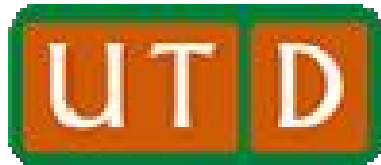


The University of Texas at Dallas Welding, Cutting, Heating, and Brazing Safety Manual



WELDING, CUTTING, HEATING, AND BRAZING SAFETY

I. PURPOSE

To establish safe practices for welding, cutting, and brazing.

II. PROCEDURES

A. Only fully qualified personnel who are familiar with required safety practices will be authorized to perform welding, cutting, and brazing operations.

B. Personal Protective Equipment

1. Welding helmets will be used during all welding arc operations. Welding goggles or other suitable eye protection will be used during all gas welding, cutting and brazing operations. Eye protection will be worn when chipping slag or metal fragments.
2. All welders will wear flameproof gauntlet gloves. Flameproof aprons may be desirable for protection against radiated heat and sparks. All clothing should be reasonably free from oil or grease. Safety shoes should be worn to prevent foot injury from hot, heavy, or sharp objects.

C. Protective Booths and Welding Bays

1. The walls of arc welding bays and booths should be painted with a low reflectivity finish.
2. Personnel adjacent to the welding areas shall be protected from rays by noncombustible screens or shields.

D. Ventilation

1. Mechanical ventilation must be provided when welding or cutting is done:
 - a. In a space of less than 10,000 cubic feet per welder
 - b. In a room having a ceiling height of less than 16 feet
 - c. In confined spaces or where the welding space contains partitions or other structural barriers that significantly obstruct ventilation.
 - d. On materials or under conditions likely to cause the release of harmful quantities of toxic airborne contaminants.

Such ventilation shall be at the minimum rate of 2,000 cubic feet per minute per welder, except when local exhaust ventilation or supplied air respirators are provided.

2. Local exhaust ventilation may be by either of the following two means.
 - a. Freely movable hoods intended to be placed by the welder as near as practicable to the work being welded and intended to provide a rate of air flow sufficient to maintain a velocity in the direction of the hood of 100 linear feet per minute. (Note: Increased rate of ventilation may be required for specific airborne contaminants.)
 - b. A fixed enclosure with a top and not less than two sides surrounding the welding or cutting operation must have a minimum air flow to maintain velocity away from welder's breathing zone of not less than 100 linear feet per minute.

The vapors from cleaning operations involving chlorinated hydrocarbons (methylene chloride, trichlorethylene) will be located so that no vapors from these operations will reach or be drawn into the atmosphere surrounding any welding operations.

E. Cutting or welding shall not be permitted in the following situations:

1. In the presence of flammable or explosive atmosphere
2. Near readily ignitable materials
3. In air handling units or ducts
4. Outside of a regularly assigned welding area without authorization.

F. Compressed Gas Cylinders

1. Gas cylinders will be stored in approved spaces and must be secured from falling.
 - a. Oxygen cylinders will not be stored with cylinders of flammable gases or combustible materials unless separated by a distance of 20 feet or by a fire resistant partition at least 5 feet high.
 - b. The control valves of cylinders not in use will be covered by protective caps.
2. Compressed gas cylinders shall be legibly marked to identify the gas contents.
3. Acetylene cylinders must be kept in an upright position to prevent acetone (solvent used to dissolve the acetylene) from spewing out

with the gas.

4. All gas units must have anti-flashback devices installed on them.

G. Brazing

Brazing is frequently necessary to join metals at low temperatures. Since brazing is a process requiring heat, precautions should be taken for handling hot objects to prevent workers from being burned.

1. Proper outer clothing, preferably woolen, and eye protection should be worn.
2. Protective gloves should be worn when handling the chemicals used for brazing. Chemicals such as acids and alkalines are sometimes used to clean parts before brazing and can produce chemical burns if allowed to come in contact with the skin.
3. The caution notices on the packages should be followed when using brazing fluxes. Fumes generated during brazing can be a serious hazard. Brazing fluxes generate fluoride fumes when heated. Cadmium in silver brazing alloys vaporizes when overheated and produces cadmium oxide, a highly toxic substance. If cadmium oxide fumes are inhaled into the respiratory tract, they can cause pulmonary distress, shortness of breath and in cases of severe exposure, may cause death.
4. When using silver solder, the prescription listed below should be followed.
 - a. Know the materials with which you are working. Be sure you are not brazing on cadmium plated parts.
 - b. Read warning labels on filler metals and fluxes and label instructions.
 - c. Wear eye and face protection and protective clothing as required by the job.
 - d. Work in well ventilated areas, or use air-supplied respirators as required by the job.
 - e. Apply heat to base metal, not directly to the brazing filler metal.
 - f. Do not overheat either the base metal or the brazing filler metal.
 - g. Wash hands thoroughly after handling brazing fluxes and filler metals.

5. To use silver solder safely, the following information should be kept in mind.
- a. The American Society designations for silver brazing filler metals containing cadmium are: BAg-1, BAg-1a and BAg-2 and BAg-3. These silver brazing alloys can be safely used however, if precautions are followed.
 - b. The BAg-1 and BAg-1a classes of silver brazing filler metal can be successfully and properly used at temperatures below 1400 degrees F; brazing can be carried on safely using these two classes of filler metal. The remaining two classes of silver brazing temperature ranges are 1295-1550 degrees F respectively. Brazing can be carried on safely using temperatures below 1400 degrees F with these latter classes of filler metal. Since temperatures in the upper portion of these ranges can be reached, it is important to provide adequate local exhaust ventilation or where this is not possible, individual air supply respirators. "Local exhaust or general ventilation systems shall be provided and arranged to keep the amount of toxic fumes, gases or dusts below the maximum allowable concentration as defined by the Acceptable Concentrations of Toxic dusts and Gases, American Standard Z37". The 1969 ACGIH threshold limit value for cadmium is 0.1 mg per cubic meter of air.
 - c. It should be noted that the most serious cause of cadmium oxide fume generation occurs when all of these silver brazing filler metals are overheated. Care must be taken to control the temperature of the silver brazing operation. Under no circumstances should a torch flame be applied directly to the silver brazing alloy. The heat of the base metal should be used to melt and flow the brazing filler metal.
 - d. Another source of cadmium fumes is from brazing on cadmium plated parts. Since the torch flame is applied directly to the base metal, cadmium plated parts are potentially more hazardous than cadmium-bearing silver brazing alloys. When in doubt about a base metal, check with the supplier of the part. Cadmium plating should be removed before heating for brazing.
 - e. For additional information contact:

* Hand Soldering and Brazing
Data Sheet No. 445
National Safety Council
425 N. Michigan Avenue

Chicago, IL 60611

- * Safety in Cutting and Welding
American Welding Society
345 E. 47th Street
New York, NY 10017