Isolation of Hazardous Energy
CoW Technical Standard

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Introduction

Isolation of Hazardous Energy (IHE) requirements are designed to prevent injuries to personnel, damage to property or adverse environmental impact due to the unexpected energization of equipment or release of residual and/or stored energy during constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. Potentially hazardous energy includes electrical, mechanical, hydraulic, pneumatic, kinetic, potential, thermal, chemical and radiation.

This standard defines the requirements for the opening of process equipment and/or performing isolation of machinery, process and other industrial equipment, electrical equipment and overhead powerlines, vessels, piping, and pressure relief systems from sources of hazardous energy. The requirements of this standard are also relevant to non-intrusive isolation of hazardous energy that involves breaking the containment and controlling long-term isolations.

Scope

These requirements are not intended for emergency situations where loss of containment has occurred and immediate isolation of inventory is required.

This standard does not apply to the following:

- Work on cord and plug connected electric equipment
- Hot tap operations
- Servicing and/or maintenance which takes place during normal production operations as long as:
  - A guard or other safety device is not bypassed, altered, or removed
  - Personnel are not required to put any part of their body into a machine or equipment to perform work at a point of operation or in a designated zone of danger around machinery

Requirements

The following sections provide minimum requirements for Isolation of Hazardous Energy as well as supporting guidance to clarify the intent of those requirements.

- Requirements of this Standard **shall** be met.

General

1.	**Requirement:**	**Energy shall be isolated if there is a potential for unwanted or unexpected energization, start-up, or release of residual or stored energy from processes, systems and/or machinery/equipment during servicing, maintenance, or while equipment is in a state of disrepair or disassembly.**
	Guidance:	When isolating energy in systems that contain hazardous inventories, contents should be removed and, where necessary, residual fluids and any solid deposits cooled and cleaned out before breaking containment. An assessment of the risks associated with hazardous inventories should be conducted. The extent of purging and flushing depends on the inventory involved, the nature of the intrusive activity planned, and the extent of the Boundary/System Isolation. The process should be defined in the Isolation Certificate, Energy Control Procedure, or equivalent, and may require activities such as depressurizing, water flush, nitrogen purge, forced air movement, high-pressure water jetting, and extensive gas testing.
2.	**Requirement:**	**Isolation of hazardous energy that involves changes to operational procedures/methods or operational equipment changes shall comply with the JO's Management of Change (MOC) requirements.**
3.	**Requirement:**	**Electrical work isolations shall be carried out in accordance with the Electrical Safe Work SHEERS Standard and applicable legal requirements.**
	Guidance:	Industry standards should be consulted if applicable.
4.	**Requirement:**	**JO shall have procedures for isolations at property/demarcation lines and isolations off Joint Operations property that include:** **a. The clear identification of isolation owner and group accountable.** **b. Specific methods for maintaining control of the isolation.**
5.	**Requirement:**	**A hazard analysis shall be conducted in accordance with the Hazard Analysis CoW Technical Standard when planning work involving the isolation of hazardous energy, including, but not limited to, addressing Line of Fire hazards.**
	Guidance:	Non-process isolation hazards to be considered include mechanical equipment hazards, electrical equipment hazards, hazardous atmospheres in confined spaces, potential environmental impacts, adjacent work, and static electricity or radioactive substance hazards.

Isolation Methods

6. Requirement:

JO shall develop, approve, and maintain documentation of their isolation methods based on the type of activities and process medium/category.

- **a. Positive Physical Isolation (PPI) is required, at a minimum, for the following activities:**
  - **i. Work that involves entry into a confined space.**
  - **ii. Open flame hot work on process piping or equipment containing or having contained a flammable process medium that has not been confirmed as cleared of residual contents.**
- **b. PPI shall be the preferred and first isolation method considered for all other activities involving opening processes, systems, and/or equipment in hydrocarbon or chemical service that have not been confirmed clear of residual contents, and for long-term isolations regardless of service medium.**
  - **i. If PPI is not a feasible method of isolation, JO shall evaluate and determine an alternative isolation method and identify any additional and/or alternative controls and verifications necessary for the selected isolation method.**
  - **ii. JO shall define the positions/levels of the organization authorized to approve the alternative JO method of isolation.**

Guidance:

Documenting the rationale for choosing an isolation method other than PPI aids in demonstrating conformance to requirement 6.b.

Refer to Appendix E for the JO isolation method determination process flow. See Isolation Matrix

JO should identify the isolation method based on the hazards involved and mitigation methods used, following the hierarchy of controls.

There are three primary categories of isolation that may be approved for implementation. The typical methods of isolations can be found in Appendix D.

- Positive Physical Isolation (PPI) - complete separation of the plant/equipment to be worked on from other parts of the system by removing spools, inserting blinds or closing spectacle blinds.
- Verified Valve Isolation - valved isolation where effectiveness of the isolation can be confirmed via vent/bleed points before breaking into the system.
- Unverified Valve Isolation - valved isolation without confirmation of the effectiveness of the isolation being confirmed.

Bleed valves shown in Appendix D are fitted to prove that valves are holding the hazardous inventory and to control leakage. The various bleed valve configurations and operational requirements used for

	specific isolations are determined by the risk assessment carried out for the isolation. The potential consequence from the hazard should be considered when evaluating potential isolation methods and their level of integrity. For electrical isolations, alternative isolation through “air-gapping” may be acceptable to reduce the likelihood of exposure to potentially hazardous electrical energy.
7. Requirement:	**JO shall establish requirements for a deviation and authorization process for isolation activities that deviate from this standard’s required isolation methods and for temporary deviations from JO-approved isolation methods.** **a. The deviation procedure shall require at a minimum:** **i. Rationale for the deviation.** **ii. Additional risk assessment (HAZID study).** **iii. Identification of any additional and/or alternative controls and verifications to be implemented as determined by the risk assessment.** **iv. Approval of the deviation.** • **JO shall define the positions/levels of the organization authorized to approve deviations.** **b. Retention of approved deviation documentation shall be as follows:** **i. Temporary deviations shall be retained in accordance with CoW documentation retention requirements defined in the CoW SHEERS Process.** **ii. Permanent deviations from the isolation methods required by this standard shall be retained as long as the deviation is in place.**
Guidance:	This requirement is not applicable to permanent deviations “revisions” to JO approved isolation methods, they are managed by requirement 6 of this standard. Reasons for deviations may include, but are not limited to: • Short-duration work where the overall risk of undertaking the activity using positive isolation (including the risks associated with installing and removing the isolation) is greater than the overall risk of using a less secure isolation method • Minor intrusive work, such as isolations of instruments • Testing of plant/equipment following intrusive work • Subsea pipeline isolations • Work on equipment not designed for the method of isolation required Since a deviation involves a lower standard of isolation, additional risk-reduction measures (e.g., pressure reduction) need to be

		considered. It may be helpful to engage the Risk Management advisor for assistance in determining additional mitigation measures and utilizing risk assessment tools. Refer to Appendix E for the JO isolation method determination flowchart.
8.	**Requirement:**	**JO shall define and document a procedure for the management of long-term isolations.** **a. The procedure shall include a requirement for recurring verification of the isolation to maintain a zero-energy state.**
	Guidance	Verification intervals should be determined based on the isolation method used and the integrity of the method to maintain the isolation at a zero-energy state. Consideration should be given to moving active (live) isolations to the status of "Long Term Isolation" if there are no immediate plans to perform work associated with the isolation (e.g., waiting on parts with a lead time of 30 days). This provides a more accurate picture of active work within an operating area. For equipment that is isolated with no plans on returning to service, the JO should designate the equipment as "Out of Service" and replace IHE locks and tags with other more appropriate locks and tags. This will preserve the intent of IHE locks and tags as visual indicators only associated with IHE activities. The preferred method for placing equipment Out of Service is through Positive Physical Isolation (PPI).

Control of Work Documentation

9.	**Requirement:**	**Equipment-specific Energy Control Procedures (ECP) shall be developed, documented, and utilized for the control of potentially hazardous energy.** **a. ECPs are required for all Isolation of Hazardous Energy activities except for Exempt Isolations.** **b. ECPs shall include the following at a minimum:** **i. Scope, purpose, rules, and techniques to be utilized for the control of hazardous energy.** **ii. Sequential steps for shutting down, isolating, blocking, and securing equipment to control all hazardous energy sources.** **iii. Specific procedural steps and responsibilities for the placement, removal, and transfer of lockout devices or tagout devices.** **iv. Specific requirements for testing equipment to verify the effectiveness of the energy control measures.** **v. Sequential steps for de-isolation, re-energization, and return-to-service.** **c. Machines, equipment, systems, and/or processes with similar design specifications, controls, and the type and magnitude of energy can be grouped and covered**

	by a single ECP provided the criteria above is the same for each piece of equipment covered by the ECP. **i. Specific information about the equipment to be isolated shall be identified in the CoW documentation associated with the work.**
Guidance:	The Equipment-Specific Energy Control Procedure template or an existing Operating Procedure with startup & shutdown information will be used to record the steps that must be performed from shutdown through startup prior to commencing work on the equipment. Isolation diagrams (developed from Piping and Instrumentation Diagrams (P&ID), Process Flow Diagrams (PFD), Electrical One Line, etc.) should be considered for more complex isolations to validate that all isolation points have been identified and included in the steps for isolating the process, system, and/or equipment.
10. Requirement:	**Work Authorization shall be documented (e.g., Permit, Isolation Certificate) for all isolations except for:** **a. Own Isolations** b. **Exempt Isolations**
11. Requirement:	**Work shall be authorized in accordance with the Work Authorization CoW Technical Standard.**

Isolation Point Identification and Verification

12. Requirement:	**Isolation points identified in the ECP shall be locked and tagged and their status of isolation recorded prior to beginning work.** **a. JO shall have a procedure in place to verify that isolation points remain locked and tagged throughout the duration of the isolation (e.g., during revalidation of permits).**
Guidance:	Documentation of isolation points and their status may be accomplished in multiple ways (e.g., permit, Isolation Certificate, ECP, etc.). The isolation method utilized needs to be within the design limitations of the equipment to ensure the effectiveness of safety systems or equipment design/integrity is not compromised. Hydraulic, pneumatic and/or electrically operated valves need to be isolated and disconnected from their power sources, or otherwise made safe to prevent any possibility of the valve opening. Types of commonly approved valves for the purpose of controlling energy include: • Gate • Ball • Plug • Orbit

	• Needle • Double or triple offset butterfly (with owner acceptance) • Integrated double block and bleed (DBB) valves When actuated valves are used for isolation, the actuator mechanism needs to be isolated from all possible supply sources before work starts. The following types of valves are not used for effective isolation of equipment, plant, and systems: • Choke • Check • Globe • Control • Relief • Non-return (NRVs) Use of remote controlling equipment for electrical isolations may be prohibited, except during minor maintenance tasks where: • Exposure to rotating equipment is not a hazard • An approved procedure is utilized • Equipment is out of service for a short duration • Task is identified as a low risk/consequence • There is no direct exposure to potential energy if an accidental start was to occur (for example, rotating equipment, pump discharge, etc.) • The remote controlling equipment is tagged Out of Service for the duration of the task
13. Requirement:	**Isolation points that cannot be locked shall be tagged and recorded on the ECP, Isolation Certificate, or equivalent prior to beginning work.**
Guidance	JO should evaluate the potential risks associated with isolations points that cannot be locked, and only tagged. The process, system or equipment should be evaluated to determine if there are any isolation points upstream of the tag only point that can be secured via a locking device.
14. Requirement:	**Isolation points closest to the location of the work activity shall be identified on the ECP and secured.** **a. Where it is not feasible to secure isolations adjacent to the work location, a risk-based approach shall be utilized to evaluate, document, and approve the alternative isolation location.**
15. Requirement:	**When two or more work activities require isolation at the same point, isolation locks shall be affixed for each independent activity per each ECP.**

Lockout and Tagout Devices

16. Requirement:	**Lockout and tagout devices shall:**

	a. **Be marked with a distinct indicator that is standardized within a JO or facility identifiable by at least color, shape, or size.** b. **Be used only for the purposes of IHE activities.** c. **Withstand the environment to which they are exposed.** i. **Tagout devices shall be constructed to withstand exposure to weather conditions without deterioration of the tag or legibility of the message on the tag.** d. **Be durable.** i. **Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques (e.g., bolt cutters).** ii. **Tagout devices shall be constructed to prevent accidental or inadvertent removal.** e. **Have a suitable means of attachment.**
Guidance:	Red Isolation Locks will be the standard locks used to isolate equipment for maintenance.
17. Requirement:	a. **Tags shall display a message warning against hazardous conditions if the machine or equipment is energized.** b. **Tags shall legibly identify the name of the person that applied the lockout device and the date the device was applied to the equipment.**
18. Requirement:	a. **Isolation locks shall be uniquely keyed or keyed alike per lockbox.** b. **Personal isolation locks shall be uniquely keyed.** c. **JOs shall develop procedures to manage duplicate keys that are not controlled by the isolation (e.g., securing extra isolation keys locked in lockbox, having extra keys under the control of management, etc.).**
19. Requirement:	**Procedures for the use of lockout devices shall include requirements that address the following, at a minimum:** a. **Notification to Affected Personnel of the application and removal of lockout or tagout devices before controls are applied, and after they are removed from the equipment.** b. **Individuals protected by the energy isolating devices shall have control of the isolation and be notified of status changes.** i. **Personal locks and tags are used by only one authorized, documented individual.** ii. **Personnel shall be in control of their personal lock key (or code if using electronic lock) at all times.** c. **The order for applying and removing lockout devices.**

	d. Removal of lockout devices when the person(s) who applied their lock(s) is not available to remove their lock(s) including at a minimum: **i. Identification of the person authorized to remove the lock** **ii. Verification that the lock/tag owner is not at the location** **iii. Need for exhaustive effort to contact the Authorized Person to communicate removal of their lock/tag prior to the Authorized Worker resuming work at the facility** **iv. Defined approval chain and process**
Guidance:	A Red Lock Box must be used when more than one person is working. Complete the following steps in order: • Isolate the equipment using Red IHE Locks. Place each of those keys inside the lock box. • Once isolation is completed, Operations will affix a Red IHE lock and tag with name, date and job description to the hasp of the lock box for identification purposes. This will be the last lock removed from the Lock Box. • The Operations Rep assigned to the task will affix their Blue Personal Lock and tag with their name, date and job description to the lock box and retain the key. • Each worker will then place their own blue personal lock and tag with their name, date and job description on the lockbox and retain their personal key. • Once their task is complete, each worker will remove their personal lock & tag from the lock box. • The Operations Rep must then verify that all work has been completed before removing their personal lock. • Operations will remove their red IHE lock from the box to gain access to the keys for the isolation locks to allow for de-isolation.
20. Requirement:	**JOs shall develop a procedure for the management of blinds (spade, spectacles, blank flange, etc.) utilized for the purpose of isolating hazardous energy. At a minimum the procedure shall include:** **a. Methodology for the selection of blinds that are compatible with the service fluid and rated for the maximum expected source of energy (pressure, temperature, stresses, etc.) of the system in which they are to be installed.** **i. System to clearly identify/mark the size, material, and class rating on the blinds.** **ii. System to clearly differentiate between the types of blinds.**

	iii. **Mechanism to verify the condition and suitability of the blind(s) before installation.** b. **Mechanism to verify that blinds have been correctly installed (e.g., piping geometry, gasket selection, torquing)** c. **Mechanism to visually indicate that a blind has been installed at the isolation point.** d. **System to tag and track the installation of blinds within the facility/location.**
Guidance:	Air gapping/removable spools should also include a blind on the side of the process with source energy – see Blind Flange Selection Procedure & Appendix D. Blinds should be installed at locations as close as possible to the location of the work. A hazard analysis may need to be conducted to evaluate the hazards and mitigations necessary for the installation of the blinds. When not in use, blinds should be stored in a manner that does not compromise their integrity. If blinds (e.g., spectacle, spades, slip, paddle) are used, JO should have a system in place to quickly identify (e.g., shape of handle, holes in tail, ring) the type of blind installed.

Lockout Methods

21. Requirement:	**Personal Protection Lockout shall be the preferred and the first lockout method considered.** a. **The Alternative Group Lockout method shall only be used when Personal Protection Lockout methods are not feasible.** i. **JO shall define when the use of Alternative Group Lockout is allowed, and the level of management required to authorize its use.** ii. **If Alternative Group Lockout is used, JOs shall follow OSHA Instruction CPL 02-00-147 (located in the CoW Repository).**
Guidance:	Refer to Appendix F and G for illustrations of the types of Lockout Methods. Alternative Group Lockout uses an administrative system to track when personnel are working on the isolated system and is therefore less protective than the use of Personal Protection Lockout. As such, it should only be used after an assessment is conducted which determines Personal Protection Lockout is not feasible or practical.

	Protocols for multi-group isolations include, but are not limited to: • A single individual is responsible and accountable for the group lock and must be identified on the permit. • The single individual is responsible and accountable for the group lock and must account for and document all names of the individuals that are protected by the group lock on the IHE permit or on the equipment isolation checklist.

Verification of Isolation

22. Requirement:	**JO shall establish inspection procedures to verify that the isolation and de-energization of equipment, machinery or processes are adequate for safe work. Procedures shall be completed by qualified personnel and include at a minimum the following requirements:** **a. Potentially hazardous stored or residual energy shall be relieved, disconnected, restrained and otherwise rendered safe.** **b. Verification that the system has been appropriately isolated as described in the ECP, Isolation Certificate, or equivalent prior to authorizing work** **i. Subsequent verifications of isolation shall be conducted where there is the potential for re-accumulation of stored energy.** **ii. Refer to the Electrical Safe Work Standard for verification of isolated electrical systems.** **c. Confirmation of zero-energy state shall be part of the verification.** **i. If a zero-energy state cannot be demonstrated, a risk-based assessment shall be conducted to determine if any additional or alternative controls are needed.**
Guidance:	Isolation SWC and energization/ de-energization SWC shall be completed as a verification before and after isolation activities. The onsite Person Managing Control of Work must verify and validate, via signature, that all equipment is operational and ready to be placed back in service prior to closing out IHE permits.
23. Requirement:	**A procedure shall be in place to identify and mitigate the exposure to potentially hazardous conditions when opening equipment, pipelines, vessels, etc., based upon the operating conditions (e.g., process medium, pressure, temperature, etc.) prior to opening the process, system, and/or equipment.** **a. Line of Fire hazards shall be addressed and eliminated or mitigated.** **b. Gas testing shall be conducted in accordance with the Portable Gas Detection SHEERS Standard and local regulatory requirements.**
Guidance	The scope of the procedure should include:

	• The hazards related to carrying out draining, venting, purging and flushing (DVPF) and the necessary risk-reduction controls • The level of isolation necessary to allow DVPF activities • The required level of cleanliness and how to show/test that this has been achieved • The hazards related to opening process, system, and/or equipment for the intrusive work When performing DVPF activities where systems contain hazardous substances, remove the JOlk contents and, as necessary, cool, and clean away residual fluids and any solid deposits before breaking containment. Bleeds or vents are pipework connections that allow fluid to be drained or depressurized from the system. They enable safe depressurization of parts of the plant and are necessary to check the integrity of isolations. Inadequate provision and siting of bleeds or vents may compromise the safety of an isolation. Venting and draining will be needed prior to installation and testing of an isolation where: • A positive isolation is installed/removed. This intrusive work will require prior valved isolation, venting and draining; or • The isolation method, (e.g., double block and bleed (DBB)), requires removal of the fluid to prove integrity of the isolation. Caution should be taken with removal of hazardous substances to prevent further hazardous conditions including but not limited to: • Overloading the drains and/or vent systems. • Inadvertent/uncontrolled ingress of air into pipework and equipment. • Formation of ice/hydrates. • Creating a vacuum in vessels not designed for the purpose.
24. Requirement:	**Opening piping and equipment for the purpose of installing Positive Physical Isolation (PPI) shall have verified valve isolation prior to approval of work.** **a. Where verified valve isolation is not practical, a risk assessment shall be conducted to determine the appropriate controls to prevent exposure.**
Guidance	The initial isolation is of relatively short duration, and it enables the insertion of a positive isolation after the equipment that is downstream of the initial isolation has been depressurized and purged.

Other Requirements

25. Requirement:	**JO shall have a procedure in place to effectively control exposure to hazards when removing energy isolating devices and/or tagout devices to temporarily re-energize the isolated equipment. The procedure shall include the following requirements:**

	a. **The Hazard Analysis shall consider potential exposures to hazardous energy associated with this activity.** b. **All work not associated with the activity (e.g., testing, positioning) shall stop and not recommence until equipment has been validated as re-isolated.** c. **Tools and equipment are removed from any areas that may involve moving parts.** d. **All personnel are safely positioned or removed from the isolated system.** e. **Energy isolating devices and locks are removed as specified in this standard.** f. **All affected parties are notified and of the change in isolation state.** g. **Changed isolation points are tracked to ensure they are returned to the isolated state after completion of the required work/tests.** h. **The process, system, and/or equipment has been verified deenergized and energy controls measures have been reapplied.** i. **Energy isolation devices and locks are re-applied as specified in this standard.** j. **All affected parties are notified when the equipment has been re-isolated.**
Guidance:	The testing or positioning of isolated equipment is commonly referred to as: • Sanction to Test • De-isolation for Test It is often used to test for rotation or polarity, or to confirm equipment was correctly installed.
26. Requirement:	**JO shall establish procedures to inspect and verify that equipment is safe to be de-isolated and returned-to-service including Line of Fire hazard elimination or mitigation.**
Guidance:	The Isolation of Hazardous Energy Start Work Check shall be utilized for the verification.
27. Requirement:	**Audits/reviews shall be performed to ensure that templated/library ECPs are accurate, implemented properly, and that employees are familiar with their responsibilities under these procedures.** a. **JOs shall establish a frequency for conducting the audit/review of templated/ECPs in alignment with frequencies established by regulatory requirements, industry standards, or Joint Operations best practices.** b. **Audits/reviews shall be documented and include at a minimum:** i. **Observation of implementation of isolations per the applicable ECPs by authorized persons.**
Guidance	Periodic Inspections of the Energy Control Procedures should:

		• Be conducted at least annually to ensure the procedure and the requirements of this standard are being followed. • Be performed by trained, competent, and authorized persons. – The person conducting the inspection should not be the same person that is utilizing the ECP being inspected. • Identify the process/system/equipment on which the ECP was being utilized, the date of inspection, employees included in the inspection, and person performing the inspection. • Evaluate each authorized employee against their responsibilities under the procedure being inspected. – Evaluate the communication between persons applying the ECP and those affected by the isolation. • Correct any identified deviations and inadequacies. The inspection may include a sampling of ECPs grouped by equipment type, as well as a sampling of employees demonstrating their competency implementing them. • If this sampling method is utilized, the results of the sampling should be summarized and shared with all JO employees with roles associated with this procedure group or equipment type, including any gaps / areas of emphasis for improvement identified.
28.	**Requirement:**	**Personnel conducting activities associated with the isolation of hazardous energy shall be authorized to do so and shall meet the training and competency requirements that apply to their roles, in accordance with the Training and Competency Standard.**
29.	**Requirement:**	**Documentation associated with the isolation of hazardous energy shall adhere to the record retention requirements detailed in the Control of Work SHEERS Process.**

Appendix A: Terms and definitions

Term	Definition
Blind/Spade/Blank Flange	A circular metal plate used to block the flow path in a pipeline that is bolted between two pipe flanges. The circular plate must have a portion attached that extends outside of the pipeline to show that a blind/spade is installed. Typically, either a “pancake blind” (sometimes called a "skillet blind”) or “spectacle blind’ is used. The blind/spade must be designed for the full, maximum design pressure of the equipment into which it will be installed.
Boundary Isolation / System Isolation	Applying a means of isolation at every point of the boundary /system. Typically, such isolation is used on plant maintenance shutdowns or ‘turnarounds’ where the inventory of hazardous fluids is removed. Isolation of the boundary prevents re-pressurization of the system by, or ingress of hazardous materials from, any adjacent live process systems.
Double Block and Bleed	Either a special valve or a combination of valves that close a line, duct or pipe by closing (blocking) the main line and opening a drain or vent valve in the line between the two closed valves to bleed off pressure.
Energy Isolation Device	A device that physically prevents the transmission or release of energy, including but not limited to the following: • Manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently. • Valves • Spades, spectacle blinds • Physical disconnection • Blocks and any similar device used to block or isolate energy • Push buttons, selector switches and other control circuit type devices are NOT energy isolating devices
Exempt Isolations	Isolations that meet a pre-determined set of criteria. Exempt isolations provides a level of concession from having to develop an Energy Control Procedure in order to implement the isolation. In order to qualify as an exempt isolation, all of the following criteria shall be met: 1. The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shut down which could endanger employees. 2. The machine or equipment has a single energy source which can be readily identified and isolated. 3. The isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment. 4. The machine or equipment is isolated from that energy source and locked out during servicing or maintenance. 5. A single lockout device will achieve a locked-out condition. 6. The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance.

Term	Definition
	7. The servicing or maintenance does not create hazards for other employees. 8. The employer, in utilizing this exception, has had no accidents involving the unexpected activation or re-energization of the machine or equipment during servicing or maintenance.
Alternative Group Lockout	Singularly identified isolation lock(s) placed on the isolation point(s). The keys to the isolation lock(s) are placed inside of an isolation lockbox (or similar device) and Isolation Lock identifies the persons working behind the isolation and utilizes administrative controls to identify and protect each worker under the protection of the Isolation Lock.
Hazardous Energy	Any of the following energy forms: • Electricity • Kinetic energy (energy of a moving object or materials) • Potential energy (stored energy that an object has the potential to release) • Pressurized liquid or gases, including air • Chemical energy • Thermal energy • Mechanical energy • Hydraulic energy • Pneumatic energy • Radiation
Isolation	The process that segregates the hazardous energy or toxic substance from the recipient. This may be achieved by a number of methods such as blinding, electrical isolation or positive physical isolation.
Isolation Lock	A lockout device that is used for locking energy isolation devices in the state that prevents the transmission or release of energy.
Isolation Tag	A device used to identify an isolation point and to indicate the reason for the isolation. Tags warn workers not to operate the tagged item. Each tag must indicate when it was fitted and who fitted it.
Lockout	The process by which a lock is used to secure a device in the “off” or “safe” position ensuring that the isolating device and equipment being controlled cannot be operated until the lockout device is removed.
Lockout Device	A device that utilizes a positive means such as a lock, either key or combination type, to secure an energy isolating device in the safe position and prevent the inadvertent energization of a system or equipment. Included are blank flanges and bolted slip blinds.
Multi-lock hasp	A device used in the isolation of hazardous energy to apply multiple locks.
Out of Service	A device or component is out-of-service (OOS) when it is not being used to perform its intended function, and it is properly isolated by the approved isolation method.
Own Isolation	Isolation where the same person both installs the isolation and carries out the intrusive work. Such isolations may be carried out under work authorization with an energy control procedure. Own isolations require that:

Term	Definition
	• Isolation, intrusive work, and reinstatement are carried out by the same person; and • That person is competent to perform the isolation, to undertake the task and to reinstate the equipment; and • The isolation points are identified, secured, and under the control of the competent person (own isolator), who is continuously present at the worksite while the system is open; and • Communication with any appropriate control room or operating unit (e.g., by radio) is available throughout the task. The separation of the isolation activity and intrusive work is usually performed by two (or more) separate persons/groups managed by the work authorization arrangements. For own isolations, the same person implements the isolation and performs the intrusive work. Own isolations normally fall into the following types: • Routine plant operator activities, for example: – Removing, cleaning and reinstating filters from pressure envelopes – Process sampling • Third party maintenance of specialist vendor kit • Isolation of instrument systems for maintenance where these are designed to be isolated from process plant streams Typically, this might include transmitters, impulse lines, sight-glasses, analytical instruments, and gauges.
Personal Isolation Lock	A lockout device that is used for protecting a person from inadvertent transmission or release of energy while performing break-in work on a system or piece of equipment.
Personal Protection Lockout Methods	• Isolation Point – Person breaking-in or performing work on an isolated system or equipment place their own personal lockout device (personal isolation lock) and fully documented personal isolation tag at all identified isolation point(s). • Group Lockout – Singularly identified isolation lock(s) placed on all identified isolation point(s). The keys to the isolation lock(s) are placed inside of an isolation lockbox (or similar device) under the control of the function that placed the isolation lock(s). Person(s) breaking-in or performing work on an isolated system place their own personal lockout device (personal isolation lock) on the isolation lockbox (or similar device).
Positive Physical Isolation (PPI)	An isolation where there is zero potential of an energy release. That is, equipment is positively separated from the hazardous energy and toxic substance using one of the following methods: removal of a section (spool) of piping; physical removal of a circuit breaker and grounding (earthing) the system; removal of mechanical couplings; or blinding.
Tag-Out	The process of attaching a tag at each isolation point to warn personnel not to operate the tagged item until the tag is removed.
Tagout Device	A warning device, such as a tag, that is securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Term	Definition
Unverified Valve Isolation (UVI)	In reference to the Isolation of Hazardous Energy, UVI involves a system that does not have a means of verifying (bleed or vent) that a valve is sufficiently holding to allow for safe opening of piping and equipment. A check valve, filter or other similar obstruction between the primary valve and the bleed is considered unverified valve isolation.
Verified Valve Isolation (VVI)	In reference to the Isolation of Hazardous Energy, VVI involves a system that includes a bleed or vent that can be used to verify that a valve is sufficiently holding to allow safe opening of piping and equipment. A check valve, filter or other similar obstruction between the primary valve and the bleed is not considered verified valve isolation.
Zero Energy State	The maximum protection against unexpected movement or activation of equipment or machinery, release of stored pressure, or flow of liquid or gas when maintenance or repair is performed.

Appendix B: Roles and responsibilities

Role	Definition	Responsibilities
Affected Personnel	Persons whose job requires that they operate or use a machine or equipment on which servicing, or maintenance is being performed under lockout or tag-out or whose job requires that they work in an area in which such servicing or maintenance is performed.	• Knowledgeable about potential sources of hazardous energy • Understands the planned work and emergency notification procedures • Understands when to stop work
Authorized Personnel	Individual(s) who are authorized by the JO to lock out or tag-out machines or equipment to perform servicing or maintenance on that machine or equipment or have inspection roles and work authorizations. Specifically, the individuals: • Are trained for their assigned task according to written guidelines. • Are competent for their assigned task according to written guidelines. • Monitor and use Stop Work Authority and/or Management of Change should conditions fall outside of the original scope of work	• Knowledgeable about potential sources of hazardous energy • Understands the planned work and emergency notification procedures • Confirms that system is isolated as described on Equipment Isolation Checklist • Witness the verification of zero energy for an isolated system • Places group / craft locks on isolated systems to assure the system remains isolated for the duration of the planned work • Removes group / craft lock only when all crew personal locks (or equivalent alternative) have been removed and the planned work is complete • Understands when to stop work

Appendix C: References

American Petroleum Institute (API)

Recommended Practice 54	Occupational Safety and Health for Oil and Gas Drilling and Production Operations
Recommended Practice 75	Safety and Environmental Management System for Offshore Operations and Assets
Recommended Practice 76	Contractor Safety Management for Oil and Gas Drilling and Production Operations

Health & Safety Executive

HSG 253	The Safe Isolation of Plant and Equipment

International Association of Oil & Gas Producers (IOGP)

ISO 45001:2018	Occupational health and safety management systems - Requirements with guidance for use

National Fire Protection Association

NFPA 70E	Standard for Electrical Safety in the Workplace

Occupational Safety & Health Administration (OSHA)

OSHA 29 CFR 1910.147	The Control of Hazardous Energy (Lockout/Tagout)
CPL 02-00-147	The Control of Hazardous Energy – Enforcement Policy and Inspection Procedures

U.S. Department of Energy

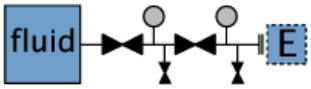
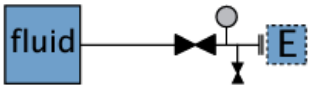
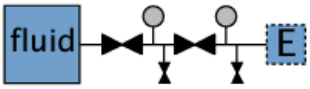
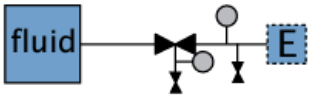
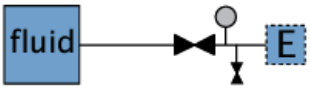
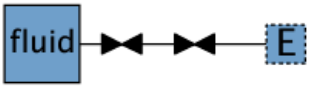
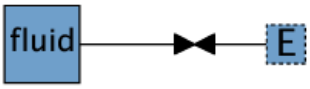
DSHEERS-HDBK-1028-2009	Human Performance Improvement Handbook

Appendix D: Isolation methods

Source: HSG 253 The Safe Isolation of Plant and Equipment

The table below provides a breakdown of the features and methods within each of the three categories of isolation methods. Within each category, illustrative examples of each method are provided to depict a schematic of how the energy sources are isolated.

Within each category, the methods listed do NOT all provide an equivalent degree of security. There is a hierarchy of security for the categories, as well as the methods within each category.

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

Key:

Live system

Equipment/process system to be isolated

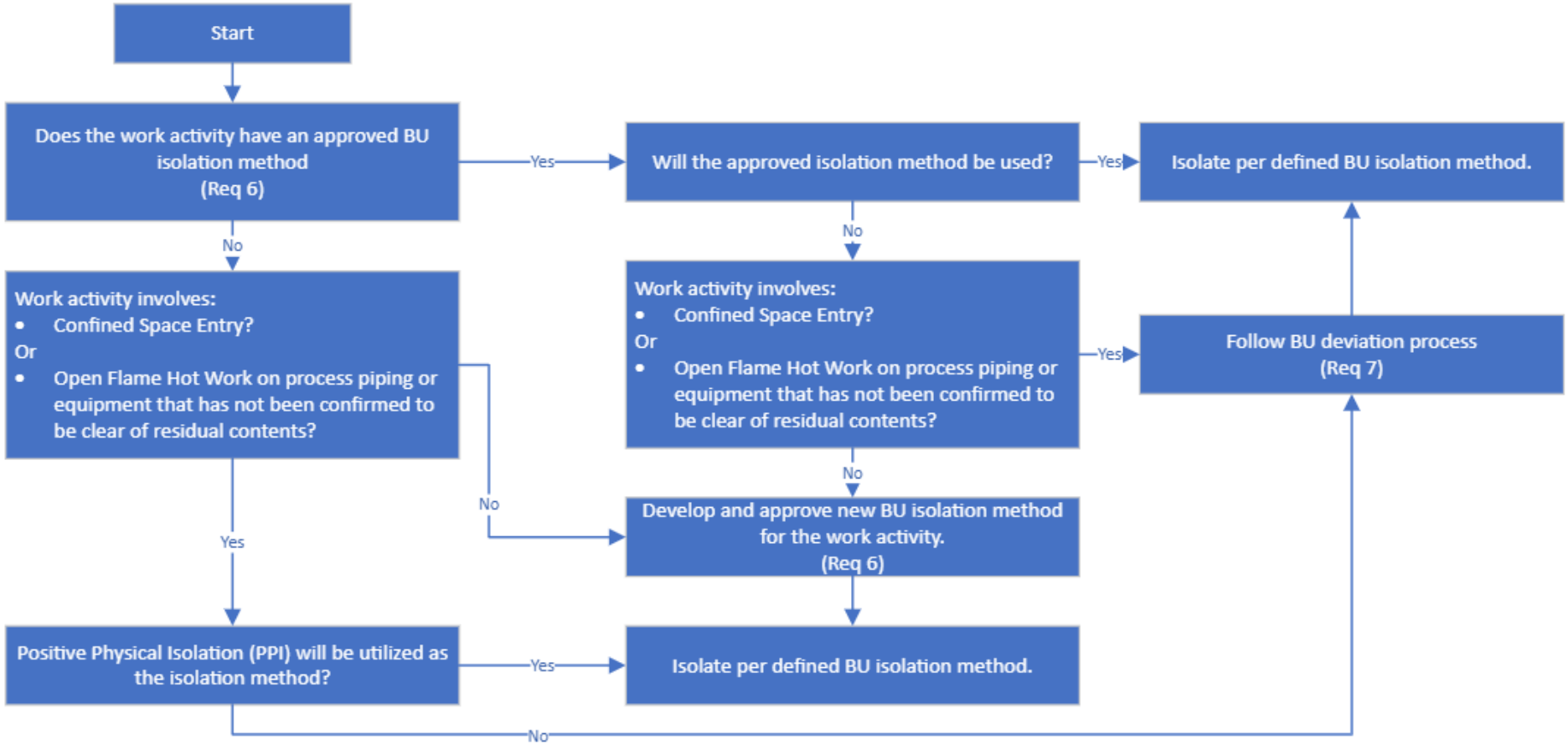

Block valve (closed)

Vent or bleed (valve position should be determined by risk assessment)

Blank flange or spectacle plate

Pressure monitoring facility

Appendix E: Isolation method determination flowchart



Appendix F: Lockout Methodologies

The illustrations below depict common types of lockout methodologies. The colors DO NOT represent any trade/function/craft but are used to illustrate that multiple locks are being placed.

Personal Protection Lockout Methods

Personal Lock at Isolation Point – Persons performing work on an isolated system utilize a device, like a multi-lock hasp, to secure their personal lock and tag to the energy isolating device(s) at the identified isolation points.

Group Lockout – Singularly identified isolation lock(s) are used to secure energy isolating devices(s) at the identified isolation points. The key(s) to those lock(s) are secured in lockbox(es), to which persons performing work on an isolated system affix their personal lock and tag.

Alternative Group Lockout Method

Group Isolations - Persons performing work on an isolated system are protected by a lock placed by a single authorized person who is responsible and accountable for the lockout, including the administrative controls to identify and protect each worker under the isolation.

OR

plus, Administrative Controls

This Isolation of Hazardous Energy Matrix provides a sampling of activities that could occur at a facility and shows acceptable isolation methods for each.

Activity	*Single (or Double) Isolation Valve(s)*	*Double Block and Bleed*	*Positive Physical Isolation*	*Comments*
Confined Space Entry – in spaces that can be exposed to Hydrocarbons	*Not Allowed*	*Not Allowed*	*Required*	*Requires a CSE Permit.*
Spool piece removal and installation (ICP) containing hydrocarbons	*Allowed with Operations Representative in attendance when Double Block and Bleed is not feasible*	*Preferred Method* *Allowed with Operations Representative in attendance*	*Required if left unattended*	*Verify that valves are holding and Operations Representative in attendance*
General Hot Work	*Not Allowed*	*Acceptable – Operations must verify isolation and lock and tag block and bleed valves*	*Preferred Method*	*Piping/Equipment must be clean (hydrocarbon free) before start of hot work. A monitoring plan must be in place during Hot Work to detect hydrocarbon vapors.*
Hot Work In and On hydrocarbon containing vessels and tanks	*Not Allowed*	*Not Allowed*	*Required*	*Hot Work on a vessel requires specialized requirements and potentially a CSE Permit if entering the vessel.* http://laf-ctnau.chevron.com/manuals_gom/documents/Hot_Work_In_and_On_Vessels-Guidance_Document_Official_7-15-10.docx
Valve Replacement	*Allowed with Operations Representative in attendance when Double Block and Bleed is not feasible*	*Preferred Method* *Allowed with Operations Representative in attendance*	*Required if left unattended*	*Verify that valves are holding and Operations Representative in attendance*

Positive Physical Isolation

A state where the equipment is positively separated from the hazardous energy and toxic substance by use of one of the following methods (may also be referred to as "Daylighting" or "Air Gapping" in some locations):

- *Removal of a section (spool) of piping and isolation with blind flanges*
- *Disconnection and/or physical removal of a circuit breaker and grounding (earthing) the system*
- *Removal of mechanical couplings*
- *Use of spectacle blinds*
- *Use of spade/skillet blinds with spacers*

Double block and Bleed
Two non-leaking valves in a series that are closed, locked and tagged with the pressure between the valves bled through a locked open and tagged vent line directed to a safe location.

Double Block
Two non-leaking valves in a series that are closed, locked and tagged.

Single Valve Isolation A single, closed, locked and tagged, non-leaking block valve used to isolate pressure.

Appendix G: Alternative Group Lockout Structure

Diagram A Depicts Alternative Group Lockout with one crew involved in the work. The craft/crew performing work behind the isolation are protected by locks placed at the isolation points by a single authorized person (or, with the authorized person's key on a lockbox controlling the isolation point lock keys) who utilizes administrative controls to monitor and be responsible for the persons working behind the isolation. An example of when this could be applied, is during pipeline repair along a right-a-way between isolation points that are a significant distance apart.	**Diagram B** Depicts Alternative Group Lockout with multiple (3) crews involved in the work. The crafts/crews performing work behind the isolation are protected by locks placed at the isolation points by the a single authorized person for each crew (or with the authorized person's key on a lockbox controlling the isolation point lock keys) who utilizes administrative controls to monitor and be responsible for the persons working behind the isolation; overall oversight of the isolation is managed by an individual person that coordinates with the authorized persons of the multiple group isolations to ensure the continuity of protection of all affected workers. An example of when this could be applied, is during turnaround activities.