Guideline for

Implementation of

AM

Safety ST001 - Isolation

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1 Purpose

The purpose of the isolation guidelines is to comply with the standard AM Safety ST001 - Isolation:

- to provide work instructions to establish and operate a system for the safe removal and isolation of hazardous energy sources (electrical, mechanical, stored,..) whenever any work is performed on an installation / equipment or systems, to prevent accidents and injury through accidental start-up or re - energization.
- to provide good practices which today are available within the AM group
- these Isolation guidelines will help sites to implement the FPS of isolation and help them to reach level 3 or more on the FPA in the near future. These guidelines can be used as basis for a review of the site isolation procedure.

Training of the guidelines:

- An associated training will be available on these guidelines including good practices which are available today within the AM group.

2 Scope/related requirements

The FPS on Isolation is mandatory and is to be completely implemented and executed in all premises of ArcelorMittal.

Tag Out is temporarily tolerated as a form of transition to lockout, an action plan must be developed to guide this transformation in the shortest possible delay.

Besides the isolation standard and the respective Golden Rule and Isolation Work Instructions are mandatory as well due to legal requirements:

OSHA directive US 1910.147;
You must have a lockout program if any of your employees perform maintenance work on installation or equipment that either:
- exposes them to injury if the equipment were to accidentally be started, or
- exposes them to injury if an unexpected release of hazardous energy were to occur, such as a blast of steam, corrosive chemical, or an electrical arc flash.

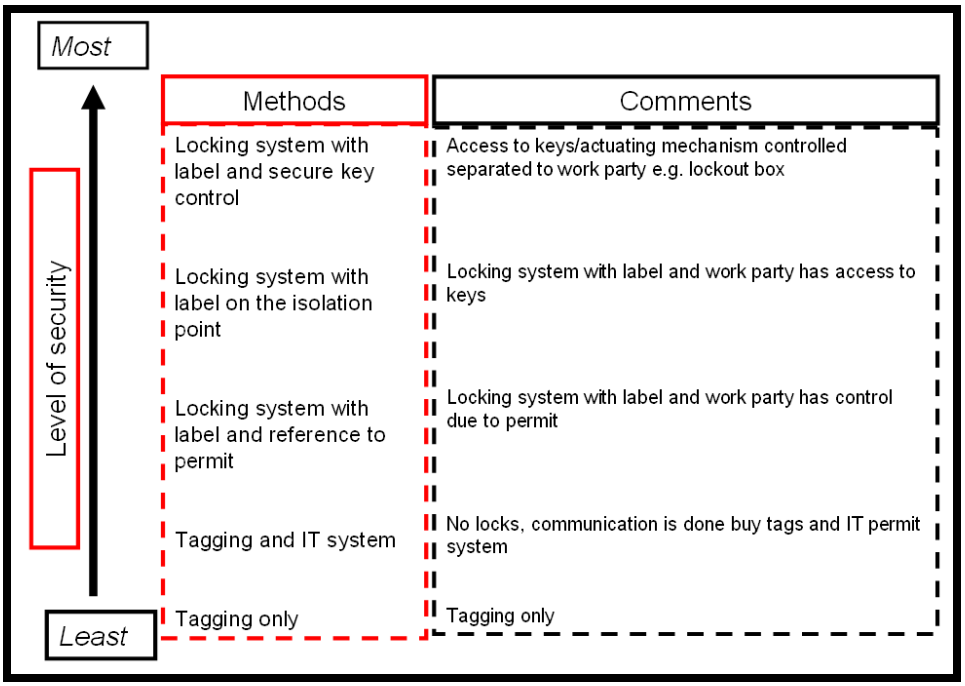
EU directive 89/655;
Employers must establish a program and utilize procedures for affixing appropriate lockout devices or tag-out devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energizing, start up or release of stored energy in order to prevent injury to employees.
The employer must take appropriate measures to reduce risks to a minimum. All work equipment must have clearly identifiable means to isolate it from all its energy sources. Maintenance work should take place when the equipment is shut down and maintenance workers must be able to achieve all necessary equipment under constant conditions of security.

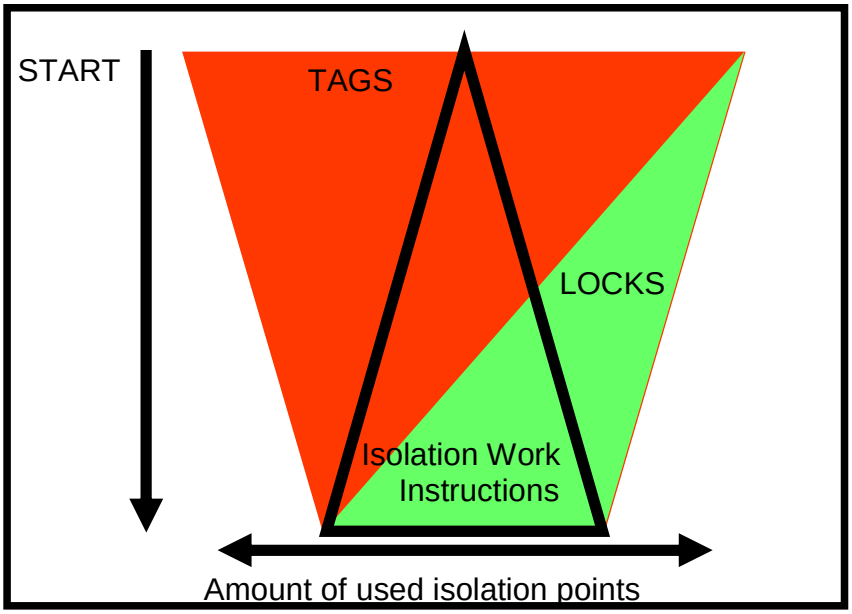
Not in the scope of the Lockout standard nor this guideline:

- Normal operating procedures those are “routine, repetitive, and integral to the use of the equipment”. For instance, lockout is not required each time material is added to a baler. Guards or interlocks should adequately protect the employees during such operations.
- Machine guards and safety interlocks: those are to protect employees during normal operation. Lockout on the contrary is intended to protect employees during maintenance and jam clearing when safety guards often have to be removed or be overridden. If a safety guard is being removed or overridden from a piece of equipment, it is a powerful clue that lockout may be necessary (do HIRA)!

3 General Approach to positive lock out

We must install the highest level of security, the positive lockout = is installing a locking device which physically blocks an energy isolation device and which is identifiable.





- Identify and understand the differences that can facilitate the compliance with this FPS (e.g. having lockable isolation devices by construction – work under total rather then partial isolation)
- Identify the possible consequences of the compliance (e.g. lengthen the stoppage for maintenance – equip the isolation devices with lockable system)

4 Definitions

Isolation

- Taking a piece of equipment or installation and temporarily or permanently placing it into a condition (or state) of zero power supply (and Zero Energy State) and of zero dangerous substance.
- Also making sure that the equipment or installation can not move or cycle due to stored or potential energy.

Isolation procedure

An isolation procedure is a written document describing a set of predetermined steps that has to be followed to keep an installation and/or equipment and its components from being energized or being set in motion or to prevent the release of stored energy, and avoid the release of hazardous substances in order to protect the safety of persons during services and/or maintenance and/or total productive maintenance tasks and/or tasks in degraded situations and/or inspections, which take place during normal production operations.

Energy sources

Any one or combination of (but not limited to) Electrical, Pneumatic, Hydraulic, Stored energy (accumulators, pressure vessels, batteries, springs, capacitors), Potential energy by virtue of position that needs to be support, heat such a hot water or steam and radiation (for example from reheating furnaces), hazardous substances, gases, … .

Listed next are short definitions of the types of energy sources.

- Chemical Energy: Power created by the reaction between two or more substances e.g. petroleum, natural gas, and propane.
- Electrical energy: A form of power created by the movement of electrons. Electrical energy, or electricity, can cause electric shock.
- Hydraulic energy: Power created by the compressive force or movement of a liquid in a confined area e.g. Machines that lift objects often use hydraulic energy.
- Mechanical energy: A combination of kinetic and potential energy resulting from the force of gravity, stored or the movement or release of a machine component e.g. such as a spring, clamp, wheel, counterweight, table (falling or moving), …..etc.
- Pneumatic energy: Power created by the compressive force or movement of air or gas in a confined area e.g. assembly tools often use pneumatic energy to force parts together.
- Potential energy: Power that is stored or suppressed or that exists because of its position and the effects of gravity e.g. machines that have large components that rise and lower, such as a press, contain potential energy that becomes kinetic energy when it is released. Stored energy are water, air, fluids, steam or another gas, liquid or vapour, … etc.
- Thermal energy: Power created by or in the form of heat. Heat can be retained in machine parts and cause burns.
- Radiation: Refers to any radiation process in which chemical changes can damage biological tissues and structural materials e.g. radiation sources.
- Kinetic Energy/ Stored Energy: is the extra energy which it possesses due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its current velocity.
- Hazardous substances are any toxic, corrosive or flammable material, which has the potential to cause injury or illness, e.g. gases, vapours, steam, liquids and dust.

Energy isolating device (isolation point or switching item)

A device (included are blank flanges and bolted slip blinds) that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all underground supply conductors, and, in addition no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy to which either a lock or key or combination type can be attached to avoid unwanted movement of the switching element.

Push buttons, selector switches and other control circuit type of devices are **not** energy isolating devices, unless they are safety devices designed to securely drop out energy source power.

Positive lockout
Is installing a lockout device which physically blocks an energy isolation device and which is identifiable.

Interlock system
Is a system with devices, especially one operated electromechanically, used in a logic circuit or electrical safety system to prevent an activity being initiated unless preceded by certain events (e.g. safety gate systems; a safety device that disables or prevents a machine start-up if a guard or door remains open.) This is **NOT** the same as a lock-out!

Tag out device
A prominent warning device, such as a tag and a means of substantial attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled will not be operated until the tag out device is removed. Tags must forbid hazardous actions at the energy isolating device, and be treated/respected as though it were a physical lock.

Energy isolation verification
Verification performed to ensure that the equipment has been isolated, e.g by operating the machine start-up controls, control lamps and displays taking measurements at bleed points, taking measurements to check the absence of power in the case of work involving electrical hazards

Zero potential energy
This means that the equipment/machine/device/system or any part of it has zero potential energy stored within it after isolation.

Live equipment
Live equipment is considered machines or equipment not disconnected or isolated from the main energy source/s.

Capable of being locked out
An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which or through which a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

HIRA
Hazard Identification and Risk Assessment

Isolation Inventory (II)
Is a general plant inventory of all equipment on a site / in a department which records all isolation points of a machine or process which will or can be used during isolation depending on the tasks to perform. These inventories are the basis of a task Isolation Work Instruction (IWI).

Isolation Work Instruction (IWI)
Is a document which describes how an installation for a specific job must be isolated from his energy sources. Including; energy sources, lockout points, locations, methods, verifications, checks, emergency control information, lockout application steps and release steps.

Affected employee (all members of the work execution team)
An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under isolation, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed (cleaners, crane driver, forklift driver,….).

Individual Isolation operator ('own isolation')
Is a person who only locks out energy sources for his own safety ('own isolation') and is declared competent to do so on selective equipment. Must undergo training and be assessed as competent; e.g. mobile equipment isolation, routine operational tasks, etc

Individual lock identification label
Is a label with all necessary information of the owner of the individual lock and attached to the lock when performing the lock out.

General Isolation operator (authorized person)
A person who locks out machines or equipment in order to perform servicing or maintenance on that machine or equipment. One familiar with the equipment and hazards involved who possesses the skills and techniques necessary to execute a safe isolation. Must undergo training and be assessed as competent.

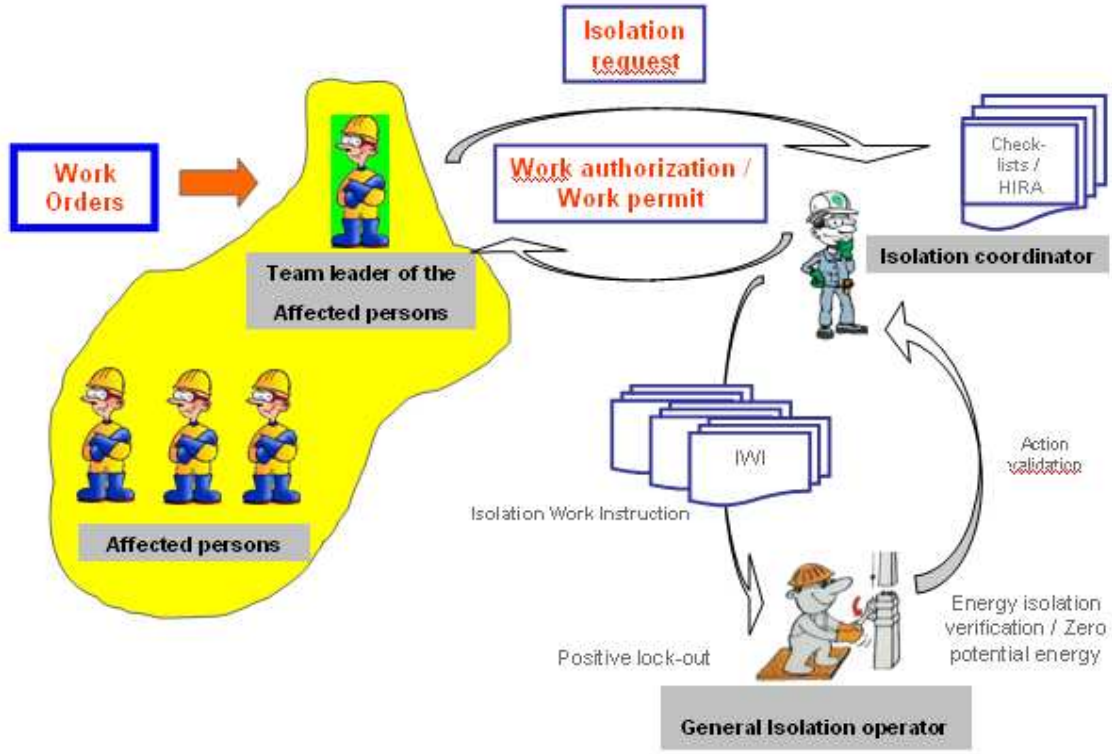
General lock identification label
Is a label that is used with relevant information during a general lockout by a general isolation operator e.g. in combination with department locks or service locks.

Isolation coordinator
He coordinates and checks follow-up activities between all parties during safety execution phase, mostly during maintenance days. This role could be dispatched through to several persons if business does not want to put a dedicated person in place for this activity. Must undergo training and be assessed as competent. Isolation coordinator normally doesn't perform the lock out.

Maintenance Department/Division Safety Manager/Supervisor
He is responsible for maintenance and safety for his perimeter. He has to define the risks/protective actions linked to the functional locations of the installation tree. He has to do the safety studies for proper isolation in each area. He is responsible to see that isolation inventories and task IWI's are in place and followed.

Work control system
All documents, procedures and installation schemes related with the lock out of equipment.

Workflow authorized isolation



5 Basics & pre requisites

Major basics & prerequisites for an appropriate isolation process are:

- A well defined organization with clearly defined roles and responsibilities
- A detailed Assessment
  - to identify and to inventory all types of energy
  - to inventory all isolations points
  - to carry out a respective isolation work instruction
- A work permit procedure
- Training to achieve competency on isolation process for all persons involved

Lockout pre requirements

- Consideration must be given to wear the correct PPE while lockout is being done, e.g. when electrical switchgear must be switched for lockout purposes.
- Plants must issue specific instructions regarding the required PPE when switching and lockout of specific equipment is performed. This is to be spelled out in the isolation work instruction (IWI) of each plant.

5.1 Organization: roles & responsibilities

Roles such as ‘Affected employee’, ‘Individual Isolation operator’, ‘General Isolation operator’, ‘Isolation coordinator’, ‘Maintenance Department Safety Manager’, ‘Safety Work Order Approver’, ‘Planner’ do not necessarily mean dedicated functions. Depending on the plant and organization, one person can often be in charge for several single activities. Roles must be described in detail and persons nominated and listed.

5.2 Assessment to identify & to inventory all types of energy

- Every plant must conduct an assessment of all energy sources present on the plant; that assessment must include the following:
  - Chemical energy (gases, petroleum, steam, etc.)
  - Electrical energy (AC, DC, batteries, capacitors, etc.)
  - Hydraulics (systems, accumulators, etc)
  - Mechanical energy (kinetic and potential energy)
  - Pneumatics
  - Thermal energy
  - Radiation
  - …….
- The assessment should include the potential for, and consequences of, human errors.
- Once the energy sources are determined, an isolation inventory must be set up.
- Define a working area that must be clearly delimited to avoid interference with any neighbouring not isolated energy source
- Consider risk reduction measures such as (but not restricted to):
  - reducing pressure and/or temperature;
  - reducing inventory;
  - detailed planning of the work:
    - to minimize the duration of exposure to broken containment;
    - to reduce the duration of the isolation; and
    - to ensure that the correct type and quantity of PPE is immediately available;
  - restricting incompatible or non-essential work nearby;
  - restricting access around the worksite by barriers;
  - reducing the number of people working on the plant;
  - monitoring the isolation more frequently;
  - having an operator in attendance throughout the isolation; and/or increasing supervision.
  - …

5.3 List / inventory all isolation points

- The plant must be divided into areas and the machines listed in each area. For each of the equipments the types of energy sources present are to be listed. The isolation point of each energy source must be determined and listed. When listing these energy source isolation points, the following must be included:
  - Upstream or downstream impact of isolation (safety related impact)
  - PPE required during isolation
- A labelling policy for the isolation points should be defined for the whole plant.
- The isolation inventory can then be used to determine all the energy sources that need to be isolated and locked out when work needs to be done on a specific machine, regardless the type of task that will be performed.
- When working on machines, the machine must be locked out, taking into account as well the other machines / equipment in the area that could endanger the safety of workers and as a consequence those machines / equipment must be isolated and locked out as well.

5.4 Assessment to build a respective isolation work instruction

- Appointing a person (Isolation coordinator and/or maintenance manager/supervisor) who through supervision ensures isolation procedures are rigorously applied.
- Defining and appointing responsibilities for isolation activities.
- The development of the written isolation work instruction should be done in consultation with relevant health and safety representatives, operators, people who are doing adjustments, cleaning, maintenance, repairs or inspections of the plant and, if possible, with plant manufacturers, suppliers and people who designed and installed the plant. If the appropriate expertise does not exist at the workplace for the development of procedures, the employer should engage the services of a suitably qualified person or persons.

- Isolation work instructions are written documents which are accessible to the relevant employees at the workplace.
- The isolation procedures must require isolation work instructions for all situations under which the isolation procedure is to be implemented.
- All equipment must have written isolation work instructions developed from a risk assessment. These procedures will set out how the equipment is to be made safe and kept safe. It will include, for example: decontamination; venting of stored energy; securing of rotors or fan blades; chocking of vehicles, disconnecting, blocking or bleeding of equipment, cables, pipes and vessels. It will also show the isolation points for lockout and test procedures as well as the procedure to remove another person's lock/tag.

Written Isolation Work Instructions

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Written isolation work instruction must be developed and revised by a competent person with knowledge of the equipment, area, process and task, and must include:

- Description of tasks or areas made safe by the procedure, including the means and sequence by which the isolation will be achieved and the checks that are to be performed prior to the commencement of work
- The identification/description of equipment, devices or items requiring energy control.
- Identification of isolation devices.
- Identification of all temporary connections or back feeds planned during the isolation.
- The method used to isolate (e.g., open electrical breaker, physical disconnection, blocking, pinning, pressure release) will be included when required for clarity
- The identification of possible sources of stored energy, and a description of how to dissipate or restrain the energy will be included when isolation is complex and the nature of the stored energy is not readily apparent.
- A description of how to verify the energy control effectiveness will be included for all isolations.
- Date, author and approver is required on IWI
- Revision history

5.5 A permit to work procedure and lock out permit

Permit-to-work (PTW) systems are used within safe systems of work to authorize work of a hazardous or **non-routine** nature on a plant as well as for people working in an area to which they are not familiar.
The PTW system supports a range of permit types including access permits, isolation permits, confined space permits, hot work & welding permit, critical installation permit, digging permit, ……etc. A PTW system can impose a detailed step functionality which reduces significantly the risk of human error in the application and restoration of isolations.

Therefore tasks that require isolation are described in an Isolation Work Instruction (IWI); the isolation procedure should require a Permit-to-Work system which ensures the necessity of an IWI for isolation tasks (pre-planned standard isolation lists).
This PTW will include an extract of the HIRA's (Job related and related to the work environment).
PTW should also be used by own personnel when doing a job in an area that is not familiar to them to make sure they are informed of and acquainted with the risks of the area.

In general IWI are sufficient for routine activities; define when PTW must be used e.g.;

- Contractors
- Multiple Lockouts & Areas (ensure adequate control, security, monitoring and communication!!)
- Non-production work (e.g. maintenance, inspection, testing, construction, dismantling, adaptation, modification,…etc)
- Plant access permit
- Non–routine operations
- Transfer of work from one team to an other
- …..

6 Training to achieve competency on isolation process

6.1 Employee Training

- Own employees
  - Initially training and motivational training on the why, who, when and how of lockout
  - When new equipment or energy sources are added to the workplace or changes are made
  - For the purpose of discussion only, we distinguish between 3 types of employees (see also definitions in paragraph 4 of this guideline) :
    - Affected employee (do not do any lockout themselves);
      - Your job requires you to operate or use installation or equipment on which servicing or maintenance is being performed under LOTO or if your job requires you to work in an area in which servicing or maintenance is being performed.*
      - Must be trained in; recognition of lockout equipment, the dangers of overriding lockout, prohibitions against attempting to operate any equipment that they have been notified is locked out, or appears to be locked out and must be tested to make sure they have the required knowledge
    - Individual isolation operator (own lockout);
      - You apply LOTO **for yourself one** to installation or equipment in order to perform servicing or maintenance on installation or equipment
      - Must be trained in full detail of the lockout procedure, hazards associated with uncontrolled energy, written lockout program, proper techniques for applying lockout and must have been tested to make sure they have the required knowledge and skills
    - General isolation operator (authorized person);
      - You apply LOTO **for yourself and for others** to installation or equipment in order to perform servicing or maintenance on installation or equipment
      - Must be trained in full detail of the lockout procedure, hazards associated with uncontrolled energy, written lockout program, proper techniques for applying lockout and must have been tested to make sure they have the required knowledge and skills

- Contractors
  - Information / training must be given to all contractors and or other employers
  - Require them to respect the lockout procedures and locked out equipment in all related aspects
  - Contractors can be ‘authorized’; this requires a detailed training, testing of their knowledge and they must be sufficiently acquainted with the equipment and environment.

- Visitors
  - Information about the general isolation procedure must be given as is appropriate for the visit they will be making to the plant and equipment.

6.2 Employee Retraining

Retraining will be provided whenever one of these situations occur:

- Change in job assignments;
- Change in machines, equipment or process present a new hazard;
- Change in the energy lockout/energy control procedures;
- Whenever a periodic inspection reveals, or there is a reason to believe, that there are deviations from or inadequacies in the knowledge or use of the energy lockout procedures;
  - Annual program evaluations;
- Accidents, near hits or dangerous acts or dangerous situations whereby the effectiveness of the lockout program is in doubt; after written procedures are revised.

7 Planning and preparation of equipment

Adequate planning requires:

- enabling task-specific risk assessments and/or pre-planned standard isolation lists (IWI) to be made and mitigation actions put in place;
- identifying whether a larger section of the plant might need to be shut down or the work deferred;
- identifying interaction with other sections of plant subject to temporary isolation;
- involving sequencing and co-ordination of intrusive work with other plant operations;
- including a 'walk-the-plant' step, to check that the installation matches with what is described and, especially, that all isolation points have been identified and are accessible/ can be operated, etc;
- ensuring preparation and co-ordination of job documentation such as risk assessments, method statements, permits and isolation permits;
- ensuring cross-referencing of relevant permits; and
- enabling all necessary tools, equipment, materials, etc (including any additional personal protective equipment required for those installing and removing positive isolations) to be available at the worksite at the start of the job.
- listing any additional **unplanned or ad-hoc tasks** and lockouts that may be required during a planned maintenance. These can be important tasks that came up after final planning the previous day(s). If possible, avoid those tasks because they will always create supplementary hazards and risks.
- the deferent responsibilities for the planning preparation must be defined into a procedure

8 Emergency procedures

- Consider also in the risk reduction measures the easy way to allow workers to escape in an emergency due to a failure of a lock out put in place. In this respect: make sure any mechanical blockage applied if failsafe in it's own!
- During an emergency where (a) person(s) is (are) involved in an incident of electrical burns (flash) or electric shock , the normal electric shock first aid procedures must be followed. These are displayed prominently inside all electrical switch rooms, control rooms and sub-stations and must be followed and applied by trained first aiders, including requesting assistance from the medical emergency services.
- The required response during an emergency is captured in the emergency procedures document of each plant or department with all required details; mock drills must be done with specific reference to incorrect isolation and lockout procedures. All such incidents must be captured on an occurrence safety management system for formal investigation and corrective actions.

9 Isolation methods & their use

9.1 Lock Out

Lock out is the best way of working and must systematically according to the standard as described in standard AM Safety ST 001.

9.2 Tag out

When lockout doesn't yet exist and as a consequence tag out systems are temporarily used during the transitions phase, employees shall be trained (apart from the proper application of the procedure) on the following limitations of tags:

- Tags are essentially warning devices affixed to energy isolating devices, and **do not provide the physical restraint on those devices that is provided by a lock and thus not the same level of safety**.
- When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.
- Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.
- Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
- Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

9.3 Failures

The greater the potential hazard, the more effective, secure and controlled the isolation should be.
Where a number of options for risk exclusions exist, you must use the lowest-final-risk option that is reasonably practicable. Engineering solutions are preferred to procedural controls or to reliance on the use of personal protective equipment (PPE).

All isolation methods can fail (even positive isolations – particularly during installation and plant reinstatement activities). The potential for human failure is a major factor affecting the overall reliability of an isolation method. The performance of an isolation depends not only on the integrity of the isolation hardware, but also on the adequacy of the arrangements to identify each isolation point, secure the isolation, prove/monitor the isolation and maintain overall control of the work. When selecting an isolation method, you should consider the potential for technical and **human failure**.

9.4 Controlling changes

Any change to isolation arrangements should be **reviewed**, **reassessed** and **authorized**. When an isolation deviation occurs, whether controlled by isolation work permit or a safe work isolation instruction, stop the task and re-evaluate it and take appropriate actions before continuing the execution of the task(s) !

9.5 Exception

A. Work on small cord and plug equipped equipment where the plug can remain under the control of the employee performing the work and unplugging the cord completely isolates all hazardous energy. EXAMPLE: Changing the bit in a portable drill.

An acceptable approach to rendering the equipment inoperative for the worker doing the work is to :

1. disconnect the plug from its electrical supply,
2. keep the plug in sight and within reach so that no one else can accidentally plug in the equipment, and
3. keep the plug under his or her exclusive and immediate control at all times while working on the equipment.

If the worker leaves the equipment unattended and the work is incomplete, then the worker must verify that the plug is disconnected from its supply before the worker resumes work on the equipment.

In the case of permanently connected equipment, the worker must lock out the equipment's energy isolating device(s) e.g. circuit breaker, disconnect switch, etc. before proceeding with the work.

B. Working on live equipment

No person is allowed to do maintenance and repairs on live equipment. After faultfinding, lockout must be performed to carry out the necessary repairs.

However, some tasks such as lubricating or adjusting moving equipment or machines are done on live equipment and as a consequence (a) specific task procedure(s) must be in place, personnel must be trained, tested and declared competent to perform such tasks and they must furthermore be equipped with supporting tools to mitigate risk. Risks must be analyzed and the safety of employees may not be compromised.

- Nobody shall permit or require any person other than a competent person or a person who has been trained to the satisfaction of an inspector to do any task on or near any live installation if such task may endanger him …
- When performing a task on live equipment there must be a second person in the area who has visual control on the performer.

C. Temporarily activation

On certain occasions it is necessary to activate equipment that was locked out for a short period to move a piece of equipment or to test a part of the machine. Despite the fact that lifting isolation through the process as described in this document and then to request isolation and to perform it again, could, and in many cases, will take a very long time, the procedure as spelled out below must be followed in all such cases to ensure the safety of all workers involved and those not involved in the specific task and on the specific machine.

Different steps:

1. The person in charge of the task will ensure that all team members and other present people vacate the installation/ area of danger.
2. All team members as well as other people present will remove their personal isolation locks from the key safe / lock box. This action states that they are not locked out anymore and may not enter the machine.
3. The person in charge of the task, must post “guards or watch man” in adequately structured places or secure the area to ensure that no person is able to enter the machine / danger area. These watch persons must remain on guard until the equipment is locked out again.
4. The person in charge of the task will request for the part / piece of equipment to be activated and will make available the key/s. The rest of the keys of the equipment that remains locked out, must be protected by locking it out again with his/her lock on the key safe / lock box of the team.
5. After completion of the test / movement of equipment, the energy source/s must be locked out again and the keys returned and locked out on the key safe / lock box.
6. All team members will again lock out with their personal isolation locks on the key safe / lock box.
7. The “guards” may be removed and the team may enter the machine and continue to work.

10 Isolation process

10.1 Securing isolations

Isolations must remain secure through the full duration of the intrusive task. The **degree of security** required for isolation will be **proportionate to the risks** resulting from isolation failure. Use locking arrangements to physically prevent accidental or unauthorized removal of the isolation.

All plant and equipment relating to each specific isolation should be clearly identified on the worksite. Permanent labelling for this purpose is required. All isolation points, including bleeds, spades and main electrical, pneumatic and hydraulic switches/ valves etc. should be fully documented, identified and referenced within the work control system to ensure the correct position and sequencing of all the components associated with an isolation scheme. This is in addition to full checks at the worksite.

10.2 Detailed Isolation Procedure Steps (example)

i. Request for isolation

- The request for isolation should be the result of a work permit for a planned or non-planned activity on equipment. Traceability of all the involved persons and their responsibilities should be clear and signed off. There must be a written document which shall be recorded during a defined time.
- Who can request for isolation :
  - After the completion of lockout training and being declared competent, one may be appointed as authorized to request lockout that must be performed by the General Isolation Operator.
- When an Individual and General Isolation Operator requests lockout, he/she must follow the procedures as set out in the training manual.
- An Individual Isolation Operator can become a General Isolation Operator for a specified task after having been trained and tested. He/see will put locks on the equipment for him/herself and those working with him; the following will apply:
  - Isolate and lock out the equipment with his/her personal isolation lock.
  - Attach his/her lock identification tag on the lock.
  - The isolation lock key goes into a lock box or key safe if a team is working with him/her.
  - Other team members lock out on the same lock box or key safe using their personal isolation locks.
  - There must be a proper transfer of responsibility. Lock can stay on the isolation point but there must be a transfer with a lock somewhere e.g. at the isolation coordinator and on the lock-box between the users of the lockout.

ii. Identify all energy sources and other hazards, Risk assessment and selection of isolation practice (HIRA)

- All energy sources likely to re-activate the plant, and places where people doing the work at risk, should be identified in an assessment (IWI, inventory, check lists,…).
- If original designer and installer “as built” diagrams of plant installations are not available, new diagrams/photographs showing location and details of various plant components, isolation points, switches, valves, energy lines, pipes, power sources, and control points (including computers) need to be developed as part of the isolation procedures. These diagrams/photographs can then also be used, along with the IWI’s, for information and training of workers.

- Shutting the plant down may require other hazards to be identified and the risk of injury eliminated or minimized. For example, associated equipment may need to be locked-out to prevent re-activation, or valves on pipes and lines carrying gases or fluids may need to be locked shut or blanked off.
- Depending on the type of plant, other hazards may include: hazardous substances, such as gases, acids, alkalis and solvents, falls, burns, asphyxiation, impact……..
- Risk can be different when the equipment is charged with material or if it is free of material.

The IWI needs to be completed whenever a new task/hazard combination is identified. It should be reviewed and revised when appropriate, which may include a change to the task, procedure, or equipment design; anyway a regular review of documents is needed (e.g. once per year).

iii. Identify all isolation points

- All plants and equipment of a type that could require an isolation procedure should be designed with appropriate isolation points for all energy sources to enable work on the plant or equipment to be carried out safely.
- It is important to identify all isolation points in a system, as it may be necessary to use a local isolator to shut down a specific part of the machine (e.g. a motor) while the remainder of the associated plant or equipment remains in operation.
- Emergency stop buttons and similar stop devices on their own will not achieve isolation. It is extremely dangerous and therefore not allowed to rely solely on emergency stopping devices, as they are not designed for frequent use, cannot be locked out in all cases and may allow energy to be inadvertently re-activated. They may also allow control circuits to remain live. Remote control rooms and process computers should be considered when identifying isolation points.
- Consider secondary power supplies as well as the primary supplies.

iv. Preparation for shut down

- **During planned maintenance days**, the available time is of critical importance and must be utilized in an effective manner. Lockout of equipment on a planned maintenance stop could take a long time. Define rules and guidelines to ensure that lockout commences as soon as the plant or equipment has been stopped and the execution is done in an efficient way.
- Notify affected employees that the equipment is being locked out for maintenance.
- Plants or equipment that has a **single energy source** can usually be shut down by the operation of a single control such as a switch or valve. More complex plants or equipment may have to be shut down in a certain sequence, e.g. one conveyor before another, or by shutting down several energy sources, e.g. electricity, hydraulics, pneumatics, petrol, oil, steam, LPG, LNG, coal etc.
- Unscheduled repairs need special attention: the use of a PTW or prepared work orders (repair works that are foreseen but not planned) must include a risk assessment and appropriate explanation to the person(s) performing the task prior to the start of the task.

v. Machine or equipment shutdown

General Isolation Operators or Individual Isolation Operators must shut down the equipment, installation, or other system components, placing them in a zero-energy state. All potential energy (mechanical, electrical, gas, hydraulic, pneumatic, hydrostatic, suspended mass, rolling stock on a slope, etc.) must be eliminated, purged, relieved, discharged or blocked out in a safe manner. Persons responsible for isolation must test for zero potential before tasks on the plant or equipment commences. The person, who is executing the work, must perform a test to confirm effective lockout.

Trace all systems to locate and lockout energy sources. The main source may be electrical, for instance, but pneumatic and other forms of energy may also be present. Always look for other possible energy sources.

All equipment capable of being energized or activated electrically, pneumatically, or hydraulically etc must be de-energized or de-activated by physically disconnecting or otherwise making the apparatus inoperable. Make sure that any blockage used is secure on its own (e.g. against gravity etc).

Always ensure that the operators are aware of the plan to shut down and lock out equipment, installation, or other system components.

In some cases, operations personnel or equipment operators may be required to shut down components because of their special qualifications or knowledge of the system before lock-out can be done by the Individual or General Isolation Operators.

All contractors who are permanently on site, trained on the isolation procedures and demonstrate competency according to approved procedures, can be appointed by the management to execute isolation

vi. Isolate all energy sources

All plant and equipment relating to isolation should be clearly identified and labelled on the worksite. Permanent labelling, attached to the isolation point, for this purpose is required. All isolation points, including bleeds and spades, should be fully documented and referenced within the IWI to ensure the correct position and sequencing of all the components associated with an isolation scheme (e.g. the position of vents, the removal of physical isolations). This is in addition to full checks at the worksite.

Attach an isolation point identification label to each component of an isolation scheme, including bleeds and spades. This allows to check that all necessary isolations are in place and gives a visual indication that a device is in active use as a means of isolation. Lock numbers should match the line diagrams in the isolation documentation.

vii. De–energize all stored energies

Take any of the following steps that are necessary to guard against energy left in the plant after it has been isolated from its energy sources:

- Inspect the plant to make sure all parts have stopped moving
- Install ground wires
- Relieve available pressure
- Release the tension on springs, or block the movement of spring-driven parts
- Block or brace parts that could fall because of gravity and make sure the blocking is stable on its own in all conditions
- Block parts in hydraulic and pneumatic systems that could move from the loss of pressure and make sure the blocking it stable on its own in all conditions
- Bleed the lines and leave vent valves open
- Drain process piping systems and close valves to prevent the flow of hazardous material
- If a line must be blocked where there is no valve, use a blank flange
- Purge reactor tanks and process lines
- Dissipate extreme cold or heat, or provide protective clothing
- If stored energy can re-accumulate, monitor it to make sure it stays below hazardous levels.
- Etc.

viii. Applying lockout devices

- All relevant energy – isolating devices are to be locked.
- Only standardized devices can be used and they are not to be used for anything else.
- Use a lockout device if your lock cannot be placed directly on the energy control.
- Every employee in the work crew must attach his personal lock and identification label on the energy control. If this would not be possible, than the keys of the locks which are directly on the energy controls will be locked by all workers using their personal lock (e.g. by use of a lock box). There must be a system where the equipment cannot be restarted without the removal of each person's lock/tag.
- When several workers or trades are working on a machine, you can add additional locks by using e.g. a lockout bar or similar. One can add any number of locks by inserting another lockout bar into the last hole of the previous bar.
- The competent person must first Lock out the energy source(s) and add also his/her Individual Lock Identification Tag or general lock identification tag. This will always be the first lock on and the last lock off.
- Where isolation involves only one person, that person must be deemed competent by site.
- Personal Locks may never be removed except by the person to whom they belong.
- No isolation procedure is deemed as meeting the requirements of this standard if it relies on shutting off emergency stops or control power; isolation of electrical sources shall be at the primary power source or through the use of a positive lock out device.
- A record, as part of the IWI, must be kept of all equipment locked out or otherwise rendered inoperable so that all of these devices can be reactivated once the work is complete.

ix. Locking

- Each worker involved in a lockout operation must attach a durable lock identification label to his or her personal lock. The individual lock identification label must identify the worker's name, in addition some other information can be mentioned e.g. ; the worker's employer (contractors) and/or the date and time of lockout, the telephone number, work area involved, and the reason for the lockout. A lock identification label in itself offers no guarantee that a machine or system is locked out. It simply provides information.

x. Verification of isolation/ de-energizing

- After locking and tagging, make sure all danger areas are clear of personnel before doing a trial.
- After plant or equipment has been shut down, locked out and tagged, all isolated power sources should be tested first with appropriate instruments (pressure, high voltage, voltage,..) and then by trying to activate the plant, before any person attempts to start work on the plant. This should be done by a person who understands the complexity of the plant or equipment (or parts of the plant or equipment, including control stations and computers remote from the plant or equipment).
- Verification shall be made that all live circuits, parts, and other sources of hazardous energies and products, have been disconnected, released and/or restrained. A general isolation operator who is qualified shall operate the equipment operating controls, perform voltage verification, inspect open switches and draw out breakers to ensure that energy sources are isolated.
- Specific standards must be put in place which describes how qualified General Isolation Operators must perform the Voltage verification test and application of grounding. The calibration of all instruments required to test isolation procedure should be checked before use.
- Press all start buttons and other activating controls on the equipment itself and return controls to the off position when testing is complete.

- It is not safe to assume an isolator has locked out an electricity source simply because it is in an open position. While normally this should open an air gap between contact points, it is possible for contact points to become welded together by the passage of electricity, and remain so even when the isolator appears to be open.
- Work on the plant should not begin until tests have confirmed it is safe to do so.

xi. Perform the task

Each worker who is working under isolation must assure his own safety by means of a personal lock on the isolation point or by means of his personal lock on a lock-box. This lock must be added before starting the job.

xii. Re-energizing

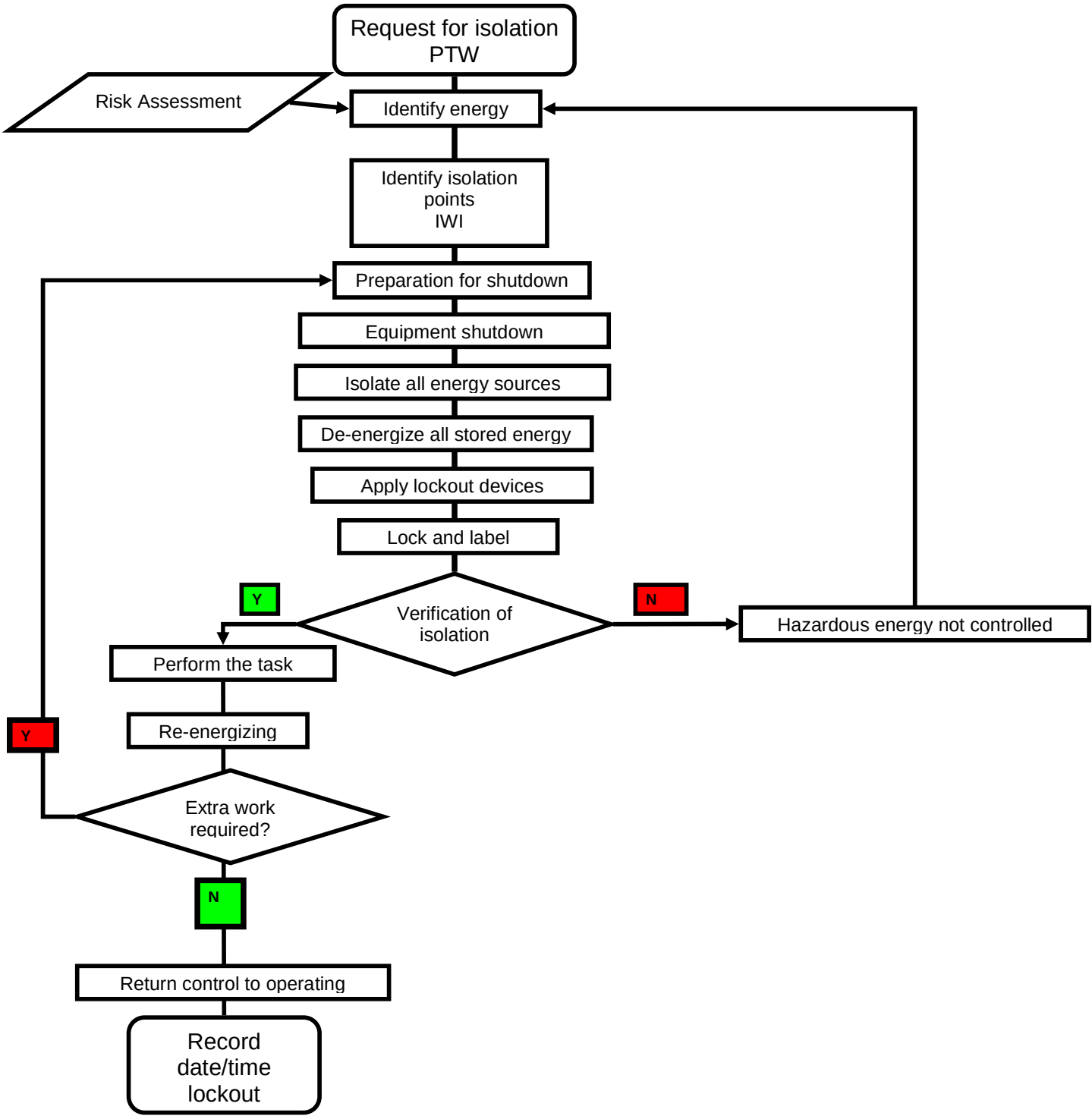
- Tests and visual inspections;
  A General Isolation Operator or an Individual Isolation Operator shall conduct tests and visual inspections to verify that all personnel are in the clear and that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed so that the circuits and equipment can be safely energized.
- Put the safety guards back in the original position;
- Warning employees;
  Employees exposed to the hazards associated with reenergizing the circuit or equipment shall be warned to stay clear of circuits and equipment.
- Each worker has to remove his own lock
- Removing Lock:
  Each lockout device shall be removed from each energy-isolating device by the General Isolation Operator or by a Individual Isolation Operator (competent for the specific task), i.e. by the one who applied the lockout device.
- Return system to operational status and the switches to power ON. Have qualified personnel restart installation or equipment.

xiii. Return control to operations

When all work is completed, the person in charge of the lockout operation should formally return control of the equipment or system to plant personnel.

xiv. Record date/time lockout removed and system restored

This last step is important. It saves valuable information that may be lost if not recorded. Staff involved in the shutdown may not remain at the same jobsite. Owners or operators may require this information to help plan future shutdowns.


Request for isolation PTW
Risk Assessment
Identify energy
Identify isolation points IWI
Preparation for shutdown
Equipment shutdown
Isolate all energy sources
De-energize all stored energy
Apply lockout devices
Lock and label
Verification of isolation
Y
N
Hazardous energy not controlled
Perform the task
Re-energizing
Y
Extra work required?
N
Return control to operating
Record date/time lockout

11 Audits/Evaluation and Records

11.1 Periodic Program Evaluation/ Audits

- Interviews with authorized and affected employees
- Inspections to ensure that the equipment has been properly locked out
- Inspection to ensure that all equipment used in lockout is appropriate for your written lockout program

11.2 Record Keeping

- Traceability of the isolation performance
- Employees training records
- Periodic program evaluations and follow-up
- Accident and near hit reports, dangerous acts and dangerous situations
- Documentation of employee lock removal by others, when inadvertently left on (see 14.9.).

11.3 Example Program Evaluation

- Are all employees conducting work on the equipment properly trained and defined competent on the lockout procedure?

12 Design, engineering and new, revamped or modified equipment

Suitable isolation arrangements on the plant should be clearly specified at the design stage.

The opportunity to achieve an inherently safer design is greatest for new plant and equipment; the same approach should be followed for plant modifications and revamps. These opportunities must be used to assure the installation is capable of being locked out and in line with the company standards and legal requirements, i.e. it is obligatory that the construction of new installation or revamp must include the implementation of the state of art isolation system, allowing lock out in compliance with AM Safety ST 001.

Consider the reduction of isolation points per isolation so this will simplify the execution of the isolation. Also consider isolating on a higher level, global isolation, since it will reduce the execution time.
The potential for human failure, including error, should be addressed and, wherever possible, minimized in the design (less isolation points/ technical solutions).

13 Computer Support for the Isolation Process

- A good isolation process requires many information transactions. These transactions come in the form of paperwork, electronic data or a combination of both. Good LOTO software can help to have a better process and a safer process. If integrated into the existing maintenance software, it will reduce the workload significantly. Before considering the many benefits of computer support of the LOTO process you must ask yourself if this support for LOTO is the right thing to do (now)?
  - Technical aspect: IT support, integration in the existing software, it is a safety tool,…
  - Financial feasibility: ROI, great payback potential, reducing the overall time to complete the work,
  - Process improvement: change of the process and commitments of all participants

- Benefits : how can LOTO software make the equipment lock-out and workers safer?
  - Reduce human errors?
  - Less space for changes; restrictive environment, not allowing additional work to be assigned to open or active work orders, ….
  - Restricted work flow
  - Shared lockout; only one lock/tag on the isolation point; this feature significantly reduces the workload and simplifies a complex procedure.
  - Time reduction
  - Safer planning
  - Integration into the Maintenance Management System (Work permits and orders)
  - Conflict checks
  - Maximum communication
  - Recording the LOTO activities
  - Coordination

14 Practical guidance's

14.1 Shift or personnel changes

In order to ensure the continuity of lockout protection, this section contains a provision for the orderly transfer of lockout device protection between off going and oncoming employees, to minimize exposure to hazards from the unexpected energizing or start up of the machine or equipment, or release of stored energy:

- The off going employee shall communicate with the oncoming employee as to the machine or equipment status and compliance with the lockout procedures prior to leaving shift.
- The off going employee shall in the case of e.g. a lock box closed with an individual department lock of the General Isolation Operator, remove his personal lock affixed to the lock box and the oncoming employee add his/her own personal lock to the existing previous shift's lock box; the individual department lock of the general isolation operator must be appropriately changed face to face with the oncoming general isolation operator. **OR**
- If only involving a single locking device (personal lock), the off going employee shall accompany the oncoming employee to the affected equipment or machine where isolation devices (locks) will be appropriately changed (face to face) over without energizing.

14.2 One person, One lock

- All persons who are working on the same plant or equipment shall attach their own lock to prevent the isolator being opened before all locks have been removed or opened. The isolation procedure should identify common lock out points to ensure energy cannot be restored while someone is still working on the plant.
- If two or more people are working on plant that is isolated through several lockout points, each person should attach a lock to each lockout point.
- As an alternative, to avoid the need for multiple locks on each lockout point, a lock box may be used. Under this system each lockout point is locked by only one lock and the key(s) to the locks of the plant's resp. equipment lockout points are placed inside a box which is locked by all the individual locks of all persons working on the same plant resp. equipment.
- In case of an IT supported isolation system the related permit to work has to be put into or fixed to a lock box (must be visual and readable). The keys connected to the permits have to be kept by a nominated responsible person in the organization. The signed off of the permit to work at the end of the work is necessary before you de-isolating.

14.3 One lock, One key

- Each person working on the plant should have his / her own individual lock and key. There should be no duplicate key available for any lock, except a master or duplicate key for use in an emergency that is secured and not readily available (See 13.6. for detailed explication).
- During inspection, repair, maintenance, cleaning or adjustment of the plant, the one key to each person's lock should be held only by that person, who is responsible for both locking and unlocking the lockout device.

14.4 Multiple energy sources

- If more than one energy source or hazard has to be locked out to enable safe shutdown of the plant, the single key to each lockout device or lock sets should be held by the same person.

14.5 Locks

Different locks can be used to apply to the isolation procedure, the use must be described and in line with the principal of one key, one lock and one person. Locks and keys must always be traceable up to one responsible nominated person who is the owner of them.

Locks can be made traceable in at least two ways:

- they can bear a marking unique to each worker e.g. engraved name, identification code, colour code, symbol code, etc., or

- incorporate an lock identification tag; individual lock identification tag or general lock identification tag that identifies the worker or service/department to whom the lock is assigned. If this method is used, the lock identification tag must be secured to the lock in such a way that the tag cannot fall off.

The practical use of locks will be explained more in detail in the training on these guidelines. Nevertheless we can give some overview of the different types of locks that are available in our sites.

Securing individual workers :

Personal Safety Locks / individual locks

Each worker involved must attach his or her own personal lockable securing device, typically a keyed padlock, to the energy isolating device.

A worker who has placed a lock is also responsible for verifying that the energy source has been effectively isolated.

In the case where more than one worker is working at the same isolation point, each worker must attach his or her own personal lockable securing device, typically a keyed padlock, to the energy isolating device.

When using personal locks and in the case where the worker is reassigned before the work is completed, or the work is extended from one shift to another, continuity of hazardous energy control must be maintained.

A safety lock used for individual safety (1 person, 1 lock and 1 key principle) is :
- Supplied with one unique key
- Used only by person identified on the label

Securing groups

When multiple workers are involved or multiple energy isolating devices must be secured, a group process must be used.

A GIO or a competent IIO (declared responsible for a defined task and responsible for a team of workers) must then;

- place a securing device (typically a keyed padlock) on each energy isolating device,
- put the key to each securing device in a lockable key securing device (lock box, key ring, etc.) an apply his or her personal lock
- complete, sign, and post a list identifying the machinery or equipment included in the procedure, and
- confirm and document that all hazardous energy sources in the group lockout situation are effectively isolated.

Documenting this step provides a record of the activity having been completed. This is not confirming that the locks were placed in the correct locations. This is making sure that placement of the locks has resulted in the energy sources being effectively isolated. Having a worker confirm that locks are physically placed in the correct location is not the same as verifying that all energy sources are effectively isolated.

Once effective isolation has been verified and before starting the work activity, each worker involved in the work then applies his or her own lock to the key securing device. This ensures that the master key(s) cannot be removed from the key securing device until each worker removes his or her personal lock. This prevents the equipment from being returned to operation until each personal lock is removed.

In the case where a worker is reassigned before the work is completed, or the work is extended from one shift to another, continuity of hazardous energy control must be maintained.

Upon completing the work, each worker removes his or her lock from the key securing device. When the last lock is removed, the worker authorized by the employer to do so then removes his or her lock from the energy isolating device and verifies that no worker will be in danger due to removal of the lock.

Equipment Safety Locks

Used onto the energy source and fitted by a General Isolation Operator or a competent Individual Isolation Operator used for the purposes of locking equipment out of service and must be:

- Identified with the name of the department/service and user of the locks must be traceable.
- Supplied with only **one** unique key;
- Accompanied by a system to log which locks have been applied, the reason for application and to transfer authority for the lock (e.g., from shift to shift).
- These locks are **not** to be used as personal safety locks.

Multiple safety lock sets

Multiple safety lock sets are typically used when several pieces of equipment must be locked out and a lock box is used. Mostly installed by a General Isolation Operator or a competent Individual Isolation Operator on the equipment :

- Keyed alike in multiple sets;
- Supplied with one unique key only per set;
- Equipped with a suitable lock identification tag on the key to identify the lock set and the number of locks that the key opens. Identified with the name of the department on the lock or on a lock identification tag*, and identified as a set.

*(Lock identification tags can be permanently attached or of a temporary nature as long as they identify the lock.)

The Use of Multiple Safety Lock Sets

The use of multiple safety lock sets shall meet the following conditions:

- Multiple safety lock sets are installed by the Isolation Coordinator or the General Isolation Operator and must be installed first prior to work commencing and removed last, when the job is complete.
- Once the multiple safety lock set is applied, there must be a signature of the Isolation Coordinator or the General Isolation Operator on or the IWI or the PTW or the equipment lock out list (completed and signed by nominated responsible person of the department confirming that the procedure has been followed, energy has been dissipated or restrained and isolation effectiveness checked) is to be added.
- The signed and dated IWP or IWI document must be secured in the appropriate lock box so it is visible and readable. The document must indicate which IWI has been used for the isolation or what specifically has been isolated.
- The key(s) to the multiple safety lock set(s) must be locked in the same lock box and be visible, when the lockbox is in use.
- The Isolation Coordinator or the General Isolation Operator applies his / her own personal safety lock to the box.
- All other personnel working in the area apply their personal safety lock to the box, after ensuring that their specific job procedure isolation requirements are satisfied.

Multiple safety lock sets may be used as an extension of one person's personal safety lock, if **all** of the following conditions are met:

- The use and user of a multiple lock set must be identified and recorded
- The key remains in the control of the person relying on the locks.

Equipment Locks for "Out Of Service" or long term lock out (see 14.6)

Locks may be used for purposes other than protecting personal safety, such as locking a piece of equipment out of service. Accompanied by a system to log which locks have been applied, the reason for application e.g. a motor is out of service and the new one is not yet arrived.

Lock Boxes

Lock boxes are used in conjunction with multiple safety lock sets and where teams are working under the same isolation. Lock boxes must be visible, and clearly labelled If more than one lock box is used in an area, they may be colour-coded to differentiate between the boxes.
Lock boxes should be located so that they are easily accessible to all those working on the job.
The key(s) to the multiple safety lock set(s) must be locked in the lock box and be visible, when the lockbox is in use.
The completed IWI or PTW which include a equipment lock out list must be secured in the appropriate lock box so it is visible for anyone to review prior to the start of their work. The posted document must also include a location for a signature so that those performing the isolation can indicate that all isolation points have been isolated and locked, that energy has been dissipated or restrained, and that the isolation effectiveness has been verified. The document must indicate which procedure has been used for the isolation or what specifically has been isolated.

14.6 Long term lockout

- If a task takes a long period, then we do not talk about long term lockout because people are working on the equipment. Long term lockout may be for other reasons, examples of which could be:
  - A machine taken out of operation for a long period for whatever reason, but will be used again.
  - A machine or equipment locked out for repairs but money only available at a later stage.
  - A machine or equipment locked out for a long period as spares will take a long time to arrive.
  - A machine or equipment locked out for a long period due to economical reasons.
- In situations like these, the responsible superintendent must complete a lockout register and a danger card and an isolation lock must be attached to the supply energy source/s. A note must be made on the lockout register and back of the danger card as to the reason for long term lockout.
- The responsible superintendent will keep the lockout register and isolation lock/s key/s in his/her possession until such time that the equipment is to be put in operation again. The supervisor will then sign off the IWP or the lockout register and make the isolation lock key/s available to set the equipment back into operation. So basically the same lockout procedures must be followed but the person in charge (authorized person) will be the responsible supervisor.

14.7 Permanent Lockout

- There is no such practice as permanent lockout. Good engineering practices dictate that where a machine or equipment is taken out of use permanently, the supply energy sources are removed permanently and the plant drawings updated accordingly. The original electrical power source (feeder, panel, etc.) is then marked “Spare” with electrical cables disconnected and removed. Mechanical power sources must likewise be stripped out / blanked off permanently.

14.8 Out of service tag

- If equipment is faulty labeled, place an out of service tag on it and report to your supervisor. This equipment should not be used or operated while an out of service tag is attached.

14.9 Removal of lockout by another person

- This procedure must be followed when the physical removal of a lockout lock is required by any other person than the one who placed it on the equipment originally.
- Remember, removing a lockout lock from a piece of equipment is a serious act and must be treated as such. Every precaution must be taken to protect the person who originally placed the lock or tag on the equipment and have him or her return and remove the lockout device.
- The following procedure must be completed before a lockout lock is removed by anyone other than the person who originally placed it. When the authorized employee who applied the lockout or tagout device is not available to remove it, the device may be removed under the direction of another authorized employee provided that (all steps to be fulfilled before removing) :
  - It has been decided it is absolutely necessary to remove the lockout at this time.
  - It is determined who placed the lock on the equipment.
  - that person is contacted to find out if he or she is (still) present in the plant.

  - If the person can not be reached, that person's department is contacted to determine if he or she is (still) present in the plant.
  - If the employee is in the plant, he/she is asked to remove the lock.
  - If the employee is at home, it is first determined if there is enough time for him/her to come to the site to remove the lockout lock.
  - If the lock has to be removed immediately, the person is informed that it is being removed, and he / she upon next arrival at the site must personally talk to the department head or his designee before returning to work and similarly the department has to assure the person is seen and spoken to before he/she resumes any work (in order to assure there is no confusion on the situation, since such a confusion may put the person at risk).
- If the employee cannot be reached at all, nor in the plant or at home, the person desiring to remove the lock will contact the following people (in all cases, at least two persons are necessary, incl. the chief of the department):
  - A maintenance mechanical or electrical person etc, depending on the kind of isolation to be taken away;
  - An operating person if one is assigned to the area;
  - Chief of the department.
- These persons will :
  - determine why the lock was originally placed on the equipment. They will search the area for person/persons or equipment that may be in danger if the power is restored or the equipment started. They will watch the equipment to keep people from entering the area while the lock is removed and power restored.
  - Verify that the employee has left the plant or is not able to remove his own lock.
  - Determine if the job is complete and equipment is ready to be put into service and everyone is in the clear.
  - If the lock has to been removed (immediately) without the person being informed, assure the person is seen and spoken to before he/she resumes any work (in order to assure there is no confusion on the situation, since such confusion may put the person at risk).
  - Assure these actions are documented in writing and signed by all involved

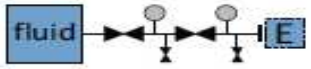
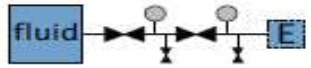
14.10 Complex group process (e.g. shared lockout)

In some cases it may not be reasonably practicable to use an individual or group lock out process. To maintain worker safety, normal group lock out practices may need to be adapted or modified. A complex group control process allows an employer to do this. The complex group control process relies on written procedures and a work permit or master lockout procedure to ensure the safety of workers. These two elements replace the traditional approach of each worker placing a personal lock on each energy isolating device.

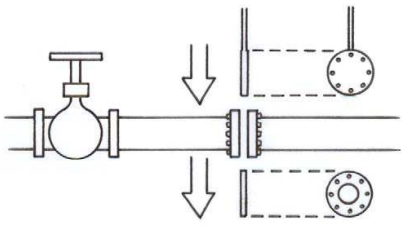
- Identical isolation requests of different demanders on the same installation or equipment, or parts of it, can be coordinated and performed only once by a qualified person. This specific practice must be coordinated by a competent person in the organization and under specific conditions which must be described in the isolation procedure. Clear communication will be established.
- The isolation coordinator can group different isolation requests into a mother isolation, one per technical specialty (electrical, hydraulic, mechanical, ….etc). In general the mother isolation will be on a high level, i.e. shutdown of a whole installation.
- A risk assessment shall be done to identify if supplementary risks will occur due to this practice.

This method is not to be used as an ‘easy escape’, but applies only in very well investigated cases.

14.11 Example; Positive Lockout of fluids

Category	Features	Method	Illustrative example
I Positive isolation	Complete separation of the plant/ equipment to be worked on from other parts of the system. Valved isolation of an appropriate standard is required during the installation of positive isolation.	Physical disconnection (eg spool removal)	
		Double block, bleed and spade	
		Single block and bleed and spade	
II Proved isolation	Valved isolation. Effectiveness of valve closure(s) can be confirmed via vent/ bleed points before intrusive work commences. Within this isolation category the level of mechanical security is greatest for DBB and lowest for SBB. As a general rule, SBB should not be used with hazardous substances (see paragraph 120).	Double block and bleed (DBB)	
		Double seals in a single valve body with a bleed in between	
		Single block and bleed (SBB)	
III Non-proved isolation	Valved isolation. No provision to confirm effectiveness of valve closure prior to breaking into system. Where possible, double valve isolation should be used rather than single valve.	Double valve	
		Single valve	

Example blanking!



Example of a selection tool to establish the ‘baseline standard’ for a final isolation.

HSE\Selection Isolation class.pdf

Appendix 1: AM Safety ST 001 v1 - Guidelines FPS Isolation - Appendix 1 - English.pdf

14.12 Example; High Voltage Procedures

In addition to the guidelines for lockout, there are more stringent safety requirements for high voltage systems. As an example take the following information into account :

- Ensure that only authorized employees work around high voltage equipment.
- Provide a High Voltage warning sign when necessary.
- Ensure that terminal voltage ratings can withstand surges caused by electrical faults or switching transients.
- Be careful around output circuits even when the input power is off. Parallel power sources and energy storage devices can still be dangerous.
- Be careful when working with power supplies that serve more than one area.
- Before working in a high voltage area, inspect the power supply and check all protective devices.
- Do not work alone near high voltage.
- Label equipment to identify power sources. Label input power sources to identify connected power supply loads.
- Attach emergency shutdown instructions and phone numbers to equipment that is remotely controlled or unattended while energized.

Before entering a power supply or associated equipment enclosure to work on hazardous energy sources, complete the following:

- De-energize the equipment.
- Lockout/ the main input power circuit breaker.
- Check for auxiliary power circuits that could still be energized.
- Inspect automatic shorting devices for proper operation.
- Short the power supply with grounding hooks.

Minimum Clear Working Space

The following table from the National Electric Code provides minimum depth of clear working space in front of electrical equipment:

Minimum Clear Distance [NEC Table 110.34(A)]			
Normal Voltage to Ground	Condition 1	Condition 2	Condition 3
601-2,500 V	900 mm (3 ft)	1.2 m (4 ft)	1.5 m (5 ft)
2,501-9,000 V	1.2 m (4 ft)	1.5 m (5 ft)	1.8 m (6 ft)
9001-25,000 V	1.5 m (5 ft)	1.8 m (6 ft)	2.8 m (9 ft)
25,001-75 kV	1.8 m (6 ft)	2.5 m (8 ft)	3.0 m (10 ft)
Above 75 kV	2.5 m (8 ft)	3.0 m (10 ft)	3.7 m (12 ft)

Where conditions (1), (2), and (3) are as follows:

(1) Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated bus bars operating at not over 300 volts shall not be considered live parts.

(2) Exposed live parts on one side and grounded parts on the other side. Concrete, brick, or tile walls will be considered as grounded surfaces.

(3) Exposed live parts on both sides of the workspace [not guarded as provided in condition (1)] with the operator between.

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Appendix 1: AM Safety ST 001 v1 - Guidelines FPS Isolation - Appendix 2 - English.pdf

15 References

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