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Department	Environmental, Health and Safety	Policy Number	EHS 415
Subsection	All Employees, All Departments	Effective Date	June 29, 2020

#### I. INTRODUCTION

#### A. Purpose

Grand Canyon University (GCU) is committed to maintaining a campus environment which will not adversely affect the health, safety, and well-being of students, employees, contractors, visitors, and the community.

The purpose of the Hot Work program is to ensure that proper safeguards and procedures are followed before commencing any hot work and necessary safeguards are taken to minimize the potential for unintentional fires.

Hot work activities shall be conducted in accordance with Federal, State and Local regulations. Refer to Section II – References for the applicable regulations. This GCU Hot Work Program constitutes written operating policies and procedures required by those regulations and meets the requirements of the Phoenix Fire Code.

#### B. Scope

This written program applies to all employees, supervisors, managers and contractors working at Grand Canyon University. GCU will follow a hierarchy of controls to assess the need for hot work activity: 1) hot work activity will be avoided using alternative means of completing the work, 2) hot work will be completed at a designated area whenever possible, 3) hot work will be conducted per the requirements of this Hot Work Written Program.

Exceptions: This program does not apply to the following:

- · Laser cutting and all other laser use
- · Candles used in research and theater arts, if attended for the duration of use.
- Ovens specifically designed and built by a reputable manufacturer with a Nationally Recognized Testing Laboratory (NRTL) certification (such as Underwriters Lab (UL)) for heat treatment or annealing of research materials
- Electric soldering irons
- · Bunsen Burners and other flame operations in Labs or spaces design and supplied for this type of equipment
- · Stoves and other cooking operations
- Pyrotechnics or special effects

#### **Important Contacts**

Environmental, Health and Safety	602-639-2931	<u>ehs@gcu.edu</u>
HR Service Center	602-639-6549	<u>hr@gcu.edu</u>
Public Safety	602-639-8100 <b>911 for emergencies</b>	
Facilities	602-639-6200	facilities@gcu.edu

#### II. REFERENCES

- 1. U.S. Department of Labor, OSHA, Welding, Cutting, and Brazing, 29 CFR 1910.251-254
- 2. National Fire Protection Association, NFPA 51B Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes
- 3. The Phoenix Fire Code (2018 Edition), Chapter 35 Welding and Other Hot Work

### **III. DEFINITIONS**

**Competent Person** – An individual who by experience and training is capable of identifying existing and predictable hazards related to hot work activities in the surroundings or working conditions which are hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate or protect against those hazards.

• Hot Work Operator is considered a Competent Person under this Program.

**Combustible Material** – A material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

**Fire Watch** – A person or persons responsible for continuously observing the hot work area, maintaining fire-safe conditions, and responding to emergencies during hot work operations and in the established period.

**Hot Work** – Work involving burning, welding or similar operation (flame-producing activities, spark-producing activities, and heat production, either through conduction or radiation/convection) that is capable initiating fire or explosions.

Hot Work Equipment - Electric or gas welding or cutting equipment used for hot work.

**Hot Work Operator** – An individual who operates hot work equipment and is designated to complete hot work activities under the authorization of the Hot Work Permit Coordinator. Due to the duration of some Hot Work activities the Hot Work Operator can be changed over the life of the project and should be noted on the permit.

**Hot Work Permit** – A document issued by the Hot Work Permit Coordinator for the purpose of authorizing performance of hot work activities.

Hot Work Permit Coordinator (HWPC) - The individual designated by management to authorize hot work.

#### Permissible Areas -

**Designated Hot Work Area** – A specific location that is approved for hot work operations and is maintained fire-safe, such as a maintenance shop or detached outside location, that is noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas.

**Permit-Required Area** – Any location other than a designated area that is approved for hot work and is made fire-safe by removing or protecting combustibles from ignition sources.

#### **IV. RESPONSIBILITIES**

#### A. <u>General Responsibilities:</u>

- 1. Environmental, Health & Safety (EHS)
  - EHS is responsible for the development and review of health and safety policies covering faculty, staff, students and other GCU affiliated individuals.
  - EHS provides consultative and technical assistance to all GCU departments and affiliates with respect to working in a safe manner and for maintaining GCU compliance with any applicable Federal, State or local regulations.
  - Representatives of EHS have the authority and responsibility to order work to stop if imminently dangerous or unsafe procedures are observed involving hot work operations or any other health and safety issue.
  - EHS is available to assist with technical training and to review specific or proposed work procedures.

- EHS will conduct periodic audits of the hot work program to verify compliance.
- · EHS will coordinate training for employees, supervisors and designated personnel.
- 2. Facilities Management and Other Departments

All University departments conducting hot work are expected to follow the requirements of the GCU Hot Work Program and to ensure that all individuals conducting hot work operations have received the training necessary to perform hot work procedures in a safe manner. University departments are also responsible for ensuring contractors under their control follow the requirements of this written program.

3. Contractors / Third Parties

All contractors are expected to follow applicable health and safety regulations, as well as, the requirements of this program.

New construction. Subcontractors working under the direction of a general contractor must follow the requirements of the GC's safety program. For hot work activities that occur in occupied GCU buildings, GCU EHS and the GC will coordinate and determine which party is responsible for hot work permitting.

#### B. Hot Work Operations Roles & Responsibilities

Refer to Appendix A for the current list of GCU designated personnel.

1. Hot Work Program Manager

The Hot Work Program Manager shall be responsible for monitoring the implementation of the Hot Work Program and ensure that it is being effectively administered. The GCU Fire Safety Manager will serve as the Hot Work Program Manager.

Duties include:

- Designates one or more personnel as the "Hot Work Permit Coordinator" who will be responsible to issue hot work permits.
- Maintains records of all employee safety training related to hot work.
- Maintains records of all Hot Work Permits issued within the previous 12 months.
- Conducts periodic audits to ensure that employees are utilizing approved equipment, materials, and work methods, and records are properly maintained.
- Responsible for obtaining a current City of Phoenix Hot Work Program Permit as required by the Phoenix Fire Code (105.6.23).
- Responsible for training and educating GCU departments regarding the requirements of this program.
- 2. Hot Work Permit Coordinator (HWPC)

The designated "Hot Work Permit Coordinator" (HWPC) is responsible for the safe operations of hot work activity and ensures the proper precautions are taken to prevent fires and the spread of fires.

The HWPC shall be competent person, by way of training and/or experience, is knowledgeable of applicable standards and the requirements of this program, and is capable of identifying workplace hazards relating to hot work.

Duties include:

- Authorized to take prompt corrective measures to address and eliminate hazards associated with hot work.
- Conducts hazard assessments of proposed hot work areas to determine potential fire risks.
- · Approves and issues hot work permits to hot work operators.
- Ensures pre-hot work inspections have been properly completed.

- Ensures all individuals involved in hot work operations are properly trained and understand the emergency procedures in the event of a fire.
- · Monitors hot work operations to ensure work is conducted safely and follows the requirements of this program.
- · Conducts schedule and unscheduled audits of open permits and ongoing hot work activity.
- · Designates, reviews and re-permits designated hot work areas annually.
- Signs-off Hot Work Permits at completion of work and forward for record-keeping.

#### 3. Supervisor

Supervisors of Hot Work Operators are responsible for ensuring all hot work activities are conducted safely and per the requirements of this program.

Duties include:

- Ensures all hot work activities are permitted prior to work starting.
- · Ensures all hot work precautions are implemented.
- · Reviews proposed hot work activities and ensures prohibited hot work is not scheduled.
- Ensures the necessary personnel are assigned to complete the hot work activity safely.
- Ensures Hot Work Operators and Fire Watches are properly trained.
- Ensures employees have the proper tools, equipment, welding blankets, shields, partitions and personal protective equipment (PPE) to safely perform Hot Work Operations.
- Ensures that all hot work equipment is safe for use and properly handled.
- Ensures contractors under their control are properly supervised, informed of site-specific hazards and follow the requirements of this written program.
- Ensures hot work paperwork is properly completed and submitted to the HWPC for recordkeeping.
- 4. Hot Work Operator

The Hot Work Operator shall have the necessary knowledge, experience and training to handle and use applicable equipment safely and perform work so as not to endanger lives and property.

Duties include:

- · Complete required hot work training prior to conducting any hot work activities.
- Inspect all equipment for defects or damage prior to each use.
- Properly use any required personal protective equipment.
- · Complete pre-hot work inspection checks and mitigate identified hazards.
- Ensure an approved hot work permit and fire watch are in place prior to starting any hot work activities.
- Stop hot work operations if unsafe conditions develop.
- Notify the HWPC if conditions develop that are deemed unsafe for reassessment.
- Review job activities and associated Hot Work Permit with the Supervisor.
- Be aware of the surroundings, identify and mitigate conditions that would pose a hazard during hot work activity.
- Submit hot work paperwork to HWPC for recordkeeping.

#### 5. Fire Watch

The designated fire watch is an individual, other than the Hot Work Operator, posted to observe the hot work activity. The Fire Watch monitors conditions to ensure that a fire or explosion does not occur as a result of the work performed. The fire watch is authorized to stop any unsafe operation.

Duties include:

- Watch for fires, smoldering material or other signs of combustion.
- Be aware of the inherent hazards of the work site and of the hot work.
- Ensure that safe conditions are maintained during hot work operations and stop the hot work operations if unsafe conditions develop.
- · Have fire-extinguishing equipment readily available and be trained in its use.
- Extinguish fires when the fires are obviously within the capacity of the equipment available. If the fire is beyond the capacity of the equipment, sound the alarm immediately.
- Be familiar with the facilities and procedures for sounding an alarm in the event of a fire.
- A fire watch shall be maintained for at least 30 minutes after completion of hot work operations in order to detect and extinguish smoldering fires. The duration may be extended by the HWPC, as deemed necessary.
- More than one fire watch shall be required if combustible materials that could be ignited by the hot work operation cannot be directly observed by a single fire watch (e.g. in adjacent rooms where hot work is done on a common wall).

#### **V. REQUIREMENTS**

#### A. General Requirements:

- Hot work is allowed only in areas that are or have been made fire-safe. Hot work may only be performed in either designated areas (refer to Section C – Designated Areas) or permit-required areas.
- A permit-required area is an area made fire-safe by removing or protecting combustibles from ignition sources.
- Certain hot work operations are prohibited. Refer to Section D Prohibited Hot Work.
- Refer to Appendix E Types of Hot Work and Safety Precautions for further guidance.
- Students performing hot work operations must follow the requirements of this written program. College are responsible for ensure students are aware of these requirements and receive the proper training and supervision.

#### B. Hot Work Permit Requirements:

- Hot work is only permitted in areas that have been made fire safe.
- When possible, all hot work should be completed at a Designated Hot Work Area.
- When work cannot be moved to a Designated Hot Work Area, the area shall be made safe by removing combustibles or protecting combustibles from ignition sources.
- The floor must be swept clean for a radius of 35 ft if combustible materials, such as paper or wood shavings, are on the floor.
- Combustible floors (except wood on concrete) must be:
  - kept wet or be covered with damp sand (note: where floors have been wet down, personnel operating arc welding or cutting equipment shall be protected from possible shock); or
  - be protected by noncombustible or fire-retardant shields.

- All combustible materials must be moved at least 35 ft away from the hot work operation. If relocation is impractical, combustibles must be protected with fire-retardant covers, shields or curtains. Edges of covers at the floor must be tight to prevent sparks from going under them, including where several covers overlap when protecting a large pile.
- Openings or cracks in walls, floors, ducts or shafts within 35 ft of the site must be tightly covered with fire-retardant or noncombustible material to prevent the passage of sparks to adjacent areas.
- If hot work is done near walls, partitions, ceilings, or roofs of combustible construction, fire-retardant shields or guards must be provided to prevent ignition.
- If hot work is to be done on a wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side by relocating combustibles. If it is impractical to relocate combustibles, a fire watch on the opposite side from the work must be posted.
- Hot work must not be attempted on a partition, wall, ceiling, or roof that has a combustible covering or insulation, or on walls or
  partitions of combustible sandwich-type panel construction (refer to Section D Prohibited Hot Work, for more information on
  EIFS wall cladding).
- Hot work that is performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings, roofs, or other combustibles is not allowed if the work is close enough to cause ignition by conduction.
- Equipment to be used (e.g. welding/cutting equipment, shields, personal protective equipment, fire extinguishers) must be in satisfactory operating condition and in good repair.
- Fully charged and operable fire extinguishers that are appropriate for the type of possible fire shall be readily available at the work area (minimum rating of at least 2-A:20-BC). Contact the GCU Fire Prevention department to obtain a fire extinguisher. Do not use building fire extinguishers.
- Special precautions must be taken to avoid accidental operation of automatic fire detection, fire sprinkler or fire suppressions systems. Contact the GCU Fire Prevention department to coordinate.
  - Where hot work is performed close to automatic sprinklers, noncombustible barriers or damp cloth guards shall shield the individual sprinkler heads and shall be removed when the work is completed. If the work extends over several days, the shields shall be removed at the end of each workday.
- · Nearby personnel must be suitably protected against heat, sparks, slag and UV light.

#### C. Designated Areas:

- A Designated Hot Work Area is a specific area designed or approved for such work, such as a maintenance shop or a detached
  outside location that is of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents,
  and suitably segregated from adjacent areas.
- Designated Hot Work Areas are permitted on an annual basis. Contact the HWPC to request an assessment and obtain an approved Designated Hot Work Area Permit.
- Refer to Appendix C Approved Designated Hot Work Areas for a list of currently approved designated areas.

- Designated Area Requirements:
  - Must meet the requirements of Section 1 and Section 2 above.
  - Only trained and authorized personnel are allowed to perform hot work.
  - The area must have a written standard operating procedure outlining how the area is to be maintained, pre-hot work
    inspection and work closeout requirements, equipment use, handling and storage requirements, safety signage, training, fire
    extinguisher requirements, and emergency procedures.
    - Partitions segregating hot work areas from other areas of the building shall be noncombustible.
    - Partitions shall be securely connected to the floor such that gaps do not exists between the floor and the partition. Partitions shall prevent the passage of sparks, slag, and heat from the hot work area.
    - · Floors shall be noncombustible surfaces and kept clean.
    - Fire extinguishers are in working condition and readily accessible. Minimum rating of 2-A:20-BC.
    - · Ventilation is working properly.
    - Hot work equipment is in working order.
    - A fire watch is not required for designated areas if the area has no fire and combustible hazard exposures. The HWPC will make this determination on the initial assessment.
    - Storage piles are not allowed within 60 feet.
    - · Signage: CAUTION: HOT WORK IN PROGRESS STAY CLEAR
    - The Hot Work Permit for the designated area can be suspended for non-compliance.
  - Supervisors are responsible for completing periodic audits of the Designated Hot Work areas to ensure safe work practices are being followed.
  - Supervisors are responsible for completing an annual renewal of the Designated Hot Work Area Permit.
  - The HWPC will perform quarterly audits of designated areas. The audits can be schedule or unplanned.
  - Refer to Appendix D Designated Hot Work Area Guidance for additional information.

#### D. Prohibited Hot Work:

- · Hot work shall not be permitted in the following situations:
  - In areas not authorized by management.
  - In sprinklered buildings while such protection is impaired.
  - In the presence of explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air), or explosive
    atmospheres that may develop inside uncleaned or improperly prepared tanks or equipment which have previously
    contained such materials, or that may develop in areas with an accumulation of combustible dusts.
- Hot work operations on or near Exterior Insulation Finishing System (EIFS) wall cladding is prohibited.
  - If hot work operations are unavoidable to buildings with EIFS cladding, these additional procedures must be followed:
  - Cover any exposed insulation with fire resistant tarps.
  - Supervisor shall periodically check the area for at least two (2) hours after the completion of the hot work activity before signing off on the hot work permit.
- Prohibited Hot Work Areas:
  - Fuel Tank near 42-CCOB and Fuel Tank at Golf Course

#### **VI. PROCEDURE**

#### A. Pre-Hot Work Inspection

The Hot Work Operator shall conduct an inspection that includes the:

- · Hot work equipment is in satisfactory operating condition.
- Hot work site is clear of combustibles materials (at least 35 feet), or such materials are protected.
- Combustible material within 35 feet shall be removed or provided with appropriate shielding to prevent sparks, slag or heat from igniting exposed combustibles.
- Combustibles on the other side of walls are removed or otherwise protected.
- Openings within 35 feet are protected or covered.
- Floors are kept clean.
- Flammable liquids, dust, lint and oil deposits are removed.
- Approved actions have been taken to prevent accidental activation of fire protections systems (i.e. fire alarm, fire sprinkler, fire suppression equipment). Coordinate with the GCU Fire Prevention Department.
- Fire extinguishers and fire hoses (where provided) are operable and available.

#### B. Hot Work Permit

The Hot Work Operator shall conduct an inspection that includes the:

- Once the Pre-Hot Work Inspection has been completed, the Hot Work Operator will notify the HWPC.
- The HWPC will review the proposed hot work and ensure all applicable Pre-Hot Work Inspection items are completed, verify no prohibited hot work activity is occurring and issue approved permit.
- Refer to Appendix B GCU Hot Work Permit.

#### C. Work Closeout

- A fire watch shall be maintained for at least 30 minutes after completion of hot work operations in order to detect and extinguish smoldering fires.
- Once the fire watch has been completed, the fire watch signs off on the permit and gives it to the Supervisor.
- The Supervisor reviews and notifies the HWPC. The permit is not closed until the HWPC is notified and closes the permit.
- The Supervisor submits the closed permit to the HWPC for recordkeeping.

### **VII. TRAINING REQUIREMENTS**

- All GCU personnel involved in hot work operations must receive training on the requirements of this Hot Work Program prior to completing hot work activities.
- Employees responsible for performing hot work operations and performing fire watch duties must complete the following:
  - Hot Work Safety Training: A review of this written program, safe work practices for hot work operations, required personal
    protective equipment and emergency procedures. Frequency: Every two (2) years.
  - Fire Extinguisher Use: Hands-on Training every two years.
- All completed training must be documented.
- It is the responsibility of the College to ensure students performing hot work activities are properly trained.

#### VIII. DOCUMENTATION AND RECORDKEEPING

- A written copy of this program is kept in the EHS Office (Building 96) and available to all employees. Employees may also access the written program through the GCU EHS website.
- Training records are maintained by the EHS Department. These records will be updated as new employees are trained and as existing employees receive refresher training.
- Designated Hot Work Area Permits are maintained by the GCU Fire Safety Manager.
- Closed Hot Work Permits are retained by the GCU Fire Safety Manager for 12 months.
- Hot Work Permits shall be available for review by the fire code official at the time work is conducted and for 48 hours after work is complete.

#### **IX. APPENDICES**

- Appendix A Designated GCU Personnel
- Appendix B GCU Hot Work Permit
- Appendix C Approved Designated Hot Work Areas
- Appendix D Designated Hot Work Area Guidance
- Appendix E Types of Hot Work and Safety Precautions
- Appendix F Welding and Cutting with Oxygen-Fuel Gas Checklist
- Appendix G Mobile Oxy-Acetylene/Propane Unit Procedure
- Appendix H Hot Work Permit Decision Tree
- Appendix I Illustrated Examples

### X. REVISION HISTORY

Rev #	Date	Changes	Sections	Approved by
1	June 29, 2020	Original	All	Facilities Planning and Operations

## **Appendix A**

**Designated GCU Personnel** 

Current as of: 6/7/2020

#### 1. Hot Work Program Manager:

Brandon Noble, Fire Safety Manager GCU EHS, Fire Prevention 602-540-7731 Brandon.Noble@gcu.edu

#### 2. Personnel authorized to issue hot work permits and designated as "Hot Work Permit Coordinator":

Jim Levenda, Fire Safety Associate GCU EHS, Fire Prevention 602-639-7545 Jim.Levenda@gcu.edu

Bill Kinsey, Manager GCU Facilities, General Maintenance 602-725-2690 <u>William.Kinsey@gcu.edu</u>

### 3. Environmental, Health & Safety (EHS)

Office: Building 96, 27th Ave Campus Main: 602-639-7279 <u>EHS@gcu.edu</u>

## Appendix B

Hot Work Permit Contact EHS – Fire Prevention for current Hot Work Permit form. 602-639-7279

### GRAND CANYON UNIVERSITY

EHS 415 - Hot Work Program

## Appendix C

### Approved Designated Hot Work Areas

Date Approved	Area	Location	Responsible Person	Contact Information

## **Appendix D**

#### Designated Hot Work Area Guidance

### INTRODUCTION

Hot Work is usually defined as any open flame, spark or heat producing activity and is typically associated with cutting, welding, grinding and brazing operations.

### **DESIGNATED HOT WORK AREAS**

A designated hot work area is a permanent location suitable for on-going hot work operations, such as a maintenance shop, welding booth or outside location. These areas do not require a daily permit to perform hot work but do require an annual permit that must be issued by the GCU Hot Work Permit Coordinator. Appropriate safeguards and safe work practices must be in place and followed to ensure the designated area is fire safe. Refer to Section C – Designated Areas under REQUIREMENTS.

### **DESIGNATED HOT WORK AREA REQUIREMENTS**

- · Non-combustible, fire-resistive construction; essentially free of combustibles and flammables.
- The working surface for the use of the soldering and brazing activities should be of a noncombustible material (i.e. Laboratory bench top, Duraboard, tile, etc).
- Suitably segregated from adjacent areas.
- Partitions used to segregate the hot work area from other areas of the building shall be noncombustible.
- Partitions shall be securely connected to the floor such that gaps do not exists between the floor and the partition to prevent the passage of sparks, slag, and heat from the hot work area.
- Floors shall be noncombustible and kept clean.
- Equipped with fire extinguisher(s) that are in working condition and readily accessible. Minimum rating of 2-A:20-BC.
- Equipped with a heat detector rather than a smoke detector.
- Equipped with mechanical ventilation to control smoke and fumes.
- Storage piles are not allowed within 60 feet.
- Conspicuous signs shall be posted to warn others before they enter the hot work area. Such signs shall display the following warning: CAUTION: HOT WORK IN PROGRESS STAY CLEAR
- Inspected and approved by Hot Work Permit Coordinator.

### **PROHIBITED HOT WORK AREAS/ACTIVITIES**

Hot work may not be performed under the following circumstances:

- · In areas not authorized by Facility Management and/or EHS.
- When the building's fire protection systems are impaired/shut off (i.e. fire sprinkler, fire alarm).
- · In the presence of explosive/flammable atmospheres.
- In the immediate area of combustible materials.

### INSPECT THE FOLLOWING/OPERATIONS PRIOR TO USE

- Remove all combustible materials from the area (35-foot clearance).
- Ensure all openings are protected.
- Ensure floors are clean.
- Ensure partitions are in place, if needed, and provide adequate protection for to prevent the passage of sparks, slag, and heat to other areas.
- · Ensure there is adequate natural or mechanical ventilation.
- Ensure the area is free from water or damp conditions (for electrical safety).
- Assign a fire watch, if required. If required, then the fire watch must remain for 30 minutes after hot work operations have completed.
- Ensure fire extinguishers are present, operable and readily accessible.
- Ensure emergency exits are unobstructed.
- Inspect Hot Work Equipment to ensure the equipment is in working order and safe for use.
- Notify personnel in the area.
- Follow safety precautions for the equipment being used.
- Upon completion of hot work operations, ensure all hot work equipment is put into a safe state and the area is cleaned up.

#### **EMERGENCY PROCEDURES**

- Any fire or use of a fire extinguisher must be reported immediately to your supervisor and EHS.
- Emergency Procedure:
  - Stop hot work operations.
  - Alert others in the area.
  - Extinguish the fire when the fire is within the capability of the fire extinguisher available and safe to do so.
  - Notify supervisor and EHS.
- If the fire is beyond the capability of the fire extinguisher available or the situation is not safe, then employees should sound the alarm, notify those in the area to evacuate and call 911 or GCU Public Safety at 602-639-8100.

### **Appendix E**

#### Types of Hot Work and Safety Precautions

Common types of activities that require a hot work permit include:

- Welding, brazing, and soldering
- Grinding and cutting
- Thawing pipes
- The use of open flames, such as blow torches

### FIRE HAZARDS POSED BY HOT WORK INCLUDE

- Flying sparks
  - The main risk posed by hot work.
  - Sparks can easily get trapped in cracks, pipes, gaps, holes, and other small openings, where it will potentially smolder and start a fire.
- Flammable swarf, molten metals, slag, cinder, and filings
  - The debris and residue that hot work creates are often highly combustible and/or hot.
- Heat conduction when working on pipes
  - Cause a pipe to heat up substantially and this heat can easily transfer through the process of conduction to another, potentially
    flammable surface and cause a fire.
- Hot surfaces
  - Flammable materials or substances from the area could come into contact with a surface that has become hot during the work and start a fire.
- Explosive atmospheres
  - In certain environments, there may be vapors or gases in the air that are highly combustible and could ignite when exposed to hot work.
  - Hot work could generate fumes that create an explosive atmosphere.

### **ELECTRIC ARC HOT WORK**

- Welding equipment shall be maintained in good operating condition.
- Cables shall be kept dry and free of oil and suspended when possible.
- Cables shall be protected if exposed to falling sparks.
- Electrode holders shall be fully insulated and in good condition.
- Operator shall make certain all electrical connections are secure made prior to starting.
- Operator shall maintain a dry working area.

- · Operator shall wear rubber-soled shoes to provide resistance to electrical flow.
- Electrical welding equipment is properly grounded, and a disconnecting switch supplied if the equipment does not have one.
- A switch or circuit breaker shall be provided so that fixed electric welder and control equipment can be disconnected from the supply circuit and marked "Emergency Disconnect".
- If there are other personnel (students, staff, visitors) in the vicinity of the welding operations, it must be screened so that arc activity cannot be seen.

#### **GAS WELDING AND CUTTING**

Refer to Phoenix Fire Code Section 3505 - Gas Welding and Cutting

- The storage or use of a single cylinder of oxygen and a single cylinder of fuel gas located on a cart shall be allowed without requiring the
  cylinders to be separated when the cylinders are connected to regulators, ready for service, equipped with apparatus designed for cutting
  or welding and all of the following:
  - Cylinder carts have a stable base, secure cylinders individually and substantially constructed.
  - Cylinder carts are not stored within any part of a means of egress.
  - Cylinders are secured to the cart to resist movement.
  - Cylinder valves are closed when work is finished.
  - Cylinder valves are closed prior to moving cart.
  - Cylinder valve outlet connections conform to the requirements of CGA V-1.
- Cylinders, valves, regulators, hose and other apparatus and fittings for oxygen shall be kept free from oil or grease. Oxygen cylinders, apparatus and fittings shall not be handled with oily hands, oily gloves, or greasy tools or equipment.
- Acetylene gas shall not be piped except in approved cylinder manifolds and cylinder manifold connections, or utilized at a pressure
  exceeding 15 pounds per square inch gauge (psig) (103 kPa) unless dissolved in a suitable solvent in cylinders manufactured in accordance
  with DOTn 49 CFR Part 178. Acetylene gas shall not be brought in contact with unalloyed copper, except in a blowpipe or torch.
- Oxygen and fuel-gas cylinders and acetylene generators shall be located away from the hot work area to prevent such cylinders or generators from being heated by radiation from heated materials, sparks or slag, or misdirection of the torch flame.
- The torch valve shall be closed and the gas supply to the torch completely shut off when gas welding or cutting operations are discontinued for a period of 1 hour or more.
- · Welding or cutting work shall not be held or supported on compressed gas cylinders or containers.
- Tests for leaks in piping systems and equipment shall be made with soapy water. The use of flames shall be prohibited for leak testing.
- Fuel gas hose shall have contrasting color (red for acetylene, green for oxygen).
- The acetylene line on an oxy/acetylene cart shall have a back-flow check valve. Each torch shall have a back-flash arrestor.

### **COMPRESSED GAS CYLINDERS**

Refer to Phoenix Fire Code Chapter 53 - Compressed Gases, NFPA 55

General and Storage:

- Cylinders shall be secured to prevent falling caused by contact, vibration or seismic activity at all times to a fixed object with one or more restraints.
- Each cylinder must be clearly marked with the name of the gas and be visible from any direction. The marking must be in accordance with DOT requirements and CGA C-7.
- Cylinders must be protected from vehicular damage both indoors and outdoors by bollards or other approved means.
- Cylinder valves must be protected from physical damage by use of a protective cap, collar or other protective device when stored and not in use.
- Cylinders shall not be placed near elevators, unprotected platform ledges or other areas where falling would result in the cylinder being allowed to drop distances exceeding one-half the height of the container, cylinder or tank.
- Cylinders stored inside of buildings shall be stored in a well-ventilated dry location at least 20 feet from combustible materials or means of egress.
- · Cylinders shall not be placed in areas where they are capable of being damaged by falling objects.
- Cylinders shall not be exposed to corrosive chemicals or fumes that could damage containers, cylinders, tanks, valves or valve protective caps.
- Cylinders, whether full or partially full, shall not be heated by devices that could raise the surface temperature of the cylinder to above 125°F (52°C).
- · Cylinders shall not be located where they could become part of an electrical circuit. Cylinders shall not be used for electrical grounding.
- · Cylinders shall not be used for any purpose other than to serve as a vessel for containing the product that it is designed to contain.
- Cylinders that have been exposed to fire shall be removed from service by an approved, qualified person.
- Leaking, damaged or corroded cylinders shall be removed from service. Leaking, damaged or corroded cylinders shall be replaced or repaired by qualified person to a serviceable condition.
- To prevent bottom corrosion, cylinders shall be protected from direct contact with soil or unimproved surfaces. The surface of the area on which the containers are placed shall be graded to prevent accumulation of water.
- Flammable gases (ex., acetylene) shall are incompatible with oxidizer gases (ex. Oxygen) and shall be stored by a partition wall or by at least a 20' line of site separation.
- Signs shall be prominently identifying the gases stored (ex., "NON-FLAMMABLE GAS ONLY" and "FLAMMABLE GAS ONLY").

#### Handling and Use:

- · Shutoff valves shall not be removed or otherwise altered to prevent access.
- Ropes, chains or slings shall not be used to suspend / lift cylinders. Valve protection caps shall NOT be used to lift cylinders.
- When changing out a cylinder, ensure that the cap is secure. Use proper cylinder handling techniques. Do not drag, slide, roll or drop cylinders. Use a cylinder cart when appropriate. Do not lay cylinders on their side.

Other:

- Hot work shall NOT be performed on containers or equipment that contains or has contained flammable liquids, gases or solid until the container and equipment have been thoroughly cleaned, inserted or purged.
- Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag or flame, will not reach them.
- Smoking it not allowed during and/or near hot work operations.
- Wear the proper PPE while performing hot work operations.

### **ADDITIONAL REFERENCES**

Appendix F - Welding and Cutting with Oxygen-Fuel Gas Checklist Appendix G - Mobile Oxy-Acetylene/Propane Unit Procedure

## **Appendix F**

Welding and Cutting with Oxygen-Fuel Gas Checklist

### **INSPECTION CHECKLIST**

This checklist covers regulations issued by OSHA under the general industry standard 29 CFR 1910.253 and the construction standard 29 CFR 1926.350. It applies to operations involving oxygen-fuel gas welding and cutting. This checklist must be used with the Welding, Cutting, and Brazing–General Requirements checklist. A yes answer to a question indicates that this portion of the inspection complies with OSHA.

This checklist does not cover the extensive regulations dealing with manifolding of cylinders, service piping systems, pressure relief devices, piping protective equipment, and acetylene generators. Consult the OSHA regulations in 29 CFR 1910.253 or the EHS department for further details.

### **GENERAL REQUIREMENTS**

1.	Is acetylene generated, piped, or used at pressures no greater than 15 PSI-G (pounds per square inch, gauge) or 30 PSI-A (pounds per square inch, absolute)? [29 CFR 1910.253(a)(2)]	□Yes □No □N/A
2.	Is all welding apparatus (torches, regulators, pressure- reducing valves, acetylene generators, and manifolds) purchased from reputable welding dealers who have indicated the equipment is suitable for the intended purpose? [29 CFR 1910.253(a)(3)]	□Yes □No □N/A
3.	Are all employees trained and judged competent in the use of welding apparatus? [29 CFR 1910.253(a)(4) and 1926.350(d)]	□Yes □No □N/A
4.	Are rules and instructions covering the operation and maintenance of oxygen or fuel-gas supply equipment readily available? [29 CFR 1910.253(a)(4)]	□Yes □No □N/A

### **CYLINDERS AND CONTAINERS**

1.	Are all compressed gas cylinders legibly marked on their shoulders (by stenciling, stamping, or permanent labeling) with the chemical or trade name of the gas? [29 CFR 1910.253(b)(1)(ii)]	□Yes □No □N/A
2.	Are oxygen and acetylene cylinders kept away from radiators and other sources of heat? [29 CFR 1910.253(b)(2)(i)]	□Yes □No □N/A
3.	Inside buildings, are cylinders stored in well-protected, well-ventilated, dry locations at least 20 feet from highly combustible material such as oil? [29 CFR 1910.253(b)(2)(ii)]	□Yes □No □N/A
4.	Are cylinders stored in designated spaces where they will not be knocked over, damaged by passing or falling objects, or subjected to tampering by unauthorized people? [29 CFR 1910.253(b)(2)(ii)]	□Yes □No □N/A

5.	Do empty cylinders have the valves closed? [29 CFR 1910.253(b)(2)(iii) and (b)(5)(ii)(H) and 1926.350(a)(8)]	□Yes □No □N/A
6.	Are valve-protection caps always in place on cylinders that are not in use? [29 CFR 1910.253(b)(2) (iv) and 1926.350(a)(1)]	□Yes □No □N/A
7.	Is storage of fuel gas cylinders inside a building limited to a total gas capacity of 2,000 cubic feet or 300 pounds of liquefied petroleum gas (except for those being used or attached and ready to use)? [29 CFR 1910.253(b)(3)]	□Yes □No □N/A
8.	Is a separate, specially constructed room or compartment provided to store cylinders that have more than 2,000 cubic feet total gas capacity or 300 pounds of liquefied petroleum gas? [29 CFR 1910.253(b)(3)(i)]	□Yes □No □N/A
9.	Are stored oxygen cylinders separated from fuel-gas cylinders or combustible materials (especially oil or grease) by at least 20 feet, or by a noncombustible barrier at least 5 feet high with a fire-resistance rating of at least one-half hour? [29 CFR 1910.253(b)(4)(iii)]	□Yes □No □N/A
10.	Are cylinders, cylinder valves, couplings, regulators, hoses, and apparatus kept free from oily and greasy substances? [29 CFR 1910.253(b)(5)(i) and 1926.350(i)]	□Yes □No □N/A
11.	Are employees and students required to handle oxygen cylinders with oil- and grease-free hands or gloves? [29 CFR 1910.253(b)(5)(i) and 1926.350(i)]	□Yes □No □N/A
12.	Is care taken to ensure cylinders are not dropped, struck, handled roughly, or permitted to strike each other violently? [29 CFR 1910.253(b)(5)(ii)(B), (b)(5)(ii)(0), and (b)(5)(iii)(B); and 1926.350(a)(3)] Note: Cylinders may be moved by tilting and rolling them on their bottom edges, but a cylinder cart is strongly recommended	□Yes □No □N/A
13.	Is using valve-protection caps prohibited for lifting the cylinder from one vertical position to another? [29 CFR 1910.253(b)(5)(ii)(C) and 1926.350(a)(5)]	□Yes □No □N/A
14.	Unless the cylinders are secured on a special truck, are regulators removed and valve-protection caps installed before cylinders are moved? [29 CFR 1910.253(b)(5)(ii)(D) and 1926.350(a)(6)]	□Yes □No □N/A
15.	Do cylinders without fixed hand wheels have keys, handles, or nonadjustable wrenches on the valve stems while the cylinders are in service? [29 CFR 1910.253(b)(5)(ii)(E) and 1926.350(d)(2)]	□Yes □No □N/A
16.	Are cylinder valves closed when work is finished and before cylinders are moved? [29 CFR 1910.253(b)(5)(ii)(F) and (b)(5)(ii)(G) and 1926.350(a)(8)]	□Yes □No □N/A

17.	Are cylinders kept far enough away from the welding or cutting operation so that sparks, hot slag, or flames will not reach them? Or, are fire-resistant shields provided? [29 CFR 1910.253(b)(5)(ii)(I) and 1926.350(b)(1)]	□Yes □No □N/A
18.	Are cylinders placed where they cannot become part of an electrical circuit? [29 CFR 1910.253(b) (5)(ii)(J) and 1926.350(b)(2)]	□Yes □No □N/A
19.	Is using cylinders as rollers or supports prohibited? [29 CFR 1910.253(b)(5)(ii)(K) and 1926.350(c)(1)]	□Yes □No □N/A
20.	When cylinders are hoisted, are they secured on a cradle, slingboard, or pallet? [29 CFR 1926.350(a)(2)] Note: Cylinders may not be hoisted or transported by magnets or choker slings.	□Yes □No □N/A
21.	Is using a hammer or wrench to open cylinder valves prohibited? [29 CFR 1910.253(b)(5)(ii)(Q)] Note: Cylinders may not be hoisted or transported by magnets or choker slings.	□Yes □No □N/A
22.	Is a policy in place to report problems promptly to the supplier? [29 CFR 1910.253(b)(5)(ii)(R)(1)] Note: Employees and students should not attempt to repair a cylinder.	□Yes □No □N/A
23.	Are fuel-gas cylinders placed with the valve end up whenever they are in use? [29 CFR 1910.253(b) (5)(iii)(A) and 1926.350(b)(3)]	□Yes □No □N/A
24.	Are compressed-gas cylinders secured in an upright position so they cannot fall or be knocked over? [29 CFR 1926.350(a)(9)] Note: Use a suitable cylinder truck, chain, or other steadying device.	□Yes □No □N/A
25.	Before connecting a regulator to a cylinder valve, do employees open the valve slightly and close it immediately? [29 CFR 1910.253(b)(5)(ii)(P) and (b)(5)(iii)(C) and 1926.350(d)(1)] Note: Open the valve while standing to one side of the outlet; never in front of it. Never crack the fuel-gas or oxygen cylinder valve near other welding work or near sparks, flames, or other possible sources of ignition and combustion.	□Yes □No □N/A
26.	Before a regulator is removed, is the cylinder valve closed and the gas released from the regulator? [29 CFR 1910.253(b)(5)(iii)(D) and 1926.350(d)(4)]	□Yes □No □N/A
27.	For torches or other devices equipped with shutoff valves, is the fuel gas from cylinders only used through a suitable regulator to reduce the pressure? [29 CFR 1926.350(d)(3)]	□Yes □No □N/A

28. If cylinders have leaky valves or fittings that cannot be stopped by closing the valve or tightening the gland nut, are cylinders immediately taken outside away from sources of ignition and slowly emptied? [29 CFR 1910.253(b)(5)(iii)(F) and 1926.350(d)(5)]	□Yes □No □N/A
29. Is tampering with safety devices prohibited? [29 CFR 1910.253(b)(5)(iii)(H)]	□Yes □No □N/A
30. Are cylinder valves always opened slowly? [29 CFR 1910.253(b)(5)(iii)(J) and 1926.350(d)(2)]	□Yes □No □N/A
31. Do employees and students know not to open acetylene cylinder valves more than 1-1/2 turns of the cylinder, and preferably no more than 3/4 of a turn? [29 CFR 1910.253(b)(5)(iii)(K) and 1926.350(d)(2)]	□Yes □No □N/A
32. Is flash-back protection provided by an approved device that will prevent flame from passing into the fuel-gas system? [29 CFR 1910.253(e)(3)(ii)(C)(3)]	□Yes □No □N/A
33. When parallel lengths of oxygen and fuel-gas hose are taped together for convenience or to prevent tangling, is four inches (or less) of every 12 inches of hosed taped? [29 CFR 1910.253(e)(5) (ii) and 1926.350(f)(2)]	□Yes □No □N/A
34. Are the fuel-gas hose and oxygen hose easily distinguished from each other? [29 CFR 1926.350(f)(1)]	□Yes □No □N/A
35. Are all hoses inspected at the beginning of each day? [29 CFR 1926.350(f)(3)]	□Yes □No □N/A
<ol> <li>Are leaking, defective, burned, or worn hoses removed, repaired, or replaced? [29 CFR 1910.253(e) (5)(v) and 1926.350(f)(3)]</li> </ol>	□Yes □No □N/A
37. Are hose couplings of the type that cannot be unlocked or disconnected by a straight pull without rotary motion? [29 CFR 1926.350(f)(5)]	□Yes □No □N/A
38. Are boxes used for the storage of gas hose ventilated? [29 CFR 1926.350(f)(6)]	□Yes □No □N/A
39. Are hoses, cables, and other equipment kept clear of passageways, ladders, and stairs? [29 CFR 1926.350(f)(7)]	□Yes □No □N/A
40. Are clogged torch-tip openings cleaned with suitable cleaning wires, drills, or other devices designed for this purpose? [29 CFR 1926.350(g)(1)]	□Yes □No □N/A

41. Are torches inspected at the beginning of each day for leaking shutoff valves, hose couplings, and tip connections? [29 CFR 1926.350(g)(2)]	□Yes □No □N/A
42. Are defective torches removed from use? [29 CFR 1926.350(g)(2)]	□Yes □No □N/A
<b>43.</b> Are torches lighted by friction lighters or other approved devices? [29 CFR 1926.350(g)(3)] Note: Torches should not be lighted by matches or from hot work.	□Yes □No □N/A
44. Are regulators (including gauges) repaired only by skilled mechanics who have had proper instruction? [29 CFR 1910.253(e)(6)(ii)]	□Yes □No □N/A
45. Are gauges on oxygen regulators marked USE NO OIL? [29 CFR 1910.253(e)(6)(iii)]	□Yes □No □N/A
46. Are union nuts and connections on regulators inspected before use to detect faulty seats that may cause leakage of gas when the regulators are attached to the cylinder valves? [29 CFR 1910.253(e)(6)(iv)]	□Yes □No □N/A

## **Appendix G**

Mobile Oxy-Acetylene/Propane Unit Procedure

Operators should always follow the Manufacturer's instructions for the specific equipment in use. Safety Data Sheets for the gases being used should be available & understood.

Lię	ght Up Procedure
	Hot work requirements are followed
Check	Fire extinguishers are available
	Appropriate PPE is in use
Visual Checks	Before use visual checks are completed (see over)
	Purge <b>oxygen</b> & <b>fuel</b> assembly in turn
Purge <b>Oxygen</b> & <b>Fuel</b> Hoses in Turn Whilst	Open <b>cylinder valve</b> to a maximum 1.5 turns
Setting Working Pressures	Open <b>torch valve</b>
Purging should only take place in well	Open <b>regulator</b> & adjust to set for initial working pressure
ventilated areas not in confined spaces	Completely purge each hose & gas assembly checking for gas flow from torch
	Close torch valves
Leak Check	Leak check every joint

<b>Ensure torch val</b>	ves are closed	before proceeding
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Purge Torch	Open <b>oxygen</b> torch valve purge 3-5 seconds close torch valve
	Open <b>fuel</b> torch valve purge 3-5 seconds close torch valve
Lighting the System Naked flames must not be used	Open <b>fuel</b> gas torch valve. Use the correct spark lighter for the fuel gas in use
	Light the torch. For acetylene increase fuel gas valve to reduce smoke if necessary
	Slowly <b>open</b> the <b>oxygen</b> torch valve until a clear sharply defined flame is achieved

Shut Down Procedure		
The fuel gas is normally switched off first – however, consult the Equipment Supplier's handbook as there may be variations.		
Extinguish the Working Flame at the Torch	Fuel gas off	
	Oxygen off	
Close Cylinder Valve	Turn the cylinder valve keys clockwise until closed	
Vent System (No Gas)	Open torch valves in turn	
	Vent the gas from each of the hoses	
	Check Gauges are reading zero	
Close Torch Valves	Close all torch valves	
Close Regulator	Close regulator pressure adjustment screw	
Check 3 Stops		
	1 Cylinder closed	
Three stops employed!	2 Torch valves closed	
	3 Regulator closed	
Safely Stow Equipment	Preferably do not stow hoses around the cylinders	
	Remove the cylinders from any confined space	

EMERGENCY PROCEDURE FOLLOWING FLASHBACK EXPLOSIONS & SUSTAINED BACK FIRE		
Turn off only if it is safe to do so	1 Oxygen torch valve first	
	2 Fuel gas torch valve	
	3 Cylinder valves	
Immediately put down the torch, preferably in water, as the oxygen may use the torch components as a fuel causing the torch to melt.		
Check Acetylene Cylinder (if used)	If the cylinder appears to generate its own heat, or has been involved in a fire, evacuate the area & call the Fire Services.	
Check Equipment for Damage	Replace damaged hose & any damaged equipment	
Restart	Ensure visual before use checks & light up procedures are repeated	

In the event of an emergency:

Call: 9-1-1 Public Safety: 602-639-8100

Notify: EHS: 602-639-7279

## **Appendix H**



Hot Work Permit Decision Tree

### GRAND CANYON UNIVERSITY

EHS 415 - Hot Work Program

## **Appendix I**

#### **Illustrated Examples**



Example of 35 Rule Illustrated



#### **Example of Where Multiple Fire Watchers Are Needed**

#### Source: NFPA 51B - Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, 2019

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