HOT WORK ACTIVITIES (WELDING/CUTTING)

20.0
This Procedure provides safety and health instructions regarding, gas and electric welding, cutting, brazing, or similar flames or sparks resulting from hot work operations. It is to help combat injuries caused from heat, evolved gases and fumes, electrical shock, explosion, fires, and other dangers.

This procedure shall apply to all employees of the Facilities Management group and contractors that are responsible for planning, supervising, and conducting welding and cutting operations.

20.1 ASSIGNMENT OF RESPONSIBILITIES

A. Supervisors shall be responsible for the following:
   1. Ensure that this procedure is adhered to during all welding and cutting operations.
   2. Designate an individual, or individuals, responsible for authorizing welding and cutting operations.
   3. Ensure that welding/cutting operations are performed in designated areas by trained and authorized personnel.
   4. Advise contractors about flammable materials or hazardous conditions of which the contractors may not be aware, and select cutting/welding contractors with appropriately trained personnel who understand the risks involved.
   5. Approve hot work permits for welding and cutting operations in non-designated areas.

B. Employees designated as a welder/cutter shall be responsible for the following:
   1. Adhere to this procedure during all welding and cutting operations.
   2. Perform welding and cutting operations in designated areas.
   3. Obtain an approved hot work permit prior to performing welding or cutting operations in non-designated areas.
   4. Report any injury, including suspected flash burns, to their supervisor.

C. The Occupational Safety Coordinator shall be responsible for:
   1. Provide guidance to employees and supervisors in the implementation of this procedure.
   2. Ensure all work areas and equipment used for welding/cutting operations are being inspected for compliance with the requirements of this procedure.
   3. Ensure that this procedure is adhered to during all welding and cutting operations.
   4. Maintain hot work permit records on site.
D.
When a host employer arranges to have employees of a contractor perform welding or cutting work, the contractor will be informed on the requirements of this Welding and Cutting Procedure. Each contract employee is expected to follow this Welding and Cutting Procedure when performing welding and cutting operations.

The host employer shall be responsible for the following:

1. Inform the contractor of areas authorized for welding and cutting operations.
2. Inform contractors of specific areas and/or equipment where welding and cutting are not authorized.
3. Inform the contractor of any precautions or procedures the host has implemented for employees in or near the contractor’s work areas.
4. Coordinate welding and cutting actions with the contractor when both the host employees and contractor employees will be working on or near the same equipment, machinery, or systems.
5. Evaluate the compliance of contract personnel with this Welding and Cutting Procedure.
6. Debrief the contractor at the conclusion of welding and cutting operations to determine any hazards confronted or created in the work area.
7. Ensure proper risk transfer is in place.

E.
Contractors shall be responsible for:

1. Obtain any available information regarding welding and cutting procedures from the host employer.
2. Coordinate welding and cutting actions with the host employer when both host and contractor personnel will be working employees will be working on or near the same equipment, machinery, or systems.
3. Inform the host employer of any hazards confronted or created in the welding and cutting work area.

20.2 CYLINDER STORAGE, TRANSPORTATION AND USE

A.
Below covers the general requirements for storage, transportation, and use of Oxygen/acetylene cylinders and fuel cylinders:

1. Fuel gas cylinders (oxygen/acetylene/LP gas, etc.) must be stored in their upright positions with caps in place and secured when not in use.
2. Oxygen and fuel gas cylinders must be kept a minimum of 20-feet apart or stored in an approved storage unit.
3. Compressed gas cylinders shall not be stored overnight within a University facility.
4. Oxygen/acetylene cylinders shall be transported/used/stored in approved carts only. Approved carts consist of a noncombustible barrier at least 5-feet high between oxygen/acetylene cylinders which meet a fire-resistance rating of at least ½-hour.
5. Gauges shall be removed and caps in place when transported in mobile equipment.
6. Outside storage areas must be protected from direct sunlight, external heat sources, electric arcs, or high temperatures.
7. Cylinders shall not be kept in unventilated enclosures such as lockers and cupboards, or inside the cabs or passenger areas of vehicles.
8. Valve protection devices must be in place when cylinders are not in use, and during storage and transport. Valve protection devices **must not** be used for lifting cylinders.
9. Cylinders must be prevented from tipping, falling, or rolling.
10. All empty cylinders will be handled and stored as if they were still pressurized.

### 20.3 GENERAL REQUIREMENTS

**A.**
1. Gauges, gauge covers, valves, hoses and other torch set components will be inspected prior to each use.
2. Personnel shall report any equipment defect or safety hazard to a supervisor, and the use of such equipment must be discontinued until it is repaired by qualified personnel.
3. Flashback arrestors will be required between torch head and hose assembly on all assemblies.
4. Personnel are required to use approved welding, cutting, and grinding equipment and follow the manufacturer’s instructions.
5. Such equipment shall be maintained in safe working order at all times.
6. Welding blankets, welding screens and similar protection will be utilized to prevent damage to equipment, product, finished surfaces and employee injury. Air scrubbers and adequate ventilation must be utilized at all interior welding operations. Fire blankets, welding screens and similar controls are to be utilized to control welding areas and zones.

### 20.4 VENTILATION IN HOT WORK/ WELDING AREAS

**A.**
Whenever possible, welding and/or cutting operations should be performed in areas that are isolated and designated for such uses. Welding or cutting must not be performed in the following areas:
1. In the presence of explosive atmospheres
2. In areas near the storage of quantities of exposed, ignitable materials
3. In buildings that contain sprinkler systems that are impaired
4. In areas not authorized by management or by a hot work permit.

**NOTE** Whenever welding operations are interrupted for a substantial period of time (e.g., lunch or overnight) or completed, "hot" metal areas must be identified, and the equipment must be shut off with any valves closed.

**B.**

Cutting or welding operations must be performed in areas with adequate ventilation to keep fumes and gases within safe limits.

The following are a few guidelines to follow for good ventilation practices:

1. Local exhaust ventilation must be used when potentially hazardous materials are being worked on. (Examples of potentially hazardous materials include, but are not limited to, chromium, fluorides, zinc, beryllium, cadmium, lead, and mercury).
2. Adequate exhaust ventilation must be used when using inert-gas welding, plasma-arc cutting or carbon-arc cutting.
3. The metal surface shall be free of all chlorinated solvents during any welding or cutting operations.
4. Process/utility pipe welding (stainless steel or similar) will utilize all practices related to the identification and controls related to hexavalent chromium. When welding/cutting process-piping a Safe Plan of Action must be developed and reviewed to ensure craftsman and workers are protected from exposure.

**20.5 PERSONAL PROTECTIVE EQUIPMENT**

A. Approved personal protective equipment (PPE) shall be worn by all employees performing or assisting in welding and/or cutting operations. Examples of PPE include eye protection, helmets and hand shields, flame resistant gloves, limb/body protection, and respiratory protection.

Some other PPE guidelines to follow include:

1. While performing overhead or vertical welding, personnel must wear leather personal protective equipment (shoulder, head, and ear covers).
2. All welders should wear flame-resistant aprons, coveralls, gauntlet gloves and shirts with sleeves of sufficient length and construction to protect the arms from heat, UV radiation, and sparks.
3. Wool and leather clothing are preferred because they are more resistant to deterioration and flame than cotton or synthetics.
4. Synthetic fiber clothing should not be worn unless it is specifically manufactured to be fire retardant.
5. Clothing should be kept reasonably free of oil or grease.
6. Front pockets and upturned sleeves or cuffs should be prohibited. Sleeves and collars should be kept buttoned and high boots should be worn under pant legs (or leggings worn) to prevent hot metal slag or sparks from contacting the shin.
7. Personnel must wear respiratory protection when ventilation is not sufficient to prevent exposure above permissible limits. (When performing cutting or welding operations involving coatings which generate toxic substances upon heating, or working with materials that contain beryllium, cadmium, lead, or mercury, personnel must wear supplied-air respirators).
8. Workers welding on metal alloys should wear work uniforms, coveralls, or similar full-body coverings that are laundered each day. Lockers or other closed areas should be provided to store work and street clothing separately.
9. Other personnel in welding/cutting areas not protected by noncombustible or flameproof screens or shields must wear appropriate goggles.
10. Welding Hoods: Soft hoods are not allowed when overhead hazards exist. A minimum of No. 5 shade lens will be required in welding hoods and goggles while cutting or welding using oxygen/acetylene-cutting torches.

20.6 HOT WORK PERMITS

A. Prior to performing welding/cutting operations in the following circumstances, a hot work permit must be completed and approved by the appropriate supervisor.

(REFER TO APPENDIX I-HOT WORK PERMIT)

The following are guidelines pertaining to hot work permits:

1. Must be issued for locations that have not been designated as welding locations.
2. Must be issued for areas in confined spaces.
3. The employee who is conducting the work shall initiate the permit.
4. Must be issued in areas where a fire hazard may exist (example: weeds, wood products, fabrics, etc).
5. Must be issued for areas where combustibles are closer than 35' to the point of operation.
6. Must be issued for areas where combustible materials are adjacent to the opposite side of metal walls, partitions, ceilings, or roofs and areas likely to be ignited by conduction or radiation.
7. If in doubt whether to issue a hot work permit, it is recommended that a permit be issued subject to the provisions of this procedure.

8. The Permit must remain visible in the immediate work area until the hot work is completed.

9. Hot Work Permits are task specific and valid ONLY for specific period of time indicated on the permit. Permits expire at 1) job completion; 2) change of location; 3) end of work shift.

B. Steps to obtaining a hot work permit:

1. The employee who is conducting the work shall initiate the permit.

2. The supervisor must sign the permit certifying they have inspected the immediate and surrounding work area for fire hazards and that sufficient precautions are being taken to reduce the risk of fire.

3. The Safety Coordinator, the Director of Facilities Management or the Assistant Director of Facilities Management must review the permit and initial and date it after it is entered on the hot work permit log in the Safety Office.

4. It is the responsibility of the requesting supervisor or his designee to post the Hot Work Permit in the area where it is clearly visible and to ensure the permit is retrieved at the end of the operation. The supervisor or his designee shall ensure that the permit is returned to the Safety Office upon completion of the operation.

5. The Safety Coordinator, the Director of Facilities Management or the Assistant Director of Facilities Management are the ultimate and final authority for approving hot work permits.

Copies of open permits must be maintained at the job site and in the Occupational Safety Coordinator’s office. Upon job completion, closed permits should be maintained for three (3) years.

20.7 HOT WORK PERMITS FOR WORK ON BUILDING ROOFS

All hot work permits issued for work on any building roof require additional steps to ensure the protection of University employees and property.

(REFER TO APPENDIX I - HOT WORK PERMIT)

A. Guidelines to obtaining a hot work permit for work on roofs:

1. The Hot Work Requester and the Supervisor responsible for the work MUST physically check the area and ensure that all necessary precautions have been taken to prevent a fire.
2. Once both the Requester and the Supervisor have taken steps to prevent a fire they must call the Safety Coordinator, the Director of Facilities Management, or the Assistant Director of Facilities Management and inform them that the physical review has been completed.

3. The Safety Coordinator, the Director of Facilities Management, or the Assistant Director of Facilities Management will then give their final approval and the permit will be entered on the log.

THIS MUST BE COMPLETED PRIOR TO ANY WORK BEING PERFORMED.

20.8 PERFORMING HOT WORK ACTIVITIES (WELDING/CUTTING)

A. The following are guidelines and precautions to follow when performing the actual hot work/welding:

1. The cutter/welder should affix the Hot Work Permit to a visible place in the immediate work area. The Permit must remain in place until the hot work is completed. The cutter/welder is responsible for conducting the hot work within the authorized parameters and time limit set by the permit. Hot work may continue as long as conditions remain safe and not new hazards have been introduced.

2. Perform hot work in the approved or designated area. If hot work cannot be moved to this area, follow all hot work procedures.

3. Use equipment that is in good condition. Valves, regulators, hoses and torches MUST be thoroughly inspected prior to use.

4. Do not perform welding, cutting, or other hot work operations in an area where sprinklers are out of service or where fire extinguishers have been removed.

5. Move all combustibles at least 35 feet from hot work operations. If combustibles cannot be moved, they should be protected by metal guards or by flame proof curtains or covers. Do not use ordinary tarpaulins.

6. Do not perform hot work in or on any vessel containing flammable or combustible materials, including residues, until they have been disconnected or blanked, completely cleaned out, and purged.

7. Check the atmosphere for combustible gases or vapors, where necessary, using reliable combustible gas detection equipment. If there is a possibility of gas release during the hot work operations, continuous-duty portable combustible gas detectors should be used to continuously monitor the area.

8. Ensure that a workable 5lb fire extinguisher is readily available in the immediate area.

9. Where combustible materials are on the floor, the floor shall be swept clean for a radius of 35 feet in all directions of the hot work operations. If hot work operations are performed above combustible surfaces (i.e. wood floors or built up roofs), the surface shall be kept damp, covered with damp sand, or protected by fire resistant
shields or tarpaulins. Where damp sand is used, personnel operating arc welding or cutting equipment shall be protected from possible shock.

10. Do not perform hot work until all wall and floor openings within 35 feet of the operations have been tightly covered or otherwise protected with metal guards or flame proofed tarpaulins.

11. Do not start hot work operations until a fire watch, where required, has been assigned and is in place to watch for dangerous sparks in the area and on the floors above and below the operation area.

12. Secure gas cutting and welding cylinders so they will not be damaged and replace protective caps (and close gas supply valves) on all cylinders not actually in use. All cylinders MUST be stored in an upright position and secured with a chain or cable.

13. Carefully and securely connect the ground clamp when using electrical arc welding equipment. Since improper grounds can be a source of ignition, the ground clamp should be connected as close to the work area as possible so that it can be easily observed.

14. Ensure adequate ventilation is maintained during hot work operations to assure that personnel are not exposed to harmful fumes. This may include positioning of an exhaust blower close to the point of the exhaust fumes. Respiratory protection should also be considered.

15. Remove all electrodes from the holders, carefully locate them so that accidental contact cannot occur, and disconnect the welding machine from the power source if hot work is to be suspended for any substantial period of time (lunch, break, overnight).

20.9 COMPLETING THE HOT WORK PERMIT PROCEDURE
When the hot work is completed, either the welder/cutter or the fire watch shall remain in place for at least one hour, carefully inspecting the work area and the adjacent areas for the possibility of any smoldering fires.

Barring any fires, the cutter/welder or fire watch shall remove the hot work permit. The permit will then be signed and indicate the time the watch was completed indicated. The permit will then be returned to the Safety Office.

20.10 HOT WORK (WELDING/ CUTTING IN CONFINED SPACES)
A. Proper precautions must be taken by personnel who are required to perform welding or cutting operations in a confined space area.
Below are guidelines to follow for performing hot work activities (welding/cutting) in a confined space:

1. Mechanical ventilation shall consist of either general mechanical ventilation systems or local exhaust systems prior to any welding activities.
2. Contaminated air exhausted from a working space shall be discharged into the open air or otherwise clear of the source of intake air.
3. When sufficient ventilation cannot be obtained without blocking the means of access, employees in the confined space shall be protected by airline respirators. An employee on the outside of such a confined space shall be assigned to maintain communication with those working within it and to aid them in an emergency.
4. Other employees exposed to the same atmosphere as the welders or burners shall be protected in the same manner as the welder or burner.
5. Where a welder must enter a confined space through a manhole or other small opening, means shall be provided for quickly removing him in case of emergency. When safety belts and lifelines are used for this purpose they shall be so attached to the welder’s body that his body cannot be jammed in a small exit opening. An attendant with a pre-planned rescue procedure shall be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.

20.11 FIRE SUPPRESSION AND PROTECTION
A. Fire protection equipment must be maintained ready for use at all times that welding or cutting operations are being performed.

Below are guidelines for fire suppression and protection for performing hot work activities (welding/cutting) activities:
1. If welding is to be performed in areas where a fire hazard may exist, fire watch practices must be established and implemented.
2. When performing welding or cutting operations on coated surfaces that are highly flammable (determined by a flammability test), the coating must be stripped from the area to prevent ignition.
3. All surfaces covered with toxic preservatives, including coatings which generate toxic substances upon heating, must be stripped for a distance of at least 4 inches from the area of heat application.
4. Suitable fire protection equipment must be maintained ready for use at all times that welding or cutting operations are being performed. If welding is to be performed in non-approved areas, supervisory personnel must complete a hot work permit.

B. During some welding/cutting operations there may be a need for a Firewatch.
A Firewatch is defined as a dedicated person or personnel that is a temporary measure intended to ensure continuous and systematic surveillance of an area for the purposes of identifying and controlling fire hazards, detecting early signs of an unwanted fire, raising an alarm of fire and notifying the fire department.

A Firewatch and a hot work permit are required when welding or cutting is performed where:

1. Combustibles are closer than 35' to the point of operation, or where there are appreciable combustibles easily ignited by sparks
2. Wall, floor, or other openings within 35' radius that expose combustible materials
3. Combustible materials are adjacent to the opposite side of metal walls, partitions, ceilings, or roofs and are likely to be ignited by conduction or radiation.

C. Duties of the Firewatch include:
   1. Using fire extinguishing equipment to extinguish fires within the capacity of equipment available
   2. Sounding an alarm in the event of a fire
   3. Watching for fires in all exposed areas
   4. Maintaining a fire watch for at least 1/2 hour (30 minutes) after completion of welding or cutting operations.
   5. Reporting any injury, including suspected flash burns, to their supervisor

20.12 SOURCES OF IGNITION

A. A source of ignition is a flame, tool spark, static electric charge or electric spark that could cause a fire or explosion.

Examples of ignition sources:
1. Welding, burning, brazing, soldering, or any use of an open flame
2. Metal removing such drilling, chipping, abrasive cutting, milling, grinding, etc.
3. Internal combustion engines
4. Explosive-actuated fastening tools
5. Cutting or chipping concrete with or without reinforcement
6. Operating non-explosion proof equipment and tools in an explosion-proof area
7. (Includes battery powered equipment and tools)
8. Operating any cleaning device utilizing a metal or any other material contact that can produce sparks
9. Work on live electrical circuits of any voltage in hazardous locations
20.13 TRAINING

Training will be conducted annually or as deemed necessary.