1.0 BACKGROUND & PURPOSE

1.1 The prevalence of hazardous energy in the workplace warrants a broad application of specialized equipment, construction methods, and safe work practices to prevent incidents, especially serious injuries or fatalities (SIF). Providing personnel with proper training focused on hazard recognition, High Energy hazard and Direct Control prioritization, and the control or "isolation" of energy will reduce the risk of such incidents.

1.2 Per OSHA regulation, *"The employer must develop and document procedures and techniques to be used for the control of hazardous energy."* Additionally, OSHA 1910.147(a)(3) states *"Purpose - This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start-up or release of stored energy in order to prevent injury to employees."*

1.3 This document is not intended to be used as a finished program or procedure. This guidance does not address design activities, nor does it address all options available for the activities described.

1.4 The guidance in this document is not intended to supersede or replace, nor be all inclusive of the applicable regulatory requirements. The content is intended to be supportive and complementary to such requirements.

1.5 All "Must" or "Shall" statements contained in this document reflect a regulatory requirement by OSHA or an enforced industry standard. Other guidance in this document is based on industry best practice and consensus input from the membership.

2.0 SCOPE

2.1 The scope of this guideline is to provide information to aid in the development of an **Energy Isolation** process that supports a Control of Work Program (CoW) and fosters a workplace for personnel that is free from unacceptable risk resulting from working with or around uncontrolled hazardous energy.

2.2 High Energy Control Assessments (HECA) are specifically designed to prevent Serious Injuries and Fatalities (SIF). In this context, Energy Isolation methods such as Lockout/Tagout (LOTO) may be classified as Direct Controls. As a Direct Control, LOTO measures ensure that energy cannot be accidentally released during ongoing work by isolating energy sources through the physical locking of energy isolating devices (such as manually operated circuit breakers, disconnect switches, or valves) along with the attachment of prominent tags that warn others not to operate the machine or equipment.

2.3 A Control of Work Program contains the components of the safety management system that assess and define access and control of certain tasks based on risk and the hazards associated with the task. Control of Work processes ensure that the correct personnel execute higher risk tasks such as working in confined spaces, welding, brazing, electrical work, and work around energized systems.

2.4 The type of isolation and supporting processes will vary from company to company and even between disciplines within the same company. Performing a proper risk assessment to understand and mitigate the hazards is critical.

2.5 This guideline provides some specifics for isolating machinery, equipment, vessels, piping, process systems, and electrical circuits from sources of potential energy. This guideline also defines the methodology and the required documentation for securing hazardous energy sources during maintenance and construction activities.

2.6 Energy Isolations must be conducted in accordance with Company and governmental regulatory requirements for protection of personnel, health, safety, and the environment, while maintaining equipment compliance and reliability.

2.7 The responsibility for the control of hazardous energy should be delegated to someone with a complete knowledge of energy-related hazards, safe work practices, and the appropriate standards for installation and performance.

3.0 DEFINITIONS

3.1 Definitions per OSHA 1910.147 - The Control of Hazardous Energy (Lockout / Tagout) and industry best practice.

(Area Authority, Isolating Authority, and Task Owner are generic terms to group levels of responsibility and may be absorbed into a specific role's responsibilities without using these names)

3.2 **Affected employee**. An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

3.3 **Area Authority.** The Area Authority function may be performed by Management. This function must ensure no employee is permitted to operate, maintain, isolate, or return to service, any equipment unless they have received the appropriate training and been deemed competent. The Area Authority also is responsible to assign an Isolating Authority to develop isolation plans, authorize isolation and return to service plans, assign an Isolating Authority to assist in the risk assessment of isolation procedures, and perform inspections of operation's

compliance with isolation and return to service requirements as part of regular supervisory oversight.

3.4 **Authorized employee**. A person who locks out or tags out machines or equipment to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

3.5 **Capable of being locked out**. An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

3.6 **Direct Control**. A barrier that is specifically targeted to the high-energy source; effectively mitigates exposure to the high-energy source when installed, verified, and used properly; and is effective even if there is unintentional human error during work that is unrelated to the installation of the control.

3.7 **Energized.** Connected to an energy source or containing residual or stored energy.

3.8 **Energy isolating device.** A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

3.9 **Energy source**. Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

3.10 **High Energy Hazard**. A hazard that exceeds 1500 Joules (roughly 500 foot-pounds) of physical energy and is most likely to cause a serious injury or fatality if an employee contacts the energy.

3.11 **Hot tap**. A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels, or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

3.12 **Isolating Authority.** The Isolating Authority is the employee responsible for developing the isolation plan and lockout log for the system or equipment to be

isolated. This employee also is responsible for implementing the isolation plan, ensuring that all energy sources are controlled. The Isolating Authority must be competent in operations equipment, the requirements for isolation, and return to service. Additionally, they must demonstrate the integrity of the isolation as required, witness the insertion and removal of blinds when required, and bring any isolation problems to the attention of the AREA AUTHORITY.

3.13 **Lockout.** The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

3.14 **Lockout device**. A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

3.15 **Normal production operations**. The utilization of a machine or equipment to perform its intended production function.

3.16 **Servicing and/or maintenance**. Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

3.17 **Setting up.** Any work performed to prepare a machine or equipment to perform its normal production operation.

3.18 **Tagout.** The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

3.19 **Tagout device.** A prominent warning device, such as a tag and a means of attachment, which can be 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.

3.20 **Task Based Risk Assessment (TBRA).** A structured process to identify the hazards and specify actions to mitigate these hazards for a work activity or task.

3.21 **Task Owner.** The employee performing the work on the isolated system / equipment. This employee must understand the work to be undertaken, the isolation, and all applicable Lock Out / Tag Out (LOTO) requirements. The Task

Owner must also inform all affected workers of the isolation and LOTO requirements, adhere to all isolation instructions and requirements, and Stop Work if the isolation plan is violated or inadequate.

4.0 ROLES AND RESPONSIBILITIES

4.1 **Management Responsibilities** (Includes all personnel with a supervisory role)

4.1.1 Show commitment to a Control of Work (CoW) Program by leading the development and sharing of the hazard assessments, JSA's and any other applicable tool, including actions to confirm that:

- The scope of work is reviewed thoroughly
- All High-Energy (life-threatening) Hazards are identified and emphasized per CS-G-9, “Guidance for Serious Injury and Fatality Prevention”.
- Direct and Alternative Controls are identified for all High Energy hazards. When a Direct Control is unapplicable, unfeasible, or absent, an Alternative Control is implemented.
- All other hazards are identified and analyzed, and relevant controls were implemented to mitigate or eliminate the hazard.
- Hazard and control information are shared with all affected personnel.

4.1.2 Ensure that ALL personnel associated with or affected by the process have a means to give feedback and share improvement opportunities

4.1.3 Ensure that adequate resources are available to execute the program.

4.1.4 Ensure that applicable on-site personnel have proper training and acquire the understanding, knowledge, and skills necessary for the safe performance of their responsibilities.

4.1.5 Conduct appropriate reviews and revisions to the hazard assessment, SSSP, JSA's, and all other applicable supporting documents to ensure that all hazards are identified and communicate any changes to pertinent field personnel as applicable. Prioritize and highlight High Energy Hazards and Direct Controls.

4.1.6 Contribute to continuous improvement of this process by ensuring the periodic review of all applicable supporting documents and the execution of process.

4.1.7 Perform objective assessments on the quality of preparation and communication of all guidance relative to the control of potentially hazardous energy.

4.2 Health and Safety Personnel Responsibilities

4.2.1 Assist with developing the hazard assessment, SSSP, JSA's, and all other applicable supporting documents, including but not limited to providing technical support.

4.2.2 Perform periodical audits of the hazard assessment, SSSP, JSA's, and all other applicable supporting documents to ensure proper application of Energy Isolation processes.

4.2.3 Effectively use hazard identification and monitoring tools (i.e., Energy Wheel, High Energy Hazard icons, HECAs) per CS-G-2, “Job Safety Analysis”.

4.2.4 Review Direct Controls for all identified High Energy Hazards. Report any cases where Direct Controls are unapplicable, unfeasible, or absent to assess vulnerability to life-threatening hazards.

4.2.5 Review mitigations to other identified hazardous energy.

4.2.6 Assist Management/Supervisors in the development/enforcement of Safe Work Practices (SWPs), Training Programs, and compliance with applicable regulations.

4.3 Employee Responsibilities

4.3.1 Be Fit for Duty when performing any role.

4.3.2 Review the SSSP and JSA prior to entering a site / project (where applicable).

4.3.3 Abide by all guidance in the SSSP and JSA applicable to the work scope / site.

4.3.4 Participate in the development and communication of SSSP’s and JSA's, as applicable to assigned tasks and job responsibilities.

4.3.5 Continuously review, identify, assess, and monitor High Energy Hazards and the condition of implemented controls in their work area.

4.3.6 Immediately notify supervisor of any unsafe conditions or acts that may be of danger to workers or others.

4.3.7 Review SSSP’s and JSA's when conditions change (e.g., weather, scope of the task, nearby activity), and make appropriate changes to potential hazards and/or control measures.

5.0 HAZARD ASSESSMENT

5.1 **Hazard/Risk Assessment.** The level of risk associated with a particular job / task that is on or near energized lines/parts/equipment drives the need for the necessary level of hazard analysis, work planning, authorization, and direct field supervision.

5.2 **High Energy Hazard.** Electrical sources exceeding 50 volts and arc flashes are High Energy Hazards, where contact with the human body is highly likely to result in serious injury or fatality.

5.3 When conditions are associated with electrical hazards, refer to the **CS-S-4 Electrical Safety Guideline** for detailed steps on risk assessment relative to electrical hazards.

5.4 The risk assessment procedure shall address employee exposure to hazards and shall identify the process to be used by the employee before work is started to carry out the following:

- Identify all hazards associated with the full work scope, prioritize High Energy Hazards.
- Ensure all applicable Direct Controls are implemented. For High Energy Hazards without applicable, or feasible Direct Controls, ensure Alternative Controls are in place.
- Practice Safe Work Authority per CS-G-4, “Site Specific Safety Plans (SSSP)” to stop any work activity that is perceived to be unsafe.
- Implement Direct, Alternative, and Critical controls as applicable per CS-G-9 for all High Energy Hazards.
- Implement controls and mitigations for all other hazards per “Hierarchy of Controls” model.

5.5 The risk assessment procedure requires that all High Energy Hazards and applicable Direct Controls are identified. If a Direct Control is absent and cannot be feasibly installed, ensure Alternative Controls are implemented.

5.6 All other identified hazards should be mitigated using preventive and protective risk control methods in accordance with the "Hierarchy of Controls" model.

5.7 Once a hazard is identified (i.e., exposed electrical parts) the employer, “Shall verify that the required workplace hazard assessment has been performed through a written certification that identifies” [see OSHA 1910.132(d)(1)]:

- the workplace evaluated,
- the person certifying that the evaluation has been performed,
- the date(s) of the hazard assessment, and

- identifies the document as a certification of hazard assessment.

6.0 HAZARD MITIGATION / CONTROL

6.1 **Direct Controls.** Specifically defined to prevent the release of High Energy Hazards, Direct Controls are defined to meet the following criteria.

- **Targeted:** It specifically addresses and mitigates a high-energy hazard, directly preventing exposure to the hazard.
- **Robust:** It remains effective when properly installed and verified, ensuring protection even in the presence of human error.
- **Reliable:** It consistently functions as intended without relying on administrative controls or procedural adherence, thereby providing a dependable safeguard against serious injury or fatality.

6.2 **Hierarchy of Risk Control Methods.** To prevent and mitigate hazards, controls must be tailored to the work being performed, the risk of harm posed by the work, and the extent or degree of harm that could occur while performing the work. This tailoring of controls to hazards based upon risk is generally referred to as the "graded approach." The priority must be the elimination of the hazard; each method that follows it is considered less effective than the one before it.

The preferred hierarchy of controls is:

- Elimination/Substitution: Removing the hazard completely or replacing the hazard with a less dangerous alternative.
- Engineering controls – Implementing physical changes to the workplace or equipment to reduce exposure to the hazard (i.e., guards)

  Administrative controls* - Changing work practices or procedures to reduce risk. Administrative controls include restricted access to qualified workers, documented safe work plans/practices, and implementation of a safe work condition through use of an Energy Isolation process (Lockout/Tagout).
- Personal protective equipment (PPE) – Providing safety gear (i.e., gloves, hardhat, safety glasses).

6.3 **Energy Isolation Procedure**

6.3.1 Procedures shall be developed, documented, and utilized for the control of potentially hazardous energy.

6.3.2 Energy isolation de-energizes equipment so that others cannot start, energize, or use it while personnel are installing, servicing, repairing,

modifying, or inspecting equipment. Hazardous energy sources that must be isolated include, but are not limited to:

- Chemical
- Electrical
- Biological
- Hydraulic
- Mechanical
- Potential
- Pneumatic
- Radiation
- Pressurized Liquids/Gases
- Thermal

6.3.3 General considerations include:

- When isolating energy sources to prepare for work on equipment, record all isolations on an Isolation Log.
- Outside energy sources (e.g., Chemical - Nitrogen) cannot be introduced while equipment is isolated without a Task Based Risk Assessment (TBRA).
- Refer to the Electrical Safety Guideline for requirements of Electrical Isolations

6.3.4 Energy Isolation Procedures should address all types of isolation that could be required for normal operations and maintenance as well as construction. Additionally, the procedure should contain language to address isolations that do not fall into the normal or routine category.

6.3.5 **Documentation**

Required documentation may include the following based on the task and risk:

- Procedures for the control of hazardous energy including shutdown,
- Equipment isolation,
- Lockout/tagout application,
- Release of stored energy,
- Verification of isolation,
- Documented periodic inspections,
- Documented training,
- Identify the specific types of energy to be controlled,
- Identify type and location of specific equipment covered by the common procedure,
- Identification of the energy to be controlled by magnitude and type of energy,

- A hazard analysis or other basis on which the program related to the standard was developed.

6.3.6 Complex Isolations

An isolation that includes one or more of the following high-risk activities is classified as a complex isolation and may require additional approvals prior to the start of work. Examples:

- Permit Required CSE.
- Line Break (not clear).
- Electrical sources greater than 600 volts.

Criteria for complex isolations should be defined to include level of approval required for the acceptance of the Isolation Plan

6.3.7 Single Point Isolations (Simple Isolation)

Single Point Isolations include work on a piece of equipment that has a single energy source and a single lockout device. Work can proceed without an Isolation Supplemental Permit, Isolation Log and Lockbox. The Isolating Authority determines which isolations are classified as Single Point Isolations. Single Point Isolations can be used for:

- Operational and maintenance tasks where the TASK OWNER is the person installing the isolation, and where isolation is required for no more than a single shift.
- If single point isolation goes beyond one shift, then an isolation plan and Supplemental Permit is required.

Single point isolations must conform to the following:

- TASK OWNERs must be present while task is in progress or isolation is in place. If necessary, the TASK OWNER may leave worksite for short interruptions, provided the isolation is left in a safe condition (i.e., lock remains, with all covers, caps, blanks or barriers in place).
- Isolator always remains within view of the isolation.
- Isolation points are identified and clearly documented on the Job Safety Analysis (JSA).
- Isolation integrity is proven (refer to Section 6.4.8) before starting task.
- If required, verify that any other required permit is in place prior to single point isolation.

Single point isolations are not allowed on:

- Equipment fed from more than one source.

- Isolations that require multiple disciplines.
- Equipment with operating pressure greater than 150 psi.
- High voltage equipment (greater than 600 volts).

6.4 Isolation Planning

6.4.1

Prior to conducting work on equipment, systems, or piping, energy sources must be isolated and verified safe. The ISOLATING AUTHORITY shall verify isolation points have been identified, isolation plan developed, and Isolation Log completed. Obtain all required permits prior to conducting job activities including, at a minimum, a General Work Permit (GWP), JSA, and Isolation Permit (if applicable).

Machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees because of the equipment stoppage.

6.4.2 Isolation Permitting

Isolations should align with company Control of Work guidance including Permit to Work processes. The presence of an Isolation Permit does not eliminate the need for any other work permits or a JSA for any work being conducted behind an isolation.

When risk assessments are done in connection with energy isolation, they must identify each form and source of energy that may impact the work process. Electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy must be considered in a systematic manner to assure that the necessary controls are established and implemented.

6.4.3 Field Checks

Equipment and process lines requiring isolation shall be field checked during the planning process. Field checks may be done during the risk assessment walk down if the job requires a TBRA. The purpose of the field check is to confirm the accuracy of reference drawings and assist in identifying other hazards that may need to be managed, including:

- Access to isolation points.
- Serviceability of isolation points.
- Hazards related to draining / depressuring / inerting etc.
- Logistical/ergonomic issues etc.
- Test requirements.
- Simultaneous Operations (SIMOPS).
- Any other pre work requirements.

6.4.4 Verification of Isolation

In addition to the field checks conducted by the ISOLATING AUTHORITY, the IA and the TASK OWNER must field verify the integrity of the isolation during the walk down before issuing the GWP that authorizes the work crew to break the line open. The IA will also confirm that nearby work activities do not present a SIMOPs hazard. The Isolation Log details the isolation points required for each GWP and serves as the guide for the walk down by the IA and TASK OWNER.

6.4.5 Zero Energy Integrity Testing

The IA will confirm that the system is at a zero-energy state before issuing the GWP for line breaking. Zero Energy confirmation includes:

- Pressure Test to confirm by instrumentation or gauges that the system indicates no pressure.
- Obstruction Checks to visually inspect and confirm that all, vents and drains are free from obstruction. Vents and drains may need to be directed to a safe location.
- Leak Checks to monitor each bleed, vent, and drain with appropriate gas detection equipment to assure no leaks exists.

6.4.6 Retests

A retesting and reconfirmation of energy isolations will be performed and documented at any of the following times:

- At the discretion of the work group.
- At the discretion of the AREA AUTHORITY.
- After any temporary discontinuation of energy isolation for testing.

6.4.7 Safety Critical Equipment

Isolating a safety critical device should be thoroughly risk assessed and could necessitate higher level approvals and / or permitting. The process for bypassing or overriding a critical safety device must be defined in a documented procedure.

6.5 Isolation Devices

Isolation devices include, but are not limited to:

- Equipment Isolation locks and keys.
- Equipment Isolation tags.
- Lock boxes.
- Personal and Craft locks.

Isolation devices should be substantial enough to prevent removal without use of excessive force or unusual techniques. All isolation materials are supplied by the company and will not be used for any other purposes. At a minimum, when in use, these isolation device(s) will indicate the identity of the person applying device(s).

Isolation devices for future use will be kept in appropriate designated area. The reason for issue, person issued to and relevant tracking numbers for each piece of isolation material supplied will be recorded by the Isolating Authority or designated person.

When isolation devices are issued, they will be tracked on log sheets and properly maintained by the Isolating Authority.

6.5.1 Equipment Isolation Locks and Keys

The purpose of an equipment isolation lock is to execute the “Lock Out” part of the isolation process. Isolation locks are padlocks. All locks and keys in set will carry the same unique serial number for ease of tracking; only one key will be issued per set.

6.5.2 Equipment Isolation Tag

Each isolation point will be fitted with an isolation lock and tag. Tags will be constructed of a weather resistant and durable plastic with an eyelet at top, with words” Do Not Operate” printed on them. Tags will be securely attached to the lock with tie-wraps or with the shank of lock through metal eyelet on the tag. Equipment isolation locks and tags will only be installed and removed by an ISOLATING AUTHORITY.

Where an isolation lock cannot be applied, a tagout device may be used. Tagout attachments will be of a non-reusable type, attachable by hand, self-locking, and non-releasable. Tagout devices must have a minimum unlocking strength of 50 pounds and be equivalent to a one-piece, all environment-tolerant nylon cable tie.

Once the ISOLATING AUTHORITY has installed the isolation, they shall install an Isolated Equipment Tag to the proven locked out piece of equipment. During the walkdown process the ISOLATING AUTHORITY and TASK OWNER will complete the back side of the tag.

6.5.3 Lock Out Chains and Hasps

Chains will be a weather-resistant material and strong enough to prevent intentional or accidental breakage. Scissor-hasps will be a heavy-duty polycarbonate construction, chemical and abrasive resistant, and include a feature located on base of hasp allowing for easy tag attachment.

6.5.4 Lock Boxes

Lock Boxes will be traditional style metal boxes with a latch-tight feature to ensure that keys cannot be accessed until the last lock is removed. Each box will be sequentially numbered with a unique serial number for ease of tracking.

6.5.4.1 Area Lock Boxes

When more than one Lock Box is used to isolate a system, then one Lock Box will be designated as the Area Lock Box. Keys from other lock boxes are placed in Area Lock Box.

The purpose of Area Lock Box is to allow keys to isolation locks to be locked away by a personal lock so that isolation locks may not be removed, and equipment operated while it is being worked on. Personal locks on area lock boxes will be fitted with tags. These tags will clearly state “Do Not Operate”. Information will be provided on the tag as to reason for energy isolation, name of person responsible for fitting lock, area lock box number and date lock was fitted.

6.5.4.2 Satellite Lock Boxes

A Satellite Lock Box is a mobile Lock Box that can be used in the work area and may be used when a work crew has three or more members. Crew members will attach personal locks to the Satellite Lock Box once the satellite lock key is inside.

6.5.5 Personal and Craft Locks

The personal isolation lock is a second lock used in the lock-out process. These locks carry a Personal Isolation Tag with customized permanent, write-on labels. The purpose of a personal lock is to lock the Area Lock Box to prevent access to key/s for isolation locks. These personal isolation locks will be used for single-point isolations.

Craft isolation locks are assigned per Company discipline (i.e., Instrumentation) and used to identify that a particular craft is involved in the Lock-Out. Craft locks are installed at the start of the job and will not be removed until completion of specified work activity.

Contract companies may use specific Company issued contractor craft locks to identify that their crew is working on the Lock-out.

6.5.6 Spare Keys

Spare keys for all isolation devices will be kept in a locked cabinet under the control of Site Manager or designee. In extreme circumstances there may be the need for spare keys to be accessed for use, some of these circumstances are:

- Broken keys.
- Keys accidentally taken offsite by outgoing ISOLATING AUTHORITY.

In these instances, access and use of a spare key will be granted by the Site Manager or designee in writing after the absence of the original key is thoroughly investigated.

6.6 Isolation Techniques

In compliance with regulatory requirements, hazardous energy sources, (electrical, pneumatic, hydraulic, chemical, and thermal energy) require proper isolation, and verified zero-energy. Systems that cannot be verified zero energy require proper controls identified and installed through the TBRA process.

There are three categories of isolation techniques; Positive Isolation, Proved Isolation, and Non-Proved Isolation. The categories are listed in order of the mechanical security they provide, with Positive Isolation being the most secure.

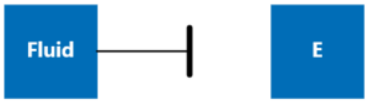
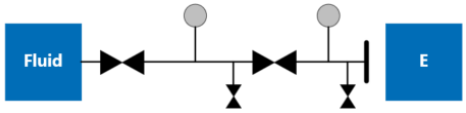
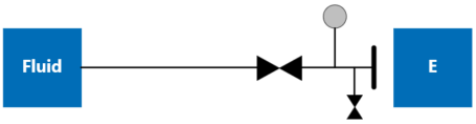
These isolation techniques are to be considered when making the Isolation Plan. Once approved, the Isolation Plan serves as the required isolations for the job and changes must be approved by Site Controller.

6.6.1 Positive Isolation

Positive Isolations guarantee physical separation between systems; therefore, there is no possibility of loss of isolation due to equipment failure or human error. Positive Isolation is the complete separation of the system/equipment to be worked on from other parts of the system (e.g., spool removal with blind flange, air gap, or blind/spade). Refer to Table 1 for descriptions of positive isolations. Positive Isolation is required for:

- Boundary Isolation.
- Equipment to be Mothballed.
- CSE.

Table 1 – Positive Isolation Descriptions

Isolation	Description
	**Physical disconnection** isolations are the removal of a pipework section or spool piece and blanking the live end, also called 'air gapping'
	**Double Block, Bleed and Spade** blind isolations are established by the closure of two block valves in series and a spade, an open bleed valve between the two block valves to eliminate the potential for pressure buildup between them causing leakage through the closed valve to the work site.
	**Single Block, Bleed and Spade** isolations consists of the closure of a single block valve and a spade with an open bleed valve between them to eliminate the potential for pressure buildup between them causing leakage through the closed valves to the work site

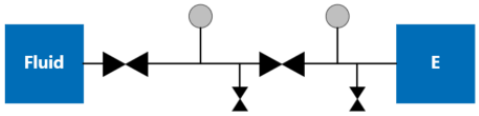
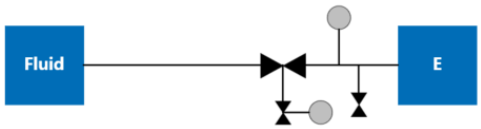
- Positive isolation is regarded as the most secure method and must always be considered first when planning energy isolation projects.
- Blinds/spades shall be designed with manufacturer stamp.
- Double block and bleed for Confined Space Entry must follow the High Residual Risk Process.

6.6.2 Proved Isolation

Proved Isolation includes valve isolations in which the effectiveness of valve closure(s) can be confirmed via vent/ bleed points before intrusive work commences. Proved Isolations are the standard method of separating systems. Within Proved Isolation the level of mechanical security is greatest for Double Block, and Bleed and lowest for Single block and Bleed. Proved Isolations are used when the formal risk assessment deems, they are appropriate or when required to break containment for the insertion of blinds/spades (positive isolations). Refer to Table 2 for descriptions of proved isolations.

Valves shall be locked or otherwise immobilized to prevent unauthorized operation. It may be necessary to apply additional immobilizing devices under certain circumstances.

Table 2 – Proved Isolation Descriptions

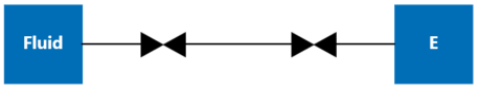
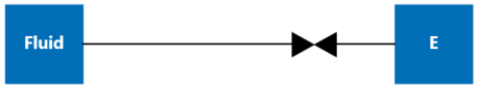
Isolation	Description
	**Double Block and Bleed (DBB)** isolations are established by the closure of two block valves in series with an open bleed valve between them to eliminate the potential for pressure buildup between them causing leakage through the closed valves to the work site.
	**Double-Seated Valve** isolation is a single valve with a double seal in a single body, with a cavity bleed between the seals. These provide an equivalent protection as a double block and bleed isolation. Examples of such valves are suitably specified as double wedge gate, parallel expanding gate, and double-seating ball valves.
	**Single Block and Bleed (SBB)** are established by the closure of a block valve with an open bleed valve to prove no leakage through the closed valve.

- Two valves in a series without a bleed valve between is counted as a single valve isolation.
- Double-Seated valve isolations are not considered DBB for CSE.
- Some double-seated valves require line pressure to energize the upstream or downstream seals. These are not considered acceptable as DBB by the Company and should be treated as single valves. Only valves with a dual positive seal or two separate valve elements, with a drainable cavity in between, are acceptable for DBB isolations.
- Valve cavity bleeds are not to be attempted if there is only a grease nipple fitting installed into the cavity bleed port without an isolation valve.
- SBB isolations on equipment with an operating pressure greater than 145 psig require an approved operating procedure.

6.6.3 Non-Proved Isolations

Non-Proved Isolations include no provision to confirm effectiveness of valve closure prior to breaking into system. Where possible, a double valve isolation should be used rather than a single valve. Refer to Table 3 for non-proved isolation descriptions.

Table 3 – Non-Proved Isolation Descriptions

Isolation	Description
	**Double Block Valve** isolation consists of the closure of a two-block valve in series. Any valve used for double block isolations must provide a reliable seal. Non-return valves, flow control valves, and other valves that do not provide tight shutoff must not be used. Valve integrity must be confirmed by conducting a leak test (or approved flange breaking method) before commencing work.
	**Single Block Valve (SBV)** consists of the closure of a single block valve. Any valve used for SBV isolation must provide a reliable seal. Non-return valves, flow control valves, and other valves that do not provide tight shutoff must not be used. Zero energy must be confirmed by conducting a leak test (or approved flange breaking method) before commencing work.

6.7 Actuated Valves

In cases where the actuated valves such as emergency shutdown valves, remotely operated valves or motor operated valves are part of the isolation points, the following additional barriers are required:

- The power (hydraulic, pneumatic, or electric) supply must be isolated.
- Control fluid accumulators must be depressurized or disconnected when not required to maintain the isolated position of the valve.
- The control cabinet or power supply must be secured and locked.
- Control system isolation points must be appropriately tagged.
- Where possible, mechanical restrictions (lockout caps) should be used on valves so equipped.
- Zero energy must be confirmed by conducting a leak test (or approved flange breaking method) before commencing work.
- Fail safe position of actuated valves may compromise the isolation integrity; and should not be used for isolation purposes. If no other alternative is reasonably practicable, the condition must be reported to the Area Authority for a path forward.

6.8 Blinds and Blinding

6.8.1 Blinding is a positive and safe means of preventing the migration of hydrocarbons, hazardous or other substances into equipment or systems that are isolated to be entered or worked on (or both). Blinds are installed on lines to prevent combustible or toxic liquids, vapors, or gases from entering the work area during maintenance or construction on a section of the line. For all operations a marked-up P&ID and a specific procedure should be used to support the activity. Table 4 illustrates the type of blinds commonly available.

Table 4 –Descriptions of Commonly Available Blinds

Blind	Description
	**Spade, Skillet or Paddle Blind:** A pressure-rated solid-steel plate installed between two flanges. A skillet (or “paddle”) blind may be used only if a tagged vent to atmosphere is located between a closed and locked block valve and the blind.
	**Spectacle Blind:** A pressure-rated combined spade and slip ring (spacer). Slip ring (spacer) is a pressure-rated ring installed between two flanges to facilitate the insertion of spade
	**Blind Flange or Blank:** A pressure-rated solid-steel plate fitted to the end of an open spool, valve, vessel, or other piece of equipment. A method of positive isolation where a spool piece or valve or other piece of equipment is removed, and blind flange installed to form a complete separation between the energy source and the system or equipment.

6.8.2 The ISOLATING AUTHORITY will verify the exact location of the blind prior to fitting the Blind Tag

6.8.3 The TASK OWNER will consult with the ISOLATING AUTHORITY for proof that the equipment and piping has been de-pressurized. They shall verify the size, metallurgy and rating of the flange and gasket type and determine what product or material has been contained in the equipment or piping.

6.8.4 Appropriate personal protective clothing and equipment shall be worn.

6.8.5 When opening flanges suspected to contain toxic gases, the atmosphere will be tested using a self-contained breathing apparatus or supplied air respirator with an egress bottle to determine content. If equipment to be blinded is above atmospheric pressure, verify that the AREA AUTHORITY has given approval for the flange to be broken.

6.8.6 When fitting the blind, the flange bolting shall be removed in accordance with the process outlined in an authorized maintenance procedure. Flanges should be opened a minimum length of time consistent with the safe installation of the blind.

6.8.7 When blind installation is to be done at heights (e.g., on pipe racks), fixed working platforms shall be used that are designed to bear the combined load of the personnel and the blind.

6.8.8 Only a full-rated blind will be installed. Blind selection will be based on these considerations:

- Blinds are to be appropriately sized and rated for their intended use.
- Blind location is to be evaluated for accessibility, i.e., ease of installation and removal.
- Blind must effectively isolated.
- Blind must have manufacturer certification.

6.8.9 Blinding is required anytime:

- A positive isolation is required.
- The equipment is to be entered.
- On open-ended pipe, when job site is left unattended.
- A tested DBB (or double-seated valve) cannot be achieved.
- Between existing production equipment and new equipment under construction.
- Whenever segregation is required between systems.
- There is open pipework.

6.8.10 In instances where blinding is required but blind installation would involve greater risk than not blinding, an alternate Isolation Plan is required with Area Authority Approval.

6.8.11 Blind Documentation

Documentation of completed work is required to control the fitting and removal of blinds. This documentation details what work has been completed at each stage and includes:

- Location of blind
- Blind install complete
- Blind removed
- Inspection complete
- Return to service

When a work scope includes multiple blinds, a master blind list will be developed to track the installation and removal of all blinds associated with the work to be executed.

6.8.12 Installation of Blinds

Blinds shall be installed at the flange closest to equipment being isolated, unless there is a conflict of pressure ratings (Spec. Break) located in such a position that will result in the isolated pipe section experiencing higher than its specification pressures. In these instances, the blind shall be installed at the specification break point.

Where equipment is interconnected in such a way that blinding of each is not possible or practical, the group of equipment is to be considered as one unit, and the appropriate isolations made for that unit.

A blind shall always have new gaskets installed on both sides to prevent damage to the flange surface and to give a true seal.

A new gasket is required each time a joint is broken and remade.

Bolting should be of the correct strength and length to accommodate any extra thickness of the blind.

Joint faces should be properly prepared (i.e., cleaned), square and fully bolted (full threads through the nuts) and tightened.

Blanks, blinds, bolting and gaskets shall meet the piping specification of the area in which they are to be installed i.e., compatible with the process fluid and rated for the design pressure and temperature of the line.

6.8.13 Blind Removal

All blinds are removed, and flanges made up with appropriate gaskets according to the isolation plan. Flanges are torque/tensioned as directed in the maintenance procedure.

After work on the equipment requiring blinding has been completed, the ISOLATING AUTHORITY will be notified. The ISOLATING AUTHORITY will carry out a check to ensure that the blinds may safely be removed. It is always required to check the bleed before the blind is removed. Special care must be taken to ensure that prior to the breaking of containment for the removal of the blinds, that the system immediately upstream and downstream the blind is free from all sources of energy.

If the check identifies that the valve isolation has been passing, then the bleed shall be closed, and the blind not removed until a risk assessment has been reviewed to capture the existing hazard and authorized and approved by the Production Manager.

All the safeguards highlighted as being necessary for the installation of blinds shall be applicable to the removal of the blinds upon completion of the work on the equipment/system.

6.9 Special Isolation Techniques

6.9.1 When considering the use of blinds or plugs to contain fluids or vapors from leaking valves, the provision for depressurizing and draining before removal of the blind or plug must be included.

6.9.2 The following precautions must be taken during the use of plugs or stopples:

- A TBRA must be carried out prior to use.
- Adequate venting of the system must be confirmed to avoid pressure buildup that is above the design pressure.
- The pressure behind the plug or stopple must be continuously monitored.
- Ensure no one is in front of the pipe end where the plug or stopple is installed in case it is ejected.
- Barricade the ejection pathway and/or install a catch/restraint device.

6.9.3 A barrier provided by a plug or stopple is not as secure as a blind and must be risk assessed to ensure that preventions and mitigation steps are implemented to provide an acceptable hydrocarbon barrier and protect against ejection or leakage.

6.10 Line Break Activity

Line breaking includes actual opening/separation/removal of equipment containing or having previously contained hazards (due to chemical nature or pressure/temperature concerns). Equipment includes but is not limited to all types of flanges, tubing, hoses, sanitary connections, or other types of connections/openings in process or utility service.

Before line break, integrity checks must be performed to ensure that there is no pressure buildup both upstream and downstream of the blind location.

If there is pressure buildup, then the job must be stopped, and the isolation reassessed.

Line Cutting activities must be identified at the cut point using tape, label, or marker.

When conducting line cutting, the first cut must be a cold cut.

6.10.1 Line Break Exemptions

If hazards are not present nor have potential to be present this procedure does not apply. Certain routine operations may involve altering containment in a controlled manner that is not considered hazardous and is not subject to this procedure.

Examples of these activities include:

- Connecting/disconnecting hoses with quick disconnects, used in loading/unloading fluids from containers equipped with isolation valves.
- Connecting/disconnecting hoses at utility stations or firewater hydrants.
- Connecting/disconnecting cryogenic hoses used to drain equipment.
- Opening lids, domes or doors on tank trucks.
- Breaking instrument/analyzer tubing/sensing lines from manifold to instrument/analyzer or from process to transmitter/analyzers.
- Catching samples from pressurized lines.
- Replacing missing plugs/caps for open-ended lines as part of a Leak Detection and Repair Program.

6.10.2 Line Break Permitting

Line breaks are subject to all COW Standard and COW Procedures including the Permit to Work Procedures. At a minimum, a GWP and JSA is required for work involving line break activities. If the system cannot be confirmed “Isolated and Clear” then a TBRA shall be conducted.

6.10.3 “Isolated and Clear” Condition

An “Isolated and Clear” condition indicates that the Issuing Authority (IA) has confirmed the isolation is complete (locked and tagged) and that the system to be opened has been confirmed to be at a zero-energy state by gas testing or instrumentation.

6.10.4 “Isolated and Not Clear” Condition

When the IA cannot demonstrate that the system to be opened is at a zero-energy state by testing or instrumentation (no facility to vent or bleed and no instrumentation or gauges), the IA will declare a “Not Clear” condition and return the permit to the PTW office to conduct a TBRA.

6.10.5 Line of Fire

(Note that Line of Fire is not a Direct Control as it is susceptible to human error)

It is important not to stand in front of plugs or caps when slackening.

When unscrewing a joint, even though the system may have been depressurized:

The seal on a union-type joint breaks as soon as the ring nut is slackened.

Threaded joints continue to seal until the threads release, giving no warning of internal pressure.

Be careful with clamp lock type fittings. With nuts slackened, the fitting should be physically dislodged to confirm there is no residual pressure before final disassembly.

6.10.6 Hot Bolting

Hot Bolting is the sequential removal and replacement of bolts on flanged joints while the unit is under reduced operating pressure. The procedure generally consists of removing one bolt at a time in a flange, relubricating it, reinstalling it (or a new bolt), and retightening it to a specified torque. Hot bolting can be performed while the unit is online or once the unit is depressurized.

Working on live lines is considered high risk therefore the hazards and controls need to be identified prior to hot bolting. Hot bolting activities require a TBRA when working on live lines containing the following:

- Flammable/Explosive Streams
- Toxic/Hazardous Streams
- Operating Pressure >145 psig

6.10.7 Breaking Flanges

If 0% LEL cannot be reached, detailed controls must be outlined on the TBRA to mitigate the added hazards. If risk level remains at high, then High Residual Risk Process shall be used.

Breaking flanges shall be performed as follows:

- The bolts farthest away from the individual performing the task should be relaxed first so that the release of trapped pressure (liquid or gas) will be away from the individual(s).
- Nuts/studs shall be removed and replaced immediately.
- Bolts are to be loosened in the correct sequence.

- No bolts shall be removed until:
- They have all been slackened and the joint cracked.
- It has been confirmed that the line contents will not be released in an uncontrolled manner.
- Appropriate gas testing confirms less than 10% LEL (as specified on the TBRA).
- All hot work tasks in adjacent areas are stopped.
- The person who opens the flange shall do so in such a way as to minimize the possibility of contact with the contained fluids and of sudden escape of large fluid quantities.

When the flange is broken, the sudden drop in pressure could result in hydrate formation. If the valve is leaky, the hydrate could temporarily block the leak resulting in a defective isolation. As the hydrate melts, the valve could resume leaking and potentially result in injury to personnel.

6.11 **Validation Requirements**

An annual Health and Safety assessment will be conducted by a representative(s) of the HSE department for the following elements:

- The Isolation Procedure is accurate. Energy isolation points are properly marked and consistent with the written procedure.
- Energy Isolation Permit has been completed properly, made available to affected Personnel, and retained on file as per retention program.
- Personnel have received training as required and understand their responsibilities under the process. Training records/certifications are maintained in a company learning management system.

7.0 PPE AND OTHER PROTECTIVE EQUIPMENT

7.1 **Personal Protective Equipment (PPE).** PPE is an integral part of any employer's safety program. OSHA has determined that PPE, although a good way to protect personnel, should be used as a last line of defense and it is important to understand the limitations of PPE in the workplace.

7.2 Certain specialized PPE can be considered a Direct Control if it meets the specific criteria of targeting and reliably mitigating high-energy hazards without being susceptible to human error.

7.3 PPE should be specifically selected based on the residual potential of the hazard being addressed per the risk assessment. PPE must be maintained and periodically inspected per manufacturer's specifications.

8.0 TRAINING

8.1 Regulatory Requirements

The training of authorized employees should include the following three areas: energy control program, elements of energy control procedures relevant to employee duties, and the pertinent requirements of the standard (1910.147(c)(7) and (d) through (f)).

- Recognition of hazardous energy;
- Type and magnitude of energy found in the workplace;
- The means and methods of isolating and/or controlling energy; and
- The means of verification of effective energy control, and the purpose of the procedures to be used.

8.2 **Training specific to Electrical Work**

8.2.1 Approved personnel or "Qualified Electrical Workers" (QEW's) who service, modify, repair, or build electrical equipment must be trained and able to recognize the hazards and establish controls to prevent injury. Operators and anyone working in the vicinity of live electrical parts or equipment must be sufficiently trained to safely interact with electrical equipment including staying within its design intent and not defeating engineering controls

8.2.2 Qualification and Authorization to perform electrical or electronics work are based on a combination of formal training, experience, and on-the-job training. On-the-job training for specified equipment should be documented to ensure that training is consistent for all personnel with similar tasks. This documentation should be reviewed and approved by a person who is knowledgeable in safe work practices and is familiar with the hazards involved. This training should cover NFPA-70E, Standard for Electrical Safety in The Workplace and:

- Features of the equipment, including any specialized configuration.
- Location of energy-isolating devices.
- Techniques, tools, and personal protective equipment used for the specific equipment.
- Relevant documents such as wiring diagrams, schematics, service manuals, and operating, testing, and calibration procedures.
- The system's energy control procedures, including energy-isolating devices, grounding and shorting procedures, and other energy-control procedures.
- Specific operations in which live work is anticipated (if any).

- Record keeping and logging per designated company requirements.
- Copies of all completed training hall be kept on file and available for review at any time.

8.3 **Additional Training Considerations**. Other training that should be considered in an Energy Control Program include (but not limited to):

- Energy Wheel Hazard Identification
- High Energy Control Assessments (HECA) training and observation calibration
- CS-G-4, “Site Specific Safety Plans”
- CS-G-2, “Job Safety Analysis”
- CS-G-9, “Guidance for Serious Injury and Fatality Prevention”

9.0 CONTINUOUS IMPROVEMENT

9.1 **Program Assurance**

- Verify that affected employees have been instructed in the purpose and use of the energy control procedures.
- Verify that all other employees who may be affected by the energy control procedures are instructed about the procedure and the prohibition relating to attempts to restart or reenergize such machines or equipment.
- When Company procedures permit the use of tagout, the training of authorized, affected, and other employees shall include the provisions of 29 CFR 1910.147(c)(7)(ii) and (d)(4)(iii).
- Evaluate the Company's manner of enforcing the program (29 CFR 1910.147 (c)(4)(ii)).
- Evaluate compliance with the requirements for periodic inspection of procedures.
- Ensure that the person performing the periodic inspection is an authorized employee other than the one(s) utilizing the procedure being inspected.
- Evaluate compliance with retraining requirements which result from the periodic inspection of procedures and practices, or from changes in equipment/processes.
- Evaluate the Company's procedures for assessment, and correction of deviations of inadequacies identified during periodic inspections of the energy control procedure.

- Identify the procedures for release from lockout/tagout, including:

  (1) Replacement of safeguards, machine or equipment inspection, and removal of non-essential tools and equipment,

  (2) Safe positioning of employees,

  (3) Removal of lockout/tagout device(s), and

  (4) Notification of affected employees that servicing and maintenance is completed.

- Ensure that when group lockout or tagout is used, it affords a level of protection equivalent to individual lockout or tagout as amplified in Section 6 of this guideline.

9.2 Program Assessment

9.2.1 Assessment of the program and the personnel. Workers must have the ability to do their job safely. The employer needs to evaluate their skill. The safety program should contain the procedures to be used for this evaluation.

9.2.2 The program itself should be audited to determine if the principles used are effective.

- Document findings including any gaps / deficiencies
- Assign corrective actions if needed
- Perform follow-up review to ensure all identified gaps / deficiencies have been addressed.
- If conditions warrant, document gap/deficiency and corrective action in a Lessons Learned tool to share with the organization.
- Ensure the program is kept up to date with the OSHA regulations, NFPA standards and all other applicable safety guidelines.
- Monitor applicable worksites with High Energy Control Assessments (HECA) to observe LOTO implementation as a Direct Control.
- Document findings from assessments, investigations, lessons learned, and apply all learnings to program improvement efforts.

9.3 Management of Change (MOC)

9.3.1 To ensure that any change to equipment, systems, processes, procedures, or personnel that could affect the control of hazardous energy is evaluated, documented, and approved prior to implementation. MOC ensures continued protection of personnel and compliance with energy isolation requirements when changes occur.

9.3.2 This section applies to all changes that may impact the identification, isolation, or control of hazardous energy, including but not limited to:

- Equipment or system modifications
- New or modified procedures
- Temporary or permanent bypass of isolation devices or safety systems
- Personnel role changes affecting isolating or task ownership responsibilities
- Introduction of new chemicals, energy sources, or technologies

9.3.3 **Initiation of MOC**
Any person identifying a change that could affect energy isolation must notify their supervisor and initiate the MOC process. This includes temporary changes, pilot operations, or emergency workarounds.

9.3.4 **Hazard Identification**
A Task Based Risk Assessment (TBRA) must be conducted as part of the MOC to identify all new or modified hazardous energy sources, changes to isolation points, or procedures affected.

9.3.5 **Review and Authorization**
The Area Authority and Isolating Authority must review all MOC proposals. Work cannot proceed until the change is approved and appropriate controls—including Direct or Alternative Controls—are validated.

9.3.6 **Documentation**
The MOC must document:

- Description and reason for the change
- Affected systems, equipment, and procedures
- Updated isolation points and control measures
- Revised procedures or permits, if applicable
- Verification steps (e.g., retesting isolations)
- Communication plan for affected personnel

9.3.7 **Training and Communication**
All affected and authorized employees must be informed of the change and trained on any revised procedures or isolation plans before resuming or starting work.

9.3.8 **Validation**
Before work begins, the Isolating Authority must validate that updated energy isolations are in place, effective, and verified as zero-energy. If required, additional field checks must be conducted.

9.3.9 **Post-Change Review**
After implementation, a post-change review must be completed to verify the effectiveness of the change and to ensure no new risks have been introduced.

Note:
Changes related to **High Energy Hazards** must always prioritize maintaining or enhancing Direct Controls. If this cannot be achieved, justification for Alternative Controls must be documented and approved by the Area Authority.

10.0 REFERENCES

10.1 Regulatory / Government Entities and Industry Organizations

- Occupational Safety & Health Administration (29 CFR 1910 & 1926)

11.0 REVISION HISTORY

Number	Date	Description
0	6/24/2025	Initial publication