

Technical Newsletter from
ADOR WELDING LIMITED
Formerly Advani - Oerlikon Ltd.

SAFETY AT THE WORK PLACE

Part 2: Risk management of physical hazards and general operating hazards

Preamble:

In Part 1, we highlighted hazards related to electrical shocks and electromagnetic field during arc welding, the understanding of these hazards as well some steps to control/reduce these hazards. In this issue, we will discuss physical hazards during welding and cutting operations at the work place.

Introduction:

Welding, cutting and allied processes present numerous potential occupational hazards to welders and others. A hazard may be defined as something that has the potential to cause injury or damage to health. The risk of injury or damage to health occurring depends on how hazards are dealt with or controlled. To work safely, it is essential that hazards are recognized and identified, risk is assessed and control measures are put in place. This forms the basis of risk management. Welders may be exposed to numerous physical and general operating hazards associated with welding and cutting processes. These include:

- **Physical hazards:** electricity, radiation, heat, flames, fire, explosion, noise and magnetic fields.
In part 1, we dealt with hazards related to electricity and magnetic fields. In this article, we will detail the remaining hazards: radiation, heat, etc.
- **General safety hazards:** hazards not directly associated with welding or cutting that are also

present in the workplace and to which welders and other people may be exposed. These hazards may be moving machinery, falling objects, forklift trucks, mobile cranes, overhead cranes, site transport and hazards presented during manual handling of gas cylinders, tools, materials, equipment and consumables

Hazards of Radiation:

Welding and cutting arcs produce electromagnetic radiation. The type of radiation produced by electric arc and fuel gas processes is known as ionizing radiation. Electric arc and laser welding emit ultraviolet (UV) rays, visible light and infrared (IR) rays. Gas welding and gas cutting emit visible light and IR radiation. The potential effect of radiation on the body depends on the type and intensity of radiation, the distance you are from it and the duration of exposure. Non-ionizing radiation from welding can cause damage to skin and eyes. UV radiation can cause burns to unprotected skin and eyes (arc-eyes). Electron beam welding emits X-rays. Exposure to X-rays can cause serious damage to body tissues, including skin damage, cancer, and leukemia and reduced fertility; it can also lead to premature death. Thorium oxide, used in thoriated tungsten electrodes for TIG welding, is radioactive. In welding, it presents a minor hazard and only if dust particles are inhaled or ingested. Radiation from electric welding arcs and as flames is usually apparent, but arc flashes can occur without warning. The effects of IR and UV radiation are not normally felt until sometime after exposure. Radiation from lasers is less obvious than from electric welding arcs, and from electron beam processes can be not obvious at all, but both are serious hazards.

Identifying the Risk of radiation:

- In terms of type of radiation, gas welding and cutting processes emit IR and visible radiation, but do not emit UV; electric arc and laser welding and cutting processes emit radiation; electron beam welding processes emit X-rays.
- Welding processes (electric arc) produce high intensity UV radiation which is harmful to skin and eyes. In general, MIG welding, FCAW, MCAW and electro-gas welding processes produce higher UV radiation than MMA, TIG and plasma welding. SAW and electro-slag welding present a low risk when operated properly. Resistance welding and friction welding processes present very low risk from radiation.
- If good appropriate equipment like welding helmets or hand screens are available and used properly, then the risk of burns to welders' faces or eyes should be low.
- Filter glasses or screens must be of the correct shade for the welding process and welding current. An auto-darkening welding screen must darken to an appropriate shade and be fail-safe. Using a filter shade that is too light gives an increased risk of arc-eye or eyestrain
- While working with gas welding, gas welding goggles or screens with a filter shade that is too light gives an increased risk of glare and eyestrain.
- Protective clothing must be in good condition to ensure no areas of skin are left exposed to arc rays. Using correct protective clothing, in good condition, ensures a low risk of burns to the skin due to radiation.
- A welder working alone should have a low risk of exposure to arc radiation, but working in close proximity to other welders increases the risk of accidental exposure to arc radiation. Such exposures may result in arc-eye or serious skin burns, particularly to the back of the neck and ears.

Protection Measures against radiation:

- Protective equipment like welding screens and clothing for the face, head, hands, arms and body are the normal protection measures used to reduce exposure to radiation of the welder and others in the immediate vicinity of the process being used.
- Helmets and hand-held face shields (see Figure A) offer the most complete shading against arc radiation. The shade slips into a window at the front of the shield so that it can be removed and replaced easily. The shields are made from a hard plastic or fiberglass to protect your head, face, ears, and neck from electric shock, heat, sparks, and flames. Welders should also use safety glasses with side shields or goggles to protect their eyes from flying particles.

Welding bays and fabrication areas should be screened off to contain radiation from electric arc welding within the immediate welding area. Suitable screens, whether opaque or transparent, when properly positioned, reduce the risk of exposure to

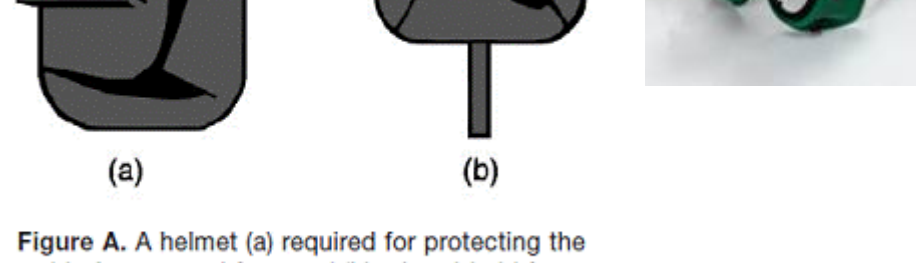


Figure A. A helmet (a) required for protecting the welder's eyes and face and (b) a hand-held face shield that is convenient for the use of foremen, inspectors, and other spectators.

Hazards of Heat, Flames, Fire and Explosion

Hazards are faced by welders every working day, since welding is a process that frequently involves heat, flames, and molten metal and high-temperature welding arcs. The source of the hazard may be arc rays, gas flames, lasers, consumables or hot metal, (whether this is a welded component or part of the welding equipment, like the nozzle on a MIG gun). Burns may range from superficial first degree burns to deep and severe third degree burns. Burns may occur to the skin or, potentially very seriously, to the eyes.

Fire and explosion are serious hazards in the welding environment. Heat and flames can result in fire or even explosion in the presence of combustible materials, dust, flammable liquids, gases or vapours. Working in a hot environment can also cause the body to overheat. This is known as heat stress. It can happen when sufficient amount of fluid is not consumed to replace that lost by sweating. In the extreme, heatstroke may occur and this condition can be fatal. Heat may be felt readily, but hot metal appears the same as cold metal, unless it is red hot or white hot. Thus, the burn hazard may not be obvious.

Flames are usually obvious (the exception being Hydrogen flame, which is invisible). An explosion hazard is often not apparent and usually occurs without warning. Heat exhaustion can creep up slowly over a period of time without the worker being aware of it and can thus be very dangerous.

Areas of heat, fire and explosion hazards:

- Fabrications or plates in the welding area are likely to be hot. Accidental burn injury can be avoided if hot plates and welded components are marked hot.
- Handling hot items like welding guns and torches, electrode holders and electrode stubs, etc. without suitable gloves may give burns.
- Flammable liquids, substances and vapours must be absent from the welding environment. Flammable substances in the vicinity may lead to fire or explosion. It may be possible that flammable vapours drift in from other areas and leads to risk of fire.
- Gases, such as Acetylene, Propane and Hydrogen, in the welding area also present a fire and explosion hazard. Readily combustible materials like paper and cardboard should not be present in the welding area otherwise it will increase the risk of fire.
- Welding in a confined space increases the risk of burns due to contact with hot metal or equipment
- Using inadequate protective clothing or not using some items of protective clothing leads to a high risk of burns to unprotected skin.

Precaution against heat, fire and explosion hazards:



Figure 2-4. Protective clothing.

- Normally protective clothing is the main protection used to reduce the risk of burns due to hot metal, welding arcs and welding flames. Hot metal items should be marked hot and checked that they are cool before handling, even if wearing gloves.
- Elimination of all flammable substances and unnecessary combustible materials from the welding area to avoid fire and explosion during welding.
- Fire fighting equipment must be readily available.
- If welding is to be carried out in or on tanks or vessels that have contained flammable substances, they must be purged to remove all traces of anything flammable or explosive.
- A strict regime of welding followed by set periods of rest is the normal control measure used to reduce the risk of heat stress and heat exhaustion. Intake of liquid is essential to offset the fluid loss that can result in dehydration.

Hazard due to Noise:

Noise is an everyday occurrence and an industrial workshop can be a very noisy place. All welding and cutting processes generate noise but some are more noisier than others and some generate noise of a higher frequency. Ancillary processes like grinding, chipping, gouging and hammering also generate varying levels of noise; associated practices, such as crane operation and forklift truck operation, also generate noise. Exposure to noise over a period of time can result in impairment or loss of hearing. In traditional boiler shops where continuous riveting and hammering took place every day, hearing loss was common place. It is also possible that permanent hearing damage can be caused by a single, intense impact noise, like an explosion. Loud impact noises can also induce acoustitus, a continuous or intermittent ringing, or other noises, in the ear. Noise is fairly easy to detect but the effects can accumulate over a long period of time.

Noisy Areas:

- Metal fabrication areas are generally noisy places.
- Processes that are often very noisy include plasma cutting and air arc gouging. Pulsed MIG welding may give off noise at a high frequency.
- Working inside a metallic fabrication, such as a ship or pressure vessel, can increase the risk of exposure to noise due to other workers hammering, grinding, etc., on the fabrication but at a distance from the welding area.

Protection against Noise:

- Ear protection equipment (ear defenders, ear plugs, etc.) is used to reduce personal exposure to noise. Ear protection devices must be in good condition and have sufficient noise attenuation properties.
- Segregation of noisy processes to one area of the workshop, away from the general work area, can be used as a control measure to reduce exposure to noise for the majority of workers.
- Some operations may have noise emissions contained completely by enclosing them in soundproof booths (e.g., shot blasting, fettling and plasma spraying). This effectively reduces exposure to noise for the majority of workers, but those involved in the operations must wear suitable ear protection.

Manual Handling and General Safety Hazards:

There are many general safety hazards not directly associated with welding but that are present in the workplace. These include hazards due to manual handling equipment, consumables and tools, etc., and physical and mechanical hazards in the workplace. Manual handling can present a hazard during lifting, lowering, carrying, pushing, pulling or moving of cylinders, tools, materials, equipment and consumables, etc. One of the most common injuries experienced by workers is back injury during manual handling. The work area itself is likely to present a variety of safety hazards associated with access and exit points, where the work area is situated, such as gangways, cranes, steps, ladders, scaffolding, pits, materials, tools, cables, machinery, plant and equipment, etc. What hazards are actually present depends on the type of welding work being carried out, but critical observation of the site can reveal a lot. There are also hazards due to falling objects from work taking place at height. Other general sources of hazard on industrial premises include forklift trucks, mobile cranes, and overhead cranes, moving machinery, site transport, delivery vehicles and so forth. General safety hazards and hazards encountered during manual handling are usually easy to recognize with some training, plus a little thought and common sense.

Identifying the risk of Hazards:

- Moving, lifting, carrying, etc. may cause injury if the things moved are heavy, large or awkward, or not lifted, carried or moved properly
- Untidy work areas, obstructed walkways, welding cables trailed along the floor or over fabrications, discarded items of equipment or consumable packaging, etc., all are prone to accidents of falls, trips, slips, collisions, etc., resulting in physical injury.
- Moving cranes and vehicles present a high risk of accidental collision and potential serious injury.
- If working at height, there is a potential risk of falling

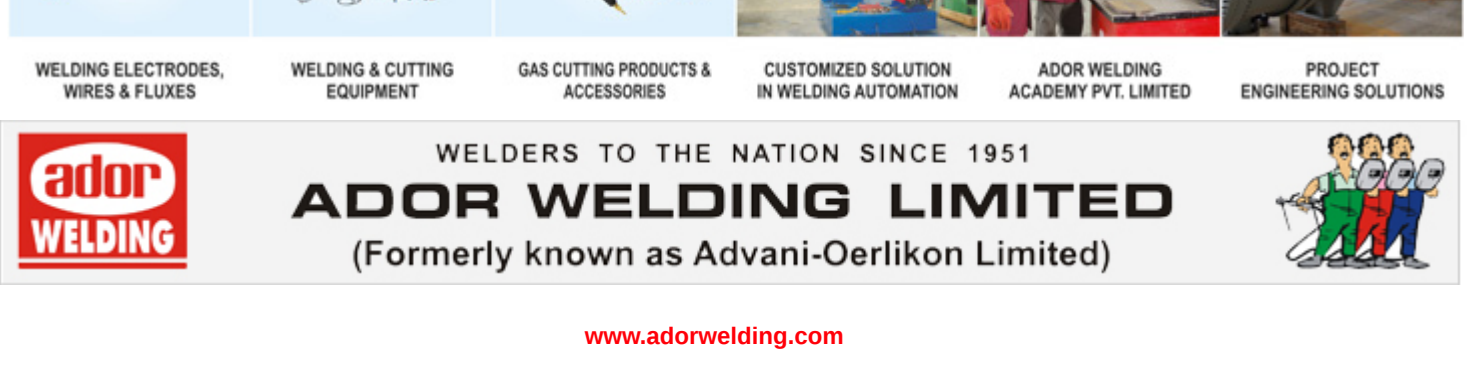
Precautionary Measures to avoid hazards:

- General hazards and hazards during manual handling activities can be controlled and significantly reduced if proper safety training is given and acted upon, if safe working practices and emergency procedures are in place, and if equipment and tools are maintained in good condition.
- Posting warning notices on sites and workshops where moving vehicles are in use alerts workers to potential hazards. Using visible and audible warning systems whenever vehicles and cranes are moving is a control measure to reduce the risk of incidents.

CONCLUSION:

Everybody has a responsibility to work safely and not to endanger themselves or any other person at work. For the welder or operator, control measures include use of Personal protective devices, following instructions and applying lessons learned in training, working in a safe manner, maintaining concentration and awareness, and not cutting corners. All these will help to reduce the risk of incidents and Physical hazards at working place. In the concluding Part 3 of this 3 series article on Safety in the work place, we will discuss the chemical hazards during welding and cutting processes.

Please contact cmo@adorians.com or visit our website www.adorwelding.com for any advice you may require in assisting you in making the work place hazard free and safe for the workers.



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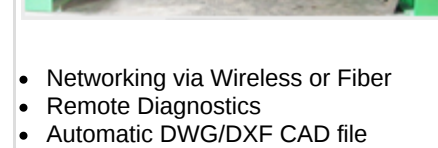
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