



**The
Combustion
Engineering
Association**

Steam Users Group

**A Guide to
Health & Safety
in the operation of
Industrial
Boiler Plant**

*The legal and practical
requirements
for the safe operation
of industrial boilers
and
associated equipment*

**Compiled by
industry experts and in
consultation with the
Health & Safety Executive**

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Combustion Engineering Association

Guide to Health & Safety in the Boilerhouse

Foreword

This publication is intended to provide guidance on the safe operation of steam boiler and steam cushion hot water plant. It will be specifically useful to the Engineer who has gained responsibility for operation of the boilerhouse, but has little practical knowledge of the health and safety requirements attached to that duty.

Section 1 covers the general principles of health and safety, explaining the relationships of legal instruments, such as health and safety legislation, and explains how this relates to the activities of the HSE and local authorities.

Section 3 looks at the boilerhouse in detail, examining the specific hazards therein, and the required safe working practices.

Appendix 1 lists the relevant legislation, HSE guidance notes, and other documents that may provide further detailed information.

Appendix 2 provides a list of useful contacts such as web sites from where further information may be obtained.

Contents

FOREWORD	2
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Section 1 - Industrial Health & Safety

1.1	Introduction	5
1.2	Administration of the Health & Safety at Work Act	5
1.3	Regulations, Codes of Practice and Standards	6
1.4	Enforcement	7
1.5	Duties of employers	7
1.6	Safety policy	9
1.7	Health and safety procedures	11
1.8	Fire and first-aid instructions	12
1.9	Good housekeeping	12
1.10	Protective clothing and equipment	13
1.11	Safe Working Practices	14
1.12	Portable tools and equipment	16
1.13	Confined spaces	17
1.14	Electricity	17
1.15	Plant and equipment	18
1.16	Safety signs and pipeline identification	21
1.17	Asbestos	22
1.18	COSHH	22
1.19	Lead	23
1.20	Legionnaires Disease	23
1.21	Other information	24
1.22	Assessment of potential hazards	24
1.23	Permits to work	25
1.24	Lone Working	26
1.25	Contractors and legislation	27
1.26	The Working Time Regulations	28

Section Two - The Boilerhouse

2.1	Introduction	30
2.2	The hazards associated with the boilerhouse	30
2.3	Fuels	30
2.4	Temperature	32
2.5	Pressure	34
2.6	Ventilation	35
2.7	Explosion	36
2.8	Thermal Shock and Water Hammer	37
2.9	Boiler Blowdown	37
2.10	Chemicals	38
2.11	Asbestos	38
2.12	Gaskets	39
2.13	Trips, slips and falls	39
2.14	The safe operation of steam boilers	39
2.15	Training needs of boiler operators	39
2.16	Automation and de-manning	39
2.17	Start-up procedures	40
2.18	Blowdown	40
2.19	Routine Checks	40
2.20	Maintenance and Inspection	43
2.21	Maintenance	43
2.22	Inspection	43
Form	Specimen Record 1	44
Form	Specimen Record 2	45
APPENDIX 1		46
Statutes		
Statutory Instruments		
HSE Guidance Notes		
Institute of Gas Equipment and Managers		
SAFed Guidance Notes		
Other Documents		
APPENDIX 2		47
Useful Contacts		

Section 1 - Industrial Health and Safety

1.1 INTRODUCTION

The **Health & Safety at Work Act 1974** (HSWA) introduced a wide-ranging duty of care for employers to safeguard the health, safety and welfare of employees while at work. This duty covers every work situation where employees may be at risk from injury or ill health. In order to comply with the duty, it is essential to identify risks, eliminate or reduce them and then make sure that the system works, i.e. a strategy of assessment, control and monitoring. The trend of health and safety legislation since then has been towards assessment based systems, rather than prescriptive limits, for example the **Control of Substances Hazardous to Health Regulations 1999** and the **Noise at Work Regulations 1989**. This trend continues with legislation, largely emanating from the EC; such regulations as the **Management of Health & Safety at Work Regulations**, the **Health & Safety (Display Screen Equipment) Regulations**, the **Manual Handling Operations Regulations**, the **Pressure Equipment Regulations**, the **Pressure Equipment Regulations** and the **Pressure Systems Safety Regulations**.

1.2 ADMINISTRATION OF THE HEALTH & SAFETY AT WORK ACT

The bodies set up to ensure the satisfactory implementation and operation of the Health & Safety at Work Act 1974 (and the Employment Medical Advisory Service Act 1972) under Section 10 of the Act are the Health & Safety Commission and the Health & Safety Executive.

1.2.1 *The Health & Safety Commission*

This consists of a body of up to ten people appointed by the appropriate Secretary of State after consultation with organizations representing employers, employees, local authorities and others as appropriate. One of the present members of the commission has been appointed to represent the public interest. The HSC's primary function is to make arrangements to secure the health, safety and welfare of people at work, and the public in the way undertakings are conducted; including proposing new law and standards, conducting research, providing information and advice, and controlling explosives and other dangerous substances. It has a specific duty to maintain the Employment Medical Advisory Service, which provides advice on occupational health matters. It also has a general duty to help and encourage people concerned with all these matters.

1.2.2 *The Health & Safety Executive*

A body of three people appointed by the commission, with the consent of a Secretary of State. The Executive advises and assists the Commission in its

functions. It has some specific statutory responsibility of its own, notably for the enforcement of health and safety law. The Executive's staff, some 4100, includes inspectors, policy advisors, technologists and scientific and medical experts. They are collectively known as the HSE.

1.2.3 Local Authorities

Local Authorities also have statutory responsibilities for enforcement of health and safety law. These apply mainly in the distribution, retail, office, leisure and catering sectors. HSE liaises closely with local authorities on enforcement matters through the Health & Safety Executive/Local Authorities Enforcement Liaison Committee. An enforcement liaison officer network in HSE regional offices across Britain also provides advice and support for Local Authorities. Local authorities also have a duty under certain environmental protection matters, especially those that fall outside the scope of the Environmental Protection Act.

1.2.4 Fire Legislation

There is legislation enforced to specifically protect people from the fire hazard. These are:

The Fire Precautions Act 1971 places a responsibility on occupiers and/or owners for the safety from fire of all persons in their premises. It also requires certain premises to have a fire certificate covering the means of escape in case of fire and associated fire safety matters. In other (usually smaller) premises exempt from the requirement to have a fire certificate, the owner/occupier is required to provide adequate means of escape for use in case of fire and means for fighting fire.

The Fire Precautions (Workplaces) Regulations 1997 apply where a work premises does not have a fire certificate. The regulations set out the fire safety arrangements that must be provided by the employer or person in control of the premises, e.g. landlord.

13 REGULATIONS, CODES OF PRACTICE AND STANDARDS

The Health & Safety Commission liaises with the Health & Safety Executive, Industry, Government and other interested parties to ensure that the general duties of the HSWA are supported by detailed provisions as follows:

1.3.1 Regulations

The Health & Safety at Work Act 1974 (HSWA) gives the appropriate Secretary of State powers to make regulations. These are documents which set out rules to give more detail to the HSWA. After they are laid before parliament and passed into law, these documents become known as Statutory Instruments.

1.3.2 *Approved Codes of Practice*

Approved Codes of Practice (ACOPs) are codes of practice approved by the Health & Safety Commission on consent of the Secretary of State. They are provided to give guidance as to the intentions of Acts and Regulations. They have a special status in law and are often regarded as an extension of the law. Non-compliance with the ACOP is not in itself an offence, however failure to observe an ACOP can be used in evidence in criminal proceedings. One of relevance is HSE COP 20 relating to Standards of Training in the Gas Industry.

1.3.3 *HSE Guidance Notes*

These documents typically contain advice on requirements to be followed and action to be taken by employers in order to comply with the law. The guidance itself has no legal force.

Following the advice contained in such documents does not and will not give a guarantee of safety at work, nor will it prevent the issuing of an improvement or prohibition notice or prosecution under the HSWA or subordinate Regulations.

14 **ENFORCEMENT**

Notices can be served by Inspectors on the spot when they make a visit. There is no need to apply to a court for permission to serve one or to await a prosecution.

1. A Prohibition Notice may be served by Inspectors if there is a risk of serious personal injury. A Prohibition Notice takes effect immediately, to stop the work or process giving rise to this risk until remedial action specified by the Inspector in the notice has been undertaken.
2. An Improvement Notice may be served by Inspectors if they believe that a person has broken and/or is breaking one or more of the relevant statutory provisions regarding health and safety. The Improvement Notice does not have to tell the employer how to put things right, though it might include instructions on what should be done by the employer, possibly referring to a code of practice.

15 **DUTIES OF EMPLOYERS**

Section 2(1) of the HSWA places employers under a general duty to ensure so far as is reasonably practicable, the health, safety and welfare at work of all their employees. Some of the requirements set out in section 2(2) include:

1. The provision and maintenance of plant and systems of work that are safe and without risks to health.

2. The provision of such information, instruction, training and supervision as is necessary to ensure the health and safety at work of their employees.
3. That the work environment be monitored, as required under the COSHH Regulations, to ensure that there is not hazard from, for example, toxic contaminants.
4. The maintenance of any place of work under the employers control in a condition that is safe and without risks to health, and the provision and maintenance of means of access to and egress from the place of work that are safe and without such risks.
5. Arrangements for ensuring safety and absence of risks to health in connection with the use, storage, handling or transport of articles or substances.
6. Maintenance of all appliance documents, inspection details, mechanical and electrical schematics and auxiliary supply systems and plant.

1.5.1 Duties of employees

The Act also places a responsibility on employees in that they must take reasonable care to avoid injury to themselves or to others by their work activities, and cooperation with their employer and others in meeting all statutory requirements. The Act also requires that employees do not interfere with or misuse anything designed to protect their health, safety or welfare.

1.5.2 Duties to non-employees

Employers must, as far as is reasonably practicable, have regard for the health and safety of contractors' employees or the self-employed who may be affected by the company's operations and for the health and safety of the general public. This covers, for example, the emission of noxious or offensive gases and dust into the atmosphere, or danger from plant and equipment to which the public or those not directly employed by the company have access.

1.5.3 Responsibilities of the self-employed

The self-employed have a similar duty to that of employers to ensure that there is no risk or danger to the health and safety of themselves or any other persons affected by their undertaking.

1.5.4 Duties of manufacturers and suppliers

Section 6 of the Act has been amended by the Consumer Protection Act 1987 and now imposes specific duties on manufacturers, importers, designers and suppliers to ensure that articles and substances supplied for use at work are safe and without risk

to health. To assist manufacturers and suppliers attain the required level of health and safety, the Health & Safety Commission have commenced approving standards laid down by such bodies as the British Standards Institution. Manufacturers are required to ensure that products that are presented to the marketplace comply with relevant Directives and Regulations, such as the Pressure Equipment Regulations and the Pressure Systems Safety Regulations.

1.6 SAFETY POLICY

It is a statutory requirement under the Management of Health & Safety at Work Regulations that an employer with five or more employees prepares a written statement of the company's general policy, organisation and arrangements for health and safety at work. This policy statement should be reviewed at regular intervals and, as appropriate, amended.

The safety policy for the company, although common in most parts with the safety policy for every company, may require preparation in detail. The policy should cover management of the company and controls of risks, and would naturally cover any process, hazardous product or procedure specific to the organisation. In preparing the policy, it is essential to ensure that parts referred to in Section 1 (3) of the HSWA are covered, i.e.:

1. The general policy statement.
2. The organisation and arrangements for carrying out the policy.

In large companies, these two aspects may be dealt with separately. In larger organisations, it can be found that it is of greater benefit if the policy document is produced in two separate formats. These would include:

1. A concise statement of the company's general policy, organisation and arrangements in a single document. It follows that this document can then be issued individually to all members of staff and contractors who work on the premises.
2. A more detailed document in the form of a health and safety manual. This manual would include the company's policy statement, company rules, safe working procedures, etc., and would normally be located in a nominated office. It is necessary in using this method that all staff are made aware of its contents and its location.

1.6.1 Policy statement

The company's general policy statement should be a declaration of the employer's intent to provide a safe and healthy workplace for all employees and should include the request that the employees provide the necessary support towards achieving the company's aims.

1.6.2 *Levels of responsibility*

The policy statement should give the name, designation and office location of the nominated senior member of the company designated as the responsible person within the organisation for ensuring that the company's policy statement is complied with. This nominated person should have high position within the company (e.g. director, senior manager, company secretary).

While the overall policy responsibility for health and safety rests with senior managers, all employees within the organisation, irrespective of their duties, have some degree of responsibility for carrying out the policy. Where appropriate, nominated persons with specific responsibilities for health and safety should be named with a summary of their responsibilities defined. It follows that there should be a procedure established whereby deputies are available during the nominated person's absences.

Where specialist knowledge is required, the relevant aspect should be clearly established and the respective persons made aware of such. This expertise can be obtained, for example, from the company's safety officer, chemist, etc. Finally, the policy statement should make clear the level of responsibility of every employee.

1.6.3 *Safety Representatives and Joint Safety Committees*

Where health and safety consultation is in place (e.g. joint safety committees) the structure with regards to members' representation should be described.

1.6.4 *Training and supervision*

Employers have a duty under the Management of Health and Safety at Work Regulations (MHSWR) as well as under HSWA to provide, as necessary, training and information to ensure that there is no risk to the health and safety of their employees. It may be found necessary to provide operators and maintenance employees with specific training to carry out certain processes or work tasks, e.g. those working on any gas installation as given in HSE COP 20 relating to Standards of Training in the Gas Industry,.

The policy statement should indicate how the company proposes to carry out training with respect to health and safety. Equally important is the responsibility placed on managers, supervisors, etc. to ensure that the individual who has been given the work task has the knowledge to carry it out without risk to themselves or others. This task may be operating a piece of equipment on which all safety measures must be in order or carrying out a maintenance task where there is an acknowledged hazard. It is therefore equally important that managers and supervisors be suitably trained in both the technical and safety aspects of the work.

1.6.5 Hazard details

Many accidents occur because the operator or maintenance person does not understand the hazards involved or has not been instructed on the precautions to be taken. The policy document should identify the main hazards within the company with advice on which rules must be obeyed while carrying out a hazardous task. Detailed instructions given to operators and maintenance personnel should be included in the safety policy document or other appropriate risk control documents. General rules should also be included to cover items such as untidy work areas, replacement of guards, and the use of protective clothing/equipment where appropriate, safe working practices in handling goods and materials, etc. It is essential that on the introduction of new products, processes, operations or plant and equipment that any hazards associated with these are brought to the attention of all concerned. Plant commissioning is a particular hazard, and detailed information is given in the Institute of Gas Engineers and managers (IGEM) document UP/4, which outlines the commissioning for gas-fired plant; it acknowledges the use of a second fuel, and provides a format for writing commissioning instructions.

1.6.6 Reporting accidents

Procedures must be prepared to ensure that the reporting of accidents meets the requirements as set out in the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR). Specific duties are imposed on the Responsible Person, who may be the employer, a self-employed person, or the controller of premises. These responsible persons are required to report fatal accidents, specified injuries, diseases and/or Dangerous Occurrences to the relevant enforcing authority both with an immediate notification and with a written report within 10 days of the occurrence.

Accidents should also be recorded in the Accident Book (Form B1510).

1.7 HEALTH & SAFETY PROCEDURES

Note that the procedures under section 1.8 below only provide a framework in which specific health and safety procedures for the individual works or premises may be prepared. A senior member of the company or the person nominated as responsible for health and safety in the organisation should write the foreword to a company's procedure. To emphasise its importance it should also include a part of the company's health and safety statement. It should be followed by an instruction such as '*You are required to read the following procedures carefully and comply with the sections relevant to your workplace*'.

1.8 **FIRE AND FIRST-AID INSTRUCTIONS**

1.8.1 ***Fire***

Fire alarms are installed in works or premises:

1. To alert all staff in the event of a fire alarm;
2. To order complete evacuation of the works or premises (in a number of workplaces such evacuation may not be necessary).

On hearing the alarm all personnel should leave the building by the nearest safe fire exit. They **should not** use the lifts or re-enter the building until given permission by the person controlling the incident. Staff should be aware of all fire-precaution notices and procedures (including the fire brigade's telephone number), fire call points, extinguishers, fire exits, escape routes and assembly points.

1.8.2 ***First-aid/medical services***

Staff should make themselves familiar with the company's first-aid procedures in the event of an accident, the location of first aid room and how to summon First Aiders. They should also be aware of all first-aid/medical notices and the telephone number to call for assistance during outside normal hours. (These are likely to differ unless the works or premises operate 24 hours a day.)

1.9 **GOOD HOUSEKEEPING**

Low standards of housekeeping are a common cause of injury and damage at work. Low standards often result from poor working practices, and/or organisational deficiencies within the workplace. Every workplace must be kept clean and tidy to avoid the creation of hazards.

General hints on keeping the workplace clean are:

1. Employees keep their own work stations reasonably tidy.
2. Ensure that there are no trailing cables that present a trip hazard.
3. Return everything to its designated storage place.
4. Always tidy up after completing the task.
5. Keep walkways clear at all times.
6. Store materials and equipment in a safe manner.

1.10 PROTECTIVE CLOTHING AND EQUIPMENT

Employers must ensure that suitable personal protective equipment is provided to employees where there is a risk to their health and safety that cannot be adequately controlled by other means:

Definition

Personal Protective Equipment shall be deemed suitable if:

- * It is appropriate for the risks involved and the conditions in the area where the exposure to the risk may occur;
 - * It takes account of the nature of the task, the demands the task places on the person (e.g. certain personal protective equipment may be unsuitable for use on a manual task in a hot environment) and the state of health of the person who may wear it;
 - * It is capable of fitting the wearer correctly;
 - * It prevents or adequately controls risks involved without increasing the overall risk;
 - * It complies with any Health & Safety Regulations relating to the design or manufacture of the personal protective equipment in respect of health or safety;
1. Eye protection should comply with the Protection of Eyes Regulations and relevant British Standards
 2. Safety helmets should comply with the relevant British Standards
 3. The Noise at Work Regulations are designed to protect workers and principally requires that employers prevent damage to the hearing of workers from exposure to excessive noise in the workplace. All employers including the self employed should assess the noise levels to which their employees are exposed, where they believe that exposure reaches or exceeds the action levels defined in the regulations. These limits are:
 - (a) A daily personal noise exposure of 85dB(A). If noise exposure reaches 85dB(A) (according to the results of the noise assessment) employers must inform employees and issue personal ear protection on request.
 - (b) A daily personal noise exposure of 90 dB(A). At this level, employers have a duty to designate and demarcate ear protection zones, and to ensure employees wear personal ear protection where necessary.

- (c) A peak sound pressure of 200 Pascals (140dB). This action level is intended to protect workers exposed to intermittent high impact noise
4. Safety footwear *must* be worn where applicable (moving heavy objects, working with hazardous materials (e.g. chemicals), working in wet conditions). Footwear should comply with the appropriate British Standards.
 5. Safety belts should comply with the relevant British Standards.
 6. Protective clothing (including gloves) *must* be used where applicable (e.g. normal duties; welding/cutting hot work; water treatment, application/use of chemicals; during servicing of batteries; descaling/chemical cleaning). Clothing should comply with the relevant British Standards.
 7. Respirators should comply with the appropriate British Standards (Refer to Form F2486, published by HSE for suppliers of respirators suitable for use against aerosols containing *Legionella*).

When in doubt as to which standard of protection is necessary, consult the manufacturers, suppliers, HSE, EMAS, the Local Authority or the Environmental Health Officer.

1.11 SAFE WORKING PRACTICES

It is essential when carrying out any operation or task that cannot be undertaken standing on a floor that an appropriate working platform is used. This can take many forms, but the methods that should be used fall within the following types: stepladders; trestles with suitable boards; towers (mobile); proprietary scaffolding or general-access scaffolding. Such access equipment should be to the relevant British Standards.

Items that should be checked on access equipment before use include:

1. General condition – is there any damaged section of part?
2. Is it the correct access equipment to carry out the task safely? Note that ladders are not to be used as working platforms; they should only be used for access unless a simple single-handed task is to be undertaken.
3. Is it positioned correctly (e.g. ladders at the correct ratio of 4:1; is the scaffold on a sound footing)?
4. Is the ladder or scaffold secured safely? Note that scaffolds should be inspected on a weekly basis.
5. What is the condition of access equipment after inclement weather?

6. Is there any risk to its use in a specific area (e.g. close to overhead power lines)?
7. Does it have handrails and toeboards fitted? (Regulations insist on these when working height is at 2 metres or more. This should not preclude taking the same measures at lower heights.)
8. Does it provide a safe working area? If in doubt, seek advice, as there are many injuries each year caused by falls or by material dropping from heights. The wearing of safety helmets is a secondary protection and should not be allowed to encourage carelessness.

1.11.1 Manual handling

Correct manual handling of material prevents strains and injury and also reduces the effort required. Persistently incorrect lifting and handling may lead to the person suffering from permanent back strain or other health problems. Points to consider when preparing to lift material are:

1. Can you lift it yourself?
2. How easy is it to grasp?
3. Is it stable?
4. Is there any obstruction where you have to walk or place the material?

When lifting the material:

1. Stand with your feet apart, with one foot in the direction you intend to move.
2. Grip the object with the palms of your hands.
3. Keep a straight back and, bending slightly at the knees, use your thigh muscles to lift.
4. With elbows and arms close to the body, slowly rise.
5. Keeping your chin in and raising your head, lift the object to the height required, adjusting the position of your feet to ensure that you maintain your balance.
6. Always wear the correct protective clothing.

7. Get help with heavy loads.

1.11.2 Mechanical lifting and handling

In addition to the general rules of the Health & Safety at Work Act 1974, there are specific requirements under the following legislation with respect to chains, ropes and lifting tackle:

The Provision and Use of Work Equipment Regulations (PUWER) came into force to ensure that work equipment should not result in health and safety risks, regardless of its age, condition or origin.

The Lifting Operations and Lifting Equipment Regulations applies to all employers, the self employed, a person at work who supervises or manages the use of lifting equipment, despite each regulation being written with reference to duties being placed on employers.

It has considerable overlap with the above legislation. Any plant, equipment or articles provided for lifting loads will also be an item of work equipment; therefore both sets of regulations are likely to apply in any situation of use.

Information on the regulations and suitable means of compliance can be found in L113 safe use of lifting equipment: Lifting Operations and Lifting Equipment Regulations. Approved Code of Practice Guidance (ISBN 07176 1628 2), available from HSE Books.

1.12 PORTABLE TOOLS AND EQUIPMENT

1. Portable electrical hand tools and equipment shall be properly grounded and wound to operate on 110V a.c. centre tapped to earth supply, and shall only be connected to the system by permanent joints or proper connections.
2. Portable lighting, when used in wet conditions or confined spaces, should operate at no more than 25 V a.c. single phase, and must be fitted with the correct guard.
3. Persons operating abrasive wheels (e.g. bench grinders, machine grinders, disc grinders) should be trained in their use. To dress or mount (change) a wheel or a disc, the operative must have attended a training course in compliance with PUWER. Attendees of such courses must be recorded in the company register.
4. Many tools or equipment are potentially dangerous and may cause injury to an operator. Adequate training must be given to ensure safe use of the tools or equipment.

1.13 CONFINED SPACES

Work in confined spaces is potentially dangerous and clearly requires employers to ensure that there is no risk to their employees when working in such an area. The Confined Spaces Regulations require employers to:

- Avoid entry to confined spaces, for example, by doing the work from outside.
- Follow a safe system of work if entry to a confined space is unavoidable.
- Put in place adequate emergency arrangements before work starts, which will also safeguard rescuers.

No person must enter or be in a confined space unless he or she has been authorised to do so, and all the appropriate safety precautions have been strictly adhered to prior to entry and while within it.

Points that must be checked prior to the issue of the appropriate permit to work should include the following:

1. Are there fumes present?
2. Is there an adequate and sustainable supply of breathable air or oxygen?
3. Will breathing apparatus be required? Has the operative had training in its use and is there adequate support?
4. Is there anything hazardous residing in the “space”?
5. Has the space been tested for being clean and gas free?
6. Is there a supporting person standing by in the event of an emergency?
7. Is there a safety harness and rope available for use when the work is to be carried out? The operative entering the space will wear a harness while the operative standing by the entrance will retain the free end of the rope attached to the safety harness.

1.14 ELECTRICITY

The Electricity at Work Regulations applies to all places where work is done on or near electricity, and therefore embraces almost all places of work. They detail the considerations necessary and the measures that should be employed to achieve the required standards of electrical safety in the workplace.

Regulation 13: Precautions for work on equipment made dead

In order to prevent danger while work is carried out on or near electrical equipment which has been made dead, adequate precautions shall be taken to prevent it from becoming electrically charged during that work if danger may arise thereby.

Regulation 14: Work on or near live conductors

No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless:

1. It is unreasonable in all the circumstances for the conductor to be dead;
2. It is reasonable in all circumstances for the person to be at work on or near it while it is live; and
3. Suitable precautions (including, where necessary, the provision of suitable protective equipment) are taken to prevent injury.

Regulation 16: Persons to be competent to prevent danger and injury

No person shall be engaged in any work activity where technical knowledge or experience is necessary to prevent danger or where appropriate, injury, unless he or she possesses such knowledge or experience, or is under such degree of supervision as may be appropriate having regard to the nature of the work.

Additional safety precautions

1. You must not work on or interfere with any electrical equipment unless you have been authorised to do so.
2. Do not use electrical equipment or switch rooms as a storage area.
3. Assume that all electrical distribution circuits are live.
4. Obtain the necessary authority/permit to work before commencing any work on electrical systems.
5. Do not improvise; electricity can kill.

1.15 PLANT AND EQUIPMENT

1.15.1 Pressure systems

1. The aim of the Pressure Systems Safety Regulations (PSSR) is to prevent the risk of serious injury from the release of stored energy as a result of a

pressure system or component failure. In particular the regulations cover the design, construction, installation, repair, modification and use of pressure systems.

More specifically they cover information and marking, safe operating limits, written schemes of examination, examination in accordance with the written schemes, actions in cases of imminent danger, maintenance records and precautions against pressurisation in relation to pressure systems.

The Regulations apply to pressure systems where:

1. The contents are 0.5 bar (about 7 psi) or more above atmospheric pressure;
2. Where steam is present at any pressure.

Written Scheme of Examination

Regulation 8(1) states:

The user of an installed system and the owner of a mobile system shall not operate the system or allow it to be operated unless he has a written scheme for the periodic examination, by a Competent Person, of all protective devices.

This regulation is the critical one for owners or users of pressure systems, especially where they may not have in-house expertise for managing the engineering aspects of the system. It is important that some knowledge of the operating and maintenance needs of the system is retained within an organisation, in order to liaise with the Competent Person chosen, to ensure that the scheme practically reflects the user's needs and level of operation of the system. A well-written scheme is a valuable document and most of the technical data required for it can be referenced from a user's database and supplied to the Competent Person. However, the Competent Person will require a detailed knowledge of the system design, its operating parameters, installed protective devices; and will agree with the user the risk levels of the various parts of the system. This will enable the Competent Person to agree the scope of examination and where the user does not have the knowledge to do this, the Competent Person may over (or under) specify the examination.

Every protective device in the system (not just those in the parts within the "scope" — where the risk may be low) must be referenced within the scheme and details of their examination requirements set out as appropriate. This may range from a detailed overhaul, setting and testing schedule for high performance safety valves to a simple maintenance requirement including regular checking, for a water level switch. A schedule of pressure systems should specify all of the protective devices and contain all the relevant set points for them. These can then be easily referenced to the written scheme.

Examination in Accordance with the Written Scheme

(1) Subject to paragraph (7), the user of an installed system and the owner of a mobile system shall:

(a) ensure that those parts of the pressure system included in the scheme of examination are examined by a Competent Person within the intervals specified in the scheme and, where the scheme so provides, before the system is used for the first time; and

(b) before each examination take all appropriate safety measures to prepare the system for examination, including any such measures as are specified in the scheme of examination pursuant to regulation 8(3)(b).

(2) Where a competent person undertakes an examination for the purposes of paragraph (1) he shall carry out that examination properly and in accordance with the scheme of examination.

Examination of a pressure system can be undertaken by the user or owner themselves as Competent Persons, providing they have the necessary attributes and can demonstrate that the process of examination and reporting is sufficiently divorced from any related production influence - i.e. that the examination is fair and reasonable and that no "management" influence has been brought to bear on the results of the examination.

For major pressure systems there is clearly an economic risk factor and most users will elect to have examination completed by appropriate engineering inspection bodies (as this may be required by their insurance companies), but for minor systems there is an argument for in-house examination where the skill exists. The user cannot leave all the work to the Competent Person but has to ensure safe conditions and access prior to examination - this will be laid down in the written scheme of examination and may include erection of scaffolding, removal of lagging and cladding, cleaning, provision of lighting and communication if necessary, plus the necessary plant operational status as discussed earlier. Any preparation must be done according to a safe system of work including permits to work for the actual examination and any testing required.

It is the user's duty to ensure that the examination takes account of all the requirements of the written scheme of examination and it is therefore wise to coordinate Competent Person examination activities including recording, with a member of staff who is a responsible engineer, or delegate it to a managing engineer.

The Competent Person is under a legal duty to conduct the examination properly and to take account of all requirements of the written scheme of examination. With

this in mind it is worth considering liability issues when deciding on a Competent Person.

1.15.2 Compressed air

Compressed air can be dangerous if used incorrectly, and guidance may be found in HSG 39:

1. Never use compressed air for cleaning. The pressure from nozzles may blow particles of dirt and dust into the eyes, ears or skin of the person using the nozzle for cleaning or of others in the vicinity.
2. Do not dust yourself down with the compressed air nozzle.
3. Indulging in horseplay with compressed air can have disastrous results.

Persons employed to use compressed air in carrying out a specific work task must be correctly equipped to prevent injury. The minimum requirement is to wear eye protectors that conform to current British Standards.

1.15.3 Machinery

The requirement for safety precautions when operating or working on all types of machinery cannot be overstressed, in that the likelihood of an accident occurring on moving machinery is invariably high. It is essential that all those who work on such machines are adequately trained as to the operation and the safeguards fitted. Machines must not be used unless properly guarded (or operatives are trained). All damaged guards/security measures must be reported.

1.16 SAFETY SIGNS AND PIPELINE IDENTIFICATION

1.16.1 Safety signs

The Health & Safety (Safety Signs and Signals) Regulations applies to signs that give a health and safety message to people at work by using certain shapes, colours and pictorial symbols. There are four basic types of safety signs which the Regulations require to conform to current British Standards:

1. Solid blue circle: mandatory (To give instructions of action required);
2. Red circle with red band across the diameter: prohibition ('Do not do');
3. Yellow triangle with black border; caution ('Warning of danger');
4. Solid green square: information ('Safe conditions')

Graphic symbols may be placed in the above shapes to give them more meaning and there may also be text affixed to them.

1.16.2 Pipework identification

Pipework should be marked clearly as to the contents. This can be achieved by marking them in accordance with the relevant British Standards.

1.17 ASBESTOS (THE CONTROL OF ASBESTOS AT WORK REGULATIONS)

Although the supply and use of asbestos is now banned in Britain except for certain applications where it is crucial to the task - the HSE estimates that around half a million workplace premises may still contain asbestos - for example, as a component of lagging or ceiling tiles.

The revised control of Asbestos at Work Regulations require employers and those responsible for premises to carry out a suitable assessment of their workplace to determine whether asbestos is present and to manage any such asbestos to ensure the health of occupants and any others who may disturb the asbestos. Asbestos is defined as any of the following minerals: crocidolite, amosite, chrysotile, fibrous anthophyllite, fibrous actinolite, fibrous tremolite and any mixture containing any of these.

Before carrying out work on any substance suspected of being asbestos, a person who is competent to advise must be called upon to give advice on its possible composition. Such a person will advise on the measures that must be taken to avoid any hazard to the occupants or others likely to be affected. Companies with asbestos on their premises should hold the appropriate documents.

1.18 COSHH

The Control of Substances Hazardous to Health (COSHH) Regulations 2002 covers virtually all substances hazardous to health. Only asbestos, lead, materials producing ionizing radiation and substances below ground in mines (which all have their own legislation) are excluded. The Regulations set out measures that employers must implement. Failure to comply with COSHH, in addition to exposing employees and others to risk, constitute an offence and is subject to penalties under the Health & Safety at Work Act 1974.

Substances that are hazardous to health include:

1. Those labelled as dangerous (i.e. very toxic, toxic, harmful, irritant or corrosive);
2. Agricultural pesticides and other chemicals used in farming;

3. Those with occupational exposure limits;
4. Harmful microorganisms;
5. Substantial quantities of dust;
6. Any material, mixture or compound used at work, or arising from work activities, which can harm people's health.

In works, premises, factories, etc. there will be substances in use that come within the control of COSHH. Seek advice!

1.19 LEAD

The Control of Lead at Work Regulations applies to work which exposes persons (both employees and others) to lead as defined in Regulation 2(1). Significant hazards which can result in harm caused by lead are:

- Lead in a form that can be ingested or inhaled (accumulation in the body leads to lead poisoning).
- Lead paint or sheet lead is hazardous if reduced to dust by grinding or grit blasting, or to fume by hot processes.
- Gas cutting or welding of lead painted surfaces is very hazardous as the temperatures will reduce the lead to fume.

1.20 LEGIONNAIRES DISEASE

Legionnaire's disease is an infection caused by the legionella pneumophila and other bacteria from the family legionellae. The bacterium is naturally occurring, and is able to proliferate in man made systems or water services, typically those heated to between 20-45 degrees Celsius.

The subsequent risk of the bacteria escaping into the atmosphere as breathable water droplets or vapour can cause significant risks especially to the elderly, the ill and those who smoke. Much useful information may be obtained from HSE Approved Codes of Practice and other guidance documents.

The significant hazards which could give rise to the contraction of legionellosis are:

- Water systems which incorporate a cooling tower.
- Water systems which incorporate an evaporation condenser.

- Hot water services.
- Hot and cold water services of any size in premises with susceptible occupants.
- Humidifiers and air washers, creating water droplets, where water temperature is likely to be above 20 degrees Celsius.
- Spa baths and pools where warm water is recirculated.

Exposure to harmful organisms, including legionella, is covered by the "Control of Substances Hazardous to Health Regulations 1999".

All water systems should be regularly checked and maintained sufficiently by persons who are competent to ensure efficient operation.

More detailed guidance can be found in the Approved Code of Practice and Guidance *Legionnaires disease: The control of legionella bacteria in water systems* L8 2000 HSE Books ISBN 0 7176 1772 6, ref L8.

Legionnaires disease: A guide for employers – IAC27 (rev 2).

1.21 OTHER INFORMATION

Numerous leaflets can be obtained from the local offices of the Health and Safety Executive or HSE Information Points. Remember, if you have any doubts about the health and safety risks involved in your undertaking you must seek advice. This information may be obtained from your company safety officer, consultants, manufacturer/supplier or equipment/material/substance, HSE or local Environmental Health Office. Use their expertise and knowledge. Do not become a statistic.

1.22 ASSESSMENT OF POTENTIAL HAZARDS

The Management of Health & Safety at Work Regulations requires the carrying out of a risk assessment so that the risks to employees and others who may be affected by their actions, are clearly identified and adequately controlled. There are no fixed rules for undertaking a risk assessment although there are general principles to follow. The detail in the risk assessment will depend on the nature of the undertaking and the type and extent of the hazards and risks and will be broadly proportional to the risk. Guidance is available in HSE IND(G) 1631, Five Steps to Risk Assessment and IGEM SR/24 Risk Assessment.

A risk assessment should be completed by a person who is competent. i.e. someone trained in the process and knowledgeable about the task to identify all the hazards

and their appropriate controls. In the main, risk assessment should be undertaken by line managers involving or consulting with the workers. Health and safety professionals may be involved in the process, particularly in the case of a sophisticated technical assessment, e.g. measurement of noise in a workshop, thermal comfort in an office, gas levels in a confined space.

A structured approach to carrying out risk assessments is preferred.

A general risk assessment of a complete work area, a work activity or process, can be a starting point to eliminate trivial risks or risks requiring no further action. This assessment will indicate the risks requiring a fuller assessment or perhaps more sophisticated assessment techniques by a specialist. Quantified risk assessments will be needed only in some cases and these are usually covered by specific Regulations (noise, manual handling, COSHH). A detailed risk assessment is warranted if the risks are considered to be potentially severe, occurring frequently and affecting large numbers of employees and thus considered to be a medium to high risk.

Generic risk assessments may be developed by trade associations, employer bodies or other organisations. Therefore it may be worth using these as a building block upon which to customise the risk assessment to reflect the specific circumstances in which the work is undertaken (e.g. humid conditions, by young persons, restricted space, poor lighting). Generic risk assessments can only be used if they are appropriate to the work and the assessment is adapted to the actual work situation.

Young workers are seen as being particularly at risk because of their possible lack of awareness of existing or potential risks, immaturity and inexperience. Employers may not take young persons into their employment unless a risk assessment has been carried out, or an existing assessment has been reviewed, in order to ensure that any risks to those young persons are identified and addressed.

1.23 PERMITS TO WORK

Where there is a risk to the employee carrying out work, a permit to work should be used. A permit to work is a formal written means of making sure that potentially dangerous jobs are examined first, before authorizing the work to commence. Its task is twofold: it ensures that the person making the system safe and the person who is to carry out the work have both checked that it is safe to carry out the work task. Permits to work cannot be transferred to other parties. If any circumstances change from the issue of the original permit to work, it must be cancelled and a new one prepared.

Permits to work can be of differing formats. Therefore, it is essential that when a permit to work has been issued it should be read carefully and understood and all

possible measures taken to reduce or eliminate the known danger. Permits can be issued for a variety of work tasks (e.g. work on high voltage electrical systems, steam boilers, hot work, confined spaces, etc).

1.24 LONE WORKING - WORKING ALONE IN SAFETY

There are a number of specific instances where work alone is not legally allowed, such as in confined spaces, or with electrical work where live electrical conductors are exposed. The requirement within the MHSWR means that in any job or task where a person may work alone, the risks have to be assessed, taking account of the differences that will exist because the person is unaccompanied.

Special Requirements for Risk Assessment

As with any other aspect of health and safety at work, this basic approach can be used for lone working. Within the concept of a “safe place”, account needs to be taken of the workplace and work risks, emergency arrangements, communication and supervision. Within the “safe person” part of the equation we need to take account of the individual themselves, which includes their health, abilities and training, etc. There is overlap also with the need for communication and supervision.

Some work is obviously high risk - work inside a confined space where there may be an atmosphere that is immediately life threatening, although the likelihood of this obvious type of hazard is very low in an office environment. However, maintenance work is a frequent requirement in all buildings, including offices, and this may sometimes be carried out in circumstances that constitute lone working.

Work on electrical systems is an example of where other legislation may prohibit lone working. Other examples are scalding, chemical spills, and being overcome by fumes. However, for the vast majority of maintenance tasks no such prohibitions will exist and the proposed work would have to be assessed. Where employees are to work alone, such as staying late, working over a weekend, work at home, etc, there will probably be few potential problems, provided a check is made on basic requirements such as the security from attack, having adequate travel arrangements, communication and so on.

The HSE has published guidance on lone working in the form of a free leaflet IND(G)73(rev), Working Alone In Safety. This guidance is primarily about controlling risks to the lone worker. Other factors that may need to be taken into account could include the mental attitude of the intended lone worker - some people may not want to work alone because of fears about personal safety, inexperience and concerns about their ability to carry out the intended task satisfactorily.

Particular Hazards

With some lone working, the potential problems have become well known. Women working alone in jobs such as estate agency and the risk of violence or abduction are a case in point. For some workers inside their employers' premises, violence may still be a possibility and security personnel can be one group at risk.

1.25 CONTRACTORS AND LEGISLATION

All organisations will probably use contractors at some time to carry out work of various types. This can range from very simple work such as window cleaning, office machinery repair or security services up to a major construction project to expand or refurbish premises.

Any arrangements by an organisation to use a contractor will result in a network of statutory duties for health and safety being created. All parties have to fulfill their legal responsibilities as well as those which will be imposed by any contractual arrangement.

The main duties which will apply to the use of contractors are contained in ss.2, 3 and 4 of the **Health and Safety at Work Act 1974** (HSWA). These have been further defined in regulations 11 and 12 of the **Management of Health and Safety at Work Regulations** (MHSWR).

The **Construction (Design and Management) Regulations** (CDM Regulations) imposes more detailed requirements on those involved in any construction work as client, designer or contractor.

Typically the company will require submission of contractor's safety policy documentation along with their tender, together with copies of any relevant risk assessments regarding the work to be carried out.

Some companies provide contractors with safety information they will need with the invitation to tender, but most issue this only to the firm that is awarded the contract in good time before work commences.

CONTRACTOR'S SAFETY INFORMATION (RECORD 1) - SEE PAGE 45

This record forms a company statement of safety requirements (and, as such, should be included in a company's main safety policy document). It should be signed, dated, etc by the person who will eventually award the contract, and sent with the "invitation to tender" documents to all those being considered for any work.

NOTICE TO CONTRACTORS (RECORD 2) - SEE PAGE 46

Record 2 should form part of the formal control measures to ensure the on-site safety of contract staff, company employees and other visitors, whilst contract work is in progress. The document should be completed by the company manager responsible for both the direct supervision of the contract work and the area in which the work takes place.

The company manager should hand the record to the senior contractor to read and complete the subsequent declaration. The lower part of the record should then be completed by the company manager, detached and handed to the senior contractor. The duly signed Part 1 should be retained in company records.

1.26 THE WORKING TIME REGULATIONS

The Working Time Regulations first came into force on 1 October 1998. The Regulations implement the EC Working Time Directive and the parts of the EC Young Workers' Directive which relate to adolescents. The new rights that the Regulations give to workers can be summarised as:

- * Four weeks annual paid leave
- * 11 consecutive hours rest in any 24 hour period and one days rest in a week
- * A limit of an average of 48 hours in a week in which a worker can be required to work
- * A limit of an average of eight hours work in 24 hours for night workers.

In more detail the provisions are as follows.

1. The Regulations apply to workers over the minimum school leaving age. A worker is someone who has a contract of employment or who undertakes work under other forms of contract, such as agency workers, freelancers, etc. The Regulations do not apply to:

- (a) Self-employed people
- (b) Transport workers
- (c) Sea fishing or other work at sea
- (d) Doctors in training

(e) Certain civil protection services.

2. A limit of an average of 48 working hours per week is set. The standard averaging period is 17 weeks, but can be extended to 26 weeks if the workers are covered by derogations of up to 52 weeks by an agreement between employers and workers. Individuals can voluntarily apply to disapply the limit.

3. There is a limit of an average of eight hours in each 24 hour period for night workers. The standard averaging period is again 17 weeks. If night work involves special hazards or heavy physical or mental strain, there is a strict limit of eight hours in every 24 hour period (rather than an average). Night workers are entitled to a health assessment (adolescent workers to a health and capacities assessment) before being required to perform night work and at regular periods afterwards.

4. Workers are entitled to one day off each week (adolescent workers to two days).

5. Workers are entitled to 11 hours consecutive rest per day (adolescent workers to 12 hours).

6. Workers are entitled to a minimum 20 minute rest break if their working day is longer than six hours (adolescent workers to a minimum 30 minutes if they work for longer than four and a half hours).

7. Workers are entitled to four weeks paid annual leave.

There are a number of derogations where the above requirements will not apply. For example, where a worker's working time is not measured or predetermined or can be determined themselves, only the paid annual leave provisions apply. In specified circumstances, derogations are allowed, so long as workers receive compensatory rest. These circumstances include:

(a) Security and surveillance activities

(b) Activities where continuity of service or production is needed, e.g. hospital services

(c) Where there is a foreseeable surge of activity.

The requirements also do not apply where there is force majeure, i.e. unexpected and unpredictable occurrences beyond an employer's control.

Collective agreements can be made with an independent trade union. Workforce agreements can be made with workers where there is no recognised trade union.

Section 2 - The Boilerhouse

2.1 INTRODUCTION

In addition to the general considerations as stated in section one of this document, there are specific considerations that must be given to the steam boiler house. The HSE has published two guidance notes, PM5 Automatically Operated Steam and Hot Water Boilers, and PM60 Steam Boiler Blowdown Systems. In addition, The Pressure Equipment Regulations and Pressure Equipment Safety Regulations are entirely relevant. The Safety Federation (SAFed) has also produced a guidance note PSG2, which contains valuable information for the operator of existing steam boiler plant. Finally, anyone who intends to install fuel-fired boiler plant must ensure compliance with the Clean Air Act (1963) and the specific requirements of the relevant Local Authority. IPC/IPPC and the Large Combustion Plant Directive may also apply. The Dangerous Substances and Explosive Atmospheres Regulations will apply to most installations.

2.2 THE HAZARDS ASSOCIATED WITH THE BOILERHOUSE

2.3 FUELS

Fuel-fired steam boilers mainly operate on gas or oil, although some coal-fired plant remains in use. Other equipment used to raise steam includes waste heat boilers, incinerators, electrode and electric boilers, and waste derived fuels such as coke oven gas.

Any fire systems should be capable of easily being tested periodically, and systems employing automatic electrical opening of safety circuits should provide for convenient re-establishment.

Care should be exercised in assessing heavier-than-air gases, be they from fuel such as LPG, or from partially vaporised liquids such as fuel oils or thermal heating oils.

2.3.1 Gas and LPG

The design of natural gas and LPG installations in boilerhouses is covered by the Institution of Gas Engineers and Managers publication UP/10.

The main difference between the two gas types is that low level ventilation must always be fitted when LPG is being used. Standards covering the installation of LPG cylinders and tanks are available from the LPGA.

The Dangerous Substances and Explosive Atmospheres Regulations has implications for all users of gas. In particular there is a need for

existing plant to have a risk assessment prepared before June 2006 to determine if there are any requirements to retrospectively apply hazardous area considerations. It is not likely that there will be any implications for plant designed and installed to recognized standards, in well ventilated areas and which are regularly maintained where the gas pressure is not more than 100 mbarg. The Institution of Gas Engineers and Managers (IGEM) are to publish guidance on this subject later in 2003.

The application of hazardous areas will to some extent be affected by the manning of the plant room as well as what, and how often, checks are made for gas tightness and/or leakage.

Gas pipework installation requirements are included within IGEM UP/1 and UP/2. In all cases it is recommended that a line diagram be displayed at various points in the plant room to show the location of emergency manual valves at tanks and meters and at the plant room. The application of Automatic Isolation Valves is detailed within UP/10, but these are not often required for low gas pressure installations in above ground boilerhouses.

Relevant training requirements for industrialists are outlined in HSE booklet COP 20 - Standards of Training in Safe Gas Installations (1987).

Note that LPG is more dense than air, so detectors may be required at low level e.g. in trenches. Low-level ventilation is not only required at all times in associated plant rooms, it is also required in storage areas.

Rubber gas hoses have a 5-year life, and their timely replacement should be documented.

2.3.2 Oil

Oil will need to be stored on site in a fully bonded area to contain any leaks. In addition to being a fire hazard, leaks will cause slippery surfaces, so it is important to clean up any spills, however small. In the event of a major leak there is an environmental issue, and advice should immediately be sought from the Local Authority. Spilt oil must not, under any circumstances, be put to drain without first being suitably treated. Heavy fuel oil tanks and pipework may require steam heating, in which case consideration should be given to installing an oil contamination detector in the condensate return line. This is because oil contaminated condensate will be returned to the boiler, where it will may collect on heat transfer surfaces, leading to localised overheating and possible catastrophic failure of the boiler shell.

Heavy fuel oils, heated for transfer and combustion purposes can scald and emit flammable gasses.

2.3.3 Coal

Coal will require mechanical handling, and protective guards must be put in place to prevent persons or clothing being accidentally drawn into the handling equipment. As with oil and LPG, coal must be stored on site, and consideration must be given to safe storage and containment in the event of the outbreak of fire. When pulverised into dust, coal is conveyed using compressed air, and is highly abrasive.

2.3.4 Electricity

The main hazard associated with electricity that of electrical shock. RCD devices have improved safety, although it is usually not practicable to include such devices on high-powered industrial equipment. Respect must be shown for this potentially lethal hazard. All electrical cable must be suitably protected within conduit, or be supported on cable tray. Damage to cables which form part of a controls circuit, although possibly not exposing hazardous voltage, may cause essential safety controls to malfunction. Any electrical cable showing signs of damage must be attended to without delay. Adequate earthing must be ensured at the design stage and attention paid to the integrity of earthing during the life of the equipment.

2.3.5 Voltage

It is important that an electrical plan is held and properly maintained for the site. All electrical equipment should be clearly labelled. Portable power tools and other equipment, where practicable, should be 110V centre-tapped earth. Portable electrical equipment must be routinely inspected and tested.

2.3.6 Isolation

Before any maintenance work is performed, it is important to ensure that the equipment is properly isolated, and the circuit proven to be so isolated.

2.3.7 Control panels

Control panels should be fitted with locks. Main power switches should facilitate padlocking in the "off" position by maintenance staff. Control panel doors will normally be fitted with isolators, and it is important not to breach this safety device except where essential for maintenance work to be performed.

2.4 TEMPERATURE

There are many parts of a steam boiler and its ancillaries that operate at high temperature and are therefore capable of causing injury. These include inspection

openings (which are usually not insulated), the smoke box of a horizontal boiler, level control chambers, and level gauge glasses and their connecting pipework. Note that blowdown pipework and safety valve discharge pipework may rapidly reach high temperature. Consideration should be given to insulating this pipework in order to provide personnel protection if it is in close proximity to operators.

2.4.1 *Burners, furnaces and flues*

These parts of a boiler are generally insulated wherever practicable. Nevertheless, the high temperatures are such that even brief contact can cause serious skin injury. It is important that flues are routed so as not to cause any obstruction or interfere with headroom. Where this cannot be avoided, suitable guards should be put in place, failing which warning placards are necessary. Burner equipment being disassembled can be extremely hot, so special care is required.

2.4.2 *Steam and condensate pipework*

Steam, HPHW and MPHWP pipework will operate at high temperature, and in the interests of both efficiency and safety should be fully insulated. Valves should also be insulated. Pipework must be routed at safe height or so as not to cause a trip hazard. Note that superheated steam leaks are invisible and can cause serious injury.

2.4.3 *Feedwater tanks*

Feedwater tanks, hotwells, and deaerators may operate at near to boiling point. Insulation is therefore important, both in terms of energy efficiency and safety. In some instances where there is a high proportion of hot condensate returning to the tank, boiling over is inevitable. Sometimes the decision is then taken to not insulate the tank in order to mitigate the problems of boiling. In such cases it is essential to place warning placards to advise that the tank is very hot. Special attention should be paid to any indication of water hammer in the tank, which may eventually cause the tank to fracture, causing a major leak of scalding water. Many feedwater tanks are fitted with a live steam injection system for heating. Attention should be paid to the level of noise produced by either the heating steam injection system or condensate return pipework. Excessive hammering noise is symptomatic of a problem in these systems, and can result in severe damage to the tank, causing scalding hot water spontaneously to leak out in great quantity. Attention should also be paid to the condition of any external level gauge glasses, and they should be fitted with adequate protection to prevent physical damage.

2.4.4 *Safety Valves*

By their very nature, steam safety valves can suddenly open, causing rapid heating to their discharge pipework. Such pipes should therefore be safely routed and

consideration be given to their insulation. The discharge from a safety valve must be directed to a safe point where its efflux cannot cause injury. Drain points from a steam safety valve or related pipework should be piped to a safe and visible location.

2.5 PRESSURE

The main pressurised element in a boilerhouse is the steam boiler itself, the steam pipework, and the feedwater pump. When working on a pressurised system, it is important to ensure double-isolation. Steam is an erosive medium, and a small leak across an imperfectly seated valve will cause characteristic 'wire-drawing' damage. On high-pressure and superheated systems, a double-block and bleed system is the best means of isolation; additionally, disconnection followed by the fitment of adequately rated spectacle blinds or blanking flanges may be deemed to be appropriate.

2.5.1 Steam pipework

Any steam leaks must be immediately fixed. Steam is very erosive, and a steam leak will in time get worse. A leaking gasket may spontaneously blow-out, and a threaded joint can suddenly fail. Leaks around drain plugs, for example in Y-type strainers, are a particular danger, because the thread may fail and plug may become blown out at high velocity. Valves used on steam service within the boilerhouse should be made of ductile iron or steel. No steam valve should be opened quickly because of the potential for causing thermal shock and water hammer damage. Steam pipework will undergo thermal expansion, so the pipework system must incorporate adequate freedom through its geometry and mounting, or by the provision of expansion joints. Note that expansion joints are intended only to accommodate longitudinal expansion of the pipework - they must not be used to allow or to compensate for lateral expansion or pipework misalignment. Note that leaks, particularly from superheated steam systems may not be visible.

2.5.1 Condensate pipework

Although often operating at low pressure, condensate return pipework can be pressurised either by a condensate return pump, or through leaking steam traps. Undue water hammer noise in the condensate pipework usually indicates a steam trap that has failed in the open position. This should be attended to.

2.5.3 Feed water pumps

The feed water pump necessarily has to discharge at higher pressure than the boiler itself, so proper isolation of the water inlet and outlet pipes must be established if the pump is to be removed or worked on.

2.5.4 Safety Valves

Note that safety valves should have pipework that is properly drained so that it cannot contain water that could freeze and block. The discharge pipework of the valve should not have any restriction, and should be routed with the minimum number of bends.

2.6 VENTILATION

Correct and adequate ventilation is essential for a variety of reasons. Note that fresh air ingress has to cater for combustion equipment as well as any other air consumers in the same room. Ventilation requirements stated in IGEM UP/10 may be used for oil and gas fired equipment. Where fresh air is introduced mechanically, the system must be interlocked with any air consumers such that if the ingress systems fail it inhibits the operation of these air consumers.

2.6.1 *Dissipation of excessive heat*

Because of the heat generated by a boiler, ventilation is required for cooling purposes.

2.6.2 *Supply of air for combustion*

An adequate supply of air for combustion must be established by the provision of ventilation, unless the combustion air is specifically ducted into the burner air intake.

2.6.3 *Dissipation of gas leaks*

There is a high risk of gas explosion caused by an accumulation of gas within a poorly ventilated room or basement. Adequate natural ventilation must be provided, and where this relies on a fan system, the fan must be interlocked with the burner to ensure complete safety. Where there is a risk of an accumulation of gas, measures should be taken to eliminate the problem and consideration may be given to the application of a leak detection system.

2.6.4 *Flue gasses*

It is essential that the pressure in a boilerhouse should never become negative relative to the outside. If this were to happen, the products of combustion may be drawn back into the boilerhouse, causing a serious safety problem. Flue gasses must be discharged through a purpose-made flue system and discharged at a safe location as dictated by the Clean Air Act and local planning requirements. Alternatively a flue dilution system may be used subject to being interlocked with the burner controls. If mechanical extraction systems are employed, then failure of the extracting system

must inhibit the operation of the related appliances. All combustion analysis points should be of the resealable type and never left open.

2.7 EXPLOSION

The most likely causes of explosion in the boilerhouse are:

2.7.1 Explosion or fire due to leak of fuel in the boilerhouse

It is important that adequate ventilation is provided in order to mitigate this risk. The condition of pipework adjacent to gas boosters requires particular attention. On oil-fired boilers, a fusible link is required to be placed above the burner, such that in the event of a fire the fuel supply is immediately cut off. Note that coal dust can, in the appropriate ratio with air also be explosive. It must be noted that whereas natural gas is less dense than air, LPG has greater density than air. Gas detection equipment, if fitted, should therefore be installed at a height appropriate to the gas properties.

2.7.2 Explosion within the furnace of the boiler

There have been many instances of explosion within the furnace of a boiler, causing varying degrees of danger to personnel. These often arise when there is a problem in getting a burner to ignite, requiring frequent attempts to start the boiler. Under such circumstances there is the temptation to bypass the air purge period, something that is a highly dangerous. The air purge is essential in order to clear the furnace of all unburnt gasses or oil fumes prior to ignition. Explosions may also arise due to off-ratation firing and maintenance should ensure that the fuel/air control system is working correctly throughout the turndown range.

2.7.3 Explosion due to failure of the pressure vessel

Structural failure of the pressure vessel will most likely be caused by loss of boiler water and will lead to the uncontrolled release of a great quantity of stored energy. Regular inspection of the boiler will be stated in the Written Scheme of Examination. This will typically (but not necessarily) consist of an annual inspection of the boiler, intended to identify any structural defects that may have developed since the previous inspection and which could give rise to danger, and the GN4 test typically at five-year intervals, (although more frequent testing may be determined by the competent person,) which incorporates NDT of critical weld areas will further establish the integrity of the pressure vessel by identifying underlying structural defects. Having eliminated structural problems, explosion is most likely to be caused by failure of the high-pressure limiter and/or safety valve. Common causes of explosion are either low water level or poor water quality. Low water level will cause the heat exchange surfaces of the boiler to become partly exposed above the water,

leading to overheating and catastrophic mechanical failure. Poor water quality can arise through failure to blow down the boiler, leading to the accumulation of solids in the bottom of the boiler, or the development of scale on the heat exchange surfaces resulting from failure of the water treatment facility. Furthermore, the boiler feedwater may itself be contaminated, often due to the ingress of process media into the condensate return system. All of these conditions will place a layer of heat insulating material on the heat transfer surfaces of the boiler, resulting in localised overheating and failure.

2.8 THERMAL SHOCK AND WATER HAMMER

Care must always be exercised when operating a steam valve. No steam valve should be opened suddenly, as this will spontaneously apply heat to the downstream piping system. This sudden application of heat will cause thermal shock. Great stresses can develop within components due to differential thermal expansion. Condensate will rapidly be formed, to be carried with the steam at high velocity thereby causing mechanical water hammer. These conditions can cause catastrophic failure to the pipework and/or valves, resulting in the sudden discharge of steam. It should be noted that the HSE recommend that grey cast iron not be used on steam service local to a steam boiler. (See also the relevant boiler standards). Boiler crown and secondary isolating valves should be made of a more ductile material such as steel or ductile iron. In the case of large isolating valves, a separate small 'warm-up' valve may be fitted to bypass the main valve.

2.9 BOILER BLOWDOWN

The water that is discharged from a boiler during blowdown will be very hot and will incorporate a significant proportion of flash steam. The traditional manner of dealing with this hazard was to use a blowdown pit, however there have been many instances where serious deterioration of the blowdown pit has gone unnoticed, leading to the foundations of buildings being seriously damaged. The HSE recommends that all new installations use a blowdown vessel - see HSE Guidance Note PM60.

2.9.1 HSE Guidance Note PM60

This Guidance Note provides detailed guidance on the safe design and operation of blowdown systems.

Particular attention should be paid to multi-boiler installations in order to provide safe conditions for persons to enter boilers for the purposes of inspection or maintenance work. Such installations require that the blowdown valves be key-operated, or if automatic, that a safe interlock be provided between the blowdown controllers. In addition, check valves and isolating valves must be installed on all blowdown lines.

2.9.2 *The Blowdown Pit or Vessel*

2.9.2.1 *The Blowdown Pit*

Blowdown pits must be inspected at regular intervals to ensure their integrity. There have been many instances of structural failure, following which the scouring action of blowdown has caused serious soil erosion. Such erosion has been known to undermine the foundations of buildings. Because the condition of blowdown pits is difficult to monitor, HSE recommend, in PM60, the use of a blowdown vessel.

2.9.2.2 *The Blowdown Vessel*

The blowdown vessel or blowdown receiver is a pressure-vessel into which the blowdown of a steam boiler is discharged. The vessel may be easily inspected. Note that a blowdown vessel operates by radiating heat, and it should therefore not be insulated. Where necessary, personnel protection should therefore be by a barrier.

2.9.2.3 *The Water Industry Act 1991*

Section 111(1)(b) prohibits waste steam or any liquid at a temperature higher than 43°C being discharged to public sewers. The ability of a blowdown vessel to dissipate heat will often ensure compliance. Most blowdown vessels may be provided with an automatic valve to add cooling water to the vessel in order to prevent excessive temperature in the drainage system. Such cooling systems are usually essential where continuous blowdown systems are fitted.

2.10 CHEMICALS

Water treatment chemicals may be stored in or near to the boilerhouse. These may be toxic, corrosive, or flammable. Care must be taken to ensure that they are stored in an appropriate place and that the storage area is provided with suitable warning notices. Where appropriate, an eye wash facility and/or a shower must be provided.

2.11 ASBESTOS

Asbestos is a widely-used material and is likely to be found in any boilerhouse. (There remain concessions that still allow the use of asbestos for a restricted number of applications). The Control of Asbestos at Work Regulations requires that all commercial and industrial premises be audited for the presence of asbestos, and the location of any asbestos or asbestos-containing materials be permanently recorded. Anyone who is about to undertake routine service work or other building work should check against these records to determine whether they will be exposed to the risk of asbestos. Asbestos is very likely to be found in a boilerhouse. The most

likely uses are as gaskets (see 1.10 below), as an insulating material, either on pipes, the boiler itself, or any other vessel such as the hotwell or storage calorifiers. It may also be used in the structure of the building itself, for example roofing sheets or wall panels.

2.12 **GASKETS**

Modern non-asbestos gaskets are made from many different materials and some are not suitable for high temperatures or pressures. Gaskets must be selected carefully and installed in strict accordance with the manufacturer's instructions. Torque settings must be observed. Note that gasket 'paste' is usually prohibited with new materials.

2.13 **TRIPS, SLIPS AND FALLS**

The floor of a boilerhouse will inevitably receive spills of water and oil. These must be cleaned up immediately. Attention should be paid to the condition of access ladders and elevated walkways. Low-level pipework such as blowdown lines should be run in a trench where practicable. Any pipework runs that present a trip hazard should be clearly marked.

2.14 **THE SAFE OPERATION OF STEAM BOILERS**

HSE guidance note PM5 should be read carefully. It contains important information on the safe automatic operation of boiler plant.

2.15 **TRAINING NEEDS OF BOILER OPERATORS**

Great emphasis is placed by the HSE, the Insurance Industry, and other responsible bodies upon the need for proper and adequate training of boiler operators. Training courses are widely available. Any persons who are charged with responsibilities in the boilerhouse must be properly trained and competent to carry out all required functions. The ultimate responsibility for ensuring due competence rests with the person under whose jurisdiction the boilerhouse lies.

2.16 **AUTOMATION AND DE-MANNING**

Automation is not an ideal substitute for permanent manning by trained personnel. Nevertheless, financial constraints and the availability of suitable personnel have led to a great deal of automation in recent years. Whenever the supervision of a boilerhouse is reduced, it is essential to consider the safety implications. This may require that additional safety devices be fitted to the boiler in order to compensate for the reduction in supervision.

2.17 START-UP PROCEDURES

2.17.1 Start-up of the Boiler

The unattended start-up from cold of a steam boiler is a practice that is not recommended by the HSE. This is because of the danger of excessive water level developing in the boiler whilst warming-up, leading to the carry-over of water into the steam system, in turn causing destructive water hammer.

Start-up of a boiler from cold must always follow the specific instruction as laid down by the manufacturer. These instructions will include test checks on the important safety controls, and these checks must not be ignored.

2.17.2 Start-up of the Steam System

As stated under 1.7, no steam valve may be suddenly opened, indeed doing so has resulted in many fatalities over the years. In the case of large steam systems, a warm-up procedure should be set in place to ensure that steam isolating valves are opened slowly so as to allow the steam pipework to heat up slowly. A small bypass valve may be provided for this purpose. Alternatively, automatic slow-opening systems are available to operate motorised valves.

2.18 BLOWDOWN

2.18.1 Main Blowdown

Steam boilers must be blown down on a daily basis at the start of the day or, where a shift system is in operation, at the start of each shift. Blowdown is required to remove precipitated solids which would otherwise collect at the bottom of the boiler shell, forming a heat-insulating layer of mud, which would cause localised overheating and damage to the boiler pressure vessel.

2.18.2 Total Dissolved Solids (TDS) Control

For all but the smallest of steam boilers a blowdown regime should be put in place to control the quantity of dissolved solids present in the boiler water. If allowed to accumulate to an excessive degree, the boiler water will foam, and boiler water will be carried over into the steam pipework where it may cause water hammer damage. Automatic blowdown systems (TDS systems) are available which can continuously monitor the TDS level and blow down the boiler accordingly.

2.10 ROUTINE CHECKS

Unless automatic high-integrity safety devices are fitted to comply with HSE recommendations regarding limited supervision, the following checks should be made

on a daily basis. The order in which these are listed is not significant: the boiler manufacturer's instructions should be followed.

2.10.1 *Blowdown of level gauge glasses*

Most level gauge glasses are fitted with three valves, and these should be operated in the appropriate sequence to individually blow through the steam and water connections, thereby ensuring that the gauges give a true reading. Note, however, that the water in the gauge of a boiler that is under full working load might typically be 15mm to 25mm lower than the true water level in the boiler. The boiler manufacturer should be consulted on this point. The operator should familiarise himself with the normal behaviour of the water level in the boiler. Note that sightglasses that become internally cloudy or otherwise obscured may be symptomatic of a problem with the chemical treatment of the boiler water.

2.10.2 *Blowdown of external level control chamber(s), where fitted*

Where level alarms and controls are fitted in external chambers, it is important that the chambers are blown down to ensure that their steam and water connections are not restricted, thereby ensuring that the chamber truly reflects the water level in the boiler. Although very old boilers may still be found with a three-valve system, this is generally held to be unsafe as there is the distinct possibility that the valves may not be left in the correct position. Use of a single sequencing purge valve has been standard for many years on new boilers, simplifying the blowdown task, and ensuring safe conditions.

2.10.3 *Check on operation of low-level limiters*

It is important to check both the first and second low water level limiters. This should be carried out in accordance with the manufacturer's instructions.

If the limiters are fitted in external chambers, this task may be performed whilst blowing down the chambers; a periodic evaporation test may be required in order to demonstrate that the sensing mechanisms do not stick when the water is lowered slowly.

Where the limiters are fitted directly to the boiler, the water should be evaporated down to first low, and only then be blown down to second low.

2.10.4 *Operation of main blowdown valve*

The requirement to blow down a steam boiler has already been discussed under item 2.4.1.

2.10.5 *Check on TDS level*

Where automatic TDS control equipment is fitted which incorporates a permanent TDS display, this value should be noted on a daily basis so that any trend may be monitored. Note that recalibration of TDS measuring equipment is required periodically.

2.10.6 *Check temperature of feedwater tank*

Most feedwater tanks have a temperature indicator. This should be checked. Any unusual trends may point to faulty steam traps or failure of a steam heating system.

2.10.7 *Check operating pressure of boiler*

The working pressure of the boiler(s) should be observed. The design pressure of the boiler must never be exceeded.

2.10.8 *Visual examination for steam and water leaks*

As part of the daily check on the boilerhouse, there should be an inspection for and steam or water leaks. These should be rectified as soon as is practicable.

2.10.9 *Examination for fuel leaks*

Close attention should be paid to any undue smells of gas or visible oil leaks. These should not be ignored. Gas leaks warrant immediate attention.

2.10.10 *Audible check for water hammer*

Any hammering in the steam pipework, condensate return system or feedwater tank is potentially dangerous and should be investigated.

2.10.11 *The log book*

A log book should be completed to record all daily inspection and test procedures.

2.10.12 *High-Integrity Level Controls*

Many boilers are today fitted with some form of self-monitoring or self-checking level alarm and limiting system. These systems are specifically approved to facilitate extended operation without permanent supervision. The required frequency of checking must be specified by the manufacturer and be directly related to the design of the safety related control systems. Typically, instead of requiring a daily level alarm test, boilers fitted with such equipment may only require testing every 72 hours or once per week. Such systems must be designed, installed, and commissioned with great care.

2.20 MAINTENANCE AND INSPECTION

A properly maintained and appropriately used steam boiler should give many years of reliable service. Only a boiler which is in a positively unsafe condition will be condemned at inspection. Frequent servicing and inspection can reveal underlying problems with water treatment or the manner in which the boiler is being operated, enabling rectification before serious and permanent damage is effected.

2.21 MAINTENANCE

All steam boilers should be maintained in accordance with the manufacturer's recommendations. An annual major service is essential, and intermediate services may be required every three or six months. Major service work is usually arranged to coincide with inspection as per the Written Scheme of Examination, which typically takes place on an annual basis.

2.22 INSPECTION

Inspection is an essential requirement, whereby a qualified independent inspector, the "Competent Person" will examine the integrity of the boiler. The nature and frequency of these examinations will be specified in the Written Scheme of Examination.

Inspection may typically consist of an annual visual examination, with a more onerous examination of the boiler shell, incorporating NDT surveys of critical weld areas, every five years. Many shell-type boilers may also require examination of their longitudinal weld area to confirm that there is no development of 'peaking' in this area of the boiler shell. Although these examinations are often referred to a 'insurance examinations', it must be understood that examination by a Competent Person is a legal duty outside of any insurance arrangements that the boiler operator may wish to make.

SPECIMEN RECORD 1 : CONTRACTOR'S SAFETY INFORMATION

1. Background

- (a) The Company fully recognises its responsibilities under current Health and Safety legislation and seeks to achieve the highest possible standards of care for employees, visitors and all others who may be affected by all company activities.
- (b) To achieve the above objectives, it is a condition of contract that contractors shall comply with the requirements of this document which forms part of the Company's Safety Policy Statement.

2. Requirements

- (a) All contractors shall have insurance cover for General Third Party Risks to an agreed minimum limit. Evidence of cover is required as is a thirty day notice of cancellation.
- (b) No faulty equipment or tools shall be brought onto site. Evidence of current safety will be required for certain items such as portable and transportable electrical equipment and electrical tools, climbing safety equipment, pressure systems and any other items specified by the company at the time of work.
- (c) Personal Protective Equipment shall be worn where necessary and all such equipment shall be suitable, provide adequate protection and be properly maintained.
- (d) All persons working on Company premises shall be properly trained and/or be under adequate supervision and competent to undertake their duties without causing danger to themselves or others who may be affected by their acts or omissions.
- (e) A safe system of work shall be agreed with your host/contact before any work commences. The agreed safe system of work shall be changed without reference to the person with which it was agreed.
- (f) If "high risk" activities are to be undertaken, a permit to work will apply.

The following activities are considered to be high risk:

- (i) hot work
- (ii) demolition
- (iii) excavation
- (iv) work with asbestos
- (v) work in confined spaces
- (vi) electrical work above 240V
- (vii) overhead work
- (viii) other work as specified by the host before work commences.

Permits shall be correctly completed and issued before any work commences.

- (g) All contractors and persons under their control shall:
 - (i) familiarise themselves with the work site and means of fire excavation
 - (ii) note the location of the nearest First Aid facilities, and
 - (iii) act upon audible alarms, notices and signs and the instructions of local supervision in cases of emergency.

The senior contractor shall be responsible for reporting to the incident officer that all persons within his control have safely evacuated the building or otherwise in cases of emergency.

- (h) Contractors and persons under their control shall comply with all relevant Health & Safety Law and all Company Health & Safety Rules.
 - (i) All accidents must be reported immediately to your Company contact.
 - (j) All contractors shall keep those under their control within the areas designated for the work being undertaken and shall only use the designated route for access and egress.

3. Conclusion

Contractors are not relieved of any of their duties or obligations under Statute or Common Law and any breach of Company Health & Safety Rules, legal requirements or agreed safety Codes of Practice, may lead to the suspension or termination of the contract at the Contractor's own expense.

Signed: _____ Date: _____

Position: _____

On behalf of: _____ (The Company)

SPECIMEN RECORD 2 : NOTICE TO CONTRACTORS

The following requirements apply to all contractors:

1. Contractors shall comply with all relevant Health & Safety and Company Health & Safety Rules.
2. All persons within your control shall be competent to undertake their work safely.
3. A Safe System of Work shall be agreed with your contact before any work commences and may not be changed without his or her prior permission.
4. Contractors are responsible for making sure that all persons under their control know the Fire Procedures for the premises and the location of the appropriate type of Portable Fire Appliance nearest to their work.
5. The normal means of escape must not be obstructed without prior permission from your contact, who will make temporary alternative arrangements.
6. The following "high risk" activities are subject to a permit to work:
 - (i) hot work
 - (ii) demolition
 - (iii) excavation
 - (iv) work with asbestos
 - (v) work in confined spaces
 - (vi) electrical work above 240V
 - (vii) overhead work
 - (viii) other specified work.
7. Faulty tools and equipment must not be brought onto site.
8. 110V CTE electrical tools are preferred. If 240V tools are used, they must be double insulated and RCD protected. All extension leads must be properly terminated with the appropriate plugs and sockets and be otherwise unjointed.
9. All portable and transportable electrical equipment, pressure systems and climbing safety equipment, shall be within their current safety certification period.
10. Personal Protective Equipment shall be worn when necessary and shall be suitable and properly maintained.

DECLARATION

I have understood and agree to comply with the above requirements.

Name: _____ Company: _____
 Signed: _____ Date: _____

(to be retained)

(Detach here and issue)

CONTRACTORS' SAFETY INFORMATION

Your contact is: _____ Telephone: _____

The person in charge of First Aid is: _____ Telephone: _____

The First Aid Kit is located: _____

The First Aid Room is location: _____

The Company emergency telephone number is: _____

Appendix One

Statutes

The Health and Safety at Work, etc Act 1974

Statutory Instruments

The Management of Health and Safety at Work Regulations
The Workplace Health and Safety Regulations
The Personal Protective Equipment at Work Regulations
The Control of Substances Hazardous to Health Regulations
The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
The Health and Safety (Consultation with Employees) Regulations
The Manual Handling Operations Regulations
Construction (Design and Management) (Amendment) Regulations (CDM).
The Children (Protection at Work) Regulations
The Working Time Regulations
The Electricity at Work Regulations
The Provision and Use of Work Equipment Regulations
The Electromagnetic Compatibility Regulations
The Health and Safety (First Aid) Regulations
The Safety Representatives and Safety Committees Regulations
The Noise at Work Regulations
The Construction (Head Protection) Regulations
The Control of Asbestos at Work Regulations
The Ionising Radiations Regulations 199
The Control of Lead at Work Regulations
The Health and Safety (Safety Signs and Signals) Regulations
The Supply of Machinery (Safety) Regulations
The Pressure Equipment Regulations
The Pressure Systems Safety Regulations
The Health and Safety (Display Screen Equipment) Regulations
The Confined Spaces Regulations
The Working Time Regulations

HSE Guidance Notes

PM5 Automatically Controlled Steam and Hot Water Boilers
PM60 Steam Boiler Blowdown Systems

Institution of Gas Engineers and Managers

UP/4 Commissioning of Gas-Fired Plant
UP/10 Installation of Gas Appliances
SR/24 Risk Assessment

SAFed Guidance Notes

PSG2 Guidelines for the Operation of Steam Boilers

Other Documents

Five Steps to Risk Assessment. INDG 163 (REV1) 1998
IND(G)73(rev). Working alone in safety.

Appendix 2

Useful Contacts

Combustion Engineering Assocn

1a Clarke Street
Ely Bridge
Cardiff CF5 5AL
Tel: 029 20 400 670
Fax: 029 20 555 542
Email: info@cea.org.uk
www.cea.org.uk

OSHE Link Ltd

Occupational Safety Health &
Environmental Consultancy
16 McLernon Way
Winslow
Buckinghamshire MK18 3FE
Tel: 01296 715166
www.oshelink.co.uk

Health & Safety Executive

HSE Books
PO Box 1999
Sudbury
Suffolk CO10 6FS
Tel: 01787 313995

Health & Safety Executive

Home page: www.open.govhse.hsehome/htm
Pubns page: www.hse.gov.uk/pubns

Inst of Gas Engineers & Managers

Charnwood Wing
Ashby Road
Loughborough LE11 3GH
01509 282728
www.igem.org.uk

AUTHORS

Michael Dunn BSc MIOSH MIIRSM
Kim Stopher, Chairman, Combustion Engineering Association

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It is the ultimate responsibility of the reader to ensure that he operates in compliance with the latest legislation, regulations, and official guidance documents such as HSE guidance publications.

COMBUSTION ENGINEERING ASSOCIATION

CEA is a registered charity and seeks to promote the science of combustion engineering in the commercial/industrial sector.

CEA is concerned with 'good practice' and the safe and efficient operation of combustion related plant and equipment, and is consulted by the UK Government through DTI, DEFRA, HSE and also the European Commission, on all new or re-used legislation as it affects the combustion sector.

CEA membership is open to companies, partnerships, sole traders and individuals, and the membership includes: boiler/Burner manufacturers, steam equipment and associated plant, environmental consultants, energy contractors, end-users from the hospital, food, chemical and various other industries.

For further information please contact:

Combustion Engineering Association
1a Clarke Street. Ely Bridge. Cardiff CF5 5AL
Tel: 029 20 400 670 Fax: 029 20 555 542
Email: info@cea.org.uk www.cea.org.uk