AirBP ANZ Procedure

PRO-4.5-0001-1-02A
Energy Isolation (Air BP ANZ)

Version:	2
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This procedure has been adopted for use on AirBP sites within Australia and New Zealand from the BP Australia MS&L procedure PRO-4.5-0001-1-02. To review changes to this document from the BP Australia MS&L procedure PRO-4.5-0001-1-02 refer to versions held in the Controlled Document Database.

Contents

1. Purpose

Whenever BP conducts construction, maintenance, demolition, remediation and other similar work that are typical of our industry, there is the potential for harm to people and the environment and for damage to equipment. This document provides requirements for the isolation of energy systems on AirBP sites, in support of PRO 4.5-0001-0-01 Control of Work and PRO 4.5-0001-1-01 Permit to Work.

Energy Isolation is a key component of the system of work that allows tasks to be completed safely without harm to people and without unplanned loss of containment with the potential to cause environmental damage or to damage a plant or equipment.

This procedure sets out a required approach to isolation of energy systems in accordance with BP's Golden Rules of Safely, the requirements of GDP 4.5-0001 Control of Work, Annex 1 and OMS Group Essentials 3.2.1 and 4.5.1.

2. Scope

The requirement specified in this procedure applies equally to BP employees and contractors engaged on AirBP Australia and New Zealand sites.

Specific sites, areas and activities may have more detailed OMS requirements and where these exist the requirements will be specified in local procedures, safe work instructions, manuals, handbooks or specific standards.

3. Definitions

Checker — A nominated second individual who is tasked with ensuring that isolations are applied as per the work permit or work clearance LOTO plan, prior to works and removed after the works.

Close Proximity (electrical) — Locations on installations, where deliberate, accidental or inadvertent contact with electrical equipment is possible, either direct or indirect through tools, long objects, drills, cutting blades, etc. For the purposes of this practice 'close proximity' is taken to be 500mm.

Competent — An individual in a Control of Work role who can demonstrate that they have professional or technical training, knowledge, actual experience, qualifications and ability to enable them to:

a. Perform duties at the level of responsibility allocated to them;
b. Understand any potential hazards related to work (or equipment) under consideration;
c. Recognise any technical defects or omissions in a task (or equipment) and the adverse implications for health and safety caused by the hazard(s) and / or omission(s); and
d. Be able to specify corrective action(s) to mitigate the hazards.

De-energised (electrical) — Disconnected from all sources of electrical power supply but not necessarily isolated, earthed or out of commission.

Electrical Worker — Person or persons engaged in the installation, maintenance, repair and testing of electrical equipment.

Extra Low Voltage (ELV) — Voltage not exceeding 50 V a.c. or 120 V ripple-free d.c.

High Energy Electrical System — Electrical systems rated at 800A or where the fault current at the point of the installation exceeds 2000A.

Isolated (electrical) — The state of equipment when disconnected from all sources of electrical power supply by breaks of a length appropriate to the voltage and the

	insulating medium.
Isolator (electrical)	A device which for reasons of safety, provides in the open position, breaks appropriate to the voltage and the insulating medium.
Lock-out	The use of locks and / or locking devices (e.g. chains and locks, clasps and locks) to ensure energy sources and energy control devices such as valves and electrical breakers are secured in a safe position. If more than one group is working on the same item (including different trades) a minimum of one responsible person from each group will install an individual group's lock.
LOTO	Lock Out Tag Out
LOTO Plan	Form to specify and record Lockout points for more complex plant isolations.
LOTO Register	A centralised site register of all current plant isolations in place at the site.
Live / energised (electrical)	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.
Low Voltage	Exceeding extra-low voltage, but not exceeding 1 000 V a.c. or 1 500 V d.c.
MCC	Motor control centre
Performing Authority	The person performing the work or may be responsible for the people performing the work. Responsible for the safety of personnel and ensuring the works are undertaken as prescribed. If the work is undertaken under a Work Permit, the person receiving the permit and sometimes referred to as the 'permit recipient'.
PLC	Programmable Logic Controller that controls the operation of equipment via software coding.
Positive isolation	Positive isolation is defined as either: a. Spool removal - removal of a valve, pipework section or spool piece and blanking the live end, also called 'air gapping'. b. Blind isolation - insertion between flanges of a blind (spade); the swinging closed of a spectacle blind (plate); or replacement of a spacer (slip-ring) with a line blind (spade).
Site Representative	The Site Representative is the Site Manager or delegate and is the person with responsibility for the overall safety on a site.
Tag-out	The attachment of prominent warning tags to locks and / or locking devices that forbids the operation of energy control device and associated equipment and communicates the reason for lock-out. It bears the name of the person who applied the tag and the date the tag was applied. If more than one group is working on the same item (including different trades) a minimum of one responsible person from each group will sign and date an individual groups "DANGER, DO NOT START", or equivalent, tag.
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 devices (e.g. valve, isolator), and that plant and equipment is de-energised (e.g. by trying to start equipment or confirming de-pressurisation / drain down. It is critical that all bleeds, vents and drains are checked to be free from blockage prior to testing.
Work Group	A group of personnel undertaking a task under the oversight of a responsible person, typically a supervisor &/or the Performing Authority. Often a trade group (e.g. electricians), however may be personnel of several different trades under the oversight of a responsible person.

4. Roles & Responsibilities

4.1. Planner

The planner is the person responsible for planning the works and associated Energy Isolation. The planner role is often not a dedicated role and may be fulfilled by a Project Manager, Project Engineer, Operations Engineer, Site Manager, Network Operations Manager, etc. The Planner shall ensure that the Performing Authority is communicated the requirements of this LOTO procedure and Control of Work requirements as part of the planning process prior to work.

4.2. Issuing Authority

The Issuing Authority is trained, assessed as competent and formally authorised to issue Work Permits as per PRO 4.5-0001-1-01 Permit to Work, including those associated with Energy Isolation. The Issuing Authority shall ensure the requirements of this procedure, the conditions of the risk assessment for the task and any associated work permits or work clearances (as applicable) are followed by the performing authority.

If isolations are undertaken for works under a Work Permit, the Issuing Authority shall approve the isolations to confirm the work is safe to undertake under the work permit.

The Issuing Authority shall not be the same person as the Performing Authority.

4.3. Performing Authority

The Performing Authority is responsible for the safety of those undertaking the work, ensuring that the work is performed in a safe manner within the conditions prescribed within this procedure, the conditions of the risk assessment for the task and any associated work permits or work clearances (as applicable). The Performing Authority shall approve the placement of isolations. PRO 4.5-0001-1-01 Permit to Work documents the responsibilities of the Performing Authority for the works to be undertaken, including those associated with Energy Isolation.

4.4. Site Representative

The Site Representative shall be the site manager or delegate, and may be fulfilled by the Site Manager, Network Operations Manager, Island Engineer, Airfield Representative etc. If the site is unmanned it may be the Issuing Authority, who assumes the responsibilities of the Site Representative.

The Site Representative is responsible for the overall safety of the site. The Site Representative shall be aware of all planned operations of the site that may interact with the work. Therefore no work, including placing of isolations, shall be undertaken before the Site Representative countersigns the work permit or work clearance.

The Site Representative may stop or defer work at any time.

4.5. Checker

A nominated second individual who is tasked with ensuring that isolations are applied as per the LOTO plan, work permit or work clearance, and that energy is safely discharged prior to works and that isolations are removed after the works. The checker shall not be the person applying the isolations, and maybe the Permit issuers, Site Representative or Performing Authority. The checker signs off the LOTO plan when the isolations are placed and again when the isolations are removed.

5. Methodology

5.1. BP's Golden Rule for Energy Isolation

Any isolation of energy systems; mechanical, electrical, process, hydraulic and others, must ensure that:

1. There is an approved method to:
    1.1. isolate equipment
    1.2. discharge stored energy
    1.3. reinstate equipment
2. Isolation points are locked and tagged.
3. A test is conducted before any related work begins to confirm the isolation is effective.
4. There is a process to communicate the status of isolations between:
    4.1. shifts
    4.2. different workgroups
5. The isolation is periodically monitored for effectiveness.

5.2. General

Plant and equipment requiring isolation shall be clearly and unambiguously identified. Isolation of the highest quality and security which is reasonably practicable shall always be used.

Competent persons shall agree to the method of isolation and discharge of stored energy and should normally include the Performing Authority and the Site Representative and /or the Issuing Authority if work is to be undertaken under a Work Permit.

Isolations shall be approved by the Site Representative (who has overall responsibility for safety on the site, and to approve any business operational impact).

Where a Work Permit or Work Clearance is issued, isolations shall be recorded on the associated Lock Out Tag Out (LOTO) Plan, Work Permit or Work Clearance. If the isolations are part of work which is to be undertaken under a Work Permit the Issuing Authority shall also approve the isolations and discharge of stored energy (to approve the work as safe to do under the isolation). The Performing Authority shall also verify isolations before commencing work.

If the work is covered by a task breakdown the isolations and confirmation of isolation shall be specified within the procedure.

The isolations and discharge of stored energy shall be executed by the responsible person(s) and verified by a nominated second individual, the checker. The responsible person shall place the isolations as per the LOTO plan, Work Permit or Work Clearance and ensure that energy is safely discharged prior to works, and that isolations are removed after the works. Once isolations have been performed, the checker shall verify that isolations are applied as per the LOTO plan, work permit or work clearance and that energy is safely discharged prior to works and that isolations are removed after the works. The checker shall not be the person applying the LOTO, however maybe the Performing Authority, Site Representative or Permit issuer.

Locks and tags shall be issued and recorded when plant is to be isolated. The same locks and tags shall be recovered and checked off when the plant is to be re-commissioned. For more complex plant isolations (as identified during the risk assessment for the task), a copy of the sites P&ID's should be marked showing which items are to be isolated and a LOTO Plan shall be prepared, listing where all locks and tags are to be placed. These shall then be checked off the LOTO plan as they are placed and again when they are removed at the end of the work - refer Annex A for a LOTO plan. For larger sites isolations should be recorded on a central LOTO register, so that all current isolations are readily apparent.

If more than one work group is required to isolate 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 and should also reference the Work Permit number if associated with a Work Permit.

5.3. Application of Isolation

5.3.1. Area Isolation

The work area shall be clearly identified and cordoned off to ensure that there is delineation between works and normal operational areas, and to control risk within the works area from vehicles or personnel not associated with the work, or other external sources e.g. SIMOPS. Area isolation is typically achieved by bunting, barricades or fencing and signage.

5.3.2. Vessel Isolation (not for confined space entry)

Isolation of the highest quality and security which is reasonably practicable shall always be used. Vessel isolations which are not positive isolation shall be subject to a risk assessment which shall consider the impact, necessary controls and response for valves passing and which shall form part of the Task Breakdown or Work Permit.

Positive isolation by spool removal or air gapping shall be considered as the minimum sole means of isolation for any vessel isolation lasting longer than one month.

Vessel isolation for any hot work shall as a minimum be positive isolation by valve and line rated spade.

Vessel isolation for routine work (e.g. filter changes) for moderate pressures on the pressure side of less than **1600 kPag** Maximum Operating Pressure, (e.g. a refuelling hydrant), shall be by double block and bleed valve, as a minimum sole means of isolation, and only for short duration (less than 4 hours), cold work, and where the immediate work site shall not be left unattended.

Vessel isolation for routine work (e.g. filter changes) for low pressures on the pressure side of less than **200 kPag** Maximum Operating Pressure, (e.g. gravity head of above ground tankage) shall be by single valve, as a minimum sole means of isolation, and only for short duration (less than 4 hours), cold work, and where the immediate work site shall not be left unattended.

5.3.3. Confined Space Entry Isolation (General)

Isolations shall be made to prevent the accidental introduction into the confined space of materials, through equipment such as piping, ducts, vents, drains, conveyors, service pipes or firefighting systems, and that the confined space is isolated from other sources of energy (e.g. electrical, thermal) as is reasonably practicable. Given the specific hazards of Confined Space Entry, LOTO Plans shall be risk assessed to verify that the isolations are of the highest quality and security which is reasonably practicable and that the confined space is ultimately safe to enter.

Isolations should be made as near as possible to the Confined Space to be entered. Where isolation at the vessel cannot be achieved due to the size of a piping connection, or where piping connections are welded to the vessel / equipment, the isolation should be made at the nearest available place to the vessel / equipment. The interconnecting piping between the vessel / equipment then becomes an integral part of the Confined Space and shall be taken into account when preparing for entry and issuing Confined Space Entry Permits.

Important aspects that should be considered are:

a. Connecting piping can contain harmful materials not removed during purging and gas freeing, which can be subsequently released due to airflow and / or solar heating or Hot Work, and
b. The effects of winds to create a low pressure area downwind of manways and other openings which could result in an airflow and contaminants moving inside a vessel / equipment in the reverse direction to that expected.

5.3.4. Confined Space Entry Isolation (Tanks)

Positive isolation by spool removal or air gapping shall be considered as the minimum sole means of isolation for confined space entry into tanks.

Valves and/or sections of pipe from each connecting pipeline including foam pipelines (where installed) shall be removed from as near to the shell as possible and the open end of the pipelines shall be sealed with an appropriately line rated blank flange.

All electrical connections other than extra low voltage equipment complying with Australian Standards (AS 3000) shall also be positively isolated.

Potential energy sources shall also be discharged e.g. floating suctions, by landing these onto solid supports or removal.

5.3.5. Confined Space Entry Isolation (valve chambers and tank turrets)

Positive isolation of all external sources of energy is often not practically achievable for Confined Space Entry into pipeline valve chambers and tank turrets.

The highest level of isolation practically achievable shall be determined in the risk assessment which shall detail the appropriate controls and monitoring of isolation and the response to a loss of containment detailed in emergency response plans.

The risk assessment outcome shall determine if the confined space entry is safe to undertake.

5.3.6. Confined Space Entry Isolation (vehicles)

It is often not practically achievable to fully drain down and gas free equipment and pipework associated with aviation refuelling vehicles. If confined space entry into aviation vehicle compartments is required, pipework shall be disconnected and isolated from compartments, pipework sealed and external vapour sources from refuelling equipment controlled.

The risk of vapour migration into vehicle confined spaces shall be determined in the risk assessment with appropriate controls and monitoring of isolation detailed.

The risk assessment outcome shall determine if the confined space entry remains safe to undertake.

5.4. The process of isolation, monitoring and de-isolation

The general process that should be followed for LOTO work is as follows:

5.4.1. Prior to work being undertaken under the isolation:

a. Identify the equipment to be worked on and all potential energy sources or situations where a release of energy or product may occur.

b. Identify all isolation points as close to the works as possible to assist in security and ease of monitoring. Competent persons shall agree to the method of isolation. The methods of isolation can be a valve, blind flange, circuit breaker, switch &/or fitting etc.

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

d. Obtain approval from the Site Representative (and Issuing Authority if a Work Permit is to be issued):

   I. For the isolations,

   II. For the method by which stored energy will be safely discharged,

   III. To inform all who may be affected.

e. Place and install isolations. If more than one work group, each work group is to place a lock and tag on the isolation. Locks and tags shall be able to withstand environmental conditions.

f. A responsible 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 that the isolation is effective.

g. Test to be conducted to confirm that equipment is isolated and that plant / equipment is de-energized / depressurized and / or cannot be started.

h. The Checker shall confirm all isolations are in place and that energy is discharged.

5.4.2. Whilst work is being undertaken under the isolation

Monitoring and testing of isolations shall be undertaken at regular intervals 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, verifying their integrity by:

1. Testing isolations regularly.
2. Monitoring isolations regularly.

5.4.3. When work is complete:

a. Check that all people involved in the work have finished.

b. Obtain approval from the Site Representative (and Issuing Authority or delegate, if a Work Permit is to be issued) to remove locks, tags and isolations, and inform all people who may be affected.

c. Check system integrity.

d. Ensure all equipment and personnel are clear.

e. Drain and depressurize and / or de-energise and remove all blinds etc. and reinstate all broken connections to the same state as before application of the LOTO. Care shall be taken when removing these isolation devices as stored energy may develop between it and the next isolation valve / point on the energized side of the plant.

f. "Unlock" lockout system and remove tags. The Checker shall confirm all isolations are removed and system integrity.

g. Test and re-commission.

h. Check all Locks and Tags back into the site LOTO system. Checker to confirm, and sign off the LOTO Plan.

5.5. Removal of Locks and Tags (De-isolation and Commissioning)

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

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

Lockout locks and tags should only be removed by the person who applied them and who is responsible for the isolation for the work group, due to the potential complexities and misunderstanding of re-commissioning requirements. If the person who placed a lock and tag is not planned to be present at the time of de-isolation, (e.g. longer projects with separate construction and commissioning phases), then a formal changeover of locks and tags between personnel shall be undertaken and subject to a Management of Change process.

Exceptions

Only under exceptional circumstances, locks and or tags may be removed by the site manager (authority not to be delegated) according to the following procedure:

a. Verify that the person who placed the Lock and Tag is not on site.

b. Make all reasonable efforts to contact the person.

c. Ensure that the plant is in a safe and operable condition, by inspection by a competent person.

d. Remove lockout and tag.

e. Re-commission plant.

f. Ensure that the person who applied the tag and lock is informed that the plant has been returned to service and the documentation has been signed off by the site representative.

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 commissioning testing is not possible at the time equipment is installed or maintenance is completed, then the works shall be deemed incomplete and the equipment shall remain locked out / tagged out until testing in service can be undertaken.

5.6. Mechanical Isolation

Isolation of the highest quality and security which is reasonably practicable shall always be used.

5.6.1. Positive Isolation

Positive Isolation is regarded as the most secure method and shall be considered in the development of all LOTO Plans.

Positive isolation is defined as:

a. Spool removal - removal of a pipework section or spool piece and blanking the live end, also called ‘air gapping’.

b. Blind isolation - insertion between flanges of a blind (spade); the swinging closed of a spectacle blind (plate); or replacement of a spacer (slip-ring) with a line blind (spade).

Positive isolation by spool removal or air gapping shall be considered as the minimum sole means of isolation for confined space entry or for any isolation lasting longer than one month. When a spool or valve is removed, (air gapped) the ‘live’ pipework side shall be fitted with a blank flange. In most circumstances the isolated equipment (vessel or pipe-work) flange should be left open to allow the vessel or pipe-work to "breathe".

Where spool removal cannot be achieved, isolation by a valve and line rated spade provides the next highest quality and security. The valve shall be locked and the spade inserted for that particular isolation. The valve and spade shall be tagged in their secure position to prevent inadvertent operation and removal.

Spectacle blinds, blank flanges, bolting, and gaskets shall, as a minimum, be adequate thickness for the line rating. New, correctly rated gaskets shall be installed and all correctly sized bolts shall be installed and tightened.

5.6.2. Valve Isolation

5.6.2.1. Double Block and Bleed

Double block and bleed is the most secure form of valve isolation. Double block and bleed isolation is provided by two sealing surfaces that, in the closed position, provides a seal against pressure from both sides and a bleed (drain /vent) valve of the cavity between them. Physically it can be two valves with a bleed between or this functionality can be combined into a single valve with two sealing surfaces with a void space between that has a bleed (drain / vent) valve on it. The isolation is provided by the two sealing surfaces with any leakage visible in the bleed (drain /vent) instead of leaking through the valves. The integrity of the isolation is dependent upon the reliability of the main valve(s) seals under the particular conditions of service, open and unclogged and monitoring of the bleed (drain /vent). The main valve(s) shall be locked and tagged closed and the bleed shall be wired and tagged open to prevent inadvertent operation.

Double block and bleed valve isolations shall be considered as the minimum sole means of isolation for routine short duration, cold work, for moderate pressures on the active side less than 1600 kPag Maximum Operating Pressure. This type of isolation shall only be used if the duration of the work is short (less than 4 hours) and the immediate work site shall not be left unattended. These conditions shall form part of a mandatory risk assessment which shall form part of the permit to work and be kept with the permits.

Figure 1: Double block and bleed Valve.

5.6.2.2. Single Valve

In single valve isolations the integrity of the isolation is critically dependent upon the reliability of the seal under the particular conditions of service and the security of the single valve operating stem.

Isolation against a tested single valve may be used for the purpose of swinging a spectacle blind, inserting a line rated spade or fitting a blind flange to achieve higher integrity isolation. Testing shall be undertaken prior to breaking containment to ensure that a valve is not passing beyond a weep which can be safely managed.

Single valve isolations may be considered as the sole means of isolation for routine, short duration, cold work where pressures on the active side are less than 200 kPag Maximum Operating Pressure. The duration of work shall be short (less than 4 hours) and the immediate work site shall not be left unattended. These conditions shall form part of the risk assessment which shall form part of the permit to work and be kept with the permits.

Figure 2: Single Valve Isolation with Lock and Tag

5.6.2.3. Tagged Isolation

Isolation by tagging out with tags only is generally not considered sufficient and may only be used in exceptional circumstances where inadvertent operation will not compromise HSSE. Tagged isolation shall require approval by the Site Representative, and if undertaken under a Work Permit, the Issuing Authority.

5.6.2.4. Valve Actuators

When used for isolation:

a. Manually operated valves shall be locked and tagged to prevent unauthorized or inadvertent operation.

b. Electrically actuated valves shall have the power supply positively isolated and any manual override shall be manually locked.

c. Pneumatic and hydraulic operated valves which fail closed shall have the control lines isolated and physically disconnected. Pneumatic and hydraulic operated valves which fail open or fail as is shall not be used for isolation purposes.

5.6.2.5. Isolation of other Energy Sources

Other energy sources can include heat, gas, steam, gravity and pressure. These shall be isolated by a physical break which is identified by a tag and secured by a lock or an equivalent mechanical means that cannot be neutralized without the use of tools. Open ends shall be blanked or capped.

Persons performing the work shall test the operation of equipment before work commences to ensure effective isolation.

5.6.3. Steps in Isolating and Making Safe

The following key steps shall be applied when making safe mechanical isolations.

a. Identify

b. Isolate and de-energise

c. Lock Out

d. Tag Out

e. Test and try

5.6.3.1. Identify

The equipment to be worked on and all isolation points shall be clearly identified. For more complex isolations, a copy of the plant P&ID's shall be marked showing which items are isolated and attached to the LOTO plan.

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.

5.6.3.2. Isolate and de-energise.

Obtain approval from the Site Representative to place tags and isolations.

The equipment to be worked on shall be isolated from all sources of energy by the highest method of isolation as reasonably practical and meeting the minimum isolation requirements as per sections 5.3.1 and 5.3.2. Consideration should also be given to isolating, locking out and tagging any originating sources of energy (e.g. pump motor circuit breakers) of the system.

Once isolations have been made 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 captured and shall not be allowed to drain to ground or be directed into open drains.

5.6.3.3. Lock out

All isolation points shall be locked out to ensure energy control devices, such as valves, are secured in a safe position from inadvertent operation.

5.6.3.4. Tag out

Appropriate warning tags shall be placed at all isolation points, which forbids the operation of the energy control device and associated equipment. The tag communicates the reason for lock-out, and includes the name and signature of the person who applied the tag and the date the tag was applied. Consideration should also be given to locking out and tagging any originating sources of energy (e.g. pump motor circuit breakers) of the system. Examples of appropriate tags are illustrated in Annex C.

5.6.3.5. Test and try

The energy control devices (e.g. valves,) as well as plant and equipment which is isolated, shall be tested prior to conducting work to prove effective energy isolation. It is critical that all bleeds, vents and drains are checked to be free from blockage prior to testing.

Once the isolations are in place, persons performing work shall, where practicable, try to energise / start the equipment for example via a local start / stop isolator or PLC, to confirm effective energy isolation.

5.7. Electrical Isolation

5.7.1. Key Considerations

Electrical equipment should be considered to be energised (i.e. live) until proven otherwise. Electrical equipment to be worked on, the appropriate point of supply and associated control systems shall be clearly identified.

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.

5.7.2. Steps in Isolating and Making Safe

The following key steps shall be applied when making safe electrical isolations.

a. Identify
b. Isolate and de-energise
c. Lock Off
d. Tag
e. Test and Try

5.7.2.1. Identify

Electrical equipment to be worked on, the appropriate point of supply and associated control systems shall be clearly identified. Identification should include labelling that is both consistent and clear at the equipment to be worked on and all points of possible isolation, e.g. control isolator and main point of supply.

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 identified and disconnected as part of the isolation process. This includes connections to motor starters, valve solenoids, motorised valves, instrument power etc.

5.7.2.2. Isolate and de-energise

The electrical equipment to be worked on shall be isolated from all sources of supply either by opening switches, removing fuses or switching circuit breakers.

Where isolation is effected at a removable or rack-out circuit breaker, a 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. All fuses in the power and control circuits shall be removed.
b. Removed fuses shall not be stored in the same panel as the fuse holder, but stored in a secure location during the period in which equipment is isolated. These fuses shall be tagged.
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.

Disconnection of PLC/DCS outputs 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.

If there is no mechanical means available to lock out equipment a licensed electrical worker, licensed for electrical installation work as required by local regulations, shall physically isolate power to the equipment by disconnection and termination of phase conductors, which shall be bonded to each other and earthed while disconnected.

Once isolations have been made all stored energy as is reasonable practicable shall be discharged.

5.7.2.3. Lock Off

All circuit breakers, switches and combined fuse switch units forming part of the power or control circuit shall be locked off and tagged. Where locking facilities are not available, temporary securing devices shall be used. Securing devices shall be able to withstand any disrupting environment, e.g. not become ineffective due to vibration.

Power circuits to equipment shall be isolated, locked out and tagged at the MCC or main switchboard containing the motor starter.

Local field isolators for equipment shall where possible be locked in the off position and shall be tagged.

Figure 2 shows a typical method for tagging and locking out circuit breakers on a distribution board.

Figure 2: Electrical Circuit Breaker with Multiple Lock hasp, Single Lock and Tag

5.7.2.4. Tag

Appropriate warning tags shall be placed at all points of switching, isolation or disconnection, which forbids the operation of the energy control device and associated equipment. Tags communicate the reason for lock-out, the name and signature of the person (normally the supervisor in charge of the work party) and the date the tag was applied. Identification labels should also include warnings for any abnormal hazards, e.g. multiple points of supply, etc.

Where tags cannot be installed because of the physical configuration, additional control measures shall be identified in the risk assessment, e.g. a designated spotter at the isolation point whilst persons are working under the isolation.

Examples of appropriate tags are illustrated in Annex C.

5.7.2.5. Test and try

All electrical equipment, unless proven to be de-energised, shall be treated as live.

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 from jurisdiction to jurisdiction in Australia and local requirements shall be applied.

Once the isolations are in place persons performing work shall, where practicable, try to start the equipment via a field isolator or PLC, to confirm effective energy isolation.

5.7.3. Cutting of Electrical Cables

When carrying out work which involves cutting existing cables, the cable shall be isolated from all sources of supply, isolators locked off and tagged. The cable shall be treated as live until positive tests are made at the point where the cable is to be cut, proving the cable is de-energised.

Consideration shall be given to the possibility whilst cutting or of cut cables becoming re-energised (live) due to the subsequent or inadvertent removal of isolations, closing of switches or circuit breakers, or the operation of automatic control devices.

If cut cables are to be abandoned, the cable shall be physically isolated from all sources of supply, made safe and tagged. Tags shall communicate that the cable is cut, the location of the cut, the name and signature of the person (normally the supervisor in charge of the work party) and the date the tag was applied.

5.7.4. Opening of Electrical Enclosures

Opening of electrical enclosures while circuits remain energised is often required to facilitate inspections, troubleshooting and maintenance activities. Opening of enclosures or cabinets where there is the presence of **exposed** voltage higher than 32Vac shall only be permitted by qualified persons i.e. electrical engineer, electrical worker.

Consideration shall be given in the risk assessment for the task to the potential for hazardous atmospheres. A gas test shall be conducted by a competent person (as defined in PRO4.5-0001-1-01 Permit to Work) 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 (within 500mm) from exposed and live electrical circuits, is not considered live electrical work under this local practice. 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.

5.8. Working On or Near Live Electrical Equipment

5.8.1. Key Considerations

Working on or near live electrical equipment shall only be considered when it is legally permitted to do so and when it is not practicable, or no reasonable alternative exists to perform the electrical work de-energised, and when an adequate risk assessment has been undertaken, documented and authorised.

When working in the vicinity of live exposed electrical conductors consideration shall be given to the potential for overcurrent circuit protection devices which may not operate in circumstances of transitory high fault currents and potential arc flash hazards and the level of PPE required.

The recommended safe guards, as listed in following section 5.6.4, shall be considered and documented in the risk assessment for the task.

5.8.2. Commissioning, Fault Finding, and testing

There may be instances when commissioning, fault finding or testing is only possible while equipment is live. In these instances the safeguards for working on live electrical equipment, as listed in following section 5.6.4, shall be applied.

5.8.3. High Energy Installations

When working, testing or fault finding on energised electrical equipment, workers should be aware that a fault current of up to 20 times the rated current of the supply transformer can flow for short duration during fault conditions. Overcurrent circuit protection may not operate in such circumstances. For installations rated above 800A or where the fault currents exceed 2000A special precautions are required.

Arcs that are produced under these fault conditions have the energy to cause an explosion and/or melt metallic components of switchboard cubicles. Arcs can cause severe burns to the skin and/or flash burns to the face and eyes. The hot gases and molten particles from arcs if inhaled can cause serious internal burns to the throat and lungs. Injury can also occur through the impact from flying debris and dislodged components.

5.8.4. Safeguards

When working on live electrical equipment the safeguards outlined in 5.6.4.1 through 5.6.4.8 (inclusive) shall apply.

5.8.4.1. Risk Assessment

Prior to commencing any work on live electrical equipment an assessment of the associated risks shall be undertaken. The person responsible for authorising live work to be carried out shall specify any particular precautions to be taken to eliminate hazards and to prevent injury. This assessment shall also include a consideration to the available fault current and the requirement for appropriate PPE based on the arc flash hazard.

5.8.4.2. Precautions

The person responsible for authorising live work to be carried out shall ensure any particular precautions to be taken to eliminate hazards and to prevent injury as documented in the risk assessment are in place prior and throughout the live work.

5.8.4.3. Competency

Any persons undertaking work on live electrical equipment shall be skilled and competent in the work to be carried out.

5.8.4.4. Earthing

When working on live electrical equipment having earthed metal, precautions shall be taken to ensure earthing continuity is maintained to any component part of the equipment at all times.

Bonding conductors may be required to be installed when removing electrical equipment from earthed metal, e.g. a live component part separated from its connected earthing medium. Bonding conductors shall be rated to withstand the 'let through' energy of the primary protection without failing.

5.8.4.5. Neutral Connections

Particular care should be taken when removing neutral connections as tests may have indicated a de-energised situation. However, when these connections are removed, a voltage may be present between conductors or between conductors and earth.

5.8.4.6. Barriers & Insulation Mediums

Only conductors at one potential should be worked on at any one time and insulated barriers should be utilised in the work area between conductors of different phases or voltage potentials.

Insulating mats or barriers should be used between electrical workers and conductors and between electrical workers and earth including building structures such as concrete and steel which may be earthed.

5.8.4.7. Stand-by safety observer

Where in the judgment of the person doing the work it cannot be carried out safely without assistance or a safety observer, that person shall be provided with the assistance required. If assistance is not provided, work shall be delayed until isolation can be arranged.

When troubleshooting involves the use of approved test equipment and the measuring of voltages by direct contact with exposed conductors exceeding 32Vac or 50Vdc the person undertaking the work shall be supported by a safety observer or stand-by person.

5.8.4.8. PPE for Electrical Work

Electrical workers and assisting personnel shall wear protective clothing suitable for the task when working on, or in close proximity to, live (energised) electrical equipment.

a. Minimum PPE for Low Energy Installations:

The minimum PPE required for working in close proximity to live low voltage exposed electrical equipment in low energy systems are:

i. Safety glasses
ii. Long sleeve cotton shirt
iii. Long cotton pants
iv. Leather safety shoes
v. Leather gloves

b. Minimum PPE for High Energy Installations:

The minimum PPE required for working in close proximity to live exposed electrical equipment in high energy systems are:

i. PPE shall be suitable for the arc flash hazard.
ii. Consideration shall be given to the use of flame resistant and non-synthetic clothing as well as insulating gloves and full face shield.
iii. Where working on or in the vicinity of exposed conductors for installations rated above 800A or where the fault currents exceed 2000A these additional PPE requirements apply.

5.8.5. Electrical Test Equipment

5.8.5.1. Key Considerations

All test equipment, including leads and probes, shall be suitable for its intended purpose and periodically inspected to ensure that it remains operational and safe

Before carrying out any tests, equipment shall be checked to ensure that it is correctly set, functional and in good condition.

Testing equipment used for detecting a live (energised) source should undergo trial operation on a known live circuit to prove that it is functioning correctly immediately before and after the test has taken place.

5.8.5.2. Requirements for Electrical Test Equipment

Electrical test equipment (including test leads) used for direct contact on low voltage systems shall comply with the requirements of AS 61010.1 or an equivalent standard and shall be a minimum of CAT III 600V design.

Contact probes and leads shall be checked for damage to insulated parts, ensure continuity and verify connections prior to use.

Insulation resistance testers shall be able to maintain a terminal voltage within +20% and -10% of the nominal open-circuit terminal voltage, when measuring a resistance of 1 MOhm on the 500 V range or 10 MOhm on the1000 V range.

Voltage indicators such as high impedance volt meters shall only be used to verify the presence of a voltage. They shall not be used to verify the conductivity of a cable, as they will operate satisfactorily with high resistances within the circuit under test.

Voltage indicating neon type devices shall not be used as the **only** means to verify the presence of a voltage.

Test equipment that has the potential to generate a spark and is intended for use within a hazardous area shall be certified with an issued Certificate of Conformity. If equipment is not hazardous area approved and has a spark potential, the normal requirements of PRO-4.5-0001-1-01 Permit to Work shall be followed.

5.9. Powered Fixed Equipment Isolation

Prior to any work starting on powered equipment it shall be positively isolated.

Electrically powered equipment shall be isolated, locked and tagged out from its power supply in accordance with the requirements of this local procedure.

Diesel driven equipment shall be positively isolated by removal and tagging out of ignition key, securing of electrical isolation switch. Consideration shall be given to disconnection of the battery, which has however its own risks of generating sparks and damage to circuit boards.

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.

5.10. Vehicles and Portable Equipment

To conduct work on any Air BP vehicle, or any equipment on the vehicle, the following procedure shall be followed to lock out / tag out the vehicle:

a. Park the vehicle safely; if possible at the maintenance workshop.

b. Turn off the vehicle ignition, remove the vehicle keys and turn the master battery isolation switch OFF.

c. Install a lock out tag on the steering wheel, with the fleet number of the vehicle, the date and time and name and signature. If possible install a lock out tag on the master battery isolation switch.

d. Inform all who may be affected.

e. Follow General LOTO procedure as described in Section 5 to undertake the necessary repair works.

f. The lock out tag shall only be removed by the maintenance fitter or the site manager, following repair work and test driving / operation has been conducted.

5.11. LOTO Equipment

To enable compliance with the lock out tag out requirements of this procedure, each site shall have lock out equipment available for the work, e.g. lockout tags, padlocks, multiple lock hasps etc. This may be provided for the period of the work by the Performing Authority or persons conducting the work.

6. Exception procedure

It is recognized that under exceptional circumstances, it may be impractical to comply with this procedure. Exceptions to this procedure shall be risk assessed and shall only be authorised by the AirBP ANZ Regional Engineering Lead, otherwise an alternate of the AirBP ANZ Operations Manager.

7. Associated Documents

Document number	Document Title
GDP 4.5-0001	Control of Work
GEN 51 Part 01	Site Safe Working Practice Lock-Out & Tag-Out
PRO-4.5-0001-0-01	Control of Work
PRO-4.5-0001-1-01	Permit to Work

8. Verification

The information outlined in this document shall be included in the Air BP ANZ Operations audit and assessment monitoring plan CoW audits or an equivalently approved BP assessment process.

9. External References

This Document was drafted with reference to relevant legislation at the date of drafting, including but not limited to, relevant Acts, Regulations, Australian Standards and industry codes and practices. Details of current legislation can be provided by the HSSE team on request.

10. Revision Summary

Version	Prepared by	Description of Change	Date
1	Adrian Connolly	Initial, replacing STP 35-20 LOTO	14/11/2014
2 (DRAFT)	Adrian Connolly	Updates to document format and layout for readability. Minor spelling and grammar corrections. Minor changes to wording of clauses to improve clarity of requirements, and to meet Standards requirements wording ('shall/should/may'). Some areas for further clarification and documentation of existing practices. No significant changes to actual requirements for Energy Isolation above standard practices.	24/4/2015
2 (DRAFT)	Adrian Connolly		16/11/15
2A (DRAFT)	Andrew Kaleski	Issued as PRO-4.5-0001-1-02A Rev 2 for use within AirBP ANZ	30/05/16

Annex A: Example LOTO Plan

	LOTO PLAN **Lock Out / Tag Out**	LOTO Plan # Page of

LOTO Plan Prepared by:	**Description of work:**

Instructions

1 Review Site Procedure for the Isolation of Equipment (Lock Out / Tag Out)
2 Note lock out points in left column (attach P&ID or equipment drawing indicating isolation points)
3 Install Plant Locks at points outlined in left column
4 Record lock number(s) beside corresponding lockout point,
5 Complete “Installed by” and “Date Installed”
6 Checker to sign to confirm all isolations, locks and tags installed, and stored energy discharged
7 Attach copies of LOTO PLAN to permit.
8 When locks are removed, complete “Removed by” and “Date Removed” columns.
9 Checker to sign to confirm all isolations, locks and tags removed and to confirm system integrity.
10 File completed copy of LOTO PLAN with completed Work Permit

#	**Identification of Valve, Electrical Disconnect, or other energy source to be Locked Out and tagged out**	**Site lock Number:**	**Installed by:**	**Installed date:**	**Removed by:**	**Removed date:**

<u>Checker</u> to complete:

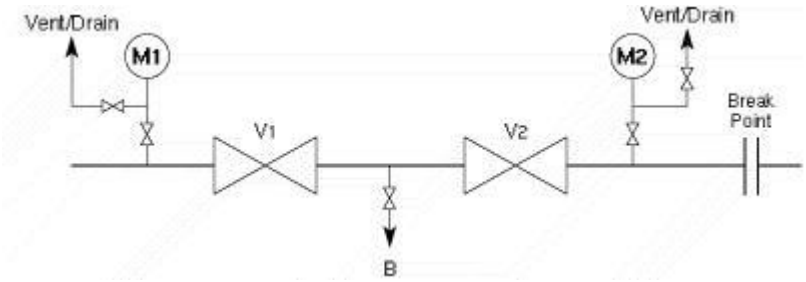
All locks and tags have been installed: _____ _____ **Date**: _____
(Name) (Signature)

All locks and tags have been removed: _____ _____ **Date**: _____
(Name) (Signature)

Annex B: Typical Valve Isolation Integrity Tests

B.1. Double Block and Bleed Isolation Integrity Test (2 Valves)

Diagram



Key

V1 - First (upstream) isolation valve from live system.

M1 - Live side monitoring point (pressure gauge or vent/drain).

V2 - Second (downstream) isolation valve from live system.

M2 - Monitoring point between valves and break point (pressure gauge or vent/drain).

B - Bleed point between the isolation valves.

Procedure

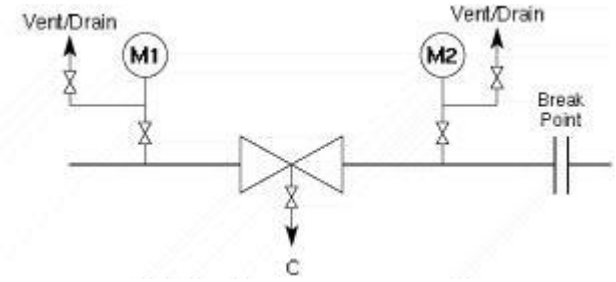
1. If possible, ensure tappings at M1, M2 and B are not blocked and pressure gauges, where installed, are operating.
2. Close downstream valve V2 and lock in closed position, tag out and record on LOTO plan.
3. Record pressure at monitoring points M1 and M2.
4. Vent/drain section of line to be broken and monitor at M2 until the pressure is near zero.
5. Close vent/drain at break point and monitor at M2 for a minimum of 10 minutes. No pressure build-up at M2 indicates the integrity of the downstream valve V2.
6. Close upstream valve V1 and lock in closed position, tag out and record on LOTO plan.
7. Record pressure at M1 and B.
8. Vent/drain between V1 and V2 (B) and monitor at B until pressure is near zero.
9. Close vent/drain (B) and monitor at M1 and B for a minimum of 10 minutes. (No pressure build-up at B indicates integrity of upstream valve V1).
10. Open vent/drain (B) and secure in open position, tag out and record on LOTO plan.

Isolation Summary

Both block valves are now closed, the bleed valve is open and all three are secured. Any fluid passing via the upstream valve is vented through the intermediate bleed valve and no pressure builds up against the downstream valve.

B.2. Double Block and Bleed Isolation Integrity Test (1 Valve)

Diagram



Key

M1 - Live (upstream) side monitoring point.

M2 - Monitoring point between valve and break point (downstream).

C - Cavity drain (between seals).

Procedure

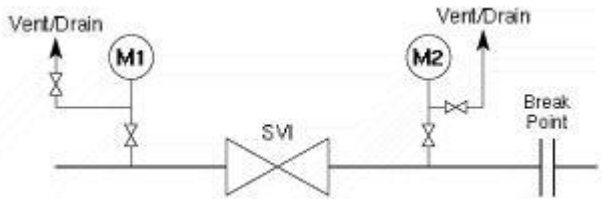
1. If possible, ensure tappings at M1, M2 and C are not blocked and pressure gauges, where installed, are operating.
2. Close isolation valve and lock in closed position, tag out and record on LOTO plan.
3. Record pressure at M1, C (in cavity) and M2.
4. Vent/drain downstream section of line to be broken and monitor pressure at M2 until pressure is near zero.
5. Close vent/drain at break point and monitor at M2 and C for a minimum of 10 minutes. (No pressure build-up at M2 and no pressure fall-off at C indicates the integrity of downstream seal.)
6. Record pressure at M1 and C.
7. Vent/drain off fluid in cavity (between seals) and monitor at C until the pressure is near zero.
8. Close cavity vent/drain (C) and monitor at M1 and C for a minimum of 10 minutes. (No pressure build-up at C indicates integrity of upstream seal).
9. Open cavity vent/drain (C) and secure in open position, tag out and record on LOTO plan.

Isolation Summary

The double sealed, single block valve is now closed, the cavity bleed valve is open and both are secured. Any fluid passing through the upstream seal is vented through the intermediate cavity bleed valve and no pressure builds up against the downstream seal.

B.3. Single Valve Isolation Integrity Test

Diagram



Key

M1 - Live (upstream) side monitoring point.

M2 - Monitoring point between valve and break point (downstream).

Procedure

1. Ensure tappings at M1 and M2 are not blocked and pressure gauges, where installed, are operating.
2. Close isolation valve and lock in closed position, tag out and record on LOTO plan.
3. Record pressure at M1 and M2.
4. Vent/drain downstream section of line to be broken into and monitor at M2 until pressure is near zero.
5. Close downstream vent/drain and monitor at M2 for a minimum of 10 minutes. (No pressure build-up at M2 indicates integrity of single valve.)
6. Open downstream vent/drain at break point and secure in open position, tag out and record on LOTO plan.

Isolation Summary

The single isolation valve is now closed, the downstream vent/drain is open and both are secured. Arrangements shall be made to monitor any fluid passing through the single valve seal.

Annex C: Tagging

All energy control devices (e.g. valves,) as well as plant and equipment which is isolated, shall have an identification tag attached. For Lock Out Tag Out, the only tags to be used are “DANGER - DO NOT OPERATE”. Additional “Out of Service” or “Information” tags may be attached to equipment, but these tags do not form part of the isolation.

End of Document