



Guidance note **Isolation of plant** 2010



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Foreword

This guidance note is issued by the Commission for Occupational Safety and Health (the Commission) under the *Occupational Safety and Health Act 1984* (the OSH Act).

The OSH Act established the tripartite Commission, which consists of representatives of employers, unions and government, as well as experts. The Commission has the function of developing the occupational safety and health legislation and supporting guidance material, and making recommendations to the Minister for Commerce for their implementation. To fulfil its functions, the Commission is empowered to establish advisory committees, hold public inquiries, and publish and disseminate information.

The Commission's objective is to promote comprehensive and practical preventive strategies that improve the working environment of Western Australians. This guidance note has been developed through a tripartite consultative process, and the views of employers and unions along with those of government and experts, have been considered.

The following information is provided as background to understanding this guidance note.

Legislative framework for occupational safety and health

The Occupational Safety and Health Act 1984

The OSH Act provides for the promotion, co-ordination, administration and enforcement of occupational safety and health in Western Australia. It applies to all industries with the exception of mining and petroleum.

With the objective of preventing occupational injuries and diseases, the OSH Act places certain duties on employers, employees, self-employed people, manufacturers, designers, importers and suppliers.

The broad duties established by the OSH Act are supported by a further tier of statute, commonly referred to as regulations, together with lower tiers of non-statutory codes of practice and guidance notes.

Occupational Safety and Health Regulations 1996

The Occupational Safety and Health Regulations 1996 (the OSH Regulations) have the effect of spelling out specific requirements of the legislation. They may prescribe minimum standards and have a general application, or define specific requirements related to a particular hazard or type of work. They may also allow licensing or granting of approvals and certificates.

Codes of practice published under the OSH Act

Codes of practice published under the OSH Act provide practical guidance on how to comply with a general duty or specific duties under the legislation.

Codes of practice may contain explanatory information. The preventive strategies outlined do not represent the only acceptable means of achieving a certain standard.

A code of practice does not have the same legal force as a regulation and is not sufficient reason, of itself, for prosecution under the legislation, but it may be used by courts as the standard when assessing other methods or practices used.

Guidance notes published by the Commission

A guidance note is an explanatory document issued by the Commission providing detailed information on the requirements of legislation, regulations, standards, codes of practice or matters relating to occupational safety and health.

Authority

This guidance note has been issued by the Commission under section 14 of the OSH Act. It provides guidance to people at work and in control of workplaces for developing safe isolation procedures to minimise the risk of injury while workplace plant is being inspected, repaired, maintained, assessed, adjusted or cleaned.

Disclaimer

Information in this publication is provided to assist you in meeting your occupational safety and health obligations. While information is correct at the time of publication, readers should check and verify any legislation referenced in this publication to ensure it is current at the time of use.

Changes in law after this document is published may impact on the accuracy of information. The Commission provides this information as a service to the community. It is made available in good faith and is derived from sources believed to be reliable and accurate at the time of publication.

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1. Introduction

Every year people at work are injured, sometimes fatally, when plant is inadvertently activated. These injuries can be prevented by introducing and following correct isolation of plant procedures.

Before any plant is inspected, repaired, maintained or cleaned it must, where practicable, be shut down and its energy sources locked out and tagged as part of an isolation procedure to ensure the safety of those doing the work.

'Plant' means more than you might think. Plant is a general name for machinery, tools, appliances and equipment. It can include items as diverse as a press in a foundry or a computer in an office. Plant includes, but is not limited to: electric drills, lifts, escalators, tractors, hand trolleys, cranes, commercial fishing nets and arc welding gear.

The people with duties in relation to isolation of plant are employers, main contractors, self-employed people, workers and people in control of a workplace or its access.

The Occupational Safety and Health Regulations 1996 covered in this guidance note are:

- regulation 4.37 Duties of certain persons as to the use of plant;
- regulation 4.37A Duties of certain persons for the purposes of regulation 4.37(1)(b) or (c); and
- regulation 4.38 Duties of employers as to damaged plant.

2. Basic principles and procedures

The basic principle of isolation

The aim is to:

- isolate all forms of potentially hazardous energy to ensure that an accidental release of hazardous energy does not occur;
- control all other hazards to those doing the work; and
- ensure that entry to a restricted area is tightly controlled.

The basic principle is comprised of three separate steps:

1. lock;
2. tag; and
3. try.

The success of the basic principle depends on two key factors:

- thorough training of all workers in isolation procedures; and
- the disciplined exercise of individual responsibility in always following the procedures.

What is an isolation procedure?

An isolation procedure is a set of predetermined steps that must be followed to ensure that plant and related hazards cannot jeopardise the safety of those working on the plant.

There must be an isolation procedure for each item of plant, including the application of isolation devices, locks and tags, as practicable.

While isolation procedures may vary in detail because of differences in plant, power sources, hazards and processes, they must include the following steps.

Basic isolation procedure

1. Identify the plant involved and the corresponding energy sources.
2. Identify all other hazards.
3. Shut the plant down.
4. De-energise all stored energy sources.
5. Isolate and lock out all energy sources.
6. Tag plant controls, energy sources and other potential hazards.
7. Control other potential hazards.
8. Test by 'trying' to re-activate the plant, without exposing the tester or others to risk, to ensure isolation procedures have been effective, before commencing any maintenance, cleaning, inspection or repairs on the plant.
9. Carry out the work on the plant.
10. Once remedial work is complete, the people who tagged the controls are to remove the tags before the plant is returned to operational status.

Written isolation procedures should be developed where plant is combined with other machinery or equipment and may involve different processes, hazards or power sources. Only people with the right skills should develop these procedures.

The procedures should be developed in consultation with safety and health representatives, people doing adjustments, cleaning, maintenance, repairs or inspections and, if possible, plant manufacturers, suppliers and people who designed and installed the plant. Where practical, people experienced in operating the plant should also be consulted.

The effectiveness of isolation procedures relies on providing workers involved with the plant with information, instruction and training, and appointing an authorised person to supervise and ensure isolation procedures are rigorously applied.

The isolation procedure should be displayed in a prominent position on or adjacent to the plant where possible.

3. Strict adherence

Once an isolation system has been introduced, it must be strictly followed, or it can become ineffective and dangerous. The system should be reviewed from time to time to ensure it remains relevant and appropriate.

4. Risk management

A risk management approach to the adjustment, inspection, cleaning, maintenance or repair of plant, and the isolation procedure itself, requires:

1. hazards to be identified;
2. associated risks to be assessed;
3. risks to be eliminated or controlled; and
4. the controls to be reviewed from time to time to ensure they remain effective.

The employer, main contractor, self-employed person and person in control of the workplace or its access must ensure all hazards are identified, and procedures are written and followed to control identified hazards. Before work commences, contractors and workers new to the plant should be briefed on the procedures to be followed and the need to observe all safety requirements.

5. If isolation is not practicable

There may be workplaces where all the steps covered in this guide for an isolation procedure cannot be carried out because of the way plant is designed or installed. There may also be certain plant that can only be cleaned, maintained, repaired or adjusted by moving components slowly under power.

In these cases regulations 4.37A(5), (6) and (7) provide for the following alternative measures to be taken by an 'authorised person' with the appropriate competencies.

If plant cannot be stopped during cleaning, maintenance or similar work, the plant must be fitted with controls that allow safe controlled movement, and written safety procedures must be developed and followed.

If isolation and lockout procedures are not practicable, the employer, main contractor or self-employed person must ensure alternative written safety procedures are developed, followed and reviewed at regular intervals, often called a 'permit to work system'.

Like isolation procedures, these alternative written procedures must be strictly followed, or they can become ineffective and dangerous.

6. Shutting down

Plant that has only one energy source can usually be shut down by the operation of a single control such as a switch or valve. More complex plant may have to be shut down in a certain sequence such as one conveyor before another, or by shutting down several energy sources eg electricity, petrol, diesel, oil, steam, pressurised air, LPG, LNG or coal.

Shutting the plant down may require other potential hazards, for example pipes and lines carrying gases, water, acids or alkalis, to be turned off and locked-out to prevent re-activation. An alternative to closing and locking-off a valve may be blanking or the insertion of a spade, sometimes called a spectacle plate because of its shape.

7. Identifying energy sources and other hazards

All energy sources and other hazards likely to place people doing the work at risk must be identified. This is especially important when employing contractors who may not be familiar with the complexities of processes associated with the plant and the lack of reliable 'as-built' diagrams of plant installations at many workplaces.

If the original designer and installer 'as built' diagrams are not available, new diagrams 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 can then also be used, along with written procedures, for information and training of workers.

8. Energy sources

Plant energy sources include:

- electricity (mains, solar and by generator);
- chemicals;
- fuels;
- heat;
- steam;
- pneumatic pressure (compressed air);
- fluids under pressure, such as water or hydraulic oil;
- energy storing devices, such as batteries, springs, flywheels, accumulators and capacitors;
- gravity; and
- radiation.

9. Other hazards

Depending on the type of plant, other hazards may include:

- hazardous substances, such as gases, acids, alkalis, solvents, glues or pooled liquids in which a person may drown;
- falls;
- burns;
- asphyxiation; and/or
- impact.

10. Isolating energy sources

The employer, main contractor, self-employed person and person in control of the workplace or its access must also appoint an 'authorised person' who knows and understands the complexities of the plant. The 'authorised person' must, as far as practicable, ensure the isolation of all energy sources and potential hazards to those working on the plant. Where required, there may be a need for the 'authorised person' to check or verify each isolation point in person eg when the risks are high or when dealing with complex plant.

Shutting off electricity is usually achieved by opening a switch to produce an air gap too wide for electricity to cross.

Electrical circuits connecting to equipment typically have a protection device at the source of each phase of the circuit, usually a switchboard.

In addition to a single or three phase local isolating switch, which simultaneously opens the supply in each phase at the equipment itself, the protection device can be in the form of:

- fuses – one per phase, sometimes accompanied by a switch, or combined as a switch fuse unit; or
- circuit breakers – one per phase, and in the case of circuit breakers protecting a three phase circuit, usually as a three phase combination.

If there is the need to de-energise the circuit to the equipment as well as the equipment itself, then any circuit protection device(s), such as a switch or circuit breakers, should be opened and fuses removed etc. Good practice requires that the local isolating switch should also be opened.

NOTE

In some circumstances electrical isolators may only isolate control circuits – this is not sufficient for the safety of people required to work on the equipment.

The mains power source feeding the plant must be isolated.

For example, a piece of plant is connected via a switch panel to the main power board. Not only does the switch panel need to be isolated but also the circuit feeding the panel from the main power board.

Care must be taken to ensure all electricity sources are identified and isolated as some equipment will have several control stations and sections which could have independent electricity sources. If programmable logic devices are used to control the equipment, then it is essential to use local isolating switches as the means to achieve secure and safe isolation. It is not acceptable to rely on the controls of the programmable logic devices for the isolation of equipment.

Isolating programs with step by step instructions must be developed and implemented wherever there is a danger of the plant being operated during periods of maintenance etc.

Isolating the electricity supply to an item of plant must include checking that the electrical supply has been isolated, not just the control circuit, and disconnected if necessary by an electrician. There should be no possibility of the plant being inadvertently energised via another source or control system.

11. Identify all isolation points

All plant of a type that could require an isolation procedure should be designed with appropriate isolation points for its energy sources to enable work on the plant 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 such as a motor while the remainder of the plant remains in operation. Clear identification markings or labels of the isolation points may be required, where this could assist the isolator select the correct isolation point, particularly where there could be the potential to make an error.

Emergency stop buttons, lanyards and similar quick-stop devices on their own will not necessarily achieve isolation. It is dangerous to rely solely on emergency stopping devices as they are not designed for frequent use and cannot be locked out in all cases. Emergency stopping devices may allow energy to be inadvertently re-activated and may also allow control circuits to remain live.

Remote control rooms and process computers should be considered when identifying isolation points.

12. Fluid, steam and pneumatic energy

Isolation of fluid, steam and pneumatic energy sources is usually achieved by closing a valve. Care needs to be taken to ensure that isolation is effectively achieved as some valves may be automatically or remotely controlled by computers. Blanking or the use of spades may be the safest approach. Some examples of fluids that may be encountered include caustic or acid solutions, gas, solvents, mineral slurries or water at varying pressure or temperature.

It may be necessary to drain pipes and lines leading to the plant, to prevent workers being exposed to hazardous gases, liquids or covered by small solids eg. mineral ore, sand or grain. It may also be necessary to break an air lock to allow fluid to drain away to avoid the possibility of the air lock breaking and fluid engulfing workers while work is being done. Compressed air held in lines connected to the plant needs to be released safely. Plant should incorporate the means to deal safely with fluids and pneumatic gases. Materials that are gravity fed should also be addressed.

13. Stored energy

While sometimes it is possible to isolate energy in storage devices, such as batteries, with a valve or a switch, in other cases the energy must be dissipated before work begins on associated plant. This is particularly important with electrical capacitors, springs and gases under pressure, such as in suspension systems.

Static electricity can be dissipated via an earth to the ground.

14. Other energy devices

Other energy storing devices that must be considered in developing an isolation procedure include:

- those with **rotational motion** (kinetic energy) such as flywheels, saws, planers, mixers, pulleys and similar; and
- those with **potential energy** due to their position. This type of energy source cannot simply be turned off. The energy must be dissipated or controlled.

When the potential energy is related to gravity, the plant must be allowed to 'complete its stroke' or 'come to rest' so that gravity has no further influence. Where this is not appropriate, it may be necessary to prevent movement by blocking, wedging or propping. The 'authorised person' should ensure props, blocks or wedges cannot be inadvertently removed. It may be possible to secure them with some type of locking system, including tagging.

15. Negative pressure

Vacuum or negative pressure, while not strictly an energy source, may be used to activate the plant. As part of the isolation procedure, any negative pressure needs to be equalised to avoid hazardous fluids being released into a work area should the vacuum break while work is being undertaken.

16. Locking out

A wide range of devices is available for locking out energy sources and other hazards that could pose a risk to people working on plant. These include switches with a built-in lock and lockouts for circuit breakers, fuses and all types of valves.

Also readily available are chains, safety lockout jaws (sometimes called hasps) accommodating a number of padlocks, and sets of robust safety padlocks.

Only devices that incorporate a lock or can accommodate one or more padlocks are suitable lockout devices.

If more than one person is working on the same plant, each person must 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.

Whatever locking device is used, it must function properly in the particular environment in which the work is undertaken. An example is lockout devices used in dusty or wet environments, as not all of them are dust or water proof and may fail under such conditions. Dust and water proof lockout devices are available from distributors of industrial safety equipment.

17. One key only

A safe lockout procedure ensures each person working on the plant must have their own lock, key and tag. There should be no duplicate key available for any lock, except a secured not readily available master or duplicate key for use in an emergency.

During cleaning, repairs, maintenance or adjustment of the plant, the one key to each person's lock must be held only by that person, who is responsible for both locking and unlocking the lockout device.

This procedure minimises the risk of the lock being inadvertently opened or removed, energy being restored and plant re-starting, placing those working on the plant at high risk.

18. More than one energy source

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 should be held by the same person.

If two or more people are working on plant that is isolated through several lockout points, each person must attach a lock and tag to each lockout point. To avoid the need for people to carry several keys, it is advisable that each person's locks respond to a single key.

Master or duplicate keys must be kept in a secure place away from the work area, under the strict control of a senior person who must ensure they are used only in an emergency.

The above describes the common lock-out system in use at most work places. 'Captured key' systems and group lock-out systems are also acceptable.

19. Tagging

A tag is NOT in itself an effective isolation device. A tag acts only as a means of providing information to others at the workplace. When practicable, a lock must be used in preference to a tag as an isolation device.

A personal danger tag should accompany each lock used in an isolation procedure and identify the person who put the tag and lock in place, the time and date this occurred and the item of plant being isolated. In a large workplace it should also identify the work group of the person who attached the tag.

The tag system requires a notice to warn personnel against using the equipment to which a tag is attached. No one should interfere with or operate any tagged equipment such as a main switch, push button or other electrical device until the item has been cleared for safe operation and the attached tag has been removed. The tag must only be removed by the person who attached it, or by the 'authorised person' in accordance with an approved procedure. The 'authorised person' is responsible for ensuring procedures affecting the use of tags are followed.

Locks are available that have a personal danger tag incorporated to ensure that the tag can only be removed by the person who put the lock in place.

20. Tags in common use

The following types of tags are commonly used when a piece of plant is isolated from other equipment or plant.

Personal danger tags

A personal danger tag (red and white) must be attached to an isolator whenever the device is used to lock out an energy source to allow work to be done.

These tags should be restricted to people who will be working on the equipment. A personal danger tag on the isolation devices of an item of equipment is a warning that the equipment is in an unsafe condition and that operation of that equipment may endanger the person who attached the tag.

The person doing the work must personally fasten their personal danger tag on all lockout devices involved in the isolation procedure.

A personal danger tag attached to an isolation device means the person is currently engaged in work on the plant, and that it is likely that the person will be injured if the isolating device is not maintained in the safe position.

If more than one person is involved in the work, each person must attach their own lock and personal danger tag to the lockout device.

A personal danger tag should be removed only by the person whose name is written on the tag.

All disposable personal danger tags should be destroyed after use.

Removal of a personal danger tag from an isolating device should be carried out as soon as practicable after completing the work. In every case a personal danger tag should be removed before leaving the worksite at the end of the shift. The isolation procedure needs to include the action to be taken if a person should fail to remove a personal danger tag before leaving the worksite.

If work on plant is not completed by the end of a working shift and the plant is required to remain isolated, arrangements must be made for 'out of service' tags to be placed on each isolating point before personal danger tags are removed. If work on the plant is to continue during the next shift there must be a 'hand over' briefing by the shift leaving the site to those taking over the work. The briefing should include the status of the work and the removal or replacement of personal danger tags and locks.

Out of service tags

A yellow and black out of service tag on a piece of plant indicates that it is unserviceable and should not be used. It can be attached to non-powered plant such as ladders, jacks and trolleys as well as powered plant and should be attached to the main controls if possible, or to a prominent part if there are no controls, eg a damaged ladder.

These tags serve to indicate plant or equipment that is out of service for repairs, maintenance, cleaning, or being installed etc. A piece of plant or equipment fitted with an out of service tag must not be operated while the tag is in place.

Out of service tags should be attached by a competent person having specific knowledge relating to the plant. However, this should not prevent any other person from attaching an out of service tag in emergency situations where it is apparent that the continued use of the equipment could be dangerous.

Out of service tags should, where applicable, be placed on devices which isolate energy sources, only when those devices are set in the 'off' or 'safe' position.

Prior to attaching an out of service tag all required details on the tag must be clearly and indelibly entered in the spaces provided, with emphasis given to the reason for placing the tag.

Tags must be securely fixed and be clearly visible.

Out of service tags should be removed only by an authorised person who is both familiar with the equipment and fully aware of the reason that the tag was placed, except in an emergency situation.

In the absence of any personal danger tag or lock, removal of an out of service tag effectively releases plant or equipment for use. This must not be done before ensuring that:

- a) all people known to have been working on the plant are clear of the equipment; and
- b) an inspection of the plant indicates that all machinery guards are in place, all protective devices are functional and all maintenance tools and aids have been removed, and that the equipment is safe for normal use.

Out of service tags are intended to convey a clear DO NOT OPERATE warning and the failure to comply may result in damage to the equipment and or could cause injury. It is essential that isolating mechanisms with out of service tags attached are not switched, manipulated, or interfered with in any way while these tags are in place.

Out of service tags must not be relied on to provide personal protection.

Personal danger tags should be used whenever work is required to be undertaken in or about equipment or machinery that could cause injury.

It may be necessary when placing an 'out of service tag' on a piece of plant to also record on any computer controlling the plant that it is out of service.

While the above relates to tagging systems used in most workplaces, group tagging is also acceptable.

21. Guarding

Guarding designed to protect workers from moving parts may need to be removed or de-activated before adjustment, inspection, cleaning, repairs or maintenance. The plant's energy source must always be isolated and locked out before guarding is removed. When work on the plant is complete, guarding must be replaced and secured before energy is restored and normal operations re-commence.

22. Testing isolation procedure

After plant has been shut down, locked out and tagged, all isolated power sources should be tested first with appropriate instruments 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 familiar with the plant or parts of the plant, including control stations and computers remote from the plant, to ensure isolation procedures have been effective.

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.

The calibration of any instruments required to test isolation procedure should be checked before use.

Work on the plant should not begin until the authorised person confirms it is safe to do so.

23. General responsibilities for safety and health at the workplace

The *Occupational Safety and Health Act 1984* (the OSH Act) requires employers and those with the duties of employers, including principal contractors, to provide workers with a safe and healthy work environment, including safe systems of work. It also requires workers to take reasonable care with their own safety and health at work, and the safety and health of others.

Duties of employers

The safety and health duties of the employer include:

- ensuring workers are not exposed, as far as practicable, to workplace hazards of a safety and health nature;
- providing workers with adequate information, instruction, training and supervision;
- consulting workers and safety and health representatives, where they exist, about workplace safety and health;
- where it is impractical to eliminate or control hazards, providing workers with adequate personal protective clothing and equipment; and
- establishing and maintaining safe systems of work.

Duties of workers

The safety and health duties of the worker include:

- taking reasonable care of their own and others' safety and health; and
- cooperating with employers in carrying out safety and health requirements.

Appendix 1: Other sources of information

Legislation

- *Occupational Safety and Health Act 1984*
- Occupational Safety and Health Regulations 1996

Copies of the above legislation can be downloaded from the website of the State Law Publisher at www.slp.wa.gov.au

Printed copies can be purchased from the State Law Publisher at 10 William Street, Perth.

Copies are also held in the WorkSafe library, 5th floor, 1260 Hay Street, West Perth.

Commission for Occupational Safety and Health publications

- *Code of Practice: Safeguarding of machinery and plant*
- *Codes of Practice: First aid facilities and services, workplace amenities and facilities, personal protective clothing and equipment*
- *Guidance Note: The general duty of care in Western Australian workplaces*
- *Guidance Note: Working alone*
- *Guidance Note: Powered mobile plant*
- *Plant Design - A guide for designers, manufacturers, importers, suppliers and installers of plant*
- *Plant Design - A guide for employers, self-employed persons and employees*

The above codes of practice and guidance notes can be purchased from WorkSafe or downloaded from WorkSafe's website at: www.worksafe.wa.gov.au. Copies are also held in the WorkSafe library.

WorkSafe and Department of Mines and Petroleum publication

- *A guide to testing and tagging portable electrical equipment and residual current devices.*

The above publication is also a useful resource for information on isolation of plant. It can be downloaded from www.worksafe.wa.gov.au

Contacts for further information

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Comprehensive work safety and health information
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