock and a tag must always be placed on each disconnecting means unless the conditions in 6A or 6B apply:

6A. *Lock Without a Tag*

A lock without a tag is permissible if all three of the following conditions are met:

1. Only one circuit or piece of equipment is de-energized.

2. The lockout period does not extend beyond the work shift and the scope of work is limited to the activities of one person.

3. There is only one source of electrical supply.

6B. *Tag Without a Lock*

If a lock cannot be applied a tag must be used.

Whenever a tag is used without a lock, it must be supplemented by at least one additional safety measure that provides a level of safety equivalent to that obtained by the use of a lock[4].

Lock and Tag Requirements

Note: Only personally assigned locks may be used for LOTO. Mechanical and other commonly keyed locks must not be used under any circumstances for personal protection (Attachment 1).

7. Each lock must be attached in such a way as to prevent operating the disconnect. Each tag must contain a statement prohibiting unauthorized operation of the disconnecting means and removal of the tag. Only Dartmouth supplied/approved tags may be used (See Attachment 2).

Lockout and Tagout Verification

8. No work will be done until the de-energized condition (zero energy state) has been verified.

[4] Examples of additional safety measures include the removal of an isolating circuit element, blocking of a controlling switch or opening of an extra disconnecting device.

9. Verification--by a qualified person--must include:

   An attempt to operate or restart the equipment using its conventional controls. After testing, the controls must be returned to the off position.

   The use of appropriate test equipment to test circuit elements and electrical parts of the equipment to verify a de-energized condition.

Re-energizing Procedure

10. Before any circuit or equipment is re-energized—even temporarily—the following requirements must be met in the order listed below:

11. A qualified person must conduct tests and visual inspections to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed in order to allow the circuits and equipment to be safely energized.

12. Employees potentially exposed to the hazards associated with re-energizing the circuit or equipment must be warned to stay clear of circuits and equipment.

13. Only the employee who applied it may remove their lock and tag[5].

14. There must be a visual and verbal determination that all employees are clear of the circuits and equipment to be re-energized.

Steam LOTO:

All systems that have steam, as an energy source must be well understood and all sources of supply identified before LOTO.

For short-term projects, valves may be closed and secured with covers, chains and tags--or some combination of these isolating means. A tag must always be used on a valve that has been isolated for some reason. The tag must indicate what was isolated, why and for how long.

For any system where the steam source and its means of control are not in close proximity, two workers using radios must coordinate the isolation process. Whenever

[5] If that employee is absent from the workplace, then the lock and/or tag may be removed by a qualified person designated to perform such task provided that (1) it is certain that the employee who applied the lock or tag is not available at the workplace and (2) that employee is made aware that the lock or tag has been removed before they resume work.

possible, multiple valves must be closed to provide a primary and secondary means of isolation.

For longer-term projects, tags may be left in place. For example, during seasonal shutdowns. Tags must be kept current, be legible and replaced as needed.

All tags must be made of materials that resist exposure to steam. Permanent makers must be used to ensure that all writing remains legible.

Verification of isolation must take place before any work begins on a steam system.

Hydraulic LOTO:

Systems that have hydraulic energy must be bleed and blocked or blocked by a substantial means to prevent sudden release and potential injury. Follow all manufacturers' recommendations for the proper means to do this work.

Whenever possible, employ the use of locks and tags to valves and other disconnecting means when isolating a system.

Special Considerations in LOTO

Group Lockout/Tagout

When servicing and/or maintenance is performed by more than one person, the following procedure must be used. This procedure has been designed to provide an equivalent level of protection as that provided by individual lockout/tagout devices.

One authorized employee must be designated as responsible for a set number of employees working under the protection of a group lockout/tagout device.

Each employee in the group must review the lockout/tagout procedure to be used.

If more than one crew, craft, etc., is involved, one authorized employee must coordinate the lockout/tagout to ensure that all control methods are applied and that there is continuity of protection for the group.

Each authorized employee must affix a personal lockout/tagout device to the group lockout device, group lockbox, or comparable device before beginning work and must remove it upon completion of their work.

Procedure for Shift or Personnel Changes

This procedure must be used during shift or personnel changes to ensure the continuity of lockout/tagout protection, for individual and group lockout/tagout.

The on-coming authorized employee must exchange lockout/tagout devices with the off-going authorized employee.

Re-testing must be done to ensure the de-energized state of the equipment.

Employees must discuss the status of maintenance or servicing and any notification of start-up or testing to be performed.

Special Conditions for the Removal of Locks

Under almost all circumstances, the only person that is authorized to remove a personal lock is the individual that attached it.

If for some reason the person who attached the lock is unavailable to remove their lock due to unforeseen circumstances the lock may be removed if all the following conditions were met.

1. The person was notified or attempts were made to notify them.
2. The supervisor and appropriate engineering staff member approves the special circumstances that warrant the removal.
3. All affected shops and individuals are notified of the need to remove the lock.
4. A traceable record of the date, time, location and individuals authorizing the removal is maintained[6].

A specially designated lock box contains the master key (and all copies) that opens personal locks. The only individuals with keys to open this box are the Director or Associate Director of FO&M or other specifically designated management staff.

[6] A designed electronic lock box with controlled access is used for this purpose.

Attachment 1

Dartmouth College
Energy Control (Lockout/Tagout) Program

Personal Locks

1. Personal protection only!
2. Color-coded by shop.
3. Individually keyed (with common master).
4. Placed and removed by authorized employee named on the lock.
5. Master key kept in designated lock box and used only when criteria for “Special Conditions for the Removal of Locks” are met.
6. Must be used with a tag unless all conditions for “Lock Without a Tag” are met.

Mechanical Locks

1. Never to be used for personal protection!
2. Always yellow in color.
3. Keyed-alike.
4. Placed and removed only by authorized employees.
5. Must be used at all times with a tag or service note attached.

Attachment 2: Approved Tags

This energy source has been LOCKED OUT.

Unauthorized removal of this lock/tag may result in immediate discharge.
Remarks: _____

_____

_____

_____

_____

_____

_____

DO NOT OPERATE

DARTMOUTH COLLEGE
LOCKOUT/TAGOUT

NAME _____

DEPT. _____

EXPECTED COMPLETION _____

Attachment 3: Approved Labels

THIS EQUIPMENT IS POWERED BY [ ] SOURCES LOCK OUT ALL POWER SOURCES

OS3219 © EMED Co., Inc. • 1-800-442-3633

THIS POWER SOURCE SUPPLIES

Equipment	Location

OS3329 © EMED Co., Inc. • 1-800-442-3633

LOCK-OUT POINT FOR

SOS84 © EMED Co., Inc. • 1-800-442-3633

MAIN DISCONNECT

SOS27 © EMED Co., Inc. • 1-800-442-3633

Attachment 3: Approved Labels

PLEASE DO NOT BLOCK ELECTRICAL PANEL

DANGER

AREA IN FRONT OF THIS ELECTRICAL PANEL MUST BE KEPT CLEAR FOR 36 INCHES

OSHA - NEC REGULATIONS

CAUTION

DISCONNECT POWER AND LOCK OUT BEFORE SERVICING

CAUTION

THIS DEVICE POWERED FROM SEVERAL SOURCES

DISCONNECT SWITCH WILL NOT SHUT OFF ALL SOURCES OF ELECTRICAL ENERGY