

Welders

Health and Safety Guide



Prepared by the Canadian Centre for
Occupational Health and Safety

Summary

Welding involves a wide range of tasks and hence a wide range of health and safety hazards, which include the following:

- chemical dusts, fumes, vapours and gases
- poor ergonomic working conditions
- electrical hazards
- falls, trips, falling objects
- moving vehicles and cranes
- operating machinery
- arc light radiation, which can expose welders to intense ultraviolet, visible and infrared light
- oxygen displacement, oxygen enrichment or flammable gas mixtures from leaking compressed gas lines and cylinders
- heat, sparks, spatter, open flames and hot surfaces
- noise from metal-on-metal impacts, materials handling, metal working and some welding processes
- confined spaces

This guide outlines the health and safety aspects of welding work, and presents safe welding procedures. For specific guidance applicable to your situation, speak to your supervisor, workplace health and safety representative, health and safety committee member, or to regulatory authorities in your area. Also you may refer to CSA W117.2 standard, “Safety in Welding, Cutting and Allied processes” or ANSI Z49.1 standard, “Safety in Welding, Cutting and Allied Processes”

Table of Contents

Section I **Basic Rules of Safety**

- 1. The Law Says... 2
- 2. Elements of On-the-Job Safety 2
- 3. Safety Tips for New Employees. 3
- 4. Safety Tips for Supervisors 4

Section II **Maintaining a High Standard of Safety**

- 1. Welding Health and Safety Policy 6
- 2. Safety Inspections. 8
- 3. Accident Investigation and Reporting 11
- 4. First Aid 15

Section III **Welding Hazards and Controls**

- 1. Welding and Cutting Processes 18
 - Shielded Metal Arc Welding* 18
 - Gas Tungsten Arc Welding*. 20
 - Flux Cored Arc Welding* 21
 - Gas Metal Arc Welding* 22
 - Plasma Arc Welding, Cutting and Gouging* 23
 - Submerged Arc Welding*. 24
 - Resistance Welding* 24
 - Air Carbon Arc Cutting and Gouging*. 25
 - Oxyfuel Welding, Cutting and Heating* 26
 - 2. Summary of Welding Hazards 27
 - 3. Safe Welding Procedures 28
 - Ergonomic Aspects of Welding* 28
 - Electrical Safety*. 35
 - Radiation* 47
 - Fumes and Gases*. 57
 - Ventilation* 69
 - Heat and Fire*. 77
 - Noise* 78
 - General Safety Hazards*. 79
 - Robots* 82
-

Section IV Special Welding Situations

- 1. Oxyfuel Welding, Cutting and Heating 86
- 2. Welding in Confined Spaces 96
- 3. Cutting of Containers 100
- 4. Hot Work Permit. 100

Section V Personal Protective Equipment

- 1. PPE Checklist. 104
- 2. Respirators 108
- 3. Safety Glasses. 110
- 4. Safety Footwear 112
- 5. Headwear 114
- 6. Hearing Protection 116

Section VI Occupational Health and Safety Legislation

- 1. Canadian Occupational Health and Safety Legislation . . 120
- 2. WHMIS 123
- 3. Fire Code 125
- 4. Building Code. 125
- 5. US Occupational Health and Safety Legislation 126

Section VII Information Sources

- 1. Canadian Government Departments Responsible 130
for Occupational Health and Safety
- 2. US Federal Safety and Health Agencies 135

Appendices

- A1. Conversion Tables 148
 - A2. Abbreviations. 149
-

Sample Inspection List

Date _____

Location/Department _____

Yes = Satisfactory No = Unsatisfactory, needs attention

Yes No Safe Work Practices

- Hot work permits
- Use of machine guards
- Proper lifting
- Designated smoking areas
- Welding screens
- Proper use of air hoses
- No horseplay
- Other _____

Use of Personal Protective Equipment

- Eye/face protection
- Footwear
- Gloves
- Protective clothing
- Head protection
- Aprons
- Respirators
- Fall protection
- Other _____

Housekeeping

- Proper storage areas
- Proper storage of flammable material (oily/greasy rags, etc.)
- Other _____

Fire Protection

- Fire extinguishers
- Proper type/location
- Fire equipment maintained
- Emergency procedures

Yes No Tools and Machinery

- Right quality and quantity of required material
- Welding torches/gun
- Power Tools
- Hand Tools
- Welding machine/power supply
- Operation guards
- Gas cylinders
- Hoisting rigging
- Maintenance, oil leakage
- Robots
- Other _____

First aid

- First aid kits in rooms/vehicles
- Trained first aid providers
- Emergency numbers posted
- All injuries reported
- Other _____

Ventilation

- Adequate
- Welders' position clear of fumes

Miscellaneous

- MSDS*/Labels
- Dust/vapour/fume control
- Safe use of ladders/scaffolds
- New processes or procedures implemented
- Other _____

*MSDS= Material Safety Data Sheet for chemicals.

Notes _____

Gas Tungsten Arc Welding (GTAW)

Gas tungsten arc welding (GTAW) is sometimes called tungsten inert gas (TIG) welding. An early trade name still used for this process is “Heliarc”.

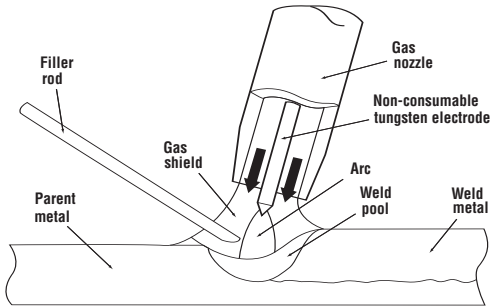


Diagram of GTAW process

In GTAW, an electric arc is established between the tip of a thoriated tungsten electrode and the workpiece. The electrode is not used up, which is why this process is referred to as a “non-consumable electrode” process.

The arc is protected by the flow of a “shielding gas” such as argon, helium or mixtures of these gases which displace atmospheric gases from the weld zone.

The arc in GTAW is very hot and can be used to fuse two metals together without the use of a filler metal. A hand-held “filler rod” can be placed near the heat zone of the arc and melted to fill any gaps.

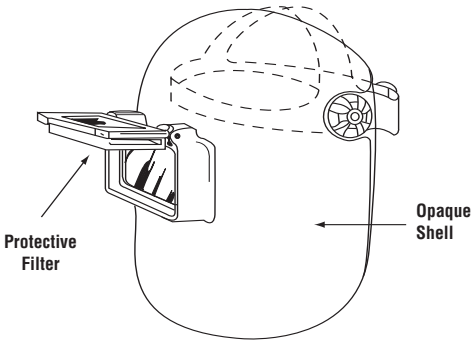
Because the electrode is not consumed and the filler rod does not transmit current, very little fume and no slag are formed with GTAW.

Ultraviolet (UV) light from the electric arc is very intense and can produce ozone gas due to the action of UV on atmospheric oxygen.

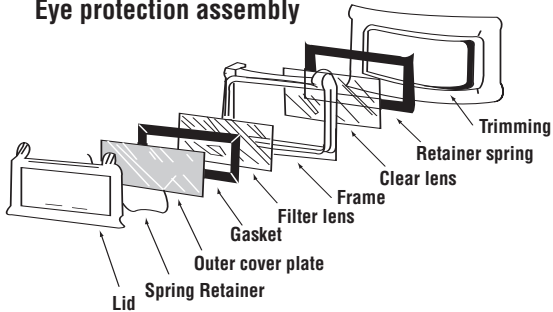
Eye Protection

The eyes are protected from welding light by a filter shade mounted on the welder's helmet.

Welders Helmet



Eye protection assembly



The helmet shell must be opaque to light and resistant to impact, heat and electricity. It is supported on the head with a headband and cradle assembly. The shell is hinged so that it can be lowered during welding and raised after.

Eye protection is provided in an assembly which includes the following components:

General Safety Hazards

Welding involves a wide range of safety hazards which include handling heavy materials; working at heights; trips and falls; and falling objects.

Hoisting and Rigging



ENSURE that lift trucks, cranes, derricks and hoists are appropriate for the loads to be lifted.

MARK all cranes and hoists, with lifting capacity, manufacturer, model, serial number, year of manufacture, and hand signals for controlling hoisting operations.

ENSURE that workers understand hand signals for controlling hoisting operations.

ENSURE that all lifting devices are inspected periodically by a competent person.

ENSURE that all repairs are performed under the supervision and instruction of a professional engineer.

ENSURE that hoisting and rigging are performed and supervised by trained and qualified personnel.

ENSURE that equipment is capable of lifting the load.

USE the proper size of wire rope and ensure that it is in good condition.

USE hooks that are equipped with a safety clasp and which are not deformed.

FAMILIARIZE yourself with emergency stopping devices on cranes and hoists operated on rails.

KNOW all the standard crane signals. Only a designated person should signal the hoist operator.



DO NOT use slings made of nylon or other materials which may melt when hot.

Work at Heights

To work on elevated platforms, workers must be aware of the requirements for safe use of ladders, scaffolds and fall protection.

3. Cutting of Containers

Before welding or cutting:



IDENTIFY the previous contents of the container and their toxic and flammable hazards (consult the material safety data sheets and WHMIS labels).

TEST for the presence of combustible materials.

CLEAN the container thoroughly by steaming or water washing.

During the actual welding or cutting, the following precautions must be taken:



FILL the container with water to within a few inches of the point where the welding or cutting is to be done.

VENT the space above the water to allow the heated air to escape.

TEST the vented gases for combustible or toxic components. If you detect any, stop welding or cutting.

AVOID explosion from expansion of trapped gases.



DO NOT weld near unvented pockets such as lap patches or seams, reinforcing pads or jacketed containers.

Refer to AWS (American Welding Society) Standard F 4.1 for further information.

4. Hot Work Permit

Work involving ignition sources in the vicinity of flammable materials is referred to as “hot work.”

Welding and cutting are examples of hot work. Fires often are the result of the “quick five minute” job in areas not intended for welding or cutting. No precautions are taken and, within minutes, sparks or hot material can start a fire.

1. Personal Protective Equipment (PPE) Checklist

Yes No

- Have you received training in the usage of PPE?
- Is appropriate PPE made available to you?
- Is your PPE certified for its intended use by a standards authority (such as CSA, CGSB, NIOSH, ANSI)?
- Does your PPE fit properly?
- Do you know how to test that PPE is being worn properly (for example, respirator fit testing)?
- Do you or your health and safety committee or representatives review the PPE rules and procedures?
- Do you or your health and safety committee or representatives help identify the needs for PPE?
- Do you review MSDSs and labels when working with chemicals to find out what PPE is required?
- Are you using the PPE as prescribed?
- Have you been instructed on how to properly care for and maintain your PPE?
- Do you have proper storage and cleaning facilities?
- Do you return used or damaged equipment in order to receive a reissue?
- Does your supervisor check PPE to ensure that it is serviceable?
- Does your workplace annually review usage in order to reevaluate the need for the selection and use of PPE?
- Do you use the PPE required by government regulations and company policy for the jobs you perform?
- Do you follow your organization's written PPE policy for specific jobs?