

# CONSTRUCTION NEWS SENSE



## Welding Safety

General welding safety involves training, selection of proper equipment, electrical awareness, adequate ventilation, fire prevention, and the use of personal protective equipment. Of the numerous types of welders available, this article focuses on portable electric arc welders, which are one of the most useful pieces of equipment used in construction projects at SNL.

One or more welders used for fabrication and repair are usually found at almost every large construction area, and most are typically AC/DC, 240-volt transformer types. Portable welders usually rely on diesel/gasoline engines to generate electrical power. When properly installed and operated, an arc welder is safe; however, when used improperly, the same equipment can expose operators to hazards such as toxic fumes, dust, burns, fires, explosions, electrical shock, radiation, noise, and heat stress, any of which can lead to injury or death. By following the guidelines in this article, an operator can minimize the risks associated with using this type of equipment.

1. An arc welder should be operated only by personnel who have been trained in its safe use by a qualified instructor or welding operator.
2. Purchase and use only arc welders that comply with the National Electric Manufacturers Association (NEMA) standards or welders that meet the Underwriters Laboratories (UL) safety standards and display their respective seals of approval.
3. Before operating any arc welder, determine whether the electrical system to which it will be attached is adequate to handle the increased load. A construction lead or a qualified electrician can help determine this. A wide range of experiments that are continually being conducted by line operations at many buildings here at Sandia. Electrical impacts to the power due to overloaded circuits and tripped breakers are unacceptable and preventable. You need to review work with your Project Technologist (Inspector) and you may need to request a dedicated circuit. A welder must be installed by a qualified electrician in compliance with the manufacturer's requirements and the National Electric Code (NEC). An improperly installed welder could cause a fire, a ground fault, or equipment failure. The frame or case of a welder must be properly grounded and must be protected by a proper fuse or circuit breaker on an independent circuit.
4. Electric welders can cause a fatal electric shock. When a welding operation is performed while an operator is

standing on a steel or similar conductive surface, the operator must also stand on an insulating mat. If the area being welded is wet or damp or the operator is actively perspiring, rubber gloves should be worn under welding gloves.

5. The welder should be used only in an area with adequate ventilation. Also, check for building air intakes and do not place welders in a location that will cause exhaust and fumes to be introduced into a building air system. A welding, cutting, and brazing permit is a task-specific occupational exposure assessment and will assist with ventilation needs and requirements. In general, when welding operations involve metals not considered hazardous, a ventilation system capable of moving air at a minimum 2,000 cubic feet per minute (CFM) per welder is satisfactory. However, many materials are considered hazardous when being welded and should be operated on only in adequately ventilated areas to prevent accumulation of toxic materials or depletion of oxygen for the operator as well as others in the immediate vicinity. Ventilation should be supplied through an exhaust system located as closely as possible to the work area. When metals with hazardous coatings (e.g., galvanized metals) are being welded, operators should use a supplied-air type respirator or a respirator designed to filter specific metal fumes. Potentially extremely hazardous materials that may be released in welding operations include welding rod fluxes, coverings, or materials containing fluorine compounds, zinc, lead, beryllium, cadmium, and mercury. Some cleaning and degreasing compounds and the metals they were cleaned with are also hazardous. Always follow a manufacturer's precautions before welding or cutting in the presence of these materials.
  6. Arc welders can produce temperatures in excess of 10,000 degrees Fahrenheit. The area where such equipment is used should be made fire safe with metal sheets or fire resistant curtains. Floors in the area should be concrete or other such fire resistant materials. Cracks in floors should be filled to prevent sparks and hot metal from entering. When work cannot be moved to a fire-safe area, the work area should be secured by removing or protecting combustibles from ignition sources. At Sandia, a fire watch is required for all hot work operations. The volume of work a fire watch can observe depends on tasks and locations. The Sandia Hot Work Permit addresses these requirements.
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# Welding Safety (Continued)

7. Suitable fire extinguishing equipment (e.g., buckets of sand or a dry chemical ABC type extinguisher) should be readily available in welding areas. Extinguishers should be large enough for the situation.
8. Arc welding operators and helpers must be properly clothed and protected from heat, ultraviolet rays, and sparks. At Sandia, escorts must also be protected from hazards. Body protection includes fire-retardant, long-sleeved coveralls without cuffs. Clothing with tears, snags, rips, or worn spots should be avoided, as these are easily ignited by sparks. Sleeves and collars should be kept buttoned. Hands should be protected with leather gauntlet gloves. High-top leather shoes, preferably safety shoes, should be used to protect feet. If low-top shoes are worn, ankles should be protected with fire-resistant leggings.
9. For those who wear prescription glasses, transparent goggles should be used over the glasses; for those who do not, safety glasses should be worn. A welding helmet or hand shield with a filter plate and cover plate is mandatory for protecting eyes from harmful rays produced by the arc. For general welding up to 200 amps, the filter plate should be at least a #10. Certain operations (e.g., carbon-arc welding and higher current welding) require darker shades. Helmets with cracked or broken filter plates or lenses should never be used. A flame-proof skull cap to protect the head and hair as well as hearing protection, in noisy situations, maybe recommended.
10. Always protect bystanders and other workers by welding inside a properly screened area, if possible. A portable screen or shield should be provided.
11. Because they are potentially explosive, drums, barrels, tanks, or other containers should not under any circumstances be subjected to welding, cutting, or hot work.
12. Work to be welded should be placed on a safe surface at a comfortable height whenever possible. Welding directly on top of a concrete floor should be avoided because heat from the arc can cause a build-up of potentially explosive steam under the floor. Cables attached to the welder should be positioned to prevent sparks and molten metal from falling on them. They should be kept free of grease and oil and located away from vehicle traffic.
13. Unused electrodes and stubs should not be left on the floor to create a slipping hazard.
14. Hot metal should be handled with tongs or pliers. To prevent painful burns from escaping steam, hot metal should be quenched carefully in water. Any metal left to cool should be marked "HOT" with a soapstone or barricading.
15. When a welding operation has ended for the day or has been suspended for any length of time, electrodes should be removed from the holder. The holder should be secured to prevent accidental contact, and the welder should be disconnected from the power source.
16. Safety precautions for engine-powered welders include, but are not limited to:
  - Operating the welder in an open, well-ventilated area or venting engine exhaust directly outdoors.
  - Checking for building air intakes and placing welders in a location that will not allow exhaust to be introduced into a building air systems.
  - Fueling the engine only while it is off and never in the presence of an open flame.
  - Wiping up spilled fuel immediately and waiting for fumes to disperse before starting the engine.
  - Removing the radiator pressure cap from liquid-cooled engines only after the engine has cooled to prevent a scald.
  - Stopping the engine before performing any maintenance or trouble shooting and disabling the ignition system to prevent an accidental re-start.
  - Keeping all guards and shields in place.
  - Keeping hands, hair, and clothing away from moving parts.

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**REMINDER—DATE/ROOM CHANGE**  
**Quarterly Construction Contractor Safety Seminar**  
**April 29, 2009**  
**2:00—4:00 PM**  
**Mountain View Club—Sandia 3/Del Norte**

