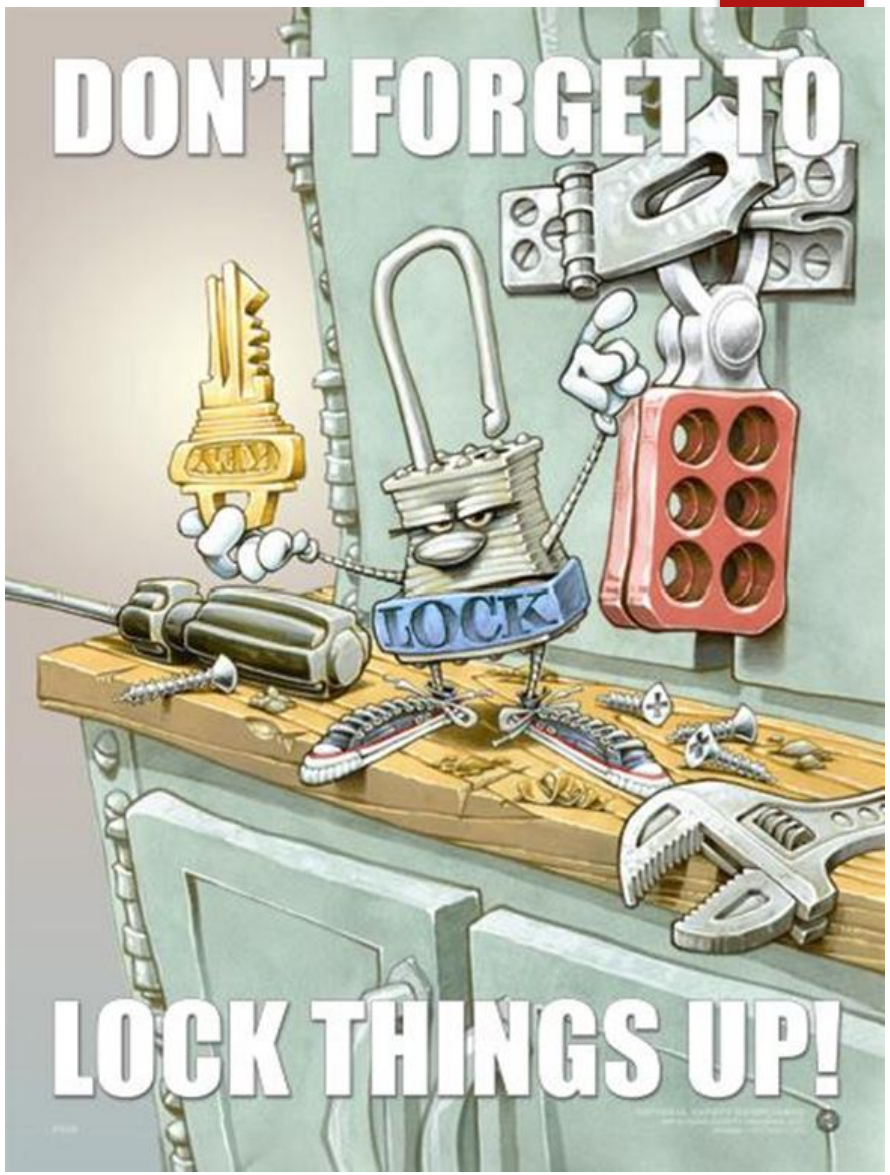
OSH for ENGINEERS

ENGG 1030

Joanne S. Dionela, ChE

7. Control of Hazardous Energy: Lockout/Tagout (LOTO)



Control of Hazardous Energy

The laser produces the hottest known temperature known to man on this earth…what produces the second hottest?

Hazardous Energy

What is Hazardous Energy?

Energy that has the _____ to cause injury or even death.

- ✓ Compressed air
- ✓ Electrical
- ✓ Hydraulic
- ✓ Light
- ✓ Radio Frequency
- ✓ Batteries
- ✓ Gas
- ✓ Thermal
- ✓ Chemical
- ✓ Mechanical
- ✓ Magnetic
- ✓ Gravity
- ✓ Springs
- ✓ Robotics

Injuries from Hazardous Energy

What kind of Injuries can happen?

- ✓Electrocution from live parts
- ✓Scalding from steam or hot liquids
- ✓Chemical burns or poisoning
- ✓From machinery:
  - Deep cuts and gashes
  - Crushing injuries
  - Amputations
- ✓All of these can be fatal when severe

Hazardous Energy Matrix

Hazardous Energy	Criteria	Equipment Examples	Injury Type / Risk
ELECTRICAL	➢ Voltage over 50 volts ➢ All radio frequencies (RF)	➢ Varian Implanter ➢ Electrical Substation ➢ Motor Control Center ➢ Breaker panels ➢ Plasma etcher	➢ Electrical Shock (could result in ventricular fibrillation) ➢ Thermal Burns ➢ Fire/Explosion ➢ Secondary Injuries (falls, broken bones, etc.)
CHEMICAL	➢ Any chemical system (for flammable chemicals) that is used to hold, deliver or drain Hazardous Production Materials (HPM) ➢ Any system capable of dispensing HPM outside its containment ➢ Any system where HPM gas (toxic or pyrophoric) is present	➢ Wet stations ➢ Varian Implanter ➢ Gas panel or valve manifold box	Health hazards: ➢ Chemical Splash ➢ Inhalation, Burns ➢ Dermatitis Physical Hazards: ➢ Fire/Explosion ➢ Chemical reaction ➢ Flammable vapors ➢ Displacement of oxygen.

Hazardous Energy Matrix

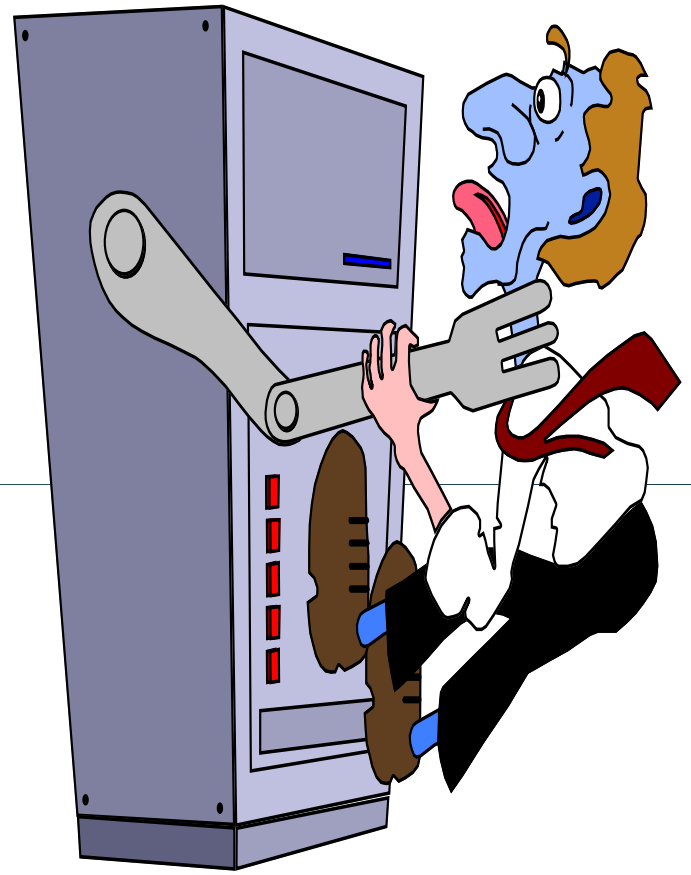
Hazardous Energy	Criteria	Equipment Examples	Injury Type / Risk
MECHANICAL	➢ Any open or accessible moving mechanical device that has the potential to pinch, poke or drop on a working technician	➢ Robotic arm ➢ Bench drill ➢ Hand drill ➢ Chamber lids	➢ Crushing ➢ Amputation ➢ Entanglement ➢ Pinching
THERMAL	➢ Any delivery energy colder than 32°F or hotter than 140°F	➢ Cutting and welding equipment ➢ Varian Implanters ➢ Radio frequency generators (subfab) ➢ Heated acid baths ➢ Diffusion furnace ➢ Solder pot	➢ Burns – Hot or Cold ➢ Fire ➢ Injury to eyes ➢ Skin damage ➢ Secondary injuries (falls, broken bones, etc.)

Hazardous Energy Matrix

Hazardous Energy	Criteria	Equipment Examples	Injury Type / Risk
POTENTIAL OR STORED	➢ Any non-hazardous (inert) compressed gas present which has potential for injury ➢ Backup electrical systems	➢ Pressured gases and liquids ➢ Gas cylinders ➢ Compressors ➢ High vacuum system ➢ Vacuum pump ➢ UPS	➢ Punctures ➢ Secondary injuries (falls, broken bones, etc.) ➢ Physical hazards, i.e. projectiles ➢ Exposure to corrosives ➢ Electrical shock
OTHER	➢ Any system or tool containing class IIIb and IV lasers ➢ Any system or tool where air or fluid activated devices exist.	➢ Air handling units ➢ Trash Compactors	➢ Injury to eyes – lasers ➢ Confusions ➢ Crushing ➢ Injections

The "Fatal 5" Main Causes of Injuries

1. Failure to stop equipment.
2. Failure to disconnect from power source.
3. Failure to dissipate (bleed, neutralize) residual energy.
4. Accidental restarting of equipment.
5. Failure to clear work areas before restarting.



Control of Hazardous Energy: LOTO

What is Lockout-Tagout (LOTO)?

A procedure to control hazardous energies by:

1. Ensuring that machines or equipment are isolated from all potentially hazardous energy sources, and, locked out and tagged out before employees or personnel perform any servicing or maintenance.

2. Preventing unexpected energization, start-up or release of stored energy in machines or equipment that will cause a severe injury.

3. Eliminating inadvertent activation to secure the machine or equipment and protect workers in the area.

Key Terms to Remember

Authorized Employee - A person who is certified to lockout/tagout equipment or machinery.

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

Other employees - All employees who are or may be in an area where energy control procedures may be utilized.

Key Terms to Remember

Capable of Being Locked-Out - An energy-isolating device is considered capable of being locked out if it:

✓Is designed with a hasp or other means of attachment to which a lock can be affixed.

✓Has a locking mechanism built into it.

✓Can be locked without dismantling, rebuilding, or replacing the energy-isolating device or permanently altering its energy control capability.

Key Terms to Remember

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 and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

Key Terms to Remember

Energized – Machines and equipment are energized when they are connected to an energy source or they contain residual or stored energy.

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

Isolation Point – location of energy-isolating device or energy source to be isolated by affixing lockout and Tagout device.

Key Terms to Remember

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

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

Key Terms to Remember

Tagout - The placement of a tagout device on an energy-isolating device, in accordance with an established procedure.

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

Energy-Isolating Devices

Examples of Energy-Isolating Devices:

Valves

plugs

circuit breaker

***Anything else that positively blocks or isolates energy.**

Examples of Lockout Devices

Plug Lockout

Pneumatic Lockout

Circuit Breaker Lockout

Cylinder Lockout

Examples of Lockout Devices

Ball valve lockout

Gate Valve Lockout

Examples of Lockout Devices

Universal valve lockout

All-purpose cable lockout

Chain lockout

Examples of Lockout Devices

Multiple-lock Hasp/Group Lockout

Examples of Lockout Devices

Pipe Lockout:

Paddle/slip blind

Spectacle Blind

Blind Flange

Examples of Tagout Devices

LOTO Devices must be:

1. **Standardized**
2. **Durable**
3. **Substantial**
4. **Identifiable**

Key Components of Energy Control Program

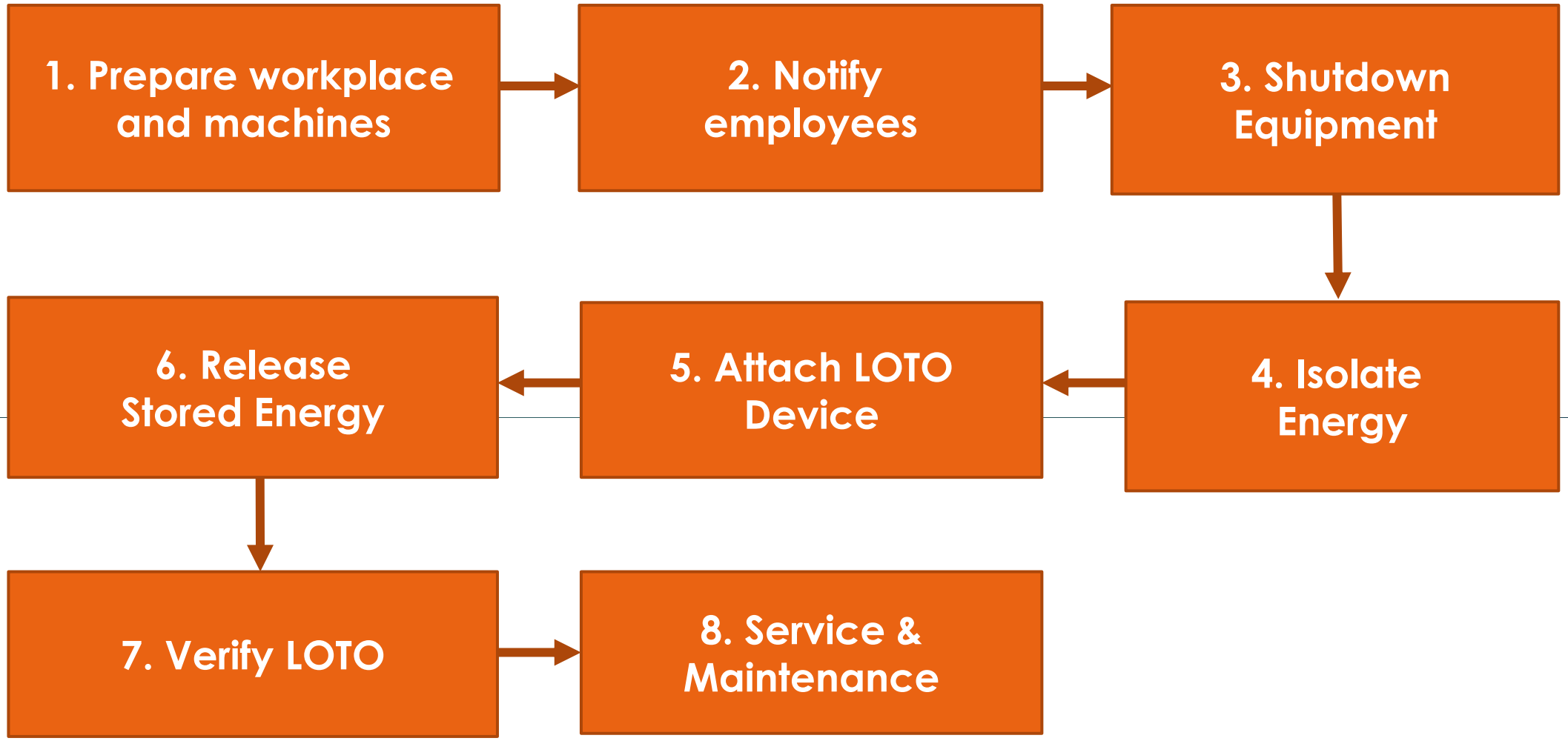
1. **Equipment-Specific Lockout/Tagout Procedure** - Energy control procedures for each type of machine.

2. **Training and retraining** - to ensure employees: authorized, affected, other employees understand the program.

3. **Lockout/Tagout Hardware** – Standard and adequate devices required to lockout and Tagout energy sources.

4. **Inspections/audits** - Periodic and random inspections conducted to ensure procedures and standards are being followed.

Lockout/Tagout (LOTO) Installation Process



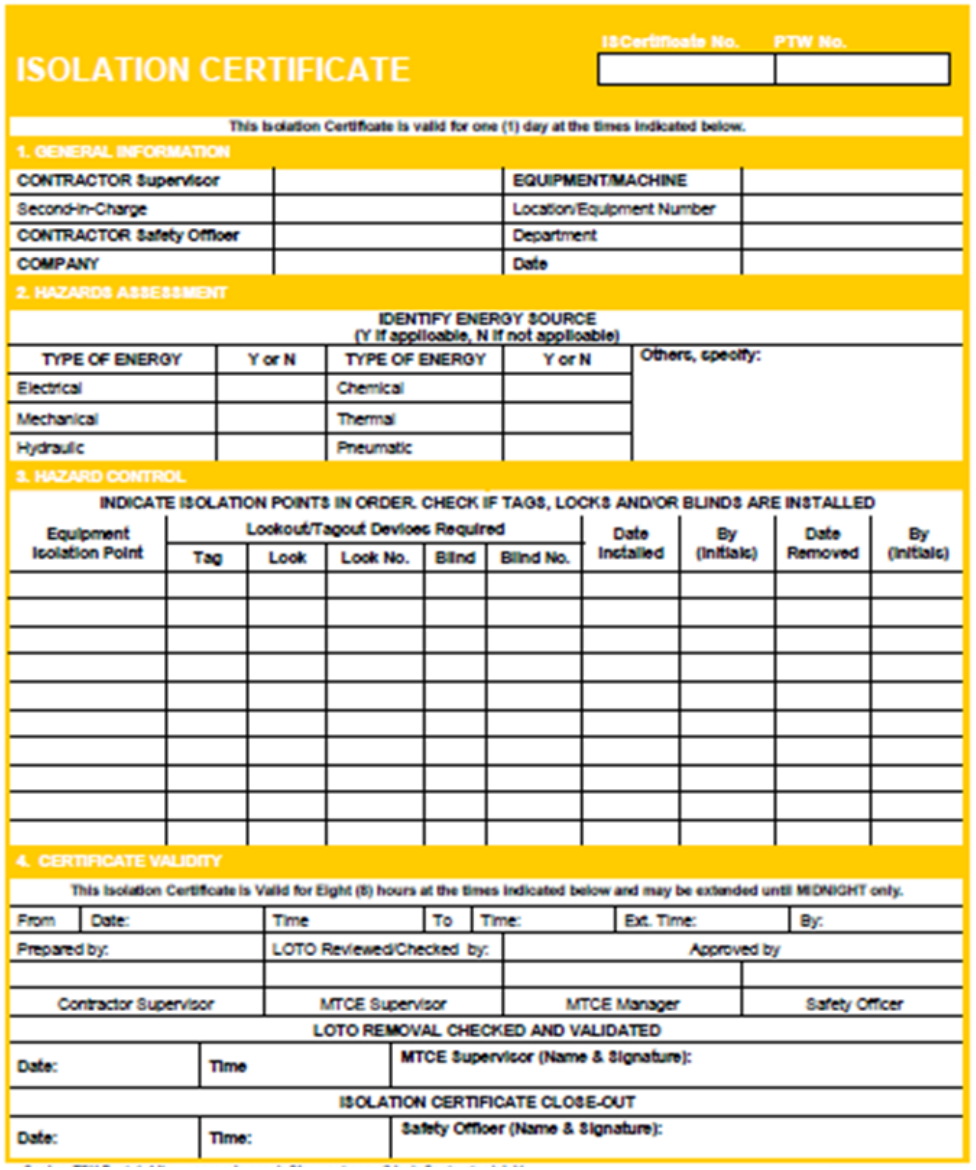
IMPORTANT: Lockout/Tagout must be done by authorized personnel only.

Example of Isolation Points Identification

1 Electrical	
2 Water	
3 Water	
4 Water	

5 Water	
6 Water	
7 Pneumatic	

Example of Isolation Certificate



ISOLATION CERTIFICATE

IS Certificate No.	PTW No.

This Isolation Certificate is valid for one (1) day at the times indicated below.

1. GENERAL INFORMATION

CONTRACTOR Supervisor		EQUIPMENT/MACHINE	
Second-in-Charge		Location/Equipment Number	
CONTRACTOR Safety Officer		Department	
COMPANY		Date	

2. HAZARDS ASSESSMENT

IDENTIFY ENERGY SOURCE
(Y if applicable, N if not applicable)

TYPE OF ENERGY	Y or N	TYPE OF ENERGY	Y or N	Others, specify:
Electrical		Chemical		
Mechanical		Thermal		
Hydraulic		Pneumatic		

3. HAZARD CONTROL

INDICATE ISOLATION POINTS IN ORDER. CHECK IF TAGS, LOCKS AND/OR BLINDS ARE INSTALLED

Equipment Isolation Point	Lockout/Tagout Devices Required					Date Installed	By (Initials)	Date Removed	By (Initials)
	Tag	Lock	Lock No.	Blind	Blind No.				

4. CERTIFICATE VALIDITY

This Isolation Certificate is Valid for Eight (8) hours at the times indicated below and may be extended until MIDNIGHT only.

From	Date:	Time	To	Time:	Ext. Time:	By:

Prepared by:	LOTO Reviewed/Checked by:	Approved by	
Contractor Supervisor	MTCE Supervisor	MTCE Manager	Safety Officer

LOTO REMOVAL CHECKED AND VALIDATED

Date:	Time	MTCE Supervisor (Name & Signature):

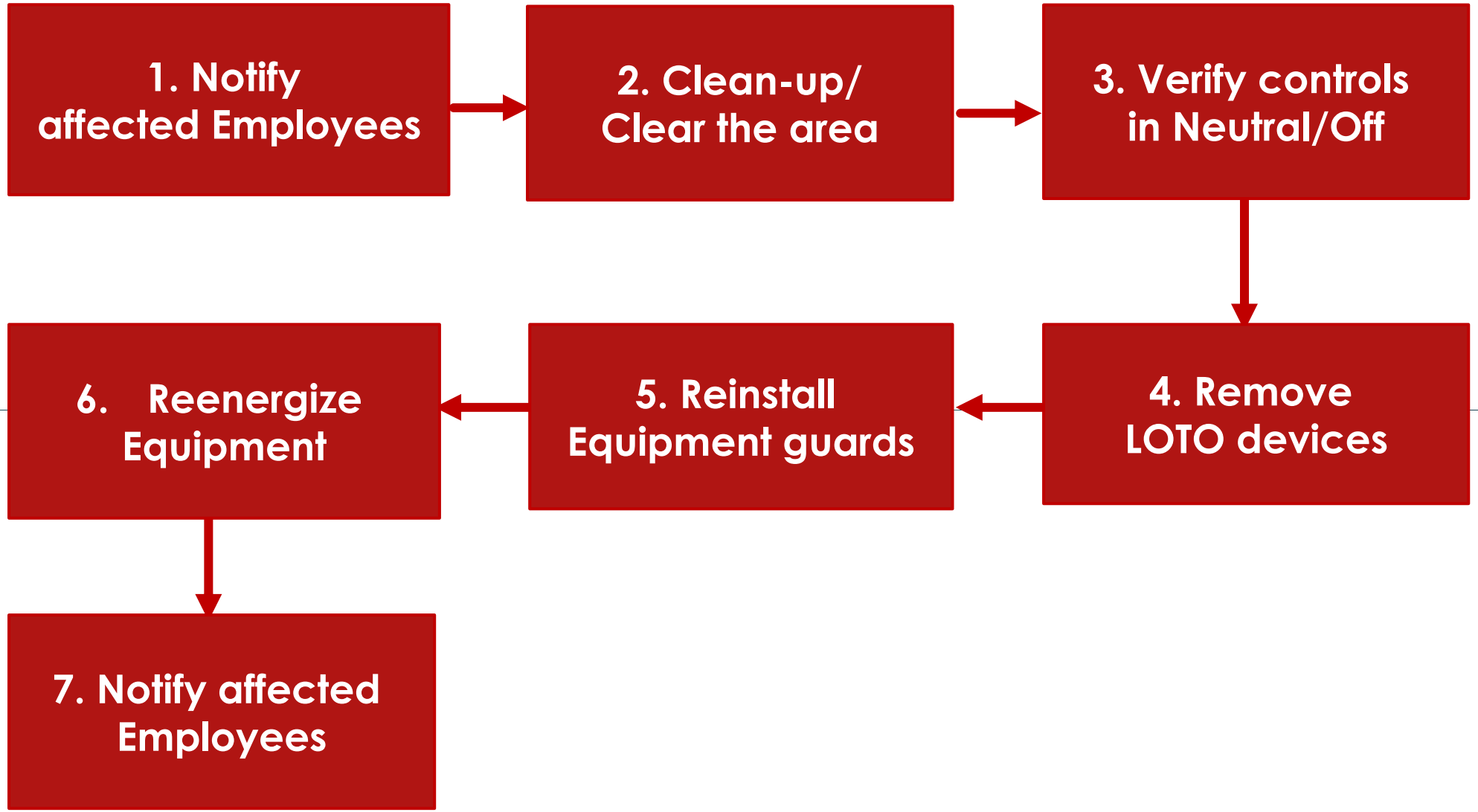
ISOLATION CERTIFICATE CLOSE-OUT

Date:	Time:	Safety Officer (Name & Signature):

An Isolation Certificate serves as permit to isolate the energy isolating devices and an attachment to General Permit to Work under the Permit-to-Work System/Program of a company. It indicates the following:

- ✓ Contractor supervisor or authorized personnel/employee assigned on the machine or equipment
- ✓ Location of the machine or equipment
- ✓ Type of machine or equipment energy source(s)
- ✓ The devices to be isolated or equipment isolation points.
- ✓ Tagout and types of lockout devices used.

Lockout/Tagout (LOTO) Removal Process



Examples of Equipment-Specific LOTO Procedure

Lockout-Tagout Procedure

ID #: LP185
Revised: 10/3/2013
Approved: John Smith

Baler B531
Main Building: Section J

LOCKOUT APPLICATION PROCESS

1. Notify affected personnel 2. Properly shut down machine 3. Isolate all energy sources
4. Apply lockout devices, locks, and tags 5. Verify total de-energization of all sources

Lockout Points	Notes	Lockout Authority
4		

ENERGY SOURCE	DEVICE	METHOD	PICTURE
GRAVITY	Yellow Baler Press Arm	Move Press Arm to ground OR install Machine Block to brace Press Arm	
CONTROL PANEL	Control Panel: CP on unit.	Power off and remove key.	
ELECTRICAL 480V	Electrical Disconnect: Local Disconnect on unit.	Move to off position and Lockout.	
ELECTRICAL 480V	Electrical Disconnect: BALER B531 DISCONNECT on wall behind unit.	Move to off position and Lockout.	

LOCKOUT REMOVAL PROCESS

1. Ensure all tools and items have been removed 2. Confirm that all employees are safely located. 3. Verify that controls are in neutral. 4. Remove lockout devices and reenergize machine 5. Notify affected employees that servicing is completed.

Martin Technical Lockout Systems www.MarTechnical.com

ESC

LOCKOUT-TAGOUT PROCEDURE

OSHA CFR 1910.147

Developed by	Reviewed by	Revised by
ESC	ESC	

Description: Air Compressor #1 — Equipment #: 866.773.7541
Location: South Utility Building — Area: Utilities — Revn: 0 — Date: N/A — Origin Date: 3/13/2013

5 Isolation Points to be Locked and Tagged

NOTE
Only shut down Air Compressor #1 when Air Compressor #2 is fully operational. Shutting down both compressors will affect facility operations.

NEXT AUDIT DUE MAR 2014 | NEXT AUDIT DUE MAR 2015 | NEXT AUDIT DUE MAR 2016 | NEXT AUDIT DUE MAR 2017

South Side View

North Side View

West Side View

ALWAYS PERFORM A MACHINE STOP BEFORE LOCKING OUT DISCONNECTS

ID	Source	Device	Location	Method	Check
E-1	Electrical 4400V	Padlock	Isolation point located on MCC-L7274M.	Move electrical disconnect "Air Compressor #1" to off. Lock out.	Attempt restart at CP-1.
E-2	Electrical 480V	Padlock	Isolation point on North side of unit.	Move electrical disconnect to off. Lock out.	Attempt restart at CP-1.
P-1	Pneumatic Outlet - 120 PSI	Cable device	Isolation point located above unit.	Turn valve to closed position. Lock out. Open bleed valve.	Visually verify zero pressure status.
W-1	Cooling Water Inlet - 40 PSI	Cable device	Isolation point on North side of unit.	Turn valve to closed position. Lock out.	Visually verify zero pressure status.
W-2	Cooling Water Inlet - 40 PSI	Cable device	Isolation point on North side of unit.	Turn valve to closed position. Lock out.	Visually verify zero pressure status.
	Thermal Energy 300 F		Be sure to wait until heat has dissipated from machine until cool to touch before servicing. Wear proper PPE before beginning work.		
	Kinetic Energy 600 RPM		Be sure to wait until all moving parts have come to a complete stop. If necessary, use a block or chain to prevent equipment from moving while servicing.		

DANGER

ESC
866-773-7541

OPENING A GUARD DOES NOT CONSTITUTE A LOCKOUT
Any machine modifications must be shown in procedure. Contact safety department to update procedure.

Safety Is Your Responsibility!

DANGER

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LOTO - Air Compressor Example

Other Considerations in LOTO Program

- Extended Lockout/Tagout.
- Lockout/Tagout procedure involving more than one person.
- Contractors performing service or maintenance. Contractors should provide their own lockout/tagout devices and follow lockout/tagout procedure of the company.
- Worker who applied LOTO is not available.

Questions?