



County of Henrico
Department of Emergency
Management &
Workplace Safety

Verification	Originator	Revised	Issued
Initials	EMWS	EMWS	EMWS
Date	05/01/2015	07/27/2023	08/01/2023

Safety Manual

Chapter 23 Hot Work (Welding, Cutting & Brazing)

Area of Application:	County of Henrico General Government & Schools	
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Revisions:		
Rev. No.	Date	Description
001	07/06/2021	Written Hot Work Permit program added.
002	07/06/2021	Hot Work Permit updated as per revised NFPA codes
003	07/28/2022	Aligned EMWS titles and terminology. Non-substantive changes.
004	07/27/2023	Minor terminology and grammatical (non-substantive) changes.

Purpose:

This chapter, along with the written Hot Work Safety Program, provides compliance assistance to Departments that perform Hot Work (Welding, Cutting, & Brazing, etc.) during work hours. "Hot Work" is defined by Virginia Occupational Safety & Health as: riveting, welding, flame-cutting or another fire or spark-producing operation. This chapter helps to ensure the County complies with Occupational Safety and Health Administration and Virginia Occupational Safety and Health program (OSHA /VOSH) Standard 29 CFR 1910.252.

Scope:

- A. This chapter, in conjunction with the written program, applies to all County employees and contractors hired to work at any County facility.
- B. This chapter addresses not only welding, cutting, and brazing, but all forms of spark or heat producing operations (i.e., grinding, which will be termed as "burning" in this chapter) that occurs in work areas where the potential for ignition of combustible materials is possible.
- C. Work areas that contain, or having the possibility to contain flammable gases and vapors. (i.e., methane, alcohols, and gasoline), and other combustible or flammable materials must adhere to this chapter and the written Hot Work Safety Program.

Program Administration:

With guidance from the Department of Emergency Management & Workplace Safety (EMWS), each affected department will establish procedures that address welding, cutting, and brazing safety. Departments will outline how the requirements of this chapter, the written program, and the standard will be met. For assistance, contact EMWS at 501-5162.

Responsibility:

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This chapter is effective for one year following the Issue Date. Older versions are obsolete.



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- A. Department Heads, or their designees, and supervisors shall be responsible for the safe use of all welding and cutting equipment.
 - 1. A Hot Work Permit (see pages 10-11 of the written program) shall be completed prior to beginning any welding/burning operation where an ignition hazard exist.
 - 2. Only Department Heads, their designees, or a designated supervisor (Competent Person) shall authorize welding and cutting operations. A valid Hot Work Permit shall be readily visible and accessible at all times at the work location.
- B. If a qualified contractor is to perform the work, Department Heads, their designees, or a supervisor shall inform the contractor of the presence of flammable materials, gases, vapors or other hazardous conditions at the work location and adjacent areas. For additional safety, the contractor's supervisor, or foreman, shall be briefed regarding these hazards if he/she is not present and/or performing the work.
- C. Supervisors and County employees will be responsible for the following:
 - 1. Handling welding and/or cutting equipment safely and working carefully while welding or cutting.
 - 2. Determining what combustible/flammable materials and/or other hazardous are present or likely to be present at the work location.
 - 3. Preventing combustibles and flammables from igniting by:
 - a. Moving materials to a location free from ignition hazards,
 - b. Using non-flammable barriers to shield combustible/flammable materials from ignition,
 - c. Using proper ventilation, such as floor fans or blowers, to purge the area of flammable gases or vapors prior to work.
 - 4. Obtaining Hot Work authorization from the Department Head, or his/her designee.
 - 5. Ensuring that a welder/worker is qualified and has approval to perform the work.
 - 6. Ensuring that appropriate fire extinguishing equipment is located at the site.
 - 7. Ensuring that firewatchers, if required, are properly trained and on site during the work.
- D. All supervisors, employees, and contractors performing or overseeing welding/cutting/burning will be trained in the proper procedures prior to any Hot Work.
- E. Appropriate training topics shall be completed (see page six of this chapter).
- F. Hazard Assessment will be conducted on site with the employees and contractors involved with the Hot Work.
- G. For Hot Work that will be performed in a Permit-Required Confined Space, the Hot Work permit and a completed Confined Space Permit will be completed prior to work. In addition, personnel qualified for a confined space entry event are required to be on-site until the project is completed.

Procedures:

- A. Necessary precautions:



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1. If precautions in C (3) a, b, and c above are not feasible, Hot Work shall not be performed.
2. If floor openings or cracks cannot be closed, combustible/flammable materials on the lower level could be exposed to sparks that fall through the opening in the floor. Precautions need to be taken to prevent a fire through an open floor. The same precautions shall be observed regarding cracks or holes in walks, doorways, and open or broken windows.
3. Fire extinguishing equipment will be readily accessible at all times during work.

B. Fire Watchers

1. Fire watchers shall be required on site whenever hot work is performed when any of the following conditions exist:
 - a. Immovable combustible materials are located within 35 feet of the operation.
 - b. Immovable combustible materials are located more than 35 feet away from the work but could be easily ignited by flying sparks.
 - c. Wall or floor openings are within a 35-foot radius of the Hot Work and may expose combustible/flammable materials inside the openings to flying sparks, and/or
 - d. Combustible/flammable materials are located on the opposite side of metal partitions, walls, ceilings, or roofs could be ignited by contact with heated materials.
2. Qualified fire watchers will:
 - a. Have fire extinguishing equipment readily available.
 - b. Be familiar with the locations of fire alarm pull stations in the event of a fire.
 - c. Watch for fires in the work area and all areas adjacent to the work.
 - d. Will try to extinguish incipient stage fires. Otherwise, engage the pull station.

C. Restrictions

Hot work shall not be permitted under the following circumstances:

1. In a location that has not been authorized by a Department Head (or designee), manager, or supervisor.
2. In sprinklered buildings where sprinkler heads are obstructed in a way that cannot be corrected. If this is the case, contact one of the Henrico County Fire Marshals for assistance. Sprinkler heads should never be permanently blocked.
3. In locations with or near explosive atmospheres (mix of flammable gases, vapors, liquids, or fine dust in ambient air); where explosive atmospheres may develop inside an unpurged tank (or other vessel); in an improperly cleaned tank or vessel that previously contained such materials; where an accumulation of combustible dust may become concentrated and airborne.
4. In a Permit-required Confined Space without first meeting the requirements of permit-required confined space entry.
5. In locations where copious quantities of exposed, readily ignitable materials are stored.



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D. Protection of Hot Work Personnel

1. A welder or helper working on an elevated platform, scaffold, or runway, or other location with a defined fall hazard will be subject to compliance with the Fall Protection Standard (see Chapter 15 of the Safety Manual and the County's Fall Protection Program).
2. Fall protection shall be accomplished using guard rails, fall arrest systems, competent safety monitors, or other equally effective methods.
3. Helmets, hand shields, and appropriate goggles will be used during all welding or cutting operations. This Personal Protective Equipment (PPE) shall be stored in a secure location and covered when not in use to prevent contamination.
4. Goggles or other suitable eye protection shall be used during all gas welding, oxygen cutting, and/or burning operations depending on the level of exposure. If needed, contact EMWS for assistance.
5. Affected personnel, including helpers, shall wear helmets and hand shields to protect the face, neck and ears from direct radiant energy from the arc.
6. If practical, use ventilated goggles or a face shield to prevent fogging.
7. In addition to hand, face, and head protection, protective clothing shall be required for personnel performing Hot Work. Specialized clothing shall be maintained in a clean, secure environment when not in use.

E. Safe Welding and Cutting Practices

1. Each person performing Hot Work shall be trained by a competent person prior to doing any such work. This shall include having a complete understanding of: each piece of welding equipment and its safe operation, gases used, and any materials or procedures that set up the welding, cutting, or brazing operation. Training shall be documented by each department.
2. All fittings, hose connections, regulators, valves, and safety devices shall be checked for leaks and proper working condition before beginning work.
3. Leak detection products or soapy water should be used for leak detection tests.
4. Hose, valves, regulators and other apparatus must be kept clean, or shall be cleaned prior to use.
5. Never allow oil or grease to contact any part of the oxygen equipment.
6. When parallel lengths of oxygen and fuel hoses are taped together to prevent tangling, no more than four (4) inches out of twelve (12) shall be covered by tape.
7. Hose connections will be clamped or otherwise fastened in a manner that will withstand, without leaking, twice the normal pressure, but in no case less than 300 pounds per square inch (psi).
8. Hoses showing leaks, burns, worn places, other defects or potential defects, shall be repaired or replaced prior to use.
9. The colors for hoses typically are:



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- a. red for acetylene and other fuel gases,
 - b. green for oxygen, and
 - c. black for inert (non-reactive) gases and/or compressed air.
10. Pressure from compressed gas cylinders shall be reduced by using regulators designed for the tank and the product in use.
 11. Using matches or hot metal to light a torch is prohibited. Always light a torch with a friction lighter or a pilot light.
 12. Flash back protection shall be installed on all torches.
 13. Acetylene shall never be used at pressures more than 15 psi unless job requirements dictate otherwise.
 14. Appropriate eye, face and body protection shall be worn at all times.
 15. Open cylinder valves slowly. Leave keys or handles on the valve stem while in use.
 16. Personnel shall stand clear of the face of the regulators when cracking a cylinder valve.
 17. Only approved wrenches shall be used.
 18. Never hammer or force open a valve.
 19. All gas cylinders shall be fastened to a cart, or other carrier, in an upright position during and after use, unless used on a construction site. Gas cylinders cannot be stored on welding carts for more than 24 hours at a construction site (29 CFR 1926.350-354).
 20. Never leave the acetylene and oxygen hoses inside tanks, vessels, or other enclosed areas while in use.
 21. Support welding or other hot work on non-combustible material only.
 22. Proper ventilation must be used when feasible. If not feasible, appropriate respiratory protection equipment shall be worn during hot work operations when the personal exposure limit (PEL) is, or may be, exceeded in an eight-hour period. **Note: No County of Henrico employee shall wear a tight-fitting respirator on a non-voluntary basis without participating in the County's written Voluntary-wear Respiratory Protection Program.** Contact EMWS for guidance.

F. Eye Protection Guidelines

1. Employees performing welding/hot work are required to wear the appropriate personal protective equipment (PPE) for the eyes according to the table "Filter Lenses".
2. This section also applies to all apprentices and helpers exposed to welding and other hot work eye hazards.

Filter Lenses

Table 1: Filter Lenses for Protection during Shielded Metal Arc Welding

Operation	Electrode Size – inch (mm)	Arc Current (Amperes)	OSHA Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations*



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Shielded Metal Arc Welding (SMAW)	Less than 3/32 (2.4)	Fewer than 60	7	-
	3/32-5/32 (2.4-4.0)	60-160	8	10
	More than 5/32-1/4 (4.0-6.4)	More than 160-250	10	12
	More than 1/4 (6.4)	More than 250-550	11	14

Table 2: Filter Lenses for Gas Welding and Oxygen Cutting Operations

Operation	Plate Thickness Inches	Plate Thickness mm	OSHA Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations*
Gas Welding	Under 1/8	Under 3.2	4	5
	1/4 to 1/2	3.2 to 12.7	5	6
	Over 1/2	Over 12.7	6	8
Oxygen Cutting	Under 1	Under 25	3	4
	1 to 6	25 to 150	4	5
	Over 6	Over 150	5	6

Table 3: Filter Lenses for Protection during Other Welding and Cutting Operations

Operation	Arc Current (Amperes)	OSHA Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations*
Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW)	Fewer than 60	7	-
	60-160	10	11
	More than 160-250	10	12
	More than 250-500	10	14
Gas Tungsten Arc Welding (GTAW)	Fewer than 50	8	10
	50-150	8	12
	More than 150-500	10	14
Air Carbon Arc Cutting (CAC-A) (Light)	Fewer than 500	10	12
Air Carbon Arc Cutting (CAC-A) (Heavy)	500-1000	11	14
Plasma Arc Welding (PAW)	Fewer than 20	6	6-8



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	20-100	8	10
	More than 100-400	10	12
	More than 400-800	11	14
Operation	Arc Current (Amperes)	OSHA Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations*
Plasma Arc Cutting (PAC) (Light)**	Fewer than 300	8	9
Plasma Arc Cutting (PAC) (Medium)**	300-400	9	12
Plasma Arc Cutting (PAC) (Heavy)**	More than 400-800	10	14
Torch Brazing (TB)		3	3 or 4
Torch Soldering (TS)		2	2
Carbon Arc Welding (CAW)		14	14

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then, go to a lighter shade which gives a sufficient view of the weld zone without going below the minimum. During oxygen gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light (spectrum) of the operation.

** Values apply where the actual arc is clearly seen. Lighter filters may be used when the arc is hidden by the workpiece.

Hot Work Permit Policy

A. Responsibilities for Hot Work Permit System:

1. The supervisor will:
 - a. Inspect the permitted area and ensure all precautions listed on permit are in place,
 - b. Sign the permit in "Permit Approval" space that authorizes the work.
 - c. Perform a final inspection 30 minutes after the last welding or cutting action was performed. The work area shall be examined for evidence of sparks, open flames, or combustion,
 - d. File the original copy of the Hot Work Permit.
 - e. Hot work permits will remain on file for a period of one year.
2. The Welder/ Cutter will:



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- a. Obtain an authorized permit for any scheduled hot work,
- b. Fill out the first page of the permit,
- c. Post the Hot Work Permit at work area,
- d. If necessary, will provide a “Fire Watch” individual for all hot work as per Section B “Fire Watchers” (pages 2 and 3 of this chapter),
- e. Keep the Hot Work Permit at the site no less than 30 minutes after the work is completed for fire watch purposes.
- f. Return the Hot Work Permit to the supervisor prior to a final inspection of the work area.

B. Fire Watch

1. A fire watch will be provided and trained in accordance with Section B, pages 2 and 3 of this chapter, “Fire Watchers.”
2. Each supervisor shall determine who will be trained in their assigned section.

Training

Affected departments shall ensure that all employees and helpers performing Hot Work are trained prior to assignment of such duties, and at least annually thereafter. Training shall include the following:

- A. Basic Procedures—how to use and maintain all Hot Work equipment,
- B. Fire Watch Procedures,
- C. Restrictions to doing Hot Work,
- D. Doing Hot Work in a Permit-required Confined Space,
- E. Personal Protective Equipment (PPE) for Hot Work,
- F. Safe Welding, Cutting, & Brazing Practices,
- G. Eye Protection Requirements,
- H. “Hot Work” Permit Policy and Requirements.

Disclaimer:

Although every effort has been made to ensure this Chapter addresses all applicable regulations, it is the responsibility of each department to maintain compliance.