

HOT WORK SAFETY GUIDE

Version	Date	Comments
5	March, 2012	Revised document
6	June, 2015	Update code citation - SFPC 2012

A. INTRODUCTION

The purpose of this Guide is to provide information regarding welding and other hot work. This Guide is designed to comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910 Subpart Q: Welding, Cutting, and Brazing and Virginia Statewide Fire Prevention Code (SFPC) Chapter 35: Welding and Other Hot Work.

B. SCOPE

This Guide applies to all George Mason University personnel and sub-contractors who perform hot work on university controlled property. For the purpose of this guide hot work will be defined as operations including cutting, welding, thermal welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof systems or any other similar activity.

C. RESPONSIBILITIES

Specific responsibilities relating to hot work operations are outlined below.

Environmental Health and Safety Office:

- Upon request, assess potential work requests to determining the need for a hot work permit.
- Inspect hot work areas as necessary to assist with compliance.
- Collaborate with supervisors to designate fixed hot work areas and determine appropriate signage.
- Review all *Hot Work Permits*. Immediately stop all hot work operations that are unsafe or have not properly complied with this guide.
- Provide Fire Extinguisher Training.
- Conduct atmospheric monitoring when flammable gasses or hazardous atmospheres are suspected.
- When necessary, conduct air and noise sampling.
- Conduct Job Safety Analysis (JSA) to determine appropriate controls and personal protective equipment (PPE).
- Immediately stop all hot work operations that are unsafe or have not properly complied with this guide.

Supervisors:

- Ensure that hot work equipment operators are suitably trained in the safe operation of their equipment and fire extinguishers.
- Establish fixed hot work areas for hot work that is conducted on a routine basis.
- Ensure that fixed hot work areas are free of hazards, are appropriately designed, and proper signage is posted.
- Ensure proper communication between the employee doing the hot work, the fire alarm technician, the heating ventilating and air conditioning (HVAC) technician, and EHS.
- Identify and mitigate the hazards including combustible materials that are present or likely to be present in the work location.
- Ensure routine operations are suspended during hot work, if they may create a greater hazard.
- Advise employees and contractors of flammable materials or hazardous conditions that exist in areas where hot work will be conducted.
- Ensure that fire protection and extinguishing equipment are properly located at the hot work location.
- Ensure that hot work area monitoring is provided (see Section F).
- Inspect the work area prior to hot work operations, including emergency hot work.
- Ensure proper PPE is available to employees performing hot work.
- Ensure that *Hot Work Permits* are properly filled out and are posted near the site of the work. Note: Completed permits must remain posted on site for 48 hours after the work has been completed.
- Ensure that, as needed, a building fire watch is conducted in accordance with the *Fire Watch Guide*.
- Notify building occupants if an odor may be present or building safety systems are impaired due to hot work.

Facilities Management Customer Service:

- Ensure that all hot work requests have “Hot Permit Required” selected as the purpose.
- Ensure that the contact information for the work order is captured in the work order and an email is generated to the safety@gmu.edu account.

Heating Ventilating and Air Conditioning (HVAC):

- Evaluate HVAC systems prior to beginning hot work and schedule shutdowns or modifications in coordination with hot work activities.
- Fill out the HVAC Technician section on *Hot Work Permit* and sign in appropriate location before work is started.
- Notify building occupants and EHS of HVAC shutdown, as appropriate.
- Return HVAC systems to normal working conditions upon completion of hot work.

- In buildings containing laboratories, contact EHS - Laboratory Safety and occupants prior to shutdown to allow for proper storage of chemicals and suspension of research activities.

Fire Alarm Shop:

- Fire alarm technicians are required to disable fire detection systems as necessary.
- Fill out the Fire Alarm Technician section on *Hot Work Permit* and sign in appropriate location before work is started.
- Notify University Police dispatch and third party fire alarm monitors, as necessary, of the location and approximate duration of the impaired system.
- Reactivate fire detection systems to normal status upon completion of hot work.

Hot Work Equipment Operators:

- Complete and maintain appropriate training qualifications required to perform hot work to include Fire Extinguisher Training.
- Secure authorization for the hot work operation from the Facilities Management Supervisor, Project Manager, or other qualified supervisor in the form of a *Hot Work Permit*.
- Inspect welding and cutting equipment and operate equipment as instructed by training and manufacturer's operating manual.
- Ensure the safe usage of cutting and welding equipment.
- Use appropriate PPE.
- Ensure required hot work area monitoring and building fire watch is being conducted.
- Complete the "*Required Precautions Checklist*" located on the *Hot Work Permit* before beginning work.

D. GENERAL REQUIREMENTS

- Post a completed Hot Work Permit on site prior to beginning work.
- Operators who perform hot work must be properly instructed and qualified in the use of hot work equipment.
- Review the university's *Compressed Gas Safety Guide* prior to beginning hot work, if appropriate.
- All personnel exposed to hazards created by hot work operations shall be protected by PPE.
- Inspect equipment for damage or defects. Damaged or malfunctioning equipment must be taken out of service until repaired and marked with the words 'Out of Service, Do Not Use.'
- No welding or cutting shall be performed on used drums, barrels, tanks, or other containers until they have been thoroughly cleaned or purged to remove all flammable liquids and gasses.

- Hot work is not permitted in: explosive atmospheres, flammable or combustible materials storage areas, unventilated areas, and public areas without additional protective equipment such as screens or barriers.
- Where the hot work area is accessible to persons other than the operator of the hot work equipment, a sign displaying ‘Caution. Hot Work In Progress. Stay Clear’ shall be conspicuously posted.

E. PROTECTION OF HOTWORK EQUIPMENT OPERATORS

Appropriate PPE must be used whenever hot work is conducted. At a minimum eye, face, and hand protection is required. Attendants on hot work area monitoring must also be provided with appropriate PPE. Other PPE (i.e., boots, gloves, hard hat, fall protection, and protective garments) must be used as required by OSHA. See the table below for selection of proper shade number for eye protection.

Welding Operation	Shade No.
Shielded metal-arc welding 1/16, 3/32, 1/8, 5/32-inch electrodes	10
Gas-shielded arc welding (nonferrous) 1/16, 3/32, 1/8, 5/32-inch electrodes	11
Gas-shielded arc welding (ferrous) 1/16, 3/32, 1/8, 5/32-inch electrodes	12
Shielded metal-arc welding 3/16, 7/32, 1/4- inch electrodes	12
Shielded metal-arc welding 5/16, 3/8- inch electrodes	14
Carbon arc welding	14
Soldering	2
Torch brazing	3,4
Light cutting, up to 1 inch	3,4
Medium cutting, 1 inch to 6 inches	4,5
Heavy cutting, 6 inches and over	5,6
Light gas welding, up to 1/8 inch	4,5
Medium gas welding, 1/8 inch to 1/2 inch	5,6
Heavy gas welding 1/2 inch and over	6,8

NOTE: In gas welding or oxygen cutting where the torch produces a high yellow light, the operator should use a filter or lens that absorbs this light.

- Indoor hot work involving zinc-bearing base materials or filler metals coated with zinc-bearing materials and lead-base metals or materials (e.g., paint) must be done within local exhaust hoods, booths, or fixed enclosures. EHS must be notified in order to conduct air or noise sampling.

- Screens must be used and arranged in a manner that provides protection for surrounding persons. Screens may not obstruct or prevent ventilation or egress.
- Local exhaust or general ventilation must be provided and sufficient to keep fumes, gases, and dusts below the permissible exposure limits and below 10% of the lower explosive limit for flammable materials.
- Welding cables and other equipment must not obstruct egress and be kept clear of passageways, ladders, and stairways.
- All operators and attendants of resistance welding or brazing equipment must use transparent face shields or goggles.

F. FIRE PREVENTION AND PROTECTION

Area Preparation:

- An approved fire extinguisher of sufficient size and appropriate type must be available within 30 feet of the hot work. The fire extinguisher must have a minimum rating of 2-A:20-B:C.
- Oxy-acetylene carts should be stored and transported along with an approved fire extinguisher.
- All movable fire hazards surrounding the hot work area must be removed. Fire hazards can include but are not limited to any material, state, process, or instance of combustion in which fuel is ignited and combined with oxygen, giving off light, heat, and flame.
- If neither the fire hazard nor the object to be welded can be moved, guards must be used to confine heat, sparks, and slag.
- Floor and wall openings or cracks must be covered or guarded so that combustible materials adjacent to the hot work area will not be exposed to sparks and hot slag.
- Ducts and conveyor systems that might carry sparks must be suitably protected or shut down.
- Combustible floors must be kept wet, covered with damp sand, or protected by fire-resistant shields. If a wet floor technique is used, operators using arc welding equipment must be protected from possible shock.
- If welding is performed on noncombustible walls, precautions must be taken to prevent ignition of combustibles on the other side of the wall. Welding must not be attempted on walls or partitions of combustible sandwich-type panel construction.

Hot Work Area Monitoring:

- The area surrounding hot work is required to be monitored by one or more persons dedicated solely to the look out and control of spot fires that may be caused by hot work activities.
- The fire watcher shall have fire extinguishing equipment readily available and shall be trained in the use of such equipment.
- The area must be monitored for at least one half hour after hot work has been completed to detect and extinguish possible smoldering fires.

- Personnel conducting the fire watch are responsible for extinguishing spot fires and communicating an alarm.

G. HOT WORK IN CONFINED SPACES

- All personnel working in a confined space must also comply with all the requirements of the Confined Space Program.
- All hot work performed in confined spaces must be adequately ventilated. Where it is impossible to provide such ventilation, EHS must be consulted.
- Oxygen must never be used for ventilation.
- Where a welder must enter a confined space, means will be provided for quickly removing the worker in case of emergency. An attendant will be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.
- When welding or cutting is performed in a confined space, gas cylinders and welding machines will be left on the outside. Before operations are started, heavy portable equipment mounted on wheels will be securely blocked to prevent accidental movement. After welding operations are completed, the welder will mark the hot metal or provide some other means of warning other workers.

H. HOT WORK PROCEDURE

George Mason University employees and contract personnel engaged in hot work must be authorized to do so by their Supervisor or approved Project Manager. The Supervisor or Project Manager must complete the following process to ensure that the proper shops are involved with hot work.

1. If assistance is needed to determine if hot work is being performed contact EHS-FS.
2. All work orders that require hot work must be purposed to EHS by Facilities Management Customer Service through School Dude at least 48-hours before the start of the hot work.
3. A *Hot Work Permit* must be completed and posted at the hot work site prior to the start of the hot work. The appropriate sections must be filled out by HVAC Shop, Fire Alarm Shop, and EHS, if necessary.
4. *Hot Work Permits* can be obtained from the EHS website (ehs.gmu.edu).
5. *Hot Work Permits* must remain posted for at least 48 hours after the work has been completed.

Emergency Hot Work:

For hot work that is deemed an emergency by the supervisor, a School Dude work order must be submitted, however it does not need to be done 48 hours in advance. If the emergency hot work is done during business hours, EHS should be notified via phone before the work starts. Supervisors authorizing emergency hot work must inspect the area prior to allowing hot work operations. Steps 3-5 above should be followed, even for emergency hot work.

Long-term Hot Work

1. Follow all hot work and *Hot Work Permit* procedures listed in this Guide.
2. Ensure that the projected start and completion dates are included in the work order.
3. Fill out and maintain a separate permit for every day that hot work is performed.
4. Supervisors must inspect work area daily prior to initiating hot work.
5. Permit holders should be prepared for an on-site safety inspection at all times.
6. At job completion, ensure that the permit remains posted for at least 48 hours.

Fixed Hot Work Areas

Fixed hot work areas may be established for units or shops that regularly perform hot work in a fixed location. These areas are exempt from the daily hot work permit process. They may be issued a six (6) month hot work permit after an inspection of the area by EHS. Before any hot work is performed, it is the responsibility of the supervisor to ensure that the area is safe to perform hot work in, and the hot work operator is properly trained (see section F and G). These areas are subject to random inspections by EHS personnel. Six month permits may be revoked if EHS deems that the hot work operations are unsafe or have not properly complied with this guide. Contact EHS (703) 993-8448 to apply for a fixed hot work permit.

FOR EHS USE ONLY

Permit Reviewed By: _____ Phone Number: _____

Date & Time: _____

Hot Work Permit

This hot work permit is required for operations involving open flames or producing heat and/or sparks. This includes, but is not limited to: Brazing, cutting, grinding, soldering, thawing pipe, torch-applied roofing, and cadwelding. This permit must be completed and posted for the duration of all hot work. This permit is only good for one day.

FOR SAFETY QUESTIONS REGARDING THIS PERMIT CONTACT EHS AT 703-993-8448

<p>HOT WORK BEING DONE BY:</p> <p><input type="checkbox"/> Mason Employee <input type="checkbox"/> Contractor Phone Number: _____</p> <p>HOT WORK PROJECT:</p> <p>W.O. #: _____ Submitted Date: _____ Expected Start Date: _____ Time: _____ Expected Stop Date: _____ Location/Building/Floor: _____ Nature of Job/Object: _____</p> <p>AUTHORIZATION:</p> <p>I verify the above location has been examined, the precautions checked on the Required Precautions Checklist have been taken to prevent fire, and permission is authorized for work.</p> <p>Name: _____ Supervisor / Responsible Party</p> <p>Signature: _____ Phone Number: _____</p> <p>HVAC TECHNICIAN:</p> <p>Name: _____ Phone Number: _____</p> <p><input type="checkbox"/> HVAC systems evaluated and shutdown or modified as necessary. Date / Time: _____ Initials: _____</p> <p><input type="checkbox"/> HVAC systems reactivated. Date / Time: _____ Initials: _____</p> <p>FIRE ALARM TECHNICIAN:</p> <p>Name: _____ Phone Number: _____</p> <p><input type="checkbox"/> Fire detection disabled. Date / Time: _____ Initials: _____</p> <p><input type="checkbox"/> Fire detection reactivated. Date / Time: _____ Initials: _____</p>	<p>REQUIRED PRECAUTIONS CHECKLIST:</p> <p><input type="checkbox"/> Automatic Fire Detection has been disabled. <input type="checkbox"/> Available sprinklers, hose streams, and extinguishers are in service / operable. <input type="checkbox"/> Hot work equipment is in good repair.</p> <p><input type="checkbox"/> <u>Requirements within 10 m (35 ft) of work:</u></p> <ul style="list-style-type: none"> • Flammable liquids, dust, lint, and oil deposits have been removed. • Explosive atmosphere in area has been eliminated. • Floors have been swept clean. • Combustible floors have been wet down, covered with damp sand or fire-resistant sheets. • Other combustibles have been removed where possible. Otherwise, protect with fire-resistant tarpaulins or metal sheets are in place. • All wall and floor openings are covered. • Fire-resistant tarpaulins are suspended beneath work. <p><input type="checkbox"/> <u>Work on walls or ceilings / enclosed equipment:</u></p> <ul style="list-style-type: none"> • Construction is non-combustible and without combustible covering or insulation. • Combustibles on other side of walls have been removed. • Ensure no danger exists by condition of heat into another area. • Enclosed equipment has been cleaned of all combustibles. • Containers have been purged of flammable liquids/vapors. <p><input type="checkbox"/> <u>Hot work area monitoring:</u></p> <ul style="list-style-type: none"> • A monitor will be provided during and for 30 minutes after work: Name: _____ Phone Number: _____ • A monitor is supplied with suitable extinguishers. • A monitor is trained in use of this equipment and in sounding alarm. • A monitor may be required for adjoining areas, above and below. • Monitor hot work area 30 minutes after job is completed. <p><input type="checkbox"/> <u>Fire alarm or suppression system impairment:</u></p> <ul style="list-style-type: none"> • Fire watch posted in building. <p><u>Other precautions taken:</u></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No Confined space entry permit required? <input type="checkbox"/> Yes <input type="checkbox"/> No Area protected with smoke/heat detection? <input type="checkbox"/> Yes <input type="checkbox"/> No Ample ventilation to remove smoke/vapor from work area? <input type="checkbox"/> Yes <input type="checkbox"/> No Lockout/tag-out required?</p>
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