

# **WELDING AND FLAME CUTTING**

(See also: [COSHH\(19\)](#); [Pressure Systems\(62\)](#); [Soldering\(79\)](#); [LPG\(48\)](#); [Motor Vehicle Repair\(55\)](#); [Electricity\(24\)](#); [Electrical Equipment\(22\)](#); [Work Equipment\(91\)](#); [PPE\(63\)](#); [Fire Safety\(26\)](#)).

## **WELDING & FLAME CUTTING**

### **INTRODUCTION**

Welding is the union of pieces of metal by fusing the opposing surfaces that have been made molten by heat. Processes similar to welding include brazing and soldering. Allied processes include the removal and cutting of metals. Common heat sources are the electric arc and oxy - gas flames.

With electric arc welding the source of heat is an arc struck between the metals to be joined and an electrode. The electrode normally melts contributing to the molten pool between the pieces being joined.

Gas welding/cutting entails heat being applied to the metal by the flame from a torch in which a gas, such as acetylene, is burnt with a supply of oxygen or air.

There are two relevant safety publications:

- (i) HS(G)118 Electrical Safety in Arc Welding (HSE)
- (ii) HS(G)139 - The safe use of compressed gases in welding, flame cutting and allied processes (HSE)

The following summarised advice is taken mainly from these two publications.

### **ASSOCIATED HAZARDS (GENERAL)**

Physical injury - burns/eye injuries/electrocution/strains etc. from manual handling.

Radiation - producing skin irritation or arc eye.

Fumes - from the electrode, parent metals or coating/contamination of the parent metal.

Gases - nitrogen oxides, ozone and others.

Discomfort - Fumes and heat.

Fire and explosion.

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## **ARC WELDING - PRECAUTIONS**

Protective clothing to suit the hazard (i.e. gloves, boots, overalls, aprons, eye protection)

Appropriate selection, care and maintenance of equipment (conforming to appropriate parts of BS 638). Suitable electrical protection (eg insulation and earthing) to be ensured.

Efficient and convenient means of switching off the power supply.

Observance of safe working practices (See HS(G)118 - Electrical safety in arc welding pp 4-5).

Adequate information, instruction and training for employees.

Inspection and maintenance of all equipment by a competent person, with particular attention being paid to electrode holders, cables, plugs, sockets, clamps and earthing.

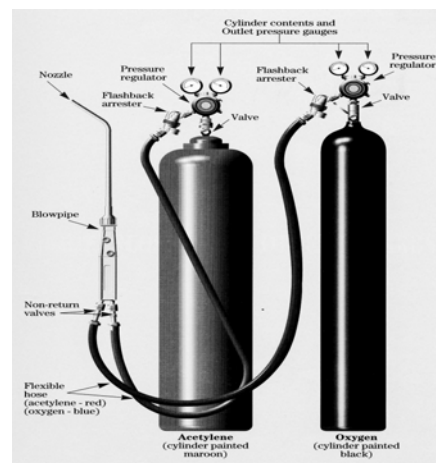
## **GAS WELDING**

(The most commonly used gases are acetylene and propane)

### **HAZARDS include:**

- leaks (from joints, fittings etc.) causing fires and explosions.
- enhanced fires and explosions due to oxygen.
- fire and explosions inside the equipment due to :
  - flashback
  - decomposition/detonation of acetylene
  - oxygen - promoted combustion (eg grease, oil, organic compounds etc)
- burns
- eye injuries (heat, intense light, ultra-violet radiation).
- explosion from over pressurisation.
- manual handling injuries from cylinders.

Typical equipment used comprises:



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## **PRECAUTIONS**

### **1 Provision of appropriate equipment and installations**

- **Materials** to be compatible with the gases used (construction, lubricants etc)
- Oxygen service equipment in particular to be free of any solid or liquid inorganic or organic contamination.
- **Cylinders to** comply with the Pressure Systems Safety Regulations 2000 and other relevant requirements.
- Use of appropriate **pressure regulators**, capable of safely handling the maximum supply pressure.
- Use of suitable **pressure gauges** (cylinder contents and outlet pressures)
- Use of suitable rubber **hose** (to BS EN 559, ISO 3821 or equivalent) is recommended. These have reinforced outer protective cover and resistant lining. Colour codings to be:
  - red for acetylene and other fuel gases except LPG
  - orange for LPG
  - blue for oxygen
  - black for non-combustible gases.
- Use of suitable **hose connections** (to BS 1389, ISO 3253 or equivalent); quick - action couplings should comply with BS EN 561 and ISO 7289)
- Use of suitable **blowpipes** (to BS 6503), suitable for the gases and process involved, producing a stable, adjustable flame and resistant to backfire.
- Use of appropriate **safety devices** including:
  - non-return valves (at each blow pipe inlet connection)
  - flame arresters - at the pressure regulator outlet connection of acetylene cylinders
    - at the pressure regulator outlet connection for other fuel gases and oxygen, or blowpipe inlet connections but this offers no protection against hose fires.
  - pressure relief valves-only if likely to exceed a pressure regulator outlet pressure of 20 bar g or more. The exception is in acetylene manifolds and distribution systems, where pressure-limiting devices must be fitted to prevent downstream pressure exceeding 1.5 bar g.

## **2. Storage and Handling of Cylinders**

- Storage of LPG - See element on Liquefied Petroleum Gas (LPG) in this manual
- Storage of other gases - preferably in clear open air; secure; free or well separated from toxic/corrosive/combustible materials; protection from heat and weather; adequate separation distance or fire wall. Detailed guidance is given in HS(G) 139 for storage in a separate building, or storage areas within a building (covering construction, separation, ventilation, explosion relief, control of sources of ignition)
- Cylinders for use to be stored and secured in upright position in a well-ventilated area within the workroom.
- Avoid hazardous manual handling activities - use of wheeled trolleys etc.

## **3. Personal Protective Equipment (PPE)**

- Eye protection (goggles with double lenses to protect against glare and flying fragments (replaceable outer lens to be clear and the inner lens tinted)
- Hand and arm protection
- Flame retardant protective clothing
- Safety footwear

## **4. Operating Procedures**

- Provision of adequate **training** for operatives and supervisors/managers
- Observance of **safe working practices** (detailed in HS (G) 139 pp 38 -42) covering pre-use equipment check, regular checks for leaks (particularly at joints) using a detergent solution, working with oxygen cylinders, lighting up and shutting down.
- Establishment of **emergency procedures** including evacuation, backfires, acetylene cylinders in fires etc.
- Prohibition on misuse of oxygen
- Ensure good ventilation and working practices to prevent exposure to substances above any Occupational Exposure Limits and to prevent any dangerous accumulations of fuel gas.

## **5. Fire Procedures**

- Safe location for the work.
- Removal or protection of combustible materials.
- Provision of suitable fire-fighting equipment.

## **6. Maintenance, Examination and Testing of Equipment**

- In addition to pre-use checks it is recommended that the following are included in a system of regular examination:
  - Leaks at connections.
  - Damage to hoses.
  - Correct operation of non-return valves, pressure regulators and pressure gauges.
  - Check for build - up of deposits of combustion products in flame arrestors (resulting in low gas flow rates)
  - Damage or malfunction of any other component.
- The necessary frequency of such checks will depend on the frequency of use of the equipment and work conditions.

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# **CHECKLIST - WELDING AND FLAME CUTTING**

- |   |  |     |    |
|---|--|-----|----|
| 1 | Have you carried out a risk assessment of welding/flame cutting activities?                                  | YES | NO |
| 2 | Have you carried out COSHH assessments, where necessary?   | YES | NO |
| 3 | Have you identified control measures/ precautions to minimise risks from the activity?                       | YES | NO |
| 4 | Do these measures include:   |     |    |
|   | • Care and maintenance of equipment and associated safety devices  | YES | NO |
|   | • Instruction and training of staff in safe working practices.   | YES | NO |
|   | • Keeping records relating to the 2 items above  | YES | NO |
|   | • The issue and use of PPE   | YES | NO |
|   | • Actions to ensure a safe and healthy environment in which to work (ventilation, housekeeping, signage etc) | YES | NO |
|   | • Standards for proper storage and handling of cylinders   | YES | NO |

## **REFERENCES/FURTHER DETAILS**

- \*1 Booklet: HS(G) 139 The Safe Use of Compressed Gases in Welding, Flame Cutting and Allied Processes (HSE) ISBN 0 - 7176 - 0680 - 5
- \*2 Booklet: Safe Under Pressure, available from BOC Ltd. The Priestly Centre, 10 Priestley Road, The Surrey Research Park, Guildford, Surrey. Telephone: (01483) 579857.
- \*3 HS(G)118 - Electrical safety in arc welding (HSE) ISBN 0-7176 - 0704 - 6.

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- \* Available to view by prior arrangement at Nuneaton and Bedworth Borough Council, Environmental Health Services, Council House, Coton Road, Nuneaton. CV11 5AA
- \*\* Free copy available from Nuneaton and Bedworth Borough Council at the above address.

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