

# Pressure Systems Safety Policy

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## 1. Introduction

The aim of this procedure is to prevent serious injury from the release of stored energy as a result of the failure of a pressure system or one of its component parts.

With the exception of the scalding effects of steam, this guidance does not consider the hazardous properties of the contents released following system failure. This is covered by the Chemical Safety Policy.

The Health and Safety at Work, etc. Act 1974 requires employers to provide and maintain plant and systems of work that are safe and without risks to health. The Provision and use of Work Equipment Regulations 1998 aims to ensure that work equipment should not result in health and safety risks, regardless of its age, condition, or origin.

This procedure informs Schools and Departments of the key requirements of the Pressure Systems Safety Regulations 2000.

## 2. Definition of a Pressure System

The regulations are concerned with steam at any pressure, gases which exert a pressure in excess of 0.5 bar above atmospheric pressure and 'relevant fluids'<sup>1</sup> which may be mixtures of liquids, gases and vapours where the gas or vapour phase may exert a pressure in excess of 0.5 bar above atmospheric pressure.

In the case of some storage systems where gas is kept in liquid form at very low temperatures in a tank, if the pressure above the liquid is below 0.5 bar then the regulations would not apply unless the pressure rises above 0.5 bar.

The Regulations do not apply simply as a result of pressure exerted by a head of liquid. The Regulations do not apply to vacuum conditions.

## 3. Roles and responsibilities

### 3.1 Owners

The duties for the owner are assessed on whether they have control over the operation of the system or if they are leasing or hiring out the equipment. This applies if the system is:

- a) An installed system fixed in a permanent location. If the system is controlled by its owner, they are regarded as the owner and the user so are therefore responsible for ensuring full compliance with the Regulations. In tenanted or leased premises, for example, multi-occupied buildings, the system owner, and its users may be different.

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<sup>1</sup> Relevant fluid is a). steam at any pressure, b). any fluid or mixture of fluids which is at a pressure of greater than 0.5 bar above atmospheric and c). a gas dissolved under pressure in a solvent (e.g. acetylene).

- b) A mobile system capable of being transported to other sites or premises. If the system is used by the owner or leased or hired out, the owner is responsible for ensuring fully compliance with the Regulations.

### **3.2 Users**

Once it is installed, the user has primary responsibility for the pressure system, in particular:

- a) Training and safe operation
- b) Maintenance
- c) Action in case of emergency
- d) Safe operating limits
- e) Written scheme of examination
- f) Periodic examination of the system
- g) Keeping records

The user has also to ensure that before the system is used by themselves or their employees the following is completed:

- a) A suitable and sufficient risk assessment is completed
- b) The system is, and remains, suitable for the purpose intended
- c) Personal protective equipment (PPE) is provided if required.

### **3.3 Procedures for users and owners of Pressure Systems on arranging maintenance, inspections, and examinations**

Most items of equipment will be owned directly by the University. Some of this equipment will be owned by the School/ Department in which the equipment is situated; this equipment is the responsibility of that School.

However, certain equipment owned by the University will be in other School/ Department premises but will not be the responsibility of that School/ Department. In these cases, the equipment will be the responsibility of Estates e.g. Hot water systems and steam mains.

It is the School or Department's responsibility to ensure that any system they own complies with the current Pressure Systems Safety Regulations and this guidance. A system must not be used until a written scheme of examination has been produced by a competent person.

Each School or Department must contact Estates to arrange for their equipment to added to the University's pressure systems inventory/ asset list and inspected by the University's insurer's competent person.

The written scheme of examination will be kept electronically by both the University's insurers and Estates.

Schools and Departments who are users and/ or owners of Pressure Systems must ensure that the system is properly maintained in good repair, so as to prevent danger. Maintenance should not be confused with the requirements of examinations under the written scheme. The maintenance will need to include the requirement for the system to be opened up for inspection by the University's competent person and for the rectification of works identified by the competent person as part of inspection.

### **3.4 Examples of Pressure Systems**

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

- Boilers and steam heating systems
- Calorifiers
- Static gas tanks (liquid nitrogen, oxygen etc.)
- Air receivers
- Autoclaves
- Compressed gas distribution systems
- Refrigeration plant

Pressures systems may also be mobile, experimental, or temporary such as:

- Air receivers
- Gas receivers
- Autoclaves
- Pressure cookers
- Retorts
- Heat exchangers
- Calorimeter bombs
- Superheaters
- Sterilisers
- Experimental rigs
- Gas cylinder and associated valve gear

### 3.5 Pressure Systems categories

There are three categories or Pressure System. In the laboratory environment, for example, most will fall in to the minor or intermediate systems:

Minor Systems	Intermediate Systems	Major Systems
Small, simple systems containing steam, pressurised hot water, inert gases, or fluorocarbon refrigerants.	Anything that does not fall into minor or major categories	Steam generator over 10MW
Pressure should be less than 20 bar (2.0 MPa) above atmospheric pressure unless the system has a direct-fired heat source, when it should be less than 2 bar (200kPa)	Pipelines are included if the pressure-volume product is greater than $10^5$ bar litres	Any pressure storage system where the largest vessel is more than $10^6$ bar litres ( $100\text{MPa m}^3$ )
Pressure-volume product for the largest vessel should be less than $2 \times 10^5$ bar litres ( $20\text{ MPa m}^3$ )		Any manufacturing or chemical reaction system where the pressure-volume product for the largest vessel is more than $10^5$ bar litres ( $10\text{Mpa m}^3$ )
Temperatures in system should be between $-20^\circ\text{C}$ to $250^\circ\text{C}$		Pipelines are included if the pressure-volume product is greater than $10^5$ bar litres
Smaller refrigeration systems operating at lower temperatures		
Pipelines are not included		

## 4. Hazards and Risk

### 4.1 The principle causes of Pressure Systems incidents are:

- Poor equipment and/ or system design
- Poor maintenance of equipment
- An unsafe system of work
- Operator error, poor training/ supervision
- Poor installation
- Inadequate repairs or modifications.

#### **4.2 The main hazards are:**

- Impact from the blast of an explosion or release of compressed liquid or gas.
- Impact from parts of equipment that fail or any flying debris.
- Contact with released liquid or gas, such as steam.
- Fire resulting from the escape or flammable liquids or gases.

#### **4.3 The degree of risk from pressure system failure depends on these factors:**

- Skills and knowledge of the people that maintain, test, and operate the equipment.
- Pressure of the system
- Type of liquid or gas and its properties
- Suitability of the equipment and pipework that contains it
- Age and condition of the equipment
- Complexity and control of the operation
- Prevailing operating conditions (e.g. high-temperature processes)

#### **4.4 Daily Checks**

All checks should be in accordance with the manufacturer's recommendations.

The Daily checklist may include:

- Pressure settings and gauge readings
- Fluid levels
- Valve operations, including signs or regular discharges
- Control-system operation
- Condition of protective devices
- General cleanliness (housekeeping) in and around the system.

These regular checks should form part of a safe system of work and ensure that they:

- Provide safe and suitable equipment
- Ensure that equipment is suitable for the intended purpose
- Ensure that the materials of manufacture are suitable for the liquids or gases they will contain
- Ensure that the system can be operated safely without access difficulties
- Be careful when repairing or modifying a system

What are the Operating Conditions:

- Is the gas or liquid toxic or flammable?
- What are the process pressures and temperatures?
- What are the safe operating limits?
- Is there a set of operating instructions for all of the equipment?
- Have the operators had suitable training on the operating instructions?

## **5. Fitting of Suitable Protective Devices**

Protective devices include pressure relief valves and electronic gear which close the system down in case of malfunction.

Ensure:

- Protective devices cause shutdown when temperature, pressure or levels are exceeded
- Protective devices are adjusted to correct settings
- Audible and visual warning devices are noticeable
- Protective devices are always kept in good working order
- Safety valves and bursting disc discharge towards a safe place
- Once set, protective devices can only be altered by an authorised person

## **6. Operation and Maintenance**

The user of a system must be provided with suitable instructions for its safe operation and for emergency action. This will often be provided by the manufacturer of a new system.

In an existing system those instructions should be verified as operable or rewritten if found to be inadequate by those responsible for managing the system.

The user must ensure that the system is operated according to those instructions.

Users of autoclaves and other high temperature equipment should be aware of the very high temperatures that may be reached and consequent risks of burns and scalds.

If needed, appropriate Personal Protection Equipment (PPE) will be provided and should always be worn if identified as necessary in the Risk Assessment. Further guidance on the selection and use of PPE can be found in SP38 PPE.

### **6.1 Written Scheme of Examination**

No Pressure Systems to be used at work can be operated unless there is a written scheme for the periodic examination. The written scheme must state the nature and frequency of the examinations, specify any extra measures necessary to prepare the system for safe examination and, where appropriate, must provide the for the examination to be carried out before the system is first used.

Properties and Facilities maintain an up to date inventory of all pressure vessels and systems in use within the University. They must be consulted prior to procurement of any system so that written schemes of examination can be devised and the necessary follow up arrangements can be put in place.

Every system will be subject to thorough examination by an insurance company competent person under the written scheme of examination.



The written scheme may be authored in conjunction with that competent person. City, University of London will ensure that the examination is carried out and must also ensure the safety of the examiner by performing the required preparatory work.

Examination periods will vary depending on the type of system, its age, and its use. Periods can vary between 12 and 14 months.

Details to be included in the examination report include:

- Name and address of the owner
- Address and locate of the system and name of the user (if different)
- Whether subject to a written scheme
- Identification of system or parts examined
- Condition of system or parts examined
- Parts not examined
- Result of examination
- Any repairs needed and the timescale for completion
- Any changes in the safe operating limits and the date by which they should be made
- Any change in the written scheme of examination
- Date by which the next examination must be completed
- Other observations
- Where the most recent examination was postponed names, date of relaxation and new date examination was to be completed
- Date examination took place
- Name and address of competent person
- Signature
- Date of report

## **6.2 Record Keeping**

With regard to installed pressure systems, documents must be kept at the same site as the system, and for mobile<sup>2</sup> pressure system, at the UK office which is in charge of their deployment.

Estates manages all such records. Where a system or part of a system changes ownership, the previous user/ owner must provider the new user/owner with all relevant documentation.

## **7. Arrangements for securing the Health and Safety of Staff, Students, and others**

London Metropolitan University will ensure that:

- a) The safe operating limits of all pressure systems are established, recorded, and visibly marked.

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<sup>2</sup> A mobile system is one that can easily be moved from place to place, e.g. an air compressor that is taken from site to site. NOTE: A steam boiler fitted with skids ('package boiler') may be installed temporarily to maintain steam supply to a site during the replacement of an existing boiler, but this should be also be treated as an installed system.

- b) Each system is periodically examined under a written scheme of examination by a competent person.
- c) The competent person is nominated in writing by the University or by the company providing this service.
- d) Operating and maintenance duties are implemented, and instructions are given to operators. **NOTE: this is the responsibility of the School/ Department managing the equipment.**
- e) Records relating to each pressure system are kept by a responsible person.

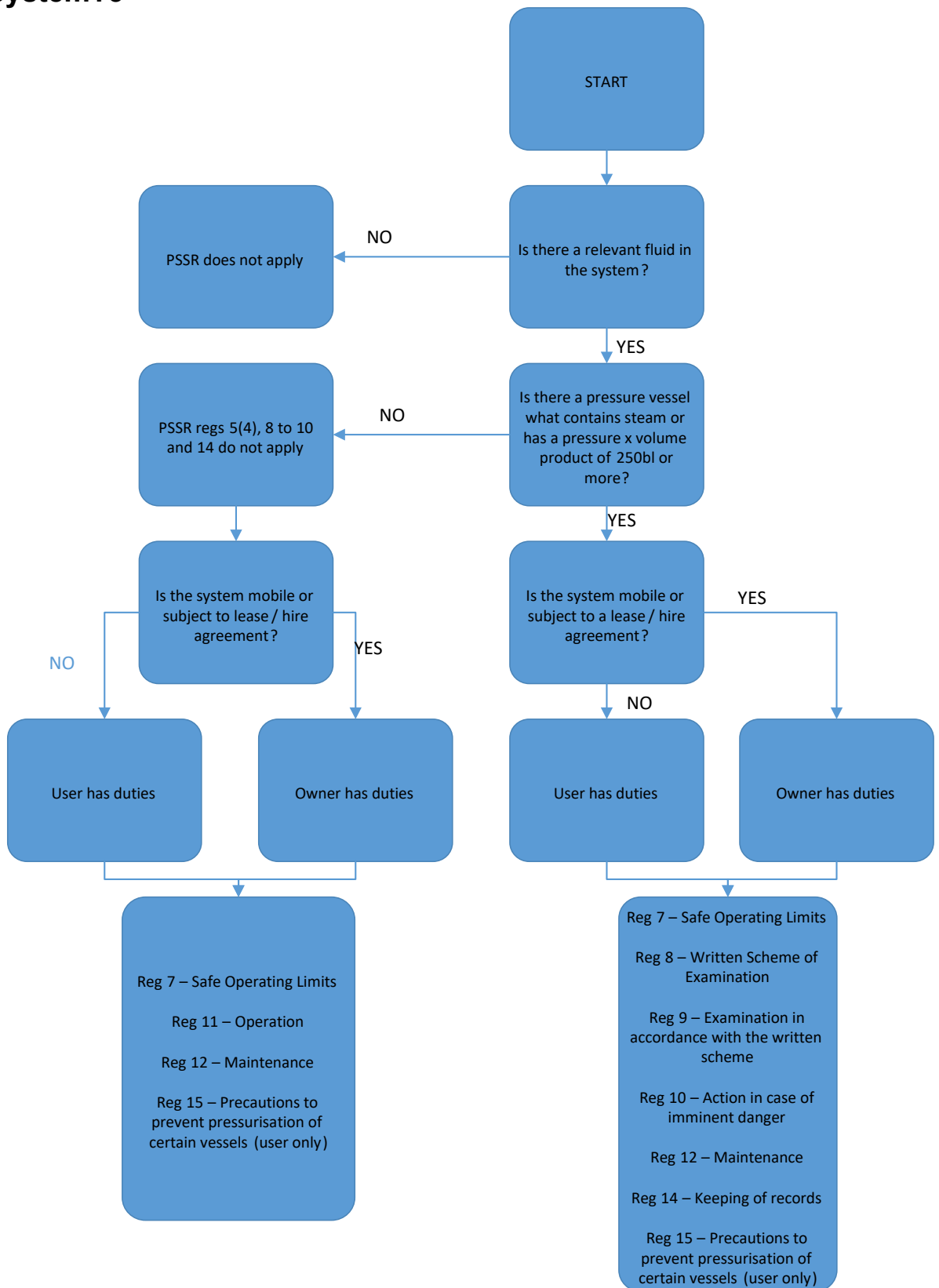
## 8. Information and Training

The University must provide sufficient information, instruction, and training to all those involved in the operation, maintenance, and examination of pressure systems. Records should be kept of any training given in compliance with statutory duties.

## 9. References and further reading

- Pressure Systems, HSE  
<http://www.hse.gov.uk/pressure-systems/>
- Approved Code of Practice, HSE:  
<https://www.hse.gov.uk/pubns/books/l122.htm>
- Pressure Systems, A brief guide to safety (HSE):  
<http://www.hse.gov.uk/pubns/indg261.pdf>
- Safety Requirements for Autoclaves (HSE):  
<http://www.hse.gov.uk/pubns/guidance/pm73.pdf>

## 10. Appendix A: Do the Regulations apply to my Pressure System?<sup>3</sup>



<sup>3</sup> Figure 1, Safety of Pressure Systems Approved Code of Practice and Guidance L122 (Second edition), HSE, 2014