

book

## 1. Zero Energy State - ZES 001 / ZES 003R: LOCKOUT, TAGOUT AND ZERO ENERGY

### 1.1 L and D Slide



# 04

## Lockout, Tagout and Zero Energy



Never  
perform  
maintenance  
or interventions  
on installations  
or equipment  
without  
confirming that  
all sources of  
energy have  
been blocked,  
identified and  
tested to be in  
a state of  
"zero energy".

CAR 04

Start

## 2. Overview

### 2.1 Overview



## 2.2 Introduction

Zero Energy State: **ZES 001 / ZES 003R**

### Introduction



There are many situations where workers performing maintenance, inspections or related activities would be at risk if there were to be an unexpected release of energy, mechanical movement, or material flow to equipment or a process.

The Zero Energy State (ZES) Program, training and procedures are intended to give all Vale and Non Vale personnel the ability to protect themselves by reducing that risk to get **HomeSafe**.

## 2.3 Introduction

Zero Energy State: **ZES 001 / ZES 003R**

### Introduction



This module is one component within the ZES Zero Energy State program.

Other components include CAR04 Lockout/Tagout and ZERO Energy, and hands-on instruction for de-energizing processes and equipment.



## 2.4 Introduction

Zero Energy State: ZES 001 / ZES 003R

### Introduction



Upon successful completion of this module you will be required to schedule and attend the hands-on component where you will receive further instruction for the Lockout/Tagout procedures for the switches and equipment you will be operating.

Be Aware that you must be *both* “Qualified” and “Authorized” prior to performing any Lockout/Tagout procedure.

## 2.5 Prerequisites

Zero Energy State: **ZES 001 / ZES 003R**

### Prerequisites

ZES MODULE 003: LOCKOUT, TAGOUT AND ZERO ENERGY is to be used for annual re-qualification of the knowledge components of the full ZES program for those individuals who are still actively working with energy isolation, locking and tagging.

The prerequisite for this module is the successful completion of the CAR04 Lockout/Tagout and ZERO Energy module.

## 2.6 Learning Objectives

Zero Energy State: **ZES 001 / ZES 003R**

### Learning Objectives

By the end of this module you will be able to:

- Explain the concept of energy.
- Describe the nine types of energy (Electrical; Gravitational Energy or Gravitational Potential Energy; Hydraulic or Water; Mechanical; Pneumatic; Chemical; Radioactive or Nuclear; Thermal; Residual or Stored).
- Identify the types of lockout devices and their uses.
- Describe the risks you are subject to when not using the safety devices and PPE.
- Describe the risks if you use them incorrectly and the preventive measures.
- List each step of the lockout and tagout procedure and activities that must be performed in the installation and removal of lockout/tagout protection.
- Recognize the existence and importance of the Vale instructions, local legislation, and the local procedures for safe lockout and tagout activities.

## 3. Definitions

### 3.1 Overview

Zero Energy State: **ZES 001** / **ZES 003R**



## DEFINITIONS

## 3.2 Introduction

### Zero Energy State: ZES 001 / ZES 003R

The following are Definitions of terminology used within the Zero Energy State Program.

**Zero Energy State;**

A state where all hazardous energy has been isolated and de-energized, or otherwise controlled to manage risk.



### 3.3 Isolation Equipment Operator;

Zero Energy State: **ZES 001 / ZES 003R**

The following are Definitions dealing with the Zero Energy State Program.

#### **Isolation Equipment Operator;**

A qualified person who operates the energy isolation device(s). e.g. controls, valves, etc.



#### **Is there an official rule for left hand switching?**

We often hear about the left hand rule.  
The left hand rule is the best practice but if you cannot operate the switch in that fashion, escalate to your supervisor, assess the situation through risk management and apply another method.



### 3.4 Protected Worker; Tagger;

Zero Energy State: **ZES 001 / ZES 003R**

The following are Definitions dealing with the Zero Energy State Program.

***Protected Worker;***

A tagger who has installed their personal protection and has verified a zero energy state.

***Tagger;***

Tagger: a qualified worker who installs and removes their personal protection and manages status tags.





### 3.5 Designated Tagger;

Zero Energy State: **ZES 001 / ZES 003R**

The following are Definitions dealing with the Zero Energy State Program.

***Designated Tagger;***

A qualified worker or another person who installs and removes Project personal protection and manages status tags.



**I.M. 3582922: Designated tagger off property and project lock cut off:**

A lock box for a water pump was to be disassembled. The designated tagger was on vacation and could not be reached. ZES program was followed and project lock was removed.





### 3.6 Qualified: Authorized;

Zero Energy State: **ZES 001 / ZES 003R**

The following are Definitions dealing with the Zero Energy State Program.

**Qualified;**

A competent person designated by their employer as being qualified because of knowledge, training and experience to safely perform an assigned task.

**Authorized;**

A person who has been given permission to perform the task.



**ATTENTION**

You must be *both Qualified and Authorized* before performing any Lockout/Tagout procedure.



### 3.7 Local Tagger;

Zero Energy State: **ZES 001 / ZES 003R**

The following are Definitions dealing with the Zero Energy State Program.

**Local Tagger;**

A qualified person who uses a Remote Tagger to install the local Tagger's personal protection locks and tags on Energy Isolating Devices.

**Remote Tagger;**

A qualified person operating, locking and tagging remote energy isolating devices on behalf of the Local Tagger (e.g. Control Room Operators, Sandfill Plant Operators).



### **3.8 Device; Isolate:**

Zero Energy State: **ZES 001 / ZES 003R**

The following are Definitions dealing with the Zero Energy State Program.

***Device;***

A piece of equipment or a mechanism designed to serve a special purpose or perform a special function.

***Isolate:***

To introduce any number of approved physical barriers between the equipment and all sources or forms of energy and/or process material.



### 3.9 Equipment;

Zero Energy State: **ZES 001 / ZES 003R**

The following are Definitions dealing with the Zero Energy State Program.

***Equipment;***

Any machine driven by electricity or any other prime mover and/or combination of machines that operate as a system/process.

Such as pumps, fans, electrical motors, mobile machines, vessels, piping, valves, etc.



### 3.10 Question 1

*(Multiple Choice, 10 points, unlimited attempts permitted)*

## 4. Hazardous Energy

### 4.1 HAZARDOUS ENERGY

Zero Energy State: ZES 001 / ZES 003R



**HAZARDOUS ENERGY**

## 4.2 Introduction

Zero Energy State: **ZES 001 / ZES 003R**



### HAZARDOUS ENERGY

Hazardous energy is defined: "any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or other energy that can harm personnel" (CSA Z460-13 *"Control of Hazardous Energy - Lockout and Other Methods"*).

Some energy sources are obvious, such as electricity, heat in a furnace, or something that might fall. Others may be hidden hazards such as air pressure in a system or a tightly wound spring.

In this module, the term energy refers to anything that can provide power to a system to allow it to perform work. The term system refers to machinery, equipment, and/or processes.

### 4.3 GRAVITATIONAL ENERGY OR GRAVITATIONAL POTENTIAL ENERGY

Zero Energy State: **ZES 001 / ZES 003R**



Hazard

#### GRAVITATIONAL ENERGY OR GRAVITATIONAL POTENTIAL ENERGY

Gravitational potential energy is the energy related to the mass of an object and its distance from the earth (or ground).

The heavier an object is, and the further it is from the ground, the greater its gravitational potential energy.

For example, a 1 kilogram (kg) weight held 2 metres above the ground will have greater gravitational potential energy than a 1 kg weight held 1 metre above the ground.





## 4.4 HYDRAULIC

Zero Energy State: **ZES 001 / ZES 003R**



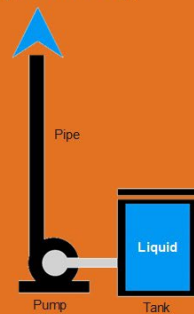
Hazard

### HYDRAULIC ENERGY

Hydraulic energy is stored within a pressurized liquid. When under pressure, the fluid can be used to move heavy objects, machinery, or equipment.

Lift cylinders, hydraulic hoses and pumps found on mobile equipment are sources of hydraulic energy.

When hydraulic energy is released in an uncontrolled manner, workers may be crushed or struck by moving machinery, equipment or other objects.





## 4.5 Pnuematic

Zero Energy State: **ZES 001 / ZES 003R**



Hazard

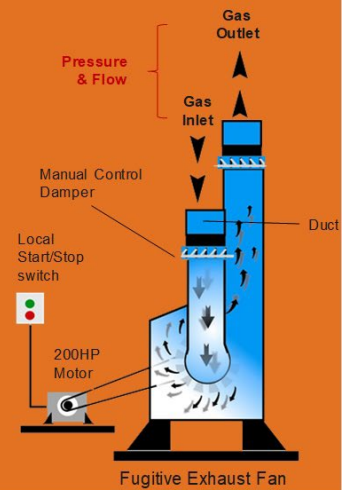
### PNEUMATIC ENERGY

Pneumatic Energy is produced from compressing air within an enclosed system.

Examples include, air or gases under pressure (pipes, tanks and vessels), vacuum pumps and rock drills.

Compressors compress gas into a smaller space and pressure is a result of this compression and it is delivered by pipes to the required location.

Compressors create a much **HIGHER** pressure than blowers / fans. Pressure can range from 0 to 1000psig.



## 4.6 Mechanical

Zero Energy State: **ZES 001 / ZES 003R**



### MECHANICAL ENERGY

Mechanical energy is transferred by means of a force on an object through a distance, or an object in motion.

For instance, a spring that is compressed or coiled will have stored energy which will be released in the form of movement when the spring expands.

Some examples of mechanical energy are, moving conveyors, flywheels, moving saw blade and rotating equipment.



## 4.7 Radioactive or Nuclear

Zero Energy State: **ZES 001 / ZES 003R**



Hazard

**RADIOACTIVE  
ENERGY OR  
NUCLEAR  
ENERGY**

Radiation energy is energy related to ionizing, low-frequency electromagnetic, optical, or radio-frequency electromagnetic radiation.

Effects may include burns, changes to genetic material or reproductive systems, or functional disorders (headache, insomnia, nervous breakdown, etc.).

## 4.8 Thermal

Zero Energy State: **ZES 001 / ZES 003R**



Hazard

### THERMAL ENERGY

Thermal energy is energy from an explosion, flame, objects with high or low temperatures or radiation from heat sources.

Thermal injury occurs when energy is transferred from a heat source to the body.

## 4.9 Chemical

Zero Energy State: **ZES 001 / ZES 003R**



Hazard

### CHEMICAL ENERGY

Chemical energy is the energy released when a substance undergoes a chemical reaction.

The energy is normally released as heat, but could be released in other forms, such as pressure.

A common result of a hazardous chemical reaction is fire or explosion.

## 4.10 Residual

Zero Energy State: **ZES 001 / ZES 003R**

Hazard

RESIDUAL  
ENERGY

Residual or stored energy is energy within the system or equipment that is not being used, but when released it can cause equipment or parts of equipment to move inadvertently if not properly identified and controlled.



## 4.11 Control

Zero Energy State: **ZES 001 / ZES 003R**




### HAZARDOUS ENERGY

It is important to understand that *all of these energy types* can be considered as either the primary energy source, or as residual or stored energy (energy that can reside or remain in the system).

Primary energy source is the supply of power that is used to perform work. Residual or stored energy is energy within the system that is not being used, but when released it can cause equipment or parts of equipment to move inadvertently.

## 4.12 Control

Zero Energy State: **ZES 001 / ZES 003R**



**HAZARDOUS  
ENERGY**

For example: when you close a valve on a pneumatic (air) or hydraulic (liquid) powered system, you have isolated the system from its primary energy source. However, there is still residual energy stored in any air or liquid that remains in the system.

In this example, removing the residual energy would include bleeding out the liquid, or venting out the air. Until this residual energy is removed from the system, unexpected movement of equipment, or pieces of equipment can occur.

## 4.13 Question 1

*(Multiple Response, 10 points, unlimited attempts permitted)*



## 5. Tags, Locks, and Lockout Devices

### 5.1 Tags, Locks, and Lockout Devices

Zero Energy State: ZES 001 / ZES 003R



**TAGS, LOCKS, AND  
LOCKOUT DEVICES**

## 5.2 Introduction

Zero Energy State: **ZES 003 / ZES 003R**

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 fractured body parts, and others.

**Locking protects  
Everyone**

**Know the Rules**

**Follow the Rules**

## 5.3 Tags, Locks, and Lockout Devices

Zero Energy State: **ZES 003 / ZES 003R**

Upon completion of this section of the module you will be able to;

- Identify the different types of Tags, Locks, and Lockout Devices.
- Describe the rules and the safe application of the Personal Protection and Equipment Status Tags.
- Describe the safe procedures for the installation and removal of the different type of Tags, Locks, and Lockout Devices.



## 5.4 What is Personal Protection?

Zero Energy State: **ZES 003 / ZES 003R**

### What is Personal Protection?

A Personal Protection Tag is an approved red tag that is used to tag an energy isolating device.



The **Personal Protection Tag** is used for **PERSONAL PROTECTION ONLY** and is used to Tag an energy isolating device.

The tag is **RED** in color and is meant to protect the worker and not the equipment.

Proper completion of this tag is not only part of the Vale Critical Activity Requirement (CAR) - **LOCKOUT, TAGOUT AND ZERO ENERGY** it is required by **LAW**.

## 5.5 What is Personal Protection?

Zero Energy State: **ZES 003 / ZES 003R**

### What is Personal Protection?



A Personal Protection Tag is an approved red tag that is used to tag an energy isolating device.

A Personal Protection Lock is an approved, single keyed red lock, capable of locking an energy isolating device or a lock box.

A **Personal Protection Lock** is an approved **SINGLE KEYED RED LOCK** capable of locking an energy isolating device or a lock box.

The **RED PERSONAL PROTECTION** lock is used in conjunction with a **RED PERSONAL PROTECTION** Tag.

The lock is *NOT* to be used for any other purpose. *ONE person ONE lock.*

## 5.6 What is Personal Protection?

Zero Energy State: **ZES 003 / ZES 003R**

### What is a Project Lock?

Blue Project locks are used on lock box applications.

Like the red personal protection lock, the Blue Project Lock is not to be used for any other purpose.

## 5.7 Personal Protection Tag Rules

Zero Energy State: **ZES 003 / ZES 003R**

### Personal Protection Tag Rules

Workers servicing or maintaining machines or equipment may be seriously injured or killed if hazardous energy is not properly controlled.

The ZES *Personal Protection Tag Rules* are in place to safeguard workers from the release of hazardous energy.

It is important that we recognize the need to protect personal safety when approaching areas identified by personal protection locks or tags.

Understanding that locking protects everyone, knowing the rules and following the rules will help manage risk to get **HomeSafe**.

Locking protects Everyone

Know the Rules

Follow the Rules

# 04

## Lockout, Tagout and Zero Energy



Never perform maintenance or interventions on installations or equipment without confirming that all sources of energy have been blocked, identified and tested to be in a state of "zero energy".

CAR 04

## 5.8 Rule #1:

Zero Energy State: **ZES 003 / ZES 003R**

### ZES Rules

#### Rule #1:

##### One person – One Lock

This means that when an individual is in a position that requires lockout protection then that person must have a lock on either the isolation / de-energization device(s) or on the lockbox.

Where the energy isolating device is not capable of being locked out, or the use of locks is unsafe, then personal protection tags shall be used in conjunction with an approved variance.



The rules of the ZES Program support Ontario Regulations and have one goal: to help ensure the safety of workers by reducing stored energy levels to manage risk.

1. One Person – One Lock
2. A RED Personal Protection Tag is the only tag to be used for personal protection on energy isolating devices.
3. Only a Tagger can install / remove his/her personal protection. (If the Tagger is unable to, or fails to, remove their personal protection, the Supervisor can remove the personal protection.)
4. Taggers shall remove their personal protection by the end of their working shift.
5. DO NOT operate an energy isolating device that has personal protection on it.
6. DO NOT operate an energy isolating device unless qualified and authorized to do so.
7. Verify a Zero Energy State before working on machinery.
8. RED personal protection and BLUE project locks are to have ONLY one key.
9. A RED Personal Protection Lock shall ONLY be used for personal protection. It should not be used for any other purposes.
10. A BLUE project lock shall be used ONLY for securing keys in a Lock Box and not be used for any other purposes.
11. Personnel who require personal protection from electrocution shall have positive isolation from all sources of power.
12. Only qualified personnel can install grounds on electrical equipment.
13. Control power or pilot pressure shall not be used for personal protection.
14. Defective energy isolating devices are to be immediately tagged with a Status Tag.
15. A Status Tag is required to identify the condition of equipment or why it cannot be operated.
16. Do not remove a Status Tag unless authorized to do so.  
Authorization to remove a Status Tag can be given by:  
A) Any Tagger who is continuing the work as stated on the Status Tag.  
B) The Tagger's Supervisor.  
C) The Operating Superintendent or his/her designate in charge of the Equipment or process.
17. A variance to a Zero Energy State Locking and Tagging procedure is only valid in the plant/mine that has developed and approved it.

\*\* See participant manual for all definitions.



## 5.9 Rule #2

Zero Energy State: **ZES 003 / ZES 003R**

### ZES Rules

#### Rule #2:

A Red Personal Protection Tag is the **ONLY** tag to be used for Personal Protection on energy isolating devices.



The rules of the ZES Program support Ontario Regulations and have one goal: to help ensure the safety of workers by reducing stored energy levels to manage risk.

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## 5.10 Rule #3:

### Zero Energy State: ZES 003 / ZES 003R

#### ZES Rules

##### Rule #3:

**ONLY** a **Tagger** can install or remove their personal protection tag. The only exception is when the tagger has left the property.



The rules of the ZES Program support Ontario Regulations and have one goal: to help ensure the safety of workers by reducing stored energy levels to manage risk.

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\*\* See participant manual for all definitions.

## 5.11 Rule #4:

Zero Energy State: **ZES 003 / ZES 003R**

### ZES Rules

#### Rule #4:

Tagger's **SHALL** remove their Personal Protection Tags by the **END** of their shift.



The rules of the ZES Program support Ontario Regulations and have one goal: to help ensure the safety of workers by reducing stored energy levels to manage risk.

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## 5.12 Rule #5:

Zero Energy State: **ZES 003 / ZES 003R**

### ZES Rules

#### Rule #5:

**DO NOT OPERATE AN** energy isolating device that has personal protection on it.



The rules of the ZES Program support Ontario Regulations and have one goal: to help ensure the safety of workers by reducing stored energy levels to manage risk.

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### 5.13 Rule #11:

Zero Energy State: ZES 003 / ZES 003R

#### ZES Rules

##### Rule #11:

IEO's need to be aware of the following ZES Rules affecting tagger's:

Personnel who require personal protection from electrocution shall have positive isolation from all sources of power.



The rules of the ZES Program support Ontario Regulations and have one goal: to help ensure the safety of workers by reducing stored energy levels to manage risk.

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\*\* See participant manual for all definitions.



## 5.14 Rule #13:

Zero Energy State: **ZES 003 / ZES 003R**

### ZES Rules



**Rule #13:**

**IEO's need to be aware of the following ZES Rules affecting tagger's:**

Control Power or Pilot Pressure **shall NOT** be used for personal protection.

*Exception:* If Control power or pilot pressure must be used, the Variance procedure must be followed, and an approved procedure must be in place.

*Example;* some mines are locking out a PLC which controls the power to the mine hoist, this type of lockout is becoming more prevalent as technology evolves.



**The rules of the ZES Program support Ontario Regulations and have one goal: to help ensure the safety of workers by reducing stored energy levels to manage risk.**

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13. Control power or pilot pressure shall not be used for personal protection.
14. Defective energy isolating devices are to be immediately tagged with a Status Tag.
15. A Status Tag is required to identify the condition of equipment or why it cannot be operated.
16. Do not remove a Status Tag unless authorized to do so.  
Authorization to remove a Status Tag can be given by:  
A) Any Tagger who is continuing the work as stated on the Status Tag.  
B) The Tagger's Supervisor.  
C) The Operating Superintendent or his/her designate in charge of the Equipment or process.
17. A variance to a Zero Energy State Locking and Tagging procedure is only valid in the plant/mine that has developed and approved it.

**\*\* See participant manual for all definitions.**

## 5.15 Who Can Remove a Personal Protection Lock?

Zero Energy State: **ZES 003 / ZES 003R**

### Who Can Remove a Personal Protection Lock?

Personal Protection Locks can only be removed by:

- The tagger who installed it, or
- The Supervisor under the direction of the Superintendent of the tagger's department if the tagger has left the property.

## 5.16 Project Personal Protection Tag

Zero Energy State: **ZES 003 / ZES 003R**

### Project Personal Protection Tag



When using a lockbox, the tags that are normally used to tag the equipment in the field for “personal protection” are also used for project personal protection.

When the project box is checked off, the tag is used as a **project** personal protection tag and is associated with a project and a lock box protected by a single keyed **BLUE** project lock.

#### Designated Tagger NOTE:

- The Designated Tagger is NOT personally protected by the project personal protection.
- If the designated tagger is required to work on the project, they are required to apply their own personal protection tag on the lock box.



## 5.17 Status Tag

Zero Energy State: **ZES 003 / ZES 003R**

### Status Tag

The Status Tag is an approved white tag used to protect equipment and identify why an energy isolating device may not be operated.

Under NO CIRCUMSTANCES is it to be used for Personal Protection.

#### Status Tags can only be removed by:

- Any tagger continuing the work stated on the status tag,
- The tagger's supervisor,
- The operating superintendent or his/her designate in charge of the equipment or process.



## 5.18 HAZARD ALERT

Zero Energy State: **ZES 003 / ZES 003R**



### HAZARD ALERT

#### Be Aware that;

Other companies use similar tags to establish personal protection and equipment status; however, it is important to note these companies may use different coloured formats for their tags.

It is **IMPORTANT** to **READ ALL INFORMATION** on tags affixed to locks, equipment, process controls, valves etc. to **UNDERSTAND** their purpose and to ensure you **MANAGE RISK**.

If you are unsure of the purpose of a tag, talk to your supervisor.

## 5.19 What is a Lock Box?

Zero Energy State: **ZES 003 / ZES 003R**

### What is a Lock Box?

A lock box is a lockable device with provision to secure, see, and count keys and also to hold forms that can be used in two basic applications:

1. By a Designated Tagger to secure keys and hold the lock box form or;
2. By a Local Tagger to secure the remote tagging form and hold the lock box form.

**Please Note:**

*No one is permitted to participate in the generation or management of Lock Boxes unless they have successfully completed the ZES003.3-Designated Tagger Program.*



## 5.20 Why use a Lock Box?

Zero Energy State: **ZES 003 / ZES 003R**

### Why use a Lock Box?

A lock box is used:

- When it isn't practical to use multiple piggy-backed lock extenders.
- When there are multiple isolating devices to tag.
- Where multiple people are participating in a project.
- To minimize the amount of people going into a high risk area.
- To provide a written record that the equipment has been brought to **ZERO** Energy State by the **IEO (Isolation Equipment Operator)**.
- To tag out ahead of time as some areas may need to be locked and tagged earlier than others.
- For other tasks associated with the ZES Program (i.e. Cascading).



## 5.21 Lock Box Form

Zero Energy State: **ZES 003 / ZES 003R**

### Lock Box Form

ONTARIO OPERATIONS ZERO ENERGY STATE LOCKING AND TAGGING PROGRAM

**Lock Box Form**

\_\_\_\_\_  
If none, identify risk assessment method i.e. SLAM, JHA

**Project Description:** (Work to be Done)

☐ Q1- Is your task part of the project?  
☐ Q2- Are the listed Energy Isolator Devices adequate for the work you are doing?  
☐ Q3- Is the listed ZERO Energy verification adequate for the work you are doing?

**Designated Tag Application** ☐ **Remote Tag Application** ☐

**Work To Be Done:**  
I have knowledge of and understand the work to be done. I have identified the equipment and/or processes that will be part of the work to be done.  
Print Name: \_\_\_\_\_ Signature: \_\_\_\_\_

**Equipment/Process Energy Isolations:**  
I have knowledge of and understand the equipment and/or processes that require lock and tagging to ensure zero energy state for the work to be done. The required isolation points are identified on this form.  
Print Name: \_\_\_\_\_ Signature: \_\_\_\_\_

**No. of Energy Isolating Devices:**  **IMPORTANT:** Once above signatures are affixed, the lock box is authorized for the number of energy isolating devices identified to the left and described in the following pages. **NO MODIFICATIONS ARE TO BE MADE.** If additional equipment or process isolations are required, or if changes need to be made, you must start a new Lock Box process or follow MPROC-65012 - Using Cascading Lock Boxes (as is applicable)

**Designated Tagger:** Isolation Completed: ☐ Zero Energy Verified: ☐  
Print Name: \_\_\_\_\_ Signature: \_\_\_\_\_

**Project Lock Installed:** Date: \_\_\_\_\_ Time: \_\_\_\_\_  
Signature: \_\_\_\_\_

**Subsequent Designated Tagger:**  
To print name and date AFTER verifying the integrity of the lock box and form and gaining control of the key for the lock box project.

Name:	Date:	Name:	Date:

Designated Taggers will fill in this form as described in Flowchart #1 of the Ontario Operations Zero Energy State Locking and Tagging Procedure MPROC-60001. Subsequent Designated Taggers will add their name and date each time they become the Designated Tagger.

Lock box forms communicate the work involved in the project and the steps taken to make the equipment safe.

Each tagger confirms that certain steps have taken place and the equipment is safe by validating against this form.



**Are pre-populated lockbox forms an accepted practice?**

The intent of the program is to have all parties get together each time and evaluate the scenario based on their risk assessment or job procedure.

There are plants that have created pre-populated forms; they need to manage the maintenance and upkeep of those forms as they apply to the processes they cover.

## Zero Energy State: ZES 003 / ZES 003R

### Lock Box Form

ONTARIO OPERATIONS ZERO ENERGY STATE LOCKING AND TAGGING PROGRAM

#### Lock Box Form

If none, identify risk assessment method (e.g. SLAM, JHA)

Project Description: (Work to be Done)

Q1: Is your task part of the project?

Q2: Are the listed Energy Isolation Devices adequate for the work you are doing?

Q3: Is the listed ZERO Energy verification adequate for the work you are doing?

Designated Tag Application

Remote Tag Application

#### Work To Be Done:

I have knowledge of and understand the work to be done. I have identified the equipment and/or processes that will be part of the work to be done.

Print Name

Signature

#### Equipment/Process Energy Isolations:

I have knowledge of and understand the equipment and/or processes that require lock and tagging to ensure zero energy state for the work to be done. The required isolation points are identified on this form.

Print Name

Signature

No. of Energy Isolating Devices:

IMPORTANT: Once above signatures are affixed, the lock box is authorized for the number of energy isolating devices identified to the left and described in the following pages. NO MODIFICATIONS ARE TO BE MADE. If additional equipment or process isolations are required, or if changes need to be made, you must start a new Lock Box process or follow MPRDC-60012 - Using Cascading Lock Boxes (as is applicable).

#### Designated Tagger:

Isolation Completed: Zero Energy Verified:

Print Name

Signature

#### Project Lock Installed:

Date: Time:

Signature

#### Subsequent Designated Tagger:

To print name and date AFTER verifying the integrity of the lock box and form and gaining control of the key for the lock box project.

Name:

Date:

Name:

Date:

Designated Taggers will fill in this form as described in Flowchart #1 of the Ontario Operations Zero Energy State Locking and Tagging Procedure MPRDC-6001. Subsequent Designated Taggers will add their name and date each time they become the Designated Tagger.

**Risk assessment of the locking and tagging using existing tools:**

If there is no procedure to do the isolation work, a risk assessment must be completed.

A field level risk assessment such as a Slam, or in the case of abnormal or non-routine tasks, a JHA, shall be performed.

#### On the Form:

A prompt for conducting a risk assessment has been added if there is no written procedure.

## 5.23 The identification of the work to be done and the required isolation points:

Zero Energy State: **ZES 003 / ZES 003R**

### Lock Box Form

ONTARIO OPERATIONS ZERO ENERGY STATE LOCKING AND TAGGING PROGRAM

**Lock Box Form**

----- If none, identify risk assessment method (i.e. SLAM, JHA)

**Project Description:** (Work to be Done)

Q1- Is your task part of the project?  
Q2- Are the listed Energy Isolating Devices adequate for the work you are doing?  
Q3- Is the listed ZERO Energy verification adequate for the work you are doing?

**Designated Tag Application** **Remote Tag Application**

**Work To Be Done:**  
I have knowledge of and understand the work to be done. I have identified the equipment and/or processes that will be part of the work to be done.  
Print Name: Signature:

**Equipment/Process Energy Isolations:**  
I have knowledge of and understand the equipment and/or processes that require lock and tagging to ensure zero energy state for the work to be done. The required isolation points are identified on this form.  
Print Name: Signature:

**No. of Energy Isolating Devices:** **IMPORTANT:** Once above signatures are placed, the lock box is authorized for the number of energy isolating devices identified to the left and described in the following pages. **NO MODIFICATIONS ARE TO BE MADE.** If additional equipment or process isolations are required, or if changes need to be made, you must start a new Lock Box process or follow MPROC-60012 – Using Cascading Lock Boxes (as is applicable)

**Designated Tagger:** **Project Lock Installed:**  
Isolation Completed: Zero Energy Verified: Date: Time:  
Print Name: Signature:


**Subsequent Designated Tagger:**  
To print name and date AFTER verifying the integrity of the lock box and form and gaining control of the key for the lock box project.

Name:	Date:	Name:	Date:

Designated Taggers will fill in this form as described in Flowchart #1 of the Ontario Operations Zero Energy State Locking and Tagging Procedure MPROC-60001. Subsequent Designated Taggers will add their name and date each time they become the Designated Tagger.

**The identification of the work to be done and the required isolation points:**

It is required to have individuals identified and have them validate the work to be done and the required isolation points to complete that work.



**On the Form:**  
Two sections that identify:

- A person who understands the work to be done.
- A person who has knowledge and understands the equipment and or process that requires locking and tagging.

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### 5.24 Lock Box Form

## Zero Energy State: ZES 003 / ZES 003R

## Lock Box Form

<h2 style="margin: 0;">Lock Box Form</h2>			
<p><small>ORION</small>      <i>If none, Identify risk assessment method i.e. SLAM, JHA</i></p>			
<p><b>Project Description:</b> (Work to be Done)</p>			
<p>Q1- Is your task part of the project?            Q2- Are the listed Energy Isolation Devices adequate for the work you are doing?            Q3- Is the listed ZERO Energy verification adequate for the work you are doing?</p>		<p><b>Designated Tag Application</b>      <b>Remote Tag Application</b></p>	
<p><b>Work To Be Done:</b>            I have knowledge of and understand the work to be done. I have identified the equipment and/or processes that will be part of the work to be done.</p>			
<p><i>Print Name:</i> _____</p>		<p><i>Signature:</i> _____</p>	
<p><b>Equipment/Process Energy Isolations:</b>            I have knowledge of and understand the equipment and/or processes that require lock and tagging to ensure zero energy state for the work to be done. The required isolation points are identified on this form.</p>			
<p><i>Print Name:</i> _____</p>		<p><i>Signature:</i> _____</p>	
<p><b>No. of Energy Isolating Devices:</b> _____ <b>IMPORTANT:</b> Once above signatures are affixed, the lock box is authorized for the number of energy isolating devices identified to the left and described in the following pages. <b>NO MODIFICATIONS ARE TO BE MADE.</b> If additional equipment or process isolations are required, or if changes need to be made, you must start a new Lock Box (process or follow MPRCO-G0012 - Using Cascading Lock Boxes (as is applicable))</p>			
<p><b>Designated Tagger:</b></p>		<p><b>Project Lock Installed:</b></p>	
<p>Isolation Completed:      Zero Energy Verified:      Date:      Time:</p>		<p>_____</p>	
<p><i>Print Name:</i> _____</p>		<p><i>Signature:</i> _____</p>	
<p><b>Subsequent Designated Tagger:</b>            To print name and date AFTER verifying the integrity of the lock box and form and gaining control of the key for the lock box project.</p>			
<p>Name: _____ Date: _____</p>		<p>Name: _____ Date: _____</p>	
<p>_____</p>			
<p><small>Designated Taggers will fill in this form as described in Paragraph #1 of the Ontario Operators Zero Energy State Locking and Tagging Procedure MPRCO-G0012. Subsequent Designated Taggers will add their name and date each time they become the Designated Tagger.</small></p>			

**The identification of the work to be done and the required isolation points:**

These sections can be completed by a trades person, operator, designated tagger, planner, supervisor, etc, depending on the complexity and type of the work.



### On the Form:

This role can be the same person, or separate persons, depending on the situation.



## 5.25 The recording of isolation points:

Zero Energy State: **ZES 003 / ZES 003R**

### Lock Box Form

ONTARIO OPERATIONS ZERO ENERGY STATE LOCKING AND TAGGING PROGRAM

**Lock Box Form**

If none, identify risk assessment method i.e. SLAM, JHA

Project Description: (Work to be Done)

Q1- Is your task part of the project?  
Q2- Are the listed Energy Isolating Devices adequate for the work you are doing?  
Q3- Is the listed ZERO Energy verification adequate for the work you are doing?

Designated Tag Application Remote Tag Application

Work To Be Done:  
I have knowledge of and understand the work to be done. I have identified the equipment and/or processes that will be part of the work to be done.

Print Name: Signature:

Equipment/Process Energy Isolations:  
I have knowledge of and understand the equipment and/or processes that require lock and tagging to ensure zero energy state for the work to be done. The required isolation points are identified on this form.

Print Name: Signature:

No. of Energy Isolating Devices: 8

**IMPORTANT:** Once above signatures are affixed, the lock box is authorized for the number of energy isolating devices identified to the left and described in the following pages. **NO MODIFICATIONS ARE TO BE MADE.** If additional equipment or process isolations are required, or if changes need to be made, you must start a new Lock Box process or follow MPROC-60012 - Using Cascading Lock Boxes (as is applicable)

Designated Tagger: Isolation Completed: Zero Energy Verified: Project Lock Installed: Date: Time: Signature:

Subsequent Designated Tagger:  
To print name and date AFTER verifying the integrity of the lock box and form and gaining control of the key for the lock box project.

Name:	Date:	Name:	Date:

Designated Taggers will fill in this form as described in Flowchart #1 of the Ontario Operations Zero Energy State Locking and Tagging Procedure MPROC-60001. Subsequent Designated Taggers will add their name and date each time they become the Designated Tagger.

### The recording of isolation points:

To ensure we execute the work as planned a section has been added to identify the number of isolation points.



### On the Form:

A section that identifies the number of isolation points, along with a reminder to everyone that no modifications are to be made.

## 5.26 The Validation of zero energy:

Zero Energy State: **ZES 003 / ZES 003R**

### Lock Box Form

ONTARIO OPERATIONS ZERO ENERGY STATE LOCKING AND TAGGING PROGRAM

#### Lock Box Form

Ref	Type of Device	Device Identification	Equipment Name	Location of Energy Isolating Device
1				
Method used to verify Zero Energy State:				
2				
Method used to verify Zero Energy State:				
3				
Method used to verify Zero Energy State:				
4				
Method used to verify Zero Energy State:				
5				
Method used to verify Zero Energy State:				
6				
Method used to verify Zero Energy State:				
7				
Method used to verify Zero Energy State:				
8				
Method used to verify Zero Energy State:				

For additional devices, insert a blank page, copy and paste above table, modify numerical references ensuring sequential numbering (i.e. 9, 10, 11 etc). Designated Taggers will fill in this form as described in Worksheet #1 of the Ontario Operations Zero Energy State Locking and Tagging Procedure MPROCC-00001. Subsequent Designated Taggers will add their name and date each time they become the Designated Tagger.

### The Validation of zero energy:

To provide a more comprehensive explanation of the method of verification used for each isolation device, the table with the list of isolation devices has been updated to include separate sections to list the method of verification of zero energy.



#### On the Form:

Individual isolating devices now have their own separate section to list the method in which the designated tagger documents the method they used.

**!** No modifications are to be made to the lockbox form after the signoffs have been completed.

## 5.27 How Do You Determine If You Are A Protected Worker?

Zero Energy State: **ZES 003 / ZES 003R**

### Lock Box Form

#### How Do You Determine If You Are A Protected Worker?

Start by asking yourself the following three questions.

**Question 1:** Is my task part of the project as listed on the lock box form?

**Question 2:** Are the energy isolation devices as listed on the lock box form adequate for the work you are doing?

**Question 3:** Is the zero energy verification as listed on the lock box form adequate for the work you are doing?



## 5.28 How Do You Determine If You Are A Protected Worker?

Zero Energy State: **ZES 003 / ZES 003R**

### Lock Box Form

#### How Do You Determine If You Are A Protected Worker?

If the answer is **yes** to all 3 questions:

Install your red personal protection lock and tag on the lock box. You are now a **protected worker** and can start the job.



## 5.29 How Do You Determine If You Are A Protected Worker?

Zero Energy State: **ZES 003 / ZES 003R**

### Lock Box Form

#### How Do You Determine If You Are A Protected Worker?

If the answer is **no** to any of the 3 questions:

You **cannot** use this lock box.

Individual personal protection is required on isolation devices.



## 5.30 Locking Devices

Zero Energy State: ZES 003 / ZES 003R

### Locking Devices

Shown here are examples of lockout - tagout devices available from suppliers.



#### I.M. #4490345 Unsafe Condition:

A cable locking device was found to be slightly loose on a hydraulic unit valves. There was potential for some movement of the valves. There was an escalation to resolve the issue.

The lock out was improved to eliminate any potential movement of the valves. Immediate Actions: lock box was redone and 4 lock extenders were used to ensure the 4 valves could not be moved.

## 5.31 Cascaded Lockboxes

Zero Energy State: **ZES 003 / ZES 003R**

### Cascaded Lock Boxes

Upon completion of this section of the module you will be able to;

- Understand the purpose of Cascading Lock Boxes for Personal Protection.
- Recognize elements of a Cascaded Lock Box.
- Recognize the three applications of a Cascaded Lock Box.
- Know how to go about receiving further training to work with Cascaded Lock Boxes.





## 5.32 Applications for Cascading Lock Boxes

Zero Energy State: **ZES 003 / ZES 003R**

### Cascaded Lock Boxes

#### Applications for Cascading Lock Boxes

Another Training Module specifically designed for Designated Taggers includes detailed instruction for how to setup a Cascaded Lock Box.

The objective in this module is to simply understand that beyond the scope of regular Lock Boxes, there are additional possibilities for locking and tagging.

In the case of Cascaded Lock Boxes, there are three possible applications.

Step by step instructions for cascading lockboxes are also provided on the job aid form.



**!** No one is permitted to participate in the generation or management of Lock Boxes unless they have successfully completed the Vale Designated Tagger Program (ZES003.3).



### 5.33 What is a Cascaded Lock Box?

Zero Energy State: **ZES 003 / ZES 003R**

#### Cascaded Lock Boxes

What is a Cascaded Lock Box?

A Cascaded Lock Box contains the keys from an identified red project lock that has been affixed to the exterior of another lock box or lock boxes.

In many cases due to commissioning or testing requirements it is necessary to access and remove the locks from a subset of energy isolating devices within a lock box at some point during a project.

With proper planning a cascaded lock box may simplify this process.



Job Aid  
Using Cascading Lock Boxes

## 5.34 How Do I use a Cascaded Lock Box?

Zero Energy State: **ZES 003 / ZES 003R**

### Cascaded Lock Boxes

How Do I use a Cascaded Lock Box?

Any Tagger using a Cascaded lockbox is accountable for:

- Ensuring that they are working on the same project as on the Cascaded lock box form.
- Installing their personal protection on the correct Cascaded lock box.
- Removing their personal protection at the end of the shift.
- Communicating the status of the equipment to the designated Tagger.
- If work is incomplete ensure a status tag is installed.



## 5.35 Cascaded Lock Box Applications

Zero Energy State: **ZES 003 / ZES 003R**

### Cascaded Lock Boxes

#### Cascaded Lock Box Applications

##### Extending a Lock Box:

When large a group or groups working at different sites are working on the same project but need to lock in different locations.

This allows multiple lockout points for the same project.

##### Cascading Multiple Existing Lock Boxes:

When a secondary project is being completed that can take advantage of existing lock boxes, or when a project has multiple phases (e.g. installation and commissioning, or rotating a piece of equipment mid-project)

##### Cascading a Lock Box Plus Additional Isolation Points:

When a secondary project is being completed that can take advantage of a combination equipment such as a lock box plus additional equipment (e.g. installation and commissioning, or rotating a piece of equipment mid-project)

### 5.36 Cascaded Lock Box Applications

Zero Energy State: **ZES 003 / ZES 003R**

## Cascaded Lock Boxes

## Cascaded Lock Box Applications

All lock boxes, both regular and cascaded shall be secured with a blue lock by a designated tagger(s).

The keys to the blue lock must be secured by the designated tagger(s) and shall not be placed inside another lock box.

If a key to a blue lock changes hands to a subsequent designated tagger, the lock box form for that lock box (and that lock box only) shall record the name of the subsequent designated tagger, regardless, of whether the lock box is cascaded or not.

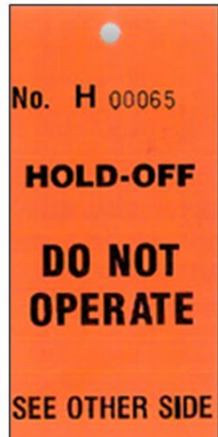


### 5.37 Other Tags Used by Electrical Tradespeople

Zero Energy State: **ZES 003 / ZES 003R**

#### Other Tags Used by Electrical Tradespeople

The Power Department has several specific tags that only they use:



These tags should not be removed  
unless authorized by the Power  
Department power system operator.

## 5.38 Other Tags Used by Electrical Tradespeople

Zero Energy State: **ZES 003 / ZES 003R**

### Other Tags Used by Electrical Tradespeople

The Power Department has several specific tags that only they use:



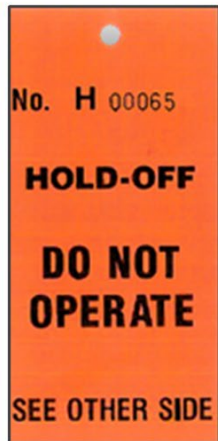
**DO NOT OPERATE TAG**  
Re-usable information tag stating authorization from the System Operator must be obtained before removing tag or operating of the device.

### 5.39 Other Tags Used by Electrical Tradespeople

Zero Energy State: **ZES 003 / ZES 003R**

#### Other Tags Used by Electrical Tradespeople

The Power Department has several specific tags that only they use:



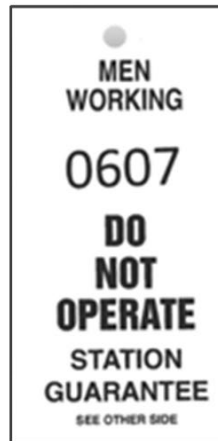
**HOLD OFF TAG**  
Affixed by a linesman or P&C technician but issued by the Systems Operator. It is hung on fused disconnects or breaker control handles to prevent individuals from reclosing a tripped device.

## 5.40 Other Tags Used by Electrical Tradespeople

Zero Energy State: **ZES 003 / ZES 003R**

### Other Tags Used by Electrical Tradespeople

The Power Department has several specific tags that only they use:



**STATION GUARANTEE TAG**  
A white, reusable numbered tag used by Power Department to identify the fact that a certain device is being used to protect a person or group of persons while working on or near equipment.



## 5.41 Other Tags Used by Electrical Tradespeople

Zero Energy State: **ZES 003 / ZES 003R**

### Other Tags Used by Electrical Tradespeople

The Power Department has several specific tags that only they use:



#### GROUND TAG

This tag identifies that a grounding device has been installed on a circuit.

This tag is to be used by *authorized and qualified* personnel only.

## 5.42 Question 1

(Multiple Choice, 10 points, unlimited attempts permitted)

## 5.49 Question 8

(Pick One, 10 points, unlimited attempts permitted)

Zero Energy State: **ZES 003 / ZES 003R**

Click to select which tag tells you that someone is actually working on equipment in the area?



Submit

  
**Question**

This image has been staged to show an example of a Lockout/Tagout infraction.

Click where you suspect the infraction might be.



Submit



## Correct (Slide Layer)

Zero Energy State: **ZES 003 / ZES 003R**

This image has been staged to show an example of a Lockout/Tagout infraction.

Click where you suspect the infraction might be.



That's right! You selected the correct response.

Personal Locks always need to be associated with a red personal protection tag (and vice versa).

Every individual must ensure their own safety by applying a Personal Protection Lock and Personal Protection Tag.

Continue

## Incorrect (Slide Layer)

Zero Energy State: **ZES 003 / ZES 003R**

This image has been staged to show an example of a Lockout/Tagout infraction.

Click where you suspect the infraction might be.



Incorrect

You did not select the correct response.

Continue

### Try Again (Slide Layer)

Zero Energy State: **ZES 003 / ZES 003R**

This image has been staged to show an example of a Lockout/Tagout infraction.

Click where you suspect the infraction might be.



Incorrect

You did not select the correct response.

Continue

## 6. Controls

### 6.1 Introduction

Zero Energy State: **ZES 001 / ZES 003R**



## CONTROLS

Legislation

ZES Rules

Accountabilities

LOCKOUT, TAGOUT Installation and Removal Process



## 6.2 Control

Zero Energy State: **ZES 001 / ZES 003R**



### CONTROLS

Not properly assessing and dissipating stored energy is one of the most common causes for workplace incidents that involve hazardous energy.

Control of hazardous energy includes isolating the system from its primary power source and identifying all sources of residual energy and depressurizing them to Zero Energy State.

## 6.3 Regulations

Zero Energy State: **ZES 001 / ZES 003R**

### Regulations

**Ontario Regulation 854 Section 185 (7) stipulates that;**

If any work is being done on a machine,

- a) The moving parts SHALL be STOPPED;
- b) Any stored energy that could be a hazard to workers shall be dissipated or contained;
- c) Energy isolating devices SHALL be installed IF the machine is NOT already equipped with them;
- d) and ALL energy isolating devices SHALL be properly engaged, locked and tagged.

**Ontario Regulation 854 Section 185 (10) stipulates that;**

If it is not practical to comply with any of the above requirements, work to which those requirements apply may be done IF, while it is being done, barriers shields or other effective precautions are used or taken for the SAFETY OF A WORKER.

## 6.4 Regulations

Zero Energy State: **ZES 001 / ZES 003R**

### Regulations

**Ontario Regulation 854 Section 185 (8) stipulates that;**

Before doing any work to which subsection (7) applies, a worker shall verify, by testing, that the requirements of that subsection have been complied with.

**Ontario Regulation 854 Section 185 (9) stipulates that;**

A tag required by clause (7) (d) shall,

- a) Be secured to prevent its accidental removal;
- b) State the reason the energy isolating devices are locked and tagged;
- c) Show the name of the person responsible for locking and tagging the energy isolating devices; and
- d) Show the date on which the energy isolating devices were locked and tagged.

## 6.5 Regulations

Zero Energy State: **ZES 001 / ZES 003R**

### Regulations – Confined Space

#### Ontario Regulation 632/05, Section 14

Isolating of energy and control of materials movement.

The employer shall, in accordance with the relevant plan, ensure that each worker entering a confined space is adequately protected,

- a) Against the release of hazardous substances into the confined space,
  - i. By blanking or disconnecting piping, or
  - ii. If compliance with subclause (i) is not practical in the circumstances for technical reasons, by other adequate means;
- b) Against contact with electrical energy inside the confined space that could endanger the worker,
  - i. By disconnecting, de-energizing, locking out and tagging the source of electrical energy, or
  - ii. If compliance with subclause (i) is not practical in the circumstances for technical reasons, by other adequate means;

## 6.6 Regulations

Zero Energy State: **ZES 001 / ZES 003R**

### Regulations – Confined Space

#### Ontario Regulation 632/05, Section 14

Isolating of energy and control of materials movement.

The employer shall, in accordance with the relevant plan, ensure that each worker entering a confined space is adequately protected,

- c) Against contact with moving parts of equipment inside the confined space that could endanger the worker,
  - i. If compliance with subclause (i) is not practical in the circumstances for technical reasons, by immobilizing the equipment by blocking or other adequate means; and
- d) Against drowning, engulfment, suffocation and other hazards from free-flowing material, by adequate means.

#### CSA-Z460 Control of Hazardous Energy

This Standard specifies requirements for controlling hazardous energy associated with potentially harmful machines, equipment, and processes (including mobile machinery and equipment).

## 6.7 Accountabilities of the IEO

Zero Energy State: **ZES 001 / ZES 003R**

**As an Isolating equipment Operator, you are Accountable and Responsible for;**

Following the steps of the ZES Installing Personal Protection procedure with regard to isolating energy.

Safely operating the energy isolating devices.

Stating readiness to lock and tag, once the energy is isolated and de-energized.

Returning isolating devices to operating status once all tags and locks are removed.





## 6.8 Accountabilities of the Tagger

Zero Energy State: **ZES 001 / ZES 003R**

**As the Tagger, you are Accountable and Responsible for;**

Ensuring all tags are properly filled out and information is legible.

Attaching tags securely so they will not fall or be blown off.

Listening to information communicated from the IEO's

Informing IEO's or other workers in the area when removing personal protection.

Do NOT operate an energy isolating device that has Personal Protection on it.

Do NOT operate an energy isolating device unless **qualified and authorized** to do so.





## 6.9 Lockout/Tagout

### Zero Energy State: **ZES 001 / ZES 003R**

In this part of the module you will learn how to complete the Lockout/Tagout and Zero Energy Steps for getting to and maintaining Zero Energy State.

Listed below are the LOCKOUT/TAGOUT STEPS, to perform the Lockout, Tagout and Zero Energy process safely, it is important to execute the steps in the correct order.

STEP 1: Obtain **Authorization**

STEP 2: **Identify** Equipment to be Isolated/Locked/Tagged

STEP 3: **Check** to Ensure Energy Source(s) have been Properly Identified

STEP 4: **Isolate** Energy Source(s)

STEP 5: **Release** all Residual Energy, Including Steps to Maintain Zero Energy State

STEP 6: **Apply** Lockout/Tagout Protection

STEP 7: **Test** Process/System to Ensure Zero Energy State has been Achieved

## 6.10 Lockout/Tagout

Zero Energy State: **ZES 001 / ZES 003R**

### Lockout/Tagout and Zero Energy Procedures for Installing Personal Protection

#### STEP 1: Obtain Authorization

Authorization will be granted by the equipment owner or their designate and can be obtained in person, via phone call or through radio communication.

#### STEP 2: Identify Equipment to be Isolated/Locked/Tagged

Ask the Isolation Equipment Operator to assist in the identification of all mechanical sources of energy.

#### STEP 3: Check to Ensure Energy Source(s) have been Properly Identified

Ask the Isolation Equipment Operator to assist in the identification of all mechanical sources of energy.

## 6.11 Lockout/Tagout

Zero Energy State: **ZES 001 / ZES 003R**

### Lockout/Tagout and Zero Energy Procedures for Installing Personal Protection

#### STEP 4: Isolate Energy Source(s)

Close all isolation valves as identified in the procedure or plan.

#### STEP 5: Release all Residual Energy, Including Steps to Maintain Zero Energy State

Depressurize the equipment or system.

#### STEP 6: Apply Lockout/Tagout Protection

Apply your lock and tag, ensure tag is completed, legible and is fastened so it can't fall or be blown off.

#### STEP 7: Test Process/System to Ensure Zero Energy State has been Achieved

Ensure all personal in the area are clear of the equipment prior to checking for zero energy.

## 6.12 Lockout/Tagout - Activity

*(Drag and Drop, 10 points, unlimited attempts permitted)*

## 6.13 Electrical Lockout/Tagout Procedures

Zero Energy State: **ZES 001 / ZES 003R**

### Lockout/Tagout and Zero Energy Procedures - Electrical



This part of the module defines the requirements to ensure electrically powered equipment will not be able to start or release electrical energy.

These instructions apply to electrically powered equipment, up to and including 600 volts (low voltage).

Over 600 volts requires involvement of the Electrical Department.



## 6.14 Hazards of Electricity

Zero Energy State: **ZES 001 / ZES 003R**

### Hazards of Electricity

Electricity finds the easiest path to ground by attempting to find a conductor. Conductors include metal, water, or YOUR BODY.

8 milliamps under the right conditions can be FATAL.

Household ground fault plugs are set to trip at 5 milliamps, which is just below shock level.

Electricity is often referred to as an electrical flow, energy flows when the circuit is **closed**.

To interrupt electrical flow, we **OPEN** the circuit.



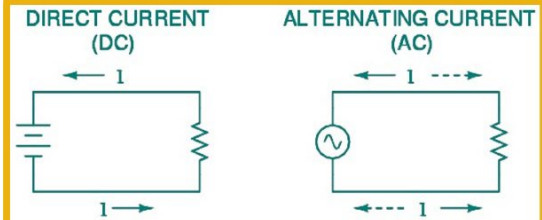
## 6.15 Hazards of Electricity

Zero Energy State: **ZES 001 / ZES 003R**

### Hazards of Electricity

There are two types of electricity, alternating current (AC), for example, household power, or electric motors. Direct current (DC) examples include batteries and generators.

As an Isolating Equipment Operator, you will be trained to isolate power up to and including **600 volts (low voltage)**.



**Both types can be equally fatal!**

## 6.16 Hazards of Electricity

Zero Energy State: **ZES 001 / ZES 003R**

### Hazards of Electricity

**Delayed Starts**, used to delay the operation of a process or start of a motor, pump, fan, etc. The time can be varied depending on the requirements and typically uses time delay relays to accomplish it.

**Soft Starts** are used with AC motors to reduce the load and torque on the powertrain and current surge during start up. Allow the motor to slowly (softly) ramp up to full speed.

**Frequency Drives** are used with AC motors, it is a type of motor controller that varies the frequency and voltage supplied to the motor. In doing so it can vary the motor speed to match the load requirements of the motor such as controlling the speed of a conveyor belt, fan, mine hoist, etc.





## 6.17 Hazards of Electricity

Zero Energy State: **ZES 001 / ZES 003R**

### Hazards of Electricity

In addition each of these devices can have **interlocks** present in their circuits. The interlocks prevent the devices from energizing their output devices (motors, fans, etc.) until certain conditions are met to satisfy the interlocks, allowing the device to energize their output devices.

When attempting to electrically isolate these devices the only safe way is to disconnect power feeding these devices or disconnect power (field disconnect) going to the devices they operate (motors, pumps, fans, etc.)

Delayed Starts, Soft Starts and Frequency Drives all require knowledge and experience to know how they function and when they are safe to work on.



## 6.18 Installation - Step 1

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

#### STEP 1: Obtain Authorization



**Authorization will be granted by the equipment owner or their designate and can be obtained in person, via phone call or through radio communication.**

Its very important to provide the following information:

- Your name,
- Contact information,
- Who you are working for,
- The task or work order,
- The equipment, provide as much detail you can give, location, area, what floor.
- How long you anticipate the work will last,
- Repeat back what you have heard as clear communication is key before proceeding to the next step.

*If work is not complete by the end of shift, authorization will be required before work commences on any other day.*

## 6.19 Installation - Step 2

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

STEP 2: Identify Equipment to be Isolated/Locked/Tagged



**Ask the Isolation Equipment Operator to assist in the identification of all electrical sources of energy.**

The IEO can be an operator or an electrician,

Be Aware that an electrician is required for any isolation in a switchroom. The electrician will document the isolation in the log book and get you to sign off that the isolation is complete.

Other resources to assist in the identification of equipment include prints and procedures.

## 6.20 Installation - Step 3

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

STEP 3: Check to Ensure Energy Source(s) have been Properly Identified



**Read all of the identification tags to ensure they match the equipment you are about to isolate.**

**Be Aware** of switches, field disconnects, the equipment, and combination starters if locking and tagging in a switch room.



## 6.21 Installation - Step 4

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

#### STEP 4: Isolate Energy Source(s)



Follow the **ISOLATE-LOCK-TAG-CHECK** steps below when isolating energy sources:

- If equipped, turn the local/remote (or manual/auto) switch to local (or manual) (turn the Hand-Off-Auto Selector to the off position).
- Stop the energy source by depressing the STOP button.
- Visually check the equipment to ensure it is not running,



## 6.22 Installation - Step 4

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

#### STEP 4: Isolate Energy Source(s)



Follow the **ISOLATE-LOCK-TAG-CHECK** steps below when isolating energy sources:

Use the Left-Hand Rule, if you are not able to, discuss with your supervisor to assess and decide how best to manage risk.

1. Look AWAY from the switch.
2. Do NOT stand in front of the disconnect while controlling the switch.
  - Do NOT allow anyone else in front of disconnect, and,
  - Ensure that other tagger's or people in surrounding area are in a safe position.
3. Stand an arms length from the switch.
4. Plant your feet solidly on the ground.



## 6.23 Installation - Step 4

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

#### STEP 4: Isolate Energy Source(s)



Follow the **ISOLATE-LOCK-TAG-CHECK** steps below when isolating energy sources:

Use the Left-Hand Rule, if you are not able to, discuss with your supervisor to assess and decide how best to manage risk.

5. IEO is now to call control room or any areas with remote capabilities, to ensure the local button is working properly and it **CANNOT BE STARTED** before using left hand rule. This ensures total control from area of isolation.
6. Close your eyes, hold your breath and turn your head away from the switch to ensure no vapour or heat is inhaled if mechanism fails.
7. Use a good, dry leather glove, using an open hand, open the switch.





## 6.24 Installation - Step 5

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

STEP 5: Release all Residual Energy, Including Steps to Maintain Zero Energy State



**Ensure there are no other electrical sources of energy backfeeding the system such as, battery banks etc.**

- Always push the stop button after attempting to start the equipment to prevent engaging the equipment into a load condition.



## 6.25 Installation - Step 6

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

#### STEP 6: Apply Lockout/Tagout Protection



##### Apply your lock and tag to the electrical device(s).

- Ensure you clearly enter 100 percent of required information on the tag, and that it is legible.
- Ensure the tag is securely fastened, so that it cannot fall or be blown off.
- Once applied test that the electrical device cannot be thrown into a closed position and the key to the lock is under your control and not left in the lock.



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Sump Pump #4

Remove and Replace  
Sump Pump #4  
Best Electrical  
John Doe  
132117  
555-9999

Flip Tag Over

## Untitled Layer 1 (Slide Layer)

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

#### STEP 6: Apply Lockout/Tagout Protection



##### Apply your lock and tag to the electrical device(s).

- Ensure you clearly enter 100 percent of required information on the tag, and that it is legible.
- Ensure the tag is securely fastened, so that it cannot fall or be blown off.
- Once applied test that the electrical device cannot be thrown into a closed position and the key to the lock is under your control and not left in the lock.



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Sump Pump #4

Remove and Replace

Sump Pump #4

Best Electrical

John Doe

132117

555-9999

**Flip Tag Over**

## 6.26 Installation - Step 7

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Electrical

STEP 7: Test Process/System to Ensure Zero Energy State has been Achieved



Ensure all personnel in the area are clear of the equipment prior to checking for zero energy,

- Push the start button giving ample time for the equipment to start.
- **Be Aware** of soft starts, interlocks, delays and frequency drives.
- Always follow through by pushing the stop button to prevent engaging the equipment into a load condition.



## 6.27 Removal of Personal Protection - Returning Equipment to Service

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Removal of Personal Protection and Restoring Energy: Electrical

Removal of Personal Protection - Returning Equipment to Service



**Obtain Authorization from operations personnel prior to returning equipment to service.**

- Confirm, either in person or by phone, that all workers are clear of the area and all tools and materials are safely stored.
- Confirm that the equipment is ready for service, ensure the name and number on the equipment being restored is the same as the number at the switch.
- Remove your lock and tag at the switch. Tear the tags and dispose of them in the proper recycling container.
- If there are locks and tags on the equipment which you are not authorized to remove, then the equipment cannot be returned to service until these locks and tags are removed by authorized personnel.

*\* All workers require plant specific training to be qualified and authorized IEO's*



## 6.28 Removal of Personal Protection - Returning Equipment to Service

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Removal of Personal Protection and Restoring Energy: Electrical

Removal of Personal Protection - Returning Equipment to Service



#### Restore Energy

1. Ensure the Hand-Off-Auto Selector is in the off position and press the stop pushbutton, if one exists at the switch. This is a final check to ensure the equipment will not start as the switch closes.
2. Using the left-hand rule / best practice, CLOSE the switch.
3. Stand at arms length from the switch in a position which does not require you to reach across the door of the switch to operate the handle.
4. Turn your face and body away from the switch, close your eyes, take a deep breath and hold it. This position will minimize injuries should there be a catastrophic failure of the switch as it is closed.
5. Plant your feet solidly on the ground.
6. Use a good, dry leather glove, open hand, close the switch.





## 6.29 Removal of Personal Protection - Returning Equipment to Service

Zero Energy State: **ZES 001 / ZES 003R**

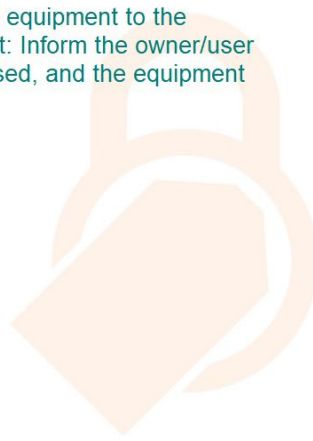
### Procedures for Removal of Personal Protection and Restoring Energy: Electrical

Removal of Personal Protection - Returning Equipment to Service



#### Restore Energy

7. Communicate the condition of the equipment to the person in charge of the equipment: Inform the owner/user that the electrical devices are closed, and the equipment is in the remote or local mode.





## 6.30 Non - Electrical Lockout/Tagout Procedures

Zero Energy State: **ZES 001 / ZES 003R**

### Lockout/Tagout and Zero Energy Non - Electrical

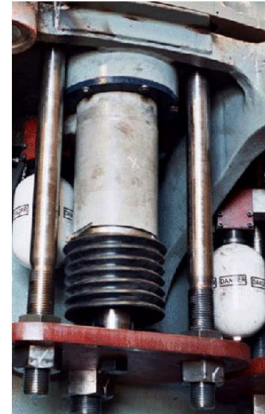


This part of the module defines the requirements to ensure mechanically powered equipment will not be able to move or release energy.

These instructions apply to all pneumatic and hydraulic powered equipment, regardless of the operating pressure.

Know the product you are isolating and the hazards you may encounter.

Some systems or equipment require special attention and training BEFORE isolation (e.g., acids, nickel carbonyl, slurries, oxygen, etc.).



## 6.31 Installation - Step 1

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

#### STEP 1: Obtain Authorization



**Authorization will be granted by the equipment owner or the their designate and can be obtained in person, via phone call or through radio communication.**

Its very important to provide the following information:

- Your name,
- Contact information,
- Who you are working for,
- The task or work order,
- The equipment, provide as much detail you can give, location, area, what floor.
- How long you anticipate the work will last,
- Repeat back what you have heard as clear communication is key before proceeding to the next step.

*If work is not complete by the end of shift, authorization will be required before work commences on any other day.*

## 6.32 Installation - Step 2

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

STEP 2: Identify Equipment to be Isolated/Locked/Tagged



**Ask the Isolation Equipment Operator to assist in the identification of all mechanical sources of energy.**

All equipment which could cause a hazard to personnel, or damage if operated, shall be closed or placed into a safe position, locked, tagged and checked. This includes valves, service lines, gates, doors, chutes, etc.

Be aware of other valves for pressure elimination or reduction, cleaning, purging, washing, etc.

Other resources to assist in the identification of equipment include prints and procedures.

*\* Non-Vale workers require plant specific training to be a Qualified and Authorized Isolating Equipment Operators (electrical and mechanical).*

## 6.33 Installation - Step 3

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

STEP 3: Check to Ensure Energy Source(s) have been Properly Identified



**Read all of the identification tags to ensure they match the equipment you are about to isolate.**

**Be Aware** of the locations of other valves to reduce the risk of failure, such as a valve not fully closing, or a bleed valve becoming plugged, resulting in the inability to isolate the system or equipment.

Restraints, valve lockout covers, or similar locking devices shall be installed to secure equipment in a safe position and shall be Locked and Tagged. All blocking valves shall be locked in the closed position and all bleed valves locked in the open position.



## 6.34 Installation - Step 4

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

#### STEP 4: Isolate Energy Source(s)



Follow the **ISOLATE-LOCK-TAG-CHECK** steps below when isolating energy sources:

Following the procedure for the equipment or system:

- Close all isolation valves in the procedure or plan.
- Begin upstream first, to STOP the flow.
- If required, close the downstream valve(s) to prevent backflow.



## 6.35 Installation - Step 5

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

STEP 5: Release all Residual Energy, Including Steps to Maintain Zero Energy State



**Particular care is required when isolating pressurized systems or equipment which incorporates stored energy devices.**

- Some examples are pressurized service lines, system headers, air receivers, accumulators, tanks, and charged springs.
- Ensure the pressure or stored energy is released, or isolated, prior to working on the equipment.



## 6.36 Installation - Step 6

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

#### STEP 6: Apply Lockout/Tagout Protection



##### Apply your lock and tag to the mechanical device(s).

- Ensure you clearly enter 100 percent of required information on the tag, and that it is legible.
- Ensure the tag is securely fastened, so that it cannot fall or be blown off.
- Restraints, valve lockout covers, or similar locking devices shall be installed to secure equipment in a safe position and shall be Locked and Tagged.
- All blocking valves shall be locked in the closed position and all bleed valves locked in the open position.

*Once applied always test that the mechanical device cannot be opened and the key to the lock is under your control and not left in the lock.*

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Sump Pump #4

Remove and Replace

Sump Pump #4

Best Electrical

John Doe

132117

555-9999

Flip Tag Over



## Untitled Layer 1 (Slide Layer)

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

#### STEP 6: Apply Lockout/Tagout Protection



**Apply your lock and tag to the mechanical device(s).**

- Ensure you clearly enter 100 percent of required information on the tag, and that it is legible.
- Ensure the tag is securely fastened, so that it cannot fall or be blown off.
- Restraints, valve lockout covers, or similar locking devices shall be installed to secure equipment in a safe position and shall be Locked and Tagged.
- All blocking valves shall be locked in the closed position and all bleed valves locked in the open position.

*Once applied always test that the mechanical device cannot be opened and the key to the lock is under your control and not left in the lock.*

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Sump Pump #4

Remove and Replace

Sump Pump #4

Best Electrical

John Doe

132117

555-9999

**Flip Tag Over**

## 6.37 Installation - Step 7

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Installing Personal Protection: Mechanical

STEP 7: Test Process/System to Ensure Zero Energy State has been Achieved



**Ensure all personnel in the area are clear of the equipment prior to checking for zero energy,**

Be prepared to observe the system drain, look for;

- Signs of leakage, this may indicate the isolation valve is not fully seated, you may have to re-seat the valve or isolate another valve to obtain full closure of the line.
- A drain valve that does not show expected flow, which could indicate a plugged drain valve, you may have to open additional drain valves.

## 6.38 Removal of Personal Protection - Returning Equipment to Service

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Removal of Personal Protection and Restoring Energy: Mechanical

#### Removal of Personal Protection - Returning Equipment to Service



**Obtain Authorization from operations personnel prior to returning equipment to service.**

- Confirm, either in person or by phone, that all workers are clear of the risk area and all tools and materials are safely stored.
- Confirm that the equipment is ready for service.
- Remove your lock and tag. Tear the tags and dispose of them in the proper recycling container.
- If there are locks and tags on the equipment which you are not authorized to remove then the equipment cannot be returned to service until these locks and tags are removed by authorized personnel.

*\* All workers require plant specific training to be qualified and authorized IEO's*

## 6.39 Removal of Personal Protection - Returning Equipment to Service

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Removal of Personal Protection and Restoring Energy: Mechanical

Removal of Personal Protection - Returning Equipment to Service



#### Restore Energy

- Place your body in a safe position, out of the “line of fire”.
- Open valve SLOWLY. This will help equalize the pressure and allow quick shutoff should a situation arise.
- With the bleed valves closed, supply valves open and system started, CHECK for leaks and ensure pressures and flows are NORMAL.

## 6.40 Special Considerations

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Removal of Personal Protection and Restoring Energy: Mechanical

Removal of Personal Protection - Returning Equipment to Service



#### Special Considerations

When working with highly corrosive liquids, lethal gasses, high temperatures, very high pressures, etc., refer to specific work procedures for special precautions and procedures.

*Be Aware that separate qualification and authorization is required to work on, or with, oxygen systems.*

*NEVER attempt to control (throttle) OXYGEN, unless the valve is specially designed for that purpose.*

## 6.41 Special Considerations

Zero Energy State: **ZES 001 / ZES 003R**

### Procedures for Removal of Personal Protection and Restoring Energy: Mechanical

Removal of Personal Protection - Returning Equipment to Service



#### Special Considerations

Where equipment has both electrical and mechanical energy sources, standard lock and tag practices for all of these hazards must be followed to ensure you and your co-workers are safe.

For example, to remove a steam unit heater with an electrical fan, the heater shall be isolated from both the electrical supply to the fan and the steam supply to the heater.

Personnel must be aware of any other potential hazards involved in working on mechanical equipment (i.e. pinch points, hot components, possibility of equipment rolling or moving, etc.) before commencing work on the equipment.

## 7. Conclusion

### 7.1 Mobile Equipment

Zero Energy State: **ZES 001 / ZES 003R**



**Congratulations, you have successfully completed your study of this LOCKOUT, TAGOUT AND ZERO ENERGY module.**

- Explain the concept of energy.
- Describe the nine types of energy (Electrical; Gravitational energy or gravitational potential energy: Hydraulic or water; Mechanical; Pneumatic; Chemical; Radioactive or Nuclear; Thermal; Residual or Stored).
- Identify the types of lockout devices and their uses.
- Describe the risks they are subject to when not using the safety devices and PPE.
- Describe the risks if they use them incorrectly and the preventive measures.
- List each step of the lockout and tagout procedure and activities that must be performed in the installation and removal of lockout/tagout protection.
- Recognize the existence and importance of Vale's instructions, local legislation, and the local procedures for safe lockout and tagout activities.