"Lockout/Tagout" refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities. This requires, in part, that a designated individual turns off and disconnects the machinery or equipment from its energy source(s) before performing service or maintenance and that the authorized employee(s) either lock or tag the energy-isolating device(s) to prevent the release of hazardous energy and take steps to verify that the energy has been isolated effectively. If the potential exists for the release of hazardous stored energy or for the re-accumulation of stored energy to a hazardous level, the employer must ensure that the employee(s) take steps to prevent injury that may result from the release of the stored energy.

Lockout devices hold energy-isolation devices in a safe or "off" position. They provide protection by preventing machines or equipment from becoming energized because they are positive restraints that no one can remove without a key or other unlocking mechanism, or through extraordinary means, such as bolt cutters. Tagout devices, by contrast, are prominent warning devices that an authorized employee fastens to energy-isolating devices to warn employees not to reenergize the machine while he or she services or maintains it. Tagout devices are easier to remove and, by themselves, provide employees with less protection than do lockout devices.

WHY LOCKOUT / TAGOUT:

Lockout/Tagout is performed to prevent injury to personnel or damage to property and or environment by the unexpected release of hazardous energy/materials. When planning a lockout, it is important to consider the nature of all hazardous energy/materials that may be present.

WHAT IS HAZARDOUS ENERGY:

Energy sources including electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other sources in machines and equipment can be hazardous to workers. During the servicing and maintenance of machines and equipment, the unexpected startup or release of stored energy can result in serious injury or death to workers.
Workers servicing or maintaining machines or equipment may be seriously injured or killed if hazardous energy is not properly controlled. Injuries resulting from the failure to control hazardous energy during maintenance activities can be serious or fatal! Injuries may include electrocution, burns, crushing, cutting, lacerating, amputating, or fracturing body parts, and others.

- A steam valve is automatically turned on burning workers who are repairing a downstream connection in the piping.
- A jammed conveyor system suddenly releases, crushing a worker who is trying to clear the jam.
- Internal wiring on a piece of factory equipment electrically shorts, shocking worker who is repairing the equipment.

Craft workers, electricians, machine operators, and laborers are among the millions of workers who service equipment routinely and face the greatest risk of injury.

**WHEN LOCKOUT & TAGOUT IS REQUIRED:**

When someone will be servicing, repairing or doing Installation & Commissioning of machinery or equipment AND the unexpected machinery start-up or release of stored energy could cause injury.

Establish minimum performance requirements for the control of hazardous energy.

**WHAT KIND OF INJURIES CAN HAPPEN:**

Most accidents that still occur when lockout/tagout procedures are in place are a result of ignorance or improper training. Everyone using and potentially maintaining a machine must be trained on proper lockout/tagout procedures for it, and retraining should occur any time a new machine is brought into a workplace. Not only must everyone be trained, but they need to understand that the lockout/tagout process must be followed every time, regardless of the situation.

Various accidents/ injuries resulting due to non-adherence LOTO procedure:
➢ From machinery:
   - Deep cuts and gashes
   - Crushing injuries
   - Amputations
➢ Shock/Electrocution from live parts
➢ Scalding from steam or hot liquids
➢ Chemical burns or poisoning
➢ All of these can be fatal when severe

**Fatality Example:** A man working inside a supermarket cardboard compactor was crushed when the unblocked compactor suddenly came down on top of him.

**WHAT IS HAZARDOUS ENERGY:**
Hazardous energy is one of the following:

- Electricity – live or stored
- Moving machinery parts
- Stored heat (steam lines or hot liquids)
- Chemicals in pipelines under pressure or force
- Any other active or stored energy sources that could harm a person
- Engines that move machinery parts
ENERGY ISOLATION:

Separation of the equipment, machinery or area where work is to occur, from sources of hazardous energy or materials in such a way that only a conscious and deliberate act can restore the connection.

Examples:

- Tagging and Isolation is an extremely important part of safely accomplishing a vessel entry. The vessel must be completely isolated from all lines entering/exiting the vessel and all moving/rotating equipment must be de-energized and disconnected.

- Rotating equipment must be secured from rotating and disconnected from their drive mechanisms by one of the following:
  - Disconnect the drive coupling
  - Remove drive belts
  - Isolate the motor at the breaker (MCCB in this case)

The appropriate prime mover must be properly tagged.
Servicing, Maintenance, Installation, Commissioning, Constructing, And Retrofitting: These activities often require a worker to place all or part of their body into the machine’s hazard zone.

WHAT IS AN ENERGY ISOLATING DEVICE:

A mechanical device that physically prevents transmission or release of energy such as: Anything else that positively blocks or isolates energy.

LOCKOUT DEVICE:

A piece of equipment that prevents the unauthorized or accidental operation of a hazardous-energy-isolating device. Locks are an essential element of a lockout device.
Electrical Lockout Devices:

- Locked out circuit breaker
- Locked out electrical panel and changeover switch
- Locked out electrical plug

Fluid & Gas Lockout Devices:
Pipe Lockout-

Slip plate for Lockout

End Flange for Pipe lockout

Pneumatic Lockout-

End Flange for Pneumatic lockout
LOTO - DEFINITIONS & PRINCIPLES:

Principles Governing LOTO-

All sources of hazardous energy shall be identified prior to initiating any lockout/tagout.

All sources of hazardous energy shall be removed or controlled prior to potential exposure to the hazards.

Examples of removing or controlling hazardous energy:

- Disconnecting power and discharging any capacitance
- Isolating pressure sources and releasing the pressure
- Stopping rotating devices and securing them from further movement
- Releasing stored hazardous energy
- Lowering or securing equipment to prevent movement caused by gravity
- Protecting equipment from external forces (e.g., wind) that may cause movement

Before starting work, each individual working on a task must determine, to his or her satisfaction, that appropriate isolations are in place and the isolations are secure for the task in which he or she is involved. Where a lock can be applied, tagout alone shall not be used to control exposure to sources of hazardous energy. Where a lock cannot be applied, site procedures shall address the use of Tagout and the additional steps essential to help ensure a level of safety equivalent to that obtained by using lockout. Each person potentially exposed to the hazardous energy must place a lock and tag, when a lock can be applied. Individuals who enter the hazard zone of a lockout shall be considered potentially exposed to the hazard.

Note:
An exception to this principle shall only be made when the site has a written procedure describing the method of controlling, accounting for, and recording an individual’s involvement in the lockout.

Each person potentially exposed to the hazardous energy must participate in the lockout/tagout. Clear communication of the lockout’s/tagout’s status shall be ongoing.

An energy source shall be considered energized until the source is removed and the energy isolation is verified according to the Lockout/Tagout Procedure. An effective verification (try) step must be performed. All interlocks that may prevent an effective try step must be accounted for. A test for the absence of voltage must be performed for all electrical hazards.
**LOTOPROCEDURE:**

**LOTOPROCEDURE Describes:**

- Procedure of Lockout & Tagout
- Preparation of Lockout and Tagout
- Sequence of Lockout and Tagout
- Re-commissioning / Taking back in line, of systems after maintenance
- Lockout and Tagout Procedure involving more than one agency
- Lockout and Tagout Procedures Involving Shifts
- Temporary Removal of Lockout/Tagout Devices
- Maintenance requiring undisrupted energy supply
- Lockout Devices and Locks Tagout and Tags
- Contractors
- Exceptions
- Review of LOTO Completion
- Audit
- Training & Record keeping

**Isolation From Energy – who all are involved:**

Following persons/groups are involved in day-to-day planning and preparing for the lockout:

- Owners group supervision / Permit Issuer
- Person In-charge/ Permit Acceptor
- Authorized Electrical person (for all work requiring electrical energy isolation)
- Contractor’s supervision/ Service provider
- Other agencies/ functions (depending on the isolation and work scope)

**Isolation of Energy – Planning and Preparation:**

The following steps must be performed as planning and preparing for the lockout:

- Review appropriate drawings, and locate all energy isolating devices.
- Review energy isolating devices to determine adequacy of their isolating capability.
- Check for back feeds and dual feeds (in electrical systems and where applicable).
Lockout Procedures – Six Steps –

1. Notify affected employees that machine or equipment will be shut down and locked out.
2. Shut down the machinery or equipment Isolate energy sources with energy-isolating devices.
3. Lock out energy-isolating devices with assigned locks.
4. Release or restrain stored or residual energy.
5. Test machinery to make sure it can’t start up.
6. Service & maintenance

**ISOLATION FROM ELECTRICAL ENERGY**:

Prior to any work being performed on or near any electrical component that *could* become energized, through the operation of an isolation device such as a switch or breaker, the isolation device must be placed in the open or off position and locked and tagged in that position.

Lock Placement -- Locks must be placed on main disconnect switches

**NOT on control circuits**
### Electrical Energy Isolation Method

#### ISOLATION FROM MECHANICAL ENERGY:

**Isolation From Mechanical Energy**

Prior to any work being performed on any mechanical equipment such as a press, pump, compressor, blower, fan etc the motor or driver must be isolated from its source of energy. The source of energy could be electrical, hydraulic, pneumatic, residual energy (e.g. gravity) etc. The source of energy must be locked and tagged out.

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<table>
<thead>
<tr>
<th>Sr No</th>
<th>Electrical Energy Source</th>
<th>Location of LOTO point</th>
<th>LOTO</th>
<th>Isolation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>220KV source</td>
<td>Breakers/Isolators on respective panels</td>
<td>Lock Out Tag Out</td>
<td>Switch Off and Isolate Control Supply</td>
</tr>
<tr>
<td>2</td>
<td>132KV source</td>
<td>Breakers/Isolators on respective panels</td>
<td>Lock Out Tag Out</td>
<td>Switch Off and Isolate Control Supply</td>
</tr>
<tr>
<td>3</td>
<td>33kV, 6.6KV source</td>
<td>Breakers on respective panels</td>
<td>Lock Out Tag Out</td>
<td>Rack out</td>
</tr>
<tr>
<td>4</td>
<td>415V Source</td>
<td>PCC/ MCC/ PDB feeder</td>
<td>Lock Out Tag Out</td>
<td>Rack out / Fuse removal</td>
</tr>
<tr>
<td>5</td>
<td>415V or less Source with LO provision</td>
<td>TBB/ DB / Power points / Control Panels</td>
<td>Lock Out Tag Out</td>
<td>Fuse removal/ Switching OFF power from MCB/ MCCB/ ELCB/ RCCB Isolator</td>
</tr>
<tr>
<td>6</td>
<td>415V or less Source without LO provision</td>
<td>DB / Power points / Control Panels</td>
<td>Tag Out Develop SOP</td>
<td>Fuse removal/ Switching OFF power from MCB/ MCCB/ ELCB/ RCCB Isolator</td>
</tr>
<tr>
<td>7</td>
<td>Lightingcircuit Distribution (230V)</td>
<td>LDB</td>
<td>Lock Out Tag Out</td>
<td>Switching OFF power from MCB/MCCB/ELCB/RCCB Isolator</td>
</tr>
<tr>
<td>8</td>
<td>415V / 230V/110V sockets</td>
<td>Socket/PDB</td>
<td>Lock Out Tag Out</td>
<td>Removal of plug</td>
</tr>
<tr>
<td>9</td>
<td>220V DC</td>
<td>MCC / PDB feeder</td>
<td>Lock Out Tag Out</td>
<td>Rack out / Fuse removal</td>
</tr>
</tbody>
</table>

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**Truck bed lockout**

**Punch press blocks**
**ISOLATION FROM PLANT PROCESSES:**

Prior to any work being performed on any piping or vessel system that *could* have any hazardous process materials introduced into it (including, hot water or compressed air) through the operation of an isolation device such as a valve, the isolation device must be placed in the closed or off position and locked in that position.

*Example of hazardous materials include:*

- Corrosive (acids, caustics etc)
- Toxic (Chlorine, solvents etc)
- Flammables (CNG, Propane, HSD, LDO, Paints/thinners etc)
- High pressure, regardless of material (e.g., air, water)
- High temperature, regardless of material

**ISOLATION FROM STORED ENERGY:**

- Hazardous energy may exist as stored energy.
- Stored energy must be relieved prior to working on such equipment. Examples of stored energy are springs, elevated weights, contained pressure, flywheels, capacitors, etc.

**LOTO – DEVICES:**

![Image of LOTO devices]