

The Safety Professional's Expanded Guide to LOCKOUT TAGOUT



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CHAPTER 1

Understanding Lockout Tagout Basics

Lockout tagout is a critical component of employee safety and workplace productivity. We know that this is a fundamental part of having documented risk assessments for “live electrical work and confined spaces”. But what does that really mean for you, your employees and your safety program?

LINK 360 Lockout/Tagout Posted Procedure

Site 1 - Refrigeration Engine Room
Refrigeration Compressor #4

CR: BDDF-001-430104
Issued: 9/16/2015
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2 Lockout Points

Note: This is an example of LINK360's "Short Form". The short form is used to identify the energy sources, where they are located, and the method of device used to lock them out. For increased imagery as well as the ability to add general detail, see the "Long Form".

Lockout Application Process:

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

Disconnect in Engine Room - West of Machine

See Gate Valve Identifier for exact location

Energy Source	Location	Method	Device
1 Electrical	E-1 is located West of the machine.	PPE required. And flash sheet. & caution; close E/F gloves. Turn Disconnect to the off position and lock out.	Lock and Hasp
2 Gas	G-1 is located on the Northeast side of the machine.	Turn Gate Valve to the off position and lock out.	Gate Valve lockout device
3 Note	Add Custom Notes for company or machine specific requirements.	Use notes to call attention to miscellaneous crucial steps to safely perform the lockout.	PPE required. And flash sheet. & caution; close E/F gloves.
4 Return PPE			

Lockout Removal Process:

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

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Why Lockout Tagout?

Lockout tagout is an important safety component to your workplace. In fact, it's critical to safeguarding workers and employees around the machinery and equipment they operate, service and maintain.

This important safety practice involves de-energising all forms of energy so any hazardous energy isn't re-introduced while equipment is being serviced. That way, your employees can get their job done as safely as possible to keep your operation running efficiently.



Lockout Tagout at a Glance:



LOCKOUT

Physically ensuring an equipment is inoperable while repairs or adjustments are made with the use of a padlock and a suitable device.



TAGOUT

Clearly communicating to workers, with labels and tags, that the equipment is being serviced, should not be operated and when it will return to service.

In a nutshell, Lockout Tagout is used for energy isolation, which means zero energy. Testing of the isolation point of all forms of energy to ensure complete isolation, i.e. zero energy, needs to be verified before operating on the machine or device.

When it comes to your lockout program, your **employees** are the priority. They face equipment challenges every day on the shop floor and deserve protection they can trust.

Beyond the Products

An effective lockout tagout program goes beyond the locks, tags and devices. In fact, the majority of citations are a result of a lack of proper lockout procedures, program documentation, periodic inspections or other procedural elements.

Lockout tagout programs are most successful when you look at the complete safety picture. That means making sure employee training, instructive procedures, the right products and a dedication to continuous improvement are all part of your program. By taking this approach, you could realise great benefits throughout your organisation, including:

- **IMPROVING PRODUCTIVITY** – Reducing equipment downtime
- **CUTTING COSTS** – Significantly decreasing lost employee time and insurance costs
- **SAVING LIVES** – Preventing thousands of incidents, injuries and even fatalities annually

By taking a comprehensive approach to your lockout tagout program, just think of the accidents you could prevent.



Did you know?

Compliance with the lockout tagout standard prevents an estimated **120 fatalities** and 50,000 injuries each year in the USA.¹

CHAPTER 2

Regulatory Overview

You know you need to comply with energy isolation requirements. Now let's dive deeper into the regulations surrounding lockout tagout compliance.



Australian & New Zealand Regulatory Guide

Hazardous Energy regulations and standards outline the requirements for isolation procedures and risk controls. The high-risk nature of work in this area means that they are likely to have a higher incidence of work-related injury and disease. Therefore, appropriate regulations and standards should be followed to prevent injuries in your workplace.

The following standards can be referred to for safe guidelines:

AS/NZS 4836:2011 – Safe working on or near low-voltage electrical installations and equipment

This Standard provides a framework around isolation of potential energy sources and elimination of potential hazards. A key isolation principle is that energy sources should be locked out with a device that cannot be tampered with whilst maintenance and repair activities are being undertaken. The isolation point should also be identified visually and contain relevant instructions or a contact person (ideally both).

AS 4024.1603-2006 – Safety of machinery - Design of controls, interlocks and guards - Prevention of unexpected start-up

This Standard details the requirements for “Prevention of unexpected start-up” of equipment. The information provided in this standard includes the specific requirement for all isolated energy sources to be locked, to ensure that it is not possible for somebody to inadvertently re-energise equipment that has been isolated.

Note: The above content is provided as a guide only and businesses should check with their local State or Territory regulatory authority for full details on energy isolation standards relevant to them.

Australian & New Zealand Regulatory Guide

Work Health and Safety Regulations 2011

The WHS regulations (Part 4.7) outline specific requirements pertaining to Electrical Safety and Energised Electrical Work. The regulation specifies that a person conducting a business or undertaking (PCBU) must ensure that:

- Electrical work is not carried out on electrical equipment while the equipment is energised.
- Electrical equipment that has been de-energised to allow work to be completed is not accidentally re-energised while the work is being carried out.
- A competent person* test electrical equipment to determine whether or not it is energised.
- Safe Work Method Statements include a description of electrical work; specify associated hazards and risks with suitable control measures.
- The Work Health and Safety Regulations have been developed to provide all Australian workers with the same level of workplace safety protection despite specific work locality

Whilst regulations and standards exists, each workplace should...

Develop their own isolation procedures to ensure maximum effectiveness. Factors which may affect the isolation procedures include:

- The reason/s for the equipment isolation, such as maintenance, cleaning, set-up, etc.
- The level of expertise of the person/s who will be working on the equipment once it is isolated.

Other factors may exist that will affect the isolation procedures. This is why isolation procedures should be workplace specific to suit unique operating requirements.

** Competent person is someone who has acquired through training, qualification or experience the knowledge and skills necessary to carry out the task.*

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National & State Guide to: Regulations, Standards, Codes Of Practice and Guidance Procedures.

JURISDICTION	APPLICATION	REGULATIONS & STANDARDS
National	Electrical	<p>AS/NZS 4836:2011 Safe working on or near low-voltage electrical installations and equipment</p> <ul style="list-style-type: none"> • Specifies a minimum set of procedures, safety requirements and recommendations to manage the hazards associated with electricity.
National	Machinery	<p>AS 4024.1603-2006 Safety of machinery - Design of controls, interlocks and guards - Prevention of unexpected start-up</p> <ul style="list-style-type: none"> • This Standard includes the specific requirement for all isolated energy sources to be locked, to ensure that it is not possible for somebody to inadvertently re-energise equipment that has been isolated.
NSW, ACT, QLD, SA, TAS, NT,	Workplace Safety	<p>Work Health and Safety Regulations 2011</p> <ul style="list-style-type: none"> • Outlines specific requirements pertaining to General Electrical Safety in Workplaces and Energised Electrical Work. A PCBU must ensure electrical work is not carried out while equipment is energised.
Queensland	Mining	<p>Coal Mining Safety and Health Regulation 2001 Part 4 Electrical activities, equipment and installations Part 10 Plant</p> <ul style="list-style-type: none"> • Outlines the requirement for standard operating procedures for safety and controlling risks of unplanned energy release.

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National & State Guide to: Regulations, Standards, Codes Of Practice and Guidance Procedures.

JURISDICTION	APPLICATION	CODES OF PRACTICE AND GUIDANCE PROCEDURES
Victoria	Workplace Safety	<p>WorkSafe Victoria Isolating Plant Guidance Note</p> <ul style="list-style-type: none"> Includes recommended procedures for isolating plant.
South Australia	Workplace Safety	<p>SafeWork SA Plant Isolation Procedures - Lockout, Danger and Out of Service Tags</p> <ul style="list-style-type: none"> Provides guidance to employers and employees on the appropriate isolation procedures for plant undergoing maintenance, cleaning, repair or construction.
Western Australia	Mining	<p>Department of Industry and Resources WA Isolation and Tag-out Procedures Guideline</p> <ul style="list-style-type: none"> The purpose of the guidelines is to describe well established principles from which employers can develop effective isolation policy appropriate to particular minesite conditions.
New South Wales	Mining	<p>Electrical Engineering Safety Electrical Isolation</p> <ul style="list-style-type: none"> Provides guidance material for mine operators in the development of electrical safety standards.
National	Confined Spaces	<p>Code of Practice</p> <ul style="list-style-type: none"> This Code of Practice on how to manage the risks associated with confined spaces in workplaces is an approved code of practice under section 274 of the Work Health and Safety Act (WHS)

Note: The above content is provided as a guide only and businesses should check with their local State or Territory regulatory authority for full details on energy isolation standards relevant to them.

Lockout Tagout around the World

CANADA

CSA Z460:2013 - Control of Hazardous Energy

Definition: Control of any electrical, mechanical, pneumatic, chemical, nuclear, thermal, gravitational or other energy that can harm people.

EUROPE

C2006/42/EC - Machine Directive

Definition: Focusing on the free market circulation of machinery and the protection of workers using such machinery, this directive defines essential health and safety requirements of machinery.

22009/104/EC - Work Directive

Definition: The employer shall take every measure to ensure the safety of the equipment made available to workers.



Note: The above content is provided as a guide only and businesses should check with their local State or Territory regulatory authority for full details on energy isolation standards relevant to them.

Lockout Tagout around the World

UNITED STATES OF AMERICA

OSHA 29CFR 1910.147 – Control of Hazardous Energy

Definition: General industry workers performing servicing and/or maintenance on machines or equipment and who are exposed to the unexpected energisation, startup or release of hazardous energy.

OSHA 29CFR 1910.333 – Electrical Safety

Definition: Safety-related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energised.

ANSI Z244.1-2003 – Lockout Tagout and Alternative Methods

Definition: A voluntary national consensus standard that represents several industry hazardous energy control best practices and also promotes greater flexibility through the use of alternative methods based on risk assessments and application of the hazard control hierarchy.

There's no disputing the benefits of an effective lockout program – the sooner you start improving your program, the better for everyone involved.



Did you know?

In countries where lockout standards are followed, accidents, injuries and fatalities have been reduced by **80% or more.**²

CHAPTER 3

6 Essential Elements of Lockout Tagout

Now, where do you begin? We believe that the best approach is to establish the 6 essential elements of lockout tagout safety and then use this base to continuously improve your program.



DID YOU KNOW?

A typical lockout program can contain **many separate elements**?

This includes creating, maintaining and updating equipment lists and hierarchies, task-specific procedures and workplace regulations (such as confined space entry requirements).

To keep these tasks manageable, we split them into 6 key elements. Let's get started:

1. Program/Policy

The first step to lockout tagout success is developing and documenting your equipment energy control policy/program. A written lockout document is the skeleton of your overall lockout program – It essentially establishes and explains the elements of your program.

It's important to take into account not only Australian regulation & standard guidelines, but also custom requirements for your employees that ensure they can understand and apply the program to their workday.

A program is not a one time fix, it should be reviewed on an annual basis to ensure it's still relevant and effectively protects employees. Creating a lockout program should be a collaborative effort from all levels of the organisation.



2. Equipment/Task Specific Procedures

It's important that lockout procedures are formally documented and easily identify the equipment covered. They should detail the specific steps necessary for shutting down, isolating, blocking and securing equipment to control hazardous energy, as well as steps for the placement, removal and transfer of lockout/tagout devices.

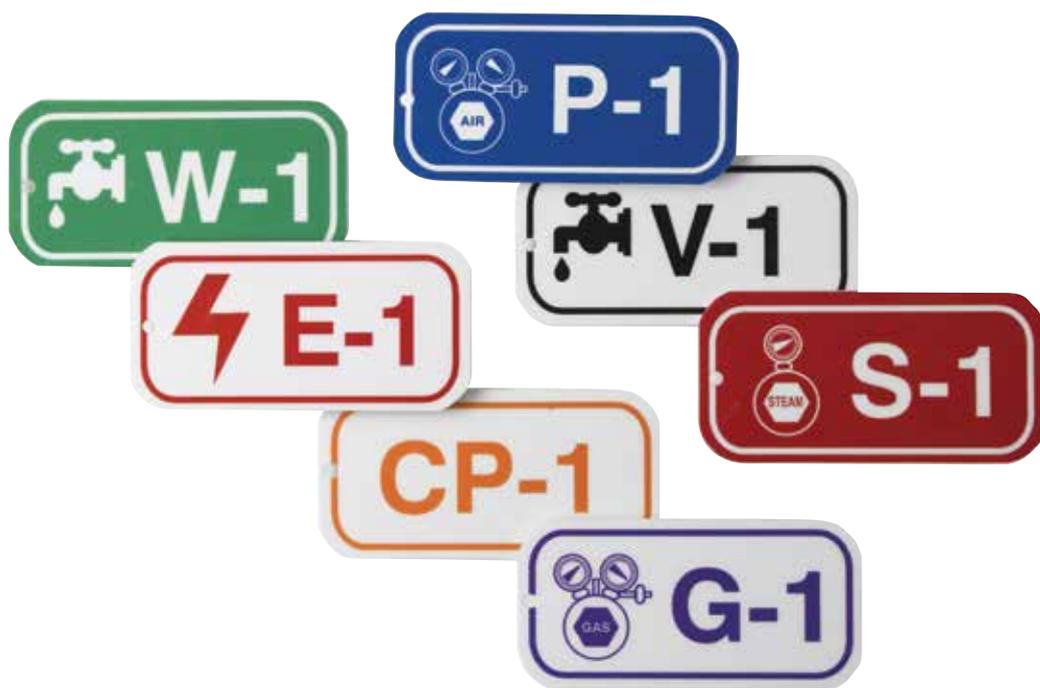
Going beyond compliance, we recommend creating best practice procedures that include equipment-specific photos identifying energy isolation points. These should be installed at the point of use to provide employees with clear, visually-intuitive instructions.

In addition, be sure your procedures are tailored to your workforce to help increase employee understanding. For example, you should post multi-lingual procedures if you have a multi-lingual workforce.



3. Identify & Mark Energy Isolation Points

Locate and identify all energy control points, including valves, switches, breakers and plugs, with permanently placed and standardised labels or tags. These points must be clearly marked. You should also keep in mind that these labels and tags should be consistent with the equipment-specific procedures from Step 2.



1	2	3	4	5	6
Program/ Policy	Machine/Task Specific Procedures	Identify & Mark Energy Isolation Points	Training and Periodic Inspections/ Audits	Provide Proper Lockout Devices	Sustainability

4. Training and Periodic Inspections/Audits

Be sure to adequately train your employees, communicate processes and conduct periodic inspections to ensure your program is running effectively. Training should not only include Australian regulations & standard requirements, but also your own specific program elements, such as your machine-specific procedures.

Often when a company is evaluated on their performance on isolation compliance, they are assessed on training for employees based on the three following categories.

- **AUTHORISED** – Those who perform the lockout on machinery and equipment for maintenance
- **AFFECTED** – Those who do not perform lockout requirements, but use the machinery that is receiving maintenance
- **OTHER** – Any employee who does not use the machinery, but who is in the area where a piece of equipment is receiving maintenance



5. Provide Proper Lockout Devices

The next element of your lockout program is providing employees with the necessary devices to keep them safe. There are many products on the market, and selecting the most appropriate solution for your application is the key to isolation effectiveness. It's important to document and use devices that best fit each lockout point.

WHEN ISOLATING A PIECE OF EQUIPMENT, IT'S ESSENTIAL TO FOLLOW THESE 7 STEPS IN ORDER TO BE COMPLIANT AND SAFE:

1. Notify affected employees of your intent to lock out the equipment
2. Review the written lockout procedure
3. Perform the normal machine stop
4. Shut off all energy isolation controls
5. Lock out the energy isolation controls
6. Dissipate any stored or residual energies
7. Verify the zero-energy state to safely begin servicing



6. Sustainability

Last but not least, we recommend taking a continuous improvement approach to your lockout program. By consistently reviewing your program, you are creating a safety culture that proactively addresses isolation. This allows your company to focus on maintaining a world-class program, instead of starting from scratch each year and reacting only when something goes wrong.

Not sure you can maintain the costs of sustainability? Consider the costs of re-creating your lockout tagout program each year – when you could simply maintain your program throughout the year to enhance your safety culture while reducing money spent re-inventing the wheel. When looking at your program from this perspective, it's clear that a sustainable program helps you stay one step ahead, while saving time and money.



The Lockout Tagout Scavenger Hunt

Now that you know the elements you need – let's put your facility to the test. Take a walk around your workplace and check to see if you have the following items:



- **Machine-Specific Procedures**

Are your employees trained on them?



- **Fully Stocked Lockout Tagout Stations**

Are they updated?



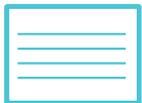
- **Permanent Identification Labels**

Are they easily identified?



- **Locks, Tags & Devices**

Were they easy to find and the proper devices for the types of equipment?



- **Tutorial or Training Posters**

Do these align with your employee training?



- **Corporate Safety Messaging**

Could your employees easily define these?

DID YOU FIND THEM ALL? GREAT! WERE YOU MISSING A FEW?

Now's your chance to update what's needed and begin your continuous improvement journey.

Next, ask a few of your employees to perform the same scavenger hunt. This will help you determine how well they understand your lockout program. After all, your employees are the ones responsible for performing lockout tasks. If they can't easily spot the device or procedure necessary, then it is likely out of sight, out of mind.

CHAPTER 4

The Cost of Non-Compliance

While aligning with the standard might be an intimidating task, the consequences of non-compliance are much more impactful.



The Cost of Non-Compliance

HOW DOES IT IMPACT YOUR EMPLOYEES?

Every employee deserves to work in a safe environment and get home safely every day. The best way to achieve this is to ensure your isolation program is not only compliant, but meets the custom needs of your workforce. We all know that non-compliance can have a serious, negative impact on the safety of your employees and your workplace.

“ People believe that even such simple equipment [devices] will slow them down. It will somehow get in the way of normal operations. But, if it’s properly designed, it certainly won’t. And it could save lives.

Judith Hackitt, CBE, HSE Chairperson
regarding management’s ownership within implementation of LOTO systems

”

The Cost of Non-Compliance

HOW DOES IT IMPACT YOUR BOTTOM LINE?

Non-compliance not only impacts the well-being of your employees, it can be a financial disaster for your company and kill your productivity.

Failure to meet Australian standards can often lead to fines that cost employers. Not to mention that a serious accident could lead to additional penalties, legal fees, medical costs, lost productivity and negative media attention, potentially costing millions of dollars for the company.

Just think about how 24 days without one of your experienced workers would impact your turn-around time, on-time delivery and parts per million (PPM) metrics at your facility.



Did you know?

Workers injured on the job from machinery that was not shut off properly lose an average of **24** work days for recuperation.³

CHAPTER 5

Your Lockout Tagout Checklist

Let's take a deeper dive into how your facility stacks up when it comes to lockout tagout.

Fill out the following checklist to determine where to go from here.



SECTION 1: PROGRAM/ POLICY

CHECK

Do you have a written Energy Control / Lockout Tagout Program and procedures in place?

Is your isolation procedure information stored and accessible to employees?

SECTION 2: PROCEDURES

Do you have machine-specific Energy Control Procedures?

In cases where machines do not have lockout procedures yet, do you have generic pre-task plans and procedures?

When you upgrade equipment, do you incorporate this into your lockout procedure?

SECTION 3: ISOLATION POINTS

Are labels clearly posted to mark energy isolation points?

Do you have your energy sources marked with energy source ID tags?

SECTION 4: TRAINING

Do you conduct training for Authorised Employees, Affected Employees and Contracted/Other Employees?

Are your employees trained on your facility-specific lockout devices?

Do you maintain lockout tagout training records?

SECTION 5: DEVICES

Do you have a documented equipment list or an asset management system?

Are your padlocks standardised by either colour, shape or size for your site and registered?

Do you have appropriate lockout devices for each type of energy control point in your facility?

Are your lockout devices readily available next to machinery or in a controlled area?

Does your facility include isolation signs and labels?

Do you utilise lockout stations?

SECTION 6: SUSTAINABILITY

Do you annually audit your lockout procedures?

Do you consistently track and continuously improve your isolation program?

You've gone through the checklist. Now think about your answers and see what lockout implementation stage your facility aligns with.

	STAGE 1	STAGE 2	STAGE 3
1. PROGRAM/ POLICY	<p>"We do not have a written program, but we have a general, site-based procedure that my employees use to lockout their equipment. Our program information, if any, is stored in an Excel file or on a shared drive."</p>	<p>"We have a site-based procedure and machine-specific lockout procedures available. Information is stored in a homegrown Excel file or through SharePoint. The company policy is posted around the plant."</p>	<p>"We have a corporate policy and documented procedures for each piece of equipment. Machine-specific lockout procedures are posted for our employees to reference. Our protocols are reviewed regularly to ensure compliance."</p>
2. PROCEDURES	<p>"We do not have machine-specific lockout procedures. We rely on the site-based lockout procedure, which is kept in a binder and can be accessed by employees at any time. I'm unsure if adjustments have been made since the documents were created."</p>	<p>"We do have procedures that have been developed for each piece of equipment. The procedures were developed internally and are kept in a binder, shared drive or SharePoint site for our employees to access. Anytime a procedure is audited, we add new equipment procedures as needed."</p>	<p>"Procedures with both written and visual components have been developed for each piece of machinery. These procedures are posted with the respective piece of equipment so that any employee working on that piece of equipment can easily access the procedure. When equipment is upgraded, a new procedure is drafted before the piece of equipment is energised."</p>
3. ISOLATION POINTS	<p>"Some points are labelled, others aren't. It really depends upon the machine."</p>	<p>"Most energy isolation points are labelled or tagged."</p>	<p>"All energy isolation points are tagged and referenced in that machine-specific procedure."</p>

	STAGE 1	STAGE 2	STAGE 3
4. TRAINING	<p>“We do not have a standardised training program. In general, the current operator will train the new operator on the procedure. We don’t worry about contractors because our contractors are coming from a third party provider.”</p>	<p>“Employees and contractors receive a brief orientation on the overarching company safety policy and general site-based lockout tagout procedures.</p> <p>A general lockout device training is included in this orientation.</p> <p>We do not differentiate between authorised and affected employees - all receive the same basic orientation. We document that the orientation has taken place.”</p>	<p>“All new, transferred and contracted employees receive a safety orientation. We then have specified tracks for affected and authorised employees.</p> <p>After training, a hands-on lockout device module is completed. In addition, all of our machinery is tagged with visual cues.</p> <p>All training is logged and tracked by each employee and I receive prompts when retraining is required.”</p>
5. DEVICES	<p>“We have a number of devices within our facility - we use whatever fits the energy isolation point. Devices are stored away from where lockout takes place.</p> <p>We do not maintain a list of equipment and lockout devices needed.</p> <p>Labels and signs are seldom used throughout the facility.”</p>	<p>“When our procedures were written, we received product suggestions and purchased accordingly. Some of our devices are kept in lockout stations.</p> <p>We maintain a spreadsheet of what equipment is used and what lockout device is needed.</p> <p>We use some labels and signs to indicate or warn workers against hazards and the need to lockout equipment.”</p>	<p>“The equipment requirements to lockout each piece of machinery are visually documented in the machine-specific lockout procedures that are posted around the plant. We use an asset management system to track our equipment and lockout devices.</p> <p>We have lockout stations positioned in every sub-section of the manufacturing facility that have been specially outfitted with devices specific to the equipment needs in those areas. Our equipment devices are standardised so employees can easily recognise them. Also, signs and labels are used throughout the facility for warnings and guidance.”</p>
6. SUSTAINABILITY	<p>“We haven’t made any adjustments to our procedures or lockout program since they were created. “</p>	<p>“We audit our procedures and update our program in the event of an issue or incident.”</p>	<p>“Procedures are audited annually. Whenever we implement a new piece of equipment, information regarding that piece of equipment is incorporated into the company policy and a machine-specific lockout procedure is drafted. We track the program throughout the year and annually review performance for continuous improvement.”</p>

CHAPTER 6

The Path to Best Practice

Now you're probably wondering where to go from here and how you can manageably move your program from your current state to a world-class state. Well, you're in luck! Let us explain...



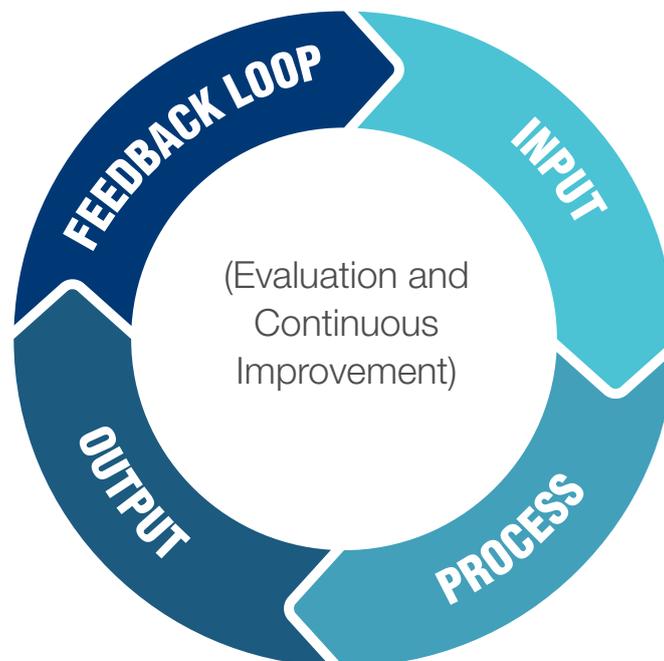
To create a best practice isolation program at your company – one that sends employees home safely every day – it’s important to take a systems approach. That means thinking of the big safety picture.

WHAT IS A “SYSTEMS” APPROACH?

To best explain, let’s first start with “programs.” A programs approach focuses on compliance – putting the devices and processes in place to align with the necessary regulations and leaving it at that. This is typically a reactive approach influenced by a previous incident.



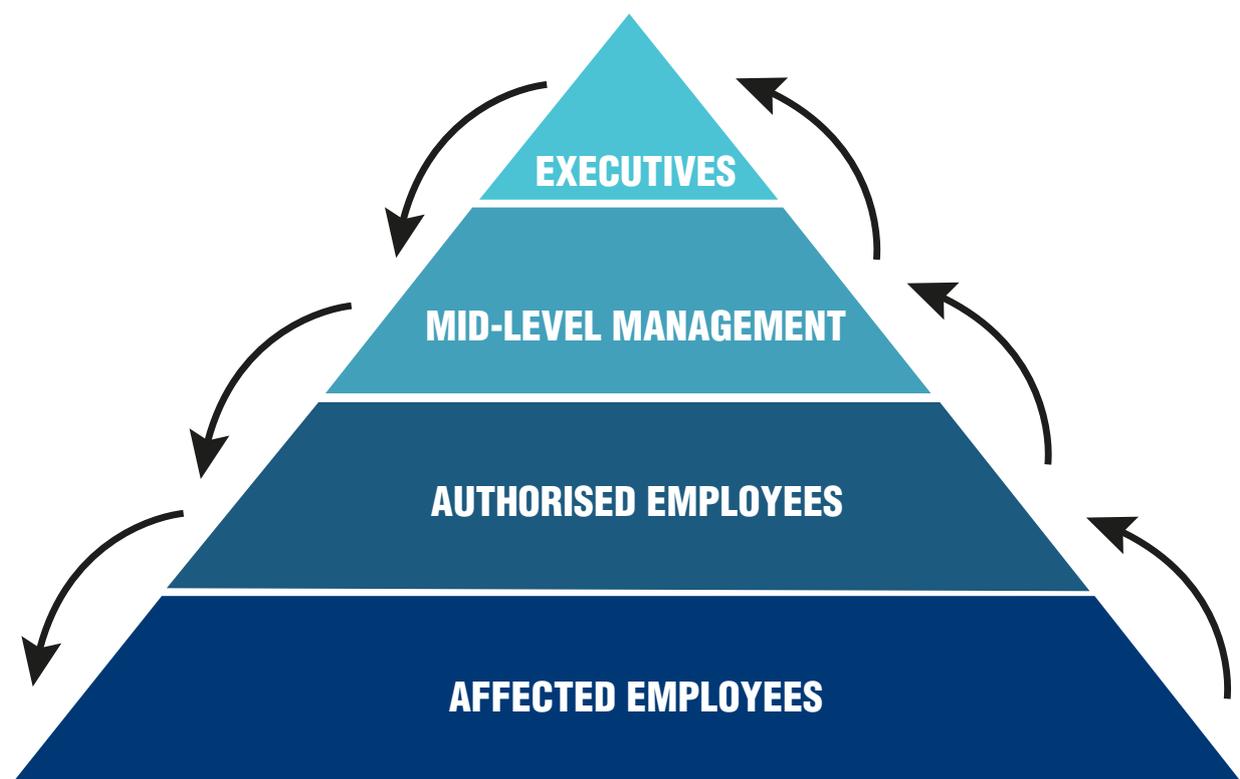
A “systems” approach goes beyond compliance to focus on performance. This is a proactive approach to continually improve your workplace and incorporate safety into the daily culture.



Let's take a look at just how a "systems" approach benefits your company.

A systems approach is integrated into the day-to-day management of the facility so that a safety culture can be formed over time. For this to occur, there are two key inputs:

- Management buy-in to promote change and sustainability
- Employee involvement from all levels: executives, mid-level management, authorised and affected employees

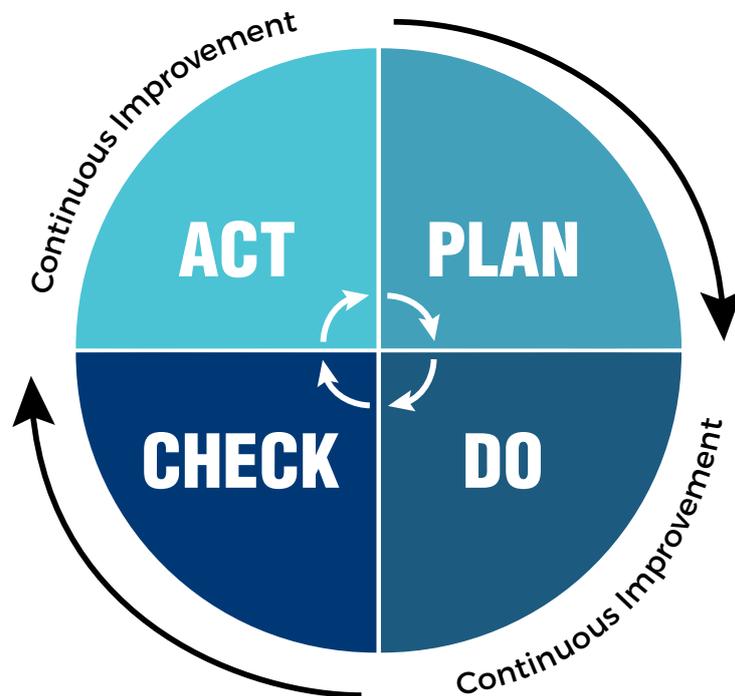


Building and Maintaining a Safety Culture

With the support of management and involvement throughout the organisation gained, the next requirement is working through the following steps⁴:

1. Develop a plan
2. Put the plan into action
3. Check the plan periodically
4. Identifying areas of opportunity

Throughout the process, it's important to reinforce employee engagement and watch your employees to better understand what they are struggling with and responding to well.



Think You Have it Down?

To be sure, take a look at how a basic compliance “programs” approach compares to a world-class “systems” approach to lockout tagout.

SYSTEMS APPROACH		PROGRAMS APPROACH
Best in Class	vs	Compliance
Integrated System	vs	Siloed Program
Multi-Level Involvement	vs	Singular Ownership
Plan-Do-Check-Act	vs	One Time Fixes

To learn more about implementing an effective, sustainable lockout tagout program that goes beyond compliance, and for more information on lockout tagout products, contact your Carroll Sales Representative on **1800 777 458**.

¹ OSHA. (2002). *Lockout Tagout Fact Sheet*. Retrieved from OSHA.gov: https://www.osha.gov/OshDoc/data_General_Facts/factsheet-lockout-tagout.pdf

² Howard, J. (2013). Workers Memorial Day 2013. Retrieved from CDC.Gov: <http://www.cdc.gov/niosh/updates/upd-04-26-13-a.html>

³ Montgomery, B. (2015). Ensuring Safety with a Lockout/Tagout Program. Retrieved from OH&S Online: <http://ohsonline.com/articles/2015/01/01/seven-steps-to-compliance.aspx>

⁴ Deming, W.E. (2015). The Plan, Do, Study, Act Cycle. Retrieved from Deming.org: <https://deming.org/theman/theories/pdsacycle>