PROCEDURE

Lock Out Tag Out (LOTO)

HS-IOA-PRO-009

ZORM

Revision Summary

Version	Author	Reasons for Change	Approver	Date Approved
1.0	V Palma	New procedure	M Guantero	29 Aug 2018
1.1		Updated documentation requirement for LOTO	M Guantero	2 Oct 2019
2	G. Knox	Full review and update to Procedure	M Guantero	15 Dec 2021

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1. Purpose and scope

This document defines how to plan, apply and remove isolations to safeguard personnel and plant from any unexpected energisation or start-up of machinery or equipment, or the release of hazardous energy / substances during service or maintenance activities. These hazardous energy or substances can include electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

The requirements specified in this procedure apply to all Z employees and contractors engaged by Z to work in any Z site.

2. Definitions

Word	Meaning
Blind isolation	Isolation by inserting blind (spade) between flanges; the swinging closed of a spectacle blind (plate); or replacement of a spacer (slip-ring) with a line blind (spade). The physical breaks shall occur as close to the equipment as possible.
Complex isolations	May include, but is not limited to, work requiring isolation of dual energy sources, multiple sources of energy requiring isolation, isolations required by multiple trades or organisations, and/or isolations required for confined space entry. Consider all sources, not just electrical, when assessing the complexity of isolations required to safely execute the work.
De-energised (electrical)	Disconnected from all sources of supply but not necessarily isolated, earthed or out of commission.
Electrical grounding or earthing	This means providing an intentional connection to earth through a ground connection of sufficiently low impedance and with sufficient current carrying capacity as to prevent voltage build-up that might result in undue hazard to persons or to connected equipment
Energised	Machines and equipment are energized when they are connected to an energy source or they contain residual or stored energy. Caution should be taken to make sure all energy sources are identified and any stored energy dissipated (e.g. capacitors, hydraulic accumulators or thermal expansion in isolated lines)
Energy-isolating device	A mechanical device 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 ungrounded 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. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.
Extra Low Voltage (ELV)	Voltage not exceeding 50V AC or 120 V ripple-free DC.
Fault Finding (electrical)	The process of taking measurements or carrying out tests on electrical installations and equipment to locate faults or prove operability. It may also include the process of applying testing instruments or devices to various parts of the electrical installation.
High Energy Electrical System	Electrical systems rate 800A or where the fault current at the point of the installation exceeds 2000A.
High Voltage	Voltage exceeding 1000V AC or 1500V ripple-free DC.
Isolated (electrical)	The state of equipment when disconnected from all sources of supply by breaks of a length appropriate to the voltage and the insulating medium.
Process Isolation	The process whereby sources of harm (pressure, Temperature, chemical, electrical or mechanical power, engulfment) are physically separated from the persons carrying out work and are protected from inadvertent operation and the means of isolation have been proven effective.

Word	Meaning
Isolation certificate	Form used to record and track isolations from planning to application and removal.
Isolator (electrical)	A device which for reasons of safety, provides in the open position, breaks appropriate to the voltage and the insulating medium.
Live (energised)	A term applied to an object when a difference of potential exists between conductors or would exist between it and earth under normal conditions of operation.
Lockout	The placement of a lockout device on an energy-isolating device, in accordance with an established procedure, ensuring that the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed.
Lockout device	Any device that uses positive means, such as a lock, blank flanges and bolted slip blinds, to hold an energy-isolating device in a safe position, thereby preventing the energizing of machinery or equipment.
Lock Out Station Board	A centralised site display of all current plant isolations in place at the site associated with Work Permits.
LOTO	Acronym for "Lock Out Tag Out"
Low Voltage	Exceeding extra-low voltage (50V AC or 120V DC), but not exceeding 1000V AC or 1500V ripple-free DC.
MCC	Motor Control Centre. This is where the main switchboard/panels and incoming power to site is. are
Normalisation	Removal of physical isolation and putting it back to normal operating state. "Reinstatement + Recommissioning"
PLC	Programmable Logic Controller that controls the operation of equipment via software coding.
Tagout	The placement of a tagout device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed. It communicates the reason for lockout, and bears the name of the person who applied the tag including the date applied. If more than one group is working on the same item (including different trades) each person from each group will sign and date an individual "DANGER, DO NOT START", or, equivalent tag.
Tagout device	Any prominent warning device, such as a tag and a means of attachment, that can be securely fastened to an energy-isolating device to indicate that the machine or equipment to which it is attached may not be operated until the tagout device is removed.
Testing (of LOTO)	The act of confirmation that plant and equipment is isolated and de-energised by checking the integrity of the local energy control device (e.g. by trying to start the equipment) or confirming depressurisation or drain down. It is critical that all bleeds, vents and drains are checked to be free from blockage prior to testing.

3. References

External References

- OSHA Standard 1910.147 The control of hazardous energy (Lock out Tag out)
- HSG253, 2006 The Safe Isolation of Plant and Equipment

ZORM References

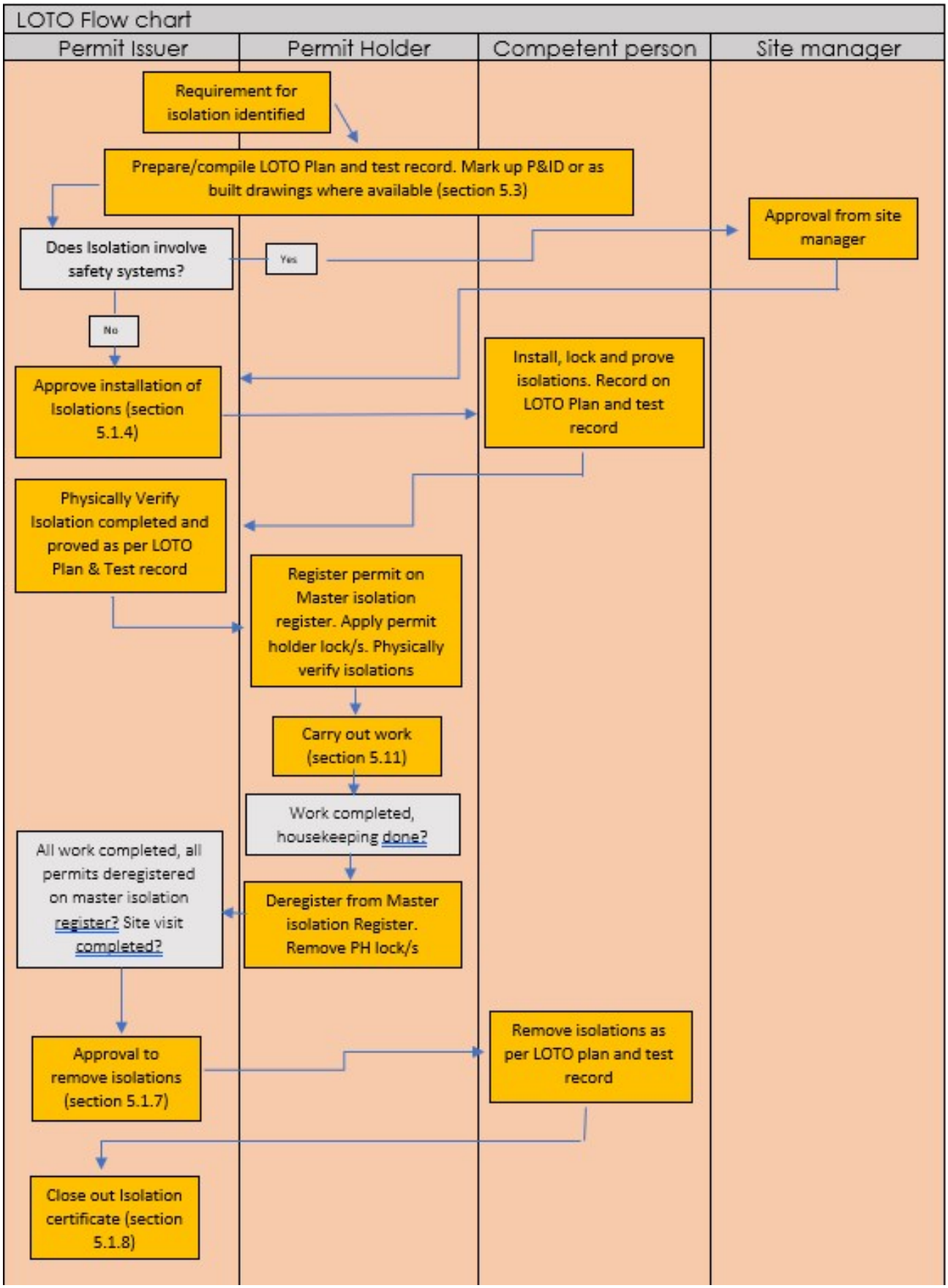
- Z PTW Manual, HS-IOA-MAN-002

4. Roles and Responsibilities

Site Manager or delegate	• Approves installation of safety system isolations. •
Permit Issuer	• Completes the Isolation certificate • Consult with affected parties to ensure plan is effectively communicated • Verifies competency of persons performing LOTO tasks • Personally verifies and test isolations in accordance with the procedure outlined. Exception to this, when the competent person is better qualified to effect the isolation, i.e. Electrician, in which case the PI must oversee the isolation. • Check work and authorise removal of isolations.
Permit Holder	• Review LOTO certificate and isolations with PTW issuer • Raise any concerns on the isolations with the PTW issuer or Site Manager • Apply Permit Holder lock or locks as applicable
Competent Person **(Compiler/Installer/ Checker)**	• Person who has been deemed competent to compile Isolations • Person who has been deemed competent to install isolations • Person who has been deemed competent to check isolations and/or isolation plans for correctness and effectiveness • Has skills and knowledge related to the construction, installation and operation of equipment to be isolated and has received safety training on the hazards involved. • Identifies and communicates any needed changes in work scope or changes in conditions to their supervisor immediately. • Reviews and participates in hazards assessment and in identifying controls to be implemented.
Qualified Electrical Person	• Has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved • Identifies and communicates any needed changes in work scope or changes in conditions to their supervisor immediately • Reviews and participates in hazards assessment and in identifying controls to be implemented • Verifies equipment is properly de-energized, isolated, and locked and tagged before applying personal locks • Carry out all electrical isolations, including testing step of isolation on systems/equipment

All staff and contractors working on the isolated equipment	• All staff and contractors involved in works being undertaken downstream of isolation should ensure they are working under a permit and that the permit is registered on the Isolation Certificate • Observe all isolations and do not attempt to operate any equipment that has been locked out. Unless it is to test the isolation I.e. hydraulic systems fitted with accumulators. • Seek out permit issuer or site manager for further information on isolations. • Remove their personal lock as soon as work is completed and their permit Deregistered on the Isolation certificate

5. Isolation Procedure



5.1. Isolation Certificate

The isolation Certificate (IC) is used to record all details for a specific isolation and must be used for all isolations. It includes 6 sections covering the following:

1. Application/description of isolation
2. Type of isolation
3. LOTO Plan and Test Record
4. Isolation of safety systems
5. Approval to install Isolations
6. Master isolation register
7. Approval to remove isolations
8. Isolation Certificate Close out

5.1.1. Application/description of isolation

This section is completed by the PI. The PI must provide details of the site where the isolation is required, details of the equipment to be isolated and the reason for the isolation. The PI will also record the name of the person who will Compile the LOTO Plan if not completing this themselves i.e. nominating an electrician to compile LOTO plan for an electrical isolation.

5.1.2. Type of isolation

This section is used to record the types of isolation that are going to be managed by the Isolation Certificate. Often one isolation procedure will contain multiple types of isolations i.e an Isolation Procedure for removing a tank from service will generally involve Process Isolations, Electrical Isolations and safety/emergency system isolations.

The following types of isolations can be managed using this procedure:

- Process isolation (refer section 5.4)
- Electrical isolation (refer section 5.5)
- Extended period isolation (refer section 5.7)
- Isolation of safety/emergency systems (refer section 5.8)

5.1.3. LOTO Plan and test record

This section is used to record the specific details of each Individual isolation point and must be used for all isolations. It must be prepared/compiled by a competent person and checked by the PI prior to the application of isolations. In instances where the PI has compiled the LOTO Plan and Test Record, the PI must have the plan checked by a competent person.

The LOTO plan and Test Record may be completed on the Isolation Certificate or attached to the document if completed separately.

5.1.4. Isolation of safety systems

This section is completed by the PI and signed by Site manager to acknowledge the isolation of safety systems. This section must be completed for all isolations of safety/emergency systems or any critical safety devices .

5.1.5. Approval to install isolations as per LOTO Plan and test record

This section is completed by the PI once the LOTO Plan and Test Record has been compiled and checked and the isolations are ready to be applied.

5.1.6. Master isolation register

The 'Master Isolation register' section of the IC, records all permits issued for work involving the specified isolations. This section records the details of all permits registered on the IC. It records the date of registration, type of permit, Permit number, name of Permit Holder and where applicable the identification number of the Permit holders Lock once applied to a lock box.

This section is also used to record when a permit is deregistered from the IC.

Once all permits that were registered on Master Isolation Register have been deregistered, and if it is safe to do so, the de-isolation process be applied. This is one of the fundamental purposes of this procedure; to ensure all work happening under an isolation is recorded and completed prior to isolations being removed.

5.1.7. Approval to remove isolations

This section is completed by the PI once it has been confirmed that all associated permits, as recorded on the Master Isolation Register (Section 6) of the IC have been deregistered and it is safe to de-isolate.

5.1.8. Isolation certificate close out

This section is completed by the PI once all Isolations have been removed and the PI has inspected the work area.

5.2. Overview of isolation/deisolation process

5.2.1 Isolations

Once a requirement for an Isolation is identified, the PI nominates/agrees a Competent Person to plan the isolation (the compiler).

The PI, Competent person and any other relevant parties (such as Permit Holder where applicable) shall discuss the details of the isolation and agree on the isolation points and isolation method.

The Compiler will develop a LOTO plan using the LOTO plan and Test Record Section of the IC and this will be reviewed by all applicable personnel to verify the plan is correct. The LOTO plan and test record may be completed separately and attached to the Isolation Certificate. (Refer section 5.3)

The PI then checks existing isolations to determine if any new isolations will conflict with any existing isolation points. Any individual point which are already isolated will have an additional lock/tag applied in the field and recorded on the appropriate IC.

The PI shall then:

1. Check the LOTO plan and Test Record for correctness and confirm it has been signed by the compiler and checker. Ensure relevant drawings have been marked up and attached where available
2. Check that there is no Simultaneous Operations occurring/ no conflict with other work underway and advise the isolation installer accordingly
3. Verify competency of installer and checker
4. Sign the 'Approval to install Isolations' (section 4) of the IC, approving that the isolation can take place

When undertaking the Isolation, the installer and the checker shall initial each step of the LOTO plan and test record to acknowledge that it has been completed correctly.

The PI shall then check that the isolations have been signed for (installed- initialled & checked) on the LOTO plan and test record and that keys are being managed as per this procedure (Refer table in 5.8)

The PI can now allow Permit Holders to register permits applicable to the isolation in the 'Master Isolation Register' section of the IC. When registering a permit, the PI must ensure the following is completed:

- The permit number is recorded on the master isolation register of the IC
- The IC number is recorded in relevant section of the applicable permit as a cross reference

5.2.2 De-isolation

Prior to allowing de-isolation of the equipment, the PI shall check that all permits recorded in the Master isolation Register section of the IC have been deregistered.

Note: The number of the relevant IC is recorded on the Permit. This is to ensure that there is cross-reference with the IC.

If there is more than one Permit operating under an isolation, the PI SHALL only sign and date the `Permit deregistered' section of the IC for the Permit applicable to the job that has been completed. The Isolation Locks/Tags **are not to be removed** until all Permits applicable to that IC have been returned and deregistered on the Master Isolation Register.
Upon completion of ALL jobs operating under an isolation, the PI SHALL inspect the work-site to ensure all work is completed and no other work is proceeding under the isolation.
The PI then grants approval to start the de-isolation by signing the 'Approval to remove isolations' section of the IC (Section 6).
A Competent Person undertakes the de-isolation initialling each step in the LOTO Plan and test record. This is to also to be verified and initialled by another competent 'Checker'.

If an isolation point is to be de-isolated and it is also common to another isolation, only the Isolation Lock/Tag applicable to the relevant IC is to be removed.

The PI shall verify the LOTO Plan and test record is completed and signs the Isolation Certificate Close out section of the IC (section 8) and files the IC and all applicable attachments appropriately.

5.3. Compiling a LOTO Plan and Test Record

Once the work scope, equipment and reason for the isolation is known the LOTO Plan and Test Record is to be compiled and signed by a competent 'compiler' and checked by a competent 'checker'.

In all cases the 'compiler' has ultimate responsibility for the completeness and accuracy of the LOTO Plan and Test Record.

The LOTO Plan and Test Record identifies a step-by-step sequence of actions taken to complete an isolation and forms part of the IC. If more than 10 steps are involved, then the LOTO Plan and Test Record must be written separately and attached to the IC.

Note: The procedure is identical both for process and electrical isolations and both will be included on the same LOTO Plan and test record

The 'Compiler' & 'Checker' SHALL always 'walk the line' to ensure that an isolation procedure developed from as-built information (i.e. drawings, operating procedures, etc) is complete and accurately reflects site and equipment conditions. 'Walk the line' applies to process and electrical isolation.
Any discrepancies observed between as-built information and field during the 'walk the line' will require a review of the isolation procedure between Compiler and Checker.

5.3.1 Compiling an isolation Plan

Text should be clear and concise; abbreviations are to be avoided. Each step of the LOTO Plan and Test Record must contain a description of the equipment, its Asset number (where applicable) and specific instruction required for that Step of the isolation plan during both installation and removal of the isolation. Specific instructions for each step should follow a consistent format, example:

Switch off breaker. Attach locking device, hasp, Locks and Tag. Attempt to start pump.

Where available, relevant drawings should be marked up and attached to the IC. Drawings should be marked up with highlighter pen and the associated step number.

5.4. Process isolation

A Process Isolation SHALL be required for opening any vessel or tank, breaking flanges or connections on pipelines, or process equipment.

A process isolation is the process whereby sources of harm (pressure, Temperature, chemical, electrical or mechanical power, engulfment) are physically separated from the persons carrying out work and are protected from inadvertent operation and the means of isolation have been proven effective.

5.5. Electrical isolation

- The electrical equipment to be worked on shall be isolated from all sources of supply (e.g. mains, generator, battery, solar) either by opening switches, removing fuses or switching circuit breakers.
- Get an electrician to review the drawings and to make sure all isolations are accounted for using the above as a checklist. In all cases the electrical drawings should be consulted where control wiring is involved.
- From the above information it will be possible to document an isolation plan for a specific piece of equipment. This can be used to save time in future isolations. Where such plans are used they can be kept current and be reviewed should any changes be made to the site.
- Consider Energy Storage if the following devices are involved:
    - Emergency light fittings with dual power supplies and or internal batteries
    - Variable Speed Drives (not soft starters)
    - Capacitors PF
    - UPS
    - Hydraulic accumulators
- Some electrical equipment may have multiple power feeds – the isolation of equipment must ensure all energy sources are locked out.
- Depending on what is to be isolated and why the following means of isolation should be used. The following list is in order of preferred of isolation:
    1. Remote isolators or circuit breakers which are locked out at the switchboard.
    2. Local isolator adjacent to the equipment being worked on and locked off as you can usually see the isolator and its normally obvious by inspection that the correct isolator has been turned off.
    3. Removal of wiring and earth conductors.
    4. Withdrawal of fuses is not an acceptable form of positive isolation unless the enclosure they are in can be locked off. This sometimes is the only means of isolation for control circuits.
    5. If there is no mechanical means available to lock out the equipment a suitably qualified electrician must physically isolate wiring to equipment by disconnection and safe termination of wiring. The equipment and wiring shall be bonded to earth during disconnection, and the duration of works.
- Where isolation is effected at a removable or rack-out circuit breaker or combined fuse switch or a removable fuse the device should be racked out or removed to provide a visible break for isolation verification.
- Where isolation is provided by the removal of fuses in a distribution board or motor starter the following shall apply:
    a. Removed fuses shall not be stored in the same panel as the fuse holder.
    b. Fuses shall be tagged and stored in a secure location during the period in which equipment is isolated.
    c. Blank or empty fuse cartridges preferably painted yellow and tagged 'for

isolation purposes' shall be inserted into the fuse holder to prevent inadvertent contact with exposed conductors and to clearly identify that equipment is under isolation.

- Confirmation shall be made that all required isolations are in place.
- Tags shall be placed at all points of switching, isolation or disconnection. Such tags shall be clearly understandable and signed and dated by the person placing the tag or by the supervisor in charge of the work party. Identification labels should also include warnings for any abnormal hazards. Any field equipment with multiple supplies should have a clear label on the equipment stating so.

5.5.1 Isolation in hazardous areas

- Unless wiring is intrinsically safe - and then there are restrictions on what can be done – all voltages need to be considered dangerous due to the risk of unintended ignition.

5.5.2 Interlocks and Automatic starting of equipment

- During the isolation consideration shall be given to the possibility of circuit wiring or electrical equipment becoming live due to the operation of automatic control devices, e.g. thermostats, float switches, PLCs and other interface and interlock devices.
- To prevent the inadvertent or automatic starting of equipment from remote locations the respective output from a PLC or DCS to equipment being isolated shall be disconnected as part of the isolation process. This includes connections to motor starters, valve solenoids, motorised valves, instrument power etc.
- Disconnection of the PLC/DCS output may be achieved by one of the following;
  a. Physically disconnecting wiring at the output module,
  b. Physically disconnecting wiring or removal of a fuse at a terminal strip in a wiring enclosure,
  c. Physically disconnecting wiring at the field device; or,
  d. Through the use of a disconnect switch on the PLC/DCS or at the equipment.

In all cases – isolation of control circuits, or interlocks via a SCADA or PLC system is not considered to be sufficient.

5.5.3 other powered equipment isolation

Powered Fixed Equipment Isolation

- Prior to any work starting on powered equipment it must be positively isolated.
- Electrically powered equipment shall be isolated locked and tagged out from its power supply.
- Diesel driven equipment shall be positively isolated by removal and tagging out of ignition key, securing of electrical isolation switch or equivalent method.
- Steam, hydraulic or pneumatic equipment shall be positively isolated from its energy source by positive isolation of its motive force. Further isolation will depend on the type of equipment and may include pipe and additional physical isolation.
- Persons performing the work shall test the operation of equipment before work commences to ensure effective isolation.

Software based isolation

- Software based systems such as SCADA systems or those used for gantry control (e.g. PC-Tas or Omega) provide the functionality to lock-out specific functions – e.g. to lockout a loading arm from delivery, or to stop a pump running. the functionality is useful for overall co-ordination of site activities, and the practice should be continued. Changes to control systems should be recorded as part of LOTO plans to ensure systems are returned to normal operating state.
- Software lockout alone is NOT considered adequate for permitted works.

Access to Safety Critical Cabinets

- Access to a Safety Critical Cabinet, i.e. those containing ESD, HHLA, and Fire Alarms – requires a permit to be issued. In which case all other works on-site are to be suspended, until the critical system has been fully tested and re-instated.

5.6. Extended period isolation

Extended Period Isolations (EPI's) are isolations which are left in place after the work permit has been closed, E.g., when awaiting parts for repair. Alternatively, an EPI may be used to record an Isolation installed due to a fault, e.g., Isolating a light at the circuit breaker due to a broken light fitting.

EPIs are not intended to be used for decommissioned equipment or equipment which is to be out of service for more than three months.

The Procedure for documenting EPI's is as follows:

1. When it becomes apparent that the work cannot be restarted within the validity period of the permit, the associated permit is to be closed by the PH & PI as normal and deregistered in the Master Isolation Register section of the IC and Permit Holder lock/locks removed.
2. The EPI Box is ticked in section 2 of the IC and dated/signed by the PI
3. The PI must add a note to the 'Reason for Isolation' box in section 1 of the IC e.g., 'Updated to EPI to await parts'
4. The IC lock/s are to remain in place. Keys remain attached to the IC and IC stored appropriately

When it becomes possible for work to restart withing the EPI boundary:

1. The PI shall review details of the LOTO plan and test record and ensure Isolations are still in place and effective
2. A new permit will be raised, entering the IC number into the applicable section of the permit. A personal lock is applied to each isolation point or the Lock box and the permit is registered in the 'master isolation register' section of the IC.

EPIs are cancelled as soon as the 'Approval to remove Isolations' section is completed on the IC.

EPI's that have been in existence for a period of more than 3 months are to be reviewed by the site manager.

5.7. Isolation of Safety/Emergency systems

Section 4 of the isolation certificate is used to ensure appropriate site personnel, Risk team and if applicable external agencies i.e. FENZ are aware of any isolation that directly effects the operation of safety and/or emergency systems or devices. Examples of its use are as follows:

- Work on fire pump units or fire ring main systems
- Work requiring the isolation of shutdown trips/interlocks in production process systems
- Work requiring isolation of automatic emergency shutdown devices
- Work requiring the isolation of automatic detectors for flame, heat and smoke
- Work on functional relief valves

5.8. Application of isolations

	Instruction	Comment
ISOLATION		
1	Prepare the LOTO Plan and Test record	(compiler) PI or Nominee
2	Mark up a P&ID or As built drawings where available	(compiler) PI or Nominee
3	Verify LOTO Plan for correctness	If LOTO Plan and Test record prepared by the PI then plan must be verified by a competent person. If plan was prepared by a nominated compiler then PI must verify plan. In either case, a line walk must be completed as part of the verification.
4	Install, lock and Prove Isolations	Competent Person. May be PI or the PH. In all cases a competent person must be the 'checker'. The same person cannot be the 'installer' and 'checker'. Numbered locks fitted as isolation applied.
5	Record lock numbers on the LOTO Plan and Test Record **as they are applied**	Competent Person. May be PI.
6	When isolations are complete, and a lock box **is not used (5 or less Isolation points and maximum one permit registered to IC):** Isolation Certificate keys are attached to the IC. Permit Holder keys are attached to the master copy of the permit When Isolations are complete, and a lock box **is used:** the keys for each isolation point are placed in a lock box and an IC lock applied to the lock box. The IC lock is then attached to the IC.	Competent person & PI **In all cases** IC locks are the first on and last off. When in use, lock box number and IC lock number to be recorded on the IC.
7	Where applicable, blinds, disconnections and blanks are to be installed and date recorded on LOTO Plan and test Record. PI to physically verify these are in the correct location and initial relevant section of LOTO plan and test record	Requires a separate permit, permit to be registered on the IC.
8	Issue work permits to work under isolation. Register permit in Master Isolation Register of the IC. Apply PH locks to isolation points or single PH lock to lock box where in use. PH Keys are always attached to the master copy of their work permit.	Each permit registered on the IC requires a PH lock be placed on the lock box.
9	The PI places the IC and attachments as per record keeping requirements of the PTW manual	Anyone involved with a Permit working under an isolation must be provided a copy of the IC on request and if necessary, shown the location of isolations

	Instruction	Comment
	DE ISOLATION	
1	On the completion of work, individual permits are deregistered in the Master Isolation Register section of the IC. Once deregistered the PH locks are removed from the Isolations or Lock box where applicable.	
2	Once all permits registered on the IC have been deregistered and PH locks removed from Isolations or the Lock box the PI checks the LOTO Plan and Test record. If blinds, disconnects or blanks were installed these can now be removed/reinstated. PI to verify reinstatement of all equipment is correct and initials relevant section of LOTO Plan and Test Record.	Separate permit required for removal of blinds or reinstatement of disconnections. Permit registered on IC and PH lock placed on lock box.
3	PI approves the removal of isolations and signs section 7 of the IC	**Note: approval can only be given if all permits registered on the IC are deregistered and all PH locks are removed from the lock box.** PI removes IC lock on lock box.
4	Individual isolations can be removed as per LOTO Plan and Test record. 'Removal of isolation' section of the LOTO Plan and Test Record completed **as they are removed**	Competent Person. May be PI or the PH. In all cases a competent person must be the 'checker'. The same person cannot be the 'installer' and 'checker'. **Note: In the event that a lock exists but cannot be traced to a permit or IC, a risk assessment must be completed prior to removal and Z line manager approval sought to remove. Risk assessment and Approval attached to the IC.**

5.9. Removal of hazardous substances from the system

Once isolation have been installed, all stored energy as is reasonable practicable shall be discharged. Prior to breaking containment of a pipeline or piece of equipment (e.g. filter vessel), it shall be de-pressurised to atmospheric pressure by means of a vent or drain to atmosphere. Any product or contaminated water shall be contained. Product or contaminated water shall not be allowed to drain to ground or be directed into open drains. It is critical that all bleeds, vents and drains are checked to be free from blockage prior to testing.

5.9.1. Line draining and de-pressurisation

- Prior to opening a pipeline or piece of equipment (e.g. filter vessel), it must be isolated and depressurised to atmospheric pressure by means of a vent, or drain to atmosphere. Any product or contaminated water shall be captured, under no

circumstances shall product or contaminated water be allowed to drain to ground, or be directed into open drains.

- Competent persons shall agree to the method by which stored energy will be discharged. A competent person shall safely discharge stored energy, e.g. drain and depressurize and / or discharge electrical or other sources of energy. It is critical that all bleeds, vents and drains are checked to be free from blockage during discharge of stored energy, and prior to testing the isolation is effective.
- Any Low Point Drain / High Point Vent valves opened for draining should be included on LOTOPTR to ensure they are closed before de-isolation.
- Thermal relief paths and reduction in upstream pressures need to be assessed with all product lines to prevent thermal expansion and potential equipment damage/ pipe rupture.

5.9.2. Decontamination

Decontamination is the process of removing or neutralizing hazardous substances or materials in the equipment that is critical to the health and safety of workers. This may include water flushing, purging, steam cleaning or forced ventilation. Appropriate PPE must be used during decontamination.

5.9.3. Purging

This refers to the displacement of contaminants from an area, vessel or Confined Space by displacement with air, inert gases, or water.

- Clean and purge the line or vessel if necessary.
- Purge with fresh air to remove harmful gases or vapours.
- Warning: Never use oxygen to purge a confined space: this can create a fire and explosion hazard.
- Use vapor and gas freeing, degassing and ventilating equipment, including but not limited to eductors, air blowers, flexible tubing for suction and exhaust, air compressors, hoses and connectors, tank opening covering and, where required, degassing vapour recovery or vapour treatment equipment.
- Permit Holders shall ensure that all hoses, valves, flanges, fittings, blinds and gaskets to be used are appropriate for the anticipated exposures and pressures.

5.9.4. Gas testing

- Gas testing must be conducted where there is a possibility of hazardous substances being present after completion of decontamination and prior to start of work.
- Test results must be recorded on the Gas Testing section of the Work Permit. Any result different to the ideal – need to be investigated, addressed, and the area re-tested prior to start of work.
- An Authorised Gas Tester (AGT) who have been trained and assessed as competent (see under Competency requirements) will carry out the gas testing.
- Additional requirements for gas testing are stipulated in the Safe Work Practices for Hot Work and Confined Space Entry.

5.10. Testing and monitoring effectiveness

Test to be conducted to confirm that equipment is isolated and that plant / equipment is de-energized / depressurized and / or cannot be started. Once isolations have been completed, verification must be completed by the Permit Issuer or Site delegate.

5.10.1. Proving Electrical Isolation

- All electrical equipment, unless proven to be de-energised, shall be treated as live.
- Only a Qualified Electrical Person shall perform the tests.
- Persons performing the work shall test the operation of equipment before work

commences to ensure effective isolation.

- Once a circuit has been isolated, it should be proven by a Qualified Electrical Person that the isolation is effective.
- When proving an isolation just because it does go doesn't mean it is isolated correctly. It is possible to isolate the wrong circuit, but it doesn't work because the control system has switched it off.
- To prove that the test equipment is working, use prove-test- prove: Prove the test equipment is functioning, test the circuit, prove the test equipment is still functioning correctly.
- The best form of proving is to start a piece of equipment, run it, Isolate it, and try to run it again
- For electrical isolation where wiring is being exposed, live wiring needs to be checked by a suitable electrical testing equipment, but where automation is involved, testing by trying to turn on the control circuit is always a good idea.
- When isolating electrical equipment in site switchboards using lockable isolators ensure these lock out the power to the motor and not just power to control circuits within the MCC that in a fault condition could still allow the motor to start.
- Where fitted, in addition to locking at switchboard isolators, local isolators adjacent to each pump shall also be locked and tagged.

NOTES:

- The physical size of a lockable switch on an MCC is not a good indicator of whether it isolates control power or motor power. If in doubt, involve an electrician.
- Local isolators adjacent to pumps are NOT designed to be switched while the motor is running. Doing so may cause them to fail.

5.10.2. Voltage tests

- Voltage tests shall be carried out between all phase conductors and between all phase conductors and earth.
- The testing of equipment with an approved test meter for the purpose of confirming that the equipment is isolated is not considered live work under this local practice. This position may vary and local requirements shall be applied.
- Any voltage tests used to prove de-energization shall be conducted in the following sequence:

a. Test the voltage tester on a known voltage source for correct operation.
b. Test between all conductors and a known earth.
c. Test between all conductors.
d. Retest the voltage tester on a known voltage source for correct operation.
WARNING: WHEN VOLTAGE TESTERS ARE USED TO PROVE DE-ENERGISATION, THEY SHALL BE TESTED FOR CORRECT OPERATION IMMEDIATELY BEFORE USE, AND AGAIN IMMEDIATELY AFTER USE, PARTICULARLY IF THE TEST RESULT INDICATES ZERO VOLTAGE, TO CONFIRM THAT THE INSTRUMENT IS STILL WORKING CORRECTLY.

5.10.3. 'Try'

- Where practicable, persons performing the work shall try to start the equipment via the field isolator or PLC once the isolations are in place. This step is sometimes referred to as the 'try' step.
- Prove-test-prove principle can also be used: i.e. start a motor, isolate, try the motor, remove isolation, start motor to confirm the correct point of isolation.

5.10.4. Cutting of Electrical Cables

- All cables must be considered live until proven otherwise. You cannot test the point

at where you intend to cut

5.10.5. Opening of Enclosures

- Opening of enclosures while circuits remain energised is often required to facilitate inspections, troubleshooting and maintenance activities. However, consideration shall be given to the potential for hazardous atmospheres. This shall be considered in the risk assessment for the task and a gas test shall be conducted by a competent person (as defined in the PTW Manual) for all such work in hazardous areas.
- Opening of electrical enclosures or cabinets for purposes of troubleshooting, inspecting or investigation, where the person is not coming into close proximity with exposed electrical circuits, is not considered live electrical work under this local practice.
- Opening of enclosures or cabinets where there is the presence of exposed voltage higher than 50V ac the permit will only be issued to a qualified persons i.e. electrical engineer, electrical worker.
- While there is low risk for a competent person when opening a panel to observe the status of wiring or to inspect components as part of troubleshooting or maintenance activities, a safe approach distance of 500mm to exposed and live conductors shall be observed.
- Placing hands or any part of the body within 500mm of live and exposed conductors shall be considered live work and additional safeguards shall be in place to protect the person from direct or indirect contact with energised conductors. Refer to SWP on Energised Electrical Work.

5.11. Carrying out work

- Include the isolation requirements on any work permits, work clearances, or procedure. Identify and record isolations that are common to more than one permit, work clearance or procedure

5.11.1. For work requiring Work Permit:

- Permit Issuer (PI), site representative (who may be the PI) and Permit Holder shall jointly view and test the approved isolations that are in place prior commencing any work.
- When multiple work (different permit) is required on the isolated equipment, each permit will be stand alone.
- All workers (contractor and Z personnel), must apply their personal lock to the isolation points or a LOTO box. This must be a single key lock. i.e. no key alike locks to be used.
- If more than one work group is required to lock out equipment (including different trades), a minimum of one responsible person from each group shall place their own lock on the energy isolating device using a multi-lock hasp. The lock shall be tagged with the name of the person(s) who applied the lock and who holds the key.

5.11.2. Whilst work is being undertaken under the isolation

Monitoring and testing intervals shall be stipulated in the work permit, risk assessment, or procedure for the task. If there is a possibility of isolations integrity being affected during the work, verify integrity by:

1. Checking isolations regularly
2. Monitoring isolations regularly.
3. Additional isolation point can be added during the intrusive work but no isolation point can be removed until work is completed.

5.12. Reinstatement of the plant

The following requirements must be met for releasing machines or equipment that have been locked out or tagged out prior to restoring energy to the equipment and using it:

5.12.1. Machine/equipment inspection

- The work area must be inspected to ensure that non-essential items (e.g., tools, spare parts) have been removed and that all machine or equipment components are operationally intact.
- Ensure all equipment and personnel are clear.
- Conduct housekeeping check to ensure that there is no unnecessary hazard around the equipment.

5.12.2. Positioning of workers

The work area must be checked to ensure that all workers have been safely positioned or have cleared the area. In addition, all affected personnel must be notified that the lockout or tagout devices have been removed before the equipment is started.

5.12.3. Plant reinstatement

On completion of the work, removal of locks and tags, de-isolation and recommissioning of the system must be performed with the same care as used during the isolation, locking and tagging. Integrity testing of the point of isolation must precede for example the removal of any blank flanges, swinging of spectacle blinds and reinstatement of pipework to test for the presence of stored energy or product, which may be released.

Once reinstated, steps must be taken to check for system integrity e.g. line walked and leak checked once back up to normal operating pressure.

5.12.4. Equipment testing

Equipment that has been removed from service for maintenance (whether routine or non-routine) shall on completion of maintenance, be tested in service to confirm the integrity of the system.

Pressure, leak and functional testing of the reinstated system shall be performed as required for the equipment. Particular care should be taken of electrically, pneumatically or hydraulically operated valves which may open or close on reinstatement of the energy source. If this is not possible at the time the maintenance is completed, then maintenance shall be deemed incomplete and the equipment shall remain locked out / tagged out until testing in service can be undertaken.

5.12.5. Decommissioned Equipment

Where equipment has been locked out using Lock Out Station resources, and the equipment is permanently removed from service, Lock Out Station resources should be changed out for "Operational Locks" or similar so the equipment is positively removed from service. This may include, but not limited to; fully draining and blanking pipework, wiring closed valves, removing valve handles, removing wiring back to the switch etc. Equipment must be clearly identified as decommissioned plant.

6. LOTO Documentation

All energy isolations that are not covered in a standard operating procedure shall be managed under the Z Permit to Work System (PTW).

6.1. LOTO Certificate

Where a permit is required, a LOTO Certificate must be used in conjunction with the permit to describe the requirements on energy isolations. It needs to consider all possible sources of risk and record how the energy will be isolated and drained/dissipated in a safe and controlled manner. This will cross-reference all relevant permits associated to the isolation list.

6.2. Isolation list / LOTO Plan (LOTOP)

This identifies the items of equipment to be locked out / tagged out, date when installed/removed and who installed/removed them. This should document the sequence of isolation / de-energization in the Isolation list / LOTOP.

Supporting documents

Where applicable, LOTO certificate/checklist must be supported by appropriate supporting documents. These documents can consist of marked up drawings (P&ID's, Electrical, drainage, hazardous areas etc.), free text, or anything else that clearly demonstrates and documents that adequate consideration has been given to all potential hazards. (Note - If a process is complex or confusing consider inviting Z Engineering to complete a HAZOP as part of planning).

Recordkeeping

All supporting documentation relevant to the isolation shall be kept and retained with the associated work permit. Refer to section 9.5 of the PTW manual.

7. LOTO tools

Personnel/facilities shall be equipped with the resources/documents required for LOTO such as:

1. Permit/LOTO board (Bulk Fuels facilities only)
2. Lockout devices
3. Lockout tags
4. LOCK box (where applicable)

Other Isolation hardware may also be available to suit location needs – including but not limited to; chains, valve handle adaptors, circuit breaker attachments.

7.1. Permit/LOTO Board

All work permit and isolations are to be written/displayed on the board at Bulk Fuels Facilities. There will be coloured or numbered button on the board to identify location of LOTO and the type of work (general work, hot work, work at height, confined space).

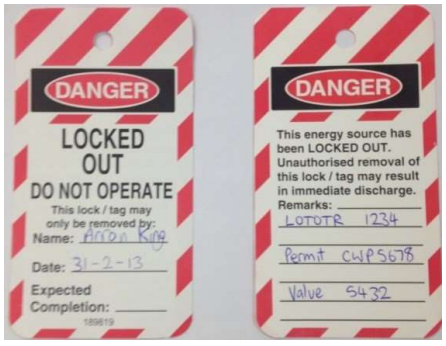
7.2. Lockout device

- All isolation points must be safely secured by using a padlock to ensure no chance of accidental operation. Each point will have a uniquely numbered LOTO padlock, AND, a Lock Out Tag referencing associated LOTO certificate.
- These should then be checked off the LOTO isolation list as they are placed and again when they are removed at the end of the work.
- Specific Lockout Devices such as chains, gate valve bonnets, valve handle adaptors, and circuit breaker clamps are available for equipment traditional unable to be locked and should be considered to allow for lock placement.
- Where an isolation point is not lockable, use addition specific lockout devices (as above) to help secure the isolation. Tag-out is a last resort for lockout and will require approval from Site Manager or delegate.

  Note: "Operational Locks" (e.g. lock open/lock closed valves) are also used on site, these are locks which are "master keyed", with access to Site Staff for the purpose of plant control. Management of these locks is not covered in the Work Permit System.
- Lockout devices shall be able to withstand environmental conditions.

7.3. Lockout tags

- Lockout tags shall be able to withstand environmental conditions.
- As a minimum requirement the following details will be recorded on each and every Lock Out Tag:
  - Who applied the lockout
  - Date applied
  - Work permit number and LOTO isolation list reference number
  - Equipment ID



7.4. Lock Box

- LOCK Box is used to ensure no isolations can be removed from Isolation points until all permits working under the isolation have been deregistered
    - Once all points have been isolated and verified as per isolation list, all keys to the locks used for lock-out tag-out (equipment locks) will be placed inside the LOTO Box.
    - A permit issuer will apply an Isolation Certificate Lock (IC Lock) to the Lock box to ensure that the key to the equipment locks remain inside the Lock Box. The Lock box number and IC Lock number will be recorded on the Isolation Certificate. The Isolation Certificate Lock is **always** the first on and last off of the Lock Box.
    - The Key to the IC lock is placed in small envelope and attached to the IC. This can only be removed when the 'Approval to remove isolations' section of the LOTO certificate is signed off.
    - Anyone who requires conducting work under this Isolation Certificate must record their Permit details in the 'Master Isolation Register' section of the IC and apply their personal lock on the Lock box. The IC number will be cross referenced on the applicable permit. Personal Lock keys will be placed in a small envelope and attached to the work permit. Only the Permit Holder can remove their Personal Lock, with authorization from a permit issuer. Removal of this lock by someone other than the Permit Holder will require approval from Site Manager.
    - Once reinstatement of plant is approved ('Approval to remove isolations' section of the IC is completed), Permit Issuer can remove the IC lock, and then issue the key to the equipment lock to reinstate isolated equipment.

8. Training / Competency

Specialised training and competencies are required before an individual is to be assigned a specific PTWS operational responsibility. Table 1 specifies training requirements for personnel involved in performing energy isolations.

Table 1. Training and competency requirements for energy isolations

PTW Roles	Training	Description
Person applying isolation	NZQA US 25043	Energy isolation
	AND Must have completed any relevant training on safe operation of equipment to be isolated **AND** Must be familiar with the hazards of the energy/substance to be isolated	
Qualified electrical person	Registered as an Electrician or Electrical Inspector; or be a Qualified Electrical Engineer AND Trained and competent to carry out: • electrical isolations on circuits • tripping of circuit breakers • testing step of isolation on systems/equipment above 50 volts with exposed parts (potentially energized)	

Appendix 1: Isolation Methods

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Features – cons	Comments, refs to industry codes
Primary devices					
Valves	The simplest form of isolation device	■ Standard use for process plant and pipelines ■ Suitable for all fluids at all pressure ranges	■ Does not require intervention into the pipe – no significant hazard to the person performing isolation ■ Facility already installed, locations identified from P&IDs ■ Isolation is fast and removal to reinstate plant is easy ■ No specialist training or materials required ■ Continual attendance or monitoring not usually required ■ Low cost	■ May not give tight shut-off due to seal damage ■ Positive indication of complete isolation is not always available, additional monitoring may be required ■ Requires locking off to prevent inadvertent operation ■ May not be in optimum position, resulting in large inventories beyond the isolation ■ Additional cost of valve and maintenance throughout the lifetime of the plant ■ Not all valve types are suitable for isolation use (Appendix 4)	Valves to be suitable for service fluid and rated to the maximum differential pressure See: ISO 14313[22] for pipeline valves API 6D

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Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Features – cons	Comments, refs to industry codes
Primary devices					
Spades and spectacle plates	A solid plate inserted between flanges See Figure 8	■ Standard use for process plant and pipelines ■ Suitable for all fluids over a range of pressure ratings	■ Positive isolation ■ Clear indication of presence ■ No specialist training or materials required ■ Continual attendance or monitoring not usually required ■ Low component cost	■ Requires intrusion into the process to break and make joints ■ Requires temporary isolation for insertion and removal – such isolations may be remote from the worksite, making control more difficult ■ Relatively slow to install ■ Flanges may not be in optimum position, especially in welded pipework, resulting in large inventories beyond the isolation	Spades and spectacles to be compatible with the service fluid and rated to the maximum operating pressure See notes for Figure 8

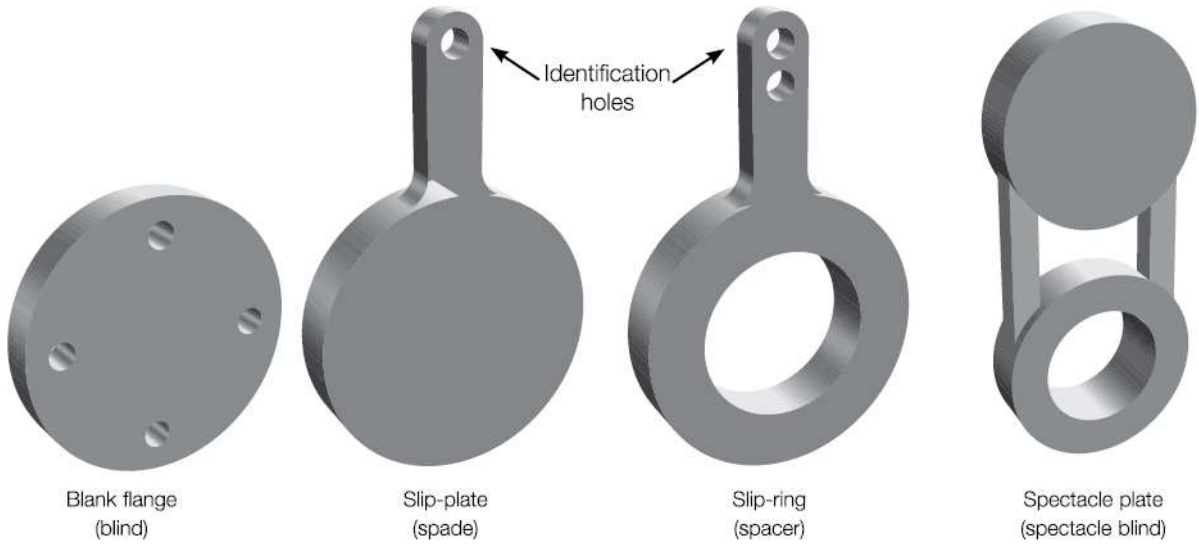

Figure 8 Spades and spectacle plates

The size and material of spades and spectacle plates must be clearly marked, together with the class rating for which they are suitable.

An unambiguous system should differentiate between slip-rings and spades, for example slip-rings have two holes on their tail while spades have one.

The condition and suitability of the spades and spectacle plates should be checked before each use. When not in use, they should be stored properly and separately.

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Features – cons	Comments, refs to industry codes
Primary devices					
Physical dis-connection	Remove spool and install blank flange (blind)	■ Standard use for process plant and pipelines ■ Suitable for all fluids over a range of pressure ratings ■ Ideal for extended term, infrequent isolation	■ Positive isolation ■ Indication of presence ■ Clear indication of even minor failure ■ No specialist training or materials required ■ Continual attendance or monitoring not usually required ■ Blank flanges can incorporate valves etc for bleeding/ venting and monitoring purposes ■ Low component cost	■ Requires intervention into the process to break and make joints ■ Requires temporary isolation for insertion and removal – such isolations may be remote from the worksite, making control more difficult ■ Care is needed when installing and removing blanks as pressure can build up behind them ■ Slow to install and reinstate ■ Flanges may not be in optimum position, especially in welded pipework, resulting in large inventories beyond the isolation	Blanks to be compatible with the service fluid and rated to the maximum operating pressure
Specialist techniques					
Squeeze off	Pipe is squeezed together to stop flow using a mechanical or hydraulic clamp	■ Specialist technique – temporary isolation of low and medium pressure gas network polyethylene pipework	■ Simple technique ■ Location of isolation flexible ■ Relatively cheap	■ Only suitable for use on polyethylene pipework ■ Causes physical deformation hence further squeeze offs should not be carried out within specified limits along the same length of pipe ■ Low differential pressure technique	IGE/TD/3[23]
Foam bagging	Foam is injected into a semi-porous bag, previously inserted into the pipework	■ Specialist technique – low and medium pressure gas network for cast iron, ductile iron and steel mains	■ Can be used when insufficient room to carry out a conventional mains isolation ■ A useful means of flow – stopping tapered, vertical or non-standard diameter pipe ■ Can be inserted without decommissioning the pipeline ■ Low cost option for abandoning mains or services	■ For permanent abandonment only – not suitable for temporary isolations ■ A second method of isolation must be used if the technique is to form a permanent isolation, eg end cap or blank ■ May require specialist equipment and training	IGE/TD/3[23]

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Features – cons	Comments, refs to industry codes
Specialist techniques					
Pipe plugs	A single multi-seal plug or a number of plugs in combination See Figure 9	■ Suitable for process plant and pipelines ■ Normally used for short- term isolations	■ Can provide an effective leak-free barrier ■ Isolation scheme can comprise a single multi-seal plug or a number of plugs ■ Medium cost	■ If used as primary isolation technique, sufficient redundancy and independence should exist within or between plugs so that failure of a part of the sealing system does not cause total loss of sealing capability ■ Care must be exercised to ensure correct fitment for the full duration of the isolation – continuous monitoring required ■ Requires open end to access pipeline – limited choice of location ■ If control lines are damaged, pipe plugs can get stuck within the pipe ■ Specialist technique, requires specific training	Pipe plugs must be suitable for use with the fluid and rated to the required pressure – consultation with manufacturer necessary

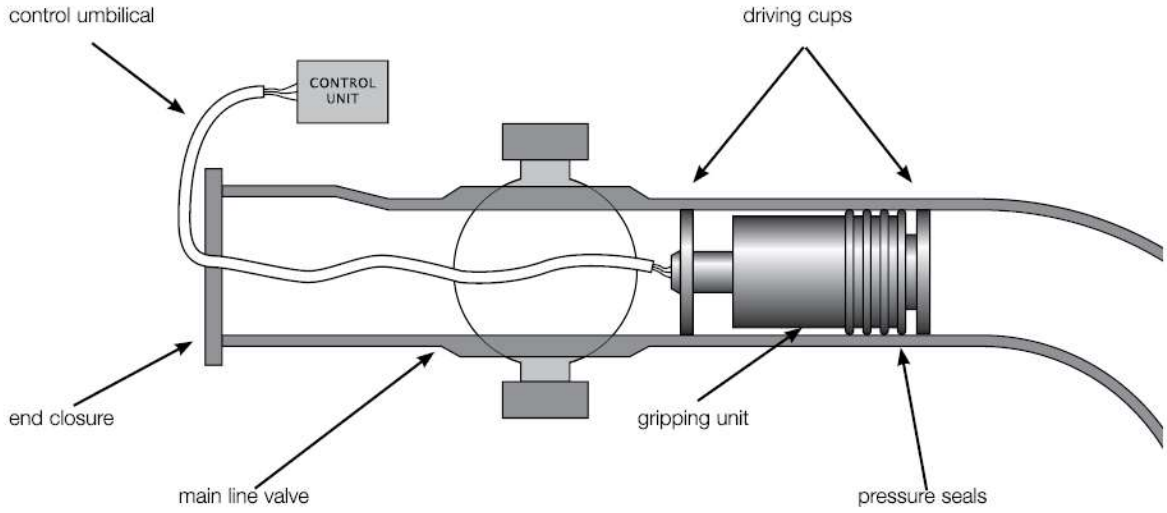

Figure 9 Pipeline plug

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Features – cons	Comments, refs to industry codes
Specialist techniques					
Pipe stoppers	A form of low differential pressure sealing plug	■ Suitable for process plant and pipelines ■ Stoppers are primarily used as a secondary seal	■ Simple to use ■ Low cost	■ Not suitable as a primary isolation ■ Care must be exercised to ensure correct fitment for the full duration of the isolation – continuous monitoring required ■ Only suitable for low differential pressure isolations ■ Requires open end to access pipeline ■ No external indication of isolation	
Inflatable bags	Inflatable bag inserted through hole in pipe prior to being filled with air or nitrogen to effect a seal	■ Suitable for use on low differential pressure isolation systems, eg low pressure gas pipelines ■ Used in pairs with a vent between bags or can be used singly as a secondary seal	■ Inserted through relatively small holes cut into the pipe wall ■ Flexible location of isolation ■ Available in a large range of sizes ■ Allows flow of fluid to be maintained if a bypass is fitted ■ Pipeline does not need to be decommissioned ■ Medium cost	■ Requires constant monitoring as bags can suddenly deflate and may be damaged when being installed through the cut hole or by swarf left in the pipe ■ Specific care must be taken when hot work is being undertaken close to an inflated bag isolation ■ Bag materials may be affected by some fluids (eg mercaptans) ■ Requires specialist equipment and trained personnel ■ Only suitable for low differential pressure isolations ■ Requires completion plugs to be fitted to pipelines	IGE/TD/3[23]

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Features – cons	Comments, refs to industry codes
Specialist techniques					
Hot tapping and stoppling	Technique for plugging a pipe which is still subject to service pressure	■ Suitable for use on most steel pipelines including sub-sea ■ Used to isolate a section of pipe and may allow continued operation by diverting the fluid through a temporary bypass	■ Flexible location of isolation ■ Allows flow of fluid to be maintained if a bypass is fitted ■ Can be used on a wide range of diameters ■ Can be installed without decommissioning the pipeline	■ Requires tee and other fittings to be welded onto pipe with high integrity welding and inspection ■ Requires careful control to prevent thermal build-up within the service fluid or interconnecting spaces ■ Not appropriate for systems containing chlorine, oxygen, hydrogen, hydrogen sulphide or hydrogen fluoride ■ Requires specialist equipment and trained personnel ■ Welded or bolted fittings and blanks remain on the pipeline ■ Relatively expensive technique	Welded fittings: BS 6990 *Code of practice for welding on steel pipelines containing process fluids or their residuals*[24] See: IGE/TD/1 Ed 4[25]
Pigs	A dynamic isolation scheme that may be used to isolate a pipeline	■ Suitable for pipelines ■ May be used in series separated by slugs of nitrogen, diesel, glycol, water (or a combination of inert fluids) to form a pig train	■ Can withstand some differential pressure (a few bar) before train starts to move	■ Requires specialist equipment and trained personnel ■ Relatively expensive technique See Appendix 7 for other operational issues	

Technique	Brief description	Typical use (process plant or pipelines) and pressure	Features – pros	Features – cons	Comments, refs to industry codes
Specialist techniques					
Pipe freezing	Fluid within the pipe is frozen to form a solid plug. A coolant (solidified or liquefied gas) is used around the outside of the pipe wall	■ Suitable for process plant and pipelines ■ Can be applied for: – water-based service liquids (using carbon dioxide as coolant) and – hydrocarbons, acids, alkalis, chlorides, ammonia, etc (using liquid nitrogen as coolant)	■ Does not require intrusion into the pipework ■ Location of isolation flexible ■ Can be used on non- standard pipe diameters	■ The plug may move/ melt leading to failure of the isolation ■ Continual monitoring required ■ Pipe materials, joints and components can be adversely affected by the freezing operation ■ Failure to equalise the pressure across the plug can result in physical damage to the pipework – when the plug thaws it will be propelled along the pipe ■ Expense and complexity of technique varies, dependent on fluid, pipe diameter and flow rate ■ Specialist training required	

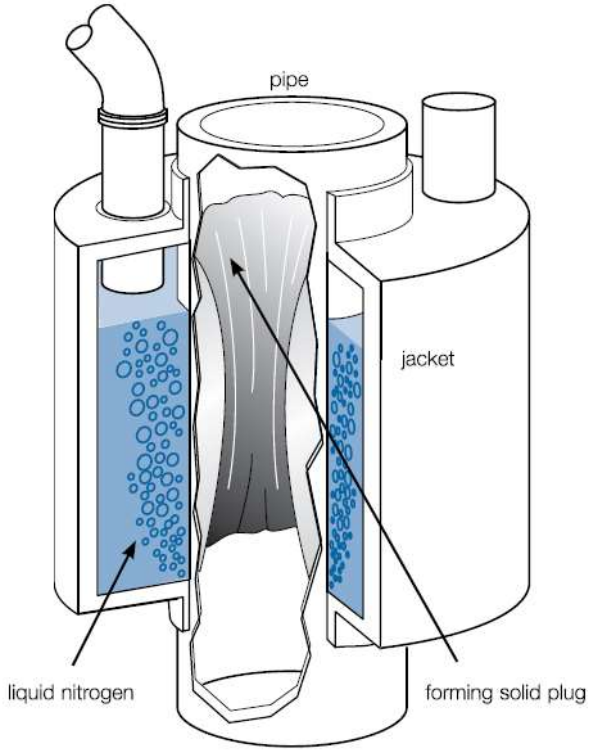

Figure 10 Pipeline freezing

Appendix 2: Competencies for Isolation Activities

Hazards

- ☐ A general awareness of the hazards represented by the plant.
- ☐ A detailed understanding of the hazards on the plant and from adjacent plant.

Documentation

- ☐ Understand the P&IDs, loop diagrams, cause and effect diagrams and power supplies applicable to the isolation.

PTW (permit-to-work)

- ☐ Understand the system of PTW and isolation certificates in use.
- ☐ Know the procedures for issuing PTW and for identifying what isolations are required.
- ☐ Certified as a permit issuer.

Isolation procedures

- ☐ Good working knowledge of isolation and risk assessment procedures for plant.
- ☐ Understand the importance of following procedures.
- ☐ Know how to check what isolations are in place and that they are the correct isolations required.
- ☐ Know the procedures for installing/removing isolations.
- ☐ Know the procedures for draining, venting, purging and flushing.
- ☐ Know how to test and confirm correct installation of isolations.
- ☐ Know how to record isolations on an isolation certificate.
- ☐ Be able to assess the risks from non-standard isolations.