

Subject: CONTROL OF HAZARDOUS ENERGY

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1.0 Purpose of Procedure

The purpose of this procedure is to protect all employees and/or contractors against injury by the accidental starting of any machine, device or process that has been made inoperable for the purpose of undertaking maintenance activities. It is also intended that this procedure will assist in ensuring compliance to the lockout requirements as detailed in the Occupational Health and Safety Act, applicable Regulations and the Ontario Electrical Safety Code.

This procedure describes methods of ensuring that:

- 1.1 The equipment or process is immobilized and isolated (zero energy state) prior to carrying out any maintenance work, and
- 1.2 No person re-energizes the equipment or process before all workers involved are aware of the intended start-up and are clear of the equipment.

2.0 Application

This procedure applies to activities such as, but not limited to, erecting, constructing, repairing, adjusting, inspecting, cleaning, operating, and maintaining machines, equipment, and processes.

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3.0 Compliance with Procedure - Brock University Employees

In consideration of personal safety and because the potential for serious injury or loss of life exists, failure to adhere to this procedure may result in discipline up to and including discharge.

4.0 Compliance with Procedures - Brock University Contractors

All Contractors working at Brock University, undertaking work subject to the Occupational Health and Safety Act and Regulations regarding Control of Hazardous Energy, will:

4.1 Provide Brock University (Project/Services Manager) with a copy of their company's Control of Hazardous Energy (LO/TO) procedure prior to the commencement of work. Note: In cases where Contractors are working with Brock University Staff where a Control of Hazardous Energy procedure is required, Brock University's Control of Hazardous Energy Procedure will be followed by University Staff.

4.2 Provide evidence to Brock University (Project/Services Manager) that the contractor's staff have been trained in their specific Lock-Out/Tag-Out (LOTO) procedure.

5.0 Definitions

Authorized Individual – A person who is qualified to engage in hazardous energy control because of knowledge, training, PPE (e.g. Arc Flash) and experience and has been assigned by a competent authority to engage in such control.

Danger Zone – The zone in and around a machine, equipment, or a process where a hazard or potential hazard exist by either the motion of machinery or the energization of a system or systems.

Energy-isolating Device – A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors; a line valve; a block; and other devices used to block or isolate energy (push-button selector switches and other control-type devices are not energy-isolating devices).

Hazardous Energy - Any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, rotational or other energy sources that could pose a risk to personal safety or could potentially cause an injury.

Interlock – A device or system whereby the status of one control or mechanism allows or prevents the operation of another.

Information Tag - A warning tag or other device, and its means of attachment, used to warn employees/contractors etc. of an existing or potential hazard. In addition to the warning, its wording also identifies who applied the tag and when. It is used in conjunction with the application of a lockout device to an energy-isolating device.

Knowledgeable Person - A person who has the appropriate expertise or professional knowledge or qualifications that enable him/her to assess the adequacy of the applied lockout procedures to ensure that they are in accordance with this procedure.

Lockout - The placement of a lock and tag to an energy-isolating device in accordance with an established procedure, thereby indicating that the energy-isolating device cannot to be operated until removal of the lock and tag in accordance with an established procedure.

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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.

Primary Authorized Individual - An authorized individual who has been assigned to perform (assumes control over) a group lockout and has authority over other authorized individuals entering into a danger zone around a hazardous machine or energy system. The primary authorized individual will be the first person to lockout and tag the equipment or process and the last one to remove their lockout device and tags. **Note:** The primary authorized individual may be a Brock University worker or a contractor employee.

Zero Energy State - All types of power including electricity, suspended weight, rotational, spring pressure, air under pressure, oil or water under pressure, and steam are dissipated so that operation of any controls will not produce movement.

6.0 Responsibilities

6.1 Senior Managers: (Deans, Directors, Chairs, Department Managers)

- 6.1.1 Provide the resources and support necessary to ensure compliance with the program requirements. Take appropriate action as required where non-conformance with this procedure is known.
- 6.1.2 Ensure that this FMOP is reviewed at least bi-annually and revised as required.
- 6.1.3 Ensure that machines, equipment and processes are designed, manufactured and installed in such a way that hazardous energy sources can be isolated and locked out in conformance with the CSA standard.
- 6.1.4 Where machines, equipment or processes are not in conformance, under the guidance of a knowledgeable person, upgrade the equipment so that it is compliant.
- 6.1.5 Ensure that all Brock University personnel impacted by this procedure are aware of and trained in its contents.

6.2 Facilities Management Supervisors and Managers

- 6.2.1 Ensure that the Control of Hazardous Energy procedure is understood and followed by all applicable employees as required.
- 6.2.2 Co-ordinate work that extends beyond one shift with other supervisors, contractors or workers as appropriate.
- 6.2.3 In consultation with the Manager, Electrical Services advise any worker who must work near live power of the hazards in doing so and provide adequate Personal Protective Equipment (PPE), training in its use, prior to work commencing. **Note:** Working near live power is to be avoided at all times.

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6.3 Primary Authorized Individual

- 6.3.1 Be aware when the Control of Hazardous Energy procedure is needed and how to apply the specific requirements.
- 6.3.2 Identify all of the energy hazards, their magnitude and appropriate methods to control the energy in preparation for the shutdown. If in doubt as to the location or types of energy involved check with their supervisor/manager.
- 6.3.3 Shut down and isolate all energy sources with appropriate energy-isolating devices, confirming that a zero energy state has been achieved.
- 6.3.4 De-energize the machine, device or process and attach the appropriate personal lockout device/tag.
- 6.3.5 Test operating controls/switches to ensure that it has been de-energized.
- 6.3.6 Prior to removing the lockout device and tag and restoring energy, ensure that the appropriate steps have been followed to protect other workers.

6.4 Workers Assisting the Authorized Individual

- 6.4.1 All authorized individuals assisting with the work require an individual tag and lock.
- 6.4.2 Be aware when the Control of Hazardous Energy procedure is needed and how to apply the specific requirements.
- 6.4.3 In concert with the worker in charge, identify all of the energy hazards in preparation for the shutdown. Note: The worker in charge is responsible for applying the primary locking device and tag.
- 6.4.4 Independently confirm that a zero energy state has been obtained after the primary authorized individual has installed their lockout device(s) and tags.
- 6.4.5 Install his or her personal lock and tag prior to working on the equipment or process.
- 6.4.6 Prior to removing the lockout device and tag and restoring energy, ensure that the appropriate steps have been followed to protect other workers.

6.5 Brock University Employee Responsibilities

- 6.5.1 Department Managers and Supervisors are responsible for developing, implementing and administering an effective control of hazardous energy program including training employees in the requirements, and ensure adequate lock-out capabilities and equipment are available to perform lock-outs.
- 6.5.2 Each employee is required to follow the standard control of hazardous energy procedure on every occasion when entering any area where there is exposure to an energy source.
- 6.5.3 Employees are expected to maintain equipment in good condition and report any defects to their supervisor/manager.
- 6.5.4 Ensure that only authorized employees are allowed to operate energy-isolating devices and to place locks and tags on controls to prevent unexpected start-ups.

6.6 Contractors Responsibilities

- 6.6.1 Contractors are responsible for developing, implementing and administering an effective control of hazardous energy program including training their employees in the requirements, and ensure adequate lock-out capabilities and equipment is available to perform lock-outs.
- 6.6.2 Contractors are responsible for ensuring that their employees have received training in the specific lockout procedures required for the equipment they are working on while on Brock University property.
- 6.6.3 Each employee of the contractor is required to follow the required control of hazardous energy procedure on every occasion when entering any area where there is exposure to an energy source.

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- 6.6.4 Contractor's employees are expected to maintain equipment in good condition and report any defects to their supervisor and to the appropriate Brock University Project/Service Manager.
- 6.6.5 Only authorized contractor employees are to operate energy-isolating devices and to place locks and tags on controls to prevent unexpected start-ups.

7.0 Control of Hazardous Energy Procedure

7.1 Every employee and / or primary authorized individual must place his or her padlock on the appropriate switch or valve. The only positive method of protecting employees from the hazards associated with inadvertent starting of machines, equipment or processes, is to lock the controls in the "OFF" position and to have a separate single keyed lock for each person. The following is required:

- 7.1.1 Locks (key type) made by a reputable manufacturer shall be provided so that an acceptable standard lock shall be used at all times. Combination locks are not permitted.
- 7.1.2 Only one key per lock is to be issued. No duplicate of master keys are allowed.
 - Mechanical Team locks coloured blue.
 - Electrical Team locks coloured red.
 - Structural Team locks coloured green.
- 7.1.3 Each employee who is to be involved in lockout tagging will use the lock assigned to them. Lockout locks shall not be used for any other application.
- 7.1.4 Only one type of information tag will be used "Danger - Do Not Operate", it must be signed, dated, state the reason for the lockout and securely fastened in place.
- 7.1.5 The use of a tag alone to prevent inadvertent operation of machinery is not allowed but is used to supplement the lock-out.
- 7.1.6 The owner of the designated lock is the only person permitted to remove the lock from an energy-isolating device.

7.2 Multiple Locks:

- 7.2.1 When a task requires the services of more than one person, each person isolating and de-energizing the equipment, machine or process must have their own locking system. So a multiple locking device (hasp) is used to allow multiple locks on the same lock-out device. The owner must retain the key to their lock.
- 7.2.2 An information tag shall be attached to each lock.
- 7.2.3 The Primary Authorized Individual will not remove his or her lock and tag until all other locks and tags have been removed.

7.3 Lock Boxes

- 7.3.1 Where each person must isolate and de-energize two or more pieces of equipment, machines or process locations, a lock box can be used.
- 7.3.2 Each lock box is numbered and will contain 10 black safety locks and one key which will fit all locks within the numbered box.
- 7.3.3 The Primary Authorized Individual will place a black lock and tag on all equipment, machine or process locations where isolation and de-energizing is required.
- 7.3.4 The key for the black safety locks will be placed in the lock box.
- 7.3.5 Each authorized individual will place his or her lock and tag on the lock box.
- 7.3.6 The Primary Authorized Individual will not remove his or her lock and tag from the lock box until all other locks and tags have been removed by their owners.

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7.4 Lockout Steps

Every employee must follow this procedure where the inadvertent or accidental starting, or energizing of a machine, device or process may endanger a worker. This may include but is not limited to situations where equipment or a process is cleaned, repaired, altered, set-up, tested or adjusted.

The primary authorized individual with the support of appropriate trades personnel will:

- 7.4.1 Ensure that the machine, device or process has been completely shut down in the normal manner.
- 7.4.2 Isolate all energy sources using the appropriate energy-isolating device(s). *Note:* This may include disconnect switches, draining and blanking of steam and water lines, relieving hydraulic / pneumatic pressures / stored or residual pressures and applying line valves, blocking and immobilizing, etc.
- 7.4.3 Ensure that an electrician is present where power is required to test or troubleshoot electrical systems or, the source of electrical power is required to be determined prior to isolation.
- 7.4.4 If fuses are to be removed, an electrician must use fuse pullers due to the proximity of the bus bar, which is still energized. The removal of fuses only does not constitute a lockout.
- 7.4. If work is to be performed on electrical circuits or equipment, an electrician shall first test for electrical potential with a proven meter.
- 7.4.6 Only authorized personnel are allowed to operate main electrical disconnects. The de-energizing of main panels must conform to Brock University - Safety Procedures (FMOP 3-3 Electrical Power Outage Procedures).
- 7.4.7 Confirm that there is no stored or residual energy that could create a hazard once the lockout device(s) have been attached and prior to work commencing.
- 7.4.8 Examples of checking for stored or residual energy are:
 - Reading pressure or temperature gauges.
 - Attempting to start the machine or device using the normal operating controls or computer commands where applicable to make sure that it has been de-energized.
 - Checking that the main disconnect switch cannot be moved to the "on" (closed) position, ensuring that all of the operating controls and switches are returned to the "off" position before starting the work activity. Checking that blocks or blanks are secure and functional.
- 7.4.9 After ensuring that the equipment or process is in a Zero State of Energy and all sources of energy are isolated, the primary authorized individual will confirm that:
 - The appropriate energy-isolating devices are in place.
 - All authorized individuals working on the equipment / process or structure have attached their tags and personal lock(s) to each of the energy-isolating devices.
 - The key for each personal lock is retained by the applicable authorized individual.
- 7.4.10 Lockout tags shall state:
 - Reason why switch / device is disconnected.
 - Name of worker who disconnected and locked.
 - Date and time when switch / device was disconnected and locked.

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- 7.4.11 Each person working on the machine, device or equipment must also:
- Ensure that the equipment or process is in a Zero State of Energy and all sources of energy are isolated.
 - Use his or her personal lock to secure each of the energy-isolating devices and personally retain the key. Complete a lockout tag(s) and affix it to his or her personal lock(s).
- 7.4.12 Any worker who is unsure as to lock-out procedure will seek direction from their supervisor before proceeding.
- 7.4.13 Startup of Equipment: When the work is completed and prior to removing personal locks and tags, each authorized individual shall ensure that:
- The operational controls are in the "off" position so that the main disconnect switching is not done under load.
 - All materials or devices used to de-energize and tools or materials used for the work are removed.
 - The machine or device is operational and all safety-related devices (i.e., guards) are re-installed.
 - All personnel are clear of the area and notified that lockout device(s) will be removed and energy restored.
 - Appropriate PPE is worn.
- 7.4.14 Extended shift requirements:
- Where work is to continue by other employees beyond the shift in which it was started, the safe removal of locks and tags placed by the working shift and for their replacement by those of the oncoming shift is required.
 - In order to facilitate this process, the current primary authorized individual will monitor the process to ensure that the lock / tag exchange between shifts is completed without incident.
 - Only when all other locks and tags have been exchanged will the current person in charge remove his or her lock and tag and the incoming person in charge replace with his or her lock and tag. At no time will the equipment or circuitry be left unlocked until all work has been completed.
 - Where work will continue for an extended period of time the primary authorized individual, in consultation with the applicable manager may keep his or her lock and tag in place until all work has been completed.

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7.4.15 Removal of Locks

- Under no circumstances may any person activate tagged equipment or disconnect switches. Always check with your supervisor or manager when you see a lock and/or tag on equipment that you have been requested to operate.
- Only the owner of the lock may authorize removal of a personal lock and/or tag under normal circumstances.
- If the owner leaves the university grounds and has left a lock and/or tag in place and the operation of the equipment / process is necessary, contact the person's supervisor.
- The supervisor will attempt to contact the worker and have them return to remove the lock, without compensation.
- If the person who owns the lock / tag is not able to return but has confirmed that the equipment is safe to operate the person's lead supervisor may remove the lock or tag, after consulting with a certified member of the JHSC.
- Such an incident must be recorded on a Circumvention Lock-Out form, see Annex B.

7.4.16 Other Requirements

- Work may be performed on portable type electrical machinery after it has been unplugged from the power source, and the plug tagged with a "Danger - Do Not Operate" tag. The plug should remain visible to the person that tagged the equipment at all times.
- Where there is a hazard of fire or explosion, or electrical arcing is a concern for any other reason, grounding will be required as part of lockout protection.
- The use of electrical control circuitry to accomplish lockout is prohibited since it does not offer positive personnel protection. Examples:
 - Electrical shorts. (Water in lines and some types of dust can create a path to complete the control circuit.)
 - Vibration or switch component failure.
 - Remote or interlocked switches not affected by control circuitry.

7.4.17 Testing of Equipment

In situations where energy-isolating devices are locked out and it is necessary to test or position the machine, equipment or process the following sequence applies:

- Ensure that the machine, equipment, or process components are operationally intact.
- Remove any temporary de-energizing devices
- Clean the machine, equipment or process of tools and materials.
- Ensure all personnel associated with the lockout are notified of the removal and re-energization.
- Ensure appropriate PPE is worn.
- Ensure that all personnel not involved with the testing stand clear of the area.
- Complete testing.

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7.4.18 Use of Alternative Methods

- Where lock-out/tag-out is not used for tasks that are routine, repetitive, and integral to the equipment operation or process an alternative method of control shall be used. Alternate methods may include but are not limited to:
- Addition of engineering safeguards (fixed / barrier guards, light curtains, pressure mats, emergency stop buttons, hold-to-run devices).
- Warning and alerting techniques (attendants, audible and visual signals, barricades, signs and tags).
- Administrative controls (safe work procedures, standard practices and checklists, training).
- Use of personnel protective equipment (eyewear, face-shields, gloves, hearing and protective heard-gear).

8.0. Training and Education

- 8.1. All employees who are required to lock and tag equipment and/or processes or supervise this type of work as part of their job function must receive training in this procedure.
- 8.2. Training must be provided before assignment to ensure that employees understand the purpose and function of the Facilities Management Control of Hazardous Energy Procedure (FMOP 2-1) and that the knowledge and skills required for the safe application, use, and removal of energy controls are acquired. The training must include the following:
 - Each authorized employee must be instructed in the purpose and use of the energy control procedure.
 - Each authorized employee must receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, the methods and means necessary for energy isolation and control, and means of verification of control.
- 8.3. Retraining must be provided annually and will be arranged by the Facilities Management Department. The training will re-establish employee proficiency with control methods and procedures, as follows:
 - Retraining must be provided whenever there is a change in job assignments, a change in machines, equipment, or processes that presents a new hazard, a change in the energy control procedures, or a revision of control methods; and
 - Additional retraining must be conducted whenever periodic audits reveal or supervisory observations give reason to believe that there are deviations from or inadequacies in an employee's knowledge or use of energy control procedures.
 - Documentation must certify that employee training has been accomplished and is being kept up-to-date. The certification must record each employee's name and dates of training.
- 8.4. As part of this training the employee must be able to demonstrate the correct procedures for locking out equipment that they are required to work on.
- 8.5. New Hires/Promotions/Transfers into related authorized employee positions must have their training reviewed and competence verified prior to working on any project where the control of hazardous energy is required. This training and/or review must be documented and provided by one of the following individuals: designated Electrician, Supervisor, or designated employee qualified to deliver the training.

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9.0 References

- Brock University Facilities Management Operating Procedure FMOP 3-3 Electrical Power Outage Procedures
- Industrial Accident Prevention Association (IAPA) - Sample Lock-out / Tag-out Procedure
- Electrical Safety Authority - Lock-Out & Tag-Out, 2000
- Occupational Health & Safety Act
 - Industrial Establishments Regulation - 851
 - Construction Projects - Ontario Regulation 213/91
- CSA Standard Z460-05 Control of Hazardous Energy and Other Methods

Lockout / Tagout Form

<p style="text-align: center;"></p> <p style="text-align: center;">DANGER</p> <p style="text-align: center;">LOCKED OUT</p> <p style="text-align: center;">DO NOT OPERATE</p> <p style="text-align: center;">This lock/tag may only be removed by:</p> <p>Name: _____</p> <p>Dept: _____</p> <p>Expected Completion: _____</p>	<p style="text-align: center;"></p> <p style="text-align: center;">DANGER</p> <p>This energy source has been <u>LOCKED OUT!</u></p> <p>Remarks: _____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
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LOCK-OUT CIRCUMVENTION

Owner of Lock:	Date:
Colour of Lock:	Equipment Locked out:
Work Request #:	

To remove a lock, the following must be completed:

1. Discuss with Issuing Authorized Individual, and Responsible Supervisor the need to remove the lock. All must be in agreement before the lock is removed.
2. Check if lock owner is not available. If yes, then have the owner remove their lock. If not, attempt to contact the owner. If receive OK from owner to remove the lock, then remove the lock and complete this form. If unable to contact the lock owner, proceed to step 3.
3. Notify Service Team Leadhand. Supervisor must inform worker(s) of lock removal before they start work the following shift.
4. Remove lock with witness. Complete form. Obtain signatures and return to Manager, Mechanical Services

Is Person Available? <input type="checkbox"/> Yes <input type="checkbox"/> No	Time:
If No, then Call Person at Home (mandatory)	Time:
Was contact made with the person? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If No, then Service Team Leadhand to inform of lock removal (mandatory)	Time:

Comments: _____

Person who removed lock:	Witness to lock removal:
<i>Print name and initial</i>	<i>Print name and initial</i>
<i>Department</i>	<i>Department</i>
<i>Date</i>	<i>Date</i>

Print Name and Initial:

Supervisor		Date	
FM Manager		Date	
Leadhand		Date	
JHSC Cert. Member		Date	

Return completed form to Manager, Mechanical Services within 48 hours of lock removal.