Section 50.0
WELDING, CUTTING, BRAZING/HOT WORK AWARENESS

A. Purpose

Welding and cutting of metals can involve a great number of health and safety hazards.

1. The purpose of this procedure is to give **JAGUAR ENERGY SERVICES, LLC** personnel an awareness of safe welding, cutting, and brazing practices to enable them to recognize potential hazards.

2. Implementation of this procedure will enable **JAGUAR ENERGY SERVICES, LLC** to comply with OSHA 29 CFR 1910.255, Welding and Cutting Guidelines.

B. Scope

1. This procedure applies to welding, cutting, and brazing activities on **JAGUAR ENERGY SERVICES, LLC** and client premises.

C. Responsibilities

1. The Safety Coordinator or his/her designee is responsible for ensuring that employees have completed the training required by this procedure.
   - (a) Additional responsibilities include:
     - (i) Ensuring that employees have been properly trained.
     - (ii) The implementation of this Policy.
     - (iii) Take corrective actions on all violations or suspected violations of this procedure.
     - (iv) Documentation of completion by each employee.

2. The Supervisor is responsible for aiding in the implementation of this Procedure.
   - (a) Additional responsibilities include:
     - (i) Keeping the Safety Coordinator informed of any incidents related to this Procedure.

(ii) Providing appropriate safety equipment to **JAGUAR ENERGY SERVICES, LLC** personnel.

3. The Supervisor is responsible for providing assistance in the implementation of this policy.
   (a) Additional responsibilities include:
      (i) Informing the Safety Director of any incidents involving welding or cutting.
      (ii) Making suggestions to management for ways to improve this Policy.
      (iii) Maintaining the records associated with welding activities including customer notification forms and copies of the customer Hot Work Permits.

4. **JAGUAR ENERGY SERVICES, LLC** personnel are responsible for understanding the contents of this procedure and recognizing hazards associated with welding activities.
   (a) Additional responsibilities include:
      (i) Informing the Safety Director of any incidents involving welding or cutting.
      (ii) Generating the records associated with welding work.

D. Procedure

1. Types of Welding

(a) **Oxygen-fuel gas welding** joins metal parts by generating extremely high heat during combustion.

(b) **Resistance welding** joins metals by generating heat through resistance created through the flow of electric current.

(c) **Arc welding** joins or cuts metal parts by heat generated from an electric arc that extends between the welding electrode and the electrode placed on the equipment being welded.

(d) **Gas Metal Arc Welding (GMAC)** is an arc welding process that uses an arc between a continuous filler metal electrode and the weld pool. Shielding (from the atmosphere) is provided by an externally supplied gas.

2. Hazards of Welding Activities

Unless certain precautions are taken, welding can be very dangerous. Both the welder and those who come in contact with the welder can be seriously injured.

(a) Common hazards include burns and fires from hot metals and sparks, eye and skin damage from infra-red and ultra-violet rays, and exposure to noxious fumes and gases.

(b) The possibility of electric shock and strains or sprains from handling materials and equipment also exists.

(c) Even though **JAGUAR ENERGY SERVICES, LLC** personnel are not welders, they should be aware of safe practices as they relate to welding.

(d) It is important to understand the hazards involved and to take precautions to prevent fires, explosions, or personal injuries from exposure to toxic fumes.

(e) Even in metal cutting or repair jobs that are considered routine, workers should always follow established safety procedures and resist the temptation to take short cuts.

3. In the event that the client does not have a Hot Work permit program, the attached form must be used.

(a) For additional information, **JAGUAR ENERGY SERVICES, LLC** employees are encouraged to consult the National Fire Protection Association (NFPA) Standard 51B "Fire Prevention in Use of Cutting and Welding Procedures" and the **JAGUAR ENERGY SERVICES, LLC** Hot Work Permit procedure.

4. Safe work practices

Supervisors, welders, cutters, and employees engaged in welding and related activities must have proper equipment, health and safety information and training, and adequate personal protective equipment.

(a) There are some precautions which if followed, can reduce the risk of injury.

(b) Welders can get hurt by any of the following by-products of the welding process:

(i) **Fire** - Sparks and hot slag can be very dangerous. Make sure there are no combustible materials in the welding area.

(ii) **Noise** - Hearing protection is available to help reduce the risk of hearing damage.

(iii) **Heat** - Slag and sparks can cause burns without direct contact because of the intense heat produced by welding. Wear personal

protective equipment at all times to avoid burns.

(iv) **Electric Shock** - Electrical equipment in general is dangerous, and so is welding equipment. Check for loose connections and make sure the equipment is properly grounded.

(v) **Leads -** Make sure to inspect your welding lead daily. Leads in need of repair should not be used.

5. Ultraviolet Radiation

(a) Also called UV radiation, ultraviolet light can cause welding burns.

(i) Wear protective hoods and clothing to avoid injuries.

(ii) Welding shields should be used to help prevent injuries to others working in the area.

(b) Exposure to UV radiation can cause a flash burn to the eyes called welder's flash.

(i) This condition can feel like you have sand in your eyes.

(ii) Never look directly at the arc when working in the area of welding activities.

6. Precautions

It is preferable to remove all welding or cutting operations to non-hazardous areas.

(a) If disassembly or removal is deemed unacceptable, or if customer-directed repairs are required on-site, follow the general precautions and procedures listed below.

(i) Notify the customer of the necessity of the proposed on-site welding or cutting.

(ii) Obtain written permission for the work from the highest available supervisor in charge of the site.

(iii) Non-supervisory authority shall not be accepted.

(iv) Notify the supervisor of the need to alert the site safety department of the proposed work.

(b) If feasible, at least 24 hours in advance of the beginning of the work, request the presence of the local fire department, fire watch team (offshore platforms), and/or the presence of fire-suppression equipment.

(c) Request the customer to provide continuous duty hazardous gas and hydrocarbon detectors ("sniffers"), and a client representative be present to ensure the satisfactory operation and monitoring of the detectors.
  (i) All personnel should be made aware of how the detector's alarm sounds by testing the alarm with all personnel present.
  (ii) Request that the station or platform be shut down, if possible.
  (iii) Request the cessation of all producing activity.

(d) Where electrical power units are involved, request the deactivation of all on-line power generation units in the same building or area where the work is to be conducted.

(e) The facility, rig, or production platform must be shut in, depressured, and deemed free of any combustibles prior to any welding or cutting being done.
  (i) The exception to this rule is if the welding or cutting is being done in a designated welding area on the facility.

(f) Piping, drums, towers, tanks, etc., must be depressured, drained, purged free of oil, hydrocarbon vapors or other flammable materials, and isolated away from other parts of the process by installing blinds.

(g) Hot tap procedures shall be followed for hot work on equipment in service.

(h) Drip pans, sewers, and drains in the immediate area where work is to be performed shall be cleaned, covered and/or sealed to prevent gas release and/or fire in the piping.

(i) Workers performing the mechanical work are responsible for removing covers and plugs at the end of each day, or immediately after the work is complete and immediately before the permit is voided.

(j) If the object to be welded or cut cannot be moved and if all fire hazards cannot be removed, then guards can be used to confine the heat, sparks, and slag.
  (i) This will provide safer operations while working immovable items that may present fire hazards.

(k) If the proper requirements for safe welding or cutting cannot be followed as per these guidelines, then welding or cutting operations shall not be performed.

(l) Welding shall not be permitted on air lines while they are in service, due to the potential for developing a combustible mixture of air and oil inside the equipment.

(m) Process water lines must be purged with steam before welding or hot work is permitted on the piping or equipment.

(n) Request copies of, and familiarize yourself with, the customer's Hot Work Permit system and Lock Out Tag Out system.

(o) Properly trained First Aid personnel with the required First Aid equipment will be available during any welding or cutting operation.

7. Fire Watch

The Fire Watch is the person designated to watch the welding and/or cutting to be performed in a given area.

(a) A Fire Watch will be required if:

- (i) Welding or cutting is in an area where anything than a minor fire might develop.
- (ii) Combustible materials are closer than 35 feet to the point of operation.
- (iii) Combustible materials are 35 ft. away but are easily ignited.
- (iv) Wall or floor openings within a 35 ft. radius expose combustible materials.
- (v) Remain in area for at least a half and hour after welding or hot work has been completed.
- (vi) Combustible materials are adjacent to the opposite side of metal partitions, ceilings, or roofs.

(b) The Fire Watch must be:

- (i) Familiar with the facilities for sounding the alarm in the event of a fire.
- (ii) Trained in Fire Watch procedures.
- (iii) Equipped and trained in the use of fire extinguishers and water, to be able to extinguish any spot fires that might start at all welding operations.

(c) The Fire Watch will:

- (i) Have no other duty to perform while on watch.
- (ii) Will watch for fires in all exposed areas, try to extinguish them only when obviously within the capacity of the available equipment, or otherwise sound the alarm.
- (iii) Watch shall be maintained for at least a half hour after completion of the welding or cutting operations to detect and extinguish possible smoldering fires.

(d) Before cutting or welding is permitted, the area shall be inspected by the individual responsible for authorizing cutting and welding operations.
- (i) Obtain the needed written Hot Work Permit if necessary.
- (ii) Recognize that if you are signing a receipt on a Hot Work Permit, you are acknowledging that you understand all precautions that must be followed.
- (iii) Consult the **JAGUAR ENERGY SERVICES, LLC** Hot Work Permit procedure for additional information as needed.
- (iv) Most the Hot Work Permit and keep it in the immediate vicinity of the work.
- (v) Where the customer wants the original Hot Work Permit for their records, request a copy of it for **JAGUAR ENERGY SERVICES, LLC**'s records.

8. Cutters, welders and their supervisors shall be suitably trained in the safe operations of their equipment and the safe use of the welding or cutting process to be used.

9. Site Preparation

(a) Thoroughly clean all floors, package interiors, and engine and ancillary equipment of all combustibles.

(b) Keep all combustible floors and structures watered down or otherwise protected.

(c) Relocate all movable combustibles at least 35 feet from the work.
- (i) Sparks can fly 35 feet or more.
- (ii) Cover all non-movable combustibles with suitable fireproof sheeting or shields, especially exposed cable/wiring.

(d) Ensure that there are no combustible materials inside any closed volumes being welded.

(e) Place fireproof sheeting or shields below the work to reduce weld splatter or sparks from cutting.

(f) Cover wall and floor openings, especially sumps and drains.

(g) Ensure that all junction boxes are closed.

(h) Cover all filters, screens, and similar systems that are impregnated with hydrocarbon deposits.

(i) Where possible, pressurize the weld area with clean outside air to prevent the induction of hazardous atmosphere.

(j) Monitor the intake air for hydrocarbons and shut down the work at the first indication of hydrocarbons; then evacuate the area.

(k) Immediately inform the Customer of any decisions to shut down the work.

10. Confined Space Welding

Personnel welding in a confined space will take the same precautions and operational procedures as all other confined space operations.

(a) Additional confined space welding procedures are:

(i) All confined space welding operations will have proper signs and barricades set up to identify the work area.

(ii) The confined space will have proper ventilation.

(iii) When hazardous fumes, gases, or dust from welding or cutting on material are possible in a confined space, special ventilation and/or respirators will be used.

(iv) Examples of these materials are:

(i) Lead Based Materials
(ii) Zinc
(iii) Cadmium
(iv) Mercury
(v) Breyium
(vi) Exotic Materials or Paints

(v) All gas cylinders will be properly secured outside of the confined space and have gas cylinder shutoff valves.

(vi) All personnel working in the confined space will be wearing life lines secured to a point outside of the confined space.

(vii) Welding electrodes will be remove from the confined space.

11. Weld Preparation

(a) If the object(s) to be welded or to be cut cannot be readily removed from possible fire hazards, all movable fire hazards in the vicinity shall be moved to a safe place.

(b) If the object(s) to be welded or to be cut cannot be moved and if all the fire hazards cannot be removed, then

guards shall be used to confine the heat, sparks, and slag, and to protect the immovable fire hazards.

(c) If the proper requirements for safe welding or cutting cannot be followed, then welding or cutting operations shall not be performed.

(d) Verify that all preparations noted above have been completed.

(i) Use the checklist provided as part of the **JAGUAR ENERGY SERVICES, LLC** Notification Form to ensure that all precautions are taken.

(e) Thoroughly clean the area to be welded.

(f) Paint and other materials can contaminate the weld.

(g) Where electric arc welding is being used, clean the paint or other coatings at the place to be used as the "ground" down to clean bare metal.

(h) Attach the electric arc ground as close to the weld location as possible.

(i) Where multiple welds are needed, move the ground each time.

(i) The welder must ensure that any compressed gas cylinders in the area do not potentially become part of an electrical circuit.

(i) If cylinders are chained or fastened to a surface, for example a metal table, the arc welder must not be grounded to the table.

12. Proper Protective Equipment

(a) **JAGUAR ENERGY SERVICES, LLC** personnel are not likely to conduct welding activities.

(b) If working in the same area as welders, avoid looking directly at the arc.

(c) Avoid wearing polyester or nylon clothing; cotton or cotton blend is preferred when working near welding activities.

(d) Welders must observe the following PPE requirements:

(i) Welders should always wear proper eye protection; safety goggles or glasses with tinted lenses under the welding helmet.

(ii) Flame-resistant aprons, vests, leggings, capes, and gauntlet gloves should be worn as needed.

(iii) Pockets and cuffs invite sparks.

(iv) Pockets, cuffs and collars on shirts and jackets should be covered or buttoned.

(v) Pants should be rolled up inside rather than outside.

(vi) When welding or cutting lead, zinc, cadmium-coated, lead-bearing, or other toxic materials, welders may be required to wear a respiratory device.

13. Oxygen-Fuel Welding and Cutting

(a) Workers left in charged of oxygen or fuel-gas supply equipment must be instructed and judged competent for such work.

(i) This also includes distribution piping systems and generators.

(b) All Cylinder Precautions

(i) Never use a cylinder as a prop or as a work bench.

(i) Welders have cut into cylinders in this way with disastrous results.

(ii) Cylinders should be kept away from any source of heat such as radiators, heaters and sunlight.

(iii) Cylinders should be stored in well-ventilated areas.

(iv) Avoid rough handling, dropping or kicking cylinders.

(v) Cylinders must be secured in an upright position and caps are to be in place when cylinders are not in use and before they are moved.

(vi) Never use a cylinder that is leaking.

(vii) Acetylene and oxygen cylinders must be repaired only by authorized personnel.

(viii) Keep sparks, flames and heat away from cylinders.

(ix) Never test for leaks with a flame, use soapy water.

(x) All cylinders must be properly secured to prevent them from being knocked over.

(xi) Never force connections that do not fit.

(xii) Always attach an acetylene pressure reducing regulator when using acetylene from a cylinder.

(xiii) The pressure should never be more than 15 pounds per square inch.

(xiv) Never use oxygen for compressed air.

(xv) Do not place cylinders under equipment or any other place where oil may leak onto oxygen valve and cause a serious explosion.

(xvi) When welding in tanks or vessels, keep cylinders and as much hose as possible outside of tank to prevent leakage of explosive gas into tank.

(xvii) Locate cylinders outside of tank vessel or enclosed space.

(xviii) All oxygen and acetylene bottles, when in use and not on a regular cart, must be tied together and supported by a steel harness with brace to the ground.

(xix) Acetylene and oxygen bottles shall always be in an upright position.

(xx) Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease) by a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

(xxi) A "NO SMOKING OR OPEN FLAMES" sign shall be posted wherever oxygen and acetylene cylinders are stored to warn employees of the combustible materials in that area.

(xxii) Slings or an electric magnet shall not be used to transport cylinders by crane or derrick.

(xxiii) Be fully alert to the explosive potential you are handling. Example:

(i) An oxygen cylinder of the type in normal commercial use, weighing 140 pounds and filled to 2500 P.S.I., could attain a velocity of about 50 feet per second in one-tenth of a second if a valve were broken off the head of the cylinder.

(c) Cylinder Valve Precautions

(i) Valve protection caps shall not be used for lifting cylinders from one vertical position to another.

(ii) Cylinder valves shall be closed when work is finished.

(iii) Valve protection caps, where the cylinder is designed to accept a cap, shall always be in

place and hand tight, except when cylinders are in use or connected for use.

(iv) An acetylene cylinder valve shall not be opened more than one and one-half turns of the spindle and preferably no more than three-fourths of a turn.

(v) No one shall tamper with safety devices in cylinders or valves.

(vi) Make sure valve outlets are clean.

(i) Visually inspect for oil or grease.

(vii) Never force connections that do not fit.

(viii) Oxygen and acetylene cylinder valves must be closed when changing torches.

(i) Never pinch the hose to shut off the flow.

(d) Oxygen and Acetylene Hose Precautions

(i) Always protect hose from being trampled or run over.

(ii) Avoid tangles and kinks.

(iii) Do not leave the hose and cable so they can trip people.

(iv) Protect the hose flying sparks, hot metal and open flames.

(v) Always keep hoses free of grease and oil.

(vi) These rot the rubber and are a hazard.

(vii) If oxygen hose should catch fire, never attempt to pinch hose. Instead, close the cylinder valve.

(viii) The hose should be racked properly when not in use, and valves on valves on the cylinder should be closed.

(ix) Pressure should be released from hose and regulators after use.

(x) Hose should be tested monthly, immersing under full working pressure in water.

(xi) At intervals, cut off a few inches of hose next to the torch and reattach to avoid leakage of hose subject to hard use.

(xii) Hoses shall be properly color coded:

(i) Oxygen - Green

(ii) Acetylene - Red

(e) Torch Handle Precautions

(i) All torch handles shall be equipped with reverse flow check valves in each line so as to prevent possible flashbacks.

(ii) Use a friction lighter to light a torch.

(i) Do not use a match; the hand may be burnt.

(iii) No employee shall carry a torch lighter of the spark or friction type in any area where sources of ignition are forbidden.

(iv) When a torch backfires, immediately close oxygen valve for a moment.

(v) Do not put down torch until gases are completely shut off.

(vi) Never lay a torch in a location where leaking oxygen or acetylene may accumulate and create an explosion.

14. Arc Welding and Cutting

There are many ways one can be injured by welding procedures.

(a) Workmen assigned to operate arc welding equipment must be properly, trained, instructed, and qualified to operate such equipment.

(b) Some of the possible ways of being injured or killed are:
- (i) Electrocution
- (ii) Asphyxiation
- (iii) Flash burns
- (iv) Explosions
- (v) Cuts
- (vi) Bruises
- (vii) Many more.

(c) These injuries can be prevented by the use of:
- (i) Approved methods of storage and handling.
- (ii) Approved methods of setting up and operating equipment.
- (iii) Good working habits.
- (iv) Maintaining equipment.

(d) Welding Rod and Wire
- (i) Welding rods and wire must be stored in a dry, well-ventilated place.
- (ii) Broken packages are preferably stored in a heated cabinet.
- (iii) Welding rods that have become wet may smoke and will not provide a good porosity-free weld.

(e) Machines and Attachments
- (i) Generally all welding equipment is damaged by water.

(i) Every effort should be made to protect equipment during transportation and use.

(ii) Handling of welding equipment as well as handling of any equipment should be accomplished in a way to prevent damage.

(i) Careless handling of cables and gas hoses, such as dragging across sharp edges, could result in damage by arc, electrocution or fire.

(ii) Snatching or jerking welding machines while towing can cause loose connections and other damage which results in improper operation of the machine.

(f) Electrical Welding

(i) Setting up for electrical welding is much the same as setting up gas equipment.

(i) Connections - clean and tight.

(ii) Torches (heli-arc) - Electrode holders

(iii) Gas bottles and connections (heli-arc).

(iv) Location of equipment.

(v) Routing of leads.

(vi) Ground always made to item being welded.

(g) Operation of Electrical Equipment

(i) Must be authorized by Foreman or Supervisor.

(ii) Must be qualified by training in proper operation and maintenance procedures before being assigned to operate or maintain.

(iii) Workmen assigned to operate or maintain arc welding equipment shall be acquainted with the requirements of 29 CFR 1910.254 (d) and with 29 CFR 1910.252 (a), (b) and (c), if doing gas - shielded arc welding, also,

(i) Recommended Safe Practices for Gas - Shielded Arc Welding, A6.1 - 1966, American Welding Society.

(ii)

(h) Good Working Habits and Personal Safety

(i) Make sure you are adequately protected before you start welding.

(ii) Wear protective equipment and clothing as required for the job at hand.

(i) Different jobs require different equipment.

(iii) To be sure you are fully protected from ultraviolet radiation follow these precautions:

(i) Cover all skin surfaces to protect yourself from arc burns, from sparks and spatter.

(ii) Keep sleeves rolled down and wear gloves at all times.

(iii) Wear leather clothing such as an apron, sleeves and spats in cases of prolonged exposure to arc radiation.

(iv) Wear a leather cap or other suitable head covering, shoulders or sleeves as required when working overhead.

(v) Use a welder's helmet or goggles that the type of welding calls for.

(i) Be sure to use the correct shade of lens as required by the current setting.

(i) Wear high snug fitting shoes.

(i) Avoid wearing low or loose shoes which would allow hot spatter to get inside.

(j) Wear clean clothes.

(i) Avoid wearing clothing that has been stained with oil and greases.

(k) Wear cuffless pants; by wearing cuffless pants you eliminate a dangerous spark and spatter trap.

(l) Proper rigging, hoists, ladders and work platform must be used to prevent accidents.

(i) Many people have been injured by improper rigging and inadequate work platforms.

15. Work Area and Operations

(a) Be certain that helpers on a welding job are properly equipped, clothed and have correct eye protection.

(b) Location of equipment and running of leads should be accomplished so as to not create a hazard to other people in the work area.

(c) Use adequate screening around job to protect others from eye injury or burns.

16. Maintaining Equipment

Properly maintained equipment is safe and will produce quality results.

(a) Operator's equipment should report any equipment defect or safety hazards.
  (i) They should discontinue use of the equipment until its safety has been assured.
  (ii) Repairs shall be made by qualified personnel only.

(b) All equipment or tooling should be inspected before use.
  (i) This will insure that the equipment is in proper order.
  (ii) Inspection must cover not only the mechanical fitness, but also the cleanliness of a machine.
  (iii) Dirty machines are the cause of a large percentage of accidents, scrapped work and damaged machines.
    (i) Be sure the machine is clean.

(c) During the inspection, should defects be found that require repairs the equipment use should be discontinued until it has been repaired or replaced.

(d) Minor repairs such as tightening connections, replacing torch parts, leads, hoses or regulators are a part of the operator's job.

(e) Major repair adjustments to electrical systems or drive engines are the responsibility of the electric department or garage.

(f) Replacement of parts or tooling of a machine which are defective should be done immediately.

(g) The failure to replace defective parts can cause a malfunction which is dangerous to the operator and others in the vicinity.

(h) The failure to replace parts immediately can also cause further damage to the machine and can result in poor quality end products.

E. Training Requirements

1. **JAGUAR ENERGY SERVICES, LLC** personnel will be trained on the following topics:
  (a) Fire Fighting.
  (b) Types of welding.
  (c) Hazards of welding processes.
  (d) Safety precautions to be taken prior to welding.
  (e) Hot Work Permits and customer notifications.
  (f) Duties of a Fire Watch.
  (g) Proper Protective Equipment.
  (h) Contents of this procedure.

F. Training Frequency

1. **JAGUAR ENERGY SERVICES, LLC** personnel will be trained according to the following schedule:
   (a) Initially upon hire.
   (b) As necessary thereafter.

G. Definitions

1. **Arc** is a controlled electrical discharge between the electrode and the work piece that is formed and sustained by a gas that has been heated to such a temperature that it can conduct electric current.

2. **Arc welding** joins or cuts metal parts by heat generated from an electric arc that extends between the welding electrode and the electrode placed on the equipment being welded.

3. **Brazing** is a welding process that joins materials by heating them to a temperature which will not melt them but will melt a filler material which adheres to them and forms a joint.

4. **Electrode** is a flux coated wire rod.

5. **Gas Metal Arc Welding (GMAC)** is an arc welding process that uses an arc between a continuous filler metal electrode and the weld pool; shielding (from the atmosphere) is provided by an externally supplied gas.

6. **Heating Torch** is a device for directing the heating flame produced by the controlled combustion of fuel gases.

7. **Oxygen-fuel gas welding** joins metal parts by generating extremely high heat during combustion.

8. **Resistance welding** joins metals by generating heat through resistance created through the flow of electric current.