UNGER
CONSTRUCTION CO.

Proof of Training

Print name: _____Signature: _____ Date: _____

Welding, Brazing and Cutting Activities
(This policy includes the Hazards of Compressed Gas Cylinders and Gas Cylinder Handling)

Purpose

The purpose of this program is to ensure the protection of employees and subcontractors from the hazards associated with welding, brazing and cutting activities. Additionally, this policy covers the hazards of compressed gas cylinders. Welding brazing and cutting are covered in the first section of this policy. Hazards of compressed gas cylinder being on page 10.

Scope

This policy will apply to all work performed by employees and subcontractors including, but not limited to the following activities: construction, installation, demolition, remodeling, relocation, refurbishment, testing, and servicing or maintenance of equipment or machines and at other times when welding, brazing and cutting activities is required.

Responsibilities

Management (Board of Directors and Project Managers)

Management is responsible for ensuring that the materials (e.g., tools, equipment, personal protective equipment) and other resources (i.e., worker training materials) required to fully implement and maintain this program are readily available where and when they are required. Additionally, management will monitor the effectiveness of the program, provide technical assistance as needed, and review the program bi-annually.

Program Manager

Dave Simpson is responsible for the development, documentation, training and administration of the program. This position carries the responsibility of insuring this program is adhered to and that proper reporting is executed.

Supervisors (Superintendents and Foreman)

Supervisors are responsible for ensuring that a task specific job hazard analysis (JHA), also known as a safe work plan, is developed. The JHA will select, implement and document the appropriate site-specific control measures as defined within this policy. Supervisors will direct the work in a manner that ensures the risk to workers is minimized, adequately controlled and that practices defined by this policy will be followed. Supervisors are responsible for ensuring Unger Construction employees and subcontractors are following expectations. Supervisors will be held accountable for enforcing the requirements of this program. Undesirable behavior will not resolve itself, therefore supervisors must be directly involved

with modifying behaviors inconsistent with program expectations. Supervisors will be held accountable for enforcing Unger Construction's disciplinary program.

Workers (Employees and Subcontractors)

Unger Construction has high expectations and requires safety excellence for each employee, crew, project and for our entire company. Workers are required to follow the minimum procedures outlined in this program. Workers are responsible for knowing the hazards and the control measures established in the JHA. Workers are responsible for using the assigned PPE in an effective and safe manner. Workers are responsible for stopping unsafe acts and correcting unsafe conditions on the spot as soon as they are discovered. Any deviations from this program must be immediately brought to the attention of your supervisor. Workers that choose to conduct themselves in a manner that is inconsistent with these expectations will be held accountable for those decisions and may incur disciplinary actions.

Hazardous Material Survey

Unger Construction requires hazardous materials surveys before demolition or renovation work begins. The survey shall include all of the following: A visual inspection of a facility or a portion thereof for suspect materials, sampling and laboratory analysis of any suspect materials found for the presence of asbestos. The hazardous materials survey will also furnish a written report that includes: a description of the area(s) visually inspected, a detailed description of any suspect material sampled, the results of any laboratory analysis of suspect materials, the method of analysis, and the total amount of asbestos containing material. Typically a floor or roof plan is included with the report to reference the written information visually.

The person conducting the survey must be certified pursuant to OSHA and/or EPA regulations. The survey may be performed by a certified Site Surveillance Technician (SST) under the supervision of a licensed consultant. Note: The survey may be performed by a certified Site Surveillance Technician (SST) under the supervision of a licensed consultant. Note: The survey needs to be kept in a project file so that it can be accessed when working on future projects.

If lead or asbestos have been confirmed to be present employees and subcontractors must follow Unger Constructions Lead and/or Asbestos program. If hazards such as asbestos or lead will be disturbed during remediation, a properly licensed professional must perform the work and follow appropriate regulations.

Job Hazard Assessment (Safe Work Plan)

Unger Construction utilizes JHA's as our means of hazard assessment and establishing a safe work plan. JHA's are performed by supervisors and/or workers. Our library of hazard assessments is maintained on the "S" drive. Before beginning a new task refer to the JHA library, generally speaking all scopes of our work are covered. For situations that have not yet been covered select one that is substantially similar and use it as a baseline. JHA's on the "S" drive are organized by work area and job description. JHA's include strategies for elimination, substitution, engineering and administrative controls. After applying all appropriate reduction and elimination technique, the remaining hazards will be analyzed and the proper PPE to reduce the hazards will be selected. PPE will be identified for hazards that are in the process of being reduced or eliminated and/or when hazard-reduction efforts are not 100% effective in eliminating the hazards.

For complex or moderate to high hazard tasks, tasks where an additional level of safety planning is needed, the safety director will perform the JHA with the supervisor and workers.

Training

Welding, brazing and cutting activities required specialized training and certification. You cannot weld, braze or flame/arc cut without proof of training and a current certification card. All welders should receive training on the safe use of equipment and processes, safe work practices, and emergency procedures. Compressed gas cylinders can only be handled or transported by certified welders. Employees in charge of oxygen or fuel gas supply equipment shall receive instruction for this work before the work begins.

Before any employee is allowed to perform welding, brazing and cutting activities, they must first receive training. Each employee must demonstrate an understanding of the required training, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE.

Proof of training is available on the “S” drive. The training data base can be sorted by employee name or by subject. This ensures supervisors and employees are able to confirm they have the necessary training and if they don’t which employees do. Employees that need training should contact their project manager or superintendent to make arrangements for them to be trained.

Retraining

The need for retraining will be indicated when: An employee’s work habits or knowledge indicate a lack of necessary understanding, motivation or skills, New equipment is installed that requires new or different PPE, Changes in the workplace make previous training obsolete, Changes in the types of PPE to be used make previous training obsolete or Upon a supervisor request.

Introduction

Welding, cutting, and brazing are hazardous activities that pose a unique combination of both safety and health risks. Control of welding hazards includes avoiding eye injury, respiratory protection, ventilation of the work area, protective clothing, and having safe equipment to use.

Rules and instructions with respect to the operation and maintenance of fuel gas supply equipment shall be readily available at the location of work.

Welding

Welding joins pieces of metal by the use of heat, pressure, or both. There are more than 80 different types of welding and associated processes. Some of the most common types of welding include: arc welding, which includes “stick” or shielded metal arc welding (SMAW), the gas-shielded methods of metal inert gas (MIG) and tungsten inert gas (TIG), plasma arc welding (PAW), and submerged arc welding (SAW). Other welding processes may use oxy-acetylene gas, electrical current, lasers, electron beams, friction, ultrasonic sound, chemical reactions, heat from fuel gas, and robots.

Brazing

Brazing or soldering, involves a filler metal or alloy (a combination of metals), which has a lower melting point than the metal pieces to be joined. The filler materials (such as lead and cadmium) can be very toxic.

Cutting

Cutting activities involves cutting with a flame, plasma or arc.

Precautions

Welding and burning operations have a high potential for causing personal injury and fires. Before performing any welding, cutting or burning operations to commence in your area, the immediate area must be inspected to insure that sparks or molten metal will not fall on combustible materials or other workers. Do not weld or cut where there are any combustible materials within five (5)-feet of the welding.

Suitable fire extinguishing equipment must be readily available at the work area. When burning or welding, exposed workers must wear appropriate eye and face protection with suitable filter lenses. Workers must never be weld, cut or burn barrels, tanks, piping, or other systems which may have contained either combustible or other unknown products without first having them tested to ensure that it is safe to do such work.

When arc welding must be performed near other workers, they must be protected (if possible) from the harmful arc rays by a noncombustible screen or each worker must wear adequate eye and face protection.

Cylinders that require a tool to open the valve shall have the tool either positioned on the valve while it is in service or very close to the cylinder such that the valve can be immediately closed in the event of an emergency.

After removing the cylinder cap but before installing the regulator inspected the sealing surfaces of the regulator and the cylinder valve for damage, wear or particulate. Damaged or worn sealing surfaces could leak and should be red tagged and taken out of service. Particulate can be removed using a cotton tipped swab and/or by cracking the cylinder valve partially open using the cylinders pressure to blow particulate out of and away from sealing surfaces. Cracking is itself a potentially hazardous activity as the particulate could be expelled with enough force to injure workers. Step to the side and make sure no one else is directly aligned with the valve outlet. Cracking introduces flammable gas into the area. Ensure there are no sources of ignition nearby and use the least amount of gas possible. Simply crack the valve and then close it then re-inspect the sealing surface. If the particulate has not been removed repeat the process once more. If the second attempt is not successful stop and use the cotton tipped swab method.

Cylinders with leaking components that cannot be corrected on the spot shall be transported to a ventilated cylinder cabinet or taken outdoors and secured away from any potential ignition sources. The surrounding area shall be secured with danger or red tape to prevent workers, equipment or sources of ignition from getting too close. Only the gas cylinder supplier or the fire department may enter this area.

Pre-use Inspections

Welding leads, insulators, electrodes, regulator assemblies, tubing, valves and associated hardware shall be inspected before each use. The inspection shall look for defects or damage to the mechanical restraints, caps, connectors, damaged or missing conductors, insulation that is damaged, frayed stressed or nicked. Welding cables shall be free from repairs or splices within 10 feet of the electrode holder. Suspect items shall be taken out of service (red tagged) or immediately repaired by a qualified individual. Repairs to electrical insulation shall be equivalent in performance to the original insulation capacity.

Unger Construction does not utilize an assured grounding program preferring instead to follow a 100% ground fault circuit interruption (GFCI) program. All corded tools and extension cords must be connected to a GFCI. GFCI's themselves must be inspected and tested monthly. Units that fail the test shall be destroyed and discarded. The ground connections for the welding equipment at the point of use shall be adequate to carry the full rated current load of the welding system.

Post Use Inspection

When not in use, the welding systems must be disconnected from their power source, and properly stowed. It is unacceptable to leave power tools or equipment operating unattended.

Health Hazards of Welding

Heat

The intense heat of welding and sparks can cause burns. Contact with hot slag, metal chips, sparks, and hot electrodes can cause eye injuries. Excessive exposure to heat can result in heat stress or heat stroke. Welders should be aware of the symptoms - such as fatigue, dizziness, loss of appetite, nausea, abdominal pain, and irritability. Ventilation, shielding, rest breaks, and drinking plenty of cool water will protect workers against heat-related hazards.

Visible Light, and Ultraviolet and Infrared Radiation

The intense light associated with arc welding can cause damage to the retina of the eye, while infrared radiation may damage the cornea and result in the formation of cataracts. Ultraviolet light (UV) from the arc can cause "welder's flash" after a brief exposure (less than one minute). The symptoms usually occur many hours after exposure to UV light, and include a feeling of sand or grit in the eye, blurred vision, intense pain, tearing, burning, and headache. The arc can reflect off surrounding materials and burn the eyes of co-workers working nearby.

Electrical Hazards

Even though welding generally uses low voltage, there is still a danger of electric shock. The environmental conditions of the welder (such as wet or cramped spaces) may make the likelihood of a shock greater. Falls and other accidents can result from even a small shock; brain damage and death can result from a large shock. Dry gloves should always be worn to protect against electric shock. The welder should also wear rubber-soled shoes, and use an insulating layer, such as a dry board or a rubber mat, for protection on surfaces that can conduct electricity. The piece being welded and the frame of all

electrically powered machines must be grounded. The insulation on electrode holders and electrical cables should be kept dry and in good condition. Electrodes should not be changed with bare hands, wet gloves, or while standing on wet floors or grounded surfaces.

Fires and Explosions

The intense heat and sparks produced by welding, or the welding flame, can cause fires or explosions if combustible or flammable materials are in the area. Welding or cutting should only be performed in areas that are free of combustible materials, including trash, wood, paper, textiles, plastics, chemicals, and flammable dusts, liquids, and gases (vapors can travel several hundred feet). Those that cannot be removed should be covered with a tight-fi tting flame-resistant material. Doorways, windows, cracks, and other openings should be covered. Never attempt to weld containers that have held a flammable or combustible material unless the container is thoroughly cleaned or filled with an inert (non-reactive) gas. Explosions, fires, or release of toxic vapors may result. Containers with unknown contents should be assumed to be flammable or combustible.
A fire inspection should be performed before leaving the work area and within 30 minutes after the operation is completed. Fires extinguishers should be nearby.

Fumes and Gases

Generally, welding fumes and gases come from the base material being welded or the filler material that is used, coatings and paints on the metal being welded, or coatings covering the electrode, gases supplied from cylinders; chemical reactions which result by the action of ultraviolet light from the arc, and heat. The health effects of welding exposures are difficult to list, because the fumes may contain so many different substances that are known to be harmful (depending on the factors listed above). The individual components of welding smoke can affect just about any part of the body, including the lungs, heart, kidneys, and central nervous system. Welders who smoke may be at greater risk of health impairment than welders who do not smoke, although all welders are at risk.

Welding “smoke” is a mixture of very fine particles (fumes) and gases. Many of the substances in welding smoke, such as chromium, nickel, arsenic, asbestos, manganese, silica, beryllium, cadmium, nitrogen oxides, phosgene, acrolein, fluorine compounds, carbon monoxide, cobalt, copper, lead, ozone, selenium, and zinc can be extremely toxic.

Exposure to welding smoke may have short-term and long-term health effects.

Short-term (acute) Health Effects

Exposure to metal fumes (such as zinc, magnesium, copper, and copper oxide) can cause metal fume fever. Symptoms of metal fume fever may occur 4 to 12 hours after exposure, and include chills, thirst, fever, muscle ache, chest soreness, coughing, wheezing, fatigue, nausea, and a metallic taste in the mouth.

Welding smoke can also irritate the eyes, nose, chest, and respiratory tract, and cause coughing, wheezing, shortness of breath, bronchitis, pulmonary edema (fluid in the lungs), and pneumonitis (inflammation of the lungs). Gastrointestinal effects, such as nausea, loss of appetite, vomiting, cramps, and slow digestion, have also been associated with welding.

Some components of welding fumes, for example cadmium, can be fatal in a short time. Secondary gases given off by the welding process can also be extremely dangerous. For example, ultraviolet radiation given off by welding reacts with oxygen and nitrogen in the air to form ozone and nitrogen oxides. These gases are deadly at high doses, and can also cause irritation of the nose and throat and serious lung disease.

Ultraviolet rays given off by welding can also react with chlorinated hydrocarbon solvents, to form phosgene gas. Even a very small amount of phosgene may be deadly, although early symptoms of expo sure—dizziness, chills, and cough—usually take 5 or 6 hours to appear. Arc welding should never be performed within 200 feet of degreasing equipment or solvents.

Long-term (chronic) Health Effects

Studies have shown that welders have an increased risk of lung cancer, and possibly cancer of the larynx (voice box) and urinary tract. These findings are not surprising in view of the large quantity of toxic substances in welding smoke, including cancer-causing agents such as cadmium, nickel, beryllium, chromium, and arsenic.

Welders may also experience a variety of chronic respiratory (lung) problems, including bronchitis, asthma, pneumonia, emphysema, pneumoconiosis (refers to dust-related diseases), decreased lung capacity, silicosis (caused by silica exposure), and siderosis (a dust-related disease caused by iron oxide dust in the lungs).

Other health problems that appear to be related to welding include: heart disease, skin diseases, hearing loss, chronic gastritis (inflammation of the stomach), gastroduodenitis (inflammation of the stomach and small intestine), and ulcers of the stomach and small intestine. Welders exposed to heavy metals such as chromium and nickel have also experienced kidney damage.

Welding also poses reproductive risks to welders. A recent study found that welders, and especially welders who worked with stainless steel, had poorer sperm quality than men in other types of work. Several studies have shown an increase in either miscarriages or delayed conception among welders or their spouses. Possible causes include exposure to: (1) metals, such as aluminum, chromium, nickel, cadmium, iron, manganese, and copper; (2) gases, such as nitrous gases and ozone; (3) heat; and (4) ionizing radiation (used to check the welding seams).

Welders who perform welding or cutting on surfaces covered with asbestos insulation are at risk of asbestosis, lung cancer, mesothelioma, and other asbestos-related diseases. Employees should be trained and provided with the proper protective equipment before welding near asbestos-containing material.

Hazards of Welding in Confined Spaces

Confined spaces require specialized training and certification. Workers must demonstrate proof of training and have a current certification card. Additionally confined spaces have specific work procedures that must be followed referred to as a confined space permit process. Please refer to our confined space program for the complete details. Summary level information is incorporated here for reference.

All confined spaces should be tested before entering for toxic, flammable, or explosive gases or vapors, and oxygen level. Continuous air monitoring may be necessary during welding. No worker should enter a confined space where the percentage of oxygen is below 19.5% unless he or she is equipped with a supplied-air respirator.

Adequate ventilation is essential for working in confined spaces. Dangerous concentrations of toxic fumes and gases can build up very quickly in a small space. Unconsciousness or death from suffocation can occur rapidly because welding processes can use up or displace oxygen in the air. High concentrations of some fumes and gases can also be very explosive. Never use oxygen for ventilation. Use continuous mechanical ventilation and a respirator whenever welding or performing thermal cutting in a confined space.

All welders who enter confined spaces shall be trained on rescue procedures, use of safety equipment, and proper procedures for entering and exiting a confined space. The worker inside the confined space should be equipped with a safety harness, a lifeline, and appropriate personal protective clothing, including a self-contained breathing apparatus. Never use an air-purifying respirator, half-mask respirator while working in a high hazard confined space.

Gas cylinders and welding power sources and all unnecessary torches and other gas or oxygen supplied equipment should be located in a secure position outside of the confined space. A trained worker must be stationed outside of the confined space, and equipped with appropriate gear (including a fire extinguisher and personal protective equipment), to assist or rescue the worker inside the confined space if necessary. If the worker notices any indications of intoxication or decreased alertness from the "inside" worker, the inside worker should be removed from the area immediately.

Ergonomics (Strains and Sprains)

Postures, especially welding overhead, vibration, and heavy lifting can all contribute to strain or sprain injuries. These problems can be prevented by proper lifting techniques: not working in one position for long periods of time; keeping the work at a comfortable height; using a foot rest when standing for long periods; locating tools and materials conveniently; and minimizing vibration.

Control of Hazardous Energy

All pipes, ducts, and power lines connected to the space, but not necessary to the operation should be disconnected or shut off. All shutoff valves and switches should be tagged and locked out so they cannot accidentally be restarted. All machines in the area with moving parts must be guarded to prevent the workers' fingers, clothing, etc. from getting caught. When repairing machinery by welding or brazing, power must be disconnected, locked out, and tagged so that the machinery cannot start up accidentally.

Trips and falls

To prevent trips and falls, keep welding areas clear of equipment, machines, cables, and hoses, and use safety lines or rails when they are provided.

Reducing the Hazards of Welding

Before beginning a welding job, it is important to identify the hazards for that particular welding operation. The hazards will depend on the type of welding, the materials (base metals, surface coatings, electrodes) to be welded, and the environmental conditions (outside or in a confined space, for instance). Ask for Material Safety Data Sheets (MSDS/SDSs) to identify the hazardous materials used in welding and cutting products, and the fumes that may be generated. Make sure you know what you are welding before you start. Some fumes, such as those released from welding a cadmium-plated surface, can be fatal in a short time. After identifying the hazard, appropriate control methods can be implemented.

Engineering Controls and Work Practices

Use less hazardous materials such as: Cadmium-free silver solders; and Asbestos-free electrodes, gloves, and hot pads. Ventilation should be used to remove harmful fumes and gases. Local exhaust ventilation, which removes the fumes and gases at their source, is the most effective method. This can be provided by a partial enclosure, such as a ventilated workbench, or by hoods positioned as close to the point of welding as possible. Ventilation systems should be cleaned and maintained regularly. General ventilation uses roof vents, open doors and windows, roof fans, or floor fans to move air through the entire work area. This is not as effective as local exhaust ventilation, and may simply spread chemicals around the workplace. General ventilation is often helpful, however, when used to supplement local ventilation. For gas-shielded arc welding processes, local exhaust can be provided by means of an extracting gun, which can reduce worker exposure to welding emissions by 70%. Hoods and ductwork should be constructed of fire-resistant materials. Use shielding (barriers) to protect other people in the work area from the light of the welding arc, heat, and hot spatter.

Welding booths should be painted with a dull finish that does not reflect ultraviolet light (such as finishes that contain titanium dioxide or zinc oxide). Acoustic shields between the worker and the noise source can be used to reduce noise levels. Alternatively, the machinery or process can be totally enclosed. Modify the process or follow safe work practices so that hazards are eliminated. Don't weld painted or coated parts. If possible, remove all surface coatings before welding. Use a water table under the plasma arc cutting to reduce fume and noise levels. Grind parts instead of air arcing. Use the sub arc process to minimize light and fumes created by a visible arc. Position yourself while welding or cutting so that your head is not in the fumes. R Remove all nearby flammable or combustible materials before striking an arc or lighting a flame. Make sure that equipment is properly maintained, for example, replace worn insulation and hoses. Welding areas should be kept free of equipment and machines that could cause trips or falls. You can minimize the production of welding fumes by using the lowest acceptable amperage and holding the electrode perpendicular and as close to the work surface and possible. Arc welding should never be performed within 200 feet of degreasing equipment or solvents.

Personal Protective Equipment (PPE)

Personal Protective Equipment should always be used along with, but never instead of, engineering controls and safe work practices! Eye protection should be used for all welding operations to protect the eyes from bright light, heat, ultraviolet light, and flying sparks. For the best protection, wear face shields or helmets and goggles. To keep slag and particles out of your eyes when removing your face shield, tip your head forward and keep your eyes closed. Welding helmets, goggles, or other eye protectors must contain special filter plates or lenses for workers exposed to arc welding or cutting processes, and

oxygen fuel gas welding, brazing or cutting. Workers performing welding and cutting operations shall be protected with filter lenses or plates.

Protective clothing which should be worn during welding (by welders and nearby workers) includes: fire-resistant gauntlet gloves; high-top hard-toed shoes; leather apron; face shield; flame-retardant coveralls; safety glasses; helmets; and leggings or high boots. Protective clothing should be made of wool, which does not ignite easily, or specially treated cotton fabrics. Sleeves and collars should be kept buttoned, and pants and shirts should be uncuffed. Capes and hard hats may also be required. Workers should use welding helmets (with appropriate filter lenses), not handheld screens.

When welding overhead, extra protection should be used, for example fire-resistant shoulder covers, aprons, head covers, leggings or suits. These items protect against falling hot items associated with your task. Earplugs should be worn when sparks or hot spatter may get in the ears.

Since welders work with highly toxic materials, lockers should be provided so that work clothes are stored separately from street clothes.

Hearing protectors (ear plugs or ear muffs) should be used during noisy operations such as air arcing and grinding.

Respirators must be specific to the hazard, and fitted, cleaned, stored, and maintained in accordance with OSHA's respirator standard and Unger Construction respiratory protection program. In addition, workers must receive training on how to use respirators properly. The National Institute for Occupational Safety and Health (NIOSH) recommends that respirators be worn whenever a carcinogen (cancer causing agent) is present at any detectable concentration, or if any other conditions are present that might be immediately dangerous to life or health. A self-contained breathing apparatus should be worn when welding in confined spaces because welding may reduce the oxygen concentration in the air.

Air Monitoring

Routine air monitoring should be conducted to determine the levels of hazardous materials and noise in the welding area.

Medical Monitoring

Because welding emissions are so hazardous, NIOSH recommends that all workers who may be exposed to welding processes should receive medical exams at least once a year. The doctor should examine the lungs, skin and eyes, heart, and hearing, in addition to any other tests that are appropriate.

Workplace Exposure Limits

There is no OSHA standard for total welding smoke, but OSHA does set standards for individual components of welding smoke. Local exhaust or general ventilation must be provided to keep your exposure to toxic fumes, gases, or dusts below the OSHA permissible exposure limit. However, NIOSH has concluded that welders can be harmed by welding smoke even when the concentrations of the individual components are well below OSHA permissible exposure limits. NIOSH recommends that welding emissions be reduced to the lowest feasible concentrations using state-of-the-art engineering controls and work practices.

Signs

Signs are required to warn workers of hazards that may lead to accidental injury. Signs should be posted in welding areas to warn workers of exposure hazards, and serve as a reminder for the need for protective equipment. Signs should also notify all workers in the area that eye injury may occur from looking at the welding arc.

Hazards of Compressed Gases - Cylinders

Gas welding and flame cutting use a fuel gas and oxygen to produce heat for welding. For high-pressure gas welding, both the oxygen and the fuel gas (acetylene, hydrogen, propane, etc.) supplied to the torch are stored in cylinders at high pressure. The use of compressed-gas cylinders poses some unique hazards to the welder. Acetylene is very explosive. It should be used only with adequate ventilation and a leak detection program. Oxygen alone will not burn or explode. At high oxygen concentrations, however, many materials (even those that are difficult to burn in air, such as normal dust, grease, or oil) will burn or explode easily.

These are some rules to follow when using compressed gases. All cylinders should have caps or regulators. Only pressure regulators designed for the gas in use should be fitted to cylinders. Compressed gas cylinders, all pressure relief valves, and all lines should be checked before and during welding operations. Blowpipes must be kept in good condition and cleaned at regular intervals. Hoses and fittings should be kept in good condition and checked regularly. Cylinders must be stored upright so that they will not fall over. Oxygen and fuel cylinders must be stored separately, away from heat and sunlight, and only in a dry, well-ventilated, fire-resistant area that is at least 20 feet away from flammable materials such as paint, oil, or solvents.

Be aware of backfires and flashbacks that are usually caused by defective or incorrectly operated equipment. If a backfire occurs, shut off the blowpipe valves, oxygen first and then the fuel gas; shutoff the oxygen and fuel gas cylinder valves; cool the blowpipe with water; and check the equipment for damage, particularly the nozzle. To prevent flashbacks use the correct lighting up procedure; ensure the blowpipe is fitted with spring-loaded non-return valves to prevent a backflow of gas into the hoses; use the correct gas pressure and nozzle size for the job; and maintain the equipment in good condition.

Close cylinder valves when work is finished. Put valve protection caps in place and release pressure in regulators and hose lines before cylinders are moved or placed in storage.

Gas Cylinder Handling and Storage Position

This policy specifies the requirements regarding the handling, storage and use of gas cylinders associated with welding and cutting activities. Gas cylinders must be properly secured at all times to prevent shifting, tipping or toppling. Cylinders must be handled carefully and transported in carts, no edge rolling. Always consider a cylinder as full and handle it accordingly. Never drop or permit cylinders to strike each together. Cylinders must be used and stored in the upright and vertical position, never on their side or in a horizontal position.

Oxygen and Acetylene must be separated by at least 20 feet or a ½ hour fire wall at least 5’ high when in storage. Regulator assemblies must be removed and the cylinders capped when not in use typically end of shift. Note: break and lunch times are exempted. Cylinders when not in use must have safety caps on

Oxygen and Acetylene shall be separated away from other combustible materials. Empty cylinders shall be marked and stored in an area designated for empty cylinders.

Acetylene is an extremely flammable gas. It is different from other flammable gases because it is also unstable. Under certain conditions, it can decompose explosively. Unlike most gases used in construction acetylene is not simply a gas. Acetylene is dissolved in liquid acetone. This means that it needs to be treated as a liquid as well as a gas. When the cylinders are in the vertical (upright) position a phase separation occurs insuring the liquid is at the bottom of the cylinder and the gas is at the top of the cylinder.

An acetylene cylinder has a different design from most other gas cylinders. It consists of a steel shell containing a monolithic porous mass. The porous mass is a cellular structure that is 85% porous which completely fills the cylinder. The acetylene gas in the cylinder is dissolved in acetone which is absorbed by the porous mass. The porous mass is designed to slow down or stifle any decomposition of the gas thereby increasing its stability.

Acetylene, when placed in the horizontal position, can become dislodged from acetone and form highly unstable explosive pockets resulting in a fire and/or explosion. Therefore, using and storing the tank in any position other than vertical (upright) can be extremely dangerous.

If you come upon an acetylene cylinder that is stored in the horizontal position contact your foreman or superintendent. To make the situation safe the cylinder should be placed in the vertical (upright) position and strapped or secured to an appropriate anchorage device. The cylinder should stand vertical (upright) for at least 90 minutes before use, to ensure the liquid and gas have been properly separated.

Acetylene is extremely explosive with air or oxygen. Acetylene shall not be stored in confined spaces such as toolboxes, unventilated cabinets, or closets.

Even though oxygen cylinders do not have the same risks as acetylene cylinders they should not be stored in the horizontal position either. This is an administrative control we use to eliminate confusion. All gas cylinders not placed on a cart shall be secured from toppling or shift by appropriate means. Typically gas cylinders are chained, strapped or wired to a rigid member at the chest and knees of the cylinder.