Science and Technology Facilities Council

SAFETY OF PRESSURE AND VACUUM SYSTEMS

STFC Safety Code No 33

Rev. 1.10, Issued February 2024

Revisions

1	Initial Launch	7th Feb 2011
1.1	Minor mod to section 4.7	9th Jan 2012
1.2	Changes to audit checklist	May 2013
1.3	Addition to para 4.2.9	Sept 2014
1.4	Modification to Purpose (para 1)	Jun 2015
1.5	Added Gas Cylinder Safety course	Jun 2015
1.6	Added generic risk assessments Added the use of warning signs Added drop/lift plates for vacuum systems	Feb 2017
1.7	Changes related to the launch of SHE Assure	October 2018
1.8	Minor update to training requirements	December 2019
1.9	Minor change to training requirements	December 2021
1.10	Changes to sections 3.2 and 4.2.6	February 2024

Contents

Safety of Pressure and Vacuum Systems

1. PURPOSE

The nature of work at the STFC involves the use of a large number of systems operating under pressure or vacuum, for example sample chambers, reaction vessels, RF waveguides, cryo-modules, heating systems, commercial coffee machine, autoclaves etc. The stored energy in pressurised systems has the potential to cause serious personal injury, significant damage to property and loss of time and money. Similarly, vacuum systems have the potential to cause personal injury through catastrophic failure (implosion).

Such failures are preventable, and the STFC aims to proactively manage the risks associated with the design, manufacture, purchase, installation, use, modification, maintenance and repair of pressure and vacuum systems.

The Pressure Systems (Safety) Regulations 2000 (PSSR 2000) impose specific legal duties on the STFC to design, construct, install and operate safe pressurised systems, and maintain and repair them to prevent danger. Additional duties are imposed by:

- The Health and Safety at Work etc. Act, 1974.
- The Management of Health and Safety at Work Regulations 1999.
- The Provision and Use of Work Equipment Regulations 1998
- The Pressure Equipment Regulations 1999 (PER) (where STFC is supplying Pressure Systems for payment)

These regulations apply to both pressure and vacuum systems. Failures of pressurised systems which may reasonably have lead to a fatality are also reportable to the Health and Safety Executive (HSE) under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR), 1995.

2. SCOPE

This Code puts in place arrangements and a structure to enable the STFC to comply with its relevant duties for Pressure Systems. It incorporates all but the most basic vacuum systems to ensure that they are managed in a similar manner.

For Pressure systems that the STFC designs and builds, this code uses the Pressure Equipment Regulations (PER) 1999 as a basis for ensuring that these systems are designed and built so as to be safe when installed, used and maintained. For vacuum systems it asks that they are designed and built by a similarly consultative and documented process to ensure that they are safe to install, use and maintain.

For Pressure systems that the STFC supplies on a commercial basis within the EU then PER **must** be complied with in full.

The requirements of this code are mandatory across the STFC and apply to all staff, tenants, facility users, visitors and contractors working with:

- **<u>any</u>** pressure system, **including** pressure systems with a Pressure * Volume of less than 250 bar litres.
- Vacuum systems in which any component has been designed or built in-house.
- “Off the shelf” Vacuum systems with a protective device fitted (to prevent pressurisation).

This includes: gas supply systems, steam based building heating systems, refrigeration systems with an input power of more than 25 kW (electrical) and cryogenic systems where the cryogen boil-off is able to pressurise the whole or part of the system it is connected to.

This code applies to:

- The design, manufacture and certification of pressure and vacuum systems by STFC staff for use within STFC, and for commercial supply (by STFC) to third parties:
- The operation, modification and maintenance of pressure and vacuum systems on STFC sites, regardless of owner:
- The statutory examination of pressure systems on STFC sites, regardless of owner; and
- The use of transportable pressure receptacles – for example nitrogen gas bottles - on STFC sites, regardless of owner.

This code only addresses the hazards posed by the stored energy in the system, and not any other hazard associated with it or its contents. These are covered, as appropriate by the relevant STFC SHE Codes for example COSHH and/or DSEAR.

This code does not apply to the following systems, which are specifically exempted from the PSSR regulations:

- Where the pressure is exerted only by a head of liquid:
- A pressure system which forms part of any braking, control or suspension system of a vehicle:
- That part of a system which is a pressure system only because it is subject to a leak test or pressurised unintentionally or a pipeline pressurised as part of a test or line clearance:
- Underground water and gas mains:
- Any water cooling system on an internal combustion engine or any compressor:
- Any tyre used or intended to be used on a vehicle:
- Any vapour compression refrigeration system not exceeding 25 kW installed power:
- Any portable fire extinguisher with a working pressure below 25 bar and having a mass not exceeding 23 kilograms; and
- Any part of a hand held tool or appliance which is a pressure vessel.

3. DEFINITIONS

3.1 Pressure Systems (Exempt and Non-exempt)

A pressure system is one which contains or is likely to contain a **relevant fluid** and consists of:

- A system comprising one or more pressure vessels of rigid construction, any associated pipework and protective devices (as may be found in a hot water heating system) or

- The pipework with its protective devices to which a transportable pressure receptacle is, or is intended to be connected (as may be found supplying gas to a laboratory); or

- A pipeline and its protective devices, which contains or is liable to contain a relevant fluid but does not include a transportable pressure receptacle.

A **non-exempt** pressure system is one to which all the provisions of PSSR 2000 apply. An example would be a compressed air system delivering air to a number of rooms in a building.

An **exempt** pressure system is one to which not all of the provisions of PSSR 2000 apply because it does not contain steam and has an internal pressure volume product of less than 250 bar litres. As a result, it does not require marking, does not need a **Written Scheme of Examination (WSE),** undergo statutory inspections, or need to go through a special process for modifications. An example might be (depending on its volume) a small stand-alone air compressor, used to drive pneumatic tools.

Use the flow chart in Appendix 1 to determine if your pressure system is exempt or non-exempt.

3.2 Relevant Fluid

A relevant fluid is:

- Steam at any pressure.
- Compressed or liquified gas, including air, at a pressure greater than 0.5 bar above atmospheric pressure; pressurised hot water above 110o Celsius.
- A gas dissolved under pressure in a solvent (acetylene).

Relevant fluids do not include hydraulic oils. Hydraulic systems, while using high pressure, do not store energy in the system and so are not covered by the PSSR legislation.

The PSSR Approved Code of Practice (ACoP), Safety of pressure systems (L122), will help determine which regulations (if any) apply.

3.3 Vacuum System

A vacuum system is any vessel or arrangement of pipework or combination thereof, designed to work at a pressure below 500mbar absolute pressure.

3.4 Protective Devices

These are devices implemented in the system to protect it against overpressure or system failure, or devices included to give warning that an overpressure or system failure might occur. An example would be a pressure relief valve or a drop/lift plate on a large vacuum system.

3.5 Written Scheme of Examination (WSE)

This is the written scheme referred to in regulation 8 of the Pressure Systems Safety Regulations 2000.

3.6 Catastrophic System Failure

For a pressure system - the unintentional release of stored energy (other than from a pressure relief system) by explosion, tear or rupture.
For a vacuum system - the failure, by implosion, fracture or collapse of a vacuum system whilst under vacuum.

3.7 Pressure/Vacuum System Design Engineer

This is a competent engineer who designs a pressure or vacuum system for use in STFC or supply to a third party.

3.8 Pressure/Vacuum System Nominated Engineer

A departmental role – a designated competent engineer who approves the design and specification of any pressure or vacuum system designed or procured by that department. A department may have more than one such person provided the scope of their responsibilities is defined on appointment. These people are also asked to witness pressure proof tests on new systems under test on STFC sites.

3.9 Third Party Inspector

Competent inspection engineer employed by an independent accredited inspection body, contracted by STFC to carry out Statutory inspections, provide WSE's and any third-party inspection or verification required under PER (witnessing of proof test, inspection of vessels during manufacture, approval of designs and specifications and assessment of manufacturers etc).

3.10 Statutory Examination

Under regulation 9 of PSSR 2000, "Statutory Examination" means examination as detailed by the WSE by a competent person independent of the equipment and its use.

4. RESPONSIBILITIES

4.1 Directors shall:

4.1.1 Ensure that the specification, design, fabrication, purchase, commissioning, operation, modification, maintenance/repair, thorough examination and decommissioning of pressure and vacuum systems are carried out by competent people and that sufficient resource and facilities are available to implement the requirements of this code.

4.1.2 In consultation with other Departmental Directors appoint in writing sufficient Pressure/Vacuum System Nominated Engineers for their department, to oversee the design, fabrication and installation of pressure and vacuum systems, and witness pressure proof tests.
Pressure/Vacuum System Nominated Engineers, based on their competence, should be appointed and their appointments and departmental scope recorded in the SHE Directory, which will generate appointments in writing.

4.1.3 In consultation with other Departmental Directors ensure that pressure and vacuum system engineers and technicians have access to a well-controlled safe area to test and maintain pressure and vacuum systems.
For practical reasons test facilities may be shared between Departments.

4.1.4 Ensure that only competent persons are authorised as “Pressure System Permit Issuers”; see Appendix 6 for training requirements. Appointment of “Pressure System Permit Issuers” should be recorded in the STFC SHE Directory, which will generate appointments in writing.

4.2 Line managers shall (for all pressure and vacuum systems):

4.2.1 Prior to work starting and following STFC SHE Code 6 (Risk Management) make sure that significant risks arising from the use, maintenance and repair of pressure and vacuum systems under their control have been:

- Assessed, hazards identified;
- Suitable control measures put in place;
- The risk assessment recorded and associated Safe System of work developed (Generic work-area risk assessments with pressure and vacuum forming part of the overall assessment are acceptable).

And ensure that maintenance on steam systems or work involving entry into a pressure vessel is only carried out under a permit to work system, where the permit has been issued by a Pressure System Permit Issuer who is familiar with the system concerned.

4.2.2 Ensure that only trained, competent personnel operate or maintain/repair pressure and vacuum systems in line with documented procedures either from the manufacturer or prepared in-house by a competent person.

4.2.3 Ensure that any pressure or vacuum system brought onto STFC sites by a facility user or other person is examined by a Pressure/Vacuum System Nominated Engineer to make sure it is safe for its intended use. See Appendix 4 for further guidance on such equipment.

4.2.4 Ensure that any major modifications – those that involve more than a direct swap of a component with an identical/similar one. For example: cutting into a system or welding additional material onto a pressure or vacuum system have been discussed and approved by the appropriate Pressure/Vacuum System Nominated Engineer before they are made to the system, and that such modifications are correctly documented.

4.2.5 Keep a list of the systems they are responsible for.

Line Managers shall (for non-exempt pressure systems only) (See flow chart in Appendix 1 to determine if your system is non-exempt):

4.2.6 Ensure that all non-exempt pressure systems are registered prior to first use. At RAL register with SHE Group, at DL and ROE register with Estates.

If a vacuum system can also be pressurised as part of a particular process (e.g. the introduction of dry nitrogen gas under pressure to prevent contamination when the vacuum has been removed) then it may need to be registered as a pressure system. In all cases there must be a protective safety device fitted to the system to prevent over pressurisation.

There are a number of possible scenarios;

1. If the vacuum system is to be pressurised with a relevant fluid (see section 3.2) above 0.5barg then it needs to be registered.

2. If the vacuum system is to be pressurised below 0.5 barg then it does not need to be registered, but a safety device must be fitted to the system.

    i. Small vessels considered relatively low risk can be protected with a small PRV which would give the required small outflow. The maintenance and inspection of this small PRV is the responsibility of the relevant Department and it need not be registered.

    ii. Large vessels considered a relatively high risk need to have a PRV or ‘Lifting Plate’ fitted with a larger aperture to give a larger outflow. If a PRV is fitted then it would need to be registered with SHE Group or Estates.

3. There are a small number of cases where fitting (especially if retrofitting) a PRV or ‘lifting plate’ is not feasible, and then the pressure source must have the failsafe protection fitted instead. This is a less favourable option and should not be used unless necessary. The protective device would usually be a PRV permanently fitted at the point of connection to the vacuum system. The pressure system and PRV needs to be registered and the backfilling operation needs to be covered by an approved RA and MS.

Note there are small PRVs available designed to work on vacuum vessels and with higher temperature ratings.

4.2.7 Ensure that for all non-exempt pressure systems, purchased directly from a supplier or designed and manufactured by STFC “in-house”, the following actions are taken:

- Before a pressure system is used for the first time, a WSE is prepared by a competent person. WSE's can be produced in-house or by the current provider of statutory examinations of pressure systems. In house schemes should contain as a minimum the information listed in Appendix 2.1:
- All pressure systems within their control are thoroughly examined to the prescribed timescale by a competent third-party inspector in accordance with the WSE; and
- Written operating instructions, either from the manufacturer or produced "in-house", are available for operators of the system.

4.2.8 Ensure that details of any major modifications to non-exempt pressure systems are passed on to the local SHE Group so that the WSE can be modified accordingly.

Line Managers shall (for gas supply systems only):

4.2.9 Ensure that gas bottle regulators on systems they are responsible for are serviced/refurbished or replaced at five years of age. This is independent of the material of construction and includes regulators on mobile gas bottles that are connected via flexible hose to deliver gas for a short period of time. In exceptional circumstances specific exemptions to this responsibility may be agreed in writing by the Pressure/Vacuum Systems Nominated Engineer and/or Statutory Pressure Systems Inspector.

Line Managers shall (for protective devices, such as pressure relief valves and drop/lift plates, fitted to protect exempt pressure systems or vacuum systems):

4.2.10 Ensure that such protective devices are:

- Registered with SHE group.
- Regularly examined in accordance with a written scheme of examination.

4.3 Pressure/Vacuum System Design Engineers shall:

4.2.11 Ensure that when designing pressure or vacuum systems they:

- Eliminate hazards and reduce risks as far as reasonably practicable.
- Carry out a suitable and sufficient Design Risk Assessment.
- Design to an applicable design code.
- Produce manufacturing information to BS8888.
- Compile a technical file.

The technical file should contain as a minimum the information specified in Appendix 2.2.

The design shall conform to the HSE approved code of practice L122 – Safety of pressure systems, Pressure Systems Safety Regulations 2000 – Approved Code of Practice.

For systems supplied on a commercial basis this is achieved by designing the system in accordance with the Pressure Equipment Regulations 1999 (PER).

For systems that are being supplied internally it is strongly recommended that PER is used as guidance – as this enables STFC to meet its obligations under PSSR2000.

For guidance on the particular steps that should be taken in the design process, or on who to consult, please see the flow chart in Appendix 3.

4.2.12 Whilst recognising that the design applications encountered by STFC are at the cutting edge of technical developments and often unique where it is not practicable to design to a recognised design code:

- Specify an adequate testing procedure to demonstrate required safety factors; and
- Ensure that other risk control measures be included in the design (e.g., vacuum chambers with thin windows fall outside of design codes and need a more stringent design risk assessment) to adequately control the risk to persons from system failure; and
- Where possible ensure that those other control measures be tested to determine the fatigue life and safe operating limit.

Consequently, there may be situations where it is impractical to go through all the relevant assurance requirements of PER for such systems. In such cases, the Pressure/Vacuum System Design Engineer should assess the need for full assurance and document alternative action.

4.3.3 Ensure that, where appropriate – either due to the level of risk involved or when a system is being provided on a commercial basis, independent third-party inspection or verification takes place at the required stages of manufacture of a vessel and inform the Pressure/Vacuum system Nominated Engineer that this inspection or verification is taking place.

4.4 Pressure/Vacuum System Nominated Engineers shall:

4.4.1 Approve all designs of pressure and vacuum systems designed and constructed “in house” for their nominated department(s). Prior to manufacture provide manufacturers with documented evidence of this approval.

4.4.2 Approve any major modification to an existing system before the modification is made.

4.4.3 Witness proof tests carried out on new pressure vessels put into service in their nominated department(s).

4.4.4 Ensure that, where appropriate – either due to the level of risk involved or when a system is being provided on a commercial basis – they are present at independent third-party inspections or verifications.

4.4.5 Assess and approve for use, pressure and vacuum systems brought in by facility users or others for use on STFC sites. See Appendix 4 for further guidance on such equipment.

4.5 Technicians who work on Pressure/Vacuum Systems shall:

4.5.1 Ensure that any work they do on a pressure or vacuum system is carried out in line with the relevant drawings and specifications.

4.5.2 Ensure that any protective devices are set to the correct relief pressure – defined by the system specification - before a system is passed over to an end user.

4.5.3 Ensure that all maintenance on a pressure or vacuum system is documented, either electronically or on paper.

4.5.4 Ensure that any modifications or changes involving cutting or welding on a system are designed and approved by the relevant Vacuum/Pressure Systems Design engineer and Vacuum/Pressure Systems Nominated Engineer.

4.5.5 Ensure that any unexpected failure of a pressure or vacuum system under test is suitably investigated before re-testing, and details of any unexpected failure mode fed back to the designer.

4.5.6 Ensure that a catastrophic failure of a pressure or vacuum system under test which led or could have led to injury or damage to property, is reported as an incident to their line manager and in Evotix Assure, see SHE Code 5, Incident reporting and investigation.

4.5.7 Ensure that control measures, such as the use of warning signs, are adopted to make staff aware of the local hazards when pressure and vacuum systems are being used.

4.6 Pressure System Permit Issuers shall:

4.6.1 Only issue Pressure System Permits where they are competent to do so, having successfully completed training identified in Appendix 6. They shall not issue permits for work they are going to carry out themselves unless this has been countersigned by another Pressure System Permit Issuer.

4.6.2 Assess all associated risks involved in the proposed work on steam systems, or on entering a pressure vessel, develop a safe system of work and issue a Pressure System Permit, ensuring all necessary precautions, including emergency procedures are taken, and all other appropriate permits (e.g. Confined Space or Hot Work – even though much of the information may be duplicated) have been taken out and issued by an appropriate person, see Appendix 5 for a sample Pressure System Permit.

4.6.3 Oversee the issue of any permit and its cancellation and check safety at each stage of the work.

4.7 SHE Group shall:

At some STFC sites these responsibilities may be undertaken by other groups.

4.7.1 Ensure that records of all non-exempt pressure systems on STFC sites are maintained and each system is issued with a unique plant reference number. The records should include the information given in Appendix 2.3.

4.7.2 Ensure that competent third-party inspection providers are appointed to undertake a programme of statutory examinations in accordance with the WSE.

4.7.3 Ensure that line managers are advised of any remedial work or alterations that are identified during a thorough statutory examination and are considered necessary for the continued safe operation of the system.

4.7.4 Provide assistance with interpretation of the requirements of this code.

4.8 Staff, tenants, facility users or visitors wishing to use pressure or vacuum systems shall:

4.8.1 When using such systems follow documented safe systems of work, and where necessary to continue using the system safely, seek assistance or clarification from their line manager or supervisor.

4.8.2 Report as an incident (or near miss), following STFC SHE Code 5 (Incident Reporting and Investigation) any instances where:

- A working pressure system fails catastrophically:
- A protective device on a pressure or vacuum system activates whilst the system is in use, for example failure of a bursting disc (unless the activation occurs as part of normal operations, e.g. a pressure relief valve on a Liquid Nitrogen dewar); and
- A vacuum system fails catastrophically, for example a window on a vacuum system fails whilst the system is in use.

4.8.3 When working with facility users who wish to bring a pressure or vacuum system to STFC for use in an experiment, request details about that system, and pass those onto the Nominated Engineer for initial assessment. See Appendix 4 for a list of the information to request.

5. REFERENCES

Electronic copies of legislation, approved codes of practice and British Standards can be accessed by STFC staff through ‘Info4 Education’ further details of which can be found on the SHE Group website.

L122 – PSSR 2000 ACOP – HSE

PER – The Pressure Equipment Regulations 1999

UKSPEC – UK Standard for Professional Engineering Competence – Engineering Council

BS8888:2008 – Technical Product Specification - BSI

Relevant BCGA (British Compressed Gas Association) design codes

CP4 Industrial Gas Cylinder Manifolds & Distribution Pipework/Pipelines (excluding acetylene). Revision 3: 2005

CP17 The Repair of Hand-held Blowpipes & Gas Regulators used with Compressed Gases for Welding, Cutting & Related Processes. Revision 2: 2004

CP18 The Safe Storage, Handling & Use of Special Gases in the Micro-Electronics Industry. Revision 2: 2005

CP23 Application of the Pressure Systems Safety Regulations 2000 to Industrial and Medical Pressure Systems Installed at User Premises. Revision 1: 2002

CP24 Application of the Pressure Systems and Transportable Gas Containers Regulations 1989 to Operational Process Plant: Revision 1: 2004

CP26 Bulk Liquid Carbon Dioxide Storage at Users' Premises. Revision 2: 2004

CP27 Transportable Vacuum Insulated Containers of not more than 1000 litres volume: Revision 1: 2004

CP28 Vacuum Insulated Tanks of not more than 1,000 litres volume which are Static Installations at User Premises: Revision 1: 2004

CP30 The Safe Use of Liquid Nitrogen Dewars up to 50 litres: 2000

CP31 Safe Storage and Use of Cylinders in Mobile Workshops and Service Vehicles

CP33 The Bulk Storage of Gaseous Hydrogen at User's Premises. 2005

CP34 The Application of the Pressure Equipment Regulations to Customer Sites: 2003

Relevant BSI (British Standards Institute) design codes

PD5500:2009	Specification for unfired fusion welded pressure vessels
BS EN 12952:1-16:2001+	Water tube boilers and auxiliary installations
BS EN 13445:1-8:2009	Unfired Pressure Vessels
BS EN 13480:1-8:2002+	Metallic Industrial Piping

Relevant STFC Safety Codes

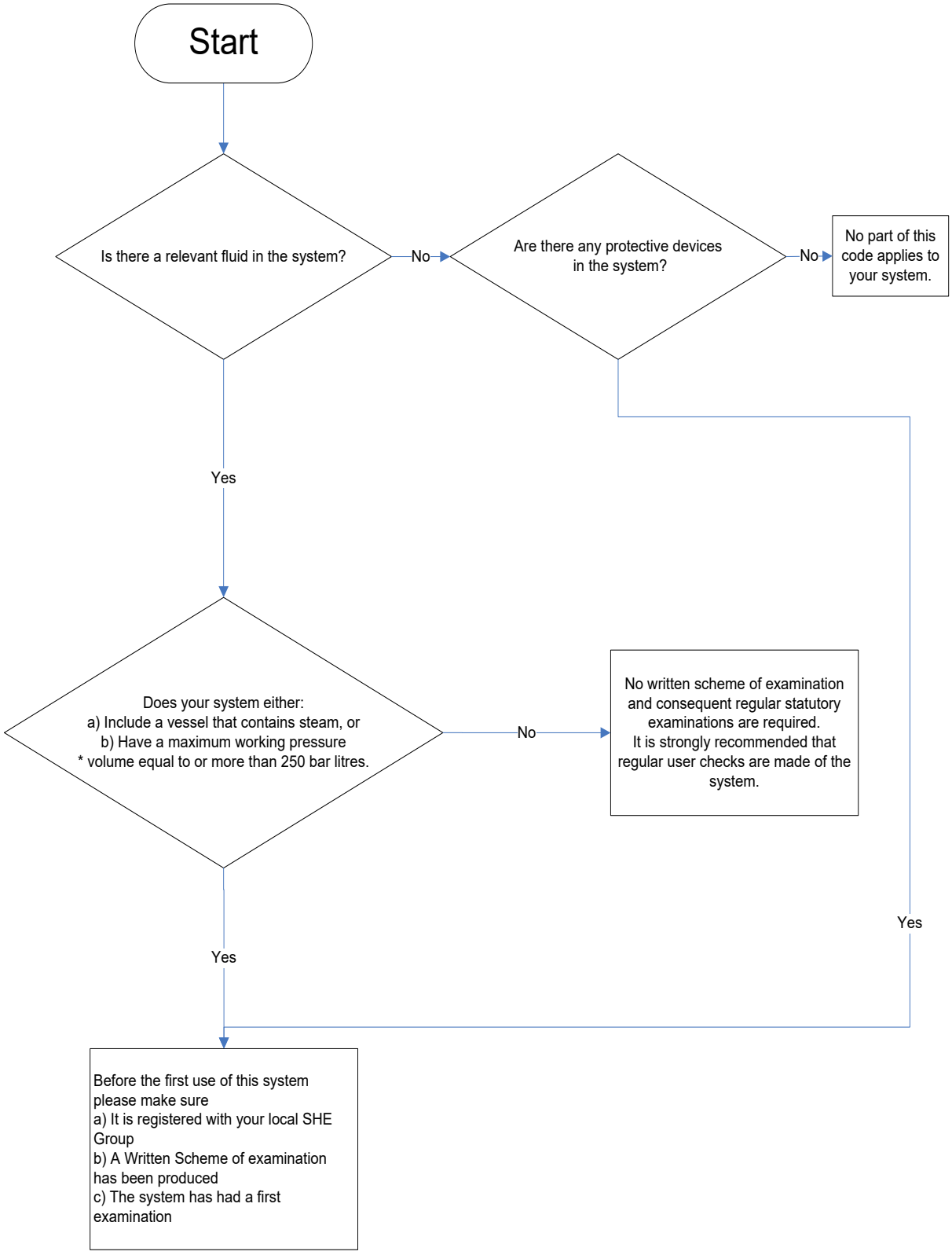
STFC SHE Code 5 (Incident Reporting & Investigation)

STFC SHE Code 6 (Risk Management)

STFC SHE Code 11 (Work in Confined Spaces)

STFC SHE Code 20 (Controlling Explosive and Flammable gases and dusts)

APPENDIX 1. IS MY PRESSURE SYSTEM EXEMPT OR NON-EXEMPT.



APPENDIX 2. CONTENTS LISTS FOR RELEVANT DOCUMENTATION

A2.1 Minimum contents for a WSE

In-house WSE's should only be produced for basic systems and should contain at least the following information:

- Full description of the system and a labelled drawing, showing all pressure relief devices and valves.
- Details of system location
- Details of responsible persons
- Details, with calculations, of safe operating limits, system volume and maximum pressure
- Details of which parts of the system need to be subject to examination
- What type of examination is required and the interval between them
- Details of all protective devices
- Information about associated pipework
- Any measures needed to prepare the system for thorough examination
- Those parts of the pressure vessel and pipework in which a defect may give rise to danger
- The critical parts of the system, which if modified or repaired, should be examined by a competent person before it is used again

They can of course contain additional relevant information if it may be considered useful to aid an inspector.

A2.2 Minimum contents for a technical file

Technical files should be produced for all pressure and vacuum systems designed in house. Their contents will of course vary depending on the nature and complexity of the system, but as a minimum the following information should be retained in a technical (construction) file and kept for the lifetime of the system by the designing group:

- A general description of the equipment;
- The overall drawing of the equipment and drawings of the control circuits, as well as the pertinent descriptions and explanations necessary for understanding the operation of the equipment;
- Descriptions and explanations necessary for the understanding of said drawings and schemes and the operation of the electrical equipment;
- Full detailed drawings, accompanied by any calculation notes, test results, certificates, etc, required to check the conformity of the equipment with the essential health and safety requirements.
- The documentation on risk assessment demonstrating the procedure followed.

The risk assessment documentation should include the following:

- A list of the essential health and safety requirements which apply to the equipment;

- The description of the protective measures implemented to eliminate identified hazards or to reduce risks and, when appropriate, the indication of the residual risks associated with the equipment;
- A copy of the EC declaration of conformity;
- Results of design calculations made, examinations carried out, etc;
- Test reports.

And, where appropriate

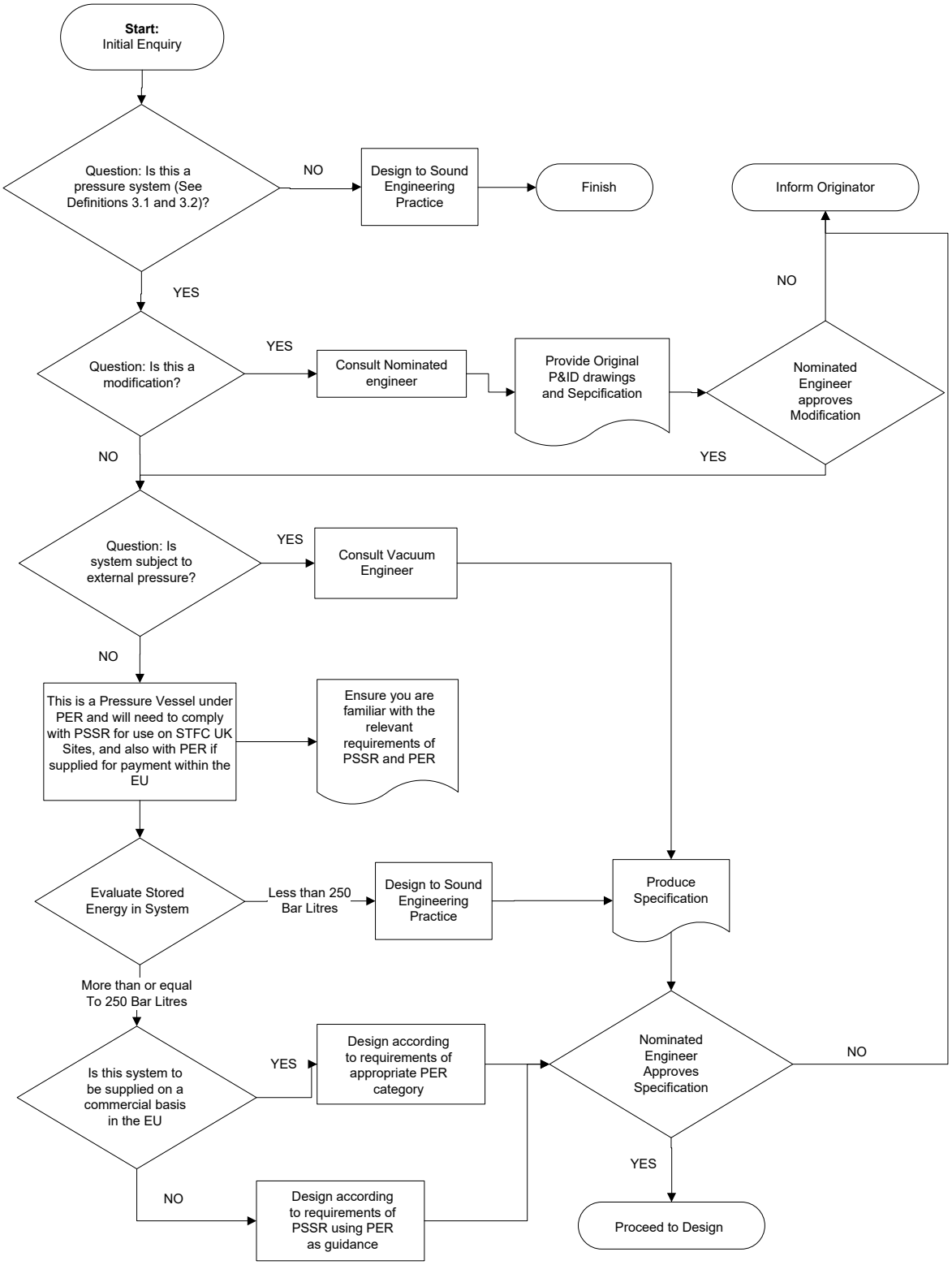
- The declaration of incorporation for included partly completed equipment and the relevant assembly instructions for such equipment;
- Copies of the EC declaration of conformity of equipment or other products incorporated into the equipment;
- For pressure systems, documentation relating to compliance with the materials specifications by using materials which comply with harmonised standards, by using materials covered by a European approval of pressure equipment materials or by a particular material appraisal;
- The standards and other technical specifications used, indicating the essential health and safety requirements covered by these standards;
- Any technical report giving the results of the tests carried out either by the manufacturer or by a body chosen by the manufacturer or his authorised representative;
- A copy of the instructions for the equipment;

A2.3 Information to be kept by SHE Group:

The following information should be recorded for each non-exempt pressure system SHE Group is informed of:

- System Location (building and room)
- System responsible person
- Date of first use
- Written Scheme of Examination
- Certificate of conformity
- Details of any pressure test (unless included on certificate of conformity)
- Unique plant reference number
- Date of last inspection
- Next inspection date
- History of Major Modifications

APPENDIX 3. DESIGN PROCESS FLOW CHART



APPENDIX 4. DEALING WITH PRESSURE AND VACUUM SYSTEMS BOUGHT IN BY OTHERS FOR USE ON STFC SITES

A4.1 General

All pressure or vacuum systems that are bought in by others to use on STFC sites should be checked before use, to ensure that they do not present a hazard when in use.

A4.2 Measures for pressure systems

The manager responsible for the area where a contractor or visitor will use a pressure system that they have bought to site should ensure that:

a. the system has been designed and tested in accordance with the PSSR2000: and

b. it will only be operated by trained competent people: and for non-exempt systems: and

c. has been thoroughly examined in accordance with its written scheme of examination.

It is unfortunate that some contractors and visitors will be unable to satisfy these criteria. In such circumstances, and **only** for exempt pressure systems that do not require statutory inspection, the managers of such areas may put in place an assurance process where **they** assess the safety of such systems and put in place a safe way of working with it on STFC sites. Such a process should:

- Start with the request for information from the system owner. The information requested should include, but not necessarily be limited to:
    - the unique identification mark of the system. i.e. its serial number,
    - a full description of the proposed work that the system will be used for,
    - a set of full engineering drawings giving key dimensions and materials used in its construction,
    - test certificates for the materials used in construction. Including any fasteners,
    - manufacturing QA documents,
    - any calculations done to prove the system's robustness. FEA plots are not sufficient,
    - any evidence of Pressure Tests done on the system,
    - the Design Pressure, Working Pressure and Test Pressure; and
    - the Design Code the system has been made to. If this is not the case the justification for the deviation.
- Include a stage where an STFC mechanical engineer checks the system over when it arrives on site:
- Include a pressure test at an appropriate multiple of the design pressure – dependent on the design code used: and
- Conclude with the system being given an STFC identification mark and being signed off for use on STFC sites by the local Pressure/vacuum System Nominated Engineer. The "signing off" should include the date after which the system cannot be used on site with re-inspection.

A4.3 Measures for vacuum systems

Any manager of the area where a contractor or visitor will use a vacuum system that they have bought to site should ensure that:

a. The system is examined by a Pressure/Vacuum System Nominated Engineer to ensure it is safe to use, and

b. It will only be operated by trained competent people, and

c. It cannot be pressurised in any way above atmospheric pressure; and

d. It will not undergo major modifications while on site without being examined by the appropriate Pressure/Vacuum System Nominated engineer.

In the event that a vacuum system is set up so it can be pressurised above atmospheric pressure, pressure relief device(s) must be fitted.

APPENDIX 5. SAMPLE PERMIT FOR HAZARDOUS WORKS ON PRESSURE SYSTEMS

Permit to Work on Steam Systems or inside a Pressure Vessel

Permit to Work No:

Site/Building/Area .....Exact location:
.....

Job Details:
.....

This permit is only valid when all sections are complete. If you are in doubt or don't understand, then please ask. *Please ensure that you sign this permit to work.* Do not proceed with your work until your permit has been authorised by the relevant member of staff.

By accepting this permit you agree to the requirements of the STFC Pressure Systems Code.

HAZARDS TO BE AWARE OF AND PRECAUTIONS TO BE TAKEN			
	Yes	No	N/A
1) Are you qualified /trained to undertake this work?			
2) The Pressure System has been isolated from all connected pipework? If yes please give details below of method used to isolate system.			
3) The Pressure System has been purged with air.			
4) The Pressure System is electrically isolated and locked out? If yes please give details below of method used to isolate system.			
5) The Pressure System is mechanically isolated and locked off so as top prevent re-energisation? If yes please give details below of method used to isolate system.			

6) The Pressure System is below 30°C on full cooling			

If the answer to any of questions 1-6 is **no**, please give full details below of the methods being used to make sure this task can be carried out safely.

Has a corresponding Entry to Confined Space Permit been taken out for this task? If yes please state number.			
Has a corresponding Hot Work Permit been taken out for this task? If yes please state number.			

Other precautions required:

Other safety equipment required:

PREPARATION COMPLETE. ACCEPTANCE AND AUTHORISATION

I verify the above location has been examined, the precautions on the checklist have been taken, and that permission is authorised for this work. I also accept responsibility for the work to be carried out.

Person responsible for work: ..... Signed:
.....

Authorised Permit Issuer:..... Signed:
.....

Date and Time: ..... Time of Expiry:
.....

EXTENSION

Permit extended to:		Signature of Authorised Permit issuer	Any additional precautions to be taken
Time	Date		

HAND BACK AND CANCELLATION PROCEDURES

I confirm that the work has been completed/partially completed, checked by myself and the area left in a safe and tidy condition. (Please delete accordingly)

Person responsible for work: ..... Date and Time:
.....

I have inspected the finished work and hereby cancel this permit.

Authorised Permit Issuer: ..... Date and Time: .....

APPENDIX 6. TRAINING REQUIREMENTS

Role	Initial Training	Refresher	Frequency	Comments
Technicians who work on Pressure/Vacuum or Heating Systems (Staff working regularly on building and maintaining such systems)	It is recognised that much of the training required for working with such systems takes the form of 'on-the-job' training. Staff working regularly with Pressure/Vacuum or Heating systems as part of their role must have the relevant technical experience and knowledge for the work. This may come from a range of sources: • Engineering apprenticeships; • formal engineering training via a degree, diploma or similar; • a large number of years of on the job training; or • training provided by equipment providers.		N/A	
Pressure System Permit Issuers	At least five years experience of the type of systems they will be issuing permits on and attendance on a "managing confined space entry" course.		5 years	
Any user of a pressure or vacuum system	Standard induction provided for any new user to scientific or other equipment addressing: • safe start up/shut down procedures; • normal operational parameters and procedures; • possible failure modes and hazards of the equipment and appropriate response.		Refresher for each period of work	
Pressure/Vacuum System Design Engineers	Those working as design engineers should have the relevant technical experience and knowledge to carry out the work. This may either come from some sort of formal training or apprenticeship, or a large number of years of on the job training. They should be familiar with the appropriate design codes, the		N/A	

	techniques required to assess the safety of a design and the design software in use. Minimum requirement – Pressure Systems Safety Regulations Awareness (PSSR) Training.		
Pressure/Vacuum system Nominated Engineers	Those working as Pressure/Vacuum system Nominated Engineers should be competent mechanical or chemical engineers with Chartered Engineer (CEng) status, or equivalent qualifications and experience. They should also be actively engaged in the practical design and construction (or operation of) pressure or vacuum systems. They should maintain their competence through a program of regular Continuous Professional Development (CPD) with the minimum requirement being Pressure Systems Safety Regulations Awareness (PSSR) Training to ensure current legislation is being followed.	Annual CPD as required to retain status	Appropriate level of experience for Chartered Engineers is five years relevant professional experience. Engineers without chartered status should have at least nine years experience in the type of Systems they are overseeing.
Any user of pressurised gas cylinders	Gas Cylinder Safety Awareness (1.5hrs) • Correctly identify gas cylinders. • Recognise the hazards associated with oxygen enrichment and deficiency. • Identify flammability hazards. • Recognise the hazards associated with handling gas cylinders. • Re-assess current storage facilities in accordance with safe working practices. • Identify hazards when transporting gas cylinders.	5 Years	

APPENDIX 7. AUDIT CHECKLIST

Ref	Item	Rating	Comments
1 (Section 4.8.1)	Evidence of established Safe Systems of Work.		
2 (Section 4.8.2)	Evidence of reported incidents.		
3 (Section 4.2.2)	Evidence of staff training.		
4 (Section 4.2.1)	Evidence of functioning control measures where pressure and vacuum systems in use.		
5 (Section 4.3.1)	Evidence of technical files with appropriate contents for systems that have been designed in house.		
6 (Section 4.4.1)	Evidence of an approval process for designs.		
7 (Section 4.4.1)	Evidence of an approval process for specifications.		
8 (Section 4.7.2)	Programme of Statutory Inspections in place and carried out in line with WSE's by competent 3rd party.		
9 (Section 4.7.1)	Up to date register/records of pressure systems on site.		
10 (Section 4.5.3)	Maintenance records present for all Pressure and Vacuum systems.		
11 (Section 4.5.6)	Evidence of reported incidents involving Pressure and Vacuum systems.		
12 (Section 4.1.2)	Suitably qualified departmental Nominated Engineer appointed.		
13 (Section 4.1.3)	Engineers and Technicians have access to a test area.		

APPENDIX 8. DOCUMENT RETENTION POLICY

Records established	Minimum retention period	Responsible record keeper	location of records	Comments/Justification
Statutory Inspection Records	Current + 3 years	SHE Group RAL	Local records systems	Legal Requirement
Statutory Inspection Records	Current + 5 Years	Estates DL/ROE	Local records systems	Legal Requirement
Written Schemes of examination	Current + 3 Years	SHE Group RAL	Local records systems	
Written Schemes of examination	Current + 3 Years	Estates DL/ROE	Local records systems	
Appointments:				
Pressure/vacuum Systems Nominated Engineer	Most Recent	Director	SHE Directory	Appointment Letter
Pressure Systems Permit Issuer	Most Recent	Director	SHE Directory	Appointment Letter