A Review of Safety Procedures and Guidelines in Welding and Cutting

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Abstract: ***Welding is a key tool in the aspect of construction as well as development. Welding is a high tech industry which can take you places all over the world. Welds are everywhere, just look around. From ladders to aircraft carriers, Welding is important to today's manufacturing. The welding processes are mostly carried out in the work shop and on the field. During these processes, manufacturers or welders are faced with a lot of hazards, due to the direct or indirect contact with the work pieces (hot or cold) or welding tools and flash arc etc. This paper intends to review some basic precautionary measures in terms of DOs and DONTs which if obeyed can eliminate or minimize this risk, and to serve as an orientation paper to technical students who may have the course to perform practical /training in welding. The DOs and DONTs as well as the negative consequences (implications) were highlighted under Different topics.***

Keywords: Safety, Hazard, flash Arc, welding, Do's, Don'ts, Recommendations.

1. Introduction

According to Wikipedia, the free Encyclopaedia, safety is the state of being "Safe", the condition of being protected against physical,social,spiritual,financial,political,emotional,occupational,psychological,educational or other types of consequences of failure, damage, error, accidents, harm or any other event which could be considered non desirable . It is also an act of control of recognized hazard to achieve an acceptable level of risk free [1].

Safety in a can be expressed as an act of eliminating all known hazard related to a particular job. Each job regardless of the type of work involved presents problem that requires special alertness, awareness and good judgement on the part of the worker and the employer, therefore, there is the need for full compliance with the requirements of the site where work is performed. It is therefore an obligation of a worker and the employer to review all safety hazards present and establish additional practices needed to minimize them, and also try to understand how each task is to be done in a safe manner and to correct any unsafe acts, practices and/or conditions for the protection of him and others [2].

Safety first; prior to beginning any task, it is important to understand and consider all of the potential risk of that task at hand and the necessary precautions to maintain safety. This can be accomplished through a Safety Task Assessment (STA), i.e. an explanation of safety precautions and actions that must be taken before preceding a task, usually given to a person that is to carry out a new or repetitive job, by his supervisor [3].

Generally speaking, all tools are dangerous when used improperly or carelessly. Working safety is the first thing a welder should learn because the safest way is the most appropriate way of doing things. A person learning to weld should first learn the safety regulations and precautions for each tool and machine, and equally learn to apply safe work habit in order to avoid the consequences of accident, "Most accidents results from non adherence to prescribed procedures" [4].

Although, each work has some safety procedures that are only applicable to it, however, the precautionary measures highlighted below are regarded as generally applicable.

2. Mental and physical acuity

Dos

- Always put safety at the bottom of your mind when working in a workshop.
- Ensure that you are mentally stable before commencing a job.
- Make sure that you are alert and attentive while working.
- Beware of your attention or lack of it to any job you are carrying out.
- Avoid all forms of distraction while working.

Don'ts

- Do not start welding while feeling dizziness/drowsiness.
- Do not go for a work after taking medication.
- Do not take alcohol or any form of intoxicant when you are about going to the work.
- Do not attempt to work while feeling tired.
- Do not leave any form of distraction close to you while carrying out a job.

Implication

The mental state of an operator is the most important factor of safety. All other procedures can only be strictly obeyed when one is mentally stable. The implication of being mentally unstable while working in the workshop is usually disastrous. It ranges from damage on machine components, bad product and/or accidents that may cause high degrees of injury or death.

3. Job Site Accident

Dos

- Lighting conditions should be adequate for the work undertaken.
- Give an extra lighting where necessary.
- Welders must keep a very steady hand position.
- The jobsite should be well heated hence must not be cold, conversely in hot weather.

Don'ts

- There should not be foot and vehicle traffic congestion.
- Do not wear jewelleries when working in a work shop.
- Do not put on rings when working in a work shop.
- Do not keep a loose hair when working in a work shop..
- Do not put on metallic watches or key chains when working in a workshop.
- Do not put on metallic hard hats and bumps when carrying out electric related work.
- Do not wear bracelets while working in a work shop.
- Do not use damage or defective welding equipment, eg frayed or damage welding cables.
- Do not litter the Job site.
- Do not Use equipment that are not Maintained.

4. Personal Protective Equipment

Dos

- Wear clothing that should offer protection from flying sparks heat and Ultraviolent radiation from an electric arc.
- Shirt should be made of tight-weave fabric, have long sleeves and pockets flaps and be worn with the collar buttoned.
- Pants should hang straight down the leg, touching the shoes tops without creases.
- Do not keep a loose hair when working in a workshop.
- Put additional covering when performing cutting operation or overhead welding.
- Make sure you wear foot wears to protect your leg from falling, rolling or sharp objects and Electric hazards.
- The foot wears should be of leather –reinforced soles or inner soles of Flexible metal.
- High top safety shoes or boots should be worn.
- Ensure that the pant legs cover the tongue and lace area of the foot wear.
- Gauntlet type welding Gloves must be worn when welding or cutting to protect against UV rays from an Electric arc and heat from any thermal welding/Cutting process.
- Soft, flexible, light weight lather gloves are use for light duty work for free hand movement.
- Always use leather hood to protect the ear from noise and spark.
- Use earmuff-type hearing protectors for maximum protection
- Always check the earmuff shell for cracks and ear cushion pads for tears before use.
- Welders should always wear tinted lens designed for electric arc use.
- Safety goggles with tinted lens (shade 3-5) and tinted side must be warn at all times when in the job areas.
- For oxyfuel welding and cutting wear tinted welding goggles (shade 4-6) over a safety glasses and wear clear face shield.
- Clear safety glasses and goggles with tinted face shield can also be use.
- For over head oxyfuel operations, a leather hood may be used in place of face shield.
- A leather hood or welding helmet with properly tinted lens (shade 9-14) must be use.

Don'ts

- Pants must not have cuffs.
- Don't wear pants that cannot cover cuffs and creases as they can cause fire.
- Never wear Polyester or other Synthetic fibres, as sparks will melt these materials causing burn.
- Sneakers, tennis shoes, and similar types of foot wear must never be worn on the job site.
- Shoes that do not conform to standard should not be use.
- Do not hold hot metal with your hand gloves, as the can burn.
- Do not wear wrong Gloves on a particular job, eg light glove on hard work.
- Do not use plain cotton in the ear as protective devices.
- Welders should never view an electric arc directly or indirectly.

Implication and Recommendation

- Safety wise, loose cloths and floating hair are discouraged because they can get caught by moving tools or give way for penetration of grit and sparks.
- Accordingly, saw dust, smoke as well as microscopic particles that can originate from metal removal when inhaled are dangerous to health. High noise intensity can cause permanent loss of hearing, while oil spill, metallic chips and dust if mistakenly get its way into the eye can cause sight problem.
- Always refer to material safety data sheet (MSDS) for the welding or cutting product being used to find out what type of protection you need for the particular job.
- Hence the employers or Authorities (in the case of school and training centres), must make the sheet available to all and make sure they adhere to it.

5. Ventilations

Dos

- Adequate ventilation should be provided to remove fumes that are produced by welding or cutting process (ANSI Z49.1-1999)
- Welding Area must contain at least 10,000 cubic feet of air for each welder.
- There must be air circulation.
- Partitions, structural barriers, or equipment must not block air circulation.
- Use a small fan to divert the direction of fumes.
- Use local exhaust ventilators.
- Keep the ventilation (4-6 inches) from the source of fumes.
- Use breathing protection in poorly ventilated areas or confined space.

Don'ts

- Avoid inhaling welding or cutting fumes and smoke..
- Take care to keep the fan from blowing directly on the work area.
- Never weld using materials coating (cadmium, mercury, lead, zinc, chromium and beryllium in poorly ventilated area.

Implication

Fumes and gases can be dangerous; over exposure can cause nausea, headaches, dizziness, metal fumes fever, and severe toxic effects that can be fatal. Studies have shown irritation to eyes, skin, and the respiratory system and even more severe complication.

6. Confined Space

Dos

- Keep the gas cylinder and welding machines out site when working in confined spaces.
- The wheels for heavy equipment are securely blocked to prevent accidental movement.
- Always provide a means for quickly removing the work, increase the emergency when working in confined space with manhole as an entry/exit.
- Remove all electrodes from holders when going for any break.
- Disconnect also the welding machine
- Closed all the cylinders supply valves.
- The valve on the torch shut off when the equipment will not be use for substantial period of time.
- After welding operation is completed, the welder must mark the hot metal or provide some other means of warning other workers.

Don'ts

- Do not work in space with concentration below 19.5%by volume as it considered deficient.
- Never use oxygen in confined spaces for ventilation purpose.

What are confined space and the implication?

Confined space refers to a relatively small or restricted space, such as a storage tank, boiler or pressure vessel or small compartment, such as underground utility, vaults, small rooms, or the un-ventilated corners of room.

Oxygen level in a confined space atmosphere must range between 19.5% and 21.5% by volume with 21% being considered the Normal level. Those above 23.8% by volume are considered as enriched.

If too much oxygen is provided in the confined space, it may be absorbed by the welders clothing and ignite. If too little oxygen is present, it can lead to the welders to the welder's death in minutes. Also in confined spaces, fumes and gases may cause asphyxiation.

7. Welding Area safety

Dos

- Work area should be pick up and swept clean.
- Te floors and the work benches should be free from dirt, scrap metal, grease oil and anything that is not essential.
- Welding electrode studs, wire hoses and cable should be kept in an electrode caddy. Hooks can be made to hold hoses and cable.
- Scrap steel should be thrown in to scrap bins.
- The ideal welding area should have bare concrete floors and bare metal walls and ceilings to avoid fire.
- Keep flammable metals as well as rags, wood, scrap piles of paper and other combustible out of the welding area.
- Eliminate anything that could trap sparks
- Must have fire extinguisher
- Whenever welding outside welding booth, use portable screens to protect other personnel from arc reflection glare.
- Keep first aid equipment nearby to treat burns in the work area.

Don'ts

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- Never weld or cut over wood floors to avoid fire.
- Never use cutting torch inside your workshop unless a proper cutting area is available.

8. Hot Work

Dos

- During a fire watch a person other than a welder or cutting operator must constantly scan the work area for fire.
- Te fire watch personnel must have ready access to fire extinguishers and alarm.
- He must know to handle it,

Don'ts

- Never work without hot work permit.

- Never work without fire watchers.

What is Hot work permit?

A hot work permit is an official document of authorisation from the site manager to perform work that may pose a fire hazard. The permit provides information such as the time, location and type of work being done.

9. Cutting Containers

Dos

- Cutting a container and even all sort of cutting should be done in designated areas in the workshop.
- The areas should be safe for welding and cutting operation with concrete floors, arc filters screen, protective drapes curtain or blanket and fire extinguishers.

Don'ts

- No combustible should be stored nearby.
- Cutting should never be performed on drums, barrels, tanks, vessel or other containers until they are emptied and cleans thoroughly.

10. Oxyfuel Gas welding safety

Dos

- Always light the oxyfuel gas torch flame using an approved torch lighter.
- If the torch is not in the welders hands, it must be off.
- Check valves and flash back arrestors must be installed in all oxyfuel gas welding and cutting outfits.
- Clear the areas of all combustible material.
- Be careful when handling liquid oxygen.
- All safety cylinders with leaking valves or safety fuse plugs and disc should be set aside and mark attention for the supplier.

Don't

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- Never point the torch at anyone when lighting it or using it.
- Never point the torch at the cylinders, regulators, hoses or anything else that may be dangerous and cause fire explosion.
- Never lay a lighted torch down on the bench or work piece.
- Do not hang it up while it is lighted.
- Never use oxygen as a substitute for compressed air.
- Do not use hammer or wrench to open the valve
- Do not temper or attempt to repair oxygen cylinder valve.

11. Electrical safety in welding

Dos

- Floors must be dry at all times.
- Use wooden/floor platforms or rubberized carpet/floor covering or other insulated material.
- Only experienced electrician may work on electric arc welding machine power connection.
- Work benches must be grounded.
- With the power off, cable connections must be checked for cracked insulation, loose contacts and worn or cut hoses.
- A machine must never be operated above its rated capacity.

Don't

- Never operate arc-welding equipment on a wet or damp floor.
- Never touch an electrode to a grounded surface because these surfaces will become electrically live.
- Never place electrode holders in contact with grounded metal surface because it could short circuit the welding machine.

12. Conclusions

Safety is every ones responsibility, proper clothing, foot wear and eye protection is essential for safe welding and cutting. Workers who fail to comply with safety rules are subject to dismissal. All welding shops must have established plans for dealing with accidents. Take time to learn the proper procedure for accident response and reporting before you need to respond to an emergency.

Accident is very harmful for both employees and employers, and they are often caused by poor behaviour and unsafe conditions. Most accidents can be prevented, by knowing and avoiding the behaviours that can be cause accidents and by keeping working conditions safe. It may be possible to avoid injuries and reduce hazards.

Try to bluff your way through job you do not understand is asking for trouble, even if you think you know the correct procedures a review may bring out an important part of the job that you may have forgotten don't be afraid to ask questions. The response you receive may help new or less experienced co-workers get answers to questions they may be too bashful to ask. Developing an attitude of safety is an excellent way for every worker to avoid or reduce all of these hazards.

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