



**THE UNIVERSITY
OF BIRMINGHAM**

Health and Safety Policy

Pressure Systems

UHSP/10/PS/04

This document sets out in more detail the arrangements for compliance with University Health and Safety Policy at Budget Centre level and it gives guidance on how these requirements may be met. This document forms a part of the University Health and Safety Policy. It has been approved by the Environment, Health and Safety Executive Committee, in consultation with the Joint Safety Advisory Committee, and it will be subject to review.

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Pressure Systems

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INTRODUCTION

Aim of the Policy

The Policy is aimed at preventing the risk of serious injury from the uncontrolled release of stored energy as a result of failure of a pressure vessel system or part of it.

Scope of the Policy

This Policy is intended to ensure compliance with relevant statutory requirements, primarily *The Pressure Systems Safety Regulations*. These Regulations apply to the **in-service aspects of pressure systems** such as operation and periodic examination. They also deal with the design and construction aspects of systems, which are outside the scope of *The Pressure Equipment Regulations*, (which apply to the **design and construction** aspects of a pressure system). The Policy takes into account the guidance issued by the Health and Safety Executive.

The policy does not cover transportable pressure receptacles (i.e. gas cylinders). These are covered by Health and Safety Policy for compressed gas¹.

This Policy should be read in conjunction with ***Statutory Examination, Inspection and/or Testing of Specified Equipment*** (UHSP/16/SIET/01) which sets out the arrangements for the carrying out and monitoring of statutory examinations, inspections and/or testing of pressure systems.

Introduction to the Policy

A pressure system comprises a rigid pressure vessel, and it may include a gas cylinder and associated pipework. (A more detailed definition is given in Appendix 1) With the exception of the scalding effect of steam the Policy does not cover the harmful effects (e.g. corrosion) of any substance that might be released, unless those effects endanger the safety of the system by accelerating wear and thereby leading to an increased risk of failure of the system.

The Policy is concerned with steam, gases under pressure and fluids, such as liquid carbon dioxide and LPG, which are artificially kept under pressure and become gases on release to the atmosphere. The statutory term '**Relevant Fluid**' is applied to these substances by the Policy when at a pressure greater than 0.5 bar above atmospheric and steam at any pressure. 'Relevant fluid' also applies to air and to hot water kept above its boiling point, provided the pressure in the system exceeds atmospheric by at least 0.5 bar.

Vessels, other than steam plant, with small amounts of stored energy are exempt from certain parts of the Policy. However, other vessels such as liquid gas dewars which could become pressurised unintentionally are covered by a separate University Health and Safety policy². The Policy is not intended to deal with vacuum conditions. Details of other exceptions to the Policy are listed in the Appendix 4.

The Policy does not apply to purely hydraulic systems, systems containing traces of dissolved gas or to liquids in storage tanks which exert a static pressure.

The Policy also may not deal with all the hazards arising from the operation of a system. However, separate legislative requirements and other University health and safety policies^{1,3} will apply so far as

¹ *Compressed Gas* (UHSP/20/CG/03)

² *Enhanced Good Chemical Practice for Work with Very Low Boiling Point Liquefied Gases* in Hazardous Substances Policy UHSP/15/HS/03 Schedule 3.12/01

³ *Hazardous Substances Policy* UHSP/15/HS/03

hazards from contents, such as toxicity, flammability are concerned and the user of a pressure system will still need to consider these other aspects when deciding on the level of precautions required.

Examples of Pressure Systems

Pressure systems may be fixed systems, usually a part of the University's plant or infrastructure, for example:

- boilers and steam heating systems
- calorifiers
- static gas tanks (liquid nitrogen, oxygen etc.)
- air receivers
- autoclaves
- compressed gas distribution systems
- refrigeration plant

or they may be mobile, experimental or temporary, for example:

- air receivers
- gas receivers
- autoclaves
- pressure cookers
- retorts
- heat exchangers
- calorimeter bombs
- superheaters
- sterilisers
- experimental rigs
- gas cylinders and associated valve gear (See appendix 1)

University owned equipment

Most items of equipment will be owned by the University. Some of this equipment will be owned by the Budget Centre in which the equipment is situated; this equipment is the responsibility of that Budget Centre. However, certain items owned by the University will be in a Budget Centre but will not be owned by or be the responsibility of that Budget Centre. In these cases they will be the responsibility of the Office of Estate Management. e.g. hot water systems and steam mains.

Hired, leased or borrowed equipment

Other items of equipment may not be owned by the University. This equipment may be hired, leased or borrowed by the University from an outside organisation. In these cases, for non-fixed installations the owner has certain statutory duties as regards inspection and testing. For fixed installations the University has the same statutory duties as it has for fixed equipment it owns unless the owner contractually takes on these duties.

Whatever the arrangement the University must ensure that the required duties are being carried out.

POLICY

All Equipment Owned by The University

Heads of Budget Centres are responsible for making arrangements to ensure that:

Identification and keeping a register

1. all pressure systems which come within the scope of this policy are identified and a register kept;
2. a copy of the register and any changes made to it should be sent immediately to Estate Management;

Operation

3. no pressure system is operated unless the safe operating limits have been established;
4. arrangements are in place to prevent defective equipment being operated;

Where written schemes of examination are required

5. a pressure system that requires a written scheme of examination it is not operated until the scheme has been drawn up and examined in accordance with the scheme;
6. a written scheme of examination is drawn up for a system where the product of the pressure and internal volume of a system is 250 bar litres or more and such systems are examined in accordance with that written scheme. The written scheme must fulfil the criteria set out in Appendix 2(a);
7. persons who draw up written schemes of examination and/or carry out examinations in accordance with such schemes must be a 'Competent Person' acceptable to the Director of the University Health and Safety Unit (see Appendix 2e);
8. before any system is examined the system is safe for examination and any measures specified in the written scheme have been taken;
9. any requirements of the report (Appendix 2b) made following each examination are implemented or if the requirements of the report are not implemented within the time specified the equipment is taken out of service;
10. if an examination required under a written scheme is postponed, use of the equipment complies with the criteria set out in Appendix 2c;
11. records of examination and testing of equipment covered by written schemes and the subsequent remedial work carried out are kept as set out in Appendix 2d;

Where written schemes are not required

12. in cases where written schemes are not required, equipment must be inspected and tested and maintained in a safe condition;

Installation

13. any member of staff of the Budget Centre who installs a pressure system is competent and that the method of installation does not give rise to danger or otherwise impair the operation of any protective device or inspection facility;

Design, manufacture, importation, supply, modification or repair

14. any member of staff of the Budget Centre who designs, manufactures, imports, supplies, modifies or repairs a pressure system or part fulfils the criteria set out in Appendix 3;
15. any modifications or repairs do not cause danger or impair the operation of any protective device or inspection facility and that sufficient written information about the modification or repair is provided to enable compliance with the requirements of this Policy;
16. no plate or any other mark relating to design, construction, test or operation is removed or altered;

Instruction and training

17. any person who operates a pressure system is provided with adequate and suitable instruction and training in its safe operation and operates the system correctly.

Fixed Equipment Not Owned By The University

(i.e. Leased, Hired or Borrowed)

Heads of Budget Centres are responsible for making arrangements to ensure that:

1. paragraphs 1 to 17 above are complied with unless the owner has contracted to take on the specific duties as regards drawing up a written scheme of examination and carrying out inspections and testing under the scheme;
2. paragraphs 1, 2, 4, 5, 12, 13, 14, 15, 16 and 17 above are complied with if the owner has contracted to take on the specific duties as regards inspection and testing under a written scheme.

Non-Fixed Equipment Not Owned by The University

(i.e. Leased, Hired or Borrowed)

Heads of Budget Centres are responsible for making arrangements to ensure that:

paragraphs 1, 2, 4, 5, 12, 13, 14, 15, 16 and 17 above are complied with.

All Equipment Whether or Not Owned by The University

The Director of Estate Management must ensure that:

A register and records of all systems notified to their office is maintained.

Individuals:

1. must use equipment safely as instructed and trained;
2. must report all defects that they may become aware of;
3. must not use knowingly defective equipment;
4. must not install a system unless competent to do so;
5. must not remove or alter any plate or any other mark relating to design, construction, test or operation;
6. who design, manufacture, import, supply or modify a pressure system or part of a system must fulfil the criteria set out in Appendix 3;
7. who modify or repair equipment do not cause danger or impair the operation of any protective device or inspection facility and that sufficient written information about the modification or repair is provided to enable compliance with the requirements of this Policy.

APPENDIX 1

Definitions

"Pressure System" means:

- a system of one or more rigid pressure vessels, associated pipework and protective devices;
- pipework and its protective devices for use with a gas cylinder, provided pressure in pipework is expected to be not less than 0.5 bar;
- a pipeline, its protective devices and valves, compressors etc. which facilitate flow of fluid;

which contains or is liable to contain a relevant fluid, but does not include a gas cylinder on its own.

Systems may either be fixed (installed) or mobile systems.

"Relevant fluid" means:

- steam;
 - any fluid or mixture at a pressure greater than 0.5 bar above atmospheric and which is
 - (i) a gas, or
 - (ii) a liquid of vapour pressure greater than 0.5 bar above atmospheric when in equilibrium with its vapour at either the actual temperature of the liquid or 17.5°;
- or
- a gas dissolved under pressure in a solvent contained in a porous substance at ambient temperature and which could be released from the solvent without the application of heat, that is acetylene.

"Gas cylinder" means:

a container of a relevant fluid, including its permanent fittings and valves which is:

- transportable for refilling and of volume between 0.5 litres and 3000 litres;
- non-refillable and of volume between 1.4 and 5 litres.

It **DOES NOT** mean:

- a portable fire extinguisher unless it is made to gas cylinder standards;
- a dewar flask.

"Head of Budget Centre" means:

- the Head of the Budget Centre to which the equipment belongs or which has hired, leased or borrowed it. In certain cases, such as the hot water distribution system, the Head of Budget Centre will be the Director of Estate Management.

"Danger" means:

- anything that can cause serious injury.

"Competent Person" means:

- an individual or group of people with adequate relevant experience and knowledge of the law, codes of practice, examination and inspection techniques and understanding of the effects of operation for the system concerned and who is acceptable to the Director of the Health and Safety Unit.

APPENDIX 2

Pressure Systems Requiring a Written Scheme of Examination

Where a written scheme of examination is required, Appendix 2 applies to all equipment belonging to the University and also fixed installations not owned by the University and where the owner has not contracted to take on the responsibility for the written scheme of examination.

a) Contents of a Written Scheme

The scheme must include and clearly identify the following parts of a system:

- all protective devices;
- every pressure vessel and/or every pipeline in which a defect may give rise to danger;
- those parts of the pipework in which a defect may give rise to danger.

The scheme must:

- specify the nature and frequency of examination;
- specify any measures necessary to prepare the pressure system for safe examination other than those it would be reasonable to expect the user or owner to take without specialist advice;
- where appropriate, provide for an examination to be carried out before the pressure system is used for the first time.

Typical contents of a scheme of examination should identify the following:

- the name or other identifier of the plant;
- the parts of the pressure system which are to be examined;
- the type of examination required (i.e. internal/external, non-destructive testing etc.) including checks on protective devices;
- the preparatory work, if any, for the examination;
- for new systems, the date by which the initial examination is to be completed;
- the maximum interval between examinations;
- the parts which if modified or repaired should be examined by the 'competent person' before the system is used again;
- the name of the 'Competent Person' drawing up or certifying the scheme of examination.

The content of the written scheme must be modified in accordance with any recommendations made by the 'Competent Person' arising out of a review of the scheme.

b) Report following an Examination

The report must:

- identify the system or parts of a system that have been examined;
- state the condition of the system or parts of the system examined and the results of the examination;
- specify any repairs or modifications, or changes to safe operating limits of the parts examined and specify the date by which these must be made;
- if necessary, specify an earlier date for the next examination than that specified in the scheme;
- state whether the scheme is suitable or should be modified and give reasons.

c) Arrangements for postponing an Examination

The date specified for further examination may be postponed to a later date by agreement in writing with the 'Competent Person' carrying out the examination if:

- postponement does not give rise to danger;
- only one postponement is made for a particular examination;
- the postponement is notified by the owner in writing to the enforcing authority before the date for examination specified in the report.

If the examination is carried out by a member of the University's staff the notification to the enforcing authority must include a declaration that the postponement will not give rise to danger.

d) Keeping of records of Examinations

The records for a pressure system must be kept by the Budget Centre to which it belongs. A copy must be kept by Estate Management. The record must include:

- the last report of examination made by the 'Competent Person';
- any previous reports if they will help in assessing whether:
 - (i) the system is safe to operate; or
 - (ii) any repairs or modifications can be carried out safely;
- any document containing information about design, construction, examination, operation and maintenance which relate to parts of a pressure system included in the scheme of examination;
- any document required to be produced when an examination, required under a written scheme is postponed. These records must be kept until the postponed examination has been carried out.

Copies of these records must be passed on to a new owner.

Reports may be kept in an electronic form.

A written copy of electronic records must be passed on to a new user/owner.

e) 'Competent Person' drawing up a Written Scheme and/or carrying out Examinations in accordance with such schemes

Such a person must have adequate practical and theoretical knowledge to assess the actual working and condition of the plant and whether it will not cause danger in the period up to the next examination when properly used and be acceptable to the Director of the Health and Safety Unit.

Since, for insurance purposes, the systems will have to be examined by a person acceptable to the University's insurers, it is recommended that the current University insurers, subject to them being acceptable to the Director of the Health and Safety Unit, be the person to draw up the written schemes and carry out examinations in accordance with such schemes.

APPENDIX 3

Design, Manufacture, Modification, Repair, Importation and Supply Of Pressure Systems

Anyone who designs, manufacturers, modifies, imports or supplies any pressure system or part of a pressure system whether new or second hand, must:

- ensure proper design and construction from suitable material so as to prevent danger;
- ensure that design and construction allows all necessary examinations for preventing danger to be carried out;
- if provided, ensure access to the interior can be gained without danger;
- provide such protective devices as are necessary to prevent danger, and ensure any such device designed to release the contents will do so safely, so far as is practicable.

Anyone who designs or supplies a pressure system must provide sufficient written information about the design, construction, examination, operation, and maintenance of a the system to enable the requirements of this policy to be complied with.

Anyone who manufacturers a pressure vessel must attach a plate to the vessel displaying the following particulars:

- the manufacturer's name;
- a serial number to identify the vessel;
- the date of manufacture of the vessel;
- the standard to which the vessel was built;
- the maximum design pressure of the vessel;
- the minimum design pressure of the vessel when it is other than atmospheric;
- the design temperature.

Anyone who modifies or repairs any pressure system or part of a pressure system must:

- ensure that the instructions and training given to users are still relevant;
- update the Budget Centre records;
- ensure that, if the equipment requires a written scheme of examination and any modification/repair is done to a part specified in the scheme that requires re-examination following any modification/repair, then the equipment is not used until it has been re-examined by a 'Competent Person' and Estate Management have been informed.

Also any safe operating level must be either displayed on the vessel or provided to the operator in writing.

Note

The above requirements of Appendix 3 apply to anyone who designs, manufactures, modifies, repairs, imports and supplies pressure systems. However if the intention is to make or assemble equipment for use by other organisations then additionally *The Pressure Equipment Regulations* are likely to apply. For further information contact the Health and Safety Unit.

APPENDIX 4

Exclusions to the Policy

- Systems which are part of the equipment of ships, spacecraft, aircraft, hovercraft and hydrofoil.
- Systems which are components of weapons systems.
- A system which forms part of the braking, control or suspension system of a road or rail vehicle.
- A system which is only a pressure system because it is subject to a leak test or because its pressurisation is unintentional or not reasonably foreseeable.
- A pipeline in which the pressure does not exceed 2 bar over atmospheric. This excludes low pressure pipelines similar to that of the british gas distribution system.
- Diving plant or equipment, other than gas cylinders, which are subject to *the diving operations at work regulations 1981(as amended in 1990)*.
- A system which is subject to *the work in compressed air (special) regulations 1958*.
- The fuel storage tank and fuel system which uses a relevant fluid for propulsion and other pressure systems found on a vehicle such as those for heating, cooking, ventilation and refrigeration.
- Any pressurised water cooling system for an internal combustion engine or compressor.
- Any two-part beer keg.
- Any beer or fizzy drink container, provided the capacity does not exceed 0.252m³ and the maximum working pressure does not exceed 12 bar above atmospheric.
- Any vehicle tyre.
- Any refrigeration system incorporating compressor drive motors, including standby motors, having a total installed power not exceeding 25 kw.
- A slurry tanker used in agriculture.
- Prime movers including turbines but not including steam locomotives or traction engines.
- Any pressure system which is an electrical or telecommunications cable.
- Any pressure system containing sulphur hexafluoride gas and forming an integral part of high voltage electrical apparatus.
- Any pressure system consisting of a water filled fluid coupling and used in power transmission.
- Any portable fire extinguisher with a working pressure below 25 bar at 60°C and having a total mass not exceeding 23 kg.
- Hand held tools.

GUIDANCE

Maintenance of Pressure Systems

Equipment where the pressure x volume of the system is 250 bar litres or more is required to have a written scheme of examination and to be examined in accordance with that scheme. However there is a general duty under Health and Safety Legislation to ensure **all** equipment is maintained in a safe condition.

When examining any pressure system particular attention should be paid to the condition of the following:

- liquid/gas control equipment;
- pipework, hoses and connections;
- cylinders/containers;
- protective devices;
- emergency controls.

The manufacture's recommendations should be followed.

The Policy specifies that any person who maintains equipment in accordance with a *Written Scheme* must be approved by the Director of the Health and Safety Unit. However anyone who maintains any pressure system, even if the system is not examined under a written scheme, must be competent to do so.

Installation of Pressure Systems

If a member of Estate Management Staff installs a pressure system then the Director of Estate Management is responsible for ensuring that the person carrying out the work is competent and that the method of installation does not give rise to danger or otherwise impair the operation of any protective device or inspection facility.

If a member of a staff of any other Department/School installs a pressure system then the above duty is on his/her Head of Budget Centre.

Instructions to Operators

In order to operate equipment safely the Policy requires users to have adequate instruction and training and be made aware of the safe operating limits of the system.

The instructions given should include a schematic circuit or flow diagram for the system, including pipework. The diagram should include all significant controls, valves and relevant safe operating limits, with those of importance in an emergency clearly identified. The diagram should be updated when changes are made to the system.

The safe operating limits may include:

- the maximum design pressure of the vessel;
- the minimum design pressure of the vessel when it is other than atmospheric;
- the design temperature;
- the maximum flow rate of the relevant fluid;
- the volume of the relevant fluid.

Keeping a Register

Each Budget Centre will keep a central register of their pressure systems. Additionally Estate Management will keep a central register of all systems requiring a written scheme of examination. This is so that examinations required under statutory duty and for insurance purposes can be co-ordinated.

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