King's College London
University of London

Health, Safety and Environmental Protection Office

SAFETY DESIGN STANDARD
No. SDS04 v.01 (2012)

LABORATORY GASES IN NEW BUILDING PROJECTS AND REFURBISHMENTS

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1 INTRODUCTION

When planning a new or refurbished laboratory (or suite of laboratories) King's College London (hereto referred to as "the College") requires and expects the Design Team, in particular the Designers, to consider and provide laboratories that are fit for purpose. The end users must provide information on the range of gases that are typically expected to be used within the laboratories and the types and numbers of equipment that the gases will serve.

The College needs a flexible workspace that can adapt to new science as quickly as it is developed and cost effective ways of delivering laboratory gases safely. In addition, the College's insurers have indicated their requirement for a reduction in the amount of cylinders within the current workplace and this will apply to new builds and refurbishments in relation to design of gas delivery systems.

This document outlines the Safety Design Standards to which any proposed laboratory gas delivery system must comply. In the event that documents referred to within this document are superseded, the most recent versions must be referred to.

If an aspect of pressurised gas system safety is not covered in this design standard the relevant industry codes of practices and British Standards must be applied and followed. In the event that documents referred to within this document are superseded, the most recent versions must be referred to.

This document applies to all buildings managed or owned by the College.

Where the College undertakes refurbishment or alteration works within buildings under the direct control of others (i.e. Trust Buildings or buildings owned by another party) the College will apply the standards set out in this document where practicable, applicable and at the discretion of the responsible party of the building.

Any queries regarding this design standard should be sent to safety@kcl.ac.uk

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3 REFERENCES

- Pressure Systems Safety Regulations 2000 (SI 2000, No 128) and ACOP L122, HSE
- Pressure Equipment Regulations 1999 (SI 1999, No 2001)
- Dangerous Substances Explosive Atmosphere Regulations 2002 (SI 2002, No 2776)
- BCGA CP4 Rev 3:2005; Installation and Maintenance of Industrial Gas Cylinder Manifolds and Distribution Pipelines.
- BCGA CP18 Rev 2:2005; The Safe Storage, Handling & Use of Special Gases in the Micro-electronics & other Industries.
- BCGA GN13:2008; DSEAR Risk Assessment.
- Health Technical Memorandum (HTM) 02-01A & B; Department of Health
- BS 9999:2008; Code of practice for fire safety in the design, management and use of buildings
- BCGA GN2 Rev.3:2005; Guidance for the storage of Gas Cylinders in the Workplace
- BS EN 60079; Explosive atmospheres.
- BCGA CP28: 2004 Rev 1:2004; Vacuum Insulated Tanks of not more than 1000 litres Volume which are Static Installations at User Premises
- BCGA CP36: Rev1:2011; Bulk cryogenic liquid storage at user's premises (up to 125000 litres).
- BCGA GN11, Rev 2: 2007 – "Reduced Oxygen Atmospheres - The management of risk associated with reduced oxygen atmospheres resulting from the use of gases in the workplace"
- BCGA standards are available through technical information service providers such as Barbour or IHS and for purchase from BCGA - http://www.bcga.co.uk/preview/publications.php

4 SAFETY DESIGN STANDARD FOR LABORATORY GAS INSTALLATIONS

The design in order to deliver laboratory gases should be subject to decisions made using a ***hierarchy of control measures,*** current and future requirements must be considered:

4.1 OPTION A

- **If the gases required by the end user can be supplied using laboratory gas generators, these must be considered in preference to cylinder gas solutions**.

  Use of analytical gas generators reduces the risks, requirements for statutory inspection regimes and planned preventative maintenance regimes. There is also the potential to reduce on-going costs associated with pressurised gas systems and cylinders, their maintenance and inspection whilst increasing the flexibility of a workspace.

  - Bench top or larger units should be considered.
  - Nitrogen, Hydrogen and Zero Air gas are amongst those available on the market for scientific application.

Note

- **The process of consideration must be documented and if it is concluded that generators are not an option, reasons must be given why such an alternative is not feasible.**
- **HYDROGEN must be supplied by gas generation at point of use and <u>not</u> by cylinders/pressurised pipeline.**
- **If option A is not feasible, the gases required cannot be produced via gas generation (e.g. helium), or the generator required needs to be located in a remote location (e.g. for reasons of size or noise) then OPTION B must be considered.**

4.2 OPTION B

- **A pressurised pipeline distribution system with a remote bulk gas cylinder room or generator location.**
  - The design must be undertaken by a competent design engineer with expertise in laboratory gas system design and must be designed and installed in a manner which complies with the Pressure Equipment Regulations 1999.
  - Design shall comply with the most current versions of the BCGA Codes of Practice (in particular CP4 and CP18).
  - In respect of CP4 the following are required:
    - Table 1 - Gas Supply/Component Relationship and Table 2 - Gas Distribution/Component Relationship, all essential and recommended components shall be included in the design.
    - Minimum safety distances given in Figure 3.1 to 3.3 CP4 shall be observed.
    - Where horizontal minimum distances cannot be achieved fire resistant walls as described on page 15 shall be constructed.
    - Design – shall record the conformance with CP4.
  - All Gas cylinders, manifolds, pipelines and stores must be sited away from emergency escape routes.
  - The Dangerous Substances Explosive Atmosphere Regulations (DSEAR) 2002 will apply to any installation of flammable and oxidising gases (e.g. methane and oxygen) and therefore the installation will require suitable zoning and equipment for the zone determined by a DSEAR risk assessment as described in BCGA guidance note GN13.

- The DSEAR risk assessment shall be carried out by the Project Team (Designers), recorded and included in the project H&S file any zoning or safety signage indicated by the assessment shall be incorporated into the project prior to practical completion.
- BS EN 60079 shall apply for zoning in respect of flammable gases and the proper selection and installation of equipment for hazardous areas.
- Pipe work that breaches compartment walls shall conform to the requirements of BS 9999 section 33.4.
- Once installed the system must be documented and maintained in accordance with the Pressure Systems Safety Regulations 2000.

Note

Pipe work routes shall not be installed in the vicinity of chemical stores, flammable liquid stores or stores for other dangerous substances and any rooms where these services may penetrate shall not be used for storage of dangerous substances.

4.3 TEMPORARY ARRANGEMENTS AND CYLINDERS WITHIN LABORATORY AREAS

- Laboratory designers and design teams may be asked by the client to install racking for pressurised gas cylinders within laboratory areas. If this is requested the project managers and design team must determine why this has been requested because the BCGA Codes of Practice will apply to this design request.
- If the client intention is to use cylinders on a temporary basis with regulators attached they will be required to detach the regulator and return these cylinders to a suitable cylinder store daily as soon as the equipment has shut down.
- The design of premises would therefore require the location of a cylinder store room in close proximity to the point of use.
- If the arrangement is intended to be a semi-permanent or permanent then the cylinders must be located in their own manifold/cylinder room connected via a permanent manifold system in accordance with CP4 and the design and location of manifold/cylinder rooms (sec 5.2.2.2) and therefore falls into **Option B** as above.

Note

Temporary arrangements are not considered as a suitable design option in either new builds or refurbishments as they are based on a management strategy and do not comply with the College's insurers requirement for reducing cylinders within College premises. If project managers and a design team are requested to include them in a refurbishment project within an existing building they should inform the client of the above options and the requirements of compliance (section 2) to this standard apply.

4.4 MEDICAL GAS SYSTEMS

Should a College project include the installation of Medical Gas Systems for clinical use within a healthcare environment then the Designers and Design Team must design, install, verify and validate the system in accordance with the Department of Health, Health Technical Memorandum (HTM) 02-01A and the system must be operated in accordance with HTM 02-01B. These HTMs apply to all new installations and refurbishment or upgrading of existing installations.

4.5 BULK CRYOGENIC LIQUID STORAGE

- Tanks and associated equipment shall be designed, manufactured and installed in accordance with BCGA Code of Practice CP36.
  - Tanks containing less than 0.5bar shall, as section 2.2 of CP36 indicates, be properly designed and constructed from suitable material to fulfil regulation 4 of the Provision and Use of Work Equipment Regulations 1998 and prevent danger.
  - Minimum safety distances given in section 2.3 and Appendix 3 of CP36 shall be observed.
  - The design – shall record the conformance with CP36

- Bulk storage of Oxygen is within the scope of DSEAR and would require risk assessment and zoning.

- For liquid nitrogen storage facilities for portable containers (e.g. Dewars & pressurised storage vessels) refer to SDS 2:2009.

4.6 GAS MONITOR ALARM SYSTEMS

- Requirements for suitable gas monitors must be addressed in the risk assessment process according to the types of gases, their physical properties and the hierarchy of control (elimination, engineering control). Monitoring must not be considered as an alternative to increasing natural ventilation or installing forced ventilation alone, but as part of the risk management control measures and early warning systems when the likelihood of high risk atmospheres are identified. BCGA guidance note GN11 sets out calculations that, according to the type of receptacles and gases, should be utilised as part of the risk assessment process to determine the required control or early warning measures.

5 DOCUMENTATION AND CLIENT RESPONSIBILITIES

The installed systems will not be allowed to operate without a Written Schemes of Examination in accordance with the Pressure Systems Safety Regulations 2000.

The Client is required to follow the guidance in section 8 (User of the Pressure System) of CP4 and section 4 to 6 (Testing and Commissioning; Operating and Maintenance; Training) of CP36

The Project Manager will be required to ensure the Written Scheme of Examination for the installed system is available at handover by ensuring that the required Written Scheme of Examination has been produced by a competent person and the installed system certified by the College's Insurer's competent person. All relevant documentation must be included as part of the Health and Safety File or its equivalent for a non-notifiable project.

The Project Manager will also be responsible for ensuring that signage for the system is in place, the equipment has been notified to the College's insurers for statutory inspection, and the client (end user and Estates and Facilities site Managers) are aware of the requirements of section 8 of CP4 through the formal handover process.

6 VARIATIONS AND CONSULTATION

Variance requests from the criteria contained within this design standard must be submitted as early as possible in writing to the HSEPO, and any subsequent variance approvals/ denials will be in writing. Such requests shall include the nature and proposed location of the variance, justification and details of proposed changes.

7 APPENDIX A – CHOOSING OPTIONS FOR GAS SYSTEM DESIGN