Welding
Jeremy Stranks

Welding and flame cutting operations involve the application of intense heat, either from an electrical source, or by the use of a compressed gas. There are a number of hazards presented by welding operations, and also a number of items of legislation relating to this work. The risks posed by the hazards need to be properly controlled by a suitable and sufficient risk assessment resulting in a safe system of work, possibly including a permit to work system and also the health issues of the workers exposed to the hazards. It is important to consider the working environment, often controlled by suitable ventilation, and those other than the operators that are also affected by the operations.

Latest Updates

13/ 11/ 2003
The HSE has issued a leaflet and poster to provide guidance on the choosing and Manual Handling of welding sets.

09/ 12/ 2002
Legislation relating to flammable materials, which would affect the control imposed by the Pressure Systems Safety Regulations 2000 of the risks during welding, was repealed by the Dangerous Substances and Explosive Atmospheres Regulations 2002 (S.I. 2002, No. 2776).

05/ 06/ 2002
New topic as an Introduction to Welding on the hazards presented by welding operations and what can be done to control the risks including assessment, safe system of work and permit to work system. The health issues of the workers exposed to the hazards and the legislation concerning this type of work are also covered.

Table of Contents

• Quick View ........................................................................................................... 4
• 1. Introduction to Welding ..................................................................................... 5
  • 1.1 Overview of Welding ..................................................................................... 5
  • 1.2 Significant Welding Hazards ......................................................................... 5
    • 1.2.1 Overview of Welding Hazards .................................................................. 5
    • 1.2.2 Fire and Explosion .................................................................................. 5
    • 1.2.3 Burns ....................................................................................................... 6
    • 1.2.4 Toxic Fumes and Gases .......................................................................... 6
    • 1.2.5 Oxygen Enrichment ................................................................................ 6
    • 1.2.6 Infrared and Ultra-violet Radiation .......................................................... 6
    • 1.2.7 Electrical Hazards .................................................................................... 6
    • 1.2.8 People Exposed to the Risk ..................................................................... 7
• 2. Legislative Requirements of Welding ................................................................. 8
  • 2.1 Health and Safety at Work etc. Act 1974 ......................................................... 8
  • 2.2 Management of Health and Safety at Work Regulations 1999 ....................... 8
  • 2.3 Provision and Use of Work Equipment Regulations 1998 ............................... 8
  • 2.4 Reporting of Injuries, Diseases and Dangerous Occurrences Regulations ....... 8
  • 2.5 Electricity at Work Regulations 1989 ............................................................... 8
  • 2.6 Personal Protective Equipment at Work Regulations 1992 ............................. 8
  • 2.7 Manual Handling Operations Regulations 1992 .............................................. 9
  • 2.8 Control of Substances Hazardous to Health Regulations 2002 ...................... 9
- 2.9 Confined Spaces Regulations 1997 ................................................................. 9
- 2.10 Noise at Work Regulations 1989 ................................................................. 9
- 2.11 Control of Lead at Work Regulations 2002 ............................................... 9
- 2.12 Construction Related Legislation ............................................................. 9
- 2.13 Pressure Systems Safety Regulations 2000 ................................................. 9
- 3. Welding Risk Controls .................................................................................. 10
  - 3.1 The Scope of the Risk Assessment ............................................................. 10
  - 3.2 Welding and Flame Cutting Risk Assessment ........................................... 10
  - 3.3 Setting Up a Safe System of Work ............................................................. 12
  - 3.4 The Environment in Which the Welding is Being Undertaken ............... 13
    - 3.4.1 Layout of the Welding Work Area ....................................................... 13
    - 3.4.2 Welding at Heights ........................................................................... 13
    - 3.4.3 Welding in Confined Spaces ............................................................... 13
  - 3.5 Personal Protective Equipment .................................................................. 13
  - 3.6 Storage of Welding Equipment .................................................................. 14
  - 3.7 Flashback Arrestors ................................................................................ 14
  - 3.8 Airborne Contaminants .......................................................................... 15
    - 3.8.1 General Airborne Contaminant Controls ......................................... 15
    - 3.8.2 Extra Controls Where Lead May be Involved ..................................... 15
  - 3.9 Ventilation ................................................................................................ 15
  - 3.10 Emergency Arrangements ....................................................................... 16
  - 3.11 Maintenance and Inspection ................................................................... 16
    - 3.11.1 Daily Checks .................................................................................. 16
    - 3.11.2 Routine Inspections ....................................................................... 17
  - 3.12 Record Keeping, Monitoring and Review ............................................... 17
- 4. Protection of People Exposed to the Health Risks of Welding ....................... 18
  - 4.1 Suitability of Worker .............................................................................. 18
  - 4.2 Authorisation of Workers ....................................................................... 18
  - 4.3 Manual Handling .................................................................................... 18
  - 4.4 Health Risk Assessment ......................................................................... 18
  - 4.5 Instruction Information and Training ...................................................... 18
    - 4.5.1 Welding Operator Training ............................................................... 18
    - 4.5.2 Instruction for Other Exposed People .............................................. 18
  - 5. Further Information ................................................................................. 23
  - 5.1 Health and Safety Executive Publications ............................................. 23
  - 5.2 British Standards .................................................................................... 23
  - 5.3 Professional Bodies and Associations .................................................... 24
  - Key Questions ................................................................................................ 26
  - Troubleshooter .............................................................................................. 27
    - Welding Fume .......................................................................................... 27
    - Fixed or Portable LEV ............................................................................. 27
    - Liaison with Emergency Services ............................................................ 27
  - Checklists ..................................................................................................... 28
    - Risk Assessment of Welding and Flame Cutting Operations ..................... 28
    - Additional Assessment for Welding Using Electrical Equipment .......... 29
    - LEV Examination .................................................................................... 30
    - Model Documents ................................................................................... 31
• Safe System of Work for Welding ........................................................ 31
• Welding Training Programme ............................................................ 31
• Addresses ...................................................................................... 35

Welding
(Printed 4/5/2004)

Copyright © GEE Publishing Ltd 2004
1. Welding and flame cutting operations involve the application of intense heat, either from an electrical source or by the use of a compressed gas. There are a number of hazards presented by welding operations, including fire, explosions, burns, electric shock, hazardous fume and vapours, oxygen enrichment or displacement and exposure to non-ionising radiation. See Introduction to Welding.

2. There are a number of items of legislation relating to this work, relating to general issues, such as the general duties of employers, risk assessment, the provision of safe equipment and so on, and also certain items of legislation covering more specific hazards, such as exposure to lead. See Legislative Requirements of Welding.

3. The risks posed by the hazards of welding must be properly controlled, starting with a suitable and sufficient risk assessment. From this a safe system of work can be drawn up, possibly including the use of a permit to work system, that takes into account the working environment, personal protective equipment, airborne contamination and its control - usually by ventilation, emergency arrangements, maintenance and record keeping. See Welding Risk Controls.

4. It is important to ensure the health of the workers exposed to the hazards of welding operations. This would include considerations of the suitability of the worker, ensuring that manual handling risks were properly controlled, health risk assessments, where necessary, are conducted and that proper instruction, information and training are undertaken. See Protection of People Exposed to the Health Risks of Welding.

5. There are a number of sources of further, more area specific, information available from the Health and Safety Executive, British Standards and Professional Bodies and Associations. See Further Information.
1. Introduction to Welding

1.1 Overview of Welding

Welding and flame cutting operations involve the application of intense heat, either from an electrical source (electrical arc welding) or by the use of a compressed gas, such as acetylene or propane, with a view to joining two metals together, or for cutting sheet metal to a specific shape or for a specific purpose, e.g. metal fabrication operations.

See also The Definition of Hot Work.

1.2 Significant Welding Hazards

1.2.1 Overview of Welding Hazards

The principal hazards likely to be encountered during welding and flame cutting operations are:

1. Heat from work - causing injury to the operator or people nearby, or damage to materials or the fabric of the building.
2. Hazardous fumes and toxic vapours - caused by vaporisation of solids or pyrolysis (change of chemical composition due to heating) during the welding or cutting; for example, when burning lead-based paint or welding stainless steel.
3. Sparks, for example from cutting or grinding - can cause a fire.
4. Hot splashes, particularly of hot molten metal - can cause injury or start fires.
5. Explosion risk from leaks of gases - particularly oxygen.
6. Fire risk - from welding or cutting in flammable atmospheres.
7. Fire risk - from welding or cutting on, or near fuel lines or containers of flammable liquid - especially if empty, since there is a more explosive mixture in an empty or partially empty container.
8. Fire risk - from nearby combustible materials igniting, even after work has ceased - the fire can also be remote from work as a result of heat conduction through the structure of the building.
9. Explosive rupture of gas cylinders - perhaps through damage or overheating.
10. Explosive rupture of sealed vessels on which welding or cutting is being carried out - e.g. drums and vehicle wheels with tyres still affixed.
11. Electrical hazards from electric arc welding - including inappropriate or ineffective earth returns from work piece causing local heating and possibly a fire.
12. Visual hazards from electric arc welding - caused by the dazzle of the bright arc and the emission of infrared and ultra-violet radiation.
13. Visual hazards - posed by the use of lasers for welding and cutting.

1.2.2 Fire and Explosion

Arcs, flames, sparks and metal spatter (the ejection of small particles of molten metal in all directions) are sources of ignition which will readily ignite flammable materials and waste in the immediate vicinity of the welding operation. Welding on systems or vessels under pressure can result in explosion.

In the case of gas welding, gases commonly used are acetylene and propane, both of which form flammable mixtures with air or oxygen. Any leakage of fuel gas is potentially hazardous, as ignition may lead to rapid or explosive combustion, particularly in confined spaces or poorly ventilated areas. Propane is heavier than air, can accumulate at floor level and will readily ignite. Acetylene, an unstable gas, can decompose explosively when subjected to heat or shock. This can
occur in the absence of oxygen and under pressure.

One of the classic causes of explosion is associated with welding operations carried out on a vehicle chassis in close proximity to the vehicle's petrol tank. The welding of tanks, drums and vessels which have not been completely freed of their flammable contents and/or purged with an inert gas can frequently result in explosions, in many cases having fatal results.

1.2.3 Burns

Welders are commonly exposed to hot surfaces and may suffer burns, in particular, to the hands and arms. Flying metal spatter may also burn other parts of the body, such as the face and neck.

1.2.4 Toxic Fumes and Gases

The inhalation of welding and cutting fumes can lead to the condition known as 'welders lung' or siderosis. Metallic fumes in the form of oxides can be evolved according to the nature of the base metals and electrodes in use. This is also the case with flux coatings. The action of heat and ultra-violet leads to the evolution of ozone, carbon monoxide and oxides of nitrogen. Heavy particulate matters in the form of respirable dusts can be created as smoke and metal spatter. Many of the gases, vapours, fumes and dusts evolved are invisible, colourless and odourless, so considerable care must be taken when welding in confined spaces or unventilated areas.

1.2.5 Oxygen Enrichment

Most welding and cutting operations use oxygen to support combustion of the fuel gas. Accidental leakage of oxygen has, therefore, considerable hazard potential. Oxygen enrichment will cause a change in the ignition characteristics of all combustible materials, including those considered to be non-combustible. Any oxygen leakage in confined or unventilated areas is a matter for immediate concern, which was the cause of the deaths in the case of R v. Swan Hunter Shipbuilders Ltd [1982] AER 264.

Activities that can cause oxygen enrichment include flame cutting, which can discharge up to 30% unconsumed oxygen into the atmosphere. On this basis, flame cutting should not be carried out in a confined space or area until special arrangements to control ventilation have been made.

1.2.6 Infrared and Ultra-violet Radiation

Welding and flame cutting operations can expose both operators and other persons in the immediate vicinity to electric arcs radiating both infrared (radiant heat) and ultra-violet (UV) radiation. UV radiation can be hazardous in that it affects the skin and eyes in a similar way to the sun.

Exposure to UV radiation can also result in the condition known as 'arc eye', a painful but temporary form of conjunctivitis. This can have an acute effect on the eye with extensive irritation and the painful sensation of 'grittiness' of the surface of the eyeball. Chronic effects can include permanent visual damage and, in extreme cases, blindness following prolonged exposure.

1.2.7 Electrical Hazards

Electric arc welding hazards can arise through poor maintenance and/or repair of equipment, improper use, and the use of unsuitable materials, e.g. insulation tape, to effect repairs to equipment and connections.

With portable welding sets the use of an inadequate power supply circuit, the need to remake earth connections for each job, and strain or damage to terminals and connections to the welding set can result in danger to operators and others in the immediate vicinity.

Electric welding sets operate on a circuit incorporating:

1. The welding lead, which carries the current from the welding set to the electrode and to the component.
2. The welding return lead, which returns the current from the component to the welding set.

3. The welding earth, which must be connected to the component.

The welding return lead is essential to prevent current taking random paths, for instance, via structural steelwork, metal pipes, etc. A particular danger is that if a random path includes a loosely bolted connection, a high resistance is set up which will cause heat to generate as the current flows through it, possibly resulting in fire. The welding return lead should be firmly clamped to the component.

The welding earth is necessary to maintain the component at earth potential and thus prevent electric shock by safeguarding against the possibility of the component becoming energised at mains voltage, or energised because of the lack of continuity in the welding return.

1.2.8 People Exposed to the Risk

Welders are at risk from:

1. High temperatures which can result in fire and burns.

2. The inhalation of dusts, fumes, gases causing welder’s lung and other conditions affecting the respiratory system.

3. Thermal radiation causes burns to the skin and arc eye.

4. Oxygen enrichment or insufficiency, particularly when working in confined spaces.

5. Electric shock.

6. Explosions, often with fatal results.

Other nearby workers such as other employees, contractors and visitors to the site, who may approach the workplace, need to be considered, particularly from hazards of fire and explosion, intense light and spatter. If the work takes place close to where members of the public may be present, action may have to be taken to protect them from the hazards also, e.g. by the use of screens and barriers.
2. Legislative Requirements of Welding

2.1 Health and Safety at Work etc. Act 1974

The Health and Safety at Work etc. Act 1974 applies to all employers and requires them to provide for employees safe plant and systems of work, safe articles and substances for use at work, information, instructions, training and supervision and a safe and healthy environment.

2.2 Management of Health and Safety at Work Regulations 1999

The Management of Health and Safety at Work Regulations 1999 (S.I. 1999, No. 3242) impose absolute duties on employers to undertake risk assessments, install management systems, appoint competent persons to assist the employer, provide comprehensible and relevant information and provide health and safety training in specific circumstances.

2.3 Provision and Use of Work Equipment Regulations 1998

The Provision and Use of Work Equipment Regulations 1998 (S.I. 1998, No. 2306) impose absolute duties on employers to maintain work equipment, ensure its suitability for the purpose, restrict the use of high risk equipment to designated persons, ensure designated persons are adequately trained and all those who use equipment are provided with adequate information, instruction and training.

2.4 Reporting of Injuries, Diseases and Dangerous Occurrences Regulations

Under the Reporting of the Injuries, Diseases and Dangerous Occurrences Regulations 1995 (S.I. 1995, No. 3163) (RIDDOR) occupational asthma contracted as a result of fumes arising from the use of rosin based flux and also from stainless steel welding is a reportable disease.

2.5 Electricity at Work Regulations 1989

The Electricity at Work Regulations 1989 (S.I. 1989, No. 635) cover all electrical equipment used at work, which will include electric arc welding.

The Regulations require employers to ensure that:

1. All electrical systems to be constructed are properly maintained.
2. Work activities connected with electrical equipment are carried out in a safe manner.
3. Equipment is not exposed to adverse or hazardous environments.
4. Earthing is provided, or other suitable precautions are taken where a system may become electrically charged.
5. There must be efficient means for protection against excess current.
6. Means for cutting off the electrical supply and the isolation of any circuit.
7. Adequate working space, means of access and lighting must be provided where necessary.

2.6 Personal Protective Equipment at Work Regulations 1992

The Personal Protective Equipment at Work Regulations 1992 (S.I. 1992, No. 2966) require that any personal protective equipment (PPE) provided, as in this case for use in welding and flame cutting operations, is suitable. This means that the PPE must be appropriate to the risks and conditions where exposure may occur, must take account of the ergonomic requirements and state of health of the wearer, must fit the wearer correctly and be effective in preventing or adequately
controlling the risks without increasing the overall risk.

2.7 Manual Handling Operations Regulations 1992

The Manual Handling Operations Regulations 1992 (S.I. 1992, No. 2793) lay down requirements for the handling of items, which would include such loads as gas cylinders, which may cause injury if the risks are not properly assessed and controlled.

Employers must undertake a risk assessment of the manual handling operations and reduce the risks to the lowest extent reasonably practicable, in particular by the avoidance of the need to handle loads that have a significant risk of causing injury by the use of physical effort.

2.8 Control of Substances Hazardous to Health Regulations 2002

The Control of Substances Hazardous to Health Regulations 2002 (S.I. 2002, No. 2677) require an employer to undertake a health risk assessment wherever an employee may be exposed to a substance hazardous to health. Welders can be exposed to hazardous fumes and gases, and these risks must be assessed and adequately controlled.

2.9 Confined Spaces Regulations 1997

The Confined Spaces Regulations 1997 (S.I. 1997, No. 1713) apply wherever welding may be carried out in a confined space. Employers must avoid entry to confined spaces wherever possible. Where this is not possible, they must ensure employees follow a safe system of work, e.g. a Permit-to-Work system, and provide adequate emergency arrangements before work starts.

2.10 Noise at Work Regulations 1989

The Noise at Work Regulations 1989 (S.I. 1989, No. 1790) impose duties on employers to prevent the exposure of employees to noise which could cause hearing damage, such as occupational deafness. Welding operations frequently expose operators to this risk and reasonable practicable measures to prevent exposure should be taken. Where prevention of exposure to dangerous levels of noise is not possible, employees must be provided with ear protectors, and their use ensured.

2.11 Control of Lead at Work Regulations 2002

The Control of Lead at Work Regulations 2002 (S.I. 2002, No. 2676) require proper control of the exposure of people to lead as a result of work activities. For certain welding and flame cutting operations, where there is a risk of exposure to lead fume, these regulations will apply.

2.12 Construction Related Legislation

The Construction (Design and Management) Regulations 1994 (S.I. 1994, No. 3140) and the Construction (Health, Safety and Welfare) Regulations 1996 (S.I. 1996, No. 1592) apply where welding and flame cutting operations feature as part of project work or demolition operations.

2.13 Pressure Systems Safety Regulations 2000

The Pressure Systems Safety Regulations 2000 (S.I. 2000, No. 128) apply to certain systems using compressed gases. This applies to certain aspects of welding operations, such as those involving compressed air.
3. Welding Risk Controls

3.1 The Scope of the Risk Assessment

A suitable and sufficient risk assessment must be undertaken, taking into account the requirements and prohibitions imposed by, or under the relevant statutory provisions. Each of the hazards identified (see Significant Welding Hazards) should be considered, as well as any hazards specific to a particular workplace, e.g. a construction site, engineering workshop or transport maintenance workshop, perhaps incorporating an inspection pit, which could be used for welding activities.

More specific risk assessments, such as those required under the Control of Substances Hazardous to Health Regulations 2002 (S.I. 2002, No. 2677), the Control of Lead at Work Regulations 2002 (S.I. 2002, No. 2676) and the Provision and Use of Work Equipment Regulations 1998 (S.I. 1998, No. 2306), may be required prior to work commencing.

It is important to consider who is at risk, e.g. in a workplace employing a number of temporary staff, young persons or workers whose knowledge and command of English is limited.

3.2 Welding and Flame Cutting Risk Assessment

The hazards from welding are many, however they are often made worse by the extra hazards presented by the environment in which the hot work (welding etc) is taking place. As a result a general checklist can be used but it must be considered within the context of the area and conditions in which the work will be undertaken.

Wherever possible welding and flame cutting operations should be avoided. It is important to determine whether a less hazardous alternative method can be used, such as drilling and bolting and the use of mechanical cutting methods, and if not, the reasons for this recorded as part of the risk assessment.

Risk Assessment of Welding and Flame Cutting Operations

- Can welding or flame cutting operations be avoided by the use of other means?
- Are competent persons appointed to assist the employer in complying with the relevant statutory provisions applying to the welding and flame cutting operations?
- Is an emergency procedure established in the event of fire or explosion from welding and flame cutting operations?
- Are employees provided with comprehensible and relevant information on the safe operation and use of the equipment and the systems of work to be followed?
- Do employees operate and use the equipment in accordance with training and instructions received, and report situations of serious or immediate danger or shortcomings in protection arrangements?
- Is the equipment maintained in an efficient state, in efficient working order and in good repair and records of maintenance kept?
- Is the use of this equipment restricted to those given the task of using it, and any repairs, modifications, maintenance or servicing restricted to designated persons?
- Are designated persons adequately trained and have supervisors and managers received similar adequate training?
- Is safety or other protective equipment suitable for its purpose, suitably maintained and properly used?
- Is a Permit-to-Work system operated for welding and flame cutting operations where there is a
foreseeably high level of risk, particularly those in confined spaces?

• Is the equipment frequently examined, inspected and tested by a competent person?

• Are all liquefied petroleum gas (LPG) cylinders stored either in the open air or in a purpose-built storeroom?

• Are LPG storage tanks, cylinders, and storerooms suitably marked 'HIGHLY FLAMMABLE - LPG'?

• Is the fire certificate in force in respect of storage arrangements?

• Is personal protective equipment provided for operators:
  • appropriate for the risks and conditions?
  • selected taking into account the ergonomic requirements and state of health of the wearer or user?
  • capable of fitting the wearer correctly?
  • effective in preventing or adequately controlling the risks without increasing the overall risk?

• Has a suitable and sufficient risk assessment of manual handling operations involving gas cylinders and other heavy items of equipment been undertaken?

• Has a health risk assessment for welding and flame cutting operations been carried out?

• Is exposure to welding fume either prevented or adequately controlled?

• Are welding fume or other airborne contaminant exposures below the stated Occupational Exposure Levels?

• Are welding workshops provided with mechanical ventilation capable of achieving six to ten air changes per hour?

• Is local exhaust ventilation provided at the point of fume production?

• Are portable extraction and filtration units used when welding is undertaken in situ on plant and equipment?

• Do sound pressure levels in welding and flame cutting operations exceed the First Action Level for noise exposure?

• Where employees are likely to be exposed to the First Action Level or above, has a noise assessment been undertaken by a competent person?

• Where operators may be exposed to lead fumes, has a health risk assessment been undertaken prior to work commencing?

• Is respiratory protective equipment further provided where control measures do not provide adequate protection?

• Where exposure to lead is significant, is adequate protective clothing provided?

• Are adequate washing facilities, together with separate facilities for the storage of protective clothing and clothing not worn during working hours, provided for operators who may be exposed to lead fumes?

• Is suitable air monitoring undertaken, where necessary, and records of such monitoring maintained?
• Are employees under medical surveillance by an Employment Medical Adviser (EMA) or appointed doctor where exposure to lead is significant or required by an EMA, and records of such surveillance maintained?

• Are employees aware of their duty to report defects in control measures, and of the need to present themselves for medical examination or biological tests?

• Are welding and flame cutting requirements, and the precautions necessary, considered at the design stage of projects?

• Are safe welding and flame cutting procedures incorporated in the rules for the management of the construction work?

• Is the pipework to which transportable gas containers may be connected provided with such protective devices as may be necessary for preventing danger?

**Additional Assessment for Welding Using Electrical Equipment**

• Are all electrical systems maintained as to prevent danger?

• Is efficient means provided for protection against excess current?

• Is adequate working space, means of access and lighting provided where necessary?

• Is the equipment installed in accordance with BS7671: 1992 Requirements for Electrical Installations; IEE Wiring Regulations, other relevant British Standards and manufacturer's instructions?

• Is a separate earthing conductor installed in addition to the welding current return cable?

• Is any damage to the insulation of cables, electrode holders, torches etc. repaired immediately, or the item replaced?

• Is the amount of trailing cable minimised to avoid impact damage and the danger from tripping?

• Are joints and connections mechanically and electrically suitable?

• Is there suitable means for cutting off the electricity supply to the equipment and are isolation switches readily available?

• Are all mains and secondary cables, terminals and cable connectors of adequate size and construction for the maximum welding current?

• Are terminal and live components adequately protected?

• Are earthing circuits of adequate capacity?

• Is there damage to the insulation of cables, electrode holders, torches, etc and should this be repaired immediately or the item replaced?

• Is the amount of trailing cable minimised?

• Are extra precautions necessary where work is to be carried out in wet, hot or damp conditions?

### 3.3 Setting Up a Safe System of Work

A safe system of work should be operated during all welding and flame cutting operations undertaken by employees or those of contractors. All persons involved in these operations should be trained in the safe system of work. The hazards and precautions necessary on the part of all persons at work when these operations are carried out should be incorporated in induction training of all employees.
1. Only appropriately trained employees, authorised in writing, may handle or use welding or flamecutting equipment, including gas cylinders.

2. Operating instructions and safety signs should be followed and any shortcomings or faults with equipment, procedures or the safe system of work should be reported immediately to your supervisor, who will initiate appropriate action.

3. Welding screens and notices must be in place at all times when welding is in progress. Anyone other than authorised employees in that department must report to the departmental supervisor before entering the welding area.

4. All potentially hazardous incidents and accidents involving welding or flamecutting should be reported to your supervisor. First aid notices in each department give details of first-aiders who are competent to deal with incidents or accidents involving pressure fluids.

5. These procedures will be monitored and reviewed as necessary.

Signed: _____________________________ (Site Manager)

Date: ______________

See also Controlling the Risk of Hot Work.

### 3.4 The Environment in Which the Welding is Being Undertaken

#### 3.4.1 Layout of the Welding Work Area

The layout of the working area should be such that there is sufficient space for welding operations to be undertaken safely. Safe access to, and egress from the work area should be provided. There should be no obstructions or physical barriers that prevent rapid egress from the work area.

The work area should be segregated by the use of fire resistant screens or covers to prevent persons other than the welder being exposed to intense light.

#### 3.4.2 Welding at Heights

Where the task entails working at a height, a purpose-designed scaffold or mobile access tower should be provided. Special consideration must be given to the means of transferring gas cylinders from ground level to the working platform.

#### 3.4.3 Welding in Confined Spaces

Dangerous levels of fumes and gases, oxygen enrichment or a lack of oxygen can arise during welding in confined spaces, such as tanks or unventilated spaces.

In accordance with the **Confined Spaces Regulations 1997 (S.I. 1997, No. 1713)**, a work activity risk assessment must take these specific factors into account. Immediate action arising from a risk assessment should include the need to operate a Permit-to-Work system and the preparation of an emergency procedure which will also safeguard rescuers, together with the training of designated competent persons to implement the emergency procedure when necessary. Continuous air monitoring is also most likely to be necessary in these cases.

### 3.5 Personal Protective Equipment

Those involved in welding and flame cutting operations must be provided with appropriate Personal Protective Equipment (PPE), namely goggles, welding masks or face shields, gloves, aprons, overalls and safety footwear. This may entail undertaking some form of risk assessment of the PPE prior to the task commencing.

Under the **Personal Protective Equipment at Work Regulations 1992**, a PPE risk assessment must ensure that PPE:

1. Is appropriate for the risks and conditions.
2. Takes account of the ergonomic requirements and state of health of the wearer.
3. Is capable of fitting the wearer correctly.
4. Is effective in preventing or adequately controlling the risks without increasing the overall risk.

Employers must assess the suitability of PPE at the selection stage and review the assessment if it is no longer valid or where there is a significant change in the matters to which it relates.

Employers must maintain that any PPE is in an efficient state, in efficient working order and in good repair, including the replacement and cleaning of the PPE.

Adequate storage accommodation must be provided for PPE when not in use and employees have a duty to return PPE to the accommodation provided.

In the selection of PPE for use in welding and flame cutting operations, the following points should be noted:

1. Face masks and goggles should be fitted with dark glass to BS679 standard in order to protect eyes from ultra-violet radiation and intense light.
2. Overalls should be flame retardant and specially designed with flaps on pockets to prevent sparks being trapped, and zip or Velcro fastenings.
3. The use of a safety helmet incorporating a welding mask is common practice for many welding and flame cutting operations, in certain cases, where welding fume may not disperse quickly, for instance, in confined spaces, 'Airstream' helmets and face masks, using an independent fresh air supply, may be necessary.
4. Welders should wear safety boots with gaiters where there may be a risk of spatter.
5. Ear protection, e.g. ear muffs, may be necessary where sound pressure levels exceed 85 dB(A) over a normal eight hour working period.

### 3.6 Storage of Welding Equipment

Storage areas should be of fire resistant construction and designed in such a way that, in the event a fire, cylinders can be removed quickly. Hazardous compressed gas cylinders, such as those containing acetylene, should be stored in an upright position and used in conjunction with a trolley or cradle. Full and empty cylinders should be kept apart and notices displayed indicating their specific storage positions. Cylinders should be stored well away from any heat source and combustible material.

All LPG (Liquefied Petroleum Gas) cylinders should be stored either in the open air, or in a purpose-built store room or storage area. Small quantities can be stored in a purpose-made cupboard or bin. LPG storage tanks, cylinders and storerooms should be marked ‘HIGHLY FLAMMABLE - LPG’. Stored cylinders should be suitably restrained and their valves protected from impact damage. Where acetylene or other combustible gas cylinders are kept in store, the lighting should be of the approved flameproof type. Switches must also be flameproof and located outside the store.

Fuel gas and oxygen cylinders should be stored separately, at least six meters apart in the open, or in a store of fire-resistant construction, with permanent high and low-level ventilation to allow any leaking gases to disperse.

Containers that have held a flammable liquid should be made safe by cleaning and/or inerting, and then purging with air. The container should be certified as free of flammable vapour and posing no harmful inhalation risk.

### 3.7 Flashback Arrestors

‘Flashback’ is a hazard commonly associated with the use of oxygen and fuel gas cylinders. Flashback arrestors and hose check valves must be installed to fuel gas and oxygen regulators and manifolds. Similarly acetylene manifolds must be fitted with a flashback arrester. The purpose of a flashback arrester is to stop and extinguish a flashback, to prevent a reverse flow of gases and to close off the supply of gas in the event of a flashback.
3.8 Airborne Contaminants

3.8.1 General Airborne Contaminant Controls

The risk of inhalation of toxic gases, fumes and other airborne contaminants arising from welding and flame cutting operations must be considered. A complex combination of airborne gases and particulates can be produced according to the type of equipment used, the metals being worked on, the fluxes used and the secondary effects of metallic coatings and paints when exposed to intense heat.

A number of management systems must be operated to prevent the risk of inhalation of airborne contaminants by operators.

These include:

1. health risk assessment
2. monitoring the effectiveness of local exhaust ventilation systems
3. supervision of the wearing and use of PPE
4. health surveillance

3.8.2 Extra Controls Where Lead May be Involved

Wherever welding may expose operators to risk of exposure to lead fume, the requirements of the Control of Lead at Work Regulations 2002 (S.I. 2002, No. 2676) must be taken into account in the health risk assessment undertaken prior to commencing work.

Factors to be considered include:

1. Control and maintenance of protective measures, e.g. LEV systems.
2. Provision of the appropriate respiratory protective equipment and protective clothing where necessary.
3. Continuous air monitoring.
4. The provision of medical surveillance.
5. The provision and maintenance of appropriate welfare amenities, including separate storage arrangements for protective clothing and clothing not worn during working hours.
6. A total ban on eating, drinking and smoking in places liable to become contaminated by lead fume.

3.9 Ventilation

Wherever practicable, welding and flame cutting should take place in a controlled environment, such as a welding workshop. Such workshops should be provided with mechanical ventilation, local exhaust ventilation (LEV) should be provided at the point of fume emission.

In the case of specific welding booths and work benches, an LEV system of the receptor type, capable of achieving a face velocity of 0.5 m s\(^{-1}\) generally and at least 1 m s\(^{-1}\) at the weld, should be installed. Where welding is undertaken in situ on machinery, plant or structures, portable extraction and filtration units should be used.

Under the Control of Substances Hazardous to Health Regulations 2002 (S.I. 2002, No. 2677) the LEV systems should be subject to regular maintenance, examination and testing.

LEV Examination
• Generally, the system should show evidence of being maintained in an efficient state, in efficient working order and in good repair.

• Records must be maintained indicating the frequency of maintenance and repairs, or modifications made to the system.

• All hoods, enclosures, ducting, filters, fans and inlets should be regularly examined for evidence of blockage, corrosion and malfunction.

• Air samples, to assess the effectiveness of the system in removing contaminants, should be taken at the entry point to, e.g. a hood, and exit point from the system.

• The system should be tested using a standard smoke stick and air speed indicators to indicate air flow and the efficiency of same.

• Fan motors should be monitored regularly to ensure they are maintaining the specified air velocity to the system.

3.10 Emergency Arrangements

There should be a fully established emergency procedure to cover situations of serious or imminent danger, such as explosion or fire.

Emergency procedures should include:

1. the sounding of the alarm
2. the isolation of power sources, where possible
3. orderly evacuation of premises
4. mustering of employees at identified assembly points
5. provision of first aid treatment to injured employees
6. calling the fire, police and ambulance services

Extensive fire and explosions may require evacuation of surrounding industrial and residential premises. Competent persons should be trained and appointed to deal with the established emergency procedure.

Carbon dioxide or foam fire appliances and other fire-fighting equipment should be provided in the immediate vicinity of the welding operation and cautionary safety signs displayed prior to commencing work. Welders should be trained in the correct use of fire appliances.

3.11 Maintenance and Inspection

3.11.1 Daily Checks

Operators, prior to commencing work, should check the following items on a daily basis:

1. personal protective equipment, e.g. face mask, goggles, ear protectors
2. welding leads and earths
3. joints and connections
4. means of isolation of electricity/gas supply
3.11.2 Routine Inspections

Routine inspections of welding and flame cutting equipment are recommended to ensure that the equipment is in an efficient state, in efficient working order and in good repair. Repairs and replacement of defective items should be undertaken immediately. It is recommended that trained operators undertake these inspections on a monthly basis and a record is maintained of such inspections.

3.12 Record Keeping, Monitoring and Review

Record keeping is required for proof of compliance as well as for monitoring the effectiveness of the health and safety management system.

Records could include:

1. The risk assessment.
2. Training records and a list of designated persons.
3. Inspection and maintenance records, including those for PPE.
4. Where local exhaust ventilation is required, record of the ventilation system specification and thorough testing and examination.
6. Records of any reported defects, incidents or accidents and actions taken.
7. For each pressure system covered by the Pressure Systems Safety Regulations 2000 (S.I. 2000, No. 128), the original scheme of inspection, manual and specification, reviews and reports, the nature and frequency of statutory examinations and all associated records.

The assessment should be reviewed periodically, say every two years, or following an incident or reported defect or shortcoming in the protection arrangements, or when circumstances or knowledge changes.
4. Protection of People Exposed to the Health Risks of Welding

4.1 Suitability of Worker

Regular health surveillance may identify workers who show evidence of respiratory disorders, in particular siderosis (welder’s lung). Such persons may need to be excluded from further welding activities. Medical advice should be sought to determine what action, if any, should be taken.

4.2 Authorisation of Workers

Use of the equipment should be limited to designated operators who are also competent to undertake repairs, modifications, maintenance or servicing. Designated persons must have adequate information, instruction and training, together with written instructions on the correct use of the equipment, foreseeable abnormal situations and the action to be taken in such situations.

4.3 Manual Handling

The manual handling of cylinders, in particular, may expose personnel to risk of back injury, which is likely to include such conditions as hernia, prolapsed intervertebral disc or ligamental strain. Such activities should be subject to a manual handling risk assessment.

The Manual Handling Operations Regulations 1992 require employers, so far as is reasonably practicable, to avoid the need for manual handling. Where this is not possible, they must make a suitable and sufficient assessment of any manual handling operation at work that involves a risk of injury. Factors to be considered include the task, the load, the working environment, individual capability and the effects of the wearing and use of PPE.

The HSE has produced a guidance leaflet Choosing a Welding Set (INDG 390) and an accompanying poster, Welding set buyers guide: Considering manual handling. These are available from HSE Books or free from the HSE website at www.hse.gov.uk/pubns/indg390.pdf (leaflet) and www.hse.gov.uk/pubns/indg390poster.pdf (poster).

The guidance follows a study which revealed that 51% of welders suffered sickness due to disorder to the muscles, joints and tendons from manual handling tasks at work.

4.4 Health Risk Assessment

The Control of Substances Hazardous to Health Regulations 2002 (S.I. 2002, No. 2677) require employers to undertake a health risk assessment wherever employees may be exposed to substances hazardous to health. Welding fume, which is a combination of toxic metallic oxides, and dust and fumes from flux coatings and the metals being welded, can present a serious health risk. The action of heat and ultra-violet (UV) light during the process can lead to the evolution of ozone, carbon monoxide and oxides of nitrogen. Heavier particulate matter is also produced as smoke and metal spatter. Specific levels are outlined in HSE Guidance Note EH40 Occupational Exposure Limits (updated yearly).

4.5 Instruction Information and Training

4.5.1 Welding Operator Training

Training and instruction should be provided for all those who use, or maintain welding or flamecutting equipment, and for direct supervisory staff, to ensure that they are aware of the risks and the appropriate controls, along with their duties and responsibilities to ensure the safety of the work. It will include the purpose and operation of all safety devices, including non-return valves, flame arresters, pressure limiting devices etc., and the correct, safe handling and storage of gas cylinders.

This requirement also applies to the selection, care, storage and use of PPE and the legislative requirements regarding pressure systems, if relevant, and hazardous substances.
<table>
<thead>
<tr>
<th>Action</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Hazards and precautions/controls</td>
<td>This will cover the identified hazards and the suitable risk controls, including the safe system of work associated with welding or flame cutting.</td>
</tr>
<tr>
<td>b) Operating procedures</td>
<td>All necessary preparatory work including work area cleanliness, fire precautions and the use of screens. Safe connecting and setting up, operation, current pressure or gas flow adjustment etc. It will include the completion and use of Hot-Work and Permit-to-Work systems and necessary preparatory work.</td>
</tr>
<tr>
<td>c) Pressure Systems</td>
<td>Where the system is covered by the Pressure Systems</td>
</tr>
</tbody>
</table>
Safety Regulations 2000 (S.I. 2000, No. 128), the following should be included in the training:

- the purpose of the regulations in ensuring that all plant and systems are designed, installed and maintained to prevent danger and the nature and frequency of maintenance and the examination by a competent person, together with necessary records.
- An assessment of the system must be carried out to ascertain if it falls within the scope of the regulations and that all relevant requirements are met.

For this, the system must
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>include one or more pressure vessels of rigid construction, associated pipework and protective devices. It contains a relevant fluid i.e. gas or mixture of gases at a pressure greater than 0.5 bar gauge with a total pressure-volume product of 250 bar litres</td>
<td></td>
</tr>
<tr>
<td>d) Personal protective equipment (PPE)</td>
<td>The correct selection, use and maintenance of PPE and procedures for storage, replacement and cleaning.</td>
</tr>
<tr>
<td>e) Protection from vapours and airborne contaminants</td>
<td>Fume or vapour hazards, exhaust ventilation and respiratory protection requirements.</td>
</tr>
<tr>
<td>f) Selection of welding rods</td>
<td>Selection for task suitability and risk minimisation.</td>
</tr>
<tr>
<td>g) Fire</td>
<td>Use of fire appliances and</td>
</tr>
</tbody>
</table>
### 4.5.2 Instruction for Other Exposed People

All other persons working on the site, including contractors, should be aware of the hazards posed by welding and flame cutting, and the safety rules to be observed and procedures to be followed.

This will include emergency procedures and prohibition of persons using or maintaining the systems, unless trained and authorised in writing. The rules regarding the importance of observing all safety signs and instructions should also be repeated in the information supplied to contractors and visitors.

<table>
<thead>
<tr>
<th>h) Reporting of defects in equipment and hazardous incidents</th>
<th>The procedures for, and importance of, reporting any defect or incident with the equipment or shortcomings in the protection arrangements.</th>
</tr>
</thead>
</table>
5. Further Information

The following are all available from: www.hsebooks.co.uk/homepage.html or by phone on the HSE Infoline on 0870 545500, or by fax on 02920 859260.

5.1 Health and Safety Executive Publications


12. Safety in gas welding, cutting and similar processes IND(G)297. 1999. ISBN 0 7176 2473 0.

13. Take care with acetylene IND(G)327 HSE 2000. ISBN 071761817X.


5.2 British Standards

1. BS 5741: 1979 Specification for pressure regulators used in welding, cutting and related processes.


3. BS 638 - Part 9: 1990 Arc welding power sources, equipment and accessories. Specification for safety requirements for arc welding equipment: welding power sources. Safety requirements for the construction and relevant performance requirements and test methods for the compliance of power sources for arc welding and allied processes designed for industrial and professional use and supplied by a voltage within the low voltage range or driven by mechanical means.

4. BS 638 - Part 7: 1984 Arc welding power sources, equipment and accessories. Specification for safety requirements for installation and use. Additional recommendations supplement the requirements and there are also recommendations for welding in environments with increased hazard of electric shock.

5. BS EN 811: 1997 Safety of machinery. Safety distances to prevent danger zones being reached by the lower limbs.


methods and performance requirements for clothing to protect the wearer from molten metal splash, short contact time with flame and UV radiation.

5.3 Professional Bodies and Associations

Association of Welding Distributors
Enterprise House
Stafford Park 1
Telford
Shropshire
TF3 3BD
Tel: 01952 290036
Fax: 01952 290037

A trade association providing support and guidance for members. See www.awd.org.uk.

TWI
Granta Park
Great Abington
Cambridge
CB1 6AL
Tel: 01223 891162
Fax: 01223 892588

Carries out research into every aspect of welding and joining technology. Teaches good practice in welding, joining and non-destructive testing.

See www.twi.co.uk/j32k/index.xtp and www.ukwelder.com/.

Engineering Equipment and Materials Users Association
45 Beech Street
London
EC2Y 8AD
Tel: 020 7628 7878
Fax: 020 7628 7862

A technical association concerned with standardisation, specifications and use of materials and engineering techniques. Provides advice in relation to the safe use of welding equipment. See www.eemua.co.uk/.

Engineering Employers' Federation
Broadway House
Tothill Street
London
SW1H 9NQ
Tel: 020 7222 7777
Fax: 020 7222 2782

Represents employers in the engineering industry. Provides members with safety advice on the use of welding equipment. See www.eef.org.uk/.

Prospect
Prospect House
75-79 York Road
London
SE1 7AQ
Tel: 020 7902 6600
Fax: 020 7902 6667
E-Mail: enquiries@prospect.org.uk
Represents professional engineers, scientists, technicians and other associated professional and qualified staff. See www.prospect.org.uk/.
Key Questions

- What are the likely causes of accidents when welding?
  See Significant Welding Hazards.

- What are the issues we must consider by law?
  See Legislative Requirements of Welding.

- How do we determine what is reasonably practicable to do?
  See Welding and Flame Cutting Risk Assessment.

- Do we need to do anything more than provide safe equipment?
  See Protection of People Exposed to the Health Risks of Welding.

- Are there any people we can contact for specialist advice?
  See Professional Bodies and Associations.
Welding Fume

Q. Our safety representatives have raised the issue of control of welding fume. Is this a serious problem?

A. Welding fume - that is very small particles formed by molten metal precipitating out in air - is a very serious risk both to the welding operator and to any people in the vicinity of the welding operations. The very small nature of the particles means that they very easily penetrate deep into the lungs, which in itself can cause respiratory difficulties. In addition almost all welding fume is toxic, as it consists of metals, oxides of metals - which can be highly toxic, and other contaminants, such as fluxes or solvents. The level of fume - 5 mg m$^{-3}$ when averaged over an 8 hour period - is given in the HSE Guidance EH/40 *Occupational Exposure Limits*, as a maximum exposure limit, which must not be exceeded.

The main factors affecting the exposure of operators to fume (and other hazardous airborne contaminants) will include the actual welding process used, the welding position or location - confined spaces being particularly hazardous, and the duration and frequency of the exposure of the operative. All of these issues must be considered when determining the risk of the particular welding operations. See Airborne Contaminants.

Fixed or Portable LEV

Q. We regularly use welding in our works. Is it better to have fixed or portable LEV units to control the airborne hazards?

A. Both types of local exhaust ventilation (LEV) have advantages and disadvantages, and it depends on the situation in your workplace. Fixed units can be larger and thus more powerful, however they tend to need longer hoses and ducting to obtain the control where it is needed - it is not always possible to move the welding operations into the workshop. Portable units are far easier to move into place, but can often be cumbersome and can be of lower power, thus reducing their effectiveness in a particular situation.

If the majority of welding is undertaken in one location then it is most likely better to use higher-powered fixed installations. However, it will also be useful to have at least one portable unit for the infrequent times when the use of the fixed unit is impracticable. If the welding location is less predictable, or the welding area is frequently blocked by other tasks, then the use of mobile units is likely to present a more economic and effective solution.

In either case it is important to appreciate the need for care when emptying the collection units of any LEV used for welding risk control, since the dusts in them will be very fine - i.e. prone to being blown around - and are likely to be toxic or highly toxic in nature. This fact alone may make fixed units a safer option, dependant on the likelihood for cleaning procedures to be properly followed with respect to mobile units. See Ventilation.

Liaison with Emergency Services

Q. We regularly undertake welding operations on our site and have been told that we need to discuss this with our local fire brigade. Is this necessary?

A. Under the *Management of Health and Safety at Work Regulations 1999* (S.I. 1999, No. 3242), reg. 9, there is a requirement that 'every employer shall ensure that any necessary contacts with external services are arranged, particularly as regards first-aid, emergency medical care and rescue work'.

Generally speaking this is to ensure that the emergency services are aware of all local hazards on site - such as the presence of a gas bottle store, or bulk quantities of hazardous substances related to welding operations - and also the increased likelihood of fire resulting from the welding. Indeed, many insurance companies will insist on you involving the local Fire Prevention Officer to obtain their specialist advice as part of the fire risk assessment before they will extend cover for the welding operations on site. See Emergency Arrangements.
Risk Assessment of Welding and Flame Cutting Operations

- Can welding or flame cutting operations be avoided by the use of other means?
- Are competent persons appointed to assist the employer in complying with the relevant statutory provisions applying to the welding and flame cutting operations?
- Is an emergency procedure established in the event of fire or explosion from welding and flame cutting operations?
- Are employees provided with comprehensible and relevant information on the safe operation and use of the equipment and the systems of work to be followed?
- Do employees operate and use the equipment in accordance with training and instructions received, and report situations of serious or immediate danger or shortcomings in protection arrangements?
- Is the equipment maintained in an efficient state, in efficient working order and in good repair and records of maintenance kept?
- Is the use of this equipment restricted to those given the task of using it, and any repairs, modifications, maintenance or servicing restricted to designated persons?
- Are designated persons adequately trained and have supervisors and managers received similar adequate training?
- Is safety or other protective equipment suitable for its purpose, suitably maintained and properly used?
- Is a Permit-to-Work system operated for welding and flame cutting operations where there is a foreseeably high level of risk, particularly those in confined spaces?
- Is the equipment frequently examined, inspected and tested by a competent person?
- Are all liquefied petroleum gas (LPG) cylinders stored either in the open air or in a purpose-built storeroom?
- Are LPG storage tanks, cylinders, and storerooms suitably marked ‘HIGHLY FLAMMABLE - LPG’?
- Is the fire certificate in force in respect of storage arrangements?
- Is personal protective equipment provided for operators:
  - appropriate for the risks and conditions?
  - selected taking into account the ergonomic requirements and state of health of the wearer or user?
  - capable of fitting the wearer correctly?
  - effective in preventing or adequately controlling the risks without increasing the overall risk?
- Has a suitable and sufficient risk assessment of manual handling operations involving gas cylinders and other heavy items of equipment been undertaken?
- Has a health risk assessment for welding and flame cutting operations been carried out?
• Is exposure to welding fume either prevented or adequately controlled?

• Are welding fume or other airborne contaminant exposures below the stated Occupational Exposure Levels?

• Are welding workshops provided with mechanical ventilation capable of achieving six to ten air changes per hour?

• Is local exhaust ventilation provided at the point of fume production?

• Are portable extraction and filtration units used when welding is undertaken in situ on plant and equipment?

• Do sound pressure levels in welding and flame cutting operations exceed the First Action Level for noise exposure?

• Where employees are likely to be exposed to the First Action Level or above, has a noise assessment been undertaken by a competent person?

• Where operators may be exposed to lead fumes, has a health risk assessment been undertaken prior to work commencing?

• Is respiratory protective equipment further provided where control measures do not provide adequate protection?

• Where exposure to lead is significant, is adequate protective clothing provided?

• Are adequate washing facilities, together with separate facilities for the storage of protective clothing and clothing not worn during working hours, provided for operators who may be exposed to lead fumes?

• Is suitable air monitoring undertaken, where necessary, and records of such monitoring maintained?

• Are employees under medical surveillance by an Employment Medical Adviser (EMA) or appointed doctor where exposure to lead is significant or required by an EMA, and records of such surveillance maintained?

• Are employees aware of their duty to report defects in control measures, and of the need to present themselves for medical examination or biological tests?

• Are welding and flame cutting requirements, and the precautions necessary, considered at the design stage of projects?

• Are safe welding and flame cutting procedures incorporated in the rules for the management of the construction work?

• Is the pipework to which transportable gas containers may be connected provided with such protective devices as may be necessary for preventing danger?

For further information on using this checklist see **3. Welding Risk Controls**

**Additional Assessment for Welding Using Electrical Equipment**

• Are all electrical systems maintained as to prevent danger?

• Is efficient means provided for protection against excess current?

• Is adequate working space, means of access and lighting provided where necessary?

• Is the equipment installed in accordance with BS7671: 1992 Requirements for Electrical
Installations; IEE Wiring Regulations, other relevant British Standards and manufacturer's instructions?

- Is a separate earthing conductor installed in addition to the welding current return cable?
- Is any damage to the insulation of cables, electrode holders, torches etc. repaired immediately, or the item replaced?
- Is the amount of trailing cable minimised to avoid impact damage and the danger from tripping?
- Are joints and connections mechanically and electrically suitable?
- Is there suitable means for cutting off the electricity supply to the equipment and are isolation switches readily available?
- Are all mains and secondary cables, terminals and cable connectors of adequate size and construction for the maximum welding current?
- Are terminal and live components adequately protected?
- Are earthing circuits of adequate capacity?
- Is there damage to the insulation of cables, electrode holders, torches, etc and should this be repaired immediately or the item replaced?
- Is the amount of trailing cable minimised?
- Are extra precautions necessary where work is to be carried out in wet, hot or damp conditions?

For further information on using this checklist see 3. Welding Risk Controls

LEV Examination

- Generally, the system should show evidence of being maintained in an efficient state, in efficient working order and in good repair.
- Records must be maintained indicating the frequency of maintenance and repairs, or modifications made to the system.
- All hoods, enclosures, ducting, filters, fans and inlets should be regularly examined for evidence of blockage, corrosion and malfunction.
- Air samples, to assess the effectiveness of the system in removing contaminants, should be taken at the entry point to, e.g. a hood, and exit point from the system.
- The system should be tested using a standard smoke stick and air speed indicators to indicate air flow and the efficiency of same.
- Fan motors should be monitored regularly to ensure they are maintaining the specified air velocity to the system.

For further information on using this checklist see 3. Welding Risk Controls
Model Documents

Safe System of Work for Welding

1. Only appropriately trained employees, authorised in writing, may handle or use welding or flamecutting equipment, including gas cylinders.

2. Operating instructions and safety signs should be followed and any shortcomings or faults with equipment, procedures or the safe system of work should be reported immediately to your supervisor, who will initiate appropriate action.

3. Welding screens and notices must be in place at all times when welding is in progress. Anyone other than authorised employees in that department must report to the departmental supervisor before entering the welding area.

4. All potentially hazardous incidents and accidents involving welding or flamecutting should be reported to your supervisor. First aid notices in each department give details of first-aiders who are competent to deal with incidents or accidents involving pressure fluids.

5. These procedures will be monitored and reviewed as necessary.

Signed: _____________________________ (Site Manager)

Date: ______________

See also Controlling the Risk of Hot Work.

For further information on using this model document see 3. Welding Risk Controls

Welding Training Programme

<table>
<thead>
<tr>
<th>Action</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Hazards and precautions/controls</td>
<td>This will cover the identified hazards and the suitable risk controls, including the safe system of work associated with welding or flame cutting.</td>
</tr>
<tr>
<td>b) Operating procedures</td>
<td>All necessary preparatory work including work area cleanliness, fire precautions and the use of screens.</td>
</tr>
</tbody>
</table>
Safe connecting and setting up, operation, current pressure or gas flow adjustment etc. It will include the completion and use of Hot-Work and Permit-to-Work systems and necessary preparatory work.

c) Pressure Systems

Where the system is covered by the Pressure Systems Safety Regulations 2000 (S.I. 2000, No. 128), the following should be included in the training:
the purpose of the regulations in ensuring that all plant and systems are designed, installed and maintained to prevent danger and the nature and frequency of maintenance and the examination.
by a competent person, together with necessary records. An assessment of the system must be carried out to ascertain if it falls within the scope of the regulations and that all relevant requirements are met. For this, the system must include one or more pressure vessels of rigid construction, associated pipework and protective devices. It contains a relevant fluid i.e. gas or mixture of gases at a pressure greater than 0.5 bar gauge with a total pressure-volume product of 250 bar litres

| d) Personal protective equipment (PPE) | The correct selection, use and maintenance |
of PPE and procedures for storage, replacement and cleaning.

e) Protection from vapours and airborne contaminants

Fume or vapour hazards, exhaust ventilation and respiratory protection requirements.

f) Selection of welding rods

Selection for task suitability and risk minimisation.

g) Fire

Use of fire appliances and emergency procedures.

h) Reporting of defects in equipment and hazardous incidents

The procedures for, and importance of, reporting any defect or incident with the equipment or shortcomings in the protection arrangements.

For further information on using this model document see 4. Protection of People Exposed to the Health Risks of Welding
Addresses

Association of Welding Distributors
Enterprise House
Stafford Park 1
Telford
Shropshire
TF3 3BD
Tel: 01952 290036
Fax: 01952 290037

TWI
Granta Park
Great Abington
Cambridge
CB1 6AL
Tel: 01223 891162
Fax: 01223 892588

Engineering Equipment and Materials Users Association
45 Beech Street
London
EC2Y 8AD
Tel: 020 7628 7878
Fax: 020 7628 7862

Engineering Employers' Federation
Broadway House
Tothill Street
London
SW1H 9NQ
Tel: 020 7222 7777
Fax: 020 7222 2782

Prospect
Prospect House
75-79 York Road
London
SE1 7AQ
Tel: 020 7902 6600
Fax: 020 7902 6667
E-Mail: enquiries@prospect.org.uk