

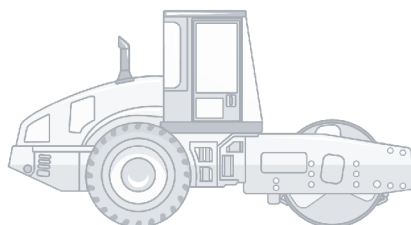
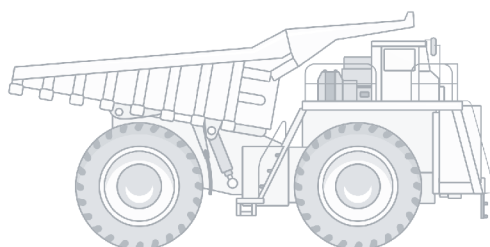
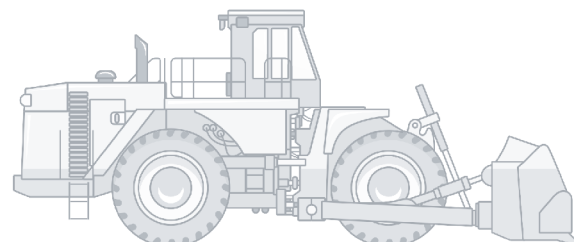
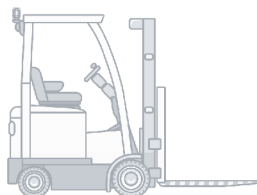
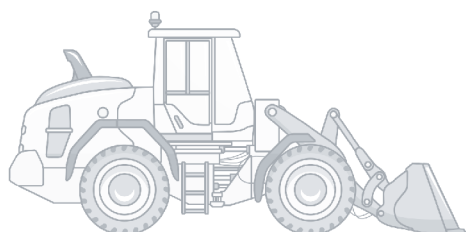
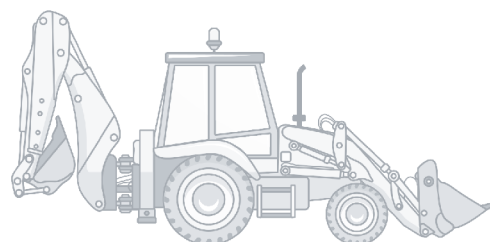
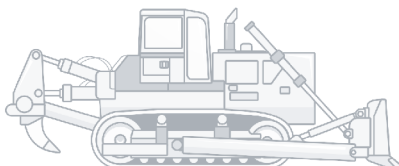
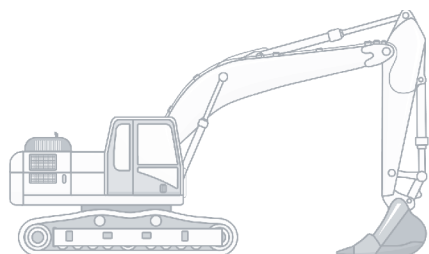
Energy Control Process

LOCKOUT AND OTHER METHODS

MOBILE EQUIPMENT

The purpose of this guide is to support the people who work for municipalities and other organizations that use, supply or procure mobile equipment: managers, employer and employee representatives, accident prevention officers, OHS committee members, workers, etc.

RG-1040



Institut de recherche
Robert-Sauvé en santé
et en sécurité du travail

Energy Control Process

**LOCKOUT
AND OTHER METHODS**

**MOBILE
EQUIPMENT**

RG-1040

SOURCE

Burlet-Vienney, D., Chinniah, Y., Aucourt, B. (2018) *Implantation du cadenassage des équipements mobiles dans le secteur municipal — Étude exploratoire (Report R-975)*. Montreal, Quebec: Institut de recherche Robert-Sauvé en santé et en sécurité du travail.

ACKNOWLEDGMENTS

We would like to thank the members of the follow-up committee for taking part in various consultations while the study was being conducted and this guide was being written.

COMMENTS

Do you have any comments or suggestions concerning this guide?
Write to publications@irsst.qc.ca

AUTHOR

Damien Burlet-Vienney, IRSST

COORDINATION

François Ouellet and Linda Savoie, IRSST

EDITING

Hélène Morin

GRAPHIC DESIGN

Lucie Chagnon

ILLUSTRATIONS

Jacques Perrault

PHOTOS

iStock

LEGAL DEPOSIT

Bibliothèque et Archives nationales
du Québec 2018
ISBN 978-2-89797-037-6
ISSN 2292-9444

IRSST

COMMUNICATIONS AND KNOWLEDGE
TRANSFER DIVISION

505 de Maisonneuve Blvd. West
Montreal, Quebec H3A 3C2
Telephone: 514 288-1551
www.irsst.qc.ca
December 2018

© Institut de recherche Robert-Sauvé
en santé et en sécurité du travail

CONTENTS

Background	3
Let's put a stop to accidents caused by improvised work procedures	4
Energy control applies to mobile equipment, too	5
Precautions to be taken when implementing an energy control program	6
Steps to follow when developing an energy control procedure (lockout or other method)	8
Main energy control procedure (interactive form)	9
Solutions other than lockout	11
Stored equipment	12

ALSO AVAILABLE FOR DOWNLOAD

- > Main energy control procedure as an [interactive PDF](#) or [customizable Word document](#)
- > Example of main energy control procedure form filled in for [one piece of equipment](#) and [several tasks](#)

ABBREVIATIONS

CNESST	Commission des normes, de l'équité, de la santé et de la sécurité du travail
CSA	Canadian Standards Association
SCCI	Safety Code for the Construction Industry [Quebec]
IRSST	Institut de recherche Robert-Sauvé en santé et en sécurité du travail
ROHS	Regulation respecting Occupational Health and Safety [Quebec]

BACKGROUND

The purpose of this guide is to support the people who work for municipalities and other organizations that use, supply or procure mobile equipment: managers, employer and employee representatives, accident prevention officers, OHS committee members, workers, etc.

More specifically, the guide seeks to:

- > Raise awareness of the requirement to include mobile equipment in energy control programs (lockout and other methods).
- > Facilitate the development of energy control procedures tailored to mobile equipment.

The term “mobile equipment” refers to **any form of self-propelled, towed or transported machine or equipment.**

This category covers a wide range of machinery, including forklifts, spreaders, dump trucks, elevating work platforms, cranes, loaders, ice resurfacers, snowblowers and many others. Mobile equipment can be found in virtually all areas of economic activity: provincial and municipal administration, manufacturing, construction, mining, agriculture, logging and forestry, etc.



HAZARDS ASSOCIATED WITH MOBILE EQUIPMENT

When performing tasks in the danger zone of mobile equipment, workers are exposed to a variety of hazards. Here are the main types:

Mechanical

Moving equipment or part (power take-off, auxiliary motor, etc.)

Electrical

Battery, generator, capacitor, etc.

Hydraulic

All components under pressure (hydraulic pump driven by vehicle's engine, jacks, hydraulic motors, distributors, accumulators, hydraulic hoses, etc.)

Gravitational

Equipment or accessories at height (bucket, vehicle on a slope, etc.)

Heat

Hot parts (motor, exhaust pipe, jacks, etc.)

Pneumatic

All components under pressure (compressors, tires, etc.)

Chemical

Battery acid, grease, oil, etc.

Other

Physical hazards

(noise, radiation, etc.)

Air quality

(for example, confined space)

Collision with other vehicles or equipment

(like an overhead crane)

Biological contaminants, etc.

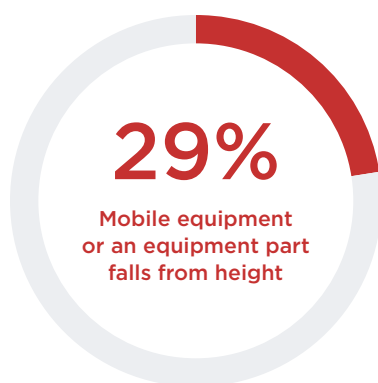
LET'S PUT A STOP TO ACCIDENTS CAUSED BY IMPROVISED WORK PROCEDURES

Between 2000 and 2013, there were an average of four fatalities per year in Quebec associated with the maintenance or servicing of mobile equipment. More specifically, 56 people died and 13 were seriously injured over that period.¹

When these accidents occurred, the work was in most cases being done in an improvised fashion (for example, motor still running, accessory left at height). Most of these situations could have been avoided if a proper energy control procedure had been followed. Unfortunately, mobile equipment is only rarely covered in organizations' energy control programs (lockout and other methods).

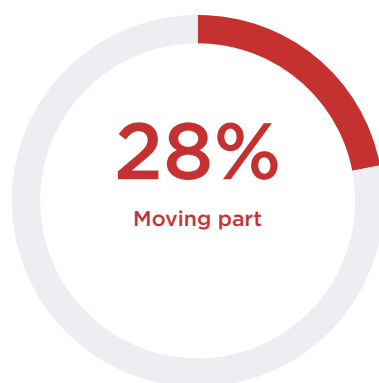
ACCIDENT TYPES

EXAMPLES TAKEN FROM CNESST REPORTS



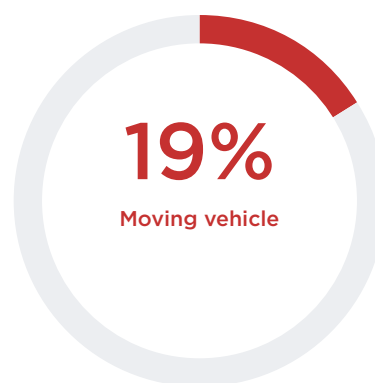
EXAMPLE

A worker was changing a hydraulic hose on a forklift. The mast was supported by a beam resting on the ground. The beam moved, causing part of the mast to hit the worker on the head.



EXAMPLE

The employer tried to raise the dump box on the back of his truck, but it got stuck and wouldn't lift up. A worker entered the area under the dump box to add oil to the hoisting system. He accidentally activated the control to bring the box down and was crushed between the truck chassis and the dump box frame.



EXAMPLE

A worker was lying underneath a loader truck, preparing to remove one of the three parts of the drive shaft to make it easier to tow. The loader rolled forward and its rear wheels crushed him.

RESEARCH

Municipalities operate a wide range of mobile equipment that must regularly be maintained, repaired or unjammed. Given the problems that occur with controlling the energy associated with mobile equipment, researchers monitored the activities of a city's mechanical shop employees for 18 months as lockout procedures were implemented. The study, completed in 2017, identified the main problems involved in energy control of mobile equipment, as well as possible solutions. This guide is based on the researchers' recommendations, which apply to all types of mobile equipment in all industries.



For further information,
see [Report R-975](#) (in French)
on the IRSST website.

1. IRSST, R-975, 2017

ENERGY CONTROL APPLIES TO MOBILE EQUIPMENT, TOO

The regulatory principles that govern the control of hazardous energy apply to all machines, including mobile equipment.

Hazardous energy is controlled by following a lockout procedure or some other equivalent method.

REGULATORY REQUIREMENTS

A lockout procedure or, failing that, “any other method that ensures equivalent safety” must be followed for work in a machine’s danger zone.² The types of work in question are installing, servicing, maintaining, adjusting, cleaning, inspecting, unjamming, setting up and decommissioning.

The goal of these methods is to prevent any untimely release of energy that could cause an accident in the course of the work. These are the steps involved in lockout:³

- 1 **Deactivation** and **complete shutdown** of the machine
- 2 **Elimination** or, if that is impossible, **control** of any **residual** or **stored energy** source
- 3 **Lockout** of the machine’s energy source **cut-off points** (each person involved installing their own lock)
- 4 **Verification of lockout** using one or more techniques to reach the highest level of effectiveness
- 5 **Safely unlocking** and **re-operating** the machine

The regulatory requirements are set out in detail primarily in sections 188.1 to 189.1 of the ROHS and, for construction sites, in section 2.20 of the SCCI.

The provisions specific to self-propelled vehicles and hoisting devices set out in sections 245 and 272 of the ROHS [maintained in accordance with the manufacturer’s instructions or standards offering equivalent safety] complement the sections regarding lockout and other methods.



To find out more, see the *Guide d’information sur les dispositions réglementaires – Cadenassage et autres méthodes de contrôle des énergies* (in French) on the CNESST’s website.

2. ROHS, s. 188.2, and SCCI, s. 2.20.2
3. ROHS, s. 188.7, and SCCI, s. 2.20.7

PRECAUTIONS TO BE TAKEN WHEN IMPLEMENTING AN ENERGY CONTROL PROGRAM



THINGS TO DO

TO ENSURE SMOOTH IMPLEMENTATION OF YOUR ENERGY CONTROL PROGRAM

- ✓ Include **foremen/forewomen, mechanics** and **machine operators** in the implementation process, because they're the ones who will be affected by the introduction of an energy control program.
 - > The common practices of qualified, experienced mechanics constitute the basis for safe working procedures.
 - > Foremen/forewomen are the link between management and the mechanics; their involvement is crucial to the success of the project.
- ✓ Include **all types of mobile equipment and energy control work** when implementing the program. The specific characteristics of the various types of equipment must be taken into account in developing the energy control procedures.
- ✓ When planning work, be sure to link the energy control procedure with the **work order**. Printed versions of procedures can also be stored in the equipment for reference when unplanned work must be performed out in the field.

TO FACILITATE THE APPLICATION OF PROCEDURES, STARTING WITH EQUIPMENT PROCUREMENT

- ✓ Opt for mobile equipment designed to **limit the number of tasks that must be done in the danger zone** (for example, featuring automatic lubrication, greasing from outside the danger zone).
- ✓ Require the incorporation of a **lockable battery master switch** that complies with standard IEC 60204-1 (2005), as well as all the necessary lockable energy cut-off devices (valves, for example). These devices must be easy to locate.
- ✓ Opt for a **separate start-up device** for each piece of equipment so as to be able to control the ignition keys in circulation (that is, no key should be able to start up more than one piece of equipment). Controlling ignition keys is an important part of controlling the situation, regardless of the energy control method chosen.
- ✓ Demand that all the accessories required to apply the energy control procedures, such as **wheel, jack and dump box chocks**, as well as **articulation mechanism blocking devices**, be included.
- ✓ Ask for the **manufacturer's manual** to describe safe work methods that comply with Quebec regulations governing the control of hazardous energy.

PRECAUTIONS TO BE TAKEN WHEN IMPLEMENTING AN ENERGY CONTROL PROGRAM

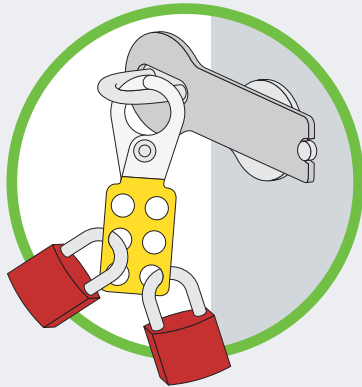


THINGS TO AVOID

TO ENSURE THAT PROCEDURES COMPLY WITH REGULATIONS

- ✗ In a lockout procedure, the use of an ignition key does not replace the application of a personal padlock for three reasons:
 - 1 Ignition keys do not act on an energy cut-off device.
 - 2 They are not unique.
 - 3 No one involved has control over the ignition keys, unless a lockout box is used.If the procedure is based primarily on controlling ignition keys, then it must be an alternative procedure to lockout.
- ✗ The use of a generic prework checklist, rather than a proper energy control procedure (lockout or other), does not meet regulatory requirements.

PREFERRED OPTION

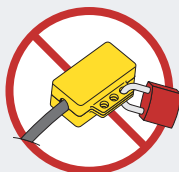
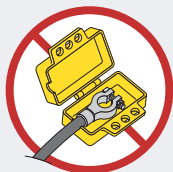


LOCKABLE BATTERY MASTER SWITCH

The use of a lockable battery master switch complies with the principles of a regulatory lockout procedure, as it acts on the power circuit and allows workers to install their personal padlocks. It also facilitates management of problems specific to remote start-up and electric vehicles.

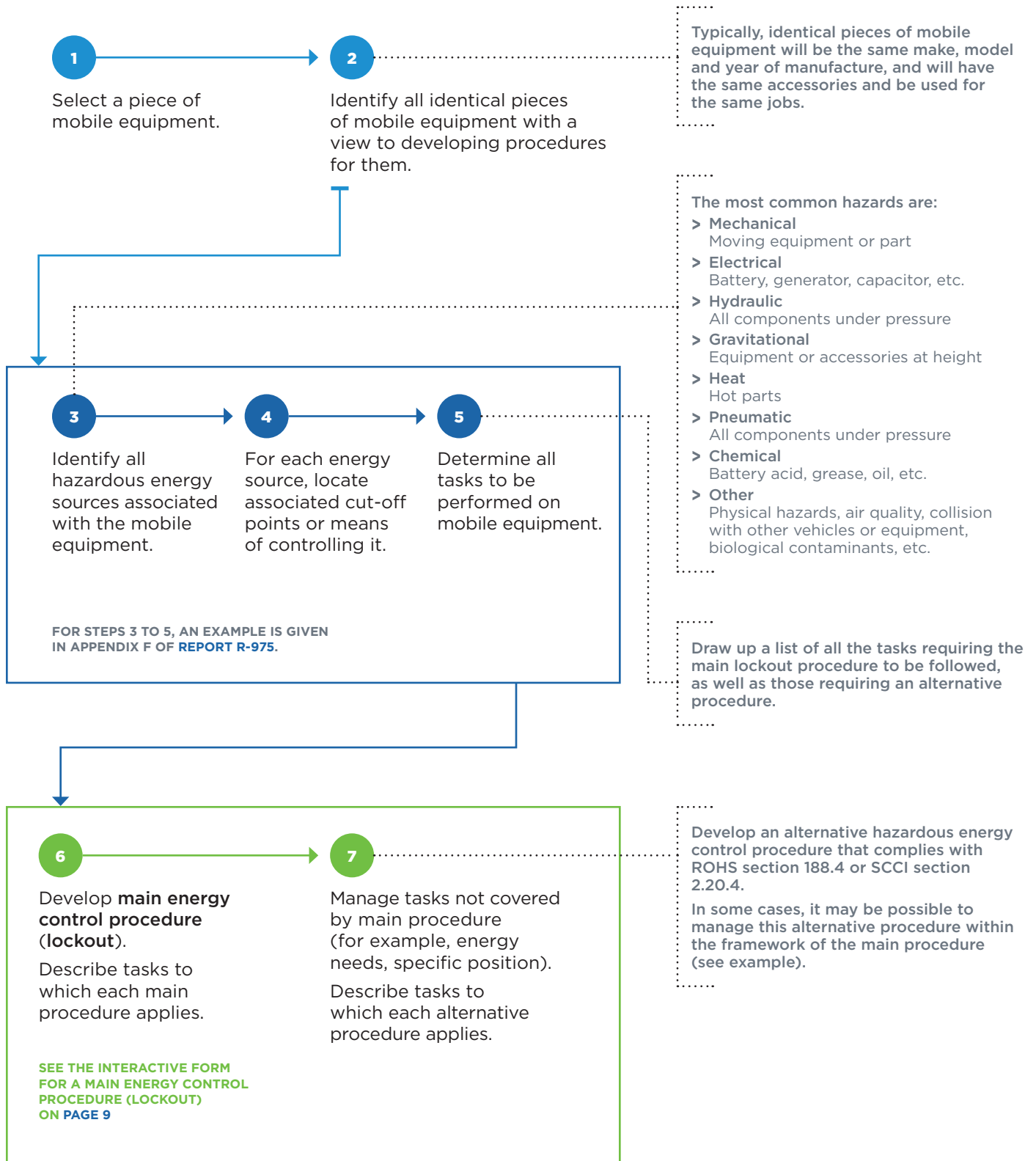
If a piece of mobile equipment is not equipped with a battery master switch, the switch should be added. If an organization's equipment fleet is large, the impact on the budget can be substantial. Moreover, adding any devices may affect the equipment warranty.

Some essential devices to which power must not be interrupted (for example, GPSs on fire trucks) can be connected to a secondary electrical circuit.



Furthermore, removing the cables and locking out the battery terminals using battery terminal covers is hazardous and can be quite complicated on some types of vehicles. Installing a battery master switch is a better option.

STEPS TO FOLLOW WHEN DEVELOPING AN ENERGY CONTROL PROCEDURE



MOBILE EQUIPMENT MAIN ENERGY CONTROL PROCEDURE LOCKOUT

Organization name	Procedure No. Equipment No. Type of equipment
Date created Last updated	Approved by Officer in charge

Consult the manufacturer's manual as needed when planning and performing certain tasks.

DESCRIPTION OF MOBILE EQUIPMENT	
Make Model Maintenance shop	Year Licence plate number
Location of devices to be operated for procedure (photos or illustrations)  	

GENERAL INSTRUCTIONS			
MANDATORY PERSONAL PROTECTIVE EQUIPMENT	Safety footwear Safety goggles	Work gloves Insulating gloves	Hard hat Face shield Other - Specify:
MATERIAL REQUIRED	Padlock Hasp Labels	Wheel chocks Circuit tester Battery terminal covers	Steering wheel cover Valve covers Blocking device/Stabilizer Other - Specify:
ASSOCIATED PROCEDURES	Road signs for roadside work Battery terminal removal Safety instructions for electric vehicle battery Confined space entry Other energy control form Biological contaminants Other - Specify:		

STEPS FOR ENERGY CONTROL

Tasks in question	Steps to follow
INSTRUCTIONS	
1 Notify employees concerned about the work under way.	N/A
2 Park on stable, flat ground, whenever possible. Put the transmission in the specified position. Apply the parking brake.	N/A
3 Lower the equipment's accessories to the ground or desired position.	N/A
4 Shut down the equipment. Remove the key from the ignition, if applicable, and keep possession of it.	N/A
5 Place chocks under the wheels if the ground is sloped.	
6 Chock or block any accessories that are not on the ground, as well as those specified by the manufacturer (for example, articulated chassis).	
7 Put up a sign (on the vehicle door or steering wheel, for instance) to indicate that work is in progress.	1 sign 1 fastener
8 Mark off the work area, in accordance with the procedure.	
9 Padlock the battery master switch in the OFF position. If there is no battery master switch, disconnect the battery terminals according to the established procedure, put terminal covers on them and lock them in place.	1 hasp and 1 padlock or terminal covers
10 Padlock the other isolating devices.	
11 Neutralize residual energy sources not already taken care of.	
12 Run a start-up test with the start button or ignition key. In the case of a start button, lock the cab once the start-up test has been completed.	N/A

CONTINUITY OF WORK

If the work cannot be completed by the end of the shift, **ensure a smooth transition with the next work crew** until it has installed its own padlocks or proceed with the installation of padlocks belonging to the department, according to the established procedure. Specify the procedure:

REMOVING PADLOCKS AND RETURNING TO SERVICE

1 Make sure the work is finished and the equipment is in working order.
2 Check that the safety devices that were removed (for example, guards) have been put back in place.
3 Check that all controls are in neutral.
4 Check that the work area around the equipment is clear and notify people concerned about the restart.
5 Remove lockout devices and other accessories, as necessary (chocks, jack stands, etc.).
6 Start up the mobile equipment and check that it is running properly.

Click below for



Blank main energy control procedure form to be filled in (PDF format)



Blank customizable main energy control procedure form (Word format)



Example of main energy control procedure form filled in for one piece of equipment and several tasks

SOLUTIONS OTHER THAN LOCKOUT

For mobile equipment, an energy control method other than lockout may be appropriate in the following situations:

1

An energy source is needed to perform the task while in the danger zone.

EXAMPLE

Diagnostic, testing or unjamming operations.

POSSIBLE METHODS

Special work procedure, such as a safety perimeter, an experienced worker, a safety distance to be observed, use of a control system, specific tools (for example, pike pole, shovel), PPE and special work clothing.

If the diagnostic operation requires two workers (one at the controls and the other near the danger zone), additional precautions must be taken (for example, a suitable method of communication).

2

Short, small, frequent, low-risk jobs

In the shop

EXAMPLE

Visual inspections, changing windshield wiper blades, replacing light bulbs.

On the road

EXAMPLE

Unjamming the snow chute of a snowblower several times per shift.

POSSIBLE METHODS

Safe shutdown, as described above. Control of duplicate ignition keys is essential to ensuring the effectiveness of this method. According to the data gathered, the shop mechanic may have trouble locating the duplicate keys in circulation in the municipality (for example, the one kept by the operator).

In the case of snowblowers, making the piece of equipment inoperable using the battery master switch, if there is one, is strongly recommended, as the potential severity of the harm is very high (that is, fatality) and the job requires two people.

3

Specific work procedures

EXAMPLE

Changing tires, electric vehicles.

POSSIBLE METHODS

Special work procedure.



In all cases, tasks and work methods must be dealt with on the basis of these considerations:

- > Risk analysis
- > Regulations currently in force
- > Manufacturer's manuals
- > Mechanics' experience

The main energy control procedure can provide inspiration for other related work methods.

A lockout procedure may not be suitable, especially in the following cases:

- > The task is an integral part of the production process (see [CSA Z460-13, s. 7.4.2](#))
- OR**
- > Lockout makes it impossible to perform the task.

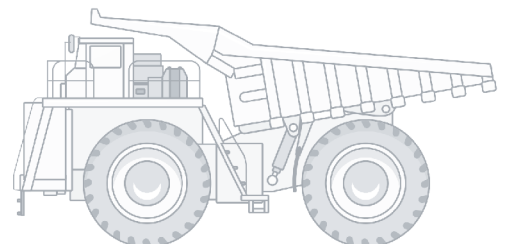
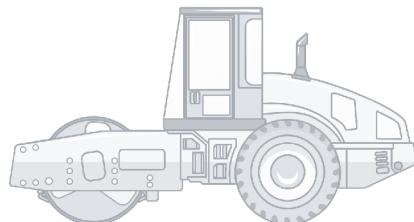
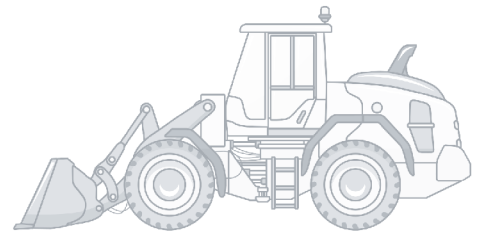
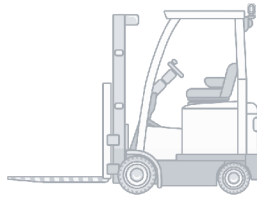
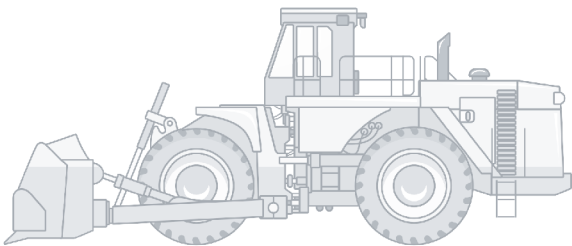
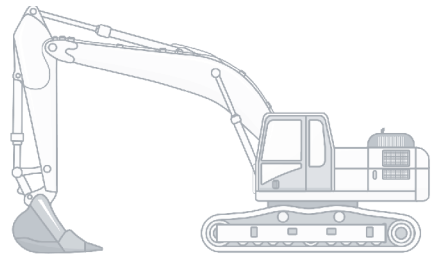
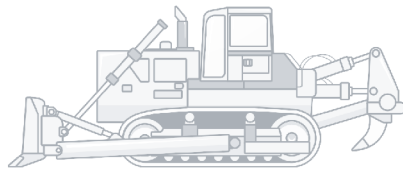
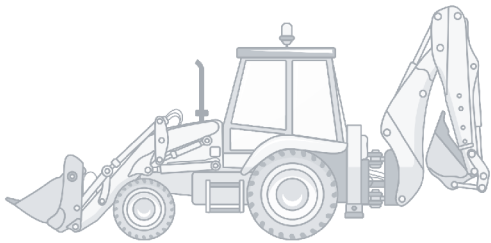
STORED EQUIPMENT

If equipment has been in storage for a long time during maintenance (waiting for a part, for instance), the equipment restart must be controlled to avoid possible hazardous situations (for example, a part falling off because another part is missing, during an unauthorized restart). The chosen method must be documented. There are a number of possible solutions:

- > Follow a lockout procedure using a padlock from the department concerned.
- > Put up signs about the work, close the vehicle cab and store the keys in a locked place.



For the forced removal of a lockout device, see the Association paritaire pour la santé et la sécurité du travail, secteur “affaires municipales” (APSAM) form *Rapport sur le retrait d'un dispositif de cadenassage* (in French).



Institut de recherche
Robert-Sauvé en santé
et en sécurité du travail