



# Welding, Cutting and Brazing Program (Hot Works)

1. Purpose: Virginia Commonwealth University developed this Program to provide occupational safety guidelines for welding, cutting and brazing (WCB) flame activities in order to comply with Occupational Safety and Health Administration (OSHA) regulations [29 CFR 1910.252](#), [1910.253](#), and [1910.254](#).
2. Scope / Applicability: This Program applies to all welding, cutting, and brazing work activities performed by VCU employees or contractors who are performing work under the direction of any VCU department.
  - a. Out of Scope: Designated areas that have taken proper precautions and are prepared during emergency situations include:
    - 1) Welding shops
    - 2) Maintenance shops
    - 3) Art facilities with designated welding areas
    - 4) Laboratories

### 3. Table of Contents:

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### 4. Definitions:

- **Brazing:** Uses molten metal to join two pieces of metal.
- **Combustible Materials:** Solid or liquid materials that are capable of burning or igniting.
- **Cutting:** Any process which produces sparks capable of igniting combustible or flammable materials and transmits heat to the work material from a hot gas.
- **Designated Hot Work Area:** Permanent area, approved by SRM, for the performance of hot work operations. This may include zone



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maintenance shops, art facilities, or laboratories and does not require a daily permit to perform hot work. These areas, except for outside areas at construction sites, will be designated by appropriate signage.

- Fire Watch: Person(s) responsible for maintaining awareness for the presence of fire or hazardous conditions within the hot work area
  - Flammable Compressed Gas: Gases under pressure that can easily catch fire and burn. Examples include acetylene, propane and natural gas.
  - Flammable Materials: Solid or liquid materials that are capable of igniting at a low temperature and will continue to burn.
  - Hot Work/Hot Work Operations: Any operation (including but not limited to temporary maintenance, renovation and construction) using gas or electric powered equipment which produces flames, sparks, or heat that is sufficient to start a fire or ignite flammable/combustible materials. This includes cutting, welding, Thermite welding, brazing, soldering, oxygen cutting, grinding, arc welding/cutting, oxy–fuel gas welding, hot taps, thermal spraying, thawing pipe, and torch applied roofing or any similar operation.
  - Hot Work Permit: A document that is required when the task requires the use of a flame, sufficient heat or sparks to generate or serve as a source of ignition. Permits are issued by Safety and Risk Management under the hot work permit program permitting welding or other hot work to be done.
  - Program Manager: The zone maintenance superintendent, department supervisor, or like position who assumes the responsibility for visiting the jobsite to determine if the hot work can be avoided, requesting the issuance of a hot work permit, and making periodic inspections of the site during hot work operations.
  - Undesignated Hot Work Area: Area where hot works operations will be performed that is not considered a designated hot work area. This area requires the issuance of a daily hot work permit.
  - Welding: Joining metal pieces or parts together by heating the surfaces to the point of melting using a blowtorch, electric arc, or other means, and uniting them by pressing, hammering, etc.
5. Procedures: Hot work should not be performed if the work can be avoided or performed in a safer manner. When practical, objects to be welded, cut, or heated must be moved to a Designated Hot Work Area. If the objects cannot be readily moved, all moveable fire hazards in the vicinity shall be taken to a safe place and a hot work permit must be issued. If



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neither is feasible, a hot work permit must be issued and guards shall be used to confine heat, sparks, and slag to protect the fire hazards.

- a. Designated Hot Work Areas shall be made of non-combustible, fire-resistive construction and essentially free of combustibles and flammables (also applies to the working surface for the use of soldering and brazing operations). These areas shall be suitably segregated from adjacent areas and equipped with a fire extinguisher, mechanical ventilation and a heat detector rather than a smoke detector. All designated areas must be inspected and approved by SRM prior to use of the site.

- The following conditions must be maintained at all times at a designated hot work area:

1. At least a 35-foot clearance from combustibles;
2. Inspect the oxy-acetylene hoses for defects and ensure the hoses fit securely on the gas valve and the burner/torch. Replace any hoses that are defective;
3. Loose clothing and jewelry will not be worn at the time of using the burner. Long hair must be tied back and secured;
4. Shop/lab personnel must be notified while the burner/torch is in use and burner/torch shall never be unattended; and
5. Shut off gas supply promptly when done.

- b. Undesignated Hot Work Areas

- Job inspections must be made prior to making a request for the issuance of a hot work permit by the Project Manager. The Project Manager shall authorize the job and request the issuance of a hot work permit.
- Approved permits must be prominently displayed or readily available upon request at the hot work area and available for 48 hours after the work is complete. All precautions on the Hot Work Permit must be met prior to performing any hot work. The Hot Work Permit will be issued by Safety and Risk Management and is valid only for the date(s) and time specified on the permit.
- To obtain a permit you can visit the Fire Safety office or Safety and Risk Management's [website](#).
- A designated Fire Watch is required to be present at all times when hot work is being conducted and remain on-site at least thirty minutes prior to work being completed.



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- c. All personnel (employees, contractors, building occupants) must be suitably protected against hazards generated by the work (e.g., heat, sparks, fumes, welding rays, other ignition sources, etc.). This may include, but is not limited to, the use of personal protective equipment, shields, screens, or local exhaust ventilation.
6. Responsibilities:
- a) Safety and Risk Management (SRM) is responsible for:
    - Developing, implementing and administering the Program and revising the Program as necessary;
    - Issuing and reviewing hot work permits;
    - Providing basic welding, cutting and brazing training and maintaining training records;
    - Conducting inspections of hot work operations in progress; and
    - Stopping any welding, cutting or brazing operations that pose safety or health concerns.
  - b) Project Managers involved in Hot Work tasks are responsible for:
    - Providing department specific training related to this Program, ensuring affected employees are trained in welding, cutting and brazing hazards and maintaining training documentation;
    - Ensuring employees comply with this Program;
    - Assuming or delegating the role of Fire Watch Supervisor for each permit;
    - Making periodic inspections to determine compliance with hot work operations;
    - Requesting hot work permits for welding, cutting and brazing operations;
    - Providing and ensuring that employees who weld, cut or braze are utilizing proper personal protective equipment;
    - Ensuring hot work procedures are being implemented and followed in other than designated areas; and
    - Ensuring that contractors follow this Program.
  - c) Employees are responsible for:
    - Complying with this Program and attending required training;
    - Notifying their supervisor when a hot work permit is needed and ensuring a hot work permit is issued prior to starting work;



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- Providing proof of permit, if requested, during welding, cutting and brazing operations;
  - Ensuring that all cutting and welding equipment is in satisfactory condition and in good repair;
  - Using personal protective equipment;
  - Protecting nearby personnel and passersby against heat, sparks, etc. by using signs, barricades, and barriers when necessary; and
  - Using local ventilation equipment when welding, cutting or brazing indoors or respiratory protection if local ventilation is not possible.
- d) Contractors are responsible for:
- Complying with this Program and all applicable fire and building codes;
  - Maintaining their own companies' written Hot Work Management Program and complying with it, or this program, whichever is more rigorous during projects on campus;
  - Ensuring a hot work permit has been obtained by a VCU employee prior to starting work;
  - Ensuring that all cutting and welding equipment is in satisfactory condition and in good repair; and
  - Protecting nearby personnel and passersby against heat, sparks, etc. when working in occupied buildings.
- e) Fire Watch is responsible for:
- Ensuring proper firefighting equipment is readily available;
  - Locating the nearest fire alarm pull station;
  - Having a means of communicating and alarm;
  - Inspecting hot work area before any hot work is conducted;
  - Consulting with SRM if unsure if any health or safety issues may arise during welding, cutting or brazing operation;
  - Extinguishing fires only when within trained capabilities to safely do so; and
  - Stay on watch at least one half hour after hot work has been completed.
7. Hazards and Precautions:
- a. Electric shock: This safety hazard is associated with operations that use electricity to generate heat, such as arc and resistance welding and cutting. Shock received from welding and cutting



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equipment can result and death or severe burns. Serious injury can occur if the welder falls as a result of the shock. Employees shall abide by the following when conducting hot work operations in an effort to prevent electrical shock:

- Use proper precautionary measures and recommended safe practices at all times to avoid electric shocks (see VCU's Electrical Safety Program);
- All personnel using electrical welding and cutting equipment must be trained on safe work practices and procedures before use of this equipment;
- Do not touch an energized electrode while you are in contact with the work circuit;
- Never stand on a wet or grounded surface or use bare hands or wet gloves when changing electrodes;
- Do not allow the electrode holder or electrode to come in contact with any other person or grounded object;
- Ground all frames or welding units;
- Insulate yourself from the work piece and ground using dry insulating mats or covers big enough to prevent physical contact with the ground, or wear approved rubber-soled boots; and
- Suspend cables overhead when working with long lengths of cable.

If working in a damp location, wearing wet clothing, or on metal floors, grates or scaffolds, additional precautions need to be taken. If any of these conditions exist, one of the following types of equipment must be used, with a DC constant voltage wire welder being the preference:

- Semiautomatic DC constant voltage metal electrode (wire) welder;
- DC manual covered electrode (stick) welder; or
- AC welder with reduced open-circuit voltage.

b) Fumes and gases: When engaging in welding, cutting, or brazing activities, various fumes, gases and vapors are generated from metals, fluxes, and fillers being used in addition to coatings, paints, galvanizing and plating. In order to protect workers from these, appropriate personal protective equipment (PPE) in the form of a respirator and/or ventilation is recommended.

c) Compressed gas cylinders:



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- Shall be stored in approved spaces, secured from falling, and kept in an upright position;
  - When not in use, control valves of cylinders will be covered by protective caps;
  - Shall be legibly marked to identify the gas contents; and
  - Have ant flashback devices installed on them.
- d) Prohibited Conditions: Welding, cutting and brazing shall not be permitted in the following situations:
- Appropriate firefighting equipment is not readily available;
  - Combustible or flammable materials are within 35 feet and cannot be moved or protected;
  - Floor and wall openings cannot be covered;
  - Any condition that could result in undue hazards by performing the work; and
  - Outside of a designated hot work area without authorization
8. Personal protective equipment (PPE): Employees exposed to the hazards created by welding, cutting, or brazing operations shall be protected by PPE. Appropriate protective clothing required for any welding operation will vary with the size, nature and location of the work to be performed. PPE must protect against hazards such as burns, sparks, spatter, electric shock, optical radiation, and inhalation hazards as identified below.
- a) General protective equipment: The following are minimum requirement for proper personal protective equipment needed for welding activities:
- Eye and Face Protection;
  - Clothing with adequate body coverage;
  - Leather boot protection;
  - Hand protection; and
  - Additional personal protective equipment may include the use of respiratory protection.
- b) Eye and face protection
- All filter lenses and plates must meet the test for transmission of radiant energy prescribed in the ANSI standard Z87.2010



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- Helmets and hand shields shall protect the face, forehead, neck and ears to a vertical line in back of the ears, from the arc's direct radiant energy, and weld splatter.
  - Welding helmets with filter plates are intended to protect users from arc rays and from weld sparks and spatters which strike directly against the helmet. They are not intended to protect against slag chips, grinding fragments, wire wheel bristles, and similar hazards which can ricochet under the helmet. Spectacles, goggles or other appropriate eye protection must also be worn to protect against these impact hazards.
  - OSHA requires that when arc cutting and arc welding with open arcs, helmets or hand shields with filter lenses and cover plates shall be used by operators and nearby personnel viewing the arc also subject to wear proper protection. Spectacles with a shade 2 lens are recommended for general purpose protection for viewers. When resistance welding or brazing; operators of resistance welding must use face shields, spectacles, or goggles depending on the particular job to protect their faces and eyes from welding hazards.
- c) Protective clothing
- Appropriate protective clothing for any welding and cutting operation will vary with the size, nature and location of the work to be performed. Clothing shall provide sufficient coverage and be made of suitable materials to minimize skin burns caused by sparks, spatter or radiation. Covering all parts of the body is recommended to protect against ultraviolet and infrared ray flash burn.
  - Dark clothing works best to reduce reflection under the face shield. Heavier materials such as wool clothing, heavy cotton or leather are preferred as they resist deterioration. Materials that can melt or can cause severe burn due to sparks that may lodge in rolled-up sleeves, pockets of clothing or pant cuffs are not recommended.
  - Other protective clothing includes durable, flame-resistant aprons made of leather or other suitable materials to provide protection to the front of the body when additional protection against sparks and radiant energy is needed.
- d) Gloves





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- The standard requires all welders and cutters to wear protective flame-resistant gloves, such as leather welder's gloves, which provide the heat resistance needed for welding. A gauntlet cuff offers additional arm protection, and insulated linings shall be used to protect areas exposed to high radiant energy.
- e) Respiratory protection
- Respiratory protection is recommended for all welding, cutting, or brazing operations regardless of ventilation due to the variable nature of potential toxic exposure to fumes that are carcinogenic or toxic at very low levels as in the case of manganese or hexavalent chrome. It is precautionary to assume that fumes will be above the level of acceptable risk during all WCB activities.
9. Ventilation:
- a) Ventilation is a means of providing adequate breathing air, which must be provided for all welding, cutting and brazing operations. Ensuring adequate ventilation depends on the following factors:
- Volume, configuration and natural air flow rate of the space where the operations occur;
  - Number and type of operations that are generating contaminants;
  - Locations of the welders' and other workers' breathing zones in relation to the contaminants;
  - Confined space welding – atmospheric monitoring shall be conducted before anyone enters the space and periodically during the entry to ensure that the welding process is not creating a hazardous atmosphere.
10. Signage: Where the Hot Work area is accessible to persons other than the operator of the hot work equipment, conspicuous signs shall be posted to warn others before they enter the work area. Sign shall read:

**Caution  
Hot Work in Progress  
Stay Clear**



# VCU

Safety and Risk  
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11. Training and recordkeeping
  - a) Training is required when employees are first hired and recommended every year after for basic refresher training. Additionally, employees are required to attend training when a new process or equipment has been obtained, if an unsafe act has been observed, or when the supervisor or SRM feels that retraining is necessary.
  - b) Welding, cutting and brazing training includes the following topics:
    - Proper equipment operation, handling and storage
    - Compressed gas cylinder safety
    - Hazards and control mechanisms
    - PPE selection and use
    - Fire precautions and watch
    - Hot work procedures
  - c) Recordkeeping: Departments/supervisors are required to maintain department-specific training records with an additional copy sent to SRM. Additionally, SRM is responsible for maintaining basic training records.
  
12. References:
  - Occupational Safety and Health regulations [29 CFR 1910.252](#), [1910.253](#), and [1910.254](#).
  - ANSI standard Z87.2010
  - 2012 Virginia Statewide Fire Prevention Code