UNIVERSITY OF PITTSBURGH HOT WORK PROGRAM

All hot work can create conditions with high probability for fire related injury or property loss. Hot work includes but is not limited to: brazing, cutting, grinding, soldering, torch-applied roofing and welding. Each type of hot work presents specific hazards depending on the methods used, the materials used, and the environment involved.

The objective of this Hot Work Program is to reduce injury, fire and/or explosion resulting from the performance of hot work. The procedures contained in this Program are applicable to all employees and contractors working at the University of Pittsburgh. The Department of Environmental Health and Safety provides oversight for this Program.

PART I GENERAL WELDING AND CUTTING GUIDELINES

University employees should observe the following general safety guidelines when performing Hot Work operations:

- Welding areas need to be kept clean and free of any excess materials, especially combustibles;
- Do not perform Hot Work operations in a building when sprinkler protection is inoperable or off-line for repairs, without permission from the Department of Environmental Health and Safety;{ phone: 4-9505, Off-Shift (412)917-0173 }
- Only authorized employees who have been properly trained shall be permitted to perform welding or cutting.
- Employees performing cutting or welding must wear the personal protective equipment required for the job. Clothing shall be free of excessive grease and oil.
- Fire extinguishers shall be readily available wherever cutting or welding is being done.
- Only perform work in an area that restricts entry by unauthorized personnel.

EQUIPMENT

Cylinders

Oily or greasy substances shall be kept away from cylinders, cylinder valves, couplings, regulators, hose and other equipment. Any equipment that has been subject to oil and grease shall be thoroughly cleaned before being placed back into service

Fittings shall never be lubricated. Only approved materials shall be used on oxygen equipment.

Contents of cylinders shall be identified by commonly accepted names legibly marked on the cylinder. Do not rely on color codes because there are no standard codes for cylinders. Report any unlabeled cylinder to your foreman/supervisor.

All cylinders shall be provided with approved pressure relief devices. No repairs of any kind are to be attempted on any cylinder or valve. Safety devices on cylinders or apparatus shall not be tampered with or removed.

Oxygen cylinders shall not be stored in the same compartment with cylinders of acetylene or other fuel gas. Unless well separated (minimum of twenty (20) feet), there shall be a fire resistant partition between oxygen cylinders and acetylene or fuel gas cylinders.

During storage and transportation, cylinders shall always be stored in an upright position and properly secured. Provisions should be made to prevent their falling over or being struck by other objects.

Cylinders shall not be stored in locations where they might be exposed to excessive heat.
All empty cylinders shall be marked ('MT') and returned to their proper storage compartments with valves tightly closed and caps replaced.

When oxygen and acetylene cylinders are mounted together on a cart, a partition of steel or other non-combustible material shall be installed between the cylinders.
Do not place cylinders where they might become part of an electric circuit. When cylinders are used in proximity to electric welding, precautions must be taken to protect the cylinders against accidental grounding.

A cap shall protect cylinder valves when the cylinders are not in use or are being transported. If the valve cannot be opened by hand, the cylinder shall be tagged and exchanged for a new one.

Fuel gas leaks can generally be identified by odor and the location determined by applying soapy water. If a leak is discovered in a cylinder, it shall immediately be removed to fresh air (away from any source or ignition), the valve opened slightly and the contents allowed to escape to a safe location.

Pressure Reducing Equipment and Torches
Oxygen, acetylene and other compressed gases shall never be used from a cylinder without reducing the pressure through a pressure-reducing regulator bearing an Underwriter Laboratory (UL) or Factory Mutual (FM) approval.

Oxygen regulators shall be used only on oxygen cylinders and fuel gas regulators on fuel gas cylinders. Oxygen regulators are provided with national standard right hand threads and fuel gas regulators with left hand threads.

Handle all pressure regulating equipment with care to avoid damage to the mechanism.

Never use oil or grease on cutting or welding equipment for any purpose.

Regulators in need of repair shall be returned to the supplier or a person authorized to do such work shall make repairs. Inspect regulating equipment and torch prior to every use. Remove unsafe equipment from service.

Always stand to the side of regulators when opening or closing valves and making adjustments.

When a regulator is not in use, the pressure adjusting screw shall be released and the cylinder valve closed. A cylinder valve shall never be opened until the pressure adjustment screw on the regulator is fully released.
When burning or welding overhead, the regulators on the cylinders shall be properly protected to prevent sparks and objects from falling on them.

Regulators shall be removed from cylinders before cylinders are moved from one location to another unless they are in a carrier specifically designed for transporting.

Hose
All units should be equipped with back-flow prevention and flash back arrestors.

Examine all hoses for defects before use. Defective hose shall not be used. New hose should be tested for leaks before use.

Oxygen and acetylene hose shall be fastened together with tape or approved clamps at intervals of three to four feet along the hose. Care must be exercised to prevent hose from being damaged.

Hose shall be fastened to the regulators and torches by approved fittings only. It is important that all connections be kept tight.

Use hose and connections made especially for gas welding and cutting. Red colored hose shall be used for acetylene or other fuel gas and green colored hose for oxygen.

Care shall be taken that the hose does not become kinked or tangled. Place the hose so that it will not be trampled on, run over or present a tripping hazard.

OPERATION

Hot work is prohibited:

- On partitions, walls, ceilings or roofs with combustible coverings or cores (e.g., expanded plastic insulation, sandwich panels).

- In areas containing unprotected flammable liquids, vapors or gases, combustible dusts or combustible metals.
- On or in rubber lined equipment.
- In oxygen enriched atmosphere.
- In storage and handling areas for oxidizing materials or explosives.
- In other areas where hot work cannot be performed safely.

University personnel may only conduct hot work outside of designated hot work areas if specifically authorized by the foreman or supervisor and the following conditions are verified:
1. No other suitable non-hot work means can be found to produce the desired result;
2. No other safe location can be found to do the hot work; and
3. The designated person(s) involved with authorizing and conducting the hot work have complied with all hot work permitting process requirements, including all precautions and required follow-up actions. Contractors hired to do work potentially involving hot work must comply with all requirements of the hot work permitting process, and will be overseen by a designated University employee.

Do not perform any welding or cutting operations in any area where there is danger of fire unless you have received permission to do so from your foreman. Provisions for Hot Work authorization shall be made and a fire watch provided to properly safeguard the area.

Attaching Regulator To Cylinder

- Keep hands and gloves free of oil and grease.
- Stand to one side when opening valve
- Open discharge valves slowly:
- With the cylinder secured in place upright, and the outlet valve pointed away from the operator, the valve shall then be opened sufficiently to blow any dirt out before attaching the regulator.
- Close the valve and tightly attach the regulator to prevent leaks. The pressure adjusting screw shall be fully released before slowly opening the cylinder valve. Do not stand in front of the outlet.

Use of Cylinder Valves, Regulators and Torch Valves

After equipment has been assembled and connected for use, the following procedure shall be employed before putting the equipment in service:

- Oxygen cylinder valve shall be opened slowly so that the needle on the high pressure gauge rises slowly. The valve shall then be opened as far as possible. Regulate desired oxygen pressure. Wrenches shall not be used on oxygen valves.

- Acetylene cylinder valve shall be opened one and one quarter turns with the "T" handle wrench, which is supplied for the cylinder. This wrench shall be kept on the valve while equipment is in use. Regulate desired gas pressure, which shall never exceed 15 pounds per square inch.

- Purge each hose before lighting the torch.
- Use only a friction lighter to ignite torch. Matches or other flames are prohibited.
- Always stand to the side of regulators when opening valves.
- Light acetylene, adjust flame, then adjust oxygen.

In the case of a "backfire", (which is the flame going out with a loud snap) the torch may relight itself. If the torch does not relight itself, the oxygen valve must be shut off quickly; then close the gas valve. After a moment relight in the regular manner. If a "flash-back" (which is the flame flashing back inside the torch, and which may extend to the hose and regulators) occurs, the torch oxygen valve shall be closed quickly, then the acetylene valve and the valves of both cylinders shall be closed. All torches and regulators must be provided with reverse flow check valves and flashback arrestors on both oxygen and fuel gas connections to reduce the possibility of “backfires".

When finished with the torch, the fuel gas shall be turned off at the torch and then the oxygen. Gas shall not be kept burning on the end of the tip as a pilot. This practice will carbon up the torch and render it dangerous. Keep torch tips clear of all foreign material.

When through using or moving the equipment, employees must insure that cylinders valves are closed and the pressure on regulators relieved.

The regulator thumbscrews shall be backed off and the pressure released from the low pressure gauges, unless the operator will be using the outfit again within a few minutes.

Do not shut off cylinder valves and leave outfit with regulator thumb screws turned in. If creeping is noted on the working pressure gauge hands, this is an indication that the regulator is faulty and must be repaired.

The valves on the torch and all connections shall be examined daily for leaks before lighting the torch. If leakage is noted around the valve stems, tighten the packing nuts and if this does not correct the situation, have proper repairs made by an authorized person.
Use great care not to allow the oxygen pressure to fall below the working pressure of the acetylene regulator. Fuel gas may flow back into the oxygen cylinder, forming an explosive mixture, which is highly dangerous.

ARC WELDING AND CUTTING

Electrical Connections

Before starting operations:

- Make certain all electric lead welding connections are secure.

- Firmly attach the ground connection as close to the work as possible.
- Work leads shall be as short as possible.
- The welding machine frame shall be grounded.

Electric Shock

It is important to take precautions to avoid electric shock. The following are especially important precautions to be taken:

- Clothing. shoes, gloves and other protective equipment shall be kept as dry as possible.
- Always wear approved hand protection and never permit the metal part of an electrode or holder to touch your body.
- Electrodes shall be removed from the holder when not in use. Electrode holders when not in use shall be placed so they cannot make electrical contact with persons or conductive objects. Be careful to avoid shock when changing electrodes.
- Check equipment regularly to see that electrical connections and cable are in good condition. Be particularly alert that the electrode holder cable connection is in good condition and secure. Only approved ground connecting devices and rod holders shall be used.
- All welding lines and connections shall be insulated.
- Welding machines shall be shut off when work is stopped.
- Only authorized employees shall make repairs on welding machines.

WELDING OR CUTTING IN CONFINED SPACES

When welding or cutting in any confined space, such as a tank, boiler, pipeline or compartment, the space shall be cleaned, tested and ventilated during the welding operation. All Confined Space requirements as outlined in the University Program must be followed.

When entering a confined space through a manhole or other small opening, means shall be provided for quickly removing employee in case of an emergency.

When arc welding in a confined space is to be suspended for any substantial period of time all electrodes shall be removed from the holders and the machine shut off.

When gas welding or cutting in a confined space is to be stopped for any substantial period of time the torch valves shall be closed and the gas and oxygen supply to the torch positively shut off at some point outside the confined area. The torch and hose shall be removed from the confined space or disconnected from the gas supply during such times. Atmospheric tests shall be made before re-entering.
Do not allow unlighted gas or oxygen to escape and exercise extreme care that hoses and connections are free from leaks. The torch shall be lighted outside and passed with care to the employee inside.

Ventilation shall be provided to keep the space purged of any possible accumulation of flammable gas or vapors. If welding or burning is done on the outside of the structure and there is any possibility of flammable gases accumulating, the interior shall be properly purged to prevent any fire or explosion.

Welding or cutting is not to be done on or in any tank, pipe line, compartment or container which has contained flammable material until it has been thoroughly purged, cleaned and proved to be free from explosive vapors or any danger of explosion, by means of gas detector.

MISCELLANEOUS

Under ordinary conditions, no artificial ventilation is necessary when welding in large or well-ventilated areas. However, special materials such as brass, galvanized or stainless materials may necessitate the use of portable exhaust fans or respiratory protection. Consult with EH&S for approved respiratory protection.

When welding is done in a space screened off on all sides, the screens shall be so arranged that no serious restriction of ventilation exists. Screens should be mounted approximately one foot above the floor

Where, because of the nature of the work or other reasons it is not possible to sufficiently ventilate an area, welders shall wear approved respiratory protective equipment. Respirator wearers must comply with the requirements of the University Respiratory Protection Program, managed by EH&S.

Electric/gas welding or cutting shall not be permitted over or in close proximity to a manhole without first testing with gas-detecting instrument.

If the object to be welded or cutting cannot be moved, combustible materials in the vicinity shall be removed to a safe place. If the object to be welded or burned cannot be moved and if the combustible materials near that object cannot be removed, then the combustible materials must be protected from heat, sparks and slag. A fire watch shall be provided and maintained.

Flammable materials in the area where burning and welding operations are to be performed shall be removed or protected from heat, sparks and molten metal.

Plasma torch cutting or inert gas shielded arc welding are specialized processes requiring that the manufacturer's recommendations with regard to safety procedures and personal protective equipment be followed.

Do not perform any welding or cutting operations on a concrete floor. Keep the work at least 12" above the floor.

PART II HOT WORK PERMIT PROCEDURES

Definitions :

Fire Watch: A person trained in the use of fire extinguishers shall be designated to observe the area surrounding the hot work and be prepared to extinguish any fire that may be ignited. A properly maintained fire extinguisher of the appropriate hazard class is required in any area where appreciable combustible or flammable materials are within 35 feet of the hot work.

Hot work: Any temporary or permanent operation involving open flames or producing heat and/or sparks including but not limited to: brazing, cutting, grinding, soldering, torch-applied roofing and welding.

Hot Work Hazard Area: Any area where the presence of open flames, sparks or other products of hot work could present a significant fire and/or explosion hazard. These designated areas require a completed Hot Work Approval Form.

Hot Work Permit: A written checklist of procedures to be implemented before performing hot work in a hot work hazard area. Signing the completed permit is done to ensure that the proposed work has been reviewed for all applicable safety considerations. Permitted hot work shall be done in accordance with the details spelled out on the permit. If conditions change, the permit must be modified or reissued by the hot work supervisor/foreman. Completed permits shall be maintained in the EH&S Department for one year.

Hot Work Supervisor/foreman: A Hot Work Supervisor/foreman is a person with training, experience and judgment to oversee hot work operations and who has the authority to direct changes or stop the work if necessary. The hot work supervisor/foreman shall determine the hazards present or likely to be present at the work location.

Permitting Instructions :

1) No person shall be allowed to perform hot work operations unless he/she has been trained and authorized by their foreman or supervisor to do so.
2) Permits shall be completed and signed by the person responsible for the hot work.
3) All applicable precautions on the permit shall be followed.
4) Permits shall be posted at the worksite and sent to the Department of Environmental Health and Safety at the completion of work.
5) Permits are only good for a single turn on a single day as conditions at the work site may change from day to day.
6) When completing the PRECAUTIONS section of the Approval Form, an " X " in the appropriate column indicates that this particular precaution is required or N/A to indicate that the precaution is not applicable. The exact precautions will be left to the determination of the foreman based upon the hazards present and the extent and type of hot work.

Fire Watch

A Fire watch is required for any job requiring a permit and whenever welding or cutting is performed in locations where any of the following conditions exist:

- Appreciable combustible materials, ignitable by sparks or slag, are closer than 35 feet to the point of operation;
- Wall or floor openings within a 35 feet radius expose combustible materials in adjacent areas including concealed spaces in walls or floors;
- Combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings or roofs and are likely to be ignited by conduction or radiation.

Fire watches:

- Must be trained in the use of fire extinguishing equipment.
- Shall be familiar with facilities for sounding an alarm in the event of a fire.
- Shall watch for fires in all exposed areas, sound the alarm if necessary, and try to extinguish them only when obviously within the capability of the equipment available.
- Shall have no other primary function.
- Shall be maintained for 1 hour after completion of the work and during breaks and lunches to detect smoldering fires.
- Shall know the location of the nearest phone and the Pittsburgh Campus emergency number (811).

For hot work in areas requiring a permit follow the guidelines listed above with the addition of:

- Explosive or flammable atmospheres shall be eliminated and periodic tests shall be conducted using LEL meters and recorded on the permit.
- Enclosed equipment shall be thoroughly cleaned and purged of combustible and flammable materials or sufficiently inerted.
- A fire watch shall be posted and supplied with suitable fire extinguishing equipment (extinguisher, water hose, fire hose…)

Hot work may be performed without a permit in the following locations:

- Departmental Shops;
- Any outdoor location free of combustibles and away from pedestrians or by standers.

For hot work in areas that do not require a permit, the following general fire safety guidelines must be followed:

- Hot work equipment shall be in good repair.
- If combustible materials are found in the area where hot work is planned the work should be moved to a location free from combustibles. If the work cannot be moved, have the combustibles moved to a safe distance from the work (at least 35 feet) or have the combustibles properly protected. If combustibles cannot be moved or protected, a fire watch must be provided.

- Combustible floors shall be wet down or covered with flame retardant covers.
- Cover all wall, floor or ceiling openings that may cause a fire to start in an adjacent area.
- Ensure that walls and ceilings are not combustible, cover or wet as necessary.
- Ducts, fans or conveyor systems that might carry sparks to distant combustibles shall be suitably protected or shut down;
- For overhead work, position flame retardant tarp to contain sparks and slag. The higher the work, the larger the area that must be protected from falling sparks and slag.
- If welding is to be done on a metal wall, partition, ceiling or roof, precautions shall be taken to prevent ignition of combustibles on the other side, due to conduction or radiation, preferably by relocating combustibles.

All other applicable University safety procedures shall be followed including but not be limited to personal protective equipment, confined space entry, compressed gas safety, lockout/tagout…

Suitable fire extinguishing equipment shall be maintained ready for use while hot work is being performed.