


National High Magnetic Field Laboratory Safety Program

TITLE: Lock, Tag, and Verification Program	SUBJECT: Lock, Tag, and Verification of Energy Sources
PROGRAM NUMBER: SP-1	EFFECTIVE DATE: August 1, 2019
REVISION NUMBER: 001	REVISION DATE: July 9, 2019
ISSUING AUTHORITY: Safety & Admin	REVIEW DATE: October 1, 2021
Additional Approval Signatures on Revision and Approval Page	APPROVAL: NHMFL Deputy Lab Director 

Overall Mission and Overview

The National High Magnetic Field Laboratory (NHMFL) Environmental, Health, and Safety (EHS) program's mission is to:

Provide support and guidance to all NHMFL departments with the implementation, maintenance and review of a comprehensive environmental, health, and safety program. The primary goal of the NHMFL Safety program is to control, reduce or eliminate work-related injuries, illnesses and loss of NHMFL resources.

The NHMFL is charged by the National Science Foundation (NSF) to safely:

- Promote magnet-related research to serve an interdisciplinary scientific user community.
- Provide unique high-magnetic-field facilities through a competitive and transparent proposal review process.
- Advance magnet and magnet-related technology.
- Partner with universities, other national laboratories and industry to enhance national competitiveness in magnet and related technologies.
- Serve the NSF as a prominent example of its successful stewardship of large research facilities.
- Support science and technology education in the United States.
- Increase diversity in the science, technology, engineering, and mathematics workforce.
- Promote collaboration among our three partner institutions: Florida State University (FSU), the University of Florida (UF) and Los Alamos National Laboratory (LANL).



LOCK-TAG-VERIFICATION PROGRAM INDEX:

- 1.0 Purpose**
- 2.0 Scope**
- 3.0 Definitions and Acronyms**
- 4.0 Roles and Responsibilities**
- 5.0 General Procedure Summary**
- 6.0 Lockout Equipment**
- 7.0 Transfer of Control**
- 8.0 Program Audit**
- 9.0 LTV Work Processes**
 - WP-A Centrally Controlled LTV General Rules**
 - WP-B Exceptions**
 - WP-C Individually Controlled LTV**
 - WP-D Group Guidelines**
 - WP-E Contractor LTV**
 - WP-F Training and Authorization**
 - WP-G Administrative Lockout**
 - WP-H Equipment Specific Procedure**
 - WP-I Air Gapping**
 - WP-J Lock Removal**
- 10.0 Appendices**
 - 10.1 SCUD User Guide**
 - 10.2 Mechanical Lockout Guidelines**
 - 10.3 Electrical Lockout Guidelines**
 - 10.4 Issuing Authority Employee List**
 - 10.5 LTV Example Chart**
 - 10.6 Lost Key/Absent Person Lock Removal Form**



1.0 PURPOSE:

The purpose of this procedure is to prevent injury from the unexpected start-up or release of energy including electrical, chemical, physical, stored, etc., during equipment service, maintenance, or construction. This program establishes the minimum safety requirements for the Lock, Tag and Verification (LTV) of hazardous energy sources and the verification of energy isolation through the use of isolating devices and techniques that ensure a zero energy state in the portion of the system where work will be performed.

- Conformance to this program ensures that hazardous energy sources are properly isolated and controlled.
- The use of this program will ensure consistent application of the NHMFL LTV requirements across all work activities.
- The use of this program prevents unexpected startup or release of stored energy that could result in injury or hazardous material exposure.

2.0 SCOPE:

This program is to be used by all personnel at the NHMFL, including employees, students, visitors, and contractors. This program identifies the specific requirements for the protection of employee(s) working on facility machinery, equipment, and systems from the hazards due to the unexpected or accidental release of stored or potential energy.

This program also establishes responsibilities as applicable for the administration and implementation of the program. All contractors will comply with this program unless they have an approved safety plan submitted and approved in advance of performing work and the plan includes equivalent or more stringent LTV procedures than those described within this document.

It is the intention of this program to ensure that employees, visitors, and contractors who are required to conduct LTV operations:

- Comply with all state and federal regulations regarding LTV.
- Identify, evaluate, and eliminate potential hazards from LTV operations.
- Are trained and have demonstrated competence on proper procedures and techniques.

Employees who fail to follow these established procedures and other applicable regulations for lockout of equipment and machinery or who fail to take appropriate steps to protect the safety of all personnel who are performing work under locked out conditions are subject to disciplinary action in accordance with the NHMFL Safety Disciplinary Policy.



Each job where the workers have the potential for exposure to hazardous energy should have its own unique LTV, created by the Primary Authorized Employee (PAE) performing the work. Every LTV must be independently verified by an Issuing Authority (IA) who is sufficiently knowledgeable of the system/equipment and environment where the work will be performed to ensure adequacy. Every Authorized Employee working under the LTV must receive instruction from the PAE or original IA regarding the portions of the system/equipment where work can be performed safely and how the zero energy state or safe condition may be personally verified by them prior to their conducting any work.

Authorized Employees must specifically be instructed by the PAE or IA, in their absence, that work may only be performed within the portions of systems isolated by their specific LTV, where a zero energy state or otherwise safe condition has been established and confirmed in accordance with authorized LTV protocols. They must also be instructed that no work shall be performed that causes removal or reconfiguration of any of the established isolation points, without either properly clearing locks and tags from the existing LTV or reestablishing new boundaries and performing zero energy state verifications under a new LTV prior to the alteration of any existing isolation boundaries following approved processes authorized under this program.

Under certain circumstances, adherence to this LTV program is not required, for example:

- When servicing or maintaining equipment that is powered by a 120V or less electrical cord or plug. Such equipment shall be worked on with the cord unplugged. The employee performing the work must have exclusive control of the plug at all times.
- When service or maintenance is being performed on equipment or systems less than 50 volts and the employee has been trained and qualified.
- When inspecting, adjusting, or testing electrical equipment and the work being performed requires the system to be energized. SP-70 - electrical safe work policy must be followed.

3.0 DEFINITIONS AND ACRONYMS:

Administrative Authority (AA): A competent person who has been designated by the NHMFL Senior Management to approve Equipment Specific LTV Procedures based on his or her level of technical knowledge and familiarity with the systems involved.

Administrative Lock: A lock that is used for a purpose other than LTV. The lock may serve a safety function other than LTV, a configuration control, or other purpose. An Administrative Lock, unlike an LTV Lock, may be controlled by one or more individuals. Administrative Locks must have a unique appearance.

Affected Employee: Any individual, including visitors or contractors, whose job requires him/her to be near or around the hazard zone (but not within the hazard zone) when equipment or apparatus is being maintained or serviced under a locked-out or tagged-out



condition. An Affected Employee needs to transition to an Authorized Employee when their job requires them to perform maintenance or service within the work zone on the equipment, machine or system.

Authorized Employee (AE): Any individual with training that is authorized to join an approved lockout. All AEs shall be trained in the basics of the NHMFL LTV Procedures and must be briefed by the PAE, or IA, for each LTV under which they will be performing work to ensure they understand the isolation boundaries and verification process.

Blocked: A condition where a mechanical device is inserted into the energy path to physically prevent movement or propagation of energy; most commonly used with mechanical machinery or fluid filled lines.

Capable of Being Locked Out: An energy isolating device is considered capable of being locked out if it meets any of the following requirements:

- It is designed so an integral part allows the installation of a locking mechanism.
- Locking out is accomplished without dismantling, rebuilding, or replacing the energy isolating device or permanently altering its energy control capability.
- Can be locked out with the use of chains, or other mechanisms.

Centrally Controlled LTV: An LTV on equipment that may be part of a larger system or a system controlled by Control Room, Cryogenics or Building Operations. Requires Safety Clearance User Database (SCUD) entry, Operations approval, and Issuing Authority review.

Complex LTV: An LTV which has more than one isolation point, or is part of a complex system, or has a complex method of verification.

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, including but not limited to the following:

- Manually operated electrical circuit breaker.
- Manually operated disconnect switch.
- 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.
- Line valve, block, or any similar device used to block or isolate energy.

Energy-Isolating Devices must be capable of allowing a lock to be installed. Push buttons, selector switches, software interlocks, control circuit type devices, or devices that require continuous air are not energy isolating devices and cannot be used to isolate hazardous energy.



Energy Source: Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy, including ionizing and non-ionizing radiation.

Equipment Specific LTV Procedure: A written document that contains equipment-specific information and procedural steps that a Primary Authorized Employee must follow in order to safely control hazardous energy while performing work on or around the equipment, for instance for service, maintenance or setup of equipment/apparatus.

Group Lock Box: A box used to contain the lock key(s) of the Energy Control Points applied by the Primary Authorized Employee. The group lock box shall be constructed in such a way as to permit multiple individual locks/tags to be attached to the outside of the enclosure, preventing it from being opened except by removal of every individual lock/tag.

Group Lockout: A method to coordinate the servicing or maintenance work assignment of several employees/groups performing LTV on a single piece of equipment.

Hazardous Energy: Energy, that if not controlled is of such a magnitude that it is capable of causing harm to an employee or loss of resources.

Hazard Zone: The area which could be affected by the energy source isolated by the LTV. For electrical work, the minimum Hazard Zone is the limited approach boundary. The Hazard Zone must always encompass the entirety of the expected scope of work. If the scope of work is expected to shift outside of the Hazard Zone, then the work must be stopped and a new LTV must be created in order to accommodate the new scope of work.

Isolated: A condition where all sources of hazardous energy have been controlled by physically isolating the energy path so that the energy cannot flow to workers.

Issuing Authority (IA): An employee designated to approve LTV requests. IA's must be trained, qualified, and authorized as an IA and have technical competence and familiarity with the equipment, areas, or systems that the LTV covers. An IA may not serve as PAE and IA for the same LTV.

Individually Controlled LTV: An LTV wherein individual Authorized/Qualified Employees are responsible for establishing an LTV for an approved single point isolation. This does not require a procedure or an entry into the SCUD.

LTV: Lock, tag and verification.

LTV Lock: A lock issued to an Authorized Employee for which no other employee has the key or means of opening without using destructive force. LTV Locks are used for control of hazardous energies. These locks shall be of a distinctive style and shall not be used for any other purpose. There are two types of LTV Locks: Energy Control Locks and Personal Locks.



Energy Control Lock: A type of LTV Lock used to lock an energy isolation point or lockbox in place. These locks must only have **one key** and that key only fits **one lock**. This type of lock can be used by a Primary Authorized Employee (PAE) or an Authorized employee (AE) in either an Individually Controlled LTV or Centrally Controlled LTV. The key must remain in exclusive control of the worker who applied the lock.

Personal Lock I: A type of LTV Lock assigned to a single person. The lock marked with the person's name and picture. This lock may be used to lock a lockbox closed, or to lock a single energy isolation point in an individually controlled lockout in position by a PAE or AE. The key for this type of lock should not be placed inside of a lockbox. This type of lock may be part of a **group of locks** that are **keyed alike** but only have **one key**. The key must remain in exclusive control of the worker who applied the lock.

Lockout: The method of applying a mechanical lockout device and a tag on an energy isolating device by a Primary Authorized Employee in accordance with established written procedures, in order to control hazardous energies and prevent the equipment from being operated until the lockout device is removed.

Lockout Device: A device that utilizes a positive means, such as a single key lock, to hold an energy isolating device in the safe position and prevent the energizing of equipment or apparatus. Included are lockout hasps, valve handle covers, and switch locks.

Lockout Tag: A prominent warning device, 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 lockout device is removed. The tag shall include the job description, equipment name, isolation point, name of employee placing the tag, and date the tag was placed. Tags must be durable and able to withstand the environment to which they are exposed for the maximum time exposure is expected. A lockout tag is not a substitute for a lockout device.

Operations Approver: An employee who is responsible for the area containing the equipment to be locked out. These employees are defined for various areas of Operations such as DC Magnet, Cryogenics, and Building.

Primary Authorized Employee (PAE): An employee with the training and experience to exercise group and system-level judgments, who is authorized to lock, tag, and verify any equipment for which they are qualified. If coordinated multiple locks and tags are applied by more than one employee, those of the PAE must be the first to be applied and the last to be removed. The PAE coordinates the affected work forces and ensures the continuity of protection.



Qualified Employee (QE): An Employee who has been trained and has demonstrated to have the skills and knowledge related to the equipment, procedures, machine, and system they are working on. A QE shall know the hazardous energy sources associated with the system and how to control the source(s).

Safety Clearance User Database (SCUD): A database that facilitates the creation, storage, display and approval of Equipment Specific Procedures (ESP) and Lockouts (LTV's).

Simple LTV: An LTV which has one isolation point, and simple method of verification.

Site Superintendent (SS): An employee who has been assigned by line management to oversee the safety aspects of tasks involving complex and hazardous systems and multiple groups.

Stored Energy Source: Any device that is capable of holding energy after equipment is shutdown. This includes, but is not limited to, magnets, capacitors, variable speed drives, cryogenic liquids or gases, tanks, pipes, springs, and flywheels.

Subject Matter Expert (SME): The Subject Matter Expert provides the knowledge and expertise in a specific subject for a project.

Supervisor: The line manager of the employee.

Task Hazard Analysis (THA): A written document that identifies hazards associated with a specific task and identifies the risk and possible mitigations.

Unqualified Employee: An employee who has insufficient training regarding the equipment, machine, or system, or insufficient knowledge of the hazardous energy associated with it or how to control the source(s).

Zero Energy State: A condition that is reached when all energy sources to or within equipment are isolated, blocked, or otherwise relieved, with no possibility of re-accumulation. Equipment is not safe to work on until it is in a zero energy state.

4.0 ROLES AND RESPONSIBILITIES:

A **Primary Authorized Employee** shall be responsible for coordinating the overall LTV process, whether for a single employee or a group of employees. The PAE shall:

- Identify boundary points for a specific work scope, identify an Equipment Specific Procedure (ESP) if applicable to the LTV, create the LTV in the SCUD system, obtain approvals, isolate and lockout energy sources, and verify the effectiveness of the lockout.
- Ensure that AE(s) understand the hazards associated with the task and the area.



- Ensure that the AE(s) understand the energy control points, scope of the task, and the work to be done within that scope.
- Approve or reject AE(s) from joining a lockout to ensure all AE(s) on the lockout are qualified and knowledgeable. One reason to reject an AE from joining a lockout is if the AE will be performing a different job scope, or working on a different time schedule. In these cases the AE must develop their own Safety Clearance. Another reason to reject an AE is if the PAE does not wish to assume responsibility for the work(er)/work scope performed by the AE.
- Manage changes to the scope of work and create a new LTV as necessary.
- Ensure all locks are removed from a group lockout before removing their own locks.
- Coordinate with Operations Approver on shutdown and restart activities.

The **Issuing Authority** has the responsibility for performing a check along with the PAE and approving the energy isolation points of equipment, machines, or systems to ensure that the appropriate isolations points have been identified and locked out. IA's shall:

- Only review LTV for those equipment, areas, machines, and systems for which they have been trained.
- Discuss the scope of work with the PAE for each LTV.
- Verify that the energy isolation boundaries are correct for the scope of work.
- Audit that the LTV was done according to all requirements of this program and the Equipment Specific Procedure if a procedure is required for the specific LTV.
- Physically check that each isolation point(s) is (are) locked and de-energized, and review the verification with the PAE.
- Approve and issue the LTVs.
- In the absence of the PAE, brief AE(s) on the LTV including energy control points, verification, scope of the task, and the work to be done within that scope.
- Approve a PAE transfer in the absence of the PAE.

An **Operations Approver** shall:

- Approves the removal from service and repositioning of isolation devices.
- Performs or assists with the draining or de-energizing of equipment.
- Coordinates with the Primary Authorized Employee on shutdown and restart activities.
- Reviews all equipment to be locked out, and determine if the equipment is ready to be shut down.
- Understands the status of the equipment and position of boundary points and accepts ownership before closing out the lockout.

The **Authorized Employee** is responsible for working on equipment that is properly locked out. The AE shall apply locks and tags to control hazardous energy. The AE shall:



- Recognize the conditions of work that require LTV.
- Understand the energy control points, scope of the task, and the work to be done within that scope for each LTV.
- Contact the PAE for permission before joining a lockout.
- Apply his or her personal lock and tag when performing servicing, maintenance, or modification work.
- Maintain control over the keys to their Personal LTV Locks.
- Must NEVER apply or remove a lock for anyone else.
- Work within the scope of the job.

An **Affected Employee** shall:

- Recognize when LTV is being used, the general reason for LTV, and the importance of not tampering with or removing a lock/tag.
- Recognize the Hazard Zone.

The **Safety Department** shall:

- Stock and distribute all materials necessary to establish a proper Safety Clearance.
- Perform audits of the LTV Program.
- Provide and track LTV training
- Approve and oversee the lock cutting process

The **Subject Matter Expert** shall be the definitive source of knowledge, technical skill, understanding, or expertise in a specific subject area for a machine, equipment, area, or system.

The SME shall:

- Review and Approve Equipment Specific Procedures
- Review and provide guidance on any issues with verification.
- Provide guidance on identifying hazards or proper lockout processes.

5.0 LOCK, TAG, AND VERIFY PROCEDURE SUMMARY:

1. Determine the hazards related to the work scope.
2. Determine the energy control process (Exempt, Individually Controlled, and Centrally Controlled) and the need for an Equipment Specific Procedure.
3. For Centrally Controlled lockouts, the PAE shall create an entry into the Safety Clearance User Database (SCUD) and obtain Operations approval.
4. Notify all Affected Employees of the lockout activities.
5. Isolate and release energy sources.
6. Verify the lockout to ensure the isolation point(s) is(are) correct and effective.
7. Hang locks and tags as appropriate.



8. For Centrally Controlled lockouts, obtain approval from an Issuing Authority.
9. Ensure that any Authorized Employees understand the lockout.
10. Perform the work.
11. Remove locks, and coordinate with Operations for return to service.

For more detailed steps, see section 9:

- Work Process A – Centrally Controlled LTV.
- Work Process B – Exceptions.
- Work Process C – Individually Controlled LTV.

6.0 LOCKOUT EQUIPMENT:

The NHMFL Safety Department shall stock and distribute all materials necessary to establish a proper Safety Clearance. This will ensure that all materials meet the requirements in OSHA 1910.147 including:

- Substantial enough to withstand the environment and prevent removal without excessive force or tools.
- Standardized and easily recognizable.
- Contain appropriate labeling.

The lockout of an Energy Isolation Point by a Primary Authorized Employee or an Authorized Employee shall include:

- A lock.
- A ganging device (if needed).
- A Danger Do Not Operate Tag with the date, equipment, energy isolation point, position, name of the primary authorized employee and the safety clearance number.

Each lock shall identify the person who hung the lock on a “Danger Do Not Operate Tag” that shall accompany the lock.

Keys shall be controlled to ensure that no one other than the employee who hung the lock can remove it, unless the procedure in section WP-J Lock Removal is used.

7.0 TRANSFER OF CONTROL:

The role and responsibilities of the designated PAE may be transferred from one employee to another. The off-going PAE may transfer control of the LTV to an oncoming PAE at any time after the LTV is completely established. Transfer of control is not permitted while the LTV is being established.

STEPS:



- The off-going PAE must thoroughly brief the oncoming PAE on the status of the LTV, including all isolations, energy dissipation devices, scope of work, and completion status of the work that will be required as the work progresses.
- When the oncoming PAE and IA are satisfied that she or he is fully briefed on all aspects of the LTV, the oncoming PAE must agree to assume the role of PAE for the LTV.
- The oncoming PAE will sign the SCUD Requesting the Transfer.
- The off-going PAE will accept the Transfer
- An IA will approve the Transfer.
- At this point the new PAE will be listed in the SCUD.
- New Tags will be printed with the new PAE's name.
- The two PAE's and IA will walk down each isolation point and & replace locks or in the case of a lockout where the keys are stored in a lockbox, replace stickers.

The PAE along with a knowledgeable IA must inspect all isolations related to the LTV and verify that the isolations are in place.

At the energy isolation point, or lock box, the oncoming PAE must apply his or her lock first, and then the off-going PAE may remove his or her lock.

In the case of a group lockout with a lockbox, Energy Control locks may be left in place but it is necessary to re-sticker the tags with the new PAE listed, unless doing so creates a greater hazard to access; i.e.- energized area or at height. If the PAE is not comfortable accepting ownership of locks or isolation points that they cannot access, they can refuse to take over the LTV as the new PAE.

Should a lockout need to be transferred due to the PAE not being present, any IA may function as the PAE for the purposes of approving the transfer of the lockout to a new PAE by using the following rules:

- The IA must work in conjunction with original PAE's supervisor and make up to 3 attempts to reach original PAE via phone. It is the responsibility of both the supervisor and the IA to inform original PAE of the change of state upon return to work.
- If the original IA is the on-coming PAE, then a second IA must approve the lockout.
- If the original PAE is expected to return before the equipment is returned to service the original PAE lock may remain until said PAE returns to work.
- If original PAE is not expected to return before equipment is restored follow NHMFL standard lock cutting procedure form.

Once transferred, the oncoming PAE assumes all responsibilities for the LTV.



8.0 PROGRAM AUDIT/PROCEDURE INSPECTION:

The NHMFL Lock/Tag/Verify Program Audit conforms with OSHA's 1910.147 periodic inspection requirements as an integral part of the NHMFL LTV program as described below.

The PAE (or any other individual) shall Stop Work and the implementation of the LTV if an Equipment Specific procedure requires revision, equipment changes have been made or is otherwise inadequate for the protection of the authorized employees.

As part of the process of issuing an LTV, the Issuing Authority determines if the procedures were applied correctly, if the LTV was effective at isolating the hazard, and if the work scope matches the isolation points. Therefore the process of issuing a LTV by the issuing authority represents an additional audit of the ESP and its application every time an ESP is used in an LTV. The IA will not approve the LTV if the audit fails.

The Safety Department shall routinely inspect the implementation of lockouts, active lockouts to check employee's knowledge of their roles, the LTV program and the hazards.

Source Requirements and References

- 29 CFR Part 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- OSHA Instruction CPL 02-00-147, The Control of Hazardous Energy – Enforcement Policy and Inspection Procedures
- ANSI/ASSE Z244.1, Control of Hazardous Energy, Lockout/Tagout and Alternative Energy Control Measures
- NFPA 70E, Standard for Electrical Safety in the Workplace
- NHMFL Lock, Tag and Verification Program
- NHMFL Integrated Safety Management Program
- DOE-STD-1030-96



REVISIONS AND APPROVALS

Revisions

Date	Revision #	Section	Description
4/18/2018	001		Updated for New SCUD LTV and ESP processes, lock removal process, contractor guidelines, DBB for >200F, training and qualification requirements for AE,PAE, IA, periodic inspection and general edits for clarity.
	002		
	003		
	004		
	005		

Approvals

Title	Reviewer	Signature
Director: DC User Program		
Assistant Lab Director: Environmental Health & Safety		



WP-A CENTRALLY CONTROLLED LTV - GENERAL RULES AND STEPS

1.0 SCOPE:

The purpose of this procedure is to establish requirements and performance objectives that protect personnel where injury can occur as a result of the unexpected release of hazardous energy. Unexpected release of hazardous energy can include any unintended motion, energization start up, or release of stored energy, deliberate or otherwise, from the perspective of the employee(s) at risk.

2.0 WP-A: CENTRALLY CONTROLLED LTV GENERAL RULES:

Lockout, Tagout, and Verification (LTV) is the process of establishing a safe work condition on equipment prior to performing work. A safe work condition is when the equipment has been placed in a verified zero-energy state and positively controlled to prevent unexpected re-energization.

- LTV is required whenever construction, service, maintenance, modification, demolition or other work is being performed on or near equipment, machines, and systems in which the unexpected energization or start-up of the equipment, or the release of stored energy, could cause injury to employees or damage to equipment. This includes access to areas where it would be unsafe unless the equipment were shut down and de-energized.
- All workers performing work on locked out equipment must be trained and authorized as Authorized Employees in accordance with WP-F Training and Authorization Process.
- Authorized Employees must only apply a lockout, tagout device. No employee should ever remove another employee's personal lockout, tagout device, except under the restrictions of the Lock/Tag Removal Process.
- For all lock and tag devices, the Authorized Employee applying the device(s) must be knowledgeable about the proper use and application of the device(s). Lock and tag devices that are improperly affixed, or that are used on energy isolations for which they were not designed, may fail to prevent actuation of the isolation or fall off entirely. For this reason:
 - Upon initially applying the device(s), the isolation is verified to ensure that it will not operate. (This is to prevent the unintentional energization if the device is improperly applied).
 - After this initial verification, other employees MUST NOT attempt to re-verify the isolation through repeated attempts at operation.
 - If any employee suspects that a device has been improperly applied, they must immediately Stop Work, and contact the Primary Authorized Employee (PAE) for resolution. If necessary, all Authorized Employees must remove their personal lock(s) in order to correct the discrepancy.



- The Hazard Zone is the area which could be affected by the energy source isolated by the LTV. For electrical work, the minimum Hazard Zone is the limited approach boundary.
- The Hazard Zone must always encompass the entirety of the expected scope of work. If the scope of work is expected to shift outside of the Hazard Zone, then the work must be stopped and a new LTV must be created for these conditions.
- The PAE of a LTV procedure must ensure that the Hazard Zone always matches the scope of work at any given time.
- Only Authorized Employees and Qualified Employees may perform the necessary manipulation and testing required establishing the lockout. This includes equipment shutdown, operation of isolation devices, releasing stored energy, and verification of de-energization. When work is finished, this requirement also includes restoration, re-energization, and start-up of the equipment.
- All lockout(s) and tagout(s) must be established following the requirements in this program. Push buttons, selector switches, EPO buttons, software interlocks, and control circuits are not energy isolations and cannot be used to isolate hazardous energy.

3.0 LTV WP-A GENERAL RULES:

Determine the Hazards

- Evaluate the type and magnitude of all potential and stored hazardous energy and the means of controlling the energy.
- Review specific equipment, written procedures, blueprints, system diagrams, valve lineups, and operating manuals.
- Confer with people who know the equipment (SME).
- Do not proceed until knowledge of the hazard(s) is obtained.

Determine the Need for an Equipment Specific Procedure

All LTV applications require an equipment specific procedure unless all of the following elements exist:

- The equipment has a single energy source which can be readily identified and isolated and a single lock-tag device will achieve a locked out condition.
- The equipment has no potential for residual, stored, or the re-accumulation of stored energy, or energy after shutdown.
- The isolation and locking out of the energy source completely de-energizes and de-activates the equipment.
- The equipment is not part of a complex system.

If an Equipment Specific Procedure is required:



- Search the SCUD ESP system for a procedure with the appropriate isolation points for the work.
- If the procedure requires revision or is otherwise inadequate, stop work and revise the procedure or create a new procedure. The revised procedure must be reapproved by a Subject Matter Expert and Administrative Approver.
- See WP-H Equipment Specific Procedures for more information.

Create an LTV in the Safety Clearance User Database (SCUD)

- The PAE must notify affected employees and inform them that the equipment will be placed out of service until work is completed.
- The PAE must coordinate all work with the system and area managers.
- The Operations Approver must grant approval prior to printing out tags, de-energizing equipment and applying locks and tags.

Isolate Energy Sources

The PAE initiates the isolation process following the Equipment Specific Procedure if required. They may request assistance from a Subject Matter Expert if they have a question and enlist qualified personnel to complete the isolation.

Verify Isolation (Attempt to Restart)

- Verify the effectiveness of the LTV following guidance in the Equipment Specific Procedure.
- The PAE shall perform or confirm the verification of the de-energized state.
- Any AE may request to witness the lockout verification.

For Mechanical Energies

- Consider the potential for re-accumulation of energy. Assume that all valves will leak through. If valve leakage is observed or suspected past any locked or tagged valve, work must not begin until a Subject Matter Expert has been consulted and a determination has been made regarding the suitability of that valve as an isolation point.

For Electrical Energies

- Verify that the incoming power has been de-energized using a volt meter per SP-70.
- Test the metering equipment for proper operation (immediately before and after verifying a de-energized state).
- Remove and release stored energy.
 - Use a grounding/shorting stick to dissipate any stored/residual energy.
 - Ground the electrical components/circuits as required for the duration of the job or task.



- Verify that the stored/residual energy has dissipated.

Obtain Approval to Work

- The PAE will request approval from an Issuing Authority.
- The IA and PAE will discuss the scope of work, hazard zone, isolation points and verification methods.
- The IA must visit each isolation point, confirm that all isolation points are in the correct position as defined in the ESP, and are locked out with the appropriate lock and tag.
- The IA will confirm the verification was done successfully.
- The IA will approve the LTV in the SCUD once they are satisfied that the lockout is appropriate for the work scope, effective, and properly done.

Perform the Work

- Periodically re-verify the integrity of the LTV. Reverification must be done daily, or before work recommences for jobs which are not continuously active.
- Other Authorized Employees may join the lockout after obtaining approval from the Primary Authorized Employee (PAE). The Authorized Employees must then apply a lock and tags to each of the energy isolations listed in the procedure, or the lockbox.
- The PAE of the lockout must remain vigilant and ensure that the scope of work does not extend beyond the isolation boundaries, and does not deviate from the initial definition of the scope of work.

Release the LTV

- *Confirm That It Is Safe to Re-energize*
 - Confirm that the work, for which the LTV was applied, has been completed and that it is safe to re-energize equipment.
 - Clear all tools and personnel. Check the work area to ensure that all tools, debris, and personnel are at a safe distance from the equipment. Replace safety guards. Check the equipment to ensure that any removed guards are reinstalled.
 - Confirm that all personnel are in a safe position. Confirm that all locks except the PAE's locks have been removed.
- *Remove Locks and Tags*
 - Remove lock(s) and tag(s). Personal lock(s) and tag(s) must only be removed by the Authorized Employee(s) who applied them, with the following exception:
 - If the employee who placed the lock and tag is not available, the procedure for LTV Lock Removal of devices shall be followed (WP-J Lock/Tag Removal Process).



- Communicate with appropriate Operations groups concerning the desired status of all isolation points such as breakers, valves, controls or other items which were manipulated during the maintenance.
- *Notify*
 - Sign off the Safety Clearance (SCUD) to indicate that the LTV has been Restored and released back to Operations.
 - Notify all affected employees that the LTV has been released and equipment will be re-energized.
 - An Operations Approver will sign off on the SCUD accepting the equipment and confirming that they are aware of the status.
- *Re-energize and Restore the Equipment to the Normal Condition*



WP-B LTV EXCEPTIONS

1.0 SCOPE:

An LTV process is required whenever construction, service, maintenance, modification, or demolition is being performed on or near equipment, machines, and systems in which the unexpected energization or start-up of the equipment, or the release of stored energy, could cause injury to employees or damage to equipment.

The following tasks, which have been identified as low risk repetitive tasks performed by skilled workers may be done without an LTV process.

2.0 LTV WP-B EXCEPTIONS:

All employees working on a service or maintenance project must agree that an exception condition exists before deciding not to use the LTV process. The specific exceptions are:

Cord and Plug $\leq 120V$

Work on plug and cord-connected electrical equipment $\leq 120V$ AC is exempted from the LTV process if the plug is under the exclusive control of the employee performing the service or maintenance. Exclusive control means in the physical possession of the employee, in line of sight of the employee, or if the employee has affixed a lockout/tagout device on the plug.

Hot Tap/Electrical Hot Work Operations

Hot tap operations involving piping systems.

- Documented procedures are followed; and protective equipment is used.

Electrical Hot Work

- When inspecting, adjusting, or testing electrical equipment and the work being performed requires the system to be energized. SP-70 - Electrical Safe Work Policy must be followed.

Operations

The following Operations are exempted from the LTV process:

- Normal production operations including lubrication, cleaning, adjustments, filling, or draining or tool changes provided that these operations do not require the removal of a safeguard or the exposure of an employee to any hazardous energy. These exemptions assume that the equipment was designed for this purpose.
- Service or maintenance without the potential for exposure to hazardous energy.



- Keeping equipment out of service for non-safety reasons using the Administrative Lockout Process (WP-G).

Allowable Task/Equipment Exceptions (Examples, not an exhaustive list)

- Draining or filling equipment.
- Changing filters in an AHU if moving parts are guarded.
- Changing light bulbs.
- Breaking or making quick-connects on compressed air systems.
- Transferring liquid helium or nitrogen into portable dewars.
- Portable tools or equipment containing a cord.
- <50V exposed conductors.
- Changing tools on a milling machine, drill press, or lathe.
- Stand alone, portable vacuum pumps < 120V.

Task/Equipment Requiring a LTV Process (Examples, not an exhaustive list)

- Working on lighting, wiring, ballasts.
- Opening covers on a 480V welding machine.
- Opening or maintaining hydraulic systems.
- Oil change on 480V vacuum pumps.
- Opening or maintaining compressed air systems.

See Appendix 10.5 - LTV Example Chart for more specific work tasks.



WP-C INDIVIDUALLY CONTROLLED LTV

1.0 SCOPE:

The purpose of this procedure is to establish requirements and performance objectives that protect personnel where injury can occur as a result of the unexpected release of hazardous energy. This section covers the circumstances and process through which an Authorized Employee may lockout equipment without the additional layers of review and approval in the Centrally Approved LTV process, and without entering the lockout in the SCUD.

2.0 INDIVIDUALLY CONTROLLED (IC) LTV:

The Individually Controlled (IC) LTV process is a lockout and tagout that does not require a specific procedure or a SCUD entry. This process may be used by an Authorized Employee to establish a safe work condition prior to performing work. The Authorized Employee is responsible for determining whether the conditions for the Individually Controlled exception process are satisfied. The IC exception is allowed only if all of the following conditions are met:

- The equipment is fed from a single energy source that can be isolated with a single isolation that is lockable, is readily identifiable, and is in the same location as the equipment to be worked upon.
- Stand-alone equipment not part of a larger system.
- Isolation is in line of sight.
- Simple verification.
- The equipment has no capacity for stored energy.
- The equipment shutdown or start-up steps do not require a particular sequence.

The Authorized Employee is responsible for determining what should be isolated and how to establish the lockout and tagout. The employee must therefore be intimately familiar with the steps described in this process.

In order to execute the IC, the Authorized Employee must also be a Qualified Employee on the equipment. After the Qualified Employee establishes a safe work condition, the Authorized Employee shall then apply their personal lock and tag.

- Only Qualified Electrical Employees may perform LTV on electrical equipment for the purpose of working on electrical circuits.
- For other forms of hazardous energy, qualification is confirmed by the authorization of the employees' supervisor.

This process must follow all other aspects of this LTV program with the exception of the SCUD and Issuing Authority approval process. This includes but is not limited to:



- Locks and Tags used under this process must meet the definition in 3.0 Definitions and Acronyms.
- Each person exposed to the hazard must hang their personal lock and identifying tag.
- All lockouts must be verified to ensure the lockout is effective in isolating all energy sources.

3.0 INDIVIDUALLY CONTROLLED LTV STEPS:

- Determine the hazards utilizing the THA process.
- Determine if the work and equipment meet all of the requirements of WP-C Section 2.0 above.
- Isolate the energy source.
- Hang lock with tag that identifies the lock owner.
- Verify the lockout.
- Perform the work.
- Remove lockout.
- Return to service.



WP-D LTV GROUP GUIDELINES

1.0 SCOPE:

A Group LTV is a process used to perform a Complex LTV with a lockbox. Instead of each Authorized Employee (AE) applying lock(s) and tag(s) to each energy isolation point, the key to each energy isolation lock and tag is placed in the lockbox, which is then locked by the PAE first and then each Authorized Employee who is working under the LTV. The Group LTV is not required although it may present a desirable solution to effectively manage a large number of persons and isolations to better facilitate the coordination of a LTV, or not to mechanically over stress an isolation point from the weight of locks.

2.0 WP-D LTV GROUP GUIDELINES:

Group LTV

- A lock and tag is applied by the PAE to each energy isolation point during the execution of a LTV process. The keys to the locks are then placed in a lockbox, which is then locked with a PAE lock.
- The locks used on isolation points shall be individually keyed. Do not use multiple locks with any one key or locks with more than one key (i.e. face locks). This could allow someone to remove locks without opening up a lockbox.

Steps to Implement a Group LTV

1. The PAE determines that the group LTV work process is appropriate.
2. The PAE executes the LTV process.
3. The PAE must place all Energy Control Lock keys inside a lockbox.
4. The PAE must lock the lockbox closed with his or her Personal lock and tag on the outside of the lockbox.
5. The PAE/IA must ensure the energy isolation points in the LTV procedure match the energy isolation points locked.
6. The IA must approve the lockout.
7. The PAE must brief all Authorized Employees before they apply their personal lock(s) and tag(s) to the lockbox.
8. All other Authorized Employees performing work on the equipment can request to either witness the verification or reverification of zero-energy state on some or all of the energy isolations. In this case, the PAE must coordinate with a Qualified Employee to perform the requested verifications. Then the AE will apply their personal lock and tag to the lockbox in a manner that prevents access to the enclosed key(s) until all locks have been removed from the box.
9. When the work has been completed, and after each worker has removed his/her respective Personal lock from the lockbox, the PAE removes their Personal lock from the outside of the



lockbox, obtains the keys from lockbox, removes the locks, and returns the equipment to service.

Location

- Once established, the lockbox must be kept in a location that is accessible to the Authorized Employees participating on the lockout.

Referencing and Paralleling Active LTV's

- If a person or group is performing a job that will require an LTV with the same isolation points as an existing, Active LTV, a determination needs to be made to join, reference or parallel the existing, Active LTV. When joining or referencing the existing, Active LTV, the PAE of the existing, Active LTV needs to grant permission to join or reference his/her LTV.
- Referencing an LTV:
 - A LTV can reference another existing, approved LTV. Lockouts are often referenced rather than paralleled. A reason for choosing referencing over paralleling may be that isolation points may be hard or hazardous to access.
 - Referencing an existing, Active LTV:
 - An LTV that references another LTV will hang an Energy Control Lock and Tag on the referenced LTV lockbox. This lock on the lockbox prevents the referenced LTV lockbox containing the isolation point keys from being opened.
 - The PAE who references another LTV is still responsible for ensuring that these points are suitable for their work scope, that the referenced LTV has been verified, and that the AE(s) understand the hazards associated with the task and the area, understand the energy control points, scope of the task, and the work to be done within that scope.
 - The PAE who references an approved LTV may assume that the LTV was administered correctly.
 - The IA is responsible for ensuring that the existing, active LTV has been verified the same day that a new referencing LTV is being established, and is suitable to the new scope of work.
- Paralleling an existing, Active LTV:
 - An LTV that parallels another LTV will hang locks in parallel with the existing LTV's locks on all isolation points.
 - The PAE who parallels another LTV is still responsible for ensuring that these points are suitable for their work scope, that the paralleled LTV has been verified, and that the AE(s) understand the hazards associated with the task and the area, understand the energy control points, scope of the task, and the work to be done within that scope.
 - The PAE who parallels an approved LTV may assume that the LTV was administered correctly, and are allowed to share initial and reverification.



- The IA is responsible for ensuring that the existing, active LTV has been verified the same day that a new paralleling LTV is being established and is suitable to the new scope of work.
- All lockouts must be re-verified each day that work occurs, including those of referenced lock boxes.



WP-E LTV CONTRACTOR GUIDELINES

1.0 SCOPE:

This procedure incorporates the standard NHMFL Lock, Tag, and Verification Program with a process to verify and ensure that the listed groups below have received the appropriate clearance prior to participating in a LTV. All groups listed performing work at the NHMFL are required to conform to the NHMFL Lock, Tag, and Verification Program:

- Contractors
- Subcontractors (Construction/ Non-construction)
- Vendors
- Manufacturer Representatives
- Non-NHMFL FSU employees

These groups represent personnel who may be performing or participating in a LTV who are not NHMFL employees and are therefore not subject to NHMFL employee LTV training and authorization requirements. This guideline contains additional requirements to ensure that they are adequately managed and protected from hazardous energy exposures.

2.0 LTV CONTRACTOR GUIDELINES:

All contractors, subcontractors (construction and/or non-construction), vendors, and manufacturer representatives must receive a Contractor Safety Training prior to the start of work that covers the hazards here at the NHMFL.

Non-Employee Prerequisites for joining an LTV as an AE

- Must receive the Contractor Safety Training
- A basic understanding of the lockout process and responsibilities.
- An understanding of the task, boundaries, the verification process, work/hazard zone and what is keeping them safe.
- Only qualified personnel may perform a verification of zero voltage on electrical lockouts.
- Name and contact information being entered into the Safety Clearance User Database.

The contractors, subcontractors, vendors, and manufacturing representatives will participate in the LTV as an AE (Authorized Employee). All AE's must be briefed by the PAE for each LTV under which they will be performing work to ensure they fully understand the isolation boundaries and methods expected for them to be able to personally verify a zero energy state or otherwise safe condition.



All contractor safety clearance requests require a designated PAE who is an NHMFL employee. The NHMFL PAE inputs the contractor safety clearance requests into the Safety Clearance User Database (SCUD) as a group LTV. The requests are reviewed and approved by the designated IA who is responsible for the area involved.

The NHMFL will provide lockout and tag out devices as needed to meet operational necessities. All lockout and tag out hardware must meet the requirements set in OSHA 1910.147.

Contractors who wish to use their own LTV program, must first submit their company LTV program or equivalent company program document to the NHMFL Safety Department and must obtain approval to use their program. This document must be evaluated for basic compliance to OSHA 1910.147 (f)(2)(I) and NFPA 70E requirements. In the event of gaps in the subcontractor's LTV program, the NHMFL Safety Department may elect to either reject the submittal or recommend specific corrections prior to acceptance.



WP-F LTV TRAINING AND AUTHORIZATION

1.0 SCOPE:

This procedure covers the general requirements for the LTV Program Training and Authorization. Only employees who have received the appropriate level of training may be authorized to perform LTV functions.

Specific training requirements are listed in Table I-1. Once the training is complete, the employee's supervisor shall authorize the appropriate SCUD qualifications.

2.0 LTV WP-F LTV TRAINING AND AUTHORIZATION:

The NHMFL shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees. The training and practical requirements shall include the following:

Authorized Employee:

- NHFML Employees or Affiliates (other FSU Employees – i.e., Maintenance & Custodial Personnel): have completed the General Electrical Safety for the Authorized Employee training.
- Contractors, Non-Employees and FSU Employees not designated as Affiliates must complete the Contractor Safety Training.
- The General Electrical Safety for the Authorized Employee Training and the Contractor safety training will cover:
 - The recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.
 - The purpose and use of the energy control procedure.
 - The prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out.

Primary Authorized Employee:

- General Electrical Safety for the Authorized Employee training
- Primary Authorizing Employee training.
- Six months of experience as a AE.
- Under a PAE's supervision, set up five separate lockouts as the PAE under instruction.



- Demonstrate familiarity with the equipment (within the context of his or her job function), how to operate isolation devices such as breakers or valves, how to perform verification.
- Have permission from his/her supervisor or their designee to be a PAE.

Issuing Authority:

- Have completed the General Electrical Safety for the Authorized Employee training.
- Have completed the Primary Authorizing Employee training.
- Have complete Issuing Authority Training.
- One year of experience as a PAE.
- Under another Issuing Authority's supervision, authorize five separate lockouts as the IA under instruction.
- Demonstrate knowledge and capability as a Subject Matter Expert (SME) for the system, equipment, or area that they would issue lockouts for.
- Have permission from his/her supervisor or their designee to be an Issuing Authority.

Retraining must be provided for employees whenever there is a change in their job assignments, a change in machines, equipment, or processes that present a new hazard.

Additional retraining must also be conducted whenever the employer has reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures. The retraining must reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

The Safety Department must certify that an employee's training has been accomplished and is kept current. The certification shall contain each employee's name and dates of training.

3.0 LINE MANAGEMENT AUTHORIZATION

- The Supervisor will determine if the employee meets the safety training requirements specified in Table I-1.
- The Supervisor will exercise their judgement as to their employee's ability to fulfill the role they are meant to assume.
- Once the Supervisor is satisfied that both the training and authorization requirements have been met, the Supervisor may authorize an employee for a particular role by updating their qualifications in the SCUD.
- Contractors and other non-employees who do not have a NHMFL supervisor can be given Authorized Employee qualifications by anyone who has verified that they have taken the NHMFL employee General Electrical Safety for the Authorized Employee training, or Contractor Safety Training.





Table I-1. LTV Training and Authorization Matrix			
Role	Training	Authorization	Refresher Training Requirements
NHFML Employees or Affiliates (other FSU Employees – i.e., Maintenance & Custodial Personnel)	General Electrical Safety for the Authorized Employee	All NHMFL Employees	Every 2 years after initial training
Contractors, Non-Employees and FSU Employees not designated as Affiliates	Contractor Training Video	All NHMFL Contractors	1 year after initial training
NHMFL Primary Authorized Employee	General Electrical Safety for the Authorized Employee SP-1 Lock, Tag and Verification for the Primary Authorized Employee Complete Initial Practical Requirements	Authorized by line management.	Every 1.5 years after initial training
Issuing Authorities	General Electrical Safety for the Authorized Employee SP-1 Lock, Tag and Verification for the Primary Authorized Employee Issuing Authority Training.	Authorized by line management. Safety Department	Every 2 years



Table I-1. LTV Training and Authorization Matrix			
Role	Training	Authorization	Refresher Training Requirements
	Complete Initial Practical Requirements		



LTV WP-G ADMINISTRATIVE LOCK CONTROL

1.0 SCOPE:

A careful distinction must be made between controlling hazardous energy by LTV and various other locking practices, collectively referred to as “administrative locking.” While LTV Locks are placed to manage and control hazardous energy and prevent the inadvertent energization of equipment, Administrative Locks are used when there is the need to provide “operational control” (control of a system, utility, or facility).

2.0 LTV WP-G LTV ADMINISTRATIVE LOCK CONTROL:

Administrative Locks

- Any lockout and tagout that is used for a purpose other than an LTV is called an Administrative Lockout. Administrative Locks may serve a safety function other than LTV, configuration-control, or any other purpose. Unlike LTV lock keys, the keys to Administrative Locks may be controlled by one or more individuals.
- Administrative Locks can be common locks with more than one key, so that anyone with access to the keys can operate the control point as needed. The lock is not specific to an individual, but to a specialized working group or department and does not need to have an individual’s name shown.
- Administrative locking does not provide individual personal protection for workers and is not a substitute for personal LTV lockout and tagout.
- An Administrative Lock must not be labeled with a danger tag or sticker, or any other marking that resembles a LTV marking. Conversely, a LTV lock cannot be used as an Administrative Lock.
- An Administrative Lock must be accompanied by a tag identifying the department, date hung, purpose, and the name of the person who hung the lock.
- Employees who have applied Administrative Locks must not perform work or enter a Hazard Zone without first following one of the safety related LTV processes described as part of this procedure.



Tag On

- Some systems, such as sump pumps, emergency lights, and refrigerators must be shut down in a controlled manner. An informational tag may be placed on their isolations to warn the user against accidental de-energization. The use of a LTV lockout and tagout is not permitted for this purpose.
- When a circuit breaker, disconnect switch, or energy-securing device is readily accessible to any employee, the circuit breaker or disconnect switch may be tagged to indicate that it is not to be turned off.
- The energy-securing device must not be locked by any means that would prevent the device from being used as an emergency disconnect.
- The tag must include the name of the responsible person and an alternate, date, and phone number.



WP-H EQUIPMENT SPECIFIC LTV PROCEDURE

1.0 SCOPE:

An Equipment Specific Procedure (ESP) is a formal document detailing all the steps required to establish a LTV. It is specific both to the equipment or system. An Equipment Specific Procedure is required for all Complex LTVs. These procedures are to be written by employees with training and system knowledge of the technical aspects of the equipment to be locked out and reviewed by Subject Matter Experts and an Administrative Authority.

2.0 EQUIPMENT SPECIFIC LTV PROCEDURE:

An Equipment Specific Procedure is required for all Complex LTVs. A Complex LTV is one which contains more than one energy isolation point.

The Equipment Specific Procedure fulfills the following purposes:

- It documents the specific isolations required for the LTV.
- It documents the verification process for each isolation point.
- It formalizes the review and approval process for the ESP.
- It establishes best practices for isolation and verification.

Procedures can be written by anyone familiar with the equipment. However, they must be reviewed and approved by a Subject Matter Expert (SME) and an Administrative Authority with suitable competency in the equipment or systems for which the procedure is written.

3.0 USING AN EQUIPMENT SPECIFIC LTV PROCEDURE (ESP):

Using an existing ESP

- A Primary Authorized Employee (PAE), will determine the work scope, identify potential hazards using the THA process, and identify the hazard zone. From this information, they will determine if an existing ESP will meet the needs of their isolation process.
- If uncertain whether an Equipment Specific Procedure meets the LTV requirements for a specific work scope, contact an Issuing Authority (IA), the Author, Subject Matter Expert or Administrative Authority who signed the ESP.
- If an existing ESP does not exist for the scope of work proposed, one will need to be developed.

When following an ESP, it is strongly recommended that the PAE have a hard copy of the LTV in hand to use as a checklist.

4.0 DEVELOPING AN EQUIPMENT SPECIFIC LTV PROCEDURE:



The Author must thoroughly investigate the scope of work in order to establish the appropriate energy isolation points. After writing the procedure, it must be submitted for approval by an SME followed by an Administrative Authority. Revisions of a procedure should also be submitted for approval by an SME and must be approved by an Administrative Authority.

The Equipment Specific Procedure must contain the following information:

- A statement of the scope of work or area of access permitted under the LTV.
- Type(s) and magnitude(s) of energy, its hazards, and the methods to control, dissipate, or restrain the energy.
- Type(s) and location(s) of operating controls.
- Type(s) and location(s) of energy isolating devices.
- Specific steps for shutting down, isolating, or blocking to control hazardous energy.
- Notification of affected employees.

Determine the Hazards

- Every procedure is dependent on properly identifying the hazards. The author must perform the following to ensure that the hazards are understood and defined:
 - Walk down the job site to identify hazards in the area that will need to be addressed.
 - Ask detailed questions to determine whether other considerations are warranted.
 - Identify hazardous energy sources and associated energy isolations.
 - Identify proper test points for each of the energy isolations (to verify the absence of energy).
 - Determine PPE requirements establishing the lockout.
 - Identify any sources of stored energy.
 - Determine suitable method to dissipate the stored energy.

Evaluate Suitability of Energy Isolation Points

- Energy isolation points shall be positive and lockable isolation devices such as a disconnect switch, circuit breaker, block valve, or blocking pin.
 - Control actuators such as an emergency stop or equipment controller shall not be used as lockout isolation points.
 - Contactors, diodes, interlock switches, check valves, and automatically controlled valves are not positive isolation devices.
 - Energy isolation points must be labeled clearly and uniquely, such as with an alphanumeric designator.

Determine Methods to Dissipate Stored Energy

- In the case of stored mechanical energy, vent valves, drains, spring releases, blocking devices, or equipment repositioning (as appropriate) must be utilized.



- In the case of stored electrical energy, approved grounding or discharge devices must be used.
- Preventing the Re-accumulation of Stored Energy
 - If there is a possibility of re-accumulation of stored energy to a hazardous level, a method to continuously discharge the energy shall be installed and maintained for the duration of the lockout.
 - For electrical systems >1000V, personal protective grounds are required.
 - For fluid systems over 500 psig, use a double-block-and-bleed method to prevent undetected re-pressurization from slow leakage past an energy isolation point.
 - For all other fluid systems below 500 psig where the working fluid is not hazardous on its own, use a single block and bleed arrangement.
- Unless specifically stated otherwise the steps written in the procedure must be performed in series. Use the procedure as a checklist to ensure that all steps are positively completed for every energy isolation point.

Subject Matter Expert Review and Approval:

- After the author has completed the ESP, it shall be reviewed by a SME who will go over the procedure in detail and ensure that the ESP properly isolates the hazards and describes the correct procedure for return to service.

Administrative Authority Review and Approval:

- An Administrative Authority is a competent person who has been designated by the NHMFL Senior Management to approve procedures based on his or her level of technical knowledge and familiarity with the systems involved.
- The Administrative Authority should obtain technical assistance as needed from Subject Matter Experts (SME) who are more familiar with the systems involved.
- The Administrative Authority will conduct a detailed examination of the procedure, and become familiar with the potential hazards and energy sources involved in the procedure.

Grouping of Procedures

- ESP's are often written before work occurs for certain hazards and isolation boundaries. ESPs cannot anticipate all possible scopes of work and operational considerations that may come up when establishing an LTV based on an ESP. Hence, it is allowable to combine multiple ESP's into one LTV. An example of this is a resistive magnet which is connected to magnet power supplies and the magnet cooling water system. Some jobs will need to isolate both energy sources, some will need to only isolate one. The PAE will determine which procedures need to be grouped together. The IA will check that the appropriate procedures were used.



- Multiple scopes of work may be performed under the same procedure provided that each scope is reviewed by the Issuing Authority and PAE to ensure the boundaries and methods are applicable.
- If uncertain how to group multiple ESPs contact an Issuing Authority or the Author, Subject Matter Expert, or Administrative Authority who signed the ESP.



WP-I LTV AIR GAPPING

1.0 SCOPE:

Air gapping is the process whereby the sources of hazardous energy are physically isolated from the work area to such an extent that LTV is not necessary. It is a natural step during either the new construction or the demolition phases of a project. It is also applicable when machinery is temporarily relocated from its normal installation area to a separate work area for repair, servicing, or maintenance.

2.0 LTV WP-L LTV AIR GAPPING:

Air gapping shall not be used as a substitute for lockout and tagout controls, where lockout controls are feasible. Because it is possible for an air gap to change over time, it is critical for the air gap to be obvious to all workers with the potential for exposure and reviewed on a daily basis.

Requirements for Air Gapping

- All energy sources must be physically and visibly separated from the work area.
- This separation must be visible without opening any panel doors, breaker doors or covers, etc.
- The minimum separation distance is three feet.
 - For electrical systems, this includes the conduit, cable tray, or other cable-supporting device.
 - Where a three-foot air gap is not achievable but lockout and tagout is not feasible, additional controls must be implemented to prevent an unplanned reconnection of the energy source. These controls must be approved by the NHMFL Safety Department on a case-by-case basis.
- Air gapping must be documented on the THA for the work done and approved by the employee's Supervisor, a member of the Safety Department, or the Site Superintendent.

Except for temporary relocation of machinery, quick-disconnects or other temporary disconnections of wiring and piping are not considered suitable for air gapping.

Removal of wiring inside of a control panel is not suitable for air gapping.

New Construction

- During new construction, work will proceed through various stages. At some point, energy sources are connected and the LTV process comes into effect. Until that point, air gapping is sufficient.
- LTV is required to perform the initial connection or tie-in to the energy source. After this time, all work performed downstream of the energy source on equipment requires the application of lockout controls.



- The transition from work under an air gap to work under LTV must be carefully managed.

Demolition

- For demolition projects, LTV is required to perform the initial demolition of the energy tie-ins.
- After initial disconnection, the conduit, piping, equipment, or machine must be removed at least three feet from the tie-in point, and in a way that cannot be immediately reconnected. After this point in time, if the tie in point has been made safe, the lockout can be cleared, and lockout controls are no longer applicable in the work area.
- The transition from work under LTV to work under an air gap must be carefully managed.

Temporary Relocation

- For work performed on equipment that has been physically removed from the normal installation area, LTV is not required.
- LTV is required to perform the initial disconnection.
- The lockout must remain in place to control the energy to the cables and pipes that are still in the area, unless these are made safe through enclosing, insulating, capping, blanking, or other methods suitable for the environment to prevent an inadvertent release of energy.
- Any employee performing work in the installation area must be on the lockout depending on their exposure.
- Prior to reinstalling the equipment, the lockout must be re-established.



WP-J LOCK REMOVAL

1.0 SCOPE:

The purpose of this procedure is to establish requirements for removal of a lock by someone other than the lock owner, or the cutting of a lock when a key is lost.

The LTV program is predicated on each employee controlling their locks to prevent restarting or reenergizing equipment while they are working on these systems. Cutting off a lock must only be done in controlled circumstances to minimize mistakes and to ensure that all employees involved are protected from the hazardous energy, Appendix 10.6.

In the event the key to a lock is lost or the Authorized Employee who applied the lock is absent and cannot return to work, the “LOST KEY/ABSENT PERSON LOCK REMOVAL FORM” must be completed and approved before the lock can be removed. This form is in SP-1, Appendix 10.6.

2.0 LOCK REMOVAL GUIDELINES:

If an employee loses their key, they are responsible for filling out the “LOST KEY/ABSENT PERSON LOCK REMOVAL FORM”.

If an employee has an item locked out, and that lockout needs to be cleared, and it is possible for them to return to work, they should return and remove their lock in person. Cutting off a lock should not be done as a matter of convenience.

In the event that an Authorized Employee is absent, or otherwise unavailable to remove his or her personal lock(s), after approval by the Director of the NHMFL or designee, the Supervisor may remove the lock(s) for the Authorized Employee. If the Authorized Employee’s Supervisor is not available, then the Absent Authorized Employee’s Department Manager or Safety may remove the lock.

3.0 ROLES:

Authorized Employees: The authorized employee is responsible for keeping track of their keys to prevent losing them. They are also responsible for keeping track of work schedules, where possible, and remove locks when they are finished with work, or when they expect to be absent from work.

Supervisor: During the lock removal process, the supervisor is responsible for ensuring that the employee knows that their lock has been removed before they return to work. In the case of a contractor, the person who hired or is supervising the contractor is responsible for fulfilling the supervisor role.



Safety: The Safety department is responsible for overseeing the lock removal process to ensure that the proper steps have been completed (Notification of AE, Approvals), and that the correct lock is removed. By holding the removed lock, the Safety department has a physical reminder to ensure that the supervisor notifies the absent employee before they begin work.

3. LOCK REMOVAL PROCESS:

3.1. Lost Key

- The Authorized employee will obtain a printed copy of the Authorized Employee Lock Removal Form, Appendix 10.6
- Complete Steps 1 and 2 of the form. Step 3 is unnecessary for lost key, since the AE is present.
- Obtain signatures for AE, Supervisor, Safety and Director with date and time.
- Remove lock in the presence of Safety who will confirm that the correct lock is being removed.
- Complete the form when locks are removed. Safety will dispose of the lock and retain the form.

3.2. Absent Employee

- The Authorized Employee's supervisor shall verify that the Absent Authorized Employee who applied his or her personal lock(s) is not present.
- The Authorized employee's supervisor will obtain a printed copy of the Authorized Employee Lock Removal Form, Appendix 10.6 and complete Steps 1 and 2 of the form.
- The supervisor will make at least 3 attempts to contact the employee. These attempts will be recorded on the call log portion of the form.
- Obtain signatures for the Supervisor, Safety and Director with date and time. The AE signature location will be completed by the supervisor with the word ABSENT.
- After obtaining all required approvals, the Absent Authorized Employee's supervisor can remove the lock(s). The NHMFL Safety Department must physically witness the lock removal and must retain possession of the lock(s).
- Before the Absent AE returns to any work duty, the Absent AE's Supervisor must ensure that the employee is informed of the removal of their lock, presented with the removed lock, is informed of the reason for the removal. The AE shall sign section 7 the form to acknowledge the notification.
- In the situation where the AE is not expected to return to work due to termination, or other circumstances, the supervisor may sign the form with Safety to close out the process.
- In the situation where the return to work date is uncertain, the form must be held for 20 calendar days before closing out the process.



- Safety will dispose of the lock and retain the form.

3.3. Unknown Lock Owner

- The PAE, or an IA shall obtain a printed copy of the Authorized Employee Lock Removal Form, Appendix 10.6.
- The PAE or an IA shall print out the list of AE's for the lockout and attempt to contact each employee. These calls shall be documented on the call log.
 - If the person whose lock is in question is discovered, they should either return to work or the ABSENT EMPLOYEE process above shall be followed.
 - If one or more AE's cannot be reached, the ABSENT EMPLOYEE Process shall be followed for each employee, using multiple copies of the Authorized Employee Lock Removal Form.
 - If all of the AE's on the LTV have been contacted, and the Identity of the lock owner is still unknown, the PAE or an IA shall complete the Authorized Employee Lock Removal Form and document the notifications on the call log. Obtain signatures for the Supervisor (PAE or IA), Safety and Director with date and time. The AE signature location will be completed by the requestor with the word UNKNOWN.
- After obtaining all required approvals, the PAE or IA can remove the lock(s). The NHMFL Safety Department must physically witness the lock removal and must retain possession of the lock(s).
- The PAE or IA will sign section 7 and Safety will dispose of the lock and retain the form.



APPENDIX 10.1 - SAFETY CLEARANCE USER DATABASE (SCUD)

1.0 PURPOSE:

The Safety Clearance User Database is a computer system that facilitates the creation, storage, display and approval of Equipment Specific Procedures (ESP) and Lockouts (LTV's). The system has 4 parts: ESP, LTV, ISO Points, and Personnel.

For How to Guides, Choose the [?] box from the top left of any list view screen. Then choose the HELP box at the bottom of the window to link to the online help.

2.0 EQUIPMENT SPECIFIC PROCEDURES

The SCUD facilitates the writing of Equipment Specific Procedures by allowing the creation of procedures from a standard template or by copying an approved procedure. Procedures contain an overview that defines the purpose and scope, isolation points that are linked to the Isolation Point Database, and approval log.

The procedures are written by an Author, reviewed by a Subject Matter Expert and approved by an Administrative Authority. All approvals are accomplished by personnel logged in with a user account with the appropriate qualifications. Once approved, the ESP cannot be changed. To revise a procedure, it has to be reopened to a DRAFT state by an Administrative Authority.

3.0 LOCKOUTS (LTVs)

The SCUD distinguishes between creating an LTV as a single point or using one of more the procedures from the ESP list. The LTV is a specific instance of the ESP. All approvals are accomplished by personnel who are logged into the system with the appropriate qualifications. Approvals such as Operations, or PAE Verifications are logged and time stamped. Tags can be printed from the Isolation Points associated with the LTV.

4.0 ISOLATION POINTS:

The SCUD contains a Database of isolation points to ensure consistency of terms and accuracy of the lockout. These points also contain information such as the magnitude and type of hazard that the points is isolating.

5.0 PERSONNEL

The SCUD maintains a database of personnel. Each person is assigned roles that determine what they can do in the system. Roles include Author, SME (for ESP's), PAE, AE, IA etc. In order for a person to approve something, their accounts has to have the correct qualifications level.



APPENDIX 10.2 - MECHANICAL LOCKOUT GUIDELINES

Piping System Practices

Systems, portions of systems, and components that are at temperatures or pressures above or below ambient should be vented and, if necessary for the performance of work, drained and brought to ambient temperature. Whenever possible, an atmospheric drain and/or vent between the component to be worked on and sources of pressure to the component should be tagged in the open position to depressurize the equipment and to accommodate thermal expansion or contraction.

Systems that operate at high pressures (e.g., greater than 500 psig), or high temperatures (greater than 200F), should be isolated from the work area by a double block and bleed system consisting of two closed valves in series and a vent and/or drain valve between the isolation valves should be opened.

If a vent and/or drain valve is not available, contact a Subject Matter Expert on how to best proceed. Whenever possible a vent/drain valve should be added before returning to service.

Verifying depressurization by breaking flanged connections, loosening valve bonnets, removing instrument tubing, or other similar actions should be avoided unless no other means for verifying depressurization exists. Strict supervisory control and advance planning are required if these methods are used.

Always consider that all valves have the potential to leak by. If you suspect a valve is leaking by, stop work and notify your Supervisor or the NHMFL Safety Department to evaluate before returning to work.

Always direct drains and vents in a safe direction.

Always verify that pressure has equalized with ambient pressure BEFORE breaking any pipe section. If you are not sure how verify pressure contact a Subject Matter Expert.

Check for signs of valve leakage before work begins each day.

Air gapping may be accomplished by removing piping from its pressure source by three feet and the three foot gap is easily observable by all potential workers without exposing themselves to additional hazards. Three foot requirement may be replaced by installing rated caps or blinds on pressure source.

Systems containing materials and geometry of the space that have a potential to create an Oxygen Deficiency Hazard (ODH) environment should be isolated by a double block and bleed system.



When any of these conditions exists and two-valve isolation cannot be provided, specific management approval must be obtained before performing work. Exceptions to the two-valve isolation must be documented in the lockout/tagout record and on the THA form, and the workers must be informed.

Valve Practices

Pneumatically operated valves and solenoid-operated valves may be used as isolation points if the following conditions are met:

- A pneumatically or solenoid-operated valve that fails open or “as is” is NOT considered closed for lockout/tagout purposes, unless the valve is forcibly closed with a device designed to block off or obstruct operation of a valve. The valve must be locked and tagged.
- A pneumatically or solenoid-operated valve that fails closed is NOT considered closed for lockout/tagout purposes unless its power (air) supply is isolated and the valve is visually confirmed to be closed. The valve and its power (air) supply isolation points must be tagged.
- A process pressure operated valve, such as diaphragm or check valve, CANNOT be used as an isolation point valve.
- The local control point (e.g. hand wheel, manual operator) for a motor or pneumatically operated valve must be locked/tagged when the valve is used as an isolation point.

Always follow the order prescribed in the LTV procedures.



APPENDIX 10.3 - ELECTRICAL LOCKOUT GUIDELINES

It is the policy of the NHMFL that all live parts operating at 50 volts or above to which an employee may be exposed shall be placed in an electrically safe work condition and locked out before work is done on or near them.

All electrical work shall follow SP-70 Electrical Work Procedure.

Electrical Hot Work requires the approved completion of a NHMFL Energized Work Permit. Wearing Arc Flash or insulated PPE is not a substitute for a properly established LTV or completion of an Energized Work Permit. The exception to this is troubleshooting and testing.

All exposed electrical parts are to be treated as live until verified using a 3 point test method with an appropriately rated voltage meter.

For lockouts of circuits >1000V, the job may require the lockout to be established in one of two ways: use of a high voltage, manually operated switch or racking of a high voltage breaker. Open contacts inside of a vacuum bottle shall not be considered positive isolation. The scope of the job and PAE will dictate the type and level of isolation required. Special training and PPE are required for lockout of these circuits.

Grounds shall be installed and locked or tagged on as part of a lockout for work on any circuits > 1000V.



APPENDIX 10.4 - APPROVED ISSUING AUTHORITIES

John Kynoch	Head of Facilities, NHMFL
Bryon Dalton	Head of Magnet Operations, DC Magnet Building
Larry Gordon	Control Room Operator, DC Magnet Building
Joel Piotrowski	Control Room Operator, DC Magnet Building
Michael Hicks	Control Room Operator, DC Magnet Building
Chris Thomas	Control Room Operator, DC Magnet Building
Chris Oxendine	Assistant Electrical Supervisor, General Science Building
Kevin Gamble	Mechanical Supervisor, General Science Building
Marshall Wood	Electrical Supervisor, NHMFL

A current list of AAs and IAs is recorded in the SCUD.



APPENDIX 10.5 - LTV EXAMPLE CHART

TASK	LTV PROCESS	SCUD	ESP	COMMENT
Working on equipment with more than one isolation point.	Centrally Controlled Complex LTV	Y	Y	Additional review required for verification.
Working on equipment with one isolation point, part of a larger system.	Centrally Controlled Simple LTV	Y	N	
Working on a 120V power supply with a cord	Cord and Plug Exception, no LTV	N	N	Retain control of plug.
Hooking up the output of a portable 240VAC input PS with a cord.	Individually Controlled LTV w lock on a cord cap	N	N	Lock on cord cap.
Changing oil on a 240V AC vacuum pump hardwired to wall. Piping disconnected	Individually controlled LTV	N	N	Lock on disconnect.
Draining a magnet of Magnet Cooling Water through a <= 1" drain	Operations Exception, no LTV	N	N	Need to follow documented checklist, perform THA.
Venting a compressed air system through a <= 1/2" compression fitting as part of a lockout process	Operations Exception, no LTV	N	N	Qualified employee. Need to perform THA.
Working on a magnet with the Anaconda cables > 3' air gap to cell stabs	Air Gap, no LTV required.	N	N	Requires significant effort to re-establish connection. THA should consider recheck status of air gap daily as a control.
Working on power supply with bus links removed	Centrally controlled complex LTV	Y	Y	Not enough distance for air gap. More than one lockout point.
Installing a pipe on a helium/nitrogen system, but not connected to the tie in point.	Air Gap, no LTV required if >3' or blanked	N	N	Requires significant effort to re-establish connection. THA should recheck status of air gap daily.
Changing a belt on an air handler, local, labeled disconnect	Individually Controlled LTV	N	N	Coordinate with Building Operations for outage. Low hazard larger system.



TASK	LTV PROCESS	SCUD	ESP	COMMENT
Changing a belt on an air handler, motor isolation point in electrical panel.	Centrally Controlled LTV	Y	N	Additional review required for verification.
Changing a belt on a hood exhaust fan, local disconnect	Individually Controlled LTV	N	N	Coordinate with Building Operations for outage. Utilize roof access/fume hood outage process.
Changing a 480V motor on a roof exhaust fan, local disconnect.	Centrally Controlled Simple LTV	Y	N	Additional review required for verification.
Changing a 480V motor on an air handler unit, local disconnect	Centrally Controlled Simple LTV	Y	N	Additional review required for verification.
Meggering a pump motor in the utility plant	Centrally Controlled Simple LTV	Y	N	Single point lockout, part of a larger system.
Removing a pump motor in the utility plant	Centrally Controlled, Complex LTV	Y	Y	Need to lockout process valves to prevent shaft spin, Complex lockout.
Putting a transfer line into a helium dewar	Operations Exception, no LTV	N	N	Qualified employee. Need to follow documented checklist, perform THA.
Thumping a helium dewar	Operations Exception, no LTV	N	N	Qualified employee. Need to follow documented checklist, perform Standing THA.
Changing out a bit on a drill press, mill or lathe	Operations Exception, no LTV	N	N	Qualified employee. Need to follow documented checklist, perform Standing THA.
Changing a blade on a stationary band saw	Individually Controlled LTV	N	N	Removal of guarding cover. Standalone equipment, single local isolation. Use checklist, THA.
Changing blade on portable band saw	Cord and Plug Exception, no LTV	N	N	120v Retain control of plug
Installing stock, cleaning chips or taking measurements on a mill or lathe	Operations Exception, no LTV	N	N	Qualified employee. Need to follow documented checklist, perform Standing THA.
Changing a belt on Res Mag deburring machine	Individually Controlled LTV	N	N	Standalone equipment, single local isolation. Use checklist, THA.
Changing filters in chilled water, equipment cooling system	Operations Exception, no LTV	N	N	Qualified employee. Need to follow documented checklist, perform Standing THA.



TASK	LTV PROCESS	SCUD	ESP	COMMENT
Working in an electrical cabinet where the wires which would supply the power are disconnected and capped inside the cabinet. Cabinet fed from a single breaker in a distribution panel.	Centrally Controlled, Simple LTV	Y	N	Does not meet air gap because conduit is not disconnected and behind a closed panel. Does not meet Individually controlled because an Electrical Distribution Panel does not provide simple verification.



APPENDIX 10.6 LOST KEY/ABSENT PERSON LOCK REMOVAL FORM



LOST KEY/ABSENT PERSON LOCK REMOVAL FORM

Date:

1. GENERAL INFORMATION

Requestor's Name: LTV Number: Lock Owner's Name: Equipment:

2. LOCK REMOVAL SITUATION

Lost Key Absent Employee Unknown Lock ID Reason lock cannot be removed by Authorized Employee, or status of unknown lock:

3. SUPERVISOR ATTEMPTS TO CONTACT THE ABSENT PERSON DOCUMENT WITH CALL LOG ON BACK. (SKIP FOR LOST KEY)

4. AUTHORIZATION TO REMOVE THE ABSENT PERSON'S LOCK

Authorized Employee : (Signature/Date/Time or "ABSENT" or UNKNOWN) Supervisor of Absent AUTHORIZED EMPLOYEE : (Signature/Date/Time) NHMFL Safety Department Authorizing Lock Removal: (Signature/Date/Time) NHMFL Director/Assistant Director/Designee Authorizing Lock Removal: (Signature/Date/Time)

5. LOCK OWNERS, OR SUPERVISOR REMOVES THE LOCK WITH, SAFETY WITNESS

6. SAFETY DEPARTMENT TO HOLD LOCK AND FORM UNTIL EMPLOYEE RETURNS

7. ACKNOWLEDGEMENT OF LOCK REMOVAL UPON EMPLOYEE RETURN

Lock Owner: (Signature/Date/Time) NHMFL Safety Department: (Signature/Date/Time)

