Lock Out Tag Out (LOTO) Isolation Safety Guideline

Section 1 - Purpose and Scope

(1) This Guideline aims to reduce the risk of injury to people at The University of Queensland (UQ) working on plant or equipment by preventing the item and its components from being set in motion and preventing the accidental release of stored energy.

(2) The Guideline provides UQ Client Facilities Managers (CFMs), Client Facility Coordinators (CFCs) and supervisors with risk-based, practical tools and information to minimise the risk of incidents or injury using Lock Out Tag Out (LOTO) isolation. This Guideline applies to work on plant or equipment on UQ campuses and sites, including work on or near equipment or mobile plant containing different forms of energy.

(3) The Guideline supports and should be read in conjunction with UQ's Safe Use Of Plant and Equipment Procedure.

Section 2 - General Requirements

(4) In a work environment, a person may be injured or killed due to the unintentional release of hazardous energy sources. This can be prevented with clearly documented LOTO procedures and the performance of isolation and maintenance to protect people from exposure to any form of hazardous energy. This results in a safer workplace whilst performing critical maintenance, cleaning, and repairs. Other benefits include:

a. Minimised risk of injuries and fatalities.
b. Increased productivity and reduced equipment downtime and damage.
c. Cost savings through lower insurance premiums.

Section 3 - Safe System of Work

(5) LOTO isolation should be implemented and authorised as part of the safe system of work for protection against hazards.

Isolation Procedure

(6) Isolation procedures in each task may vary because of differences in plant, equipment, power sources, hazards, and processes. However, every isolation procedure should include the steps outlined below.

Shut the Plant Down

(7) The operation of a single switch or valve can usually shut down plant or equipment that has a single energy source. However, complex plant or equipment may have to be shut down in a sequence (e.g. one switch before another) or by shutting down several energy sources.

Identify All Energy Sources and Other Associated Hazards

(8) Isolation procedures should identify all energy sources likely to re-activate the plant and place people at risk. The

energy sources include electricity, including mains, solar and generator, fuels, heat, steam, fluids under pressure, such as water, air or hydraulic oil), stored energy, gravity, radiation.

(9) If possible, an authorised competent person should use original designer diagrams of plant or equipment which show the location and details of its various components like isolation points, switches, valves, energy lines, pipes, power sources and control points, including computers, as part of the isolation procedures. If original designer diagrams of plant installations are not available, new diagrams/photographs should be developed.

(10) Similarly, shutting the plant or equipment down may require identifying other hazards and minimising or removing them to reduce the risk of injury. For example, associated equipment may need to be locked-out to prevent re-activation, or valves on pipes and lines carrying gases or fluids may need to be locked shut or blanked off. Depending on the plant or equipment, other hazards may include hazardous substances, such as gases, acids, alkalis and solvents, falls, burns, asphyxiation, impact. Authorised competent persons shall report any hazards noted during isolation of energy sources by reporting the hazard to the relevant UQ CFM or the person in control of the equipment.

Identify All Isolation Points

(11) Plant and equipment that may require an isolation procedure should have appropriate isolation points for all energy sources so work on the plant can proceed safely. It is important to identify all isolation points in a system, as it may be necessary to use a local isolator to shut down a specific part of the machine, a motor for example, while the rest of the associated plant remains in operation.

(12) It is important to understand that emergency stop buttons and similar stop devices on their own are not satisfactory isolation points. It is dangerous to rely solely on emergency stopping devices, because they are not designed for frequent use, cannot be locked out in all cases and may allow energy to be re-activated. They may also allow control circuits to remain live. Consider remote control rooms and process computers when identifying isolation points.

Isolate All Energy Sources

(13) The authorised competent person in control of the task should also identify a competent person who knows and understands the complexities of the plant or equipment and appoint that person to coordinate the isolation of all energy sources and hazards at the plant. Identify and isolate all electricity sources, bearing in mind some plant will have several control stations and sections of plant may have independent electricity sources. If programmable logic devices control the equipment, then it is essential to use local isolating switches to achieve secure and safe isolation.

(14) Where equipment connects via a plug and socket, only an authorised competent person, such as an electrician, should isolate and disconnect all electricity supply to an item of plant, not just the control circuit. Having an authorised competent person isolate and disconnect electricity supply ensures equipment cannot be energised via another source or control system.

De-energise All Stored Energies

(15) Take any of the following steps necessary to guard against energy remaining in the plant after it has been isolated from its energy sources:

a. Inspect the plant to make sure all parts have stopped moving.
b. Install ground wires.
c. Relieve trapped pressure.
d. Release the tension on springs or block the movement of spring-driven parts.
e. Block or brace parts that could fall.
f. Block parts in hydraulic and pneumatic systems that could move from the loss of pressure.

g. Bleed the lines and leave vent valves open.
h. Drain process piping systems and close valves to prevent the flow of hazardous material.
i. Use a blank flange to block a line where there is no valve.
j. Purge reactor tanks and process lines.
k. Dissipate extreme cold or heat or provide protective clothing.

(16) If stored energy can re-accumulate, monitor it to make sure it stays below hazardous levels.

Section 4 - General Task Responsibility for LOTO Isolation Process

(17) An authorised competent person is responsible for undertaking the activities outlined below, where required.

General Safety Precautions

(18) All equipment should be assumed to be hazardous until:

a. all sources of energy to the equipment have been positively isolated in an approved manner;
b. isolation effectiveness has been tested and proven, or inspected and confirmed, in an approved manner to provide positive and total isolation;
c. all isolation points have been clearly identified to all members of the working team; and
d. appropriate procedures for dissipating or restraining all stored energy sources have been conducted.

Identification of Plant or Equipment

(19) Prior to starting work, an authorised competent worker or contractor should perform an identification of the plant or equipment to determine:

a. the plant or equipment to be worked on;
b. safe access for all persons;
c. all sources of energy relevant to the task;
d. all relevant points of isolation to achieve positive and total isolation; and
e. any equipment affected by the isolation.

(20) All workers or contractors involved in the work performing the required positive isolations should ensure the LOTO isolation register is completed and correct before starting work.

Safe Shut Down of Plant and Equipment

(21) Simple items can usually be shut down by a single control, such as a switch or valve. More complex items may have to be shut down in a set sequence or by shutting down several energy sources. A completed ‘tag out’ should be placed on the controls of every energy source.

Risk Assessment (RA) / Job Hazard Analysis (JHA)

(22) Prior to starting any work, it must first be confirmed if a Safe Work Method Statement (SWMS) and Permit is required for the task.

(23) Identify all sources of energy associated with the item of plant or equipment and their isolation points, including ones that may be remote or hidden.

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(24) Identify all other hazards, including mechanical, chemical, falls, burns, asphyxiation, and impact.

(25) If a UQ risk assessment has determined that the work or item of plant or equipment is not safe, record the findings and contact the CFM of the precincts or campuses before proceeding further.

(26) Property and Facilities Division (P&F) CFMs/CFCs will review the RA/JHA and issue the necessary LOTO isolations to determine the level of supervision and additional measures required for task.

Isolating All Energy Sources (LOTO)

(27) Once the P&F CFM has approved the RA/JHA and has issued the necessary LOTO, isolate every energy source by means of one lock and one danger tag for every worker on every isolation point. Where several workers are involved, use safety hasps.

(28) Except for simple electrical equipment connected via a plug and socket, an authorised competent electrician must isolate and disconnect all electrical supply to an item of mobile plant or equipment.

De-energising All Stored or Trapped Energies

(29) Take any of the following steps necessary to guard against energy left in the item of plant or equipment after its energy sources have been isolated:

a. Inspect the plant or equipment to make sure all parts have stopped moving.
b. Install ground wires.
c. Block or brace parts which could fall due to gravity.
d. Release the tension on springs, or block the movement of spring-driven parts.
e. Block parts in hydraulic and pneumatic systems that could move from the loss of pressure.
f. Relieve trapped or stored pressure. Bleed the lines and leave vent valves open.
g. Drain process piping systems and close valves to prevent the flow of hazardous material.
h. If a pipe must be blocked where there is no valve, use a blank flange.
i. Purge tanks and process lines.
j. Dissipate extreme cold or heat, or provide protective clothing.
k. If stored energy can re-accumulate, monitor it to make sure it stays below hazardous levels.

Testing for Effective Isolation

(30) After the item of plant or equipment has been shut down, locked, and tagged out, but before any person attempts to start work on the item, test all isolated power sources. Test first with appropriate instruments and then by trying to activate the item. Ensure the complexity of the plant is understood. If unsure, contact the relevant CFM.

Completing the Work

(31) While performing the work, monitor the condition of the item of plant or equipment throughout the work to ensure unforeseen hazards or changing conditions do not cause injury.

(32) On completion of the work:

a. return the item of plant or equipment to a safe and serviceable condition;
b. ensure each worker removes their own safety LOTO. Only the worker who was issued with a given LOTO can remove them. Contact the CFM or other person in control if for any reason it is not possible to comply with this rule;

c. ensure the person who fitted the out of service tag removes it;
d. test the equipment for correct operation; and
e. report to CFM and return all the borrowed items.

Incomplete Work

(33) If a person who is either working alone or in a work group leaves the work area and the equipment is still out of service for any reason, they shall:

a. conduct necessary tests and/or inspections to ensure the site shall remain safe in their absence;
b. advise remaining workers that they are vacating the work area and their intention to remove their personal danger and isolation lock;
c. replace their personal isolation and danger tags with equipment isolation locks and caution/out of service tags or confirm with other workers and the CFM to take control of the isolation process;
d. test for or confirm positive isolation; and
e. arrange the management of the plant and equipment isolation lock key with the LOTO person in control or CFM. This may be at the asset location or a central point. Details of key location are to be recorded on the associated caution/out of service tags.

Section 5 - Locking out all Isolation Points

Lockout Devices

(34) A wide range of devices are available for locking out energy sources and other hazards. As well as interlocked guards, lockout devices can include padlocks and chains, safety lockout hasps which use multiple padlocks, switches with a built-in lock, lockouts for circuit breakers, fuses, and valves. Only devices that incorporate a lock or can accommodate one or more padlocks are suitable for locking out energy sources.

One Person, One Lock

(35) If more than one person is working on the same plant, each person should attach their own lock to prevent the energy isolator being opened before all locks have been removed or opened. The isolation procedure should identify common lockout points to make sure energy cannot be restored while someone is still working on the plant. If two or more people are working on plant that is isolated through several lockout points, each person should attach a lock and tag to each lockout point.

(36) The need for multiple locks on each lockout point can be avoided by using a lock box. The lock box system uses only one lock at each lockout point. Keys to the locks of the plant's lockout points are inside a box which is locked by all the individual locks of people working on the same plant.

One Lock, One key

(37) Each person working on the plant should have their own lock, key and tag. There should be no duplicate key available for any lock, except a master or duplicate key for use in an emergency. The master or duplicate key should be secured with CFM and not readily available except in an emergency.

(38) During plant inspection, repair, maintenance, cleaning or adjustment, each authorised competent worker should only hold the one key to their lock. That person is responsible for both locking and unlocking the lockout device. If there are multiple energy sources or hazard must be locked out to enable safe shutdown of the plant, the same person should hold the single key to each lockout device.

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Section 6 - Tagging

(39) A tag is not an effective isolation device. A tag acts only as a means of providing information to others at the workplace. A lock should be used as an isolation device. However, where a lock is used a tag should also be incorporated to explain the purpose of the lockout. Commonly used warning tags are outlined below.

Personal Danger Tags

(40) A personal danger tag on the isolation devices of an item of plant or equipment is a warning that it is unsafe and that operating it may endanger the authorised competent worker who attached the tag. Personal danger tags should be restricted to workers who are authorised and competent to work on the plant or equipment. A personal danger tag should be attached to an isolator in a visible position whenever the isolator is used to lock out an energy source to allow work to be done. The personal danger tag should accompany each lock used in an isolation procedure and should identify the person who put the tag and lock in place, the time and date this occurred and the item of plant being isolated.

(41) The authorised competent worker who is working on the task should fasten their personal danger tag on all lockout devices involved in the isolation procedure. If more than one person is involved in the work, each person should attach their own lock and personal danger tag to the lockout device. Locks are available that have a personal danger tag incorporated to make sure the tag cannot be removed by any person other than the person who attached it. Removal of a personal danger tag from an isolating device should be carried out as soon as possible after completing the work. Only the person whose name is written on a personal danger tag should remove the tag. This should be done before leaving the worksite at the end of the shift.

(42) Where work on plant is not completed by the end of a working shift and the plant is required to remain isolated, arrangements should be made for out of service tags to be placed on each isolating point before the removal of personal danger tags. If work on the plant or equipment is to continue during the next shift, there should be a 'hand over' briefing by the shift leaving the site to the shift taking over the work. The briefing should include the status of the work and the removal or replacement of personal danger tags and locks.

Out of Service Tags

(43) An out of service tag is a notice that states appliances or equipment are out of operation for repairs and alteration, or plant that is still being installed. Do not operate an appliance or equipment with an out of service tag attached. Out of service tags should not be relied upon to provide personal protection. An out of service tag on an item of plant or equipment shows that the plant is unserviceable and should not be used. An out of service tag can be attached to non-powered plant such as ladders, jacks and trolleys and powered plant. Out of service tags should be attached to the main controls if possible, or to a prominent part if there are no controls, such as with damaged ladder.

(44) An authorised competent person with specific knowledge relating to the plant should attach out of service tags. Out of service tags should be placed on devices which isolate energy sources only when those devices are set in the 'off' or 'safe' position. Before attaching an out of service tag, all required details on the tag should be clearly entered in the spaces provided, with emphasis given to the reason for placing the tag. Tags should be securely fixed so they are clearly visible.

(45) In the absence of any personal danger tag or lock, removal of an out of service tag releases plant for use, and should not be done before ensuring that:

a. All people known to have been working on the plant are clear of the plant. An inspection of the plant shows that all machinery guards are in place, that all protective devices are functional, that all maintenance tools and aids have been removed, and that the equipment is safe for normal use. Out of service tags should provide a

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clear 'Do Not Operate' warning and warn that failure to obey may cause damage to the equipment and/or injury to a person. It is essential that isolating mechanisms which have out of service tags attached are not switched, manipulated, or interfered with while the tags are in place.

(46) Personal danger tags and out of service tags should not be used together on the same item of equipment because they relate to different circumstances. An out of service tag should be removed when a personal danger tag is added, and vice versa. On completion of maintenance, cleaning, or other work, remove the tags before the plant returns to operation. Only authorised competent persons responsible for installing the tags should remove them.

Section 7 - Testing Isolation Procedure

(47) After plant has been shut down, locked out and tagged, all isolated power sources should be tested, first with appropriate instruments and then by trying to re-activate the plant, before any authorised competent person starts work. A person who understands the complexity of the plant, or parts of the plant should do testing and starting the plant, including remote control stations and computers.

(48) It is not safe to assume an isolator has locked out an electricity source just because the isolator is in an open position. While the open position should create an air gap between contact points, electricity can weld the points together. If the contact points become welded together, the points remain connected even when the isolator appears to be open. Work on the plant should not begin until tests have confirmed it is safe to do so. Before using any instruments that test isolation procedure, ensure the testing equipment is calibrated and working properly.

(49) An authorised competent person involved in the task should ensure the isolation is completed and correct before commencing work. All workers approaching and accessing LV and HV electrical equipment for either operational or maintenance activities (including isolation and inspection) should ensure adequate steps for personal protection from possible electrical arc flash and touch voltages are considered.

Section 8 - Training and Competency

(50) The employer 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.

Each "Authorized Employee"

(51) Shall 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.

Each "Affected Employee"

(52) Shall be instructed in the purpose and use of the energy control program. All "other employees" whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempt to restart or reenergize machines or equipment which are locked or tagged out.

Retraining

(53) Shall be provided for all authorized employees and affected employees whenever: There is a change in their job assignments. A change in machines, equipment or processes that present a new hazard. When there is a change in the employer's LOTO program.

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Additional Training

(54) Whenever a periodic inspection reveals noncompliance. 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 employer shall certify that employee training has been accomplished and is being kept up to date. When a Tag Out system is used, the employees shall also be trained in the limitations of tags.

Section 9 - Appendix

Term	Definition
Job Hazard Analysis (JHA)	Also called a Job Safety Analysis (JSA). This is a technique to identify the hazards and risks of specific tasks to reduce the risk of injury to workers.
Safe work method statement (SWMS)	In relation to high-risk construction work, is a safe work method statement mentioned in section 299 of Work Health and Safety Regulation 2011.

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