POLICY

This Company has developed the following procedures to protect employees performing hot tap work.

The Company will ensure that the policies and procedures include:

- A site hazard analysis (JSA/JHA),
- A description of the sequence of events,
- Safety precautions to address the hazards, and
- An emergency response plan.

The Company must ensure that:

- Only competent/qualified workers are permitted to carry out a hot tap operation,
- The point in the pressure-containing barrier to be hot tapped is checked and strong enough for the hot tap to be done safely,
- Adequate working space is available at the location of the hot tap,
- Exit routes are available and their locations known by workers involved in the work,
- Workers wear appropriate personal protective equipment when a hot tap is performed on equipment containing hydrocarbons, combustible fluids, superheated steam, or any other hazardous material,
- Material being supplied to the equipment being hot tapped can be shut off immediately in an emergency,
- The hot tap machine and fittings are of adequate design and capability for the process, conditions, pressure, and temperature,
- The pressure in the equipment being hot tapped is as low as practical during the hot tap operation.

The Company will ensure, where reasonably practicable, that a hot tap is not undertaken if at the proposed hot tap location:

- The equipment contains a harmful substance,
- The equipment is in hydrogen service, or
- The equipment contains an explosive mixture.

CONTROL OF HAZARDOUS ENERGY

Hot Tap: A procedure used in the repair, maintenance, and service 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. Use proper Lockout/Tagout procedures.

GENERAL REQUIREMENTS

Flammable substance lines: The connection, by welding, of branches to pipelines carrying flammable substances shall be performed in accordance with **Welding or Hot Tapping on Equipment Containing Flammables, API Std. PSD No. 2201**-1963, which is incorporated by reference as specified in 1910.6.

Federal, state, and local regulations or laws may contain additional requirements that must be taken into account when a hot tap program is developed at a specific facility.

PERSONNEL COMPETENCY AND QUALIFICATIONS

Hot tap machine operators and welders must be qualified in accordance with applicable codes and specifications. They should be thoroughly familiar with the welding and hot tap equipment and procedures to be used. Only skilled competent personnel should mount and assemble the hot tapping machine. These skills may be achieved either through on-the-job training or by a formal training program provided by the manufacturer of the hot tapping machine.

SITE SPECIFIC PLAN

Prior to conducting welding or hot tapping on piping or equipment in service, a site specific plan should be prepared which includes:

- Connection design, location, and carrier thickness.
- Hot tap procedure.
- Detailed written welding procedure (qualified in accordance with the applicable code) documenting heat input, as appropriate.
- Health, safety, fire protection, emergency response, and other appropriate procedures and instructions, including owner and user requirements.

Establish what needs to be accomplished, how the associated work is to be done, and whether hot tapping is appropriate.

An analysis should be performed to determine if alternates to hot tapping exist within reasonable engineering bounds, and whether hot tapping is appropriate.

If, after review, hot tapping is required, follow all safety and regulatory requirements.

- Do a review to determine whether fire hazards in the vicinity can be moved to a safe place.
- Designate the competent person for each job.
- Make sure all precautions used for hot work are followed.

Always minimize the risk; hot work has the potential of personnel exposure or ignition hazards which could lead to a fire or explosion. The consequences of each hazard should be carefully weighed along with unexpected conditions that might occur.

Make sure the plan covers firefighting, personnel evacuation, and/or alternate methods to finish the hot work without incident.

OSHA 1910.147 Control of Hazardous Energy (Lockout/Tagout) provides a specific exemption for performing hot tapping, with several criteria that must be met.

- Continuity of service is essential;
- Shutdown of the system is impractical;
- Documented procedures are followed;
- Special equipment is used which will provide proven effective protection for employees.

When all four of these factors cannot be met, the hot tapping should not be done and the work must be performed in conformance with the requirements of the OSHA Lockout/Tagout regulation. There may be other regulatory requirements for work on equipment subject to other regulations.

Refer to the Attachments at the end of this Chapter.

The final safety plan should be a written procedure specific to the hot tapping job to be done. If the specific job is reviewed and existing procedures are found to conform to the project needs, they can be used. If they do not address the specifics, a revised procedure should be written.

If several hot taps are to be done then each needs to have a separate procedure and permit.

The decision to authorize hot tapping should include a review of the metals consistency and line contents to ensure that hot tapping is appropriate.

PROCEDURES

Before work begins, the following conditions must be in place:

- A competent person is committed to be present during the hot tapping.
- The area where the connection is to be made has been identified and physically marked.
- The metal thickness has been verified and any metal imperfections that might prevent a proper weld have been completely evaluated and approved by a competent person. The measurements must be recent enough to represent the current metal condition.
- A plan has been prepared to monitor and control process variables within their required limits while hot tapping or welding is being performed.
- A contingency plan is in place.
- All necessary testing for flammable vapors, oxygen, and hazardous air contaminants has been conducted.
- Potential safety and health hazards have been assessed and personnel protective equipment (fire retardant clothing) is available for use as necessary.
- Appropriate hot work, hot tapping, and confined space entry if required, permits have been obtained and approved.
- A dedicated fire watch has been established and equipped with a suitable fire extinguisher or pressurized fire hose. This person must understand fire watch duties, be able to communicate with the personnel working in the area and have been trained in the use of the equipment.
- Signs and barriers have been provided when warranted to isolate the job site from unauthorized personnel or the public.
- Procedures have been prepared and are in place to isolate the work area in the event of an emergency.
- Personnel are trained and familiar with the hot tap or welding procedures and the use and location of applicable equipment.

WELDING

- Select and use a welding procedure which is qualified for the specific application as determined by a qualified person.
- Make sure that the welder is qualified for the specified procedure and appropriate code.
- Ensure that the fitting is positioned and supported before welding, so that misalignment of the hot tapping machine will not occur.
- Always protect the weld area during cleaning, preparation, welding, and weld inspection if blowing dirt, snow, or rain is present.
- Make sure that downstream pumps designed to be equipped with screens or strainers have them in place in case of a lost coupon.

INSPECTION

Make sure you visually inspect all attachment welds after welding and before attaching the hot tap machine. Dye penetrant, ultrasonic, or magnetic particle inspection is also recommended before the hot tapping machine is installed.

When these are interim tests conducted after the first weld pass, the weld area must be thoroughly cleaned of any foreign material or residues before doing any more welding passes. These procedures should not be relied upon to replace the need for hydrostatic or pneumatic testing.

Remember; when reinforcing is specified, either the hot tap machine operator or the owner of the in service equipment may want to pressure test the nozzle prior to installing the reinforcing pad.

INSTALLATION

- The hot tap valve must be of adequate size and rating, be of the proper metal consistency, and be a full opening valve. The hot tap valve should be tested for seat leakage prior to installation.
- During installation, the valve should be centered on the nozzle flange or fixture.
- Run the boring bar through the valve opening to be sure the cutter does not jam or drag.
- Calculate the travel distance of the cutter to ensure that the tap can be completed within the dimensional limits.
- Make sure that the cut will be stopped before the cutter or pilot drill touches the opposite side of the tapped pipe or equipment.
- Make sure that the retrieved cut out coupon can be retracted far enough to allow unimpeded closure of the tapping valve.
- Confirm that the bleed-off valve will hold pressure and is not plugged.
- Make sure that precautions have been established for safe bleed off and disposal of material collected in the machine above the hot tap valve.

Test the weld and machine before cutting is started:

- Always check tightness of bolts, packing, packing nuts, and any bypass line to avoid possible leakage.
- When the current temperature of the line or vessel will permit, conduct a hydrostatic test of the welded attachment and hot tapping machine in accordance with the code. The temperature of the metal should be considered to prevent brittle fracture.

SAFETY RULES AND PROCEDURES

PHYSICAL HAZARDS

- Always protect against slip, trip, and fall hazards from cables, hoses, and lines;
- Personal protective equipment must be worn (head, foot, eye, respiratory, and thermal protection in accordance with requirements for the work environment);
- Utilize Fall protection procedures and equipment when necessary;
- Make sure there is protection from electrical hazards associated with welding machines or electric lighting (use of bonding, grounding, low voltage, or GFCI);
- Make sure there is protection against eye and face injuries caused by flying particles, molten metal, liquid chemicals, acids, caustic liquids, or irritating chemical gases or vapors.

THERMAL BURNS

- High temperature contact exposure can cause serious burns.
- Avoid contact by using good work practices and protective clothing. Injuries have occurred due to sparks or hot metal falling into pockets, folds of rolled up sleeves, pants- cuffs, or work boots. Frayed clothing is easily ignited. Wear fire resistant clothing.

HEALTH HAZARDS

- Always wear the proper protective equipment and make sure there is good ventilation.
- Health hazards can occur during or shortly after exposure (e.g. irritation of the eyes or respiratory system caused by inhalation exposure to fumes).
- Make sure you know what is in the area you are working in. Materials used or stored in the area (hydrogen sulfide, chlorine, or ammonia) can create hazards.
- Welding can create health hazards. Arc flash can cause eye irritation or burns. Fumes from zinc can cause metal fume fever. Working in a hot environment can cause heat stress and oxygen deficiency.
- Make sure there is an effective hazard communication program that identifies materials warranting special attention that may be associated with the specific work and workplace activity.
- Safety Data Sheets (SDSs) should be available to aid in identifying materials in the area and contained in the piping or equipment to be hot tapped or welded upon. For welding fumes, risk relates to inhalation exposure. Emphasis on monitoring, ventilation, and respiratory protection are key factors in risk reduction.
- A hearing conservation program may be required depending on noise exposures.

FUMES

Toxic fumes can be generated during welding. Fumes from welding on metals containing alloys of lead, zinc, cadmium, beryllium, and certain other metals are recognized hazards.

Paints, particularly those containing lead, can produce toxic fumes when heated or burned. Toxicity is an independent property of the hazardous material. The risk involved depends on the composition and quantity of fumes in conjunction with exposure. The composition of the welding consumables, the coatings or paints, the process used, and the circumstances and conditions will affect the level of toxicity.

CONTROL PROCEDURES

- Where electrode material concerns are identified, investigate whether an approved acceptable material substitution is available.
- The area should be cleaned for coatings.
- Appropriate ventilation should be considered in all cases.
- Respiratory protection may be necessary if monitoring indicates a need.
- Always determine the level of exposure through measurement and/or analysis, or applicable prior experience.
- Make sure to minimize skin contact and breathing of vapors or fumes through engineering or administrative controls, or provide the appropriate personal protective equipment.
- Always keep work areas clean and well ventilated, clean up spills promptly.
- Use soap and water or approved cleaner to remove materials that contact skin. Do not use gasoline or similar solvents.
- Promptly remove and wash oil-soaked clothing, and do not use oil soaked leather gloves, aprons, or other materials.

FLAMMABLE LIQUIDS, VAPORS, SOLIDS, AND DUSTS

The work area around the hot tap work site should be hydrocarbon vapor and gas free. Check the area for any drums or other portable containers containing flammable or combustible materials.

When hot tapping is done on a vessel or piece of equipment within a unit while other parts of the same unit are in operation, the site specific plan must determine that no unconfined flammable or combustible material will be present in the work area, and that no reasonable probability exists of any such material entering the area while hot work is being done.

Precautions may include, but are not limited to:

- Cover common drains;
- Make sure all sewer traps are full and functional, using a steady flow of water when necessary; caution must be taken to ensure that hydrocarbon does not enter the work area from sewers.
- Halt transfer operations in areas where tanks are receiving flammable liquids or gases;
- Continually monitor to ensure that the atmosphere is free of flammable material;
- Block off any relief valves in the area.

Remember; in areas where hot tapping and associated welding are approved, process operators should be made aware of the work in process and must not release flammable liquids or vapor until the hot work has stopped.

Hot work should not be permitted where adjacent equipment is being opened, disassembled, steamed, ventilated, or flushed without considering how such actions might affect the hot work.

COMBUSTIBLE MATERIALS

Combustible materials should be removed from the work area or protected from welding sparks or slag. Noncombustible covers or wetting down should be utilized.

METAL CHEMISTRY

Burn through and cracking: Burn through will occur when the unmelted area beneath the weld pool can no longer contain the pressure within the pipe or equipment. Weld cracking results when fast weld cooling rates produce a hard, crack-susceptible weld microstructure. Fast cooling rates can be caused by flowing contents inside the piping and equipment that removes heat quickly.

Careful thought should be given to evaluating heat transfer during welding to determine the heat input and related welding variables in order to prevent overheating and burn through of the in- service piping or equipment.

Evaluate the expected cooling rate of the weld to determine the heat inputs required to produce welds and heat affected zones, which are free of cracking.

Make sure an engineering evaluation is conducted before in-service welding is performed on materials that contain laminations or other imperfections. Vessels or lines to be welded and hot tapped must also be inspected for adequate wall thickness and absence of imperfections. To minimize the risk of burn through, the metal thickness should be adequate for the pressure and temperature involved so that the hot tapping machine, equipment, and personnel can be safely supported and operated.

A determination must be made of the metal chemistry. The metal chemistry of the weld materials, the hot tap fitting, and the welding rod electrode must be compatible with the metal chemistry of the equipment to be welded or hot tapped. (E.g., a low-hydrogen process and electrodes are often advisable to minimize weld-cracking problems.)

Special welding considerations may be needed for high tensile strength steels to avoid weld cracking and the need for post weld heat treatment.

Burn through prevention: To avoid overheating and burn through, the welding procedure specifications should be based on experience in performing welding operations on similar piping or equipment, and/or be based on heat transfer analysis.

To minimize burn through, the first weld pass to equipment or piping less than ¼ in. (6.4 mm) thick should be made with a 3/32 in. (2.4 mm) or smaller diameter-welding electrode to limit heat input. Subsequent passes should be made with a 1/8 in. (3.2 mm) diameter electrode, or smaller if the metal thickness does not exceed 1/2 in. (12.7 mm).

The use of low heat input levels can increase the risk of cracking in high carbon equivalent materials. For equipment and piping wall thicknesses greater than ½ in. (12.7 mm), where burn- through is not a primary concern, larger diameter electrodes may be used.

Where burn-through is of concern, care should be taken by avoiding the use of excessive welding current.

Using low hydrogen rods may be preferable to reduce the possibility of burn-through and cracking when welding on high carbon-equivalency components.

FLOW IN LINES

For metal thickness less than ¼ in. (6.4 mm), some flow during hot tapping minimizes the potential for several undesirable conditions. Overheating liquids, burn through caused by elevated metal temperatures, and fluid thermal expansion in closed systems are less likely when flow is maintained.

Higher flow increases the weld-cooling rate and the risk of cracking. When welding, it is desirable to provide some minimum level of flow while avoiding high flow rates. The need for a minimum level of flow is a trade-off between the need to minimize the risks of burn-through and cracking.

References to use: Battelle Institute report Investigation and Prediction of Cooling Rates During Pipeline Maintenance Welding and Battelle's Hot Tap Thermal Analysis Models or Edison Welding Institute Project J6176.

For metal thickness between ¼ in. (6.4 mm) and ½ in. (12.7 mm), flow also increases the weld-cooling rate and risk of cracking. Minimizing the flow rate reduces the risk of cracking and keeps the risk of burn through low. For metal thickness greater than ½ in. (12.7 mm), the effect of flow on both weld cooling rates and the risk of burn-through may be negligible.

When welding or hot tapping on a flare line, there may be insufficient or interrupted flow that can result in a flammable mixture during the welding operation. In these circumstances, it may be necessary to purge or flood the line with steam, inert gas, or hydrocarbon gas to prevent the formation of flammable mixtures.

METAL THICKNESS

Piping or equipment base metal thickness must provide support for the new connection and the hot tapping machine. Alternately, reinforcing pads or auxiliary support of the hot tapping machine may be provided. The base metal must be free of laminations, hydrogen attack, or stress corrosion cracking.

Imperfections that might prevent a sound weld from being made must be evaluated by a qualified person or competent person with appropriate experience to conduct the evaluation.

Minimum base thickness requirements must be stated in the written documentation for the job. A minimum base metal thickness of 3/16 in. (4.8 mm) is recommended for most applications of welding and hot tapping.

The actual minimum thickness is a function of the thickness required for strength, plus a safety factor, usually 3/32 in. (2.4 mm), to prevent burn through. Exceptions to the recommended thickness may be permitted when metallurgical requirements and pressure (vacuum) limitations specified by a qualified company specialist are met.

FITTINGS

Make sure a qualified or competent person selects the proper fitting for the connection. Fittings must be properly sized to accommodate the hot tapping machine, to allow for full depth of cutter penetration within the travel limits of the machine, and to allow for uninterrupted tapping valve closure when the cutter and cut out coupon are retrieved.

POST WELD HEAT TREATMENT

Some equipment and piping is unsuitable for welding in service, because the metal chemistry or thickness of the metal and/or the contents require post weld heat treatment which normally cannot be done while the equipment or piping is pressurized. In such cases, mechanically attached fittings or taking the equipment out of service should be considered.

When post weld heat treatment is performed, the work should be reviewed to identify potential ignition sources and provide the appropriate permits and procedures.

METAL TEMPERATURE

The site specific plan should include considering whether heating the weld area before welding is needed when the metal temperature is low enough (below the atmospheric dew point) so that moisture forms on the metal surface.

Welding should not be performed on lines or equipment when atmospheric temperature is colder than –50°F (–45°C) unless special precautions, such as providing temporary shelter, space heaters, etc., are taken.

Preheating may be required by the welding procedure to avoid cracking whenever the base metal has high carbon equivalency or high tensile strength.

CONNECTIONS

Welding or hot tapping should not be permitted closer than 18 in. (46 cm) to a flange or threaded connection or approximately 3 in. (8 cm) to a welded seam (including a longitudinal seam of welded piping) unless determined by an engineering review to be acceptable.

Make sure that the hot tap location ensures that the connection is positioned to allow for the installation, operation, and removal of the hot tapping machine.

Access and egress in case of a potential release or emergency should be established and communicated to all workers and must address emergency response needs.

Remember; welding and hot tap connections, repairs, and alterations must be designed to the applicable codes.

The design must cover the specification of gaskets, valves, and bolts.

Reinforcing pads or saddles must be included in the design when required by the applicable code.

UNDER VACUUM

Hot tapping and hot work must not be performed on vessels under vacuum (less than atmospheric pressure) unless a qualified person concurs after performing an engineering evaluation.

Potential concerns:

- Heat from welding might cause the wall of the vessel to buckle locally and deform inward at the hot work location.
- Deformation or buckling could cause the vessel to rapidly collapse.
- If welding penetrates the vessel wall, the reduced pressure could draw in oxygen and allow the contents of the vessel to react at potentially violent rates. (There may be a high probability of introducing air, along with flame, when welding on vessels under vacuum.)

Prior to approving welding or hot tapping on vessels under vacuum, an engineering evaluation should determine:

- What temperature would be reached during the hot work
- What the LEL will be in the vessel at the calculated temperature (fuel lean is preferred since inadvertent introduction of air caused by breakthrough could bring portions of a fuel-rich mixture into the combustible range).
- What precautions are necessary to prevent burning through the vessel wall?

PIPING AND EQUIPMENT CONTENTS

Welding and hot tapping should not be performed on piping or equipment containing these materials:

- Vapor/air or vapor/oxygen mixtures near or within their flammable explosive range. The higher temperature from the heat of welding may cause a vapor mixture to enter the flammable range with the welding or subsequent hot tapping providing a source of ignition.
- Oxygen or oxygen enriched atmosphere. The oxygen may cause a vapor mixture to enter the flammable range and may affect the base metal being welded.
- Compressed air systems, unless known to be free of flammables and combustibles such as lubricating oil residues.
- Hydrogen, unless an appropriate engineering review has been performed by a qualified person who approves welding on such equipment. Carbon and ferritic alloy steel is susceptible to high-temperature hydrogen attack during process operations. A review must be conducted to ensure that the equipment has been operated within the Nelson curve for the particular steel involved.
- Temperature-sensitive, chemically reactive materials (E.g. peroxides, chlorine, or other chemicals that might violently decompose or become hazardous from the heat of welding).
- Caustics, amines, and acids (HF acid), if the concentrations and temperatures are such that the original fabrication specifications require post weld heat treatment. These services may cause cracking in the weld area or heat affected zone.

- Certain unsaturated hydrocarbons (ethylene) may experience exothermic decomposition due to high temperatures caused by welding; creating localized hot spots on piping or equipment walls that could lead to failure.
- Where hot work is being clone on the outside surface of a vessel or piping precautions should be in place to protect against overpressure due to thermal expansion of the contents.

MACHINES

- Hot tapping machines may be powered by hand, air, hydraulic fluid, or electricity. These machines must be able to retain and remove the blank or coupon.
- Make sure seals and materials of construction of the hot tapping machine are compatible with the contents in the piping or vessel.
- Material of the drill or cutter must be suitable for effective penetration of the metal of the piping or vessel being tapped.
- Make sure that hot tapping machines are designed and constructed to withstand the temperatures, pressures, and mechanical stress which may be imposed during their operation.
- Hot tap machines must be special equipment that will provide proven effective protection for employees. This provision is in accordance with U.S. Federal OSHA requirements in 1910.147 Lockout/Tagout.
- Before hot tapping is attempted, the machine, cutter, and pilot bit should be carefully inspected to ensure that they are in satisfactory condition and capable of being left in service (if necessary) in the event of mechanical problems or hot tap valve leakage.
- All hot tapping machines have maximum and minimum working pressure, and high and low temperature ratings.
- During hot tapping, careful thought must be given to the possibility of operational upsets that may alter the process temperature or pressure.
- Always remember that the hot tapping machine may have to remain in place for an extended period of time if removal of the machine is not successful.

REMEMBER

Knowledge, experience, and planning along with good procedures, competent personnel with appropriate skills who perform their work in conformance to procedures, and proper equipment are keys to safe and successful hot tapping.

Hot tapping should not be emergency work; when precautions cannot be established in advance and accommodated, then the unit or equipment should be taken out of service or shut down.

TANKS OR VESSELS

Make sure that welding on the exterior of tanks or vessels in service is not conducted unless controls are established, and in place, to prevent flammable vapors from reaching the area of the welding. Work must be stopped immediately should any flammable vapors be detected in the welding area.

Hazards associated with welding or hot tapping on tanks in operation include (but are not limited to):

- Tank venting, with vapors reaching the work area where welding is taking place.
- Product within the tank rising and overflowing.
- Inadvertently allowing the liquid level within the tank to fall below the point of welding, thereby losing the heat sink provided by the liquid, and exposing the vapor space within the tank to an ignition source.

Make sure that welding is not conducted above the liquid level or on a vessel that is double walled and/or which has an internal lining such as glass, polymeric or alloy cladding until inspection and analysis are made by a qualified person to determine whether it is possible to perform the work safely.

When welding and hot tapping is to be done on the outside surface of a vessel, and if the area is otherwise safe for the use of an open flame, precautions should be taken:

- Make sure pressure within the vessel is maintained in a range determined to be acceptable by a qualified person during the job analysis.
- Atmosphere within the vessel must be incapable of being ignited because it is too rich or too lean or is non-combustible or non-reactive as determined during the job analysis and reviews based on the chemical analysis or other reliable information.
- Make sure welding is not performed on metal contacting a vapor space without a heat sink.
- Liquid level in the tank must be maintained at least 3 ft. (1 m) above the area where the work is being performed when welding or hot tapping on atmospheric tanks in service (because of the potential danger of creating an explosive atmosphere inside the tank vapor space).
- Remember; to the extent possible, the tank should be static with no flow in or out.
- Make sure that measurements of atmospheric tank levels are verified by a hand tape gauge to verify the accuracy of automatic or remote reading gauges.
- Always take adequate precautions to prevent burning through the tank or vessel wall during welding associated with hot tapping.
- Make sure that when under a vacuum, the additional evaluations and precautions are addressed.

DECKS OF FLOATING ROOF TANKS

Welding must not be permitted on the decks of floating roof tanks in service. Floating roof tanks are subject to unique flammability hazards in specific locations:

- Inside the pontoons.
- Between the deck and liquid surface near the tank roof gauge float compartment.
- Near the roof seal vent.
- Near the floating roof lift leg vent.
- Between the primary and secondary seal.
- Near the roof drain.

ABOVE OR BELOW GRADE

For hot tapping and welding work above or below grade, provisions must be made for an easily accessible means of egress.

Tests must be conducted for oxygen, flammable vapors, and toxic air contaminants, and permit(s) issued listing the requirements and approving the entry into the confined space and hot work, to assure that the atmosphere in excavations and confined spaces is safe for entry and hot work.

Make sure that the job analysis determines if regulatory Permit Required Confined Space provisions (1910.146), training (1926.21) or ventilation (1926.353(b)) apply.

When oxygen deficiency, flammable vapors, or hazardous air contaminants are present, an air mover or other positive means of ventilation must he provided.

Respiratory equipment may be required to provide protection from hazardous contaminants, vapors, or fumes emitted as a result of welding.

Air monitoring may be required during work activity to assure that air quality remains within the permitted safe work levels.

LINED PIPING, LINED EQUIPMENT, OR CASED LINES

Welding or hot tapping should not be permitted on in-service lines or equipment with cladding, or with glass, lead, refractory, plastic or strip linings, unless specifically authorized by specialized procedures or following an engineering evaluation.

When welding or hot tapping on underground lines that run through casings, care must be taken to assure that the annular space is gas free and that the work is performed on the pipeline and not on the casing.

HOT TAPPING ON PIPING

Remember; hot tapping on piping may have specific regulatory requirements.

Flow should be established in the line to carry heat away from the weld site and to prevent buildup of hydrostatic pressure due to liquid expansion in static blocked-in piping. Reviews of piping and consumable welding material should be included in the job analysis.

A review should determine potential thermal or personnel hazards associated with the material contained in the piping. The need for knowledgeable review by qualified persons increases as temperatures and pressures increase.

UPSTREAM OF EQUIPMENT AND VALVES

Always avoid hot tapping upstream of rotating equipment or automatic control valves, unless such equipment is protected from the cuttings by filters or traps.

Lockout/Tagout	
Company:	This procedure establishes the minimum requirements for the lockout of energy isolating devices whenever maintenance or servicing is done on machines or equipment. It shall be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources, and locked out before employees perform any servicing or maintenance where the unexpected energization or start-up of the machine or equipment or release of stored energy could cause injury.
Equipment:	

1. Notify Employees: Notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance. (Document name or job title of authorized and affected employees)

Authorized Employees	**Affected Employees**	

2. Prepare for Shutdown: The authorized employee shall refer to the company procedure to identify the type and magnitude of the energy that the machine or equipment utilizes, shall understand the hazards of the energy, and shall know the methods to control the energy.

Type(s) of Energy	**Magnitude**
☐ Mechanical	
☐ Potential	
☐ Electrical	
☐ Thermal	
☐ Chemical	

3. Equipment Shutdown: If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open switch, close valve, etc.).

Type of Operating Controls:

Location of Operating Controls:

4. Equipment Isolation: Set the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).

Type(s) of energy isolating device(s)	**Location(s) of energy isolating device(s)**

5. Lock out the energy isolating device(s) with individual locks

Lockout/Tagout (page 2)	
Company:	Equipment:

6. Release Stored Energy: Stored or residual energy (such as that in capacitors, springs, elevated machine members, hydraulic systems, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.

Type(s) of Energy	Method(s) to dissipate or restrain
☐ Mechanical	
☐ Potential	
☐ Electrical	
☐ Thermal	
☐ Chemical	

7. Verify Isolation: Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.

Method to verify isolation:

Caution: Return operating control(s) to neutral or "off" position after verifying the isolation of the equipment.

8 . The machine or equipment is now locked out.

Restoring Equipment to Service

When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps shall be taken:

(1) **Check the machine or equipment** and the immediate area around the machine to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.
(2) **Check the work area** to ensure that all employees have been safely positioned or removed from the area.
(3) **Verify** that the controls are in neutral.
(4) **Remove the lockout devices** and reenergize the machine or equipment. Note: The removal of some forms of blocking may require reenergization of the machine before safe removal.

Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

HOT TAP PERMIT

Contractor:			
Subcontractor:			
Project:	Contract No.		
Location:			
Date of Hot Tap:	Time:		
Service being tapped:	Line Number:		
Line Type and Size	Tap Size:		
If the answer to any of the following questions is yes, the hot tap cannot be made!			
		YES	NO
Is hot tap diameter greater than 50% of run pipe diameter? If yes, a full encirclement pad or split tee is required.			
Is stress relief required?			
Is pressure greater than 700psi (4.83 MPa)? Pressure Reading:			
Is temperature less than 70°F (21°C) or greater than 600°F (315°C)? Temperature Reading:			
Is pipe or plate minimum thickness less than 3/16 of an inch (4.8 mm)? Thickness Reading:			
Is required flow rate in line specified in job plan? Flow Rate:			
Does hot tap area include existing weld seams?			
Are there any obstructions that may interfere with tapping machine clearance?			
Is tank or liquid vessel level less than 3 feet (915 mm) above tap location? Level:			
Is hot tap upstream of rotating equipment without filters or traps?			
Preparations Checklist	**Date Completed**	**By (Print Name)**	
Careful consideration has determined hot tap is required.			
Engineering design, with drawing approvals complete, is prepared.			
There are exceptions to the requirements; detailed in the JSA (write N/A as appropriate)			
Welding procedure is developed and signed.			
Inspection has demonstrated the machine, cutter, and pilot bit are in satisfactory condition.			
JSA is detailed, complete, and signed.			
Hot tap procedure is detailed, complete, and signed.			
Inspection has determined the area/material to be hot tapped is within the requirements			
SIGNATURES		**Date**	
Construction Mgr.:			
Construction Engineer:			
Subcontractor:			
Project Safety:			
Client Representative:			
Registered Professional Mechanical Engineer:			

Job Safety Analysis

Project:	Activity:
Contract:	
Location:	

#	Job Steps	Potential Hazards	Safe Procedures/Controls
1	Pre-hot tap pipe inspections (E.g. diameter, checking ovality, actual wall thickness, evidence of corrosion, soundness of any longitudinal seam, carbon equivalent etc.)		
2	Preparation of pipe external service for weld/joint		
3	Exclusion of moisture during operation (e.g. tent, preheat etc.)		
4	Fit up and alignment		

5	Weld/joint cleanliness		
6	Welding /jointing operation		
7	Tapping operation		
8	Pressure Testing		
9	Commissioning /purging		
10	Final inspections tests		
11			
12			

Equipment to be used	Inspection requirements	Training requirements