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# Ferris State University Hot Work Safety Procedure



**FERRIS STATE UNIVERSITY**

SAFETY, HEALTH, ENVIRONMENTAL AND RISK MANAGEMENT

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## 1. PURPOSE

- f. To provide safety requirements for welding, cutting and brazing in accordance with MIOSHA GI Part 12 & CS Part 7 Welding & Cutting of the Michigan Occupational Safety and Health Administration.
- g. To prevent any fires that may result from “**hot work**” processes.
- h. To protect life and property from fire hazards that may occur during the operation of welding, cutting and brazing job activities.

## 2. SCOPE

- f. This policy applies to all of those employees and contractors who may perform **Hot Work** such as welding, cutting, brazing, or operations with open flames or other fire hazards.

## 3. RESPONSIBILITIES

### f. Facilities Planning & Management

- i. Be responsible for ensuring the development and implementation of this policy.
- ii. Provide necessary resources as available to carry out the program.

### g. Supervisors

- i. Ensure that all directly supervised employees and contractors are utilizing appropriate welding, cutting, and brazing procedures.
- ii. Ensure that the conditions of designated hot work areas have not changed prior to authorizing hot work.
- iii. Ensure that all welding and cutting equipment is maintained in safe operating condition.
- iv. Ensure that employees are suitably trained in the operation of the equipment and safe use of the process.
- v. Issue hot work permits for work under their supervision.

### h. Employees (Welding Operators)

- i. Read and understand this policy.
- ii. Complete Hot Work training as required Ferris State University Hot Work Permit Training Procedure
- iii. Ensure that all PPE is worn properly for the specific hazard involved and that all equipment is in good working condition.
- iv. Conduct welding, cutting, brazing and/or hot work activities in accordance with all safety guidelines and procedures.
- v. Protect nearby personnel against heat, sparks, etc. when working in occupied workplaces.
- vi. Inform their supervisors of any hazards that they feel are not adequately addressed in the workplace and of any concerns that they have regarding the program.

### i. Safety Administrator

- i. Review and approve, in coordination with a shop supervisor, locations proposed for Hot Work Areas.
- ii. Maintain a list of areas designated as Hot Work Areas.
- iii. Periodically inspect designated areas to be sure that conditions have not become unsafe for welding or cutting.
- iv. Provide training for fire watches and ensure that the proper firefighting equipment is in working condition, and is available to standby personnel.
- v. Suspend welding, cutting, and brazing work if conditions become unsafe for the work being performed.

## 4. PROGRAM COMPONENTS

### f. Welding Hazards

- i. Both health and physical hazards are associated with welding depending upon the welding process, the base material, the filler material, and the shielding gas that may be used.
  - 1. Health Hazards may be either acute or chronic, the following are the most common:
    - a. Burns
    - b. Electrical shock and burns
    - c. Infrared and ultraviolet Eye injury from looking at the arc without eye protection
    - d. Lung irritation or poisoning from toxic gases or fumes from the welding operation
  - a. Physical Hazards associated with welding operations include:
    - e. Fire
    - f. Potential Explosion when welding in close proximity to closed containers that have held flammable liquids or other combustible materials
    - g. Potential Flash fire when welding in close proximity to flammable or combustible vapors at the worksite

**g. Safety Guidelines.**

- i. All hot work shall be performed in a Designated Hot Work Area, if possible.
- ii. A **Designated Hot Work Area** must meet the following requirements:
  - 1. The Designated Hot Work Area shall be a discrete area, sectioned off by noncombustible walls, or curtains.
  - 2. Adequate ventilation, such as a suction hood system providing 20 air changes per hour, should be provided for the work area if at all possible.
  - 3. Where welding, cutting and brazing are done near walls, partitions, ceilings, or a roof of combustible construction, fire-resistant shields or guards shall be provided to prevent ignition.
  - 4. Protective dividers such as welding curtains or non-combustible walls will be provided to contain sparks and slag to the combustible free area.
  - 5. Flammable and combustible liquids and material will be kept 35 feet from work area.
  - 6. Floors shall be swept and clean of combustibles within 35 feet of work area.
  - 7. At least one 10 lb. dry chemical fire extinguisher should be within access of the 35 feet of work area.
- iii. **Hot Work in areas not designated as Hot Work Areas.**
- iv. When welding, cutting, or brazing work is to be done outside of a Designated Hot Work Area, it is necessary to meet the following requirements:
  - 1. A Hot Work Permit is required for all Hot Work. *See Appendix A for details.*
  - 2. Flammable materials that cannot be removed from the area must be adequately covered or guarded before hot work is started.
  - 3. All floor openings and cracks shall be closed, sealed and/or covered to ensure that sparks cannot drop into the openings and come into contact with combustible materials.
  - 4. Guards, shields, and or fire-blankets shall be used to confine the heat, sparks and/or slag from coming into contact with any combustible material with 35 feet of the hot work
  - 5. Portable welding curtains or shields must be used to protect other workers in the welding area.
  - 6. Airflow away from the welder and others present must be established and maintained.
  - 7. Plastic materials must be covered with welding tarps during welding procedures.

8. Suitable fire extinguishing equipment shall be maintained in a state of readiness at all times for instant use. This may include fire extinguishers, water hoses or buckets of sand, depending on the nature of the combustible material exposed.
9. Fire Watchers shall be required whenever these activities are performed in locations where other than a minor fire might develop. The Fire Watcher:
10. Shall be present to ensure that sparks, slag and heat generated by the hot work do not start a fire while the welder is working.
11. Shall remain at the work location for at least thirty (30) minutes after the hot work has been completed to ensure that no sparks or slag are smoldering and that the heat generated by the hot work did not cause some other material to smolder thus creating a potential fire hazard.
12. Shall be trained in the proper use of fire extinguishing equipment and be prepared to use it.
13. Shall be familiar with facilities for sounding an alarm in the event of a fire or other emergency situation.
14. Shall also be trained to react to other potential hazards associated with the work activity such as exposure to welding fumes, welding flash and any other potential hazards unique to the area in which the work is being performed.
15. The person performing hot work and the Fire Watch shall be required to read the Hot Work Permit and sign the permit acknowledging the fact that they understand the potential hazards and will follow the requirements of the permit.
16. If feasible, floors shall be wetted prior to start of hot work to prevent ignition.

**v. Prohibited Hot Work Areas**

1. Areas not authorized by management.
2. Areas equipped with sprinkler systems that are out of order.
3. In the presence of potentially explosive atmospheres, e.g., a flammable liquid or solids.
4. Areas where combustible or flammable materials are within 35 feet and cannot be moved or protected.
5. Areas where appropriate firefighting equipment is not readily available.
6. Areas where floor and wall openings cannot be covered.

**h. Hot Work Procedures**

- i. All hot work permits shall be returned to the issuing supervisor when the hot work has been completed.
- ii. Supervisor and employee are responsible for identifying and controlling workplace hazards before hot work is performed.
- iii. Hot Work Permit procedures shall be mandatory for contractors under contract by Ferris State University.
- iv. Hot Work Permit (for non-designated hot work area) will be issued for a period covering the duration of hot work.

**v. Prior To Hot Work**

1. Inspect the hot work area to identify any fire hazards.
2. Remove all flammable or combustible materials within a thirty five (35) foot radius of the hot work.
3. Sweep floor of all loose combustible debris.
4. Placing non-combustible or flame resistant screens so as to protect personnel in adjacent work areas from heat, flames, radiant energy and welding splatter.
5. Cover sprinkler heads directly above the hot work area with wet rags or other non-combustible materials so they will not be triggered during the work if the hot work area has any.
6. Cover smoke detectors located in close proximity of the work area, or notify the electrical shop to deactivate smoke detectors in the hot work area.

7. Notify anyone nearby who may be affected by the work.
  8. Make provisions for proper ventilation.
- vi. During Hot Work**
1. Combustible floors shall be kept wet during the hot work.
  2. Store acetylene and other fuel cylinders in a secure and upright position.
  3. Place hoses so that they will not be crushed or damaged.
- vii. After Hot Work**
1. Immediately remove any covers from sprinkler heads immediately upon completion of the hot work if the hot work area has any.
  2. Immediately remove covers from any smoke detectors immediately upon completion of the hot work, or notify the electrical shop to reactivate them if they have been deactivated.
  3. Clean up any slag, debris or used electrodes resulting from the work.
  4. Restore ventilation to its original condition.
- i. Inspection and Storage of Cylinders**
- i. Inspection and Handling**
1. Inspect cylinders, regulators and hoses before use.
  2. Hammer or wrench shall not be used to open cylinder valves. If valves cannot be opened by hand, the supplier shall be notified.
    - a. When a special wrench is required it shall be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of emergency.
  3. Smoking is never allowed for your safety and the safety of others.
  4. Inspect the cylinder and the gas identification tag.
  5. Unless cylinders are secured on a special truck, regulators shall be removed and valve-protection caps, when provided for, shall be put in place before cylinders are moved.
  6. Inspect your work area for grease or oils before you use compressed gas.
  7. Always use regulators for all gas cylinder hookups, valves must be fully shut off when not in use.
  8. Ensure that you use only non-sparking tools for flammable gases.
  9. Be sure the cylinder is secure in your work area.
  10. You should limit pressure to 30 psi or less for air blow down.
  11. Never refill or attempt to repair a gas cylinder.
  12. Remove leaking cylinders out of the building and properly vent all remaining gas.
  13. Damaged cylinders should be marked "Damaged-Do not Use".
  14. Be sure to check all hose fittings for compressed air systems by using a control nozzle with self-closing valve at the operators end.
- ii. Storage**
1. Label and separate the empty cylinders from the full ones.
  2. Always install the caps back on the cylinder.
  3. Store cylinders upright and away from heat sources.
  4. Keep the storage area dry and well ventilated.
  5. Store oxygen cylinders separately from the other types.
  6. Cylinders should be chained or strapped to prevent tipping.
  7. Fuel gas and oxygen must be stored at a minimum of 20 feet apart or separated by a one-hour rated fire wall.
- j. Ventilation Guidelines for Welding, Cutting and Brazing Operations**
- i. General or Dilution Ventilation**
1. Relies on diluting airborne contaminants with fresh air from open doors, windows or fans.

2. Provides enough air movement to keep the fumes and gases out of the welder's breathing zone.

**ii. Local Exhaust Ventilation**

iii. It is much more effective in controlling welding fumes and gases because it captures the fumes and gases close to the source and keeps them from entering the welder's breathing zone. This is usually accomplished by the use of hoods and ducts. To be effective, local exhaust ventilation must:

1. Be close to the welding arc or flame where the fumes, gases and heat are generated, and
2. Have enough velocity to draw away the contaminants.
3. Ensure protection from fume and gases by (depending on circumstances) one or a combination of:
  - a. Good general ventilation
  - b. Use of a booth
  - c. Local exhaust ventilation such as fume hoods and ducts
4. Movable hoods placed as close to the work as practical and provided with a rate of 100 feet per minute in the zone of welding when the hood is at its most remote distance from the point of welding. The rates of ventilation required to accomplish this velocity using a 3-inch wide flanged suction opening accordance with MIOSHA GI Part 12 & CS Part 7 are shown in the following table:

Welding Zone	Minimum air flow cubic feet/minute	Duct diameter, inches
4 to 6 inches from arc or torch	150	3
6 to 8 inches from arc or torch	275	3 ½
8 to 10 inches from arc or torch	425	4 ½
10 to 12 inches from arc or torch	600	5 ½

**k. Types of Welding Operating Procedures**

**i. Electric Welding and Cutting**

1. Perform Safety Checks on all equipment
  - a. Ensure fire extinguisher is charged and available.
  - b. Ensure electrical cord, electrode holder and cables are free from defects (no cable splices are allowed within 10 feet of the electrode holder.
  - c. Ensure PPE (welding hood, gloves, rubber boots/soled shoes, aprons) are available and have no defects.
  - d. Ensure the welding unit is properly grounded.
  - e. Examine equipment frequently to determine that all electrical connections and insulations on holders and cables are in good condition. Loose cable connections may overheat or arc cause a fire.
  - f. Keep welding cables dry, grease and oil-free, and protected from sparks or hot metal.
  - g. Store welding rods in the container on the welding machine, do not throw on floors or staging.
2. Set Voltage Regulator no higher than the following for:
  - a. Manual Alternating Current Welders – 80 volts.
  - b. Automatic Alternating Current Welders – 100 volts.
  - c. Manual or automatic Direct Current Welders – 100 volts.
3. Uncoil and spread out welding cable.

- a. To ensure proper contact of work leads and connection.
- b. To remove any metal fragments from magnetic work clamps (to avoid electric shock do not wrap welding cables around a body part and avoid welding in wet conditions).
- 4. Avoid overheating,
  - a. Prior to spot welding, the material is usually cleaned in a caustic or slightly acid bath. Employees performing these wash operations shall be protected from splashing liquid.
  - b. The operator shall make necessary adjustment to the contactors.
  - c. In hand spot welding installations, eye protection shall be required to protect the operator from the spattering metal.
  - d. Welding of materials such as stainless and high carbon steels causes excessive spattering of metal. Operators shall be cautioned to protect against the possible penetration of the metal into the tips of the fingers.

## ii. Gas Welding and Cutting

- 1. Gas welding typically uses an oxy-acetylene gas flame as a source of heat. Some types of gas welding, such as soldering, use propane or other fuel gasses.
  - a. Brazing – Brazing applies heat to the metal, usually from an oxy-acetylene gas flame. The metal does not reach its melting point. Instead, filler material and flux from a welding rod melt to form the weld.
  - b. Soldering – Like brazing, is accomplished without melting the metal parts that will be joined.
  - c. Gas Cutting – Creates a molten pool of metal using heat from a gas torch. A jet of oxygen is injected into pool to accelerate the oxidation of the material.
- 2. Perform Safety Check on all equipment
  - a. Ensure tanks have gas and fittings are tight.
  - b. Ensure fire extinguisher is charged and available.
  - c. Ensure hoses have no defects.
  - d. Ensure PPE (welding hood, gloves, rubber boots/soled shoes, aprons) are available and have no defects.
  - e. All defective equipment must be repaired or replaced before use.
- 3. Remove flammables and combustibles
  - a. Remove all nearby flammable or combustible materials before striking an arc or lighting a flame.
  - b. Remove all flammable and readily combustible materials from your pockets, such as matches and cigarette lighters.
  - c. Place welding screen or suitable barricade around work area to provide a fire safety zone and prevent injuries to passersby.

## I. Welding Operators Protection (See more details in PPE policy)

- i. Welders need to be protected against heat, sparks, ultraviolet rays, hot slag, fumes and toxic gases. Make sure employees are outfitted with the following personal protective equipment (PPE):
  - 1. Eye and Face Protection
    - a. Safety glasses, goggles, face shields, helmets, or other suitable eye protection having the proper lens shade for the work being done shall be worn during all welding, cutting, and brazing operations.
    - b. Fire Watch personnel shall wear eye and face protection as appropriate.
    - c. Goggles shall be ventilated to prevent fogging of the lenses as much as practicable.
    - d. Goggles, helmets, and face shields shall be checked frequently.



- e. The following is a guide for the selection of the proper shade numbers. These recommendations may be varied to suit the individual's needs in accordance with MIOSHA GI Part 12 & CS Part 7 Michigan Occupational Safety and Health Administration.

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
Atomic hydrogen welding	10 – 14
Carbon arc welding	14
Soldering	2
Torch brazing	3 or 4
Light cutting, up to 1 inch	3 or 4
Medium cutting, 1 inch to 6 inches	4 or 5
Heavy cutting, 6 inches and over	5 or 6
Gas welding (light) up to 1/8 inch	4 or 5
Gas welding (medium) 1/8 inch to 1/2 inch	5 or 6
Gas welding (heavy) 1/2 inch and over	6 or 8

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

**2. Head protection**

- a. Head protection made of a flame resistant material shall be worn.

**3. Protective clothing and equipment**

- a. Protective clothing and equipment shall be suitable for the type of work to be performed, kept in good repair, and kept free of oil and grease.  
 b. Sleeves shall be kept buttoned at the wrist.  
 c. Collars shall be kept buttoned.  
 d. Fire-resistant gloves and aprons shall be worn during welding, flame cutting and brazing processes.  
 e. Safety shoes should be worn to protect the operator from spark hazard.

**4. Respiratory Protection**

- a. Engineering controls and safe work practices are the primary means to prevent employee over exposure to welding fumes, toxic gases, and dusts.  
 b. Ferris State University employees will not perform welding that cannot be safely done without the use of a respirator.

**5. Hearing Protection**

- a. Hearing Protection Devices may be required during some welding operations. See more details in Hearing Conservation Program Procedure.

## 5. TRAINING

- f. Training shall be provided initially to all personnel affected by this procedure and at any time there is a modification to this procedure that will affect work practices. The degree of training provided shall be determined by the potential hazards of the welding, cutting, and brazing job assignment.

### i. Initial training

1. To ensure employees recognize the hazards associated with welding, cutting and brazing operations.
2. To know the safe work practices for welding, cutting and brazing operations.
3. To understand the importance and requirements of Hot Work Permits.
4. To understand the requirements to establish and maintain Hot Work Areas
5. To use the appropriate personal protective equipment (PPE) for the job
6. Employees performing the hot work shall be trained in the proper use of the equipment they will be using to perform the hot work.
  - a. They shall also be trained in the proper use of the fire extinguishing equipment that is provided for the use of the Fire Watch.
  - b. They shall also be trained in the proper use of any protective equipment or procedures necessary to protect themselves or other personnel in the area and the facility.

### ii. Additional or Refresher Training

1. All authorized and affected employees shall receive appropriate training whenever there is a change in their job assignments or a change in welding equipment or processes that present a new hazard.
2. Employees or supervisors have reason to believe that there are deviations from or inadequacies in the employees' knowledge of known hazards, or use of equipment or procedures.

**Appendix A. Hot Work Permit**

**HOT WORK PERMIT FORM (sample) Contact Facilities Management to Request a Hot Work Permit.**

This form is to be filled out in its entirety by the responsible individual who has personally inspected the proposed worksite. Unless impossible due to an emergency situation, it must be received by the Ferris State University Employee Performing or Overseeing the Hot Work at least 24 hours prior to beginning the project.

*In emergency situations, notify the Facility prior to starting work.*

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**PLEASE TELL US WHO WILL DO THE WORK**

**Responsible Person:** \_\_\_\_\_ **Email:** \_\_\_\_\_ @ \_\_\_\_\_  
**Performing Shop or Company** \_\_\_\_\_ **Telephone:** (    )    - \_\_\_\_\_

- Welding       HVAC       Plumbing       General Maintenance
- Other       Contractor/Supervisor - If checked enter Company Name, otherwise enter Ferris State University Supervisor

**TELL US ABOUT THE WORK ITSELF**

**Date work to be performed:** \_\_\_\_\_ **Start time:** \_\_\_\_\_  
**Date work will be finished:** \_\_\_\_\_ **Time work will finish:** \_\_\_\_\_

**Building:** \_\_\_\_\_

**Room, area, or equipment:** \_\_\_\_\_

**Describe the work to be performed:** \_\_\_\_\_

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**Other Requirement of the Hot Work Permit of Ferris State University is to fill out and follow the Person Performing Hot Work Permit Precaution Checklist**

## Appendix B

### Person Performing Hot Work Permit Precaution Checklist

1. Complete all portions of the Precaution Checklist below that apply
2. Verify Fire Watch.
3. Return completed Hot Work Permit to Supervisor when work is completed.

#### Precaution & Safeguard Checklist

Yes No

- Fire extinguisher on job site.  
  Welding, Cutting, and Brazing equipment is in good repair.

#### Precautions within 35 feet of work

Yes No

- Floor swept clean of combustibles and overhead structure cleaned of dust, lint and debris.  
  Combustible floors wet down or covered with damp sand, welding drop cloths, or metal shields.  
  Flammable liquids removed from area and other combustibles protected with welding drop cloths or metal shields.  
  All floor and wall openings covered and or protected.

#### Work of Walls or Ceilings

Yes No

- Construction is noncombustible and without combustible covering or insulation.  
  Combustible materials moved away from other side of wall.

#### Work on Enclosed/Confined Equipment

Yes No

- When welding in confined areas, gas cylinders & power sources are located outside area and secured.  
  Adequate ventilation is provided.  
  Atmosphere checked with gas detector.  
  Purge any flammable vapors and/or gases.  
  Confined Space Permit obtained, if required.

#### Standard PPE Welding Precautions

Yes No

- Eye protection.  
  Proper clothing  
  Face shield  
  Machine grounded

#### Fire Watch

- Fire Watch will be provided during and for 30 minutes after work.  
 Fire Watch is supplied with extinguishers and/or hose.  
 Fire Watch is trained in use of this equipment and in sounding alarm.

Type of Hot Work	<input type="checkbox"/> Brazing <input type="checkbox"/> Arc Welding <input type="checkbox"/> Cutting <input type="checkbox"/> Other:
Hot Work Performed By:	<input type="checkbox"/> Ferris State University Employee <input type="checkbox"/> Contractor: _____

#### Signatures Required Before Beginning Work

I have been instructed and I understand the hazards as well as the precautions necessary to do this work safely. I verify that this work site has been inspected, that all necessary precautions have been taken to prevent fires and/or explosions to control hazardous conditions.

\_\_\_\_\_  
(Signature of person performing the work)

#### Final Check Up

Work area and all adjacent areas to which sparks and heat might have spread were inspected 30 minutes after the work was completed and during the fire watch period were found fire safe.

\_\_\_\_\_  
Name (print) & Signature of      Date and time of signature      AM or PM

## References

MIOSHA Michigan Occupational Safety & Health Administration General Industrial Standards  
Part 12 Welding and Cutting

MIOSHA Michigan Occupational Safety & Health Administration Construction Standards Part 7  
Welding and Cutting