

SAFETY AND HYGIENE REGULATIONS



Servei de Prevenció de Riscos Laborals
UNIVERSITAT POLITÈCNICA DE CATALUNYA

ARC WELDING

CODE

SHR 217

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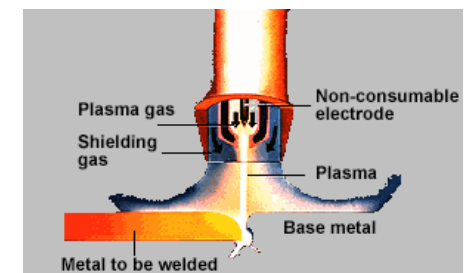
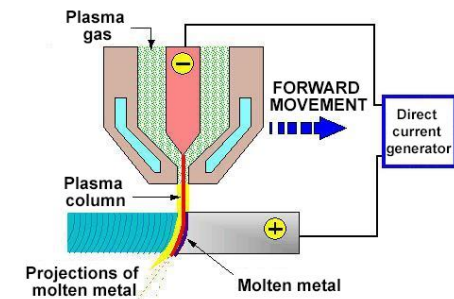
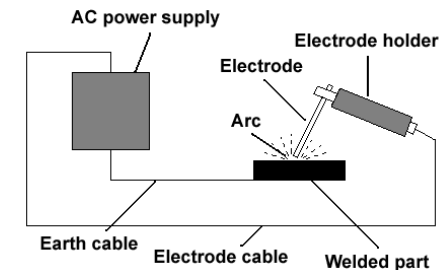
1 of 5

DESCRIPTION OF ARC WELDING

In this kind of welding, the material is melted using heat produced by the action of an electric arc between the consumable or non-consumable electrode and the base metal (the part to be welded). The main parameters that characterise the process are the type of electric current (direct or alternating), the apparatus that produces the current (generator or convertor), the type of electrode (metal or graphite), its coating (coated or non-coated) and the atmosphere that surrounds the electrode (argon, helium, CO₂, etc.).

The most common types of arc welding are:

- **Coated electrode:** in this kind of welding, a coated metal electrode is used that stabilises the arc, promotes priming, and forms a protective slag of molten metal. It can also provide alloy elements for the weld that improve the characteristics of the metal.
- **Metal inert gas (MIG):** in this kind of welding, an inert gas is used with a consumable electrode.
- **Metal active gas (MAG):** in this kind of welding, an active gas is used with a consumable electrode.
- **Tungsten inert gas (TIG):** in this kind of welding, an inert atmosphere is used with tungsten electrodes.
- **Air carbon arc cutting:** in this kind of welding, a graphite electrode is used with a burst of compressed air to remove molten metal.
- **Plasma cutting:** a process of cutting based on creating a plasma column using an electric arc established between an electrode and a cylindrical chamber (nozzle). The electric arc ionises the gas surrounding the two parts, which then passes through a small-diameter orifice so that the plasma is ejected at high speed and temperature. It can melt the material that is going to be cut and remove the slag and oxides that are formed in the process. The plasma column has directional stability, which enables higher-precision cutting.
- **Microplasma welding:** this type of welding establishes an electric arc under an atmosphere of a neutral gas (annular) between an electrode (pure tungsten or thorium) and the parts to be joined. The solder wire is used outside the welding torch. The arc passes through an orifice. A second (axial) gas circulates between the orifice and the tube and thermodynamically insulates the plasma and protects the weld seam. This is known as microplasma welding (up to 20 or 50 A) or plasma welding if the intensity is higher.



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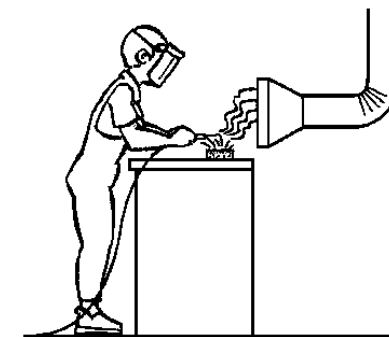
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Page:

2 of 5

GENERAL RECOMMENDATIONS

- To protect adjacent workplaces from radiation, put up suitable partitions such as screens, fireproof curtains, etc.
- Do not weld with clothing that has spots of grease, solvent or any other substance that could catch fire.
- Clothing that has got wet due to rain or sweat is conductive. It is dangerous to touch wet clothing with the welding gun inadvertently. Do not weld when it is raining or in conductive places, unless you have suitable electric protection.
- Welding fumes contain toxic substances that can be harmful if inhaled. For this reason, places where welding is carried out should be well-ventilated and extraction systems should be used locally to remove noxious fumes.
- The connection to ground must be installed according to the manufacturer's instructions. The metal frame of the workplace must be grounded. Particular care must be taken with the ground connections, which must not use gas pipes, pipes containing flammable liquids or electricity cables.
- The power outlet and socket used to connect the welding equipment to the electricity supply must be clean and free from humidity. Cut off the electricity supply before you connect the power outlet to the socket. When the equipment is not in use, the power outlet and electric socket should be covered with a cap.
- Position yourself so that gases from welding do not go directly towards your face shield, and protect other users from the electric arc using opaque partitions or screens. Wear protective clothing, goggles and footwear.



Extraction system with a movable hood

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Revision:

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Page:

3 of 5

PERSONAL PROTECTION EQUIPMENT TO USE

- The following personal protection equipment is obligatory:
 - A shield for protecting the face and eyes
 - Long leather gloves
 - A leather apron
 - Spats
 - Safety footwear, preferably insulating
 - A safety helmet when the work requires one
- Check that the face shield or mask has no cracks that allow light through, and that the glass to protect against radiation is suitable for the intensity or diameter of the electrode.
- The transparent protective glass must be changed if it is in bad condition, and replaced by another piece with a rating that is suitable for the task.
- When you remove slag or scrape solder, protect your eyes with safety goggles or a transparent screen.
- Operators who are close to the welding work must wear special goggles with filters.
When possible, place screens or partitions around the place where you are welding.
- When you position the electrode in the welding gun or electrode holder, always use gloves and disconnect the machine.
- The welding gun must be sufficiently insulated and when the equipment is live it should always be picked up with gloves.
- The welding gun should always be left on insulating materials rather than conductive materials.
- All parts of the welder's body must be covered to avoid burns due to radiation.
- When soldering is carried out on top of metal elements, insulating safety footwear is required.
- When you are working at height, use a body belt that is protected so that it cannot be burnt by sparks.



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SHR 217

Data:

January 2004

Revision:

00

Page:

4 of 5

BEFORE WELDING

1. When you connect welding equipment to an electricity supply, make sure that you connect the equipment's earth cable to the socket of the same supply.
2. You must inspect the insulation of the electric cables before you start to weld. Do not use any cables that are not in perfect condition.
3. Do not pass cables over transit routes unless they are protected with supports that can withstand compression.
4. Use suitable clamps to connect the ground cable directly and as closely as possible to the part to be welded.
5. Do not use grounding rods if you suspect that there may be underground electricity cables.

WHILE WELDING

1. The base that you weld on must be solid and supported on stable objects. The welding cable must be held with one hand while the welding is done with the other hand.
2. Cables should not rest on hot objects, puddles, sharp edges, sharp corners or any other place that could damage the insulation. Vehicles should not drive over cables. Cables should not be knocked, and sparks should be prevented from falling on them.
3. When the welding equipment's cables are hard to handle, do not pull on them as they could get cut and cause a serious accident. Do not pull on the cables to move the equipment.
4. Before you handle the welding machine in any way, cut off the electricity supply, even if you only have to move the machine.
5. Do not leave welding equipment connected to generator sets when you stop work, even if it is only for a short period.
6. To fill the generator sets with fuel, turn off the engine and leave it to cool for at least five minutes.



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Page:

5 of 5

WELDING IN CONFINED SPACES

1. A person must not work alone inside narrow chambers or enclosed spaces. The welding equipment must be left outside the confined space, under the supervision of an assistant. Fire extinguishers and body belts should be on hand to help the person who is welding.
2. Welding work cannot be carried out in containers that have held flammable or volatile materials, unless they are first cleaned and degased with steam (even when they have been empty for a long time). The absence of gases must be checked with an explosimeter.
3. If you work inside a tank, ensure that the clamps are well-insulated. Wear insulating gloves and footwear or a rubber mat. In addition, ensure that there is a local earth connection in the work zone.
4. If you work in an enclosed environment, ensure that there is good ventilation. If you use basic electrodes, it is essential to install fume extractors. If this is not possible, you must use respiratory protection equipment.

MANTENANCE, ORDER AND CLEANING

- Electrode holders must be stored where they do not come into contact with users, fuels or potential leaks of compressed gas.
- When welding work has to be interrupted for a certain period of time, take all of the electrodes from the electrode holders and disconnect the welding equipment from the electricity supply.
- Do not use electrodes that only have between 38 and 50 mm of material left; you could damage the insulating elements of the electrode holders and cause an accidental short circuit.
- Electrodes and electrode holders must be kept in dry places. If they are damp or wet for any reason, dry them completely before they are reused.
- Every week, inspect all of the material in the welding installation, particularly to check whether any of the equipment's cables are damaged or bare, there are any loose connections or terminals, the clamps for the electrode holder or earth connection are dirty or faulty, etc.
- In rotating welding equipment, check the contact brushes and replace or tighten them as necessary. In environments in which there is metal dust, periodically clean the interior of equipment with compressed air to avoid short-circuits or stray currents to the casing.