



Integrated Safe System of Work (ISSoW) Isolation

MAN - Manual

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About this Manual

Purpose

The purpose of the manual is to provide the recommended practices to isolate, prepare equipment for maintenance and return to service safely and consistently on all Ichthys facilities.

Scope

The manual applies to all work onshore and offshore where INPEX Australia (subsequently referred to as the Company) has:

- Prevailing Influence Level 1
- Legal responsibility to a Regulator for activities carried out on behalf as the title, permit or license holder
- Signatory responsibilities to any document or plan supplied to a regulatory body.

Authorised User

The authorised users of this manual are workforce who are:

- Trained and competent in ISSoW system.
- Able to execute maintenance, performance testing and engineering work scopes within the ISSoW framework.
- Required to plan permitted work scopes.
- Required to authorise work scopes.
- Required to plan and execute isolation schemes.

The following are authorised roles associated to the isolation process as specified in the [Integrated Safe System of Work \(ISSoW\) Manual](#).

- Isolation Authority.
 - Process Mechanical Isolating Authority
 - Isolation Authority – ELV
 - Isolation Authority – LV
 - Isolation Authority – HV
 - Bypass Isolation Authority.
- Responsible Person Electrical.
- Area Authority.
- Issuing Authority.
- Site Authority.
- Permit Authoriser.

Definitions / Glossary

Refer to the appendices.

1 ISOLATION INFORMATION

1.1 Background Information

Background Information

The application of an isolation varies from isolating a single item, to an integrated activity involving multiple isolations, draining and purging of large items of process equipment.

Isolation involves physical segregation from sources of energy or hazardous substances. When an item is considered 'isolated', it is rendered incapable of being made live without deliberate manual intervention.

Any isolation of energy will be managed under an isolation certificate e.g. mechanical, electrical, process, hydraulic, pneumatic and radioactive.

Isolation Types

There are four (4) types of isolation and six (6) types of certificate.

Certificate	Details
Electrical	Refer to the Electrical Safety Operating Procedure, and Section 1.10
Process	- Examples include: - Valves.
Mechanical	- Examples include: - Spectacle blinds, blinds, spades - Disconnection - Mechanical restraint.
Bypass A	Refer to the Operations Functional Safety Management Strategy
Bypass B	Refer to the Operations Functional Safety Management Strategy
Own	ELV, LV, instrumentation and limited process isolations.

Isolation Hierarchy Parent-Child Isolations

A work scope may require the isolation and deisolation to be applied in a sequenced, structured manner for preparation and or testing requirements.

Isolations may be placed in a hierarchical manner where the primary or parent isolation has subordinate (child) isolations locked onto it. This allows numerous work scopes to be subject to the primary isolation with additional 'child' isolations applied for a particular work scope.

Process Isolation Requirements

Isolation requirements will depend on:

- Hazardous nature of the contained substance's.
- Maximum operating pressure and temperature.
- Type of work to be carried out.
- Time required to complete the work.

The Isolation Safety Risk Assessment (ISRA) tool is utilised to assess the minimum isolation requirements for a piece of equipment.

The ISRA takes into consideration the following:

- The area in which an isolation is being planned (situation) and the substance that is being isolated from.
- The maximum system operating pressure and the duration of the intended work scope.

In the event that an isolation does not comply with ISRA refer to Section 1.4 on passing valves.

Additional Level of Isolation

While the ISRA states the minimum level of isolation that is required, consideration in accordance with ALARP practice shall be given to improving the standard of the isolation, such as positive isolation if equipment is to be left unattended.

Positive isolation is the complete separation of the energy source achieved by the application of rated spades and spectacle blinds, removal of spools and fitting of blind flanges.

A positive isolation may not be reasonably practicable if the risk of applying the positive isolation exceeds the risk of performing the task without a positive isolation in place.

Preferred Valves

Valves used for isolation shall be those specified in the piping specification for isolation or block service.

The preferred types of valves to be used in any isolation scheme are those that provide mechanism for positive shut-off such as:

- Ball
- Gate
- Globe.

Butterfly valves may be used on systems where this is the only valve type available.

Valves Not Used for Isolations

The following types of valves are not recommended to be used for isolations:

- Control valve
- Non-return valves
- PSVs or other forms of relief valves.

Valves fitted with a mechanical stop (unless the stop can be adjusted to facilitate full closure).

Actuated Valves

Where actuated valves are included in an isolation, the valve must be:

- Fail-closed
- Be able to be hand-jacked or driven closed for fail-open and fail-last valves
- Fail last position valves e.g. MOVs. Confirm valve cannot move in the de-energised state.
- The actuator mechanism (motive force) must be isolated, disconnected and vented from the supply source or proven with a double block and bleed before any work commences.

Isolating actuated valves is as follows:

1. Confirm the valve is failed in the closed or required position.
2. Isolate the motive power source to the actuator e.g. air, hydraulic fluid or electricity.
3. Confirm actuator has been depressurised.
4. Pneumatic v's Hydraulic valves
 - a. Pneumatic - disconnect supply tubing from the motive power source and cap tubing ends. This requirement is not necessary if an isolation can be achieved with a double block and bleed arrangement as a minimum.
 - b. Hydraulic - Where practicable, disconnection and capping of tubing should be utilised to isolate the motive source, double block and bleed isolations may be used as a minimum requirement for non CSE scopes, or where a dispensation to do so exists.
5. Lock and tag the motive power source.
6. Apply an isolation lock and tag to the valve body and confirm the valve's position.

Isolating actuated valves is complete.

1.2 Process / Mechanical Isolation Types

Boundary Isolations

Boundary isolations may be used where several activities are to be covered by a single isolation. The boundary isolation is commonly placed at system or train limits providing isolation to a wider process area e.g. plant or train shutdowns.

A boundary isolation may also be described as an initial isolation on equipment such as a pump, to allow the isolation of high-pressure sources prior to draining and purging.

When boundary isolations are employed, the following shall be considered:

- A boundary isolation shall provide sufficient isolation for all work scopes within the boundary isolation and should meet the minimum requirements of ISRA

- Positive isolation shall be considered for boundary isolations.
- Where additional permits are issued under the boundary isolation, the OTL Permit Authoriser must ensure the boundary isolation is appropriate to the task.

Where the boundary isolation is assessed as insufficient for a given activity, additional isolations may be placed to achieve the minimum level of isolation required by their cumulative effect. These additional isolations shall be linked to the boundary isolation through the parent-child hierarchy relationship.

Positive Isolation

Positive isolation is the complete separation of the plant or equipment to be worked on from the energy source or other parts of the system. Positive isolations for process systems are applied by the use of:

- Rated spades
- Spectacle blinds
- Spool removal with a blind flange fitted.

The spade shall be easily identified and must display the pressure rating.

Positive isolation examples:

Isolation	Diagram
Spectacle Blind	
Spool Removal with Blind Flange	

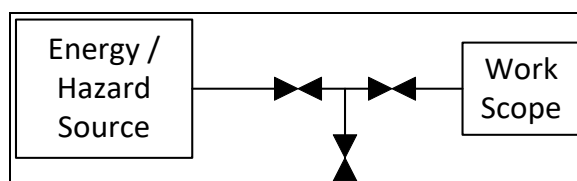
Double Block and Bleed (DBB)

Double block and bleed (DBB) isolation consists of two isolation valves in series with a bleed valve placed between the inboard and outboard isolation valves.

The bleed valve can be used to check for leakage through the outboard (pressure-facing) isolation valve and to route any leakage to a safe containment system. The bleed valve shall not be locked but will have an isolation tag attached and be identified on the isolation list as a bleed. This provides the Area Authority with ability to prove and monitor the isolation periodically via the use of a bleed register.

On any DBB arrangement, the integrity of both valves shall be proved. For a conventional arrangement using two block valves, the preferred option is by isolating and proving the inboard block valve first. Specific details of testing valves shall be documented in the prepare for maintenance procedure.

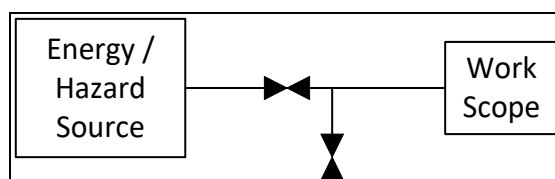
Example of DBB isolation:



Single Block and Bleed

Single block and bleed isolations consist of a single block valve with a bleed downstream. The downstream bleed valve is required in order to check for pressure and process contaminants prior to commencing invasive work.

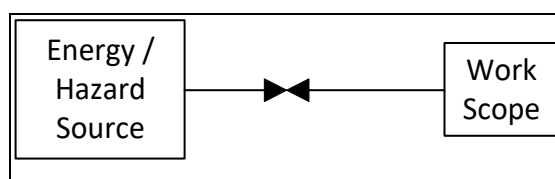
Example of single block valve with bleed isolation:



Single Block

Single block isolation consists of a single block valve with no opportunity to check integrity via a bleed. It is the least preferred method of isolation.

Example of single block isolation:



Locked Valves

Locked valves include locked open / closed and interlocked open / closed valves.

Locked valves ensure safety critical elements such as PSVs and blowdown valves remain online during normal operations and cannot be inadvertently taken offline. This may be provided to prevent equipment exceeding design conditions e.g. downstream of a pressure specification change.

Locked valves may be used as isolation points. Approval to operate a locked valve shall be granted via the permit to work system when required for an isolation certificate or with an approved procedure to operate / change over the valve.

An orange padlock shall be used to secure LO / LC valves in the correct position. Orange locks shall not be used for any other purpose.

Isolation Valve Position / Location

Isolations should be applied as close to the work as possible.

Correct Sequencing

The isolation shall be applied and removed in the correct sequence. Typical sequence is as follows:

- Isolation valves should be proven and isolated.
- Pressure relief valves and safety devices should be isolated after energy sources have been depressurized.
- Vents or open bleeds should be applied at the end.
- The deisolation is carried out in the reverse order.

The correct sequencing of the isolation process shall be identified in the prepare for maintenance procedure. Isolation lists should reflect the sequence that the isolation has to be applied.

1.3 Bleed Controls for Hydrocarbon Service – Bleeds and Venting

Bleed Options

The three (3) options for dealing with bleeds that are part of a double block and bleed are as follows:

Option	Requirement
Leave bleeds closed and monitor on a regular basis	• Bleed Closed status selected as isolation point position • As a minimum, pressure should be monitored at least once per 24hr period. • Bleed checks can be done as standalone activity or prior to endorsing PTW. • Method and frequency of monitoring will be determined by risk assessment or previous history and stated on the Isolation Certificate. • Monitoring shall be carried out by physical check / manipulation of the bleed valve with a rated electronic or analogue gauge device rated or protected from full system pressure. NOTE: Bleed checks should not be undertaken with PGM as the primary means of leak detection. • This method will not be used if either inboard or outboard valve is found to be passing.
Leave bleeds open and vented to a safe area	• Bleed Open status selected as isolation point position • Location of open bleed shall be determined and approved via a risk assessment. • Bleeds must be directed away from potential ignition sources, machinery inlets and safely monitored e.g., using a rated hose. • Process medium involved should be considered e.g. drainage or containment will be required for liquid service. • A register of open bleeds shall be maintained and utilised at the daily conflicts meeting.

	Connect bleed to a fixed system (flare or closed drains) - Bleeds of this nature shall be approved via the MOC / deviation process. - Selection shall be determined by risk assessment due to: - Potential back pressure from the flare or drain system. - Contamination or erosion of fixed drain / flare systems. - Temporary connections between systems.
Bleeds on Non-Hazardous Substances	Non-hazardous Substances, i.e. plant air, potable water: - Discuss with OTL, add comments to isolation certificate and bleed register – bleeds can be left open, HLRA not required. - Check the bleeds for non-hazardous substances prior to PTW endorsement. They do not require continual checks as per hydrocarbon bleeds. - Process medium involved should be considered e.g. drainage or containment will be required for liquid service. - If leak rate minor, vent to local area, bleed hose not required. - Apply barrier tape as required.
Bleeds In General	Bleed points shall be included on the isolation certificate, and a tag attached to the valve in the field stating, isolated position. They are not locked.
Bleeds on Steam Service	Bleeds shall be left open and vented to a safe location or personnel access shall be restricted for steam service.
Bleed Hoses	A bleed hose is a temporary hose which is pressure and type rated to the system fluids. It can be applied to continually bleed or relieve minor pressure inventories to a safe location. Hoses shall be managed as per the Hose Management Standard. The following requirements apply: - Hoses are identified for hydrocarbon use and are used solely for transferring or bleeding down hydrocarbons. - All bleed hoses shall be secured to the facility structure with free end minimised. - The free end of the hoses shall always be left open to ensure pressure does not build up in the hose. Plugs or valves shall not be fitted to the end of the bleed hose. - The route of the bleed hose shall be clearly demarcated, and the end contained in a barricaded area where practicable. - The bleed hose end shall be tagged to confirm the source of the bleed with the isolation certificate number.

Bleeds on Relief Valves

When relief valves are prepared for maintenance with the upstream and downstream isolation valves closed the upstream bleed valve shall remain open when any of the downstream isolated equipment is not rated the same as the upstream equipment. In these cases, tag the upstream bleed valve open and use a bleed hose if needed to maintain isolation integrity and protect downstream system from overpressure.

Venting Considerations

The following should be considered in the selection and alignment of vents:

- Route of pressure relief on isolated equipment where there is potential for pressure to build-up within the isolation envelope.
- Provision of pressure relief in the event of a fire.
- Potential risk which may be created by vacuum when the equipment is not able to breathe.
- Changes in pipework specifications when isolating and preparing equipment for maintenance.
- Nominated vents shall be isolated in the open position.

Zero Energy Point

The isolation envelope shall have an open vent as close to the break in point as possible.

If it is not possible to have an open vent or bleed to demonstrate zero energy, the risk and controls associated with this shall be documented in a HLRA.

1.4 Proving the Isolation Valves

Proving Isolation Valves

Preference for proving an isolation will depend on the system, the valve type and their condition. A guide of preferred methods to prove DBB isolations are noted in APPENDIX G:.

- All valves utilised for isolations shall be tested / proven under normal operating pressure to ensure integrity.
- Pressure Build Up (PBU) tests shall be utilised to determine if a valve is considered good.
- Valves that fail the PBU assessment shall have their leak rate calculated via the leak rate calculator to determine these actual leak rate.
- The bleed lines shall also be tested to ensure they are not blocked by venting the pressure or injecting nitrogen.
- If it is not reasonable to undertake the testing, the risk associated with not testing the valves shall be documented in a risk assessment, subject to review and approval by the Site Authority.
- Proving of isolation valves shall be done as per a prepare for maintenance procedure (PFM) .
- Passing valves shall have their leak rate recorded in the PFM
- A rated crystal gauge / fixed transmitter shall be used to monitor any pressure build up.
- Ensure the inboard isolation valve cavity has been depressurised as part of proving the isolation.

Passing Valves

If valves are identified as passing during isolation integrity testing the standard options available are:

- Increase the isolation envelope and amend documentation accordingly.
- For double block and bleeds, minor leaks can be assessed and managed by one of several predetermined controls. .
- Defer the scope until a planned shutdown for single block and bleed arrangements.

Conduct a HLRA to address the risks to the work party. This will only be considered where minor leak rates are confirmed. For a single valve isolation to be acceptable, its leak rate shall be determined via the leak rate assessment processes.

Passing Valve Criteria DB&B

In a double block and bleed arrangement, at least one, and preferably both, of the block valves must be leak tight. Where a single valve cannot be proven leak tight, further isolation(s) shall be required until the isolation can be secured. The known passing valve leak rate must be proven to be acceptable @ <1.0 kg/hr

Valves found to be passing at >1.0 kg but < 5.0 kg/hr shall be managed via one of the pre-determined controls selected in consultation with the OTL.

1. Vent to safe location (see section 1.3 for bleed venting)
2. Undertake the task as Gas Works
3. Eng Approved Forced ventilation plan
4. Eng Approved dilution plan
5. Dedicated vacuum pump
6. HLRA.

Should any doubt exist about the above criteria reduce the risk by extending the isolation envelope to achieve an acceptable isolation. If the isolation cannot be secured and the acceptance criteria cannot be met, then a HLRA is required at a minimum.

For non-hazardous / low pressure systems, i.e. plant air, potable water: Bleed valves may be left open for manageable leaks and no HLRA is required.

Passing Single Valve Isolation (With Bleed)

In some circumstances or design cases there may be no practicable alternative. In these cases, the SBB should be subjected to leak rate assessment (APPENDIX H:). Where a passing valve leak rate can be proven to meet the manageable criteria as outlined in the leak rate flowchart. <1.0 kg/hr the D/S equipment can be worked upon with no additional controls.

Passing Single Valve with No Bleed

In a single block arrangement, it is preferable for the block valve to be leak tight. Where a valve cannot be proven leak tight, further isolation(s) should be applied until the isolation can be secured.

SBB to Large Volume Work Envelope

For isolation proving of boundary single block isolations the large and complex volumes calculations preclude the use of the leak rate calculator.

Best practice is to complete the boundary isolation and purging as per the PFM. Followed by long duration PBU and LEL testing.

Limits Of Passing Valves	Valves found to be passing at >1.0kg but < 5.0kg/hr should be managed via one of the pre-determined controls selected in consultation with the OTL. For minor leaks (<1kg/hr) no HLRA is required for non-hazardous / low pressure systems, i.e. plant air, potable water: The criteria for the management of a passing valve shall be that any leak rate across it shall be low enough that: The DBB outboard valves maximum leak rate does not exceed 5 kPa pressure build up within the isolation cavity, with an open bleed that is vented to a safe location via a rated ½"/12mm 30' bleed hose.
Pressure Build Up Testing	PBU Go-By testing provides examples of typical PBU expected when working with DBB arrangements APPENDIX I:. If the volume of the isolation cavity does not fall within the typical volumes shown. The leak rate calculator can also be used to determine the initial PBU levels @ <1.0kg/hr. Note that smaller internal diameter (ID) line, as shown in APPENDIX H:, use a very conservative PBU rate that is significantly lower than the 1 kg/hr permitted.
Passing Valve Calculator	The passing valve calculator X060-A1-TPL-70025 shall be used to determine when an isolation valve is deemed to have met the acceptable isolation criteria. The utilisation of this calculation is defined in the process flow chart (APPENDIX H:).
Liquid Service	The PBU go-by and the leak rate calculator are not suitable for liquid services. Liquid leak rates and their controls for hydrocarbon and toxic services shall be determined via Risk Assessment or Engineering input. A MOC should be used for open bleeds to a fixed system as per Section 1.3.

1.5 Safety Systems / Critical Equipment Isolations

Isolations on Safety Systems	Particular attention shall be given to isolations on Safety Systems or Safety Integral / Critical Equipment. The following shall be considered and applied where appropriate for effecting isolation on safety systems: Relief Systems – Relief systems shall be: - Isolated only following the provision of an alternative means of relief, unless all potential sources of overpressure have been removed e.g., isolation and depressurisation. - Available for purging and reinstatement activities if test or purging pressure could exceed the operating pressure. - Typically, the last points on the isolation scheme to be isolated and first to be reinstated, other than open vents. This maintains system protection until all sources of energy have been isolated. Refer to Bypass Certificate requirements in Section 5.3.
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Isolation valves – Isolation valves secured with mechanical valve interlock mechanisms shall also have the ISSoW Lockout Tagout procedures applied.



NOTE:

Isolation schemes associated with Safety Critical Equipment shall be isolated in a sequence to ensure the equipment is isolated for the shortest possible timeframe. This reduces the risk of exposure to the facility and personnel working within the affected area while the equipment is offline.

1.6 Confined Space Isolations

Positive Isolation

Confined space isolations require all lines leading to and from the confined space, including displacement legs be positively isolated at the first available flange. All level bridles connected to the confined space shall be positively isolated, including radioactive sources.

Where a positive isolation cannot be achieved a High Level Risk Assessment and formal Deviation via MOC shall be approved for work to commence under those conditions.

CSE Isolation Exceptions

Isolation exceptions include:

FPSO

- **Ballast Tanks** – where confined space entry shall be carried out with a proven double block at minimum and as per a critical procedure.
- **Hull Tanks** – Where a confined space entry shall be carried out on a FPSO Hull Tank which has a hydraulically driven submersed FRAMO pump, entry is permissible to proceed under non-Positive Hydraulic isolations when no intrusive Work scopes will occur on the pump, The valve isolation shall be at the highest level available. Where intrusive Work scopes are to take place on the pump the hydraulic lines will require positive isolation.

CPF

- **Void Spaces** – where a confined space entry shall always be carried out with forced ventilation and positive pressure as per the entry / inspection Maintenance Work Instruction (MWI) to manage the inability to positively isolate the common vent line.
- **Ballast Tanks** – where a confined space entry is carried out within Colum 1 and 2 the water mist system will remain active and in operation due to no asphyxiation risks being present. Diesel and MEG transfer pumps will also remain in operation and not require isolation whilst active fire protection is available.

1.7 Isolations, ISRA and As Built Design

Isolations Not Meeting ISRA

If an isolation does not meet requirement of ISRA the following options are available

- Expand isolation envelope,
- Develop a specific isolation plan and conduct a HLRA,

Raise an MOC for elevated approval if there is not a reasonable alternative.

Plant Design and ISRA

In instances where the ISRA cannot be achieved due to plant design an HLRA is not required. The isolator shall complete the ISRA qualitative assessment as per Section 4.2. The PA shall confirm this assessment during ISRA endorsement.

A list of design limitations that do not require HLRA is provided in the KDL.

1.8 Special Isolations / Conditions

ILNG

PSV's - due to the inherent design of the facility (Single Block & Bleed) no HLRA is required to be developed to satisfy the deviation to ISRA. A prepare for maintenance and return to service procedure shall be used. Passing valves shall be managed under the relevant leak rate calculator / guidance.

E-stops

E-Stop use, in place of an electrical isolation is permitted for non-intrusive scope i.e. oil change, filters and strainers where there is no electrical, mechanical or motion hazard to the persons undertaking the task.

E- stops shall be secured via the LOTO process on approved OIC's only to ensure.

- First on last off principle is applied to E-stop
- E-stops are secured via a locking mechanism & tag
- OIC associated RA & Permit controls are in place
- Use of E-stops are vetted by PAM.

Where possible, confirm with CCR immediately prior to securing an E stop, that the equipment is available and after the E-stop activation, confirm with CCR that equipment is now unavailable and will not start

Note: E stop use is NOT an approved electrical isolation method.

Isolating Hydraulic Systems

Isolation valves are not commonly provided in the return or relief lines due to the inherent design of hydraulic systems. The use of a non-return valve (NRV) or pressure safety valve (PSV) may be required to affect an isolation.

The equipment specific method of isolating and executing the work shall be accompanied by a procedure / work instruction and high-level risk assessment or via the MOC / deviation process.

Considerations shall include:

- Hydraulic return or relief lines are normally at atmospheric pressure.
- Pressure from venting would dissipate due to the return or relief lines typically being larger than the supply lines.
- Exposure time is typically of shorter duration.

Isolation may also be achieved by the removal of hydraulic lines and capping.

Special Isolation Methods

Special isolation methods are available for certain services such as:

- Expandable plugs
- Freeze plugs
- Mechanical Isolation Tool (AOGV).

These types of isolation are not common practice and shall be managed via the Management of Change Procedure.

Red Spade (Install & Removal)

Controlled segregation of a facility may be managed by using red spades during construction and commissioning phases.

A red spade shall be a clearly identified positive isolation.

The Red Spade Register records the status of all red spades e.g. installation and removal. The Site Authority or delegate shall be responsible for the spade register.

Installation:

Red spade installation shall be:

- Raised as a Long-Term Isolation under a mechanical isolation certificate (MIC) by Commissioning team with RED SPADE prefix and a unique tag to identify in the register.
- Have Non-operational Awareness endorsement (Commissioning focal point) and Site Authority approval on MIC.
- Marked on a copy of the relevant P&ID and attached to MIC.
- Have a red tag identifier in the field so it is clearly visible by workers.

Removal:

Removal of a red spade is as follows:

1. The removal of a red spade shall be risk assessed (HLRA) and signed by the Site Authority and Commissioning focal point, then attached to the MIC for deisolation.

Note: Typically as a minimum, prior to removing the red spade isolation, a form of Long Term Isolation via proven ISSOW / IRSA compliant isolation prior to permitting the removal of a red spade.

2. The Commissioning focal point shall agree to the removal of a red spade by a non-operational awareness notification.
3. Site Authority shall approve the MIC de-isolation application for red spade removal.
4. Permit and Process Isolation Certificate (PIC) shall be approved by the Site Authority or their delegate for the removal of the red spade.
Prior to any delegated approval, the Site Authority Shall acknowledge awareness of the isolation certificate / PTW. Red spade can now be removed Red Spade register in Engica shall automatically record the removal of the red spade and show as de-isolated.

The removal of the red spade is to be advised site-wide by way of a Safety Bulletin issued by the Site Authority.

1.9 Temporary Equipment Isolations

Isolations are Managed

Temporary equipment isolations are managed as follows when interventions or maintenance on the equipment is required:

- Temporary equipment energy sources are physically disconnected, and the hose / power lead coiled up back to the equipment as far as practicable. The coil should be fastened with an Out of Service (OOS) tag clearly displayed on the coil.
- If an isolation is required on temporary equipment where potential for energisation exists, the standard OIC process shall be adhered to.
- If the hose / power lead cannot be physically coiled to the equipment, then the energy inlet point must be disconnected and capped / plugged, etc.

Hardware that is not Permanent

The scope of temporary equipment is limited to hardware that is not a permanent fixture e.g. a permanent gantry with an air driven hoist is not temporary whereas a portable pump or electrical device is considered temporary.

If the equipment cannot be disconnected, then it must be isolated and work completed under normal ISSoW conditions.

1.10 Other Isolations

Bypass Isolations

Refer to [Operations Functional Safety Management Strategy](#)

Subsea

Refer to [Subsea Isolation Philosophy](#) .

Gas Export Pipeline (GEP)

Isolations at each end of the GEP will be managed by both the CPF and LNG teams, when required.

The ISSoW process is as follows:

- Each facility will create a Process Mechanical isolation certificate (PMIC) with a dedicated lock box.
- The PMIC created by the facility in control of the work will form the parent isolation to which the PMIC created by the facility holding the awareness role will link to.
- The ISSoW permit will then link to the awareness role PMIC acting as the child in the isolation scheme.
- Both Onshore and CPF Site Authorities will apply their personal locks to their respective lock boxes and provide written confirmation to each other of their locked and on issue PMIC.
- The GEP permit can be issued for use on receiving confirmation of both PMIC being on issue.

1.11 Electrical Isolations

High Voltage (HV) Requirements

- All HV isolations require an approved Electrical Isolation certificate (EIC).
- Any local isolating or racking out that may affect the arc rating of the board will require a risk assessment to determine if a permit is required.
- Where possible, HV switching should be done remotely. (E.g. via the Electrical Management System (EMS) or the Power Distribution and Control System (PDCS)).
- Air insulated HV switchgear shall be isolated and earthed in the withdrawn position for electrical work.
- GIS HV switchgear shall be isolated as per manufactures instructions.
- All HV isolations require a safety observer unless done remotely.
- In addition to the requirements described in the INPEX Personal Protective Equipment Standard C075-AH-STD-0068, the PPE used for HV work shall be determined via a risk assessment and the facility Arc Flash Study.

Low Voltage (LV) Requirements

- When the reticulation of the LV system needs to be altered in order to perform an isolation an approved switching program shall be used.
- Equipment with multiple sources of electrical supply requires an EIC except where the second supply is to the motor space heater - own Isolations are not permitted in this case unless OIC is approved by the Responsible Person Electrical (RPE).
- When electrical access is required on LV equipment that is fed by withdrawable modules; the module shall be withdrawn to the disconnected position and locked into that position.
- Where direct actuation of circuit breakers/isolators is possible, such as in a small light and power distribution boards, isolation shall be performed by opening the circuit breaker or isolator and locking and tagging with an appropriate / approved locking mechanism.
- Where the circuit breaker / isolator does not have a permanent locking device, a portable padlocking attachment shall be used to affect safe isolation.
- When removing cladding and insulation over pipe work, any heat traced lines that are adjacent to or have potential to interface with non-heat traces lines are to be electrically isolated.
- When a load is fed from a panel not as described above, the isolation shall be assessed on a case-by-case basis to ensure effective and secure isolation and documented on the EIC.
- For example, relying on a fuse switch isolator (and open the cubicle to verify operation), isolating the feeder to the panel per one of the methods above, removing fuses (if any), isolation of starter system on a generator or disconnection of outgoing wires.

Mechanical Work	• To carry out any mechanical work (i.e. not electrical work) on electrically driven equipment it is required that an electrical isolation be performed in conjunction with the use of an approved EIC, or, where the criteria set out in Section 1.12 is met using 'Own Isolations'. • When performing electrical isolations for any mechanical work (non-electrical work), the isolator should be switched to the isolated position and locked. Where the equipment is not fitted with an isolator (HV switchgear) then the equipment shall be racked out and locked in the safe position. • Where the circuit breaker / isolator does not have a permanent locking device, a portable padlocking attachment shall be used to affect safe isolation. • Electrical isolations shall be confirmed and verified by a competent electrical isolating authority.
Own Isolation (Electrical)	• Own isolations will be managed in accordance with Section 1.13. • Own isolation shall not be used to isolate HV equipment or high energy LV distribution (LV circuits greater than 800A).
Instrument Isolations	• When isolating the electrical supply to an instrument an EIC shall be used unless isolating under Own Isolations. • Instrument Extra Low Voltage (ELV) circuits fed by knife switches shall be isolated by opening and tagging the knife switches. • Competency to perform process isolations for instrumentation shall be assessed in ISSOW process / mechanical competency training.
Testing for De-energisation	• All electrical equipment and conductors shall be treated as energised, until proven to be de-energised. Test (for dead) before you touch. • A voltage test to prove electrical equipment is de-energised shall be conducted by a competent authorised person. • If an electrical test-for-dead is visually impaired by the work environment or equipment a HLRA will be required which considers additional verification controls.

Proving Electrical Isolation LV

- When preparing and reviewing an Electrical Isolation Certificate or OIC, each isolation point within Engica must be populated with a comment describing how each point is to be proven as 'isolated'. For example, "M-View checked for 690VAC prior to isolation and confirmed as 0 volts once isolated. Verifier to confirm 0 volts.
- Once the Isolation Certificate is 'Under Isolation', the Electrical Isolating Authority shall:
 - Isolate per normal process and prove the isolation.
 - Isolating Authority confirmation within Engica confirms the isolation point has been applied and proven per the comments. If the proving has not been successful, the isolation cannot be confirmed as isolated.
 - Where possible, confirm with CCR immediately prior to isolating, that the equipment is available and after applying the isolation, confirm with CCR that equipment is now unavailable and will not start.
- The Electrical Isolating Authority performing the verification shall:
 - Complete the relevant isolation proving steps.
 - Isolating Authority verification within Engica confirms the isolation point has been verified and proven per the comments. If the proving has not been successful, the isolation cannot be confirmed as isolated.
 - Where possible, confirm with CCR that the isolated equipment is unavailable and will not start.

1.12 Electrical Disconnections

Requirements

All Electrical Disconnections are required to be carried out under a specific Permit containing the wording 'Disconnection / Reconnection'. This Permit shall be linked into the isolation hierarchy.

For LV and HV work, Disconnections shall be recorded as isolation points on their own child Electrical Isolation certificate which will reference the initial energy removing isolation as its parent.

Recording of ELV disconnections on their own child isolation certificate are only required when the disconnection timeframe is greater than the permit validity for reconnection to take place.

Disconnected cables must be bonded to earth and made watertight as per [Electrical Safety Operating Procedure](#) and be identified by an isolation tag specific to the disconnected cables.

Every activity where a disconnection will take place, must have its own unique Permit reflecting the intended scope.

For disconnection of electrical equipment with no subsequent work scopes (Child Isolations / Permits), where the reconnection will take place in the same shift as the disconnection may be permitted under the principles of an Own Isolation if approved by the Permit Authority.

When a disconnection results in a cable being removed from its source of supply:

- The source isolation will be made under either EIC or OIC and the cable disconnected under a suitable permit.
- The cables MUST be bonded to earth and made water tight per ESOP Section 8.6.
- A secondary EIC will be created with the disconnected cables being the point of isolation and an isolation tag must be fitted to the cable, outside of the junction box.
- Where a cable is disconnected from a junction box and remains attached to the end electrical apparatus removed from service (e.g., motor, dishwasher) upon disconnection, the second EIC (child isolation) will be secured to the field terminal enclosure where the disconnection occurred. The cables will be made safe, and an Out of Service tag will be applied to them.

This can then be transferred into LTI if applicable. The two isolation certificates **are not linked** and therefore the source isolation can be removed to re-energise the remainder of the circuit if needed.

Disconnection

1. Energy sources are isolated and covered under their own EIC
2. Standalone Permit issued under the parent EIC to perform the disconnection / reconnection
3. Disconnected tails become an isolation point on their own EIC which references the initial isolation as a parent
4. Standalone PTW for disconnection / reconnection suspended
5. Child isolations (if required) built and added to the hierarchy
6. PTW for main work scope issued.

Reconnection

1. Close out PTW for main work scope
2. Child Isolations approved for de-isolation
3. Standalone Permit for disconnection / reconnection re-issued
4. Reconnection carried out and standalone permit for disconnection / reconnection completed
5. EIC with disconnection closed out
6. Initial EIC for energy sources de-isolated.

1.13 Own Isolations**When Used**

OWN isolations allow a competent person to perform isolations by himself / herself when required for a particular work scope. OWN isolations are used for short-duration, repetitive lower risk tasks where the same person:

- Carries out the isolation.
- Performs the work.
- Reinstates the equipment.

Own isolations normally fall into the following types:

- Routine Removal, and reinstating process filters Process sampling
- Instrumentation, including pressure transmitters, level bridles, analysers
- Firefighting systems, including water mist & Inergen.

Electrical own isolations only apply to extra low voltage and low voltage instrumentation and limited process isolations.

OIC's may be used in circumstances where the overall risk of completing the task is ALARP when compared to the application of a full PMIC. The MOC approval to add this OIC to the KDL shall include ISSoW governance sign off.

Approvals

Own Isolations certificates are subject to the following approval:

- Own Isolations that are approved and recorded in the Key Decision Log – Permit Authoriser
- Own Isolations that are approved via MOC and not yet recorded in the Key Decision Log - Site Authority.

The use of additional OWN isolations, before addition to the KDL list shall be subject to MOC. The ISSoW Key Decision Log includes a list of approved OWN isolations.

The ISSoW Steering Committee will periodically review the KDL to ensure approved OICs meet the criteria and intent for OICs and that they are consistently applied across all sites.

Relevant Competency

Relevant competencies for OWN isolations are as follows:

OWN process isolations – Persons performing OWN process isolations must be competent Isolating Authorities Process Mechanical (ISO-P/M).

OWN ELV / LV electrical isolations – Persons performing OWN ELV / LV electrical isolations must be competent Electrical Isolating Authorities ELV / LV (ISO-ELV / LV).

When Work Must Be Completed

Isolations applied under an OWN isolation arrangement must be completed within one 12-hour shift and de-isolated whilst the Permit and OIC are suspended.

Where the work cannot be completed within a 12-hour shift and the isolations are required to remain in place the following options are available:

1. A normal Isolation Certificate shall be raised and isolation points transferred and verified as per the isolation process.
2. Transferred to another competent person via a hot handover if approved by the Permit Authoriser – refer to hot handover process in the ISSoW manual for further detail.

Maximum of 8 Isolation Points

All OWN isolation points shall be identified on an approved isolation list. OWN, electrical or process / mechanical isolation lists may be used to meet this requirement.

The maximum number of isolations to be applied at one time for OWN isolation schemes is eight (8). The certificate may contain more than 8 points. SA approval is required when more than 8 isolation points will be applied at one time.

Securing OWN Isolations

The following are required to secure OWN isolations:

- All isolation must be secured and tagged with personal danger tags or isolation tags for the duration of the activity.
- The key for the isolation set remains with the Permit Holder for the activity duration.

Yellow IC locks and isolation tags shall be used where more than one isolation point requires locking.

OIC Linking

The permit holder and work party shall apply their Red Lock to the Permit hasp securing the parent isolation lock box. Purple lock(s) shall be issued to the permit holder and work party members, numbers nominated via permit, to secure the OIC HASP when the own isolation is applied.

Linked OIC do not require isolation point cross locks to be applied.

Additional Personnel

Two personnel may work under an Own Isolation. Additional personnel (more than two people) may be approved for certain situations e.g. reducing amount of time safety critical equipment is isolated. The maximum number of people working under OWN isolations shall be:

- limited to those required for the task.
- stated on the permit.

In these cases, the following shall apply:

Approval – Work scope is to be pre-approved in the key decision log stating the number of personnel required as per an approved procedure. The SA can approve additional personnel for pre-approved OIC's, subject to risk assessment.

Isolating Authority – The Isolating Authority shall:

- be the permit holder and be competent to perform the isolation.
- be the first to secure and apply locks to the isolations and be the last to remove locks and restore isolations.
- demonstrate the isolation(s) to other work group members.

Permit Holder – Permit Holder is responsible for ensuring all persons working under an OWN isolation are fully aware of the isolation scheme and work scope.

Securing the Isolation – A lock hasp shall be provided in the field for all Work Party members to apply their personal locks to the hasp instead of all isolation points. The Permit Holder / Isolator isolates the points as listed on the certificate with yellow isolation locks. The key to the isolation locks is placed into a key hasp and is then locked with a personal lock by all Work Party members including the Permit Holder.

1.14 Long Term Isolations

Used When

A long-term isolation (LTI) is used when an isolation is required to remain in place while no permit is referenced for work being carried out within its boundary. It may be required because:

- work has commenced but is suspended for a period exceeding the permit validity period e.g. when awaiting spares for repair.
- an item of equipment becomes redundant and is to be isolated pending work to remove it or provide a more permanent means of isolation.
- used as a red space.

Positive Isolation Preferred

Consideration should be given to application of positive isolation for:

- isolations over long durations.
- isolations that may be left unattended.

[ISRA Calculation Tool](#) calculation results shall also be considered.

Transfer Prerequisites

The following prerequisites shall be met before transferring the isolation to long-term status:

- Close out of any associated permit documents. Permits cannot be linked to Long Term Isolation Certificates.

Any child isolations shall be made long-term or de-isolated and completed.

Convert to Long-Term

Convert to long-term isolation is as follows:

1. Close associated permit as per normal ISSoW workflow including:
 - Tick 'Work Not Completed' in permit closure section.
 - Provide a reason for the incomplete work.
2. Complete a new ISRA with emphasis on:
 - whether extended duration alters the considerations of the initial ISRA.
 - Confirming the risk assessment covers integrity checking requirements for the life of the LTI including vents and bleeds.
3. Confirm equipment within the isolation is left in a safe state e.g. blinds are fitted to open ended pipework and bleeds closed where applicable.
4. Consider pressure ratings and any requirement for venting within the isolation.

5. Record long term isolation – The Issuing Authority shall record the long-term isolation in the Long-Term Isolation Register (LTIR) within Engica. Certificate reason for isolation to include text descriptor 'Long Term'.
6. Confirm Isolation lock key remains secure and clearly marked.

Isolation is now long term.

Convert from Long Term

The following shall be required if work is required on equipment subject to a long-term isolation or if equipment is to be de-isolated:

- Isolation suitability for the task shall be assessed against the ISRA.
- Isolating Authority shall verify the isolation is defined on the isolation list and certificate.
- Isolation integrity shall be checked.
- Issuing Authority shall:
 - Change the Isolation Certificate status from 'verified' to 'isolated'.
 - Record long-term isolation as cancelled in the LTIR.

A permit can now be issued against the isolation.

Integrity Checks

Long term isolations shall be checked to monitor isolation integrity. The check shall be carried out both in the LTIR and in the field.

The Operation Coordinator Permit Authoriser shall review all entries in the LTIR to ensure:

- Isolation is correctly recorded in the register.
- Reason for the long-term isolation remains valid.

Integrity checking shall be completed within 12 months of the isolation being placed into long term status.

1.15 Instrument Valve Operation

Scope & Requirements	Instrument valve operation on pressure transmitters for calibration checks or fault finding does not require a dedicated IC, OIC or use of the ISRA tool, provided that: - the pressure transmitter is fitted with an integrated block and bleed manifold assembly - the manifold block must be located immediately upstream of the transmitter.
Exclusions	The below activities are excluded from this valve operation process: - Transmitter replacement - Where process root valves must be closed. - Configurations using bleed rings containing process volume requiring draining.
Planning & Documentation Requirements	The below requirements are expected to be in place when valve operation for maintenance is utilised. - Pressure transmitters to be worked on must be listed on the PTW, WO, or an attached list. - A marked up P&ID showing the transmitters must be included in the permit pack. - If a bypass is required, use a MOS procedure or bypass list. - Personnel must have completed ISSoW isolation training.
Unplanned/Corrective Work	Permit holder must advise the OTL of the transmitter to be worked on and have a copy of the pressure transmitter MWI.
Permit Holder Requirements	Permit holder must remain at the worksite for the duration of the activity. If the permit holder needs to leave, the instrument must be returned to service.
Instrument Valve Operation Requirements	- The manifold isolation valve must be proven closed before connecting calibration equipment. - All valve operation and proving must follow the MWI for pressure transmitter calibrations. - Reinstatement must follow the MWI reinstatement steps: - Transmitters worked on must be listed and initialled on the table in the MWI once returned to service.

2 PREPARATION OF EQUIPMENT FOR MAINTENANCE AND ISOLATION

2.1 Prepare for Maintenance

Assessment

Preparation and reinstatement activities shall be assessed and documented in an approved procedure. This includes:

- Draining
- Flushing
- Purging
- Reinstatement leak testing.

Process Flow

Refer to the APPENDIX F: Equipment Isolation and Reinstatement Flow for guidance on requirements when conducting preparation and reinstatement activities.

Hazards to Consider

Potential hazards to consider are as follows:

Hazard	Activity
Inherent	• Loss of containment during draining or swinging spectacle blinds. • Potential exposure to process contaminants e.g. mercury, benzene, NORMs and H₂S. • Pyrophoric scale • Trapped pressure e.g. NRVs, closed valve cavities • Pressure and temperature rating of closed drain or vent systems. • Hot or cold pipework or process / utility substances, contained or exposed.
Method used	• Potential for vessel or tank to collapse due to preparation methods used e.g. excessive weight of water purged system, vacuum forming from cooling during draining. • Chemical reactions with cleaning mediums, particularly exothermic reactions. • Over-pressurisation of vessels and pipework. • Static electricity as an ignition source e.g. filling, draining or high-pressure water cleaning when not correctly earthed. • Excessive hydrocarbon vaporization causing cooling. • Possible asphyxiation from nitrogen, carbon dioxide or other gases.

Safeguards when Breaking Containment

Safeguards should be used when breaking containment. This includes:

- The Area Authority shall be present to confirm that the system has been depressurised and conduct the necessary gas testing.
- Equipment is prepared and tested for hydrocarbon and contaminants prior to breaking containment.
- Consideration for additional risk assessment / HLRA and approvals.
- Consideration to exclusion zones and segregation from other concurrent activities as appropriate.
- Required permits and certificates for the location, expected contaminants and scope of work.
- Utilise the hazardous process contaminates map and test for mercury, NORMs, BTEX and H₂S as required by the map. PPE is to be identified in the risk assessment; consider full face mask and applicable cartridge for initial break in.
- Earth drip trays or buckets are in place prior to breaking containment and spill kits are available on site.

2.2 Determining Preparation Methods

Requirement for Approved Procedure

A Prepare for Maintenance (PFM) procedure is required to detail the method of preparation, for breaking the containment of hydrocarbon process systems or higher risk utility systems.

The procedure shall include how to prepare the system including:

- Method of proving isolation valves,
- The correct sequencing of the isolation
- Method of preparation, draining / purging / venting
- Gas testing locations to confirm hydrocarbon / oxygen levels.

Higher risk utility systems include systems that contain high pressure, temperature, flammable, toxic and hazardous substances.

Typically this would include complex hydraulics, steam, heating medium and fuel gas.

If PFM / RTS exemption is required a site specific HLRA shall be completed for each occurrence.

Requirement for Permit	A permit may be required to perform prepare for maintenance / return to service activities e.g. use of an external vendor for N2 purging, swinging large / high pressure spectacle blinds on drain lines. When uncertain of this requirement, the following is suggested: • Conduct a Risk Assessment. • Consult with the Site Authority.
Complex Equipment or Space Within a Space	Careful consideration shall be given to complex equipment preparation e.g. cargo tank pumps. There may be a space within a space requiring additional preparation and testing.
Under Isolation	In accordance with an approved prepare for maintenance procedure, maintenance activity isolations can be partially applied to facilitate the preparation for maintenance, provided main energy sources are: • Isolated • Proved • Locked and tagged. Preparation / reinstatement can include: • Removal / swinging of blinds. • Removal / reinstatement of spools. • Installation / removal of purge / flushing / bleed and vent points.

3 PREPARING SYSTEMS

3.1 De-pressuring and Draining

Hydrocarbon Systems

Hydrocarbon systems should be depressurised to a rated vent or flare system where available. Systems shall only be depressurised to atmosphere under strictly controlled conditions as per an approved procedure and risk assessment. Any residual liquid should be drained to closed drains when the system pressure is, at or below the system rating onshore or 500 kPag offshore. Refer to Section 1.3 Bleed Controls for Hydrocarbon Service.

This is to ensure that the closed drain system piping is not subjected to high momentum forces and low temperatures.

If there is not a closed drain system available sufficient catchment facilities shall be provided.

Flushing dead-legs with water to remove residual liquids may have to be considered if there are no flanges or connections for draining.

Valves and Trapped Pressure

Consideration shall be given to check valve positions. This is to ensure pressure is not trapped within the isolation envelope. Confirm pressure cannot be trapped in equipment that is to be removed e.g. isolation valve, control valves. Valves to be cycled when the system is depressurised and if possible, left partially open.

Contaminants

Contaminants with potential to block low point drains or instrumentation should be drained and flushed or unblocked and left in a clean state where practicable e.g., sand and sludge.

Containment Vessels

Containment vessels used for draining shall be:

- Adequately earthed or bonded.
- Clearly labelled e.g. contained contents, time, date of use and contact person's name.
- A suitable design e.g., specific for intended contents.

3.2 Flushing, Purging and Venting

Provide a Gas-Free Environment

Equipment shall be purged to provide a gas-free environment when intrusive inspection or maintenance is performed on hydrocarbon or hazardous / toxic systems.

Purging / inerting shall also be performed to remove oxygen before returning process hydrocarbon equipment to service.

When using any method the following shall be considered:

- Vessel or system design pressure or temperature must not be exceeded.
- Adequate supply of purging medium must be available and included in isolation activities planning.
- Careful consideration must be given to personnel and equipment safety when gas-freeing, purging or inerting to atmosphere.
- Exclusion zones shall be set up around any potential hazards.
- Open vents or bleeds shall be adequately tagged.

Mediums Used

Flushing, purging and venting mediums may include:

- Nitrogen (including hot nitrogen)
- Water
- Diesel
- Monoethylene Glycol (MEG)
- Steam.

Gas Mixture Limits

Gas mixture flammability limits should be considered before purging any equipment. Determine the gas or mixture:

- Contained in the equipment.
- Lower explosive limit (LEL).
- Relative density to the inerting medium.

LEL and Upper Explosive Limit (UEL) for the most common gases processed at Ichthys facilities are:

Gas	LEL (%)	UEL (%)
Methane	5.3	14.0
Ethane	3.0	12.5
Propane	2.2	9.5
Butane	1.9	8.5
Isobutane	1.8	8.4
Pentane	1.5	7.8
Isopentane	1.4	7.6
Hexane	1.2	7.5

Testing for Oxygen

When testing for oxygen content during inerting activities ensure the most appropriate and correct gas test equipment is used for oxygen.

3.3 Purging Process**When Used**

The purging / inerting process ensures hydrocarbons and air are never present in enough concentration to support combustion.

Purging shall be performed on any system containing hydrocarbons / toxic gases / liquids when:

- System is to be exposed to the atmosphere e.g. generally for maintenance activities e.g. hydrocarbon-freeing.
- Returning a system back to operation after exposure to atmosphere e.g. inerting
- A maintenance operation creates:
 - potential for exposure to air.
 - an atmosphere that may support combustion.

Purging is performed as follows:

Purging	Details
Systems out of service	• Purging is completed until the tested atmosphere cannot form an explosive atmosphere when exposed to air or an ignition source . • Level varies depending on hydrocarbon type being purged. • Level is expressed in terms of hydrocarbon by % volume in an inert atmosphere e.g., methane 2% by volume, propane 0.9% by volume. This correlates to 40% LEL if exposed to atmosphere. • Process contaminants shall also be monitored and purged until below exposure levels (e.g. BTEX, VOCs). If contaminant levels cannot be lowered to a safe level, additional controls shall be implemented to prevent personnel exposure.
Systems back to service	• Oxygen content of the tested atmosphere is reduced to ensure an explosive atmosphere cannot be formed when re-introducing hydrocarbons. • Level is expressed in terms of oxygen by % volume in an inert atmosphere. • Hydrocarbons shall only be introduced when oxygen levels are 5% by volume or less.

**WARNING:**

Where the purging activity is to remove air from the system prior to the introduction of Hydrocarbon, the system shall not be purged or depressurised to the flare system. Air must not be allowed to enter the flare systems.

Purging Methods

There are three common purging methods:

- Positive evacuation by water purging e.g., water flooding.
- Purge by nitrogen including hot nitrogen.
- Steam.

A combination of these three methods may also be considered.

Considerations when using these purging methods are:

Method	Consideration
Water purging e.g., water flooding – used to assist in hydrocarbon removal	• Vessel and support structure must be confirmed capable of supporting the additional weight when water is added. • Vessel construction materials are suitable for the type of water to be used e.g., salt water, fresh / potable water. • Disposal of contaminated water. • Determine if all water can be drained from the system • Water-flooding may not remove sludge and sand build-up. • An engineer shall review and approve the selected purging methodology taken into consideration weight of additional water.
Steam or Hot Nitrogen – reduces process contaminant levels prior to access	• Risk assessment is required. • Steaming will not remove solids or sludge; alternative methods will be required. • Potential for vacuum conditions within vessels due to cooling from high temperatures. • Steam condensate must be contained as it may be contaminated with hydrocarbon / mercury; mercury may still be present post steaming. • Hazards to personnel from hot pipework and vessels. • Temperature rating of: – System and associated pipework being steamed e.g., cryogenic equipment – Passive fire protection (PFP) coatings or other external coatings that may be affected by elevated temperatures. • An engineer shall review and approve the selected purging procedure.

Nitrogen

- Two methods of purging equipment with nitrogen:
 - Nitrogen purging by the pressure cycle method e.g., piston-purging
 - Nitrogen purging by continuous purge or sweeping method
- Both purging methods require the system or section to be depressurised and drained of hydrocarbon first.
- Refer to APPENDIX B: for the detailed methodology.

Testing

Testing shall be done to determine if the hydrocarbon / oxygen has been reduced to acceptable limits. The following applies:

- Several places and levels shall be tested to ensure the entire process / system is within the limits.
- Test points shall be stated in the prepare for maintenance / return to service procedure and results recorded for review.
- Additional purging may be required if acceptable limits have not been reached.

**NOTE:**

The appropriate gas testing equipment for inert atmospheres should be used.

4 ISOLATION PLANNING PROCESS

4.1 Isolation Structure

Process Flow Refer to the [Isolation Process Flow](#) for more information.

Structured Format Isolation schemes shall follow a structured format for:

1. Prepare
2. Review
3. Approval
4. Application
5. Confirmation
6. Verification
7. Deisolation.

4.2 Prepare Isolation

- Preparation Process**
- Prepare isolation certificate.
 - Determine the risk when applying the isolation:
 - Perform [ISRA](#) (for process isolations).
 - Obtain or create the Prepare for Maintenance procedure.
 - Build the isolation:
 - includes mark-up of associated P&IDs.
 - review and approval of the isolation scheme.

- Assessed and Mitigated Risks**
- There can be several risks when applying an isolation including:
- bleeds from a double block and bleed.
 - installation of purge points and purging.
 - swinging of blinds for draining.
 - proving isolation integrity during the work period.

These risks shall be assessed and mitigated.

- Isolation Safety Risk Assessment** All process isolations shall be assessed using the [Isolation Safety Risk Assessment \(ISRA\)](#) to assess the actual isolation level required.

ISRA Limitations

ISRA is not intended to apply to:

- Confined space entries
- Pipeline isolations
- Subsea isolations
- Extended term durations (e.g. decommissioned plant).

ISRA does not take into account risks associated with:

- preparing of equipment for maintenance
- application of an isolation
- open or closed bleeds.

Where these risks occur, the risks shall be documented in a risk assessment.

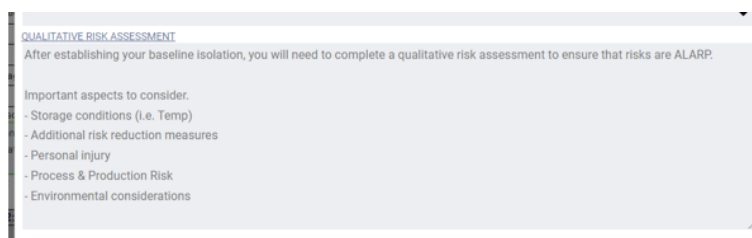
ISRA Application

Each isolated line must be calculated individually to ensure accuracy and compliance. However, lines may be grouped within the ISRA if they share identical parameters, such as:

- Isolation method
- Pressure rating
- Medium type
- Temperature range
- Risk.

ISRA Qualitative Assessment

Each ISRA shall be subjected to a qualitative assessment.

**ISRA Authorisation**

Each ISRA and its Qualitative Assessment shall be authorised by the PA prior to IC approval.

4.3 Build the Isolation**Designated Isolating Authority**

Isolations shall be built by the designated Isolating Authority in line with the appropriate competency requirement.

Zero-energy State

Isolation schemes shall ensure all energy sources for the work scope are controlled and equipment can be safely worked on in a zero-energy state.

Process isolations shall have an open vent / bleed within the isolation envelope, which can be demonstrated to the work party.

Planning Consideration

Isolation planning process considerations are:

Aspect	Consideration
Potential or previous isolation points	- Complex isolations or scope that requires a multiple discipline worksite, equipment and potential isolation points to be inspected in the field. - Search previous instances of isolation for this work scope. - Review Facility Passing Valve Register or SAP to ensure the isolation plan considers where manual valves are known to be ineffective.
Work scope	- Complexity of work scope – minor and major with multiple work fronts requiring an extensive isolation hierarchy. - CSE – confirm if positive isolation or physical separation is possible. - Equipment specific requirements involved with isolating the equipment, i.e. - Confirm if PTW is required to perform the preparation. Refer to Equipment Isolation and Reinstatement Flow APPENDIX F:
Isolation	- Category of isolation – electrical / mechanical or process, OWN. - Assess how production is impacted if the isolation result in a loss of redundancy in equipment.
De-isolation and re-instatement	- Ensure isolation hierarchy allows for de-isolation and return to service requirements or sanction to test. - IC hierarchy requires separate ICs to allow for reinstatement leak-testing. - Determine if re-instatement leak testing is required. - Service testing is to be planned. - Procedures are available for returning equipment to service.

Isolation Drawing Mark-Ups

An approved, controlled P&ID or electrical drawing for all isolations shall be:

- marked up
- attached to the Isolation Certificate.
- The final element requiring isolation shall be clearly identified.

Mark ups can be done via computer or hand drawn.

Refer to APPENDIX D: for more information.

4.4 Review the Isolation

Review Isolation Scheme

The isolation scheme shall be reviewed by another competent Isolating Authority.

Where the review identifies issues with the isolation preparation, the reviewer shall make contact with the preparer to discuss and rectify

Once satisfied the isolation meets the required criteria to remove all energy sources from the work area is the isolation review finalised and the scheme is submitted for approval

4.5 Isolation Approval

Approve Isolation Scheme

The Permit Authoriser shall review the isolation and approve provided it is appropriate for the task.

For certain work scopes it may be required for the Responsible Person Electrical (RPE) to co-authorises using the awareness functionality.

5 ISOLATION EXECUTION

5.1 Isolation Application

Process / Mechanical Apply, Prove AND Confirm

The Isolating Authority shall apply, prove and confirm isolation integrity as per isolation and prepare for maintenance procedure.

Valve and equipment tags in the field shall be checked against the isolation list's and P&ID's to ensure equipment labelling / numbering matches the isolation scheme and the correct items are isolated.

LV Electrical Apply, Prove and Confirm

The Isolating Authority shall apply, prove and confirm isolation integrity as per isolation and proving method for each point, as per Section 1.11 Proving Electrical Isolations for LV.

Lockout Tagout Process

The lockout tagout process is as follows:

Isolating Authority will:

- Apply the isolations in the field as per the isolation list
- Prove integrity of the valves physically lock the isolation points where practicable with an isolation tag attached to the yellow isolation lock.

5.2 Verify the Isolation

Independent Verification

A second Isolating Authority independently verifies isolations are:

- in place
- correct as per isolation scheme.
- For LV electrical, proves isolations as per Section 1.11

This person shall not have been involved in the isolation application.

The Verifier shall:

- remove the perforated tear off section of the tags and return them to the Issuing Authority to evidence isolation is verified.
- sign the verified section of the isolation certificate once all energy sources have been verified as removed.

Isolated Status

Issuing Authority will issue the certificate and progress to 'isolated' status when the Isolation Certificate is verified.

An isolated status effectively activates the permissions for the Issuing Authority to issue permits to all work on the isolated piece of equipment.

5.3 Remove the Isolation

Modify Isolation Refer to [Changes to Approved Isolation Certificates](#).

De-isolation De-isolation involves the removal of isolation tags and securing devices from the isolations and returning the isolation points to their nominated operating positions. The requirements will vary for all isolation schemes as they may be a simple single isolation scheme or a complex multi-isolation scheme. Examples include:

- Simple - De-isolating a light fitting
- Complex - Inerting and de-isolating a process train.

Prior to Reinstating De-isolation activities should normally occur concurrently or immediately prior to reinstating equipment to ensure a safe transition from isolated to in service.

Approved Operating Procedure The de-isolation sequence shall follow an approved operating procedure for returning equipment to service and shall have adequate detail to cover both 'Duty' and 'Standby' conditions.

Consideration shall be given to all steps including inerting / oxygen freeing and reinstatement testing.

Refer to APPENDIX F: Equipment Isolation and Reinstatement Flow.

De-isolating Key Principles The following key principles shall be applied when de-isolating:

Principle	Detail
Work completed	• Work dependent on isolation shall be completed and signed off with personal locks removed. • Dependent 'child' isolations shall be fully completed and de-isolated prior to approving parent isolation for de-isolation.
Risk evaluation	• Determine the hazards associated with de-isolation, including purging back into service and reinstatement testing. Risk mitigation measures shall be recorded in the Return to service Procedure
Safety integrity systems are on line	• Alarms associated with equipment that may have been disabled for the shutdown duration shall be re-enabled prior to commencing any de-isolation steps. • Vents, bleeds and drains are placed into the correct position to align with the Return to Service procedure. • Isolated / bypassed safety systems (PSVs) shall be de-isolated after open vents are closed. • All safety and integrity equipment is on line prior to reinstating a piece of equipment. • locks and car seals have been re-applied to correctly positioned valves

Consult with Team Leader	Consultation shall ensure no production issues will be inadvertently caused by de-isolation, nor will any existing production issues cause problems with the de-isolation and reinstatement process.
Follow relevant documentation	- Follow relevant documentation for returning equipment to service after maintenance or shutdown has occurred including: - Operating procedures (return to service). - Process line up checklists. - Instrumentation line up checklists. - Prior to or as part of de-isolation, inert / purge into service all hydrocarbon system and other systems where oxygen has to be removed e.g., MEG. - Confirm electrical, pneumatic or hydraulic operated valves do not move into a non-required position on reinstatement of the power source or medium.

De-isolation Exceptions

If it is not possible or practicable to return a valve or equipment item to its normal operating position during de-isolation, it must be:

- Recorded in the isolation list comments section and attached to the isolation pack for closeout and archiving, or
- Recorded in the isolation closeout / lessons learned section and attached to the isolation pack for closeout and archiving.
- Communicated to the Team Leader and Issuing Authority when signing the certificate closure section.

Returning Equipment to Service After Maintenance

Equipment shall be line walked prior to returning equipment to service after maintenance to ensure that all safety systems are reinstated and system integrity is intact. Refer to APPENDIX F: Equipment Isolation and Reinstatement Flow & the [Line Walking Guideline](#).

6 EQUIPMENT REINSTATEMENT TESTING

When Used

Reinstatement leak testing is used to reduce the potential for a loss of containment caused by incorrect assembly of bolted flange joints or other fittings following maintenance or installation.

Reinstatement leak testing can be done by:

- Leak Testing with inert testing medium e.g. nitrogen, nitrogen-helium or water.
- Service testing – uses a specific process medium to test system integrity.

For further guidance on leak testing, methods, execution and requirements refer to the [INPEX Leak Testing Guideline](#) and Process Flow Diagrams.

6.1 Leak Testing with Inert Testing Medium

Prove Integrity

Leak testing will be done to prove the integrity of an item of the plant in a pressurised or hazardous / toxic system.

Consideration shall be given to equipment with rotating equipment:

- Certain seal designs will not tolerate high-pressure nitrogen. Engineering support should be consulted for test procedures on rotating equipment.

Testing Requirements

Testing requirements are as follows:

- High-pressure leak-testing is a high-risk activity and shall be performed under the ISSoW system.
- System design pressure shall be known and documented.
- Test pressure shall not exceed 90% of the system PSV setpoint or 90% of the lowest system design pressure of any component within the system test envelope.
- Pressure specification changes within the leak-test envelope shall be identified and controlled.



NOTE:

A low-pressure nitrogen leak test is a “gross-leakage” test and does not provide the same level of integrity as a high-pressure leak test.

Testing Mediums

Leak testing mediums can be:

- Low-pressure nitrogen
- High-pressure nitrogen
- High-pressure nitrogen and helium mixture
- Water
- A combination of water and nitrogen.

6.2 Service Testing

System Types

Service testing by system type is as follows:

System Type	Details
Low pressure, Non-hydrocarbon and non-hazardous /non-toxic systems	• Service leak tests using non-hazardous service mediums are acceptable methods of testing for leaks during the reinstatement phase. • E.g., instrument air, potable water systems.
Hydrocarbon and hazardous / toxic systems	• Service testing will only be used where it can be proven that leak testing is not practicable, and risks associated with service testing can be reduced to ALARP. • A HLRA shall be performed prior to testing in absence of an approved and proven procedure to ensure in the event of a leak: – Contingency plans are in place. – Alternative isolations are identified. – Fire-fighting / emergency response requirements are considered. – Exclusion zones are identified. – Escalation potential is understood.
PSV's (all services)	Service testing may be utilised following PSV RTS post-test and calibration under the following conditions: Eligibility Criteria • Fewer than 3 broken joints. • Spiral wound gaskets only (Note: Ring type gaskets require HP leak testing). Leak Testing Requirements • LP gross leak testing must be completed for all upstream (U/S) joints. • Where design permits, the downstream (D/S) joint shall also be LP tested. Procedure Integration • This service testing shall be completed as part of the approved Return to Service (RTS) procedure.

Criteria and Precautions

The following criteria and precautions shall be considered for hydrocarbon or hazardous / toxic systems:

Service Test	Details
Joints and flanges	- Number of joints that have been broken shall be considered in order to control and monitor the test. - Ability to effectively monitor all previously broken flanges. - A competent technician shall have re-made the joints in accordance with the Flange Management Standard.
Pressurisation and depressurisation	- Should be controlled via a designated pressurisation route, where possible. - Shall be in incremental steps e.g., 25%, 50%, 75%, 100%. - Depressurisation routes shall be specified and if possible both local / manual and remote
Boundary isolation valves	- Consider the need to control the boundary isolation valves for the service test under the ISSoW. - Adequate pressure relief shall be established.
Low Pressure relief	Reliability of these valves is historically poor and that they may pass in both directions.

Permit and Formal Procedure

A RTS procedure is required to complete a service test. Marked up P&IDs defining the service test and test criteria shall be included.

6.3 Return to Service

Returning Equipment to Service After Maintenance

Operational equipment disturbed during the completion of the isolation or permit scope shall be site checked to ensure all safety systems are reinstated and system integrity is intact.

Removed Equipment

Process equipment shall be depressurised as part of equipment preparation for removal.

Equipment shall be confirmed depressurised when removed and before leaving the operational area.

All valves shall be cycled and left in the open position.

6.4 Decontamination

Equipment Cleaning Decontamination of process equipment shall be as follows:

- Required for all removed process equipment that may contain hazardous substances or hydrocarbons, if practical to do so. A decontamination tag shall be attached when complete.
- Job steps and hazard controls for decontaminating equipment should be documented in the original breaking containment permit raised to remove the equipment, or a separate permit specific to the task.

6.5 N₂/He Quantifiable Leak Test Acceptance

For leaks greater than 100 scf/year, checks shall be carried out on the joint before the leak is accepted. This could include, data sheet review, alignment check, torque check of bolts

In exceptional circumstances leak rates greater than 200 and less than 300 scf/year may be accepted. In such instances Tech Safety and Mechanical/ Piping TA shall be included in a risk assessment and acceptance discussions. Monitoring tasks may be determined by the risk assessment.

Max Leakage Rate (scf/year)	Condition for Acceptance
100	Acceptable
100 < Leak Rate < 200	HAZID including Site Authority
200 < Leak rate < 300	Action/Retest Required

6.6 Non Quantifiable Leak Test Acceptance

Test Result	Condition for Acceptance
No bubbles visible from taped flange	Accepted
Bubble formation > 1 bubble per minute	Discussion with site authority or delegate on acceptance or rectification plan
Detectable by PGM	Discussion with site authority or delegate on acceptance or rectification plan
FLIR Camera Identifies No Leak	Accepted
FLIR Camera Identifies Leak	Discussion with site authority or delegate on acceptance or rectification plan

APPENDIX A: REFERENCE DOCUMENTS

Reference the following documents as needed:

Document Name	Document ID
Electrical Safety Standard	0000-AH-STD-60025
Flange Management Standard	X060-AM-SPC-60002
Hose Management Standard	X060-AM-STD-60010
Isolation Standard	0000-AH-STD-60026
ISSoW Manual	X060-A1-MAN-60004
Subsea Isolation Philosophy	A100-AY-PHI-0006
ISRA Calculation Tool	X060-A1-CAL-60001
Operations Functional Safety Management Strategy	X060-AJ-STR-60007
Definition of Toxicity for Mechanical Isolation Tech Note	C075-AH-TCN-10001
Electrical Safe Operating Procedure (ESOP)	C060-AE-PRC-00001
Line Walking Guideline	X060-A1-GLN-70041
INPEX Leak Testing Guideline	X060-A1-GLN-70043
Electrical markup guideline	X060-A1-GLN-60076
Safety Related Devices (SRD)	X060-AP-PHI-70000
Controlled Valve Management Procedure	X060-A1-PRC-60041

APPENDIX B: NITROGEN PURGING BY PRESSURE CYCLE METHOD AND CONTINUOUS PURGE

In pressure cycle method the system or vessel to be purged is pressurised with nitrogen, and a period of time is then allowed for complete mixing of the nitrogen and system or vessel atmosphere. The pressure is then released to either:

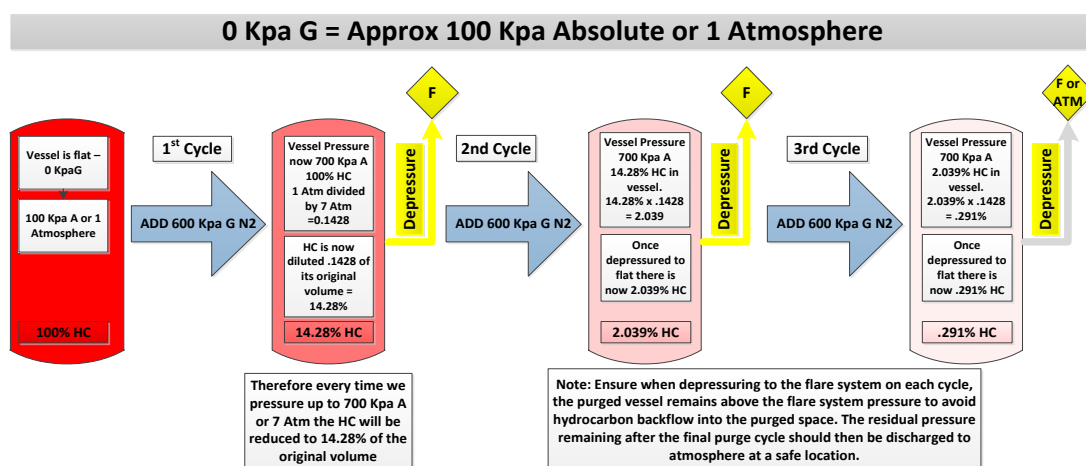
- The flare and vent system if combustible gases are being purged; or
- The atmosphere at a suitable point if air is being purged.

In pressure cycle method, the amount of nitrogen needed to reduce any gas concentration from a known initial level to a desired final level can be calculated. In the typical case, the required purge can be obtained by one or more successive cycles of pressurising and venting.

Typically, the number of cycles versus the pressure needed to effectively purge a piece of equipment would be three cycles to 600 kPa. However certain systems may have a lower design pressure. In these cases the pressure rating of the system being purged shall be taken into consideration so as not to exceed the design pressure.

The following figures display the calculation required when planning and implementing an effective purge.

The following figure is indicative of the purging process. It may be necessary to undertake more than 3 purges, particularly if hydrocarbon liquids are flashing off. Depending upon the back pressure in the flare system, the final purge may have to be vented to atmosphere. In the event that the final purge is discharged to atmosphere this shall be captured in a risk assessment.



Continuous Purge or Sweeping is the continuous flow of nitrogen through a vessel and out to vent. The purged gas is normally vented to:

- The atmosphere at a suitable point if it is air; or
- The flare and vent system if it is combustible gas.

Therefore, during the entire purging operation the vessel or system remains at just above atmospheric pressure (residual plant flares and vent system pressures should be taken into consideration to eliminate reverse flow). The nitrogen performs its function by displacing and / or diluting the purged gas. Normally the displacement and dilution processes occur simultaneously.

Consideration must be given to the flow path to ensure that all the hydrocarbon is purged out of the system, taking dead legs etc. into account.

For this method it is recommended to do a least one pressure cycle purge to assist with dilution of the hydrocarbon and to facilitate more reliable testing. Some systems such as the FPSO condensate tanks are not designed for high pressure and are designed to be purged / inerted by fixed systems to sweep the tank.

APPENDIX C: ISOLATION SAFETY RISK ASSESSMENTS (ISRA)

All Process / Mechanical isolations shall be assessed using the Isolation Safety Risk Assessment Process.

ISRA provides a systematic and calculated approach in determining the minimum isolation requirements for a piece of equipment.

The calculation takes into consideration the following factors:

- Effect Factor – based on the area in which an isolation is being planned (situation) and the substance that is being isolated from
- Release Factor - takes into account the maximum system operating pressure and the duration of the intended work scope.

All lines into and out of the equipment to be isolated shall be subject to this process.

The minimum isolation requirement (MIR) is derived from the following calculation:

Minimum Isolation Requirement Value	=	Effect Factor (Substance and Situation)	X	Release Factor (Pressure and Duration)
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Figure 1: Minimum Isolation Requirement Calculation

Limitations of the ISRA

It is noted that ISRA is not intended to apply to:

- Confined space entries (refer Section 1.6)
- Pipeline isolations
- Subsea isolations; or
- Extended term durations (e.g. mothballed plant).

For isolations over long durations, or where the isolation may be left unattended, consideration should be given to application of positive isolation, notwithstanding the results from the ISRA calculation.

The process is not designed to produce a final decision for the most appropriate final isolation method. Full consideration of an individual isolation method, including duration, pressure and hazards will be required before final selection.

The ISRA complements but does not replace competent technical judgement and good isolation practice, which should always be used to assess the outcome of ISRA before applying it.

Where an item of equipment is unable to meet the ISRA calculation due to the nature of its design, an ISRA will not be required. Compliance with the ISRA is not required if a High-Level Risk Assessment determines that the final risk is Low. The highest possible level of isolation that is available must still be applied to ensure that the risk level is ALARP.

An Approved list of Equipment unable to meet ISRA requirements is maintained within the ISSoW Key Decision Log (KDL) and is titled ISRA Exemptions. Any additions or modifications to this list must be approved by the Site Authority and accompanied by an approved HLRA.

The ISSoW Governance Committee will periodically review the ISRA exemptions in the KDL and ensure they are within criteria and aligned with other facilities.

Effect Factor

To determine the Effect Factor, select the applicable Situation Type and Substance Category from Table 1.

The Hazardous Process Contaminants Mapping tool shall be used to assist in determining the correct substance category – examples are a guide only.

For Substance Category 1 - a compound shall be classified as toxic at an in-pipe / vessel concentration equal to or greater than ten times its IDLH value (10 x IDLH) where there is clear toxicological evidence to indicate that the compound has distinct effects on the body.

For Substance Category 2 – a compound shall be classified as non-toxic at an in-pipe/vessel concentration lower than ten times its IDLH value (10 x IDLH)

Further Detail can be found in [C075-AH-TCN-10001 Definition of Toxicity for Mechanical Isolation](#). The below table from the above document specifies limits.

Compound/Substance	In-Pipe Toxicity Concentration Criteria for Application	IDLH Value
BTEX (gas)	>0.5% or 5,000ppmv	>0.05% or 500ppmv (combined BTEX concentration)
BTEX (liquid)	>0.5% or 5,000ppm w/w	>0.05% or 500ppmv (combined BTEX concentration)
Elemental Mercury	12ppmv (100mg/m ³ at standard temperature and pressure)	1.2ppmv (10mg/m ³ at standard temperature and pressure)
Hydrogen Sulphide	≥0.1% or 1,000ppmv	>0.01% or 100ppmv

Table 1: Isolation Safety Risk Assessment - Effect Matrix (Substance and Situation)

Substance Category		SITUATION TYPE				
Cat	Description	Offshore Low Ventilation Areas <i>e.g. hull</i>	Offshore Process Areas <i>Including flare and fuel gas systems</i>	Onshore Process Areas <i>Including flare and fuel gas systems</i>	Offshore and Onshore Utility Systems <i>Excluding flare and fuel gas systems</i>	Offshore and Onshore Accommodation Areas and Operations Complex
1	Gases and/or liquids which contain Toxic components $\geq 10 \times$ IDLH Value <i>e.g. mercury, BTEX, hydrochloric acid, hydrogen sulphide.</i>	10	10	9	8	7
2	Flammable gases & Flammable and / or Flashing liquids with toxicity levels $< 10 \times$ IDLH value, Asphyxiants & Steam <i>e.g. nitrogen, LNG, LPG, process hydrocarbons, carbon dioxide</i>	9	8	6	4	3
3	Other hazardous fluids <i>e.g. citric acid, , heating medium, cryogenic fluids, sewage</i>	8	6	4	3	2

Substance Category		SITUATION TYPE				
4	Flammable liquids below their flashpoint after release <i>e.g. diesel</i>	5	4	3	2	1
5	Non hazardous substances <i>e.g. water, air</i>	4	3	2	1	1

Release Factor

The Release Factor accounts for the pressure contained within the system being isolated, and the duration that the isolation will be in place.

The duration of exposure is the time period that the work party is reliant upon a non-positive isolation to maintain separation from the isolated energy source. The period of time between isolation and break in need not be taken into consideration.

Select the correct Release Factor from Table 2.

Table 2: Isolation Safety Risk Assessment - Release Factor (Pressure and Duration)

Maximum System Operating Pressure	Duration		
	< 12 hrs.	> 12 hrs. < 7 days	> 7 days
≥ 10 MPag	20	30	70
≥ 5 MPag	16	24	56
≥ 2 MPag	12	18	42
≥ 1 MPag	10	15	35
< 1 MPag	8	12	28

Minimum Isolation Requirement

The MIR is calculated by multiplying the Effect Factor and the Release Factor as shown in Figure 1.

The MIR value is used to determine the minimum isolation required in accordance with Figure 11-3. Refer to Section 1.1 for details on the isolation types.

MIR Value	0 up to 30	31 up to 100	101 up to 200	201 +
Minimum Isolation type	Single Block (SB)	Single Block and Bleed (SBB)	Double Block and Bleed (DBB)	Positive Isolation & Consider Additional Risk Reduction

Figure 2: Isolation Safety Risk Matrix - Example

Change out of a pump strainer in a toxic service within an Offshore Process Area, maximum system operating pressure 6MPag:

- Effect Factor = 10 (See Table 1; Category 1 due to toxic service)
- Release Factor = 16 (See Table 2; based on duration less than 12 hrs for activity)
- $10 \times 16 =$ Minimum Isolation Requirement Value of 160.
- For an MIR of 160, double block and bleed is the minimum isolation required.

The Isolation Safety Risk Assessment process is then performed on each separate energy source (process line) to the isolation envelope. Where the same energy source is affecting the isolation envelope at numerous locations, a single Isolation Safety Risk Assessment may cover those multiple isolation points. For example, a pump isolation envelope may have two or more drain points to the same drain system. A single Isolation Safety Risk Assessment will cover these two or more points.

Warnings

In addition to the recommended minimum isolation requirement, the ISRA tool will generate warnings in three scenarios as detailed in Table 3.

Table 3: ISRA Warnings

Scenario	Warning	
Substance Category = 1		WARNING: Toxic fluids. Apply ISRA calculation with caution. Consider whether additional measures should be applied to reduce risk to ALARP.
System Pressure $\geq$ 5MPa AND MIR $\leq$ 100		WARNING: High pressure fluids. Apply ISRA calculation with caution. Consider whether additional measures should be applied to reduce risks to ALARP. If higher isolation is available this is recommended; if not practical, document why ISRA minimum requirements are to be used.
Duration $\geq$ 12 hrs.		WARNING: Activity duration $\geq$ 12 hrs. Consider whether positive isolation should be applied to reduce risks to ALARP.

Where a warning is generated, the completed ISRA shall include the initialled warning to indicate that has been considered.

Reassessing Extended Isolation Times

If the isolation duration extends beyond the original time frame identified in the 'Release Factor' (Table 11-2), the isolation shall be reassessed using the Isolation Safety Risk Assessment to determine if the current isolation meets the minimum isolation requirements taking the extended isolation time frame into consideration.

Additional Considerations

The ISRA does not take into account the risks associated with the preparation of equipment for maintenance, the application of an isolation, nor the risk associated with open or closed bleeds. Where these risks occur, they shall be documented in a risk assessment.

APPENDIX D: ISOLATION MARK UP

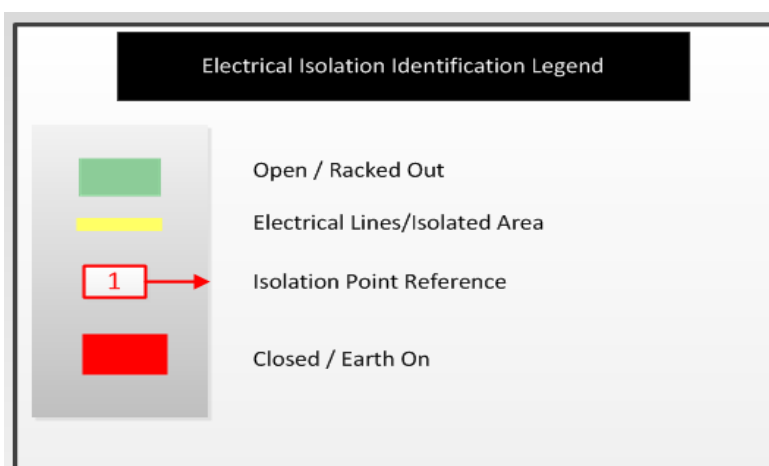
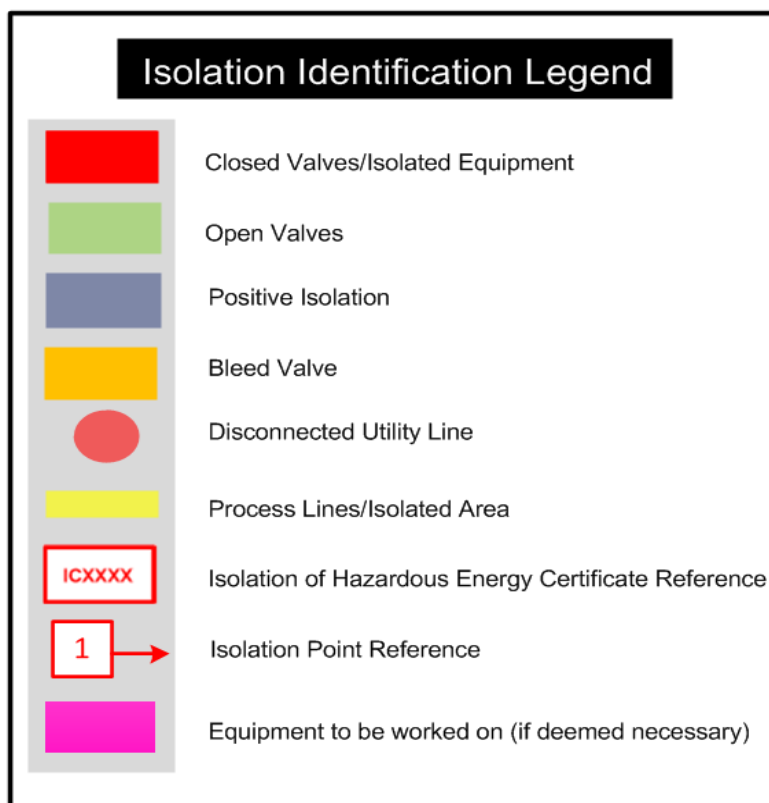
Use of Mark-ups

An approved, controlled P&ID or electrical drawing for all isolations shall be:

- marked up
- attached to the Isolation Certificate.

Mark ups can be done via computer or hand drawn.

Refer to the [P&ID Mark-up Isolation Guide](#) for more information.



APPENDIX E: LOCK-OUT TAG-OUT (LOTO)

Lock-out Tag-out Process

The lockout tagout process is as follows:

Isolating Authority will:

- apply the isolations in the field as per the isolation list.
- physically lock the isolation points where practicable with an isolation tag attached to the yellow isolation lock.
- Return the key for these isolation locks to the Issuing Authority.

Issuing Authority will:

- place key into a designated key safe / key hasp.
- lock the key safe with a teal isolation certificate lock.
- secure an isolation certificate tag to the lock.
- attach bottom tear off section of isolation certificate tag to the key of the isolation certificate lock.
- secure the key in the Issuing Authorities key cabinet.

Following independent verification by a relevant Isolating Authority, the isolation is 'progressed to isolated status' by an Issuing Authority.

A permit can now be issued on the isolated piece of equipment.

LOTO System

The Lockout – Tagout System consist of the following hardware:

- Isolation locks
- Isolation certificate locks
- Permit locks
- Personal locks
- Key safes, key hasps and lock boxes
- Securing devices
- Tags and notices.

Hardware

Hardware details are as follows:

Hardware	Details
Yellow isolation lock	• Used by Isolating Authorities to secure isolation points for the following isolations: – Process or mechanical – Electrical – Own isolation. • Isolating Authority manages locks and new lock sets as follows: – Each isolation lock set shall have only 1 key in use, 2 spare keys shall be placed under the control of the Site Authority.

	- Site Authority will issue a spare key if a key is lost. - If no spare key is available, Site Authority may authorise removal of the locks by other means.
Teal Isolation Certificate Lock	• Issuing Authorities control the application and removal of these locks. • Used to lock a key safe containing the key of the isolation locks on isolation completion. The key to the safe is tagged with the bottom tear off section of the Isolation Certificate tag and placed in the Permit Office key cabinet. • Issuing Authority will remove the Isolation Certificate key to unlock the IC lock upon completion of all work under the isolation. • The isolation group key can then be issued to the Isolation Authority to de-isolate.
Blue Permit Lock	• Issuing Authorities control the application and removal of permit locks. • Issuing Authority will place a hasp on the relevant key safe and attach a blue permit lock and tag to the hasp when issuing a Work Permit. • The hasp with permit tag will be placed on the key safe / key hasp containing the parent isolation as identified on the permit. The hasp allows room for the Work Party to attach their red personal locks and personal danger tags. • When a permit is issued and the permit lock applied, the key for the permit lock is placed with the bottom tear off section of the permit tag in the Permit Office key cabinet.
Red Personal Locks	• Used by personnel when working under a permit associated with an Isolation Certificate or OWN isolations where single point isolation is required. • All Work Party members and Permit Holder are required to lock on to the hasps and / or key safes indicated on the permit they are working under.
Key Safes and Hasps	• Removes the requirement for individuals working under an isolation to lock onto every isolation point. • Comes in the form of a lockbox or key hasp. A key safe can be in a hasp form, permanently fixed boxes or portable boxes located externally or at the work site depending on the location and size of the work scope and Work Party. • A key safe holds the isolation lock keys used to secure the isolation points. Isolation locks keys are secured in the key safe by the Issuing Authority with an isolation certificate lock.

	When the Issuing Authority issues a permit tag associated with the key safe, they shall attach a hasp onto the key safe using a permit lock. Each permit issued under the same isolation must be dedicated a separate hasp this is secured by an associated Permit lock.
Securing Devices	- Specific pieces of equipment designed to assist with the application of an isolation. - Examples include: - Cable type lock out - Pneumatic lock out - Plug lock outs - Circuit breaker lock outs - Chain, etc.

Lock Cannot be Directly Fitted

A locking device shall be applied and this device locked with the isolation lock if a lock cannot be directly fitted to the isolation point. Where a physical lock and / or lock out device cannot be applied to an isolation point, there must be a visible and obvious attempt made to limit the capacity to re-energise. The isolation point shall still be identified with an isolation point tag.

Examples of isolation points not able to be physical locked include:

- ELV knife switches
- Needle valves.

Unremoved Personal Locks

In the event a personal lock / personal danger tag (PDT) has not been removed by the lock owner, the lock owner will be contacted and requested to remove the lock / PDT in line with the normal process.

If the owner has left the site, the Site Authority shall authorise removal of the lock / PDT upon confirmation of the following:

- All associated documents and isolations have been reviewed to ensure lock /PDT removal will not affect existing work or isolations.

Work site has been inspected to ensure related equipment has been left in a safe condition.

Isolation Tags and Notices

Tag details as follows:

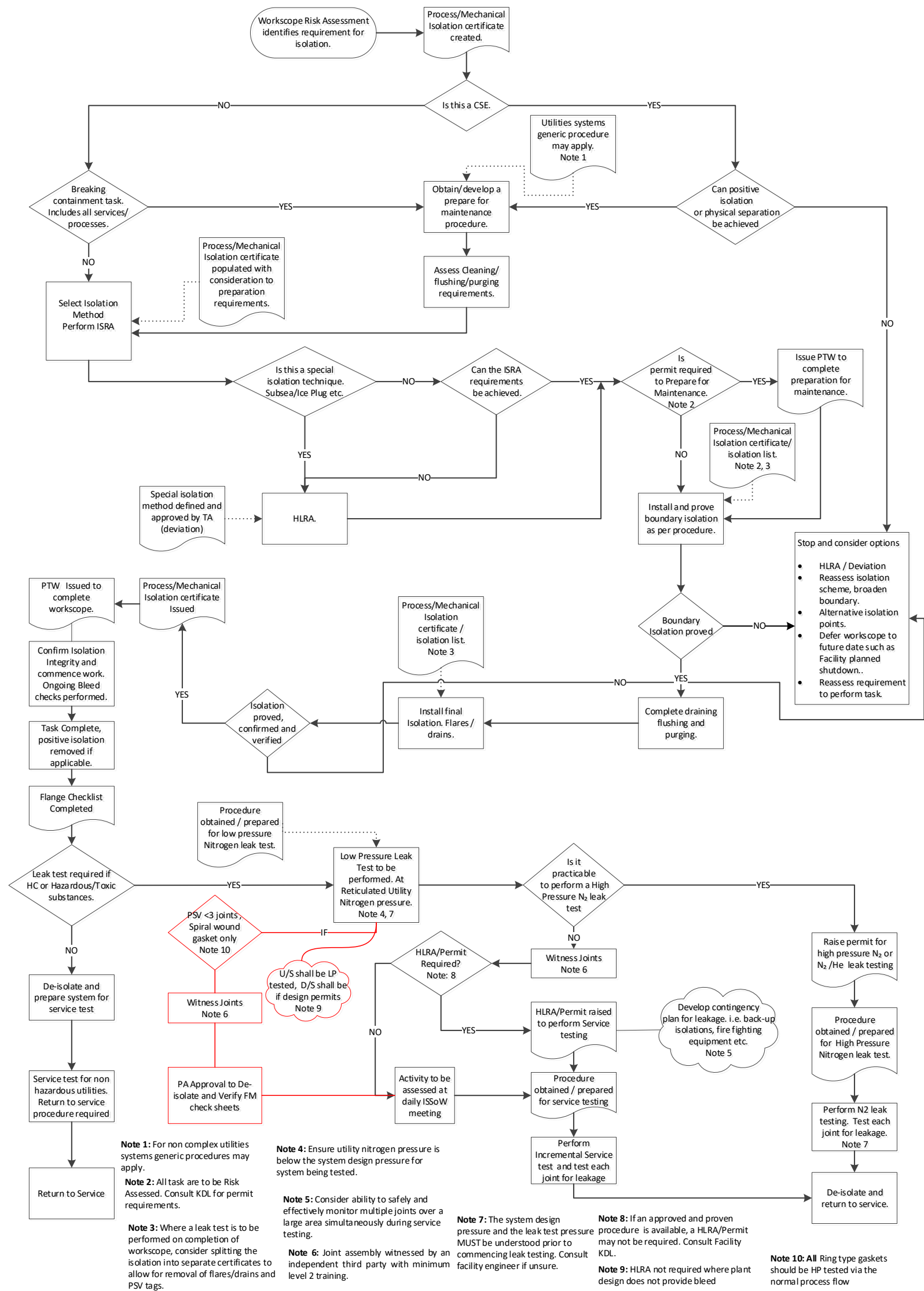
Tag	Details
Isolation point tags	- Attached to a yellow isolation point to identify and secure the isolation point in its required position. - Tag will identify: - Isolation Certificate number - Isolation Point number - Isolation Point Sequence number - Isolation type - Isolation condition e.g., valve closed - Equipment tag.
Tags Colours	- Tag colour is dependent on the isolation category and isolation method as follows and aligns with the P&ID mark-up legend Process Isolation Points: - GREEN for Open - ORANGE for bleed checkpoints - RED for all others e.g., closed, removed, disabled, isolated. Mechanical Isolation points: - BLUE. Electrical Isolation Points: - RED – Closed / Earth On - GREEN – Open / Racked Out. Key Safe – Isolation Certificate: - TEAL. Key Safe – Permit Tag: - BLUE.
Isolation certificate tag	- Required to identify a specific key safe for an isolation certificate. - Identifies the isolation certificate number and key safe number. - Top section of tag is attached to the Isolation certificate lock attached to the key safe to secure the isolation point key(s). - Bottom section of the tag is attached to the Isolation Certificate lock key and resides in the Issuing Authorities key cabinet. - Tag can only be removed by the Issuing Authority after verifying all permits are complete under the isolation.

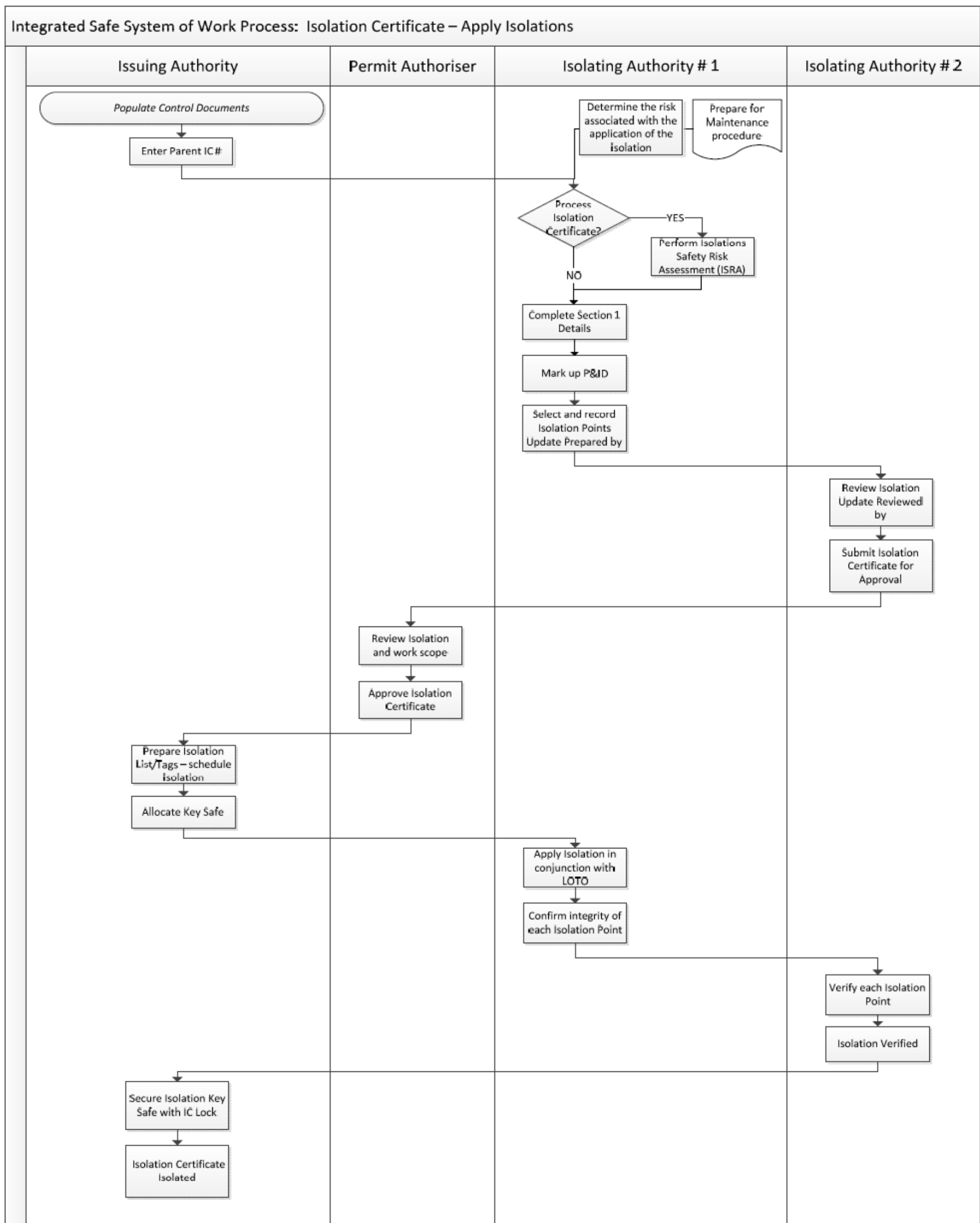
Permit Tag	- Blue permit tag is used in conjunction with a blue permit lock. - Identifies: - Permit number - Isolation certificate number - Key safe number. - Top section is used with a blue permit lock attached to the key safe box or key safe hasp. - Bottom section is placed on the corresponding key and resides in the Issuing Authorities key cabinet.
Confined Space Entry tag	- Used on an isolation key safe / key hasp highlighting a CSE is associated with the isolation. - CSE tag shall be attached using a certificate lock, the key with the tear off section resides in the Issuing Authorities key cabinet.
Personal Danger tags (PDTs)	- PDTs are available from the permit office and must be used whenever a red personal lock is used. - Requires name and company information on the front of the PDT. - Tag is then locked onto the red permit hasp displaying the PTW tag associated with the isolation for the work scope. - PDTs and red personal locks shall be removed from the red permit hasp at the end of each shift. - OWN isolation schemes with more than one isolation point shall have the personal danger tag attached to the isolation points with a yellow isolation point lock.
Out of Service tags (OOS)	- OOS shall be used for protection of equipment only. - Tag identifies: - Name and department of person placing the tag - Date - Time - Details of why the equipment is OOS. - OOS tags are designed to keep faulty, unsafe or unserviceable equipment out of use, or to identify valves or switches which should not be operated for process or mechanical reasons.

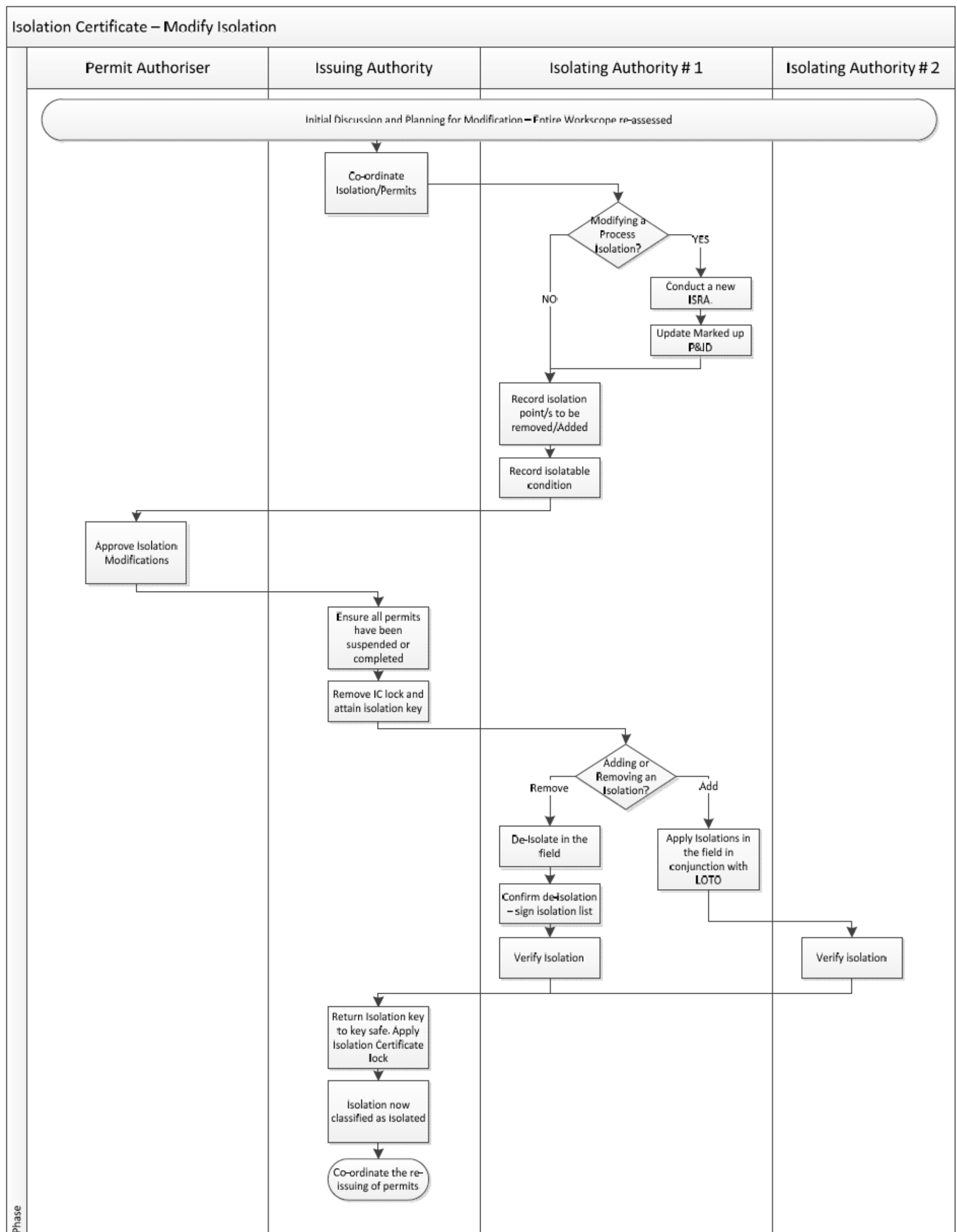
Information tag	• Used to give information about a piece of equipment e.g., can provide general information to personnel or identify the reason for active demarcation barriers at appropriate locations to inform local personnel. • Tag identifies: – Name and department of person placing the tag – Date – Time – Details for tag placement. • Used temporarily until a SAP notification is raised. Notification tag with notification number will replace the information tag.
Sanction to Test Tag (STT)	• Are placed on the key safe / key hasp of the isolation temporarily removed while testing. Tag is the visual indicator of why the key safe / hasp is currently open. • STT is also placed on each of the isolation points that have been restored to allow testing. • STT identifies: – Isolation certificate number – Sanction to test number – Date – Name of tester.

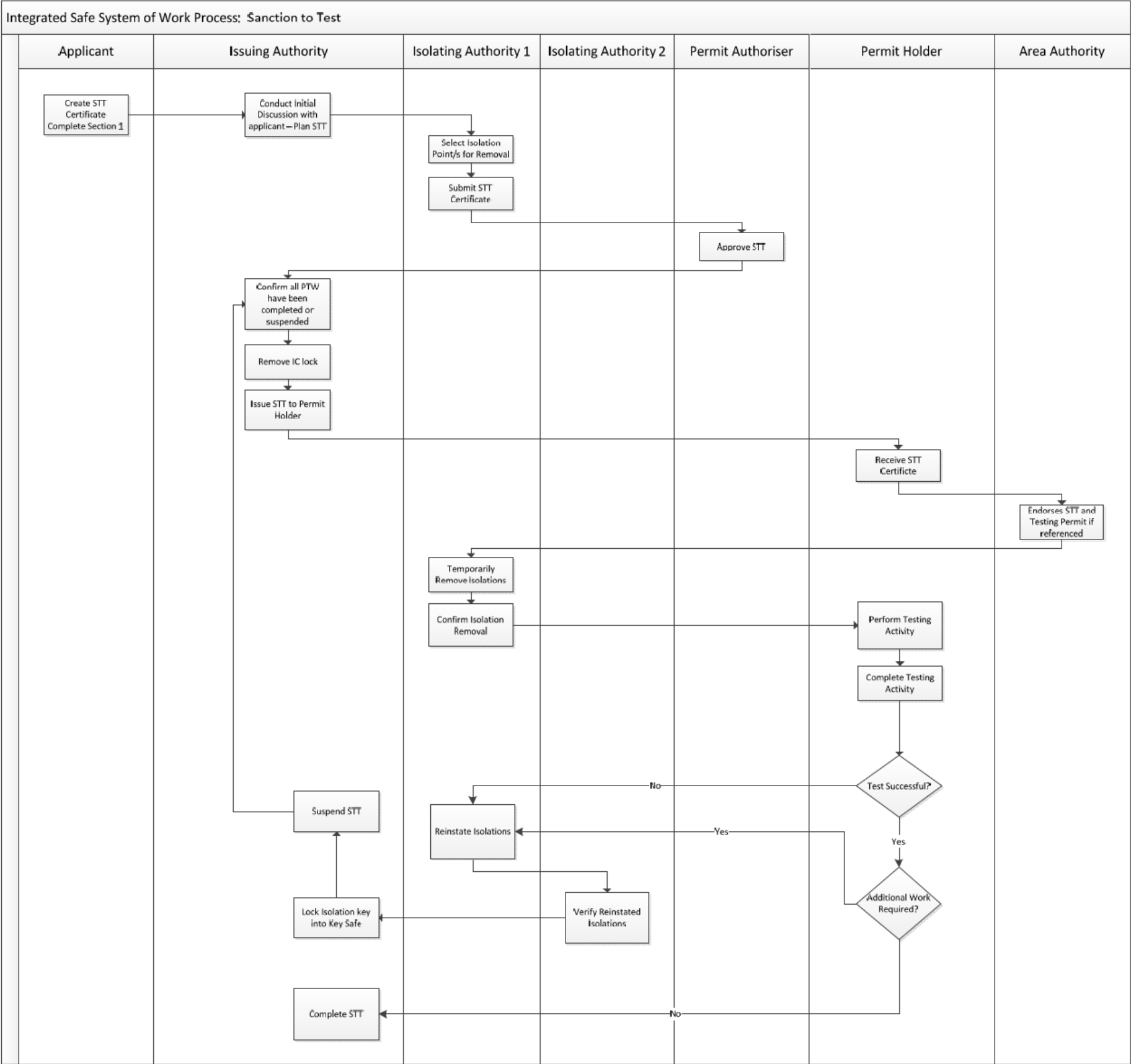
APPENDIX F: PROCESS FLOW DIAGRAMS

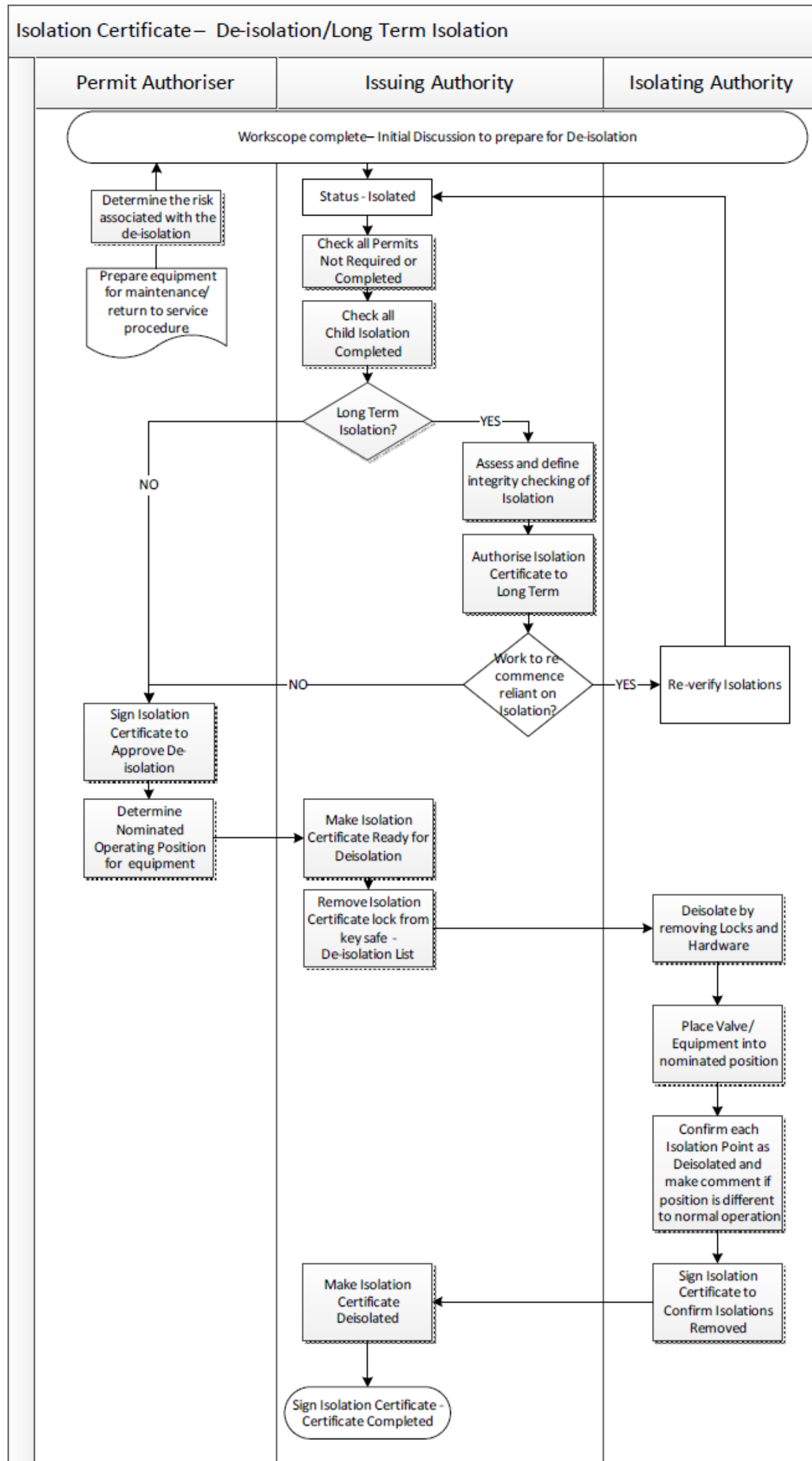
Equipment Isolation and Re-instatement Flowchart





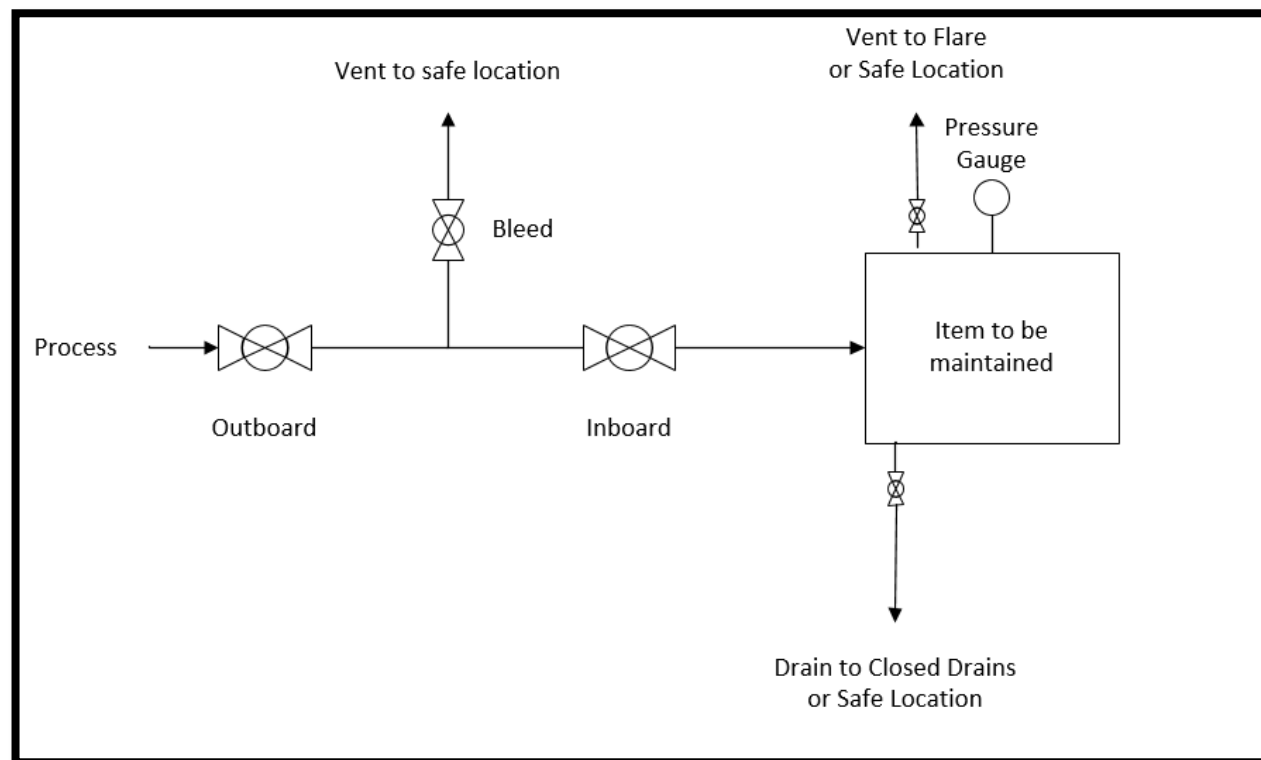






APPENDIX G: PROVING DBB ISOLATIONS

There are several ways in which valves can be tested – below are examples of preferred ways to prove the integrity of Double Block and Bleeds. However, the method of proving the integrity must be included in Prepare for Maintenance / Return to Service.



OPTION 1:

1. Shut outboard isolation valve.
2. Depressurise the item to be maintained via its vent or/and closed drains
3. Confirm the item does not re-pressurise, thus proving the outboard isolation valve is not leaking.
4. Shut the Inboard isolation valve.
5. Connect a nitrogen supply to the local bleed point.
6. Pressurise the interspace between outboard and inboard with nitrogen to a modest pressure that can be safely vented from a local vent (700 kPa) to safe location.
7. Confirm pressure in the interspace does not fall, thus proving the secondary isolation valve is not leaking
8. De-pressurise the interspace locally to the vent header or to safe location.; then close the bleed valve
9. Disconnect nitrogen.
10. Open the bleed valve routinely to confirm the outboard isolation valve was not leaking as per bleed check register.

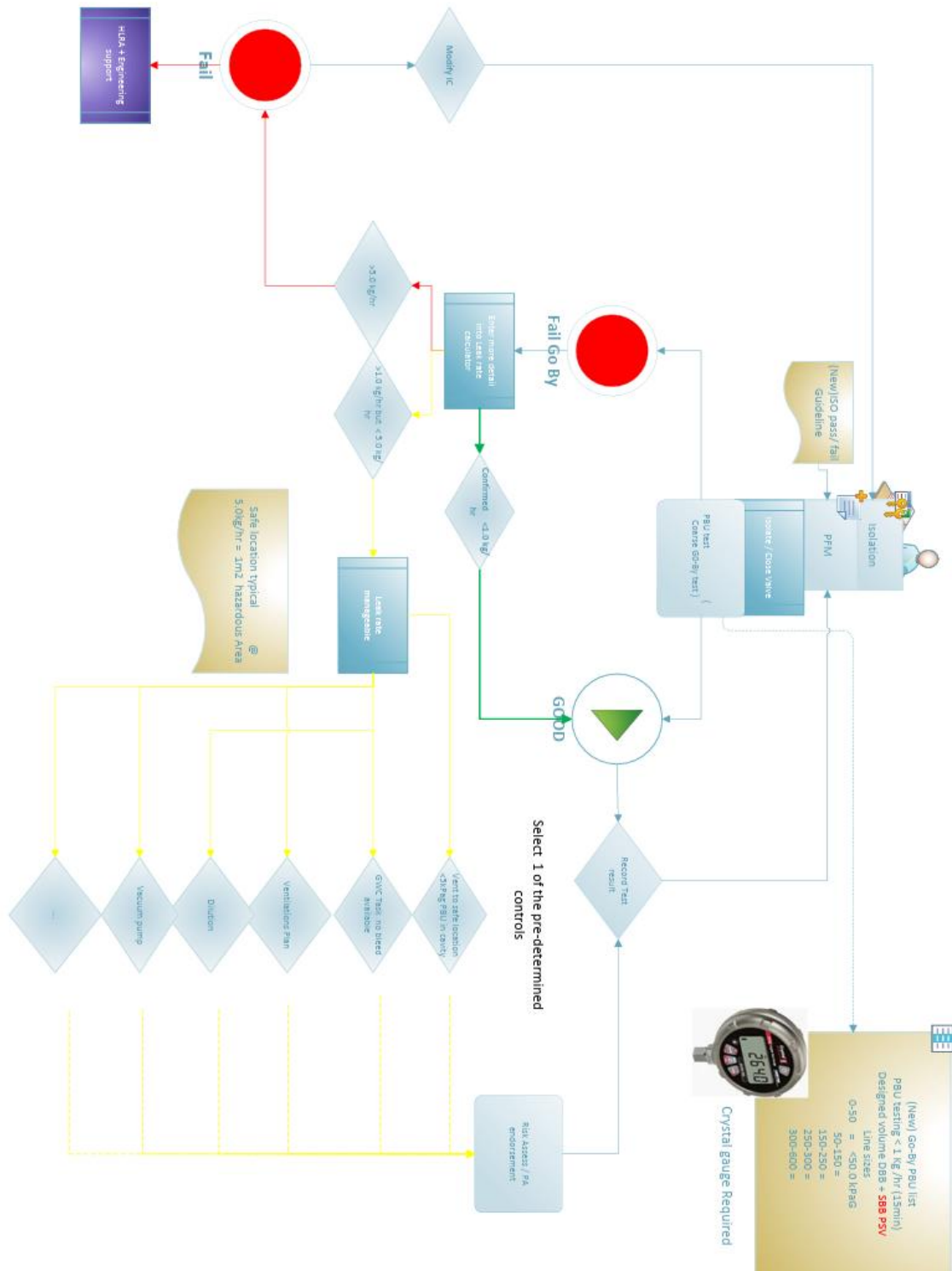
OPTION 2:

1. Shut inboard isolation valve.
2. Depressurise the item to be maintained via its vent or/and closed drains.
3. Confirm equipment being maintained does not re-pressurise, thus proving the inboard isolation valve is not leaking.
4. Shut the outboard isolation valve.
5. Confirm pressure in the interspace between block valves does not fall, thus proving the bleed valve is not leaking.
6. Open the bleed valve to de-pressurise the interspace to the vent header or to safe location.; then close the bleed valve.
7. Ensure the pressure in the interspace does not rise, thus proving the outboard isolation valve is not leaking.
8. Open the bleed valve routinely during the maintenance activity to relieve any pressure build-up in the inter-space, to confirm the outboard isolation valve was not leaking as per bleed check register.

OPTION 3 – (Ball valves with Cavity Bleeds)

1. Shut outboard isolation valve.
2. Depressurise the item to be maintained via its vent or/and closed drains.
3. Confirm the item does not re-pressurise, thus proving the outboard isolation valve is not leaking.
4. Shut the Inboard isolation valve.
5. Open outboard isolation valve
6. Pressurise the interspace between outboard and inboard with process pressure,
7. Close outboard valve.
8. Confirm equipment being maintained does not re-pressurise, thus proving the inboard isolation valve is not leaking.
9. De-pressurise the interspace locally to the vent header or to safe location.; then close the bleed valve.
10. Ensure the pressure in the interspace does not rise, thus proving the outboard isolation valve is not leaking.
11. Open the bleed valve routinely during the maintenance activity to relieve any pressure build-up in the inter-space, to confirm the outboard isolation valve was not leaking as per bleed check register.

APPENDIX H: LEAK RATE ASSESSMENT PROCESS FLOW



APPENDIX I: PBU (GO-BY TESTING) TYPICAL DBB ARANGMENTS

		N2 @ 29deg			N2		
Pipe Size		Double Block & Bleed			Single Block & Bleed		
DN	Inches	DBB Length (m)	DBB Cavity (m ³)	15min max PBU ≤1kg/hr (N2)	SBB Length (m)	SBB Cavity (m ³)	15min Max PBU ≤ 1kg/hr
DN25	1	2.536	0.001	≤1000kPag	0.619	0.0003	≤1000kPag
DN50	2	1.348	0.003	≤1000kPag	1.515	0.003	≤1000kPag
DN80	3	0.893	0.004	≤1000kPag	0.591	0.003	≤1000kPag
DN100	4	5.776	0.047	≤500kPag	0.727	0.005	≤1000kPag
DN150	6	8.501	0.103	≤145kPag	1.109	0.019	≤1200kPag
DN200	8	3.125	0.11	≤230kPag	0.606	0.019	≤1200kPag
DN250	10	1.387	0.076	≤325kPag	1.041	0.051	≤440kPag
DN300	12	1.827	0.139	≤170kPag	0.916	0.064	≤190kPag
DN400	16	4.58	0.441	≤35kPag			
DN500	20	1.363	0.217	≤80kPag			

		Propane @ 29 Deg (* phase change)					
Pipe Size		Double Block & Bleed			Single Block & Bleed		
DN	Inches	DBB Length (m)	DBB Cavity (m ³)	15min max PBU ≤1kg/hr (N2)	SBB Length (m)	SBB Cavity (m ³)	15min Max PBU ≤ 1kg/hr
DN25	1	2.536	0.001	≤970kPag*	0.619	0.0003	≤970kPag*
DN50	2	1.348	0.003	≤970kPag*	1.515	0.003	≤970kPag*
DN80	3	0.893	0.004	≤970kPag*	0.591	0.003	≤970kPag*
DN100	4	5.776	0.047	≤300kPag	0.727	0.005	≤970kPag*
DN150	6	8.501	0.103	≤90kPag	1.109	0.019	≤630kPag
DN200	8	3.125	0.11	≤140kPag	0.606	0.019	≤640kPag
DN250	10	1.387	0.076	≤200kPag	1.041	0.051	≤250kPag
DN300	12	1.827	0.139	≤110kPag	0.916	0.064	≤200kPag
DN400	16	4.58	0.441	≤20kPag			
DN500	20	1.363	0.217	≤50kPag			

Flash Gas @ 29 Deg							
Pipe Size		Double Block & Bleed			Single Block & Bleed		
DN	Inches	DBB Length (m)	DBB Cavity (m ³)	15min max PBU ≤1kg/hr (N2)	SBB Length (m)	SBB Cavity (m ³)	15min Max PBU ≤ 1kg/hr
DN25	1	2.536	0.001	≤1000kPag	0.619	0.0003	≤3000kPag
DN50	2	1.348	0.003	≤1000kPag	1.515	0.003	≤3000kPag
DN80	3	0.893	0.004	≤1000kPag	0.591	0.003	≤3000kPag
DN100	4	5.776	0.047	≤590kPag	0.727	0.005	≤3000kPag
DN150	6	8.501	0.103	≤180kPag	1.109	0.019	≤2800kPag
DN200	8	3.125	0.11	≤280kPag	0.606	0.019	≤1400kPag
DN250	10	1.387	0.076	≤400kPag	1.041	0.051	≤530kPag
DN300	12	1.827	0.139	≤210kPag	0.916	0.064	≤420kPag
DN400	16	4.58	0.441	≤45kPag			
DN500	20	1.363	0.217	≤100kPag			

GEP Gas @ 29 Deg							
Pipe Size		Double Block & Bleed			Single Block & Bleed		
DN	Inches	DBB Length (m)	DBB Cavity (m ³)	15min max PBU ≤1kg/hr (N2)	SBB Length (m)	SBB Cavity (m ³)	15min Max PBU ≤ 1kg/hr
DN25	1	2.536	0.001	≤3000kPag	0.619	0.0003	≤3000kPag
DN50	2	1.348	0.003	≤3000kPag	1.515	0.003	≤3000kPag
DN80	3	0.893	0.004	≤3000kPag	0.591	0.003	≤3000kPag
DN100	4	5.776	0.047	≤3000kPag	0.727	0.005	≤3000kPag
DN150	6	8.501	0.103	≤190kPag	1.109	0.019	≤1320kPag
DN200	8	3.125	0.11	≤280kPag	0.606	0.019	≤1320kPag
DN250	10	1.387	0.076	≤280kPag	1.041	0.051	≤530kPag
DN300	12	1.827	0.139	≤210kPag	0.916	0.064	≤420kPag
DN400	16	4.58	0.441	≤210kPag			
DN500	20	1.363	0.217	≤100kPag			

≤3000kPag Conservative Number <1kg/hr

≤1000kPag Conservative Number <1kg/hr

≤970kPag* Phase change point

APPENDIX J: RECORD OF AMMENDMENT

Revision	Section	Amendment
0	All	New format document, prepared for intended user.
0	All	Major update with multiple requirements changes as per ISSoW Governance Committee approvals. A change log of key changes since previous ISSoW Manual Rev 7 can be found in Ops Teams Folder
1	All	Manual updates / clarifications to Sections 1.1 - Isolation types 1.6 - Isolation exemptions 1.8 - Temp Equipment isolations 1.111 - Electrical disconnection 1.112 OIC' Reference additions: - Operations Functional Safety Management Strategy - X060-AJ-STR-60007 - Definition of Toxicity for Mechanical Isolation Tech Note - C075-AH-TCN-10001
2		1.10 - Electrical isolation proving - Heat trace guidance 1.12 - OIC types of guidance (from HSG253) - The Isolating Authority shall be the permit holder. - MOC for Hydrocarbon isolation 1.4 improved Passing valves guidance 2.2 PFM exemptions (KDL) removed. 5.3 Line walking guidelines Reference 6.0 Added Leak Test Guideline reference. 6.2 Added low pressure relief valve note. 6.5 & 6.6 N2/He testing guidance. Appendix C ISRA (Carbon dioxide change) References - Added Electrical markup guideline reference. - Added ESOP reference. - Added Line walking reference.

Revision	Section	Amendment
3	All	Manual updates / clarifications to Sections 1.3 - Bleed Open or Bleed closed added - Bleed checks with PGM - Remove DBB reference 1.4 - Provide guidance to isolators as to when an Isolation can be classed as isolated 1.7 - New section added Plant design and ISRA 1.8 - PSV's - due to the inherent design - E-stop inclusion 1.12 - Cable disconnected from a junction box 1.13 - OIC linking added 1.14 - LTI (OC responsibility) 3.1 - Added reference to 1.3 4.2 - ISRA for each line - Qualitative assessment Appendix F - Edit for service test Appendix H - Leak rate assessment
4	1.15	Inserted new sub-section Instrument Valve Operation

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2	29/10/24 08:00	For Use
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0	13/04/21 08:00	For Use
A	11/02/21 08:00	For Review

Delegation of Authority

From Name	To Name	Date and Time	Action

Name	Title

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Name	Title	Date and Time	Action
Jaco Blignaut	Onshore Maintenance M	15/04/26 08:19	Approver