





Hazardous Energy Lockout Standard

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Safety Resources

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Preface

In university workplaces, the various forms of energy associated with equipment and machinery have the potential for causing severe injuries, including electrocution, burns, chemical exposures, cuts, bruises, crushing, amputation or death. To protect faculty, staff, students, and visitors from the hazards associated with the inadvertent or accidental start-up of such equipment or machinery during servicing, maintenance or other activities, specific lockout and tagout procedures must be implemented to control potentially harmful energy sources.

This standard is intended to meet the requirements of machine safety and lockout under the Saskatchewan, *Occupational Health and Safety Regulations, 1996*.

In this standard, the terms “must” and “shall” are used to express a requirement, i.e. a provision the user is obliged to satisfy in order to comply with the standard. The term, “should” is used to express a recommendation or that which is advised but not required. The term “may” is used to express an option or that which is permissible within the limits of the procedure. The term “can” is used to express possibility or capability.

Revision History

Revisions to this procedure are to be documented in Table 1, Revision History.

Table 1: Revision History

Document Section	Details of Amendments	Date	Author (Initials)

1 Purpose

This standard outlines the responsibilities and minimum requirements and performance objectives for procedures, techniques, and methods to protect individuals from injury from the inadvertent release of hazardous energy when working with equipment and machines.

2 Applicable To

This standard is applicable to all university faculty, staff, students, and visitors engaged in activities including but not limited to erecting, installing, constructing, repairing, adjusting, inspecting, unjamming, setting up, troubleshooting, testing, cleaning, dismantling, servicing, and maintaining equipment, machines, and processes.

External service providers contracted to perform work, maintenance or repair on equipment, or machines shall be informed and adhere to existing hazardous energy lockout procedures, or employ procedures and practices consistent with regulatory requirements and this standard.

3 Scope

This standard applies to all instances where the isolation and lockout of hazardous energy sources is required to safely perform work or maintenance on equipment, machines, or processes. Sources of hazardous energy include any electrical, mechanical, hydraulic, pneumatic, chemical, thermal, including gravity or any other source of energy of potential harm to an individual.

A hazardous energy lockout program is not required for normal operations or production work on equipment, machines, or processes where there is no risk of exposure to hazardous energy sources or if appropriate and effective safeguards are in place to protect workers.

A lockout program is not required for electrical equipment that can be de-energized by physically disconnecting a power cable from an electrical outlet providing the equipment is under the direct and immediate control of the person performing the work.

While this standard may be used as a general lockout procedure, it is recommended that specific lockout procedures be developed which address each piece of equipment, machine, or process that pose a risk of release of hazardous energy when being worked on.

This standard, in no way, authorizes university faculty, staff, students or visitors to perform maintenance, repair or adjustments to infrastructure systems of university owned and managed buildings and facilities. This includes electrical supply and distribution systems to buildings and heating, ventilation and air conditioning systems, and emergency systems. Maintenance, repair and adjustments to these systems are the responsibility of the University of Saskatchewan Facilities Management Division and shall be performed by appropriately qualified, trained and authorized personnel from the division.

For further information or assistance with this standard or hazardous energy lockout, please contact Safety Resources at safetyresources@usask.ca.

4 Definitions

Authorized Individual: A person who is qualified to engage in hazardous energy control because of acquired knowledge, training, and experience and has been assigned to engage in such control.

Blind: A device used in process piping applications as a means of gaining a guaranteed temporary block of pipe flow in a non-energized system.

Block and Bleed Valve: A device used to isolate or block the flow of fluid in a system, so the fluid upstream of the valve does not reach other components of the system that are downstream. The block and bleed valve is used to bleed off or vent the remaining fluid from the system on the downstream side of the valve.

Control: The power to direct, regulate, or restrain hazardous energy.

Common Lock: Lock used if equipment is required to be locked out more than one work shift. A common lock may have more than one key.

De-energized: The complete absence of hazardous energy. Disconnected from all sources of energy and not containing residual or stored energy.

Energized: Connected to an energy source, or containing residual or stored energy.

Energy Isolating Device: A device that physically prevents the transmission or release of an energy source to a machine, equipment or process, including but not limited to:

- A manually operated electrical circuit breaker;
- A disconnect switch;
- Manually operated switches by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently;
- A line valve; and
- A block (e.g. blind flange, block valve) and any similar device used to block or isolate energy.

Push buttons, selector switches and other control circuit type devices are not considered energy isolating devices.

Hazard: A potential source of harm to an individual.

Hazard Assessment: A systematic process by which jobs or tasks are broken down into key functional steps and the hazards associated with each step identified. A key component of the

hazard assessment is the determination of appropriate control measures to protect individuals from identified hazards. A hazardous assessment is also sometimes referred to as job safety analysis.

Hazardous Energy: Any electrical, mechanical, hydraulic, pneumatic, chemical, thermal, including gravity or any other source of energy of potential harm to an individual.

Jerry-Rigged: Organized or constructed in a crude or improvised manner.

Lockout: The placement of a lock or tag on an energy isolating device in accordance with an established procedure, thereby indicating that the energy isolating device is not to be operated until removal of the lock or tag in accordance with an established procedure.

Lockout Device: A mechanical means of locking that uses an individually keyed lock to secure an energy isolating device in a position that prevents energization of a machine, equipment, or a process.

Personal Lock: A lock provided by the employer for use by a worker to ensure personal lockout protection.

Personal Tag: A tag that is used in conjunction with a lock. It gives the details of the job and the worker who has locked out the machine, equipment or process.

Process: The act of taking something through an established and usually routine set of procedures or steps to convert it from one form to another.

Risk Assessment: A comprehensive evaluation of the probability and degree of possible injury or damage to health in a hazardous situation, undertaken to select appropriate safeguards.

Supervisor: An individual in authority who oversees or directs the work or activities of other faculty, staff and/or students. A supervisor may be in management (at any level) within a college or administrative unit, a researcher, a graduate student or an undergraduate student.

In this standard, equipment, machines and processes will hereafter collectively be referred to as equipment.

5 Legislation

The Saskatchewan *Occupational Health and Safety Regulations, 1996*, specify minimum requirements for machine safety of which includes locking out machines prior to performing work on them. According to Section 139(1) of the *Regulations*,

Before a worker undertakes the maintenance, repair, test or adjustment of a machine other than a power tool, an employer or contractor shall ensure that the machine is locked out and remains locked out during that activity if not doing so would put the worker at risk.

Under Section 139(3) of the regulations, employers are required to provide written lockout processes to each worker who is required to work on a machine.

The Saskatchewan *Occupational Health and Safety Regulations* are available on the Ministry of Labour Relations and Workplace Safety website, <http://www.lrws.gov.sk.ca/>, as well as the Safety Resources website, <http://safetyresources.usask.ca/>. A hard copy of the regulations may be obtained from Safety Resources.

6 Hazardous Energy Lockout Program

6.1 General Program Requirements

A hazardous energy lockout program shall include the following elements:

- a) Assignment of duties and responsibilities;
- b) Assessment of equipment that require lockout;
- c) Assessment of hazardous energy sources and energy isolating devices for equipment requiring lockout;
- d) Selection and procurement of lockout devices and associated hardware;
- e) Development and maintenance of written lockout procedures for equipment requiring lockout;
- f) Training of individuals who will be performing lockout procedures;
- g) Auditing of program elements; and
- h) Records management.

6.2 Duties and Responsibilities

Supervisors shall:

- Identify situations where hazardous energy lockout procedures are required to isolate energy sources when work is being conducted on equipment;
- Ensure that equipment have up-to-day manufacturers' operating and maintenance instructions;

- Ensure that new equipment is procured in consideration of design and installation to protect individuals from hazardous energy sources during operation, servicing and maintenance;
- Develop, document, and implement appropriate procedures that accurately reflect current requirements for controlling equipment hazardous energy;
- Provide and maintain necessary equipment, tools and materials for hazardous energy lockout procedures;
- Ensure that workers authorized to conduct service or maintenance work on equipment receive appropriate training on hazardous energy lockout procedures;
- Ensure that other affected workers are informed that attempts to use, restart, or re-energize equipment that is locked out is prohibited;
- Ensure, through regular inspection, that established hazardous energy lockout procedures are being adhered to by authorized workers;
- Maintain all records associated with hazardous energy lockout procedures, including but not limited to training records, lockout procedures, and associated documents; and
- Conduct periodic reviews of hazardous energy lockout procedures.

Individuals authorized to perform hazardous energy lockout procedures, shall:

- Work in accordance with established lockout procedures for the equipment;
- Not attempt to use, start or energize equipment that is locked out; and
- Bring to the attention of their supervisor any new conditions that may negatively impact the lockout process or activities.

Safety Resources shall:

- Develop, maintain and update this standard in consultation with stakeholders;
- Support and monitor adherence to this standard; and
- Act as a resource for the campus community on hazardous energy lockout processes.

6.3 Equipment

Equipment (which includes machines and processes) shall be designed and installed in such a way that individuals are not exposed to hazardous energy during operation, servicing and maintenance.

In consideration of the intended use, equipment shall be designed, manufactured, and installed with energy isolating devices capable of controlling and/or dissipating hazardous energy. Energy isolating devices must be designed to accept a lockout device that will positively secure them in the isolated position. When energy isolating devices are not integral to the equipment, the manufacturer shall include in the instructions, recommendations for the type and location of energy isolating devices.

Special tools or devices necessary for servicing or maintaining equipment should be provided or acquired from the manufacturer.

The manufacturer of equipment should provide a manual that includes operating and maintenance instructions of which include a description and procedures for the use of energy isolating devices. Operating procedures should include instructions to safely address equipment malfunctions. If operation and maintenance instructions do not exist for the equipment, it shall be the responsibility of the supervisor to develop said instructions.

6.4 Hazardous Energy Identification and Control

In determining the need for a hazardous energy lockout program, one must consider the risk of injury from exposure to equipment sources of energy. If there is a risk of injury, a hazardous energy lockout program shall be developed and implemented.

In the development of safe lockout procedures, a hazard assessment (also referred to as a job safety analysis) shall be performed on the operation and maintenance of the equipment.

A hazard assessment is a systematic process by which hazards are identified for work activities and tasks associated with the equipment. Through the hazard assessment, appropriate control measures are determined for each identified hazard.

A record of hazard assessments shall be kept by the supervisor and the college/unit/department as part of the hazardous energy lockout program. It is noted that operations and maintenance documentation provided by the equipment manufacturer should include hazard identification and control measures.

There exist many sources of hazardous energy that should be considered when performing a hazard assessment. A summary of the main types of hazardous energy sources and general energy isolation (control) methods, which would form part of a hazardous energy lockout procedure, is presented in Table 1.

Table 1: Types of hazardous energy.

Category	Hazardous Energy Sources	General Isolation Methods
Electrical	<ul style="list-style-type: none"> • Power transmission lines • Generators • Machine power cords • Conductors • Motors • Capacitors • Solenoids • Batteries 	<ul style="list-style-type: none"> • Turn off equipment • Turn off power at main disconnect • Lock and tag main disconnect • Fully discharge all capacitive systems







Category	Hazardous Energy Sources	General Isolation Methods
Mechanical	<ul style="list-style-type: none"> • Blades • Flywheels • Materials in supply lines of bins or silos • Springs • Actuators • Counterweights • Raised loads • Top or movable part of a press or lifting device • Augers • Reciprocating motions • Pinch points 	<ul style="list-style-type: none"> • Turn off equipment • Ensure all power sources are disconnected • Review entire cycle of mechanical motion • Release all stored energy where possible • Stop and block any possible machine part movements • Block material from moving into area or work and blank as required • Lock and tag energy sources
Pressurized Liquids and Gases	<ul style="list-style-type: none"> • Supply lines • Storage tanks and vessels 	<ul style="list-style-type: none"> • Turn off equipment • Ensure all power sources are disconnected • Depressurize system • Bleed off excess liquids or gases • Isolate all inlet and outlet piping by disconnecting, inserting blinds, or use of a double block and bleed device • Lock and tag valves and other energy sources
Hydraulic	<ul style="list-style-type: none"> • Presses • Rams • Cylinders • Hammers • Shears • Punches • Drives • Hose and line failure 	<ul style="list-style-type: none"> • Turn off equipment • Ensure all power sources are disconnected • Bleed off liquids • Isolate all inlet and outlet piping by disconnecting, inserting blinds, or use of a double block and bleed device • Lock and tag valves and other energy sources
Pneumatic	<ul style="list-style-type: none"> • Air lines • Pressure reservoirs • Accumulators • Air surge tanks • Rams • Cylinders • Tools 	<ul style="list-style-type: none"> • Turn off equipment • Ensure all power sources are disconnected • Block valves upstream and downstream • Bleed off air • Isolate all inlet and outlet piping by disconnecting, inserting blinds, or use of a double block and bleed device • Lock and tag valves and other energy sources








6.5 Lockout Devices



There are a number of tools and devices that may be used for the lockout of equipment. All lockout devices used shall be appropriate for the intended function and able to withstand the usage environment. Homemade or jerry-rigged lockout devices are not permitted.

Examples of common types of lockout devices are presented in Table 2. The list presented is not considered a complete list of available lockout devices.

Table 2: Common lockout devices.

Lockout Device	Example*
<p>Lock – A lock is a device used to lockout energy sources from equipment or components of that equipment.</p>	
<p>Hasp – A device that permits the attachment of multiple locks to a piece of equipment.</p>	
<p>Cable – A lockout device intended for unusual energy isolating devices that are difficult to lockout.</p>	
<p>Circuit breaker pole lockout device - Locks levers in off position to isolate and prevent breaker use.</p>	
<p>Plug lock – A device used to enclose and secure an electrical plug so that it cannot be connected to an electrical source.</p>	
<p>Wall switch lockout - Locks switch in either on or off position.</p>	

Lockout Device	Example*
<p>Push button cover – A device to cover push button switches.</p>	
<p>Valve lock – A device that isolates and secures valves from being opened.</p>	
<p>Ball valve lock device - A device that isolates and secures valves from being opened.</p>	
<p>Pneumatic lock – A device used to isolate and secure equipment from compressed air energy sources.</p>	
<p>Gas cylinder cap – A device to prevent opening.</p>	
<p>Lock box – A device used to minimize the number of locks used when several individuals are working on the same piece of equipment or machinery.</p>	
<p>Lockout tags – Are labels attached to lockout devices to provide additional information and warnings about the equipment/machinery that have been locked out.</p>	

Lockout Device	Example*
<p>Warning tags – Are labels attached to machines or equipment to provide additional information and warnings.</p>	
<p>Energy isolation labels – Identification labels for energy isolation points on machines, equipment and processes.</p>	

*Images of Brady lockout devices courtesy of Hansen Supply Company.

6.6 Personal Locks

Every person who is required to lockout equipment must be assigned a suitable personal lock(s) with the individual's identification on it.

A personal lock has only one key which is assigned to the individual and is only to be used by the individual assigned the lock(s). Personal locks must only to be used for the purpose of lockout. Combinations locks are not permitted.

Appropriate records shall be maintained for the assignment and management of personal locks.

6.7 General Lockout Procedures

6.7.1 Introduction

Procedures developed for the safe isolation and lockout of equipment shall conform to the general protocol provided in the following sections. Only authorized individuals shall carry out lockout procedures. Authorized individuals shall understand the operation and the specific lockout procedures for the equipment.

6.7.2 Application of Lockout Procedure

1. Inform the supervisor that the equipment is to be locked out.
2. Identify the equipment that is to be locked out and assess any issues or consequences of the shutdown of the equipment.

3. Notify individuals working in the area that the equipment is to be shut down and locked out. Ensure that the act of shutting down the equipment does not cause a hazard to other workers, or impact work or research activities.
4. Gather the necessary tools and lockout devices.
5. Shut down the equipment following established procedures. Ensure that all moving parts have come to a complete stop.
6. Identify and de-activate the main energy source for each hazardous energy source. For complex equipment where it is necessary to isolate power or motion for a specific component while maintaining power to control systems, support utilities, and other devices and components, localized lockable energy isolating devices shall be used.
7. Stored, residual or potential energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or chemicals, etc.) must be dissipated or restrained by a method such as grounding, repositioning, blocking or bleeding down.
8. Apply an appropriate lockout device to each energy isolating device.
9. Apply a personal lock to each lockout device. The individual applying the lock must maintain sole custody of the key until the work is completed.

If more than one person is working on a piece of equipment at the same time, each person must apply his/her personal lock to the lockout device. If more than one person is applying a lock to a lockout device, a hasp or lock box may be used. Specific lockout procedures should include the proper use of lockout devices such as lock boxes.

10. Attach a lockout tag to each lockout device. The lockout tag must include:
 - Date and time the lock was applied;
 - Lock number;
 - Name of the individual who applied the lock;
 - Contact information; and
 - Reason for applying the lockout device.
11. Prior to performing work on the equipment, verify that isolation and de-energization of equipment hazardous energy sources. Verification can be accomplished through visual inspections, manually trying machine controls, testing circuitry, monitoring movement or discharge, or observing bleeds, gauges or indicators.
12. Once the equipment has been locked out, work activities on the equipment may proceed.

13. As deemed necessary, place barricades and/or post signage to restrict access to the area while work is being carried out on the equipment.

6.7.3 Return to Service Procedure

The authorized individual who performed the lockout is responsible for the removal of his/her personal lock(s) when the work is completed. Locks and lockout tags are to be removed only by the individual who applied them.

1. Notify individuals working in the area that lockout devices are to be removed and the equipment is to be started up or re-energized.
2. Inspect the equipment to ensure that it is safe to remove the lock(s). Ensure that all controls are off or in a neutral position, and any guarding is properly replaced and secure.
3. Remove the locks and lockout tags, and associated lockout devices from all energy isolating devices.
4. Activate energy sources.
5. Start up, and test the equipment. Perform a brief inspection to ensure the equipment is operating as expected.
6. Advise individuals working in the area that the equipment has been returned to service and may be used.

6.8 Extended Lockout

Any equipment that has been locked out for repair, maintenance or adjustments must remain locked until the work has been completed. If work on equipment is not completed by the end of a work day (shift), then the authorized individual's personal lock(s) and lockout tags must be removed and replaced with common lock(s) and lockout tags issued by the supervisor overseeing the work activity.

Prior to commencing work on a the equipment where common lock(s) are being used, authorized individuals shall remove the common lock(s) and lockout tags, and attach his/her personal lock(s) and lockout tag(s). This process shall be followed even if the same authorized individual will be performing work on the same equipment the next day (shift). This requirement and process is intended to maintain the integrity of the lockout between authorized individuals who may work on the equipment.

The use of common locks is to be managed by the supervisor overseeing the work activity. Appropriate records shall be maintained by the supervisor for the assignment and management of common locks.

Other equivalent documented procedures for extended lockout may be employed provided the equipment remains locked and secured between work activities, and until the equipment can be returned to normal operation.

6.9 Forced Removal of a Lock

If an authorized individual is unable or unavailable to remove his/her personal lock(s) from a piece of locked out equipment, a designated person may be authorized to remove the lock(s) in accordance with the following protocol. All forced removal of personal locks shall be formally documented and records maintained by the supervisor.

1. Every reasonable attempt has been made to contact the authorized individual.
2. The authorized individual's supervisor shall be informed.
3. Safety Resources and the Occupational Health Committee Co-Chairpersons shall be informed prior to removing the lock(s).
4. Advise individuals working in the area that the equipment is to be returned to service.
5. Inspect the equipment to ensure that it is safe to remove the lock(s). Ensure that all controls are off or in a neutral position.
6. Remove the locks and tags and associated lockout devices from the energy isolating devices.
7. Startup the machine, equipment or process.
8. Advise individuals working in the area that the equipment has been returned to service.

6.10 Energized Equipment

There may be situations when repairs, cleaning, lubricating or adjustments must be completed on equipment while it is in operation, in motion, or under power. In these situations, a risk assessment shall be performed, and specific work procedures shall be developed to ensure work activities are performed in a safe manner.

6.11 Special Applications

Where practicable, every effort shall be made to ensure equipment has a physical means of being locked out and secured. There may, however, be circumstances where a physical means of lockout is not possible for some equipment. In these situations, other methods of hazardous energy control must be considered and implemented to prevent the unexpected movement or motion of equipment, or to minimize the risk of a hazardous condition or event. Recognized

standards for the equipment should be sought (if available) to determine whether other control methods are necessary.

Safety Resources shall be consulted when work is to be performed on equipment where a physical means of lockout is not possible.

In situations where equipment cannot be locked out or secured, a hazardous energy control plan shall be developed. Hazardous energy plans shall include the following elements.

- Documented risk assessment;
- Implementation of risk reduction measures as determined from the risk assessment which may include;
 - Design changes, substitution of less hazardous materials or application of ergonomics principles;
 - Application of safeguarding and complementary protective measures;
 - Documented safe work practices; and/or
 - Additional training.

If, after risk reduction methods are applied, adequate risk reduction cannot be achieved, use of a lockout procedure should be considered. If a lockout procedure cannot be used and adequate risk reduction cannot be achieved using other control methods, the activity or task should not be performed.

6.12 Training

Awareness of this standard shall be provided by Safety Resources during Employee Safety Orientation and Supervisor Safety Orientation, and Contractor Safety Orientation training sessions. Specific orientation sessions on the standard may be provided to the campus community based on need.

Authorized individuals (faculty, staff, students and visitors) involved with energy isolation and lockout procedures shall be appropriately trained on the equipment they are working with, and on the specific procedures governing hazardous energy lockout. Training shall be provided by the supervisor overseeing the work activities, or a qualified designate.

Training shall be verified either through a written quiz and/or practical exercises. It is the responsibility of the supervisor to ensure that authorized individuals are able to perform lockout procedures safely and competently.

Retraining shall be provided on a regular frequency and whenever there is a change to equipment that present new hazards or a change in lockout procedures.

Training records (classroom and practical) of authorized individuals shall be maintained by the supervisor and respective college/unit/department.

Safety Resources shall provide training guidance and support to the campus community for hazardous energy lockout processes.

6.13 Records

Appropriate documentation and records shall be maintained by the supervisor for a hazardous energy lockout program. This includes:

- Lockout hazard assessments and risk assessments;
- Operating and maintenance procedures for the equipment;
- Lockout procedures for the equipment;
- Training documentation and training records;
- Records relating to the assignment of lockout devices and locks to authorized individuals;
- Records for the use of common locks; and
- Records pertaining to forced removal of locks.

6.14 Program Review

Hazardous energy lockout programs shall be reviewed at least every three years by supervisors to assess their function and effectiveness. The review should include an examination of equipment operating procedures, written lockout procedures and associated documents, energy isolating devices, lockout devices, other hazardous energy control methods (as employed), and training.

If changes are made to the hazardous energy lockout program, said changes shall be communicated to all individuals authorized to perform lockout procedures and training updated as required.

7 Standard Review

The *Hazardous Energy Lockout Standard* shall be reviewed every three years by Safety Resources. This standard may be reviewed at any time by Safety Resources if there is an identified need to make revisions to the standard.

8 References

- *Workplace Safety and Environmental Protection Policy*, University of Saskatchewan.
- *Saskatchewan Occupational Health and Safety Regulations, 1996*.
- *Workplace Responsibilities System*, Safety Resources.
- *Risk Assessment Guideline*, Safety Resources.
- *Control of Hazardous Energy – Lockout and Other Methods*, Canadian Standards Association (CSA), CSA Z460-05, 2010.
- *Lockout*, Industrial Accident Prevention Association (IAPA), 2008.
- *Lockout*, WorksafeBC, 2005.