

# **Chapter 18 – Welding**

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## 18.1 Foreword

Welding and cutting processes using electric arcs or oxy-fuel gas flames are necessary for many construction and repair tasks. Improper use of welding and cutting equipment can result in injuries from fumes, fires, and explosions. This document contains procedures to protect County employees from welding and cutting hazards.

## 18.2 Introduction

Most fires resulting from welding and cutting are caused by sparks that can scatter as far as 35 feet setting fire to combustible materials. Sparks can fall through cracks, pipe holes or other small openings in floors and partitions, often starting fires that reach serious proportions before being noticed.

Such fires can best be prevented through education, training, and on-the-job practices such as separating combustibles from ignition sources, by shielding the combustibles and requiring fire watches.

This document is mandated by Cal/OSHA Section 4848 and is part of the County's Occupational Injury and Illness Prevention Program.

## 18.3 Applicability of Standard

This policy applies to all employees who use an arc welder, MIG welder, TIG welder, plasma cutting, or whenever they use an oxy/acetylene torch for welding, cutting, or brazing.

This policy does not apply to cutting wheels, grinders, bunsen burners, propane torches, or other flames used for heating or soldering. Supervisors and employees should bear in mind, however, that since any spark or flame is dangerous, they must take care to protect themselves against eye injuries, burns, fires, and fumes. They must also familiarize themselves with all policies surrounding hot work prior to beginning a task.

## 18.4 Other Policies that Might Apply

Before starting any welding or cutting, supervisors and employees should consider if the following policies might apply to their situation:

- The *Respiratory Protection Policy* (chapter 17) applies if the welding area is not well ventilated.
- The *Confined Space Policy* (chapter 19) applies if you will be welding in a tank, boiler, etc.
- The *Lockout and Tag Policy* (chapter 16) applies if you will be welding where a sudden energy release from an electric wire, pipeline, etc., could injure you.

## 18.5 Approved Areas for Welding and Cutting

Routine welding and cutting operations should only be performed in approved areas. Such areas should be of non-combustible or fire resistive construction, free of combustible and flammable contents, and separated from adjacent areas. A specially constructed welding booth is preferred.

## 18.6 Other Areas

Sometimes it is necessary to perform welding and cutting operations in areas of a facility or worksite that are not specifically designed or approved for them. Such operations are usually divided into two classifications. Most common are when emergency repairs must be made on machinery or equipment that cannot be removed to an approved welding booth and must be repaired in place. The other involves large-scale operations found in construction, remodeling, or demolition projects.

In either example, the County Fire Marshal's office must be contacted to determine if site inspections or special permits are required before beginning such operations.

## 18.7 Safety Precautions

### 18.7.1 Approved Apparatus

Use only approved apparatus, such as torches, manifolds, regulators, or pressure reducing valves and acetylene generators. Follow specific procedures provided by the manufacturer of the equipment.

### 18.7.2 Training

Only trained cutters, welders and supervisors shall perform or supervise the work.

### 18.7.3 Notification of Hazards

Supervisors overseeing flammable materials or other hazardous conditions at County facilities must tell welders about the potential hazards.

### 18.7.4 Combustible Materials

Move all welding and cutting to a location free from dangerous combustibles. When the work cannot be moved, relocate combustibles at least 35 feet from the worksite. *When combustibles cannot be relocated, protect them with flameproofed covers or shield them from sparks and heat.*

### 18.7.5 Permit Required

Welding and cutting must not be started until the area is inspected and a permit is issued. Areas specifically designed and approved for routine welding or cutting (welding booths) may be permitted for up to one year. Permits for welding and cutting in areas not specifically designed or approved for such processes expire daily.

The County Fire Marshal's office must be notified in advance of any proposed welding or cutting work and will determine if site inspections and plan checks are required before authorizing such work to begin.

### 18.7.6 Fire Watches

Fire watches are required when cutting or welding whenever there are:

1. Combustible materials, in building construction or contents, closer than 35 feet to where the welding and cutting is being done.
2. Combustibles easily ignited by sparks.

3. Openings in walls or floors within a 35-foot radius that expose combustible material in adjacent areas including concealed wall or floor spaces.
4. Metal walls, partitions, ceilings or roofs with combustible materials adjacent to the opposite side which could be ignited by heat conduction or radiation.

Maintain a fire watch from the time cutting or welding starts and continue for at least 1/2 hour after work is finished.

### **18.7.7 Fire Watchers**

Fire Watchers must be trained in the use of fire extinguishing equipment and know how to sound the fire alarm. They shall watch for fires in all exposed areas, try to extinguish them only when within the capacity of the equipment available, and/or sound the alarm.

### **18.7.8 Combustible Construction**

*Use guards or fire-resistant shields* to prevent ignition when cutting or welding near combustible walls, partitions, ceilings, or roofs.

### **18.7.9 Combustible Floors**

Keep combustible floors wet or protected by fire-resistant shields during welding and cutting. Employees must protect themselves from possible shock when using electric arc welding or cutting equipment in areas that have been wetted down.

### **18.7.10 Openings**

Protect combustible materials exposed to sparks that may drop through cracks or openings in floors, walls, doorways, or windows.

### **18.7.11 Ducts**

Protect or shut down ducts and conveyor systems that might carry sparks to distant combustibles.

### **18.7.12 Metal Construction**

When welding on metal walls, partitions, ceilings, or roofs, relocate combustibles on the other side to protect them from ignition due to conduction or radiation. Provide a fire watch on the opposite side from the work when combustibles can not be relocated. Welding shall not be attempted on any metal partition, wall, ceiling, or roof having a combustible cover or of a combustible sandwich-type panel construction (metal over foam insulation, etc.).

### **18.7.13 Pipes & Tanks**

Do not cut or weld on pipes or metal in contact with combustible walls, partitions, ceilings, or roofs if the work is close enough to cause ignition by conduction.

Do not weld pipes, tanks, or other apparatus that contains or had contained flammable materials. Vapor or dust residues can be explosive if ignited. These materials need to be purged before welding can start.

## 18.7.14 Fire Extinguishing Equipment

Keep suitable and sufficient fire extinguishing equipment ready for use while welding and cutting.

## 18.7.15 Personal Protection

When cutting or welding wear approved welding helmets or goggles, face shields, gloves, work clothes, aprons, etc. Use non-flammable curtains or shields where needed to protect others from arc flash and sparks. Make sure your eyes are protected by the correct grade of darkened glass. Cal/OSHA regulations prohibit the wearing of contact lenses in working environments where there may be harmful exposure to materials *or light flashes*.

Beware of hazardous materials used during welding or cutting, including base metal, fluxes, coating, plating and filler material. Toxic substances include, but are not limited to, Lead, Beryllium, Cadmium, Chromium, Fluorides, Mercury, and Zinc. Highly toxic fumes may also be released during inert gas, metal arc welding or oxygen cutting of stainless steel. Employees should use appropriate respirators (N-, R-, or P100) and cartridges for airborne fumes.

Employees need to wear clothing to shield against burns from hot metal and ultra-violet radiation. Employees welding can get burned by metal spatter falling into clothing cuffs and pockets. Arc welding can cause exposure to UV light resulting in first degree burns.

# 18.8 Roles and Responsibilities

## 18.8.1 Occupational Safety and Environmental Compliance (OSEC)

- Establishes the Welding Procedures
- Oversees the welding procedures implementation, evaluation, and modification per Cal/OSHA updates

## 18.8.2 Agency/Department Head

- Ensures the implementation of the County Welding Procedures in their agency or department to include fire prevention and suppression procedures for welding and cutting operations.
- Adheres to fire prevention and suppression procedures for welding and cutting operations, including notifying the Fire Marshal's office in advance of any welding or cutting projects.
- Designates a qualified supervisor who is aware of the fire hazards involved and is familiar with this document to be responsible for authorizing welding and cutting operations in areas not specifically designed or approved for such processes.
- Insists that cutters/welders and their supervisors be trained in the safe operations of their equipment, the safe use of the process, and emergency procedures in the event of a fire.
- Selects contractors with trained personnel who are aware of the risks involved.

## 18.8.3 Safety Coordinator

- Authorizes trained welders to perform welding and cutting work in county facilities.

- Insures that cutters and welders and their supervisors are trained in the safe operations of their equipment, the safe use of the process, and emergency procedures in the event of a fire. Coordinates implementation of the procedures.
- Maintains Welding Permits & Hot Permits.
- Maintains file of permits for 3 years.

#### **18.8.4 Welding and Cutting Supervisor**

- Advises all contractors about flammable materials or hazardous conditions at the worksite.
- Ensures that fire prevention and suppression procedures are followed and all necessary documentation is maintained.
- Uses only certified cutters and welders for permitted structural welding.
- Enforces the safe use of the welding and cutting equipment and process.
- When authorized by the Safety Coordinator, may issue welding and cutting permits to certified welders for permitted structural welding. Sends copies of permits to the Safety Coordinator and OSEC. Maintains file of permits for 3 years.
- Ensures that fire protection and extinguishing equipment are available and regularly inspected.
- When required, ensures that firewatchers are at the site and remain at least 1/2 hour after welding and cutting is completed.
- When fire watches are not required, inspects for smoldering fires 1/2 hour after completion of cutting or welding.

#### **18.8.5 Welder**

- Obtains approval from the welding and cutting supervisor before cutting or welding.
- When authorized by the Safety Coordinator or the Welding and Cutting Supervisor, may complete and post welding and cutting permits. Returns completed permits to supervisor upon job completion.
- Cuts or welds only where conditions are safe and stops work if conditions change
- Follows this procedure and instructions provided by the manufacturer of the equipment used.

#### **18.8.6 Fire Watchers**

**Note:** More than one firewatcher may be needed to observe all exposed areas.

- If required, remains available during welding and cutting operations for at least 1/2 hour afterwards to detect and extinguish smoldering fires.
- Has received training in the use of fire extinguishing equipment.

- Watches for fires in all exposed areas and extinguishes them only when within the capacity of the equipment available.
- Sounds the alarm at the first sign that a fire may exceed the capacity of the equipment or the abilities of the watcher.

### **18.8.7 Contractor**

- Provides suitably trained personnel who are aware of all risks involved.
- Designates someone who is knowledgeable of safe welding and cutting operations to supervise work.
- Provides approved welding and personal protective equipment.
- Follows these procedures.

## **18.9 Arc Welding**

### **18.9.1 Arc Welding and Cutting**

- Where the work permits, the welder shall be enclosed in an individual booth painted with a finish of low reflectivity, such as zinc oxide and lamp black, or shall be enclosed with noncombustible screens having a similar low reflectivity finish. Booths and screens shall permit circulation of air at floor level. Workers or other persons adjacent to the welding areas shall be protected from the rays by noncombustible or flameproof screens or shields or shall be required to wear appropriate goggles.
- Welding machines shall be left on the outside of a confined space and heavy portable equipment shall be blocked to prevent accidental movement.
- When operations are suspended for any substantial period, such as during lunch or overnight, welding machines shall be shut off outside the confined space
- The electrodes and electrode holders shall be removed from the confined space. All electrodes shall be removed from the holders and the holders carefully located to prevent accidental contact. The welder shall provide some means of warning to other workers of the location of hot metal.
- Hot electrode holders shall not be dipped in water
- Arc welding equipment shall be in good safe working condition (free of functional defects)
- The control apparatus of arc welding machines shall be enclosed except for operating wheels, levers, and handles
- Unattended electrodes shall be removed, and holders placed to prevent employee injury
- When arc welding is performed in wet or high humidity conditions, employees shall use additional protection, such as rubber pads or boots, against electric shock

### **18.9.2 Manual Electrode Holders**

- Manual electrode holders intended for arc welding and cutting shall be capable of handling the maximum current required for such welding or cutting shall be used



- Current-carrying parts passing through those portions of the holder gripped by the employee and through the outer surfaces of the jaws of the holder shall be insulated against the maximum voltage to ground

### **18.9.3 Welding Cables and Connectors**

- Cables shall be insulated, flexible, and capable of handling the maximum current required by the operations, taking into account the duty cycles.
- Only cables free from repair or splice for 10 feet from the electrode holder shall be used unless insulated connectors or splices with insulating quality equal to that of the cable are provided.
- Cable lugs, where used as connectors, shall provide electrical contact. Exposed metal parts shall be insulated.

### **18.9.4 Ground Returns and Machine Grounding**

- Ground return cables shall have current-carrying capacity equal to or exceeding the total maximum output capacities of the welding or cutting units served
- Arc welding and cutting machine frames shall be grounded, either through a third wire in the cable containing the circuit conductor or through a separate wire at the source of the current. Grounding circuits shall have resistance low enough to permit sufficient current to flow to cause the fuse or circuit breaker to interrupt the current

## **18.10 Applicable Regulations**

CAL/OSHA, Title 8, CALIFORNIA CODE OF REGULATIONS, Section 4851

## **18.11 Appendices**

# 18.11.1 Appendix A: Welding Permit

## County of Santa Clara

### Welding Permit

THIS PERMIT EXPIRES ON \_\_\_\_\_

(date)

ONE YEAR PERMIT (for areas specifically designed or approved for welding)

ONE DAY PERMIT (for all other areas)

Time work started \_\_\_\_\_ Completed \_\_\_\_\_

Address & Location \_\_\_\_\_

Describe work to be done \_\_\_\_\_

• **Inspect Before Work Begins:**

- Welding operation approved by Fire Marshal.
- Fire sprinklers (if present) are in service.
- Welding equipment is in good repair.
- Personal protective equipment is complete.
- Welders are protected from fumes, either by ventilation or by complying fully with the County's respiratory protection procedures.
- This permit is posted at the work site.
- Other precautions \_\_\_\_\_

• **Within 35 feet of work**

- Floors are swept clean of combustibles.
- Combustible floors are wet down, covered with damp sand, metal, or other shields.
- Combustibles and flammable liquids are removed or shielded.
- All wall and floor openings are covered. Covers are suspended beneath work to collect sparks.

• **Work on Walls or Ceilings**

- Construction is non-combustible and without combustible covering.
- Combustibles are away from opposite side of wall.
- **Work on Enclosed Equipment**
  - Equipment is cleared of all combustibles.
  - Containers are purged of flammable vapors.
  - Welders are protected from confined space hazards, either by not having to enter confined spaces, or by complying fully with the County's confined space entry procedures.

• **Fire Watch**

- Is not required (see procedures for more detail).
- Is required (check all items below).
- Will watch for fires during and 30 minutes after operation.
- Has a fire extinguisher.
- Has been trained how to use fire equipment and sound the fire alarm.

**IN CASE OF FIRE, DIAL: (9) 911 (FROM COUNTY PHONES); 911 (FROM OTHER PHONES)**

I have personally inspected the work area and made sure all the necessary precautions were taken.

Signed \_\_\_\_\_ Date & Time: \_\_\_\_\_  
(individual responsible for authorizing welding and cutting)

### INSPECT FOR FIRE 30 MINUTES AFTER WORK IS DONE:

I personally inspected, 30 minutes after the work was completed, the work area and all adjacent areas to which sparks and heat might have spread, including floors above and below and on opposite sides of walls.

Signed \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/20\_\_\_\_

(Supervisor or Fire Watch)

Time: \_\_\_\_:\_\_\_\_ AM, PM

**SEND COPIES OF THIS PERMIT TO THE SAFETY COORDINATOR AND OSEC**

**Retain Original Copy for 3 Years**