Designated Nursing Officer

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Authorised Person (MGPS)

Objectives of this course

- Knowledge of the Hospital Oxygen Pipeline System
- Safe use of the system including connecting equipment
- Knowledge of the permit to work (MGPS) system including passing information to subordinate staff
- Emergency isolation of pipeline systems
- Alarm conditions and responses

What is a Medical Gas?

- Any gaseous substance that meets medical purity standards and has an application in the medical environment
- For example – Oxygen, Nitrous Oxide, Air

Important Documents

There are a number of important documents that relate to the safe use of medical gases:

- Health and safety at work act 1974
- Management of Health and safety regulations 1999
- **Control of Substances Hazardous to Health (COSHH)**
- Health Technical Memorandum (HTM)02-01 Part A&B
- HTM 05-03 - Firecode
- Medicines Act 1968

HTM 02-01

- **HTM 02-01 Part A Medical Gases - medical gas pipeline systems - part A: design, installation, validation and verification**

This document was used when we were planning the installation, we had to ensure our specification met the requirements of this document

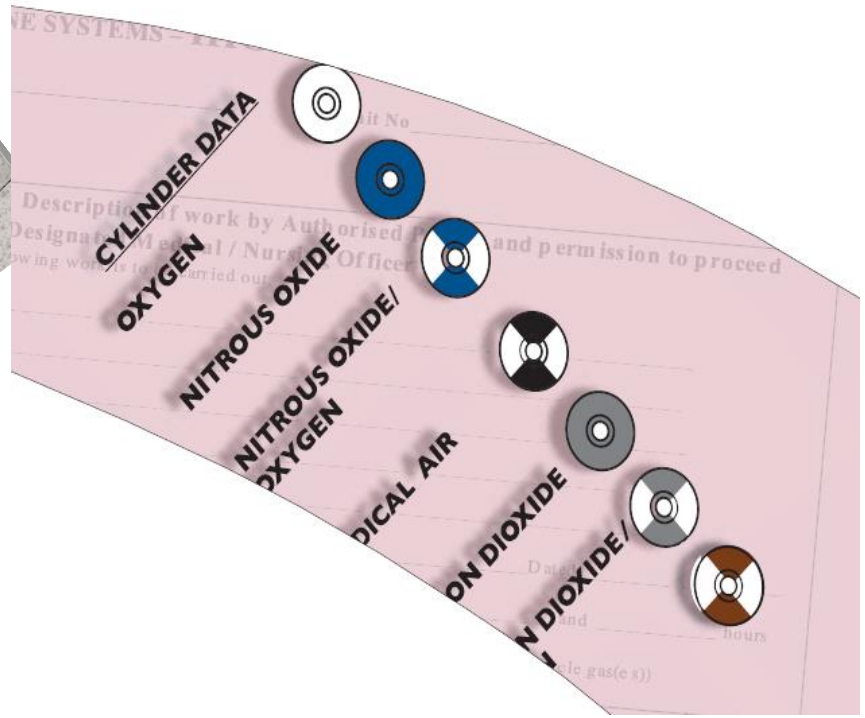
- **HTM 02-01 Part B Medical Gases - medical gas pipeline systems - part B: operational management**

This document tells us how we should operate out medical gas pipeline system

Department of Health

Medical gases
Health Technical Memorandum 02-01: Medical gas pipeline systems

Part B: Operational management



Training Requirements From HTM 02-01 Part B

Table 1 Refresher training and reassessment schedule for personnel working with medical gas systems

Personnel	Retraining	Re-assessment
Authorising Engineer	Every 3 years	Every 3 years
Authorised Person	Every 3 years	Every 3 years
Competent Person	Every 3 years	Every 3 years
Designated Medical Officer	Every 3 years	Every 3 years
Designated Nursing Officer	Every 3 years	Every 3 years
Quality Controller	Every 5 years	Every 5 years
Designated Porter	Every year	Every year
General Nursing staff	Every year	N/A (See note)

Note

A medical equipment "driving licence" for nursing staff may be introduced during the lifetime of this Health Technical Memorandum. Training and competence requirements are likely to be related directly to the terms of such a licence.

Reasons for training

You are required to undertake this training by:

- The HASAWA 1974
- COSHH
- HTM 02-01

To enable you to carry out your duties safely and effectively you must be trained in the safe use and hazards involved in all aspects of your job

Your Role as DNO

- The Designated Medical/Nursing Officer (MGPS) is the person in each ward or department with whom the Authorised Person (MGPS) liaises on any matters affecting the MGPS. It is the Designated Nursing Officer (MGPS) who has ultimate responsibility to give authorising permission for a planned interruption to the supply.

- The Designated Nursing Officer (MGPS) must give permission before any interruption to the MGPS that takes place and they must sign the appropriate parts of the permit when satisfied that the interruption may safely proceed.

- The Designated Nursing Officer (MGPS) is responsible for ensuring that all relevant staff are aware of the interruption to the MGPS and which terminal units cannot be used.
- All Designated Nursing Officers (MGPS) must have received adequate training on the MGPS relevant to their departments and on the action to be taken in the event of an emergency.
- The designated Medical or Nursing Officer (MGPS) must fully understand the implications of the permit to work prior to their authorising signature.

Your Role as DNO

- It is the responsibility of the **Director of Nursing Services** to ensure that adequate supplies of cylinders are held on site at all times. The cylinders held should be suitable for the normal day to day to requirements and to act as a 24 hour supply in the event of a loss of the Primary and Emergency Oxygen manifolds.
- The DNS should ensure that minimum stock holding levels are communicated to the caretakers so that they can order adequate stocks. The DNS will communicate with the caretakers when demand increases or decreases so that stocks of cylinders held can be increased or decreased accordingly

Hazards Associated with Oxygen

Symbol	Hazard	Medical Gas
	Oxidising	Oxygen, will encourage things burn vigorously
	Pressure	All gases supplied in cylinders stored pressure in medical gas cylinders can be up to 300bar
	Cold	The storage temperature of li cryogenic O_2 is – 183°C

Oxidisation

Hazard: oxygen enrichment and oxidisation

- Oxygen itself is not flammable but it supports combustion and will react with most substances causing them to become highly flammable and to burn vigorously.
- The main hazards from oxygen-enriched environments are fire and explosion and even materials considered ‘non-flammable’ and ‘fire retardant’ can combust and burn

Oxidisation

Hazard: oxygen enrichment and oxidisation

Oxygen enrichment can result from:

- Leaks from poor connections, damaged or poorly maintained equipment
- Using excessive flow rates of oxygen or oxidising gases
- Oxygen equipment left on when not required Poor ventilation in areas where oxygen or oxidising gases are used or stored.

Oxidisation

Hazard: oxygen enrichment and oxidisation

An increase in oxygen concentration of only four percent doubles the risk of ignition and rate of combustion for many common items. Ignition can occur from low-energy ignition sources (eg small electrical/static sparks or light friction). At higher oxygen concentrations ignition may require so little heat or energy that combustion may appear to be spontaneous.

Oxidisation

Hazard: oxygen enrichment and oxidisation

If a ward or clinical area is oxygen-enriched, the following common items are particularly vulnerable to combustion:

- Hair and clothing
- Bed linen, mattresses, pillows and curtains
- Dressings, especially if medicated or ‘wet’ (treated with ointments, emollients, etc.)
- Sanitising hand-gels and hand-rubs and any oils, greases, ointments or creams
- Cardboard and paper items
- Chemicals and equipment used for cleaning and disinfection
- Electrical and electronic equipment

Oxidisation

Hazard: oxygen enrichment and oxidisation

Best practice to minimise the risks of oxygen enrichment and oxidation fires are:

- Ensure hands and clothing are clean and free from oil, grease, hand-sanitising gels/rubs or hand creams
- Use only equipment designed specifically for use with oxygen or oxidising gases
- Ensure flowmeters and regulators are within their service date
- Use the appropriate flow rate of gas according to the method of delivery (mask, nasal ‘specs’, etc.) as prescribed

No Smoking

- Patients should never be allowed to smoke when oxygen is being administered

Storage Pressure

Hazard: pressure

- It is important to be aware of pressures at which gases are stored and used. Medical gas cylinders are filled to pressures of 127 to 300 bar (up to 150 times that of your car tyre!).
- Pressure itself is not necessarily dangerous. Hazardous situations occur when pressure is mishandled or improperly contained. In terms of medical gases it is appropriate to consider pressure as a form of stored energy that when released can be deadly.
- Exploding cylinders are able to travel in excess of 300 metres.

Hazard: temperature

- Oxygen is supplied to the hospital in both gaseous and liquid form. The liquid forms (cryogenic liquid gas) are stored at less than – 180°C. Liquid gases and their vapours can cause cold burn to exposed parts of the body.
- Prolonged exposure can also cause frostbite, possibly leading to loss of bodily extremities such as fingers, toes and nose.

Oxygen Cylinders

Oxygen cylinders are made from carbon fibre and contain gas at very high pressure (230 bar). These cylinders have a built in regulator and pressure valve. To prepare the cylinder for use the two plastic shields should be removed to expose the valve and connectors. There are two methods of connection:

- Using the fir tree connector on top of the cylinder,

Or for higher flows:

- A Schrader outlet may be used

NB Care should be taken to use a cradle or trolley that is designed for use with the carbon fibre cylinder, those designed for use with old style metal cylinders may have securing devices that can damage the carbon fibre

Common Sizes of Medical Gas Cylinders Used

- CD 460 litres
- ZX 3040 Litres

Safe use of Oxygen Equipment

You should:

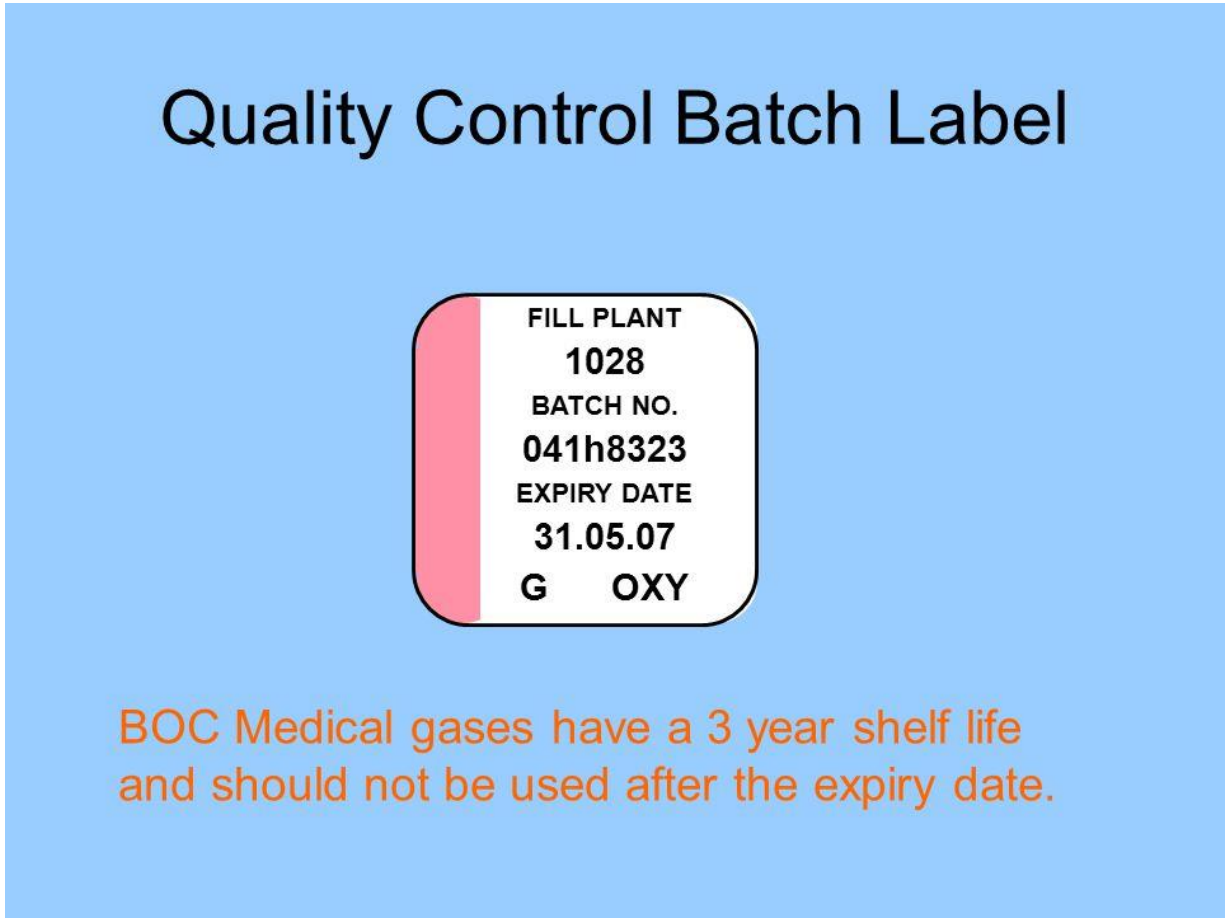
- Open the valve slowly. Rapid opening, particularly of cylinder valves, can result in brief, high oxygen speeds, causing frictional heat, particularly if any dirt or dust is present. Alternatively, if the system has a dead end, such as where a pressure regulator is connected to an oxygen cylinder, heat can be generated through oxygen. Both cases can result in a fire;
- Make sure that the regulator outlet valve is closed before opening the oxygen cylinder valve, particularly when opening the cylinder valve for the first time after changing cylinders;
- Make sure that cylinder valves are closed and piped supplies isolated whenever work is stopped. Do not try to cut off the supply of oxygen by nipping or kinking flexible hose when changing equipment, eg blowpipes;
- Maintain hoses and other equipment in good condition. Leak tests can be carried out easily using a spray or liquid solution that is certified for use on oxygen systems. Soap or liquids that may contain grease should not be used.

Where to Find Safety Information on an Oxygen Cylinder

A Hazards and precautions, B Name of product, C Hazard diamond(s), D Filled pressure, E Gross weight, F Cylinder size, G Contact information, H Unique cylinder serial number

- Cylinder collars give important safety information and usage information and will confirm the cylinder contents
- They should always be checked before a cylinder is used
- They should never be removed

Quality Control Batch Label



Cylinder safety – Moving and Handling

- Adhere to safe moving and handling techniques
- Use a dedicated trolley to move the cylinders around (ZX size)
- Be mindful of other equipment that is in the area and take care not to disconnect any other equipment

Cylinders Safety – Storage

HTM 02-01 Part B and HTM 05-03 sets out storage arrangements

- Cylinders should be stored in a suitably designed store and ONLY medical gas cylinders should be stored in this area
- No more than 24 hours supply should be stored inside the hospital
- Cylinders should be in designated parking areas and signage should be provided
- Cylinders must be stored in appropriate holders which must be fixed to a wall or stable structure (such as emergency trolley). Cylinders in trolleys should also be chained to a wall
- Cylinder valves must be turned off for storage
  - With the exception of those on a resuscitation trolley

Cylinders safety – Storage

Cylinders must never be stored in any of the following ways:

- Free standing
- Housed in poorly ventilated areas
- In direct sunlight or near to a heat source
- With chemicals and solvents
- With any combustible materials including bed linens
- Attached to any equipment when in long term storage
- With the valve turned on

Cylinders safety – Storage

Ordering and Delivery of Medical Gas

- If a cylinder is required the Nurse In Charge of the department should contact the duty caretaker
- Out of hours the NIC is responsible for arranging for the cylinder to be collected from the cylinder store

Ordering and Delivery of Medical Gas

- No more than 2 CD sized cylinders will be stored in Ward Offices in suitable wall brackets. These cylinders are for use when a patient is travelling to an area not served by the Medical Gas Pipeline system

- An emergency reserve of 24 hours supply of oxygen stored in ZX and CD sized cylinders is stored in the cylinder store

How Much Gas is in a Cylinder

		Gauge Contents					
		Full (100%)		Half (50%)		Low (25%)	
	Flow rate ltr/Min	hr/Min	mins	hr/Min	mins	hr/Min	mins
CD Cylinder (460 litres)	15	0.30	30	0.15	15	0.07	7
	10	0.46	46	0.23	23	0.11	11
	6	1.16	76	0.38	38	0.19	19
	4	1.55	115	0.57	57	0.28	28
	2	3.50	230	1.55	115	0.57	57
	Flow rate ltr/Min	hr/Min	mins	hr/Min	mins	hr/Min	mins
ZX Cylinder (3040 litres)	15	3.22	202	1.41	101	0.5	50
	10	5.04	304	2.32	152	1.16	76
	6	8.26	507	4.13	253	2.06	127
	4	12.40	760	6.2	380	3.1	190
	2	25.20	1520	12.4	760	6.2	380

Medical Gas Pipeline

- Medical gases are delivered to outlets in patient bedrooms and physio gym
- These outlets are called terminal units and are wall mounted into vertical trunking
- It should be possible to operate the outlet with one hand (engage and release)
- To prevent the wrong gas being administered each gas has a specific connection so it cannot accept a probe for any other gas
- NEVER attempt to force a probe into the wrong outlet as this will result in damage to equipment and could cause malfunction or leakage

Description of the System

- The Medical Gas Pipeline System (MGPS) for Holy Cross Hospital consists of the source of supply, a pipeline distribution system, terminal units and warning / alarm systems which are installed to ensure cost effective and convenient distribution of medical gases, to European Pharmacopoeia (Ph Eur) quality, for the use of clinical, and nursing staff, in the provision of patient care.

- The Medical Gases provided in this way are limited to Oxygen (O2) and Medical Vacuum (Med Vac).

Pipeline System Design

- HTM 02-01 proposes the adoption of 3 sources of supply in order to maintain

continuity. Therefore the Medical Oxygen supply will provide a:

- Primary liquid cylinder manifold (consisting of 2 x LC200),
- a compressed 2 x 2 cylinder automatic manifold Secondary supply and
- a reserve supply of locally based integral valve cylinders.

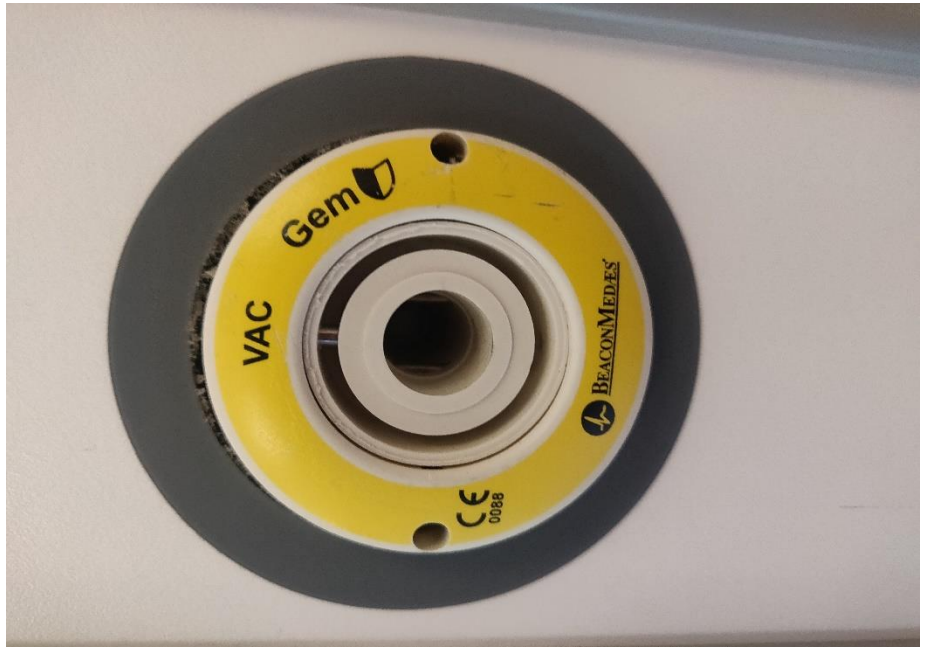
Pipeline System Design

- Based on the HTM 02-01 diversified flow rate algorithms for Medical Oxygen in an
- Adult acute day care accommodation, a flow rate of 80 litres per minute is required
- from the system. Both of the supply systems have been chosen to adequately
- perform under these conditions.
- A further calculation based on each outlet being in
- use with a prescribed maximum flow of 6 litres per minute also proves the system
- adequacy.

Gas Outlet Arrangement

- Medical gas outlets are always arranged in the same order from top to bottom and are identified by colour and by the name of the gas.
- They should also bear the name of the manufacturer and the relevant standard to which they were manufactured, which is either BS5682 or BS EN 737, and a CE mark indicating they are a medical device

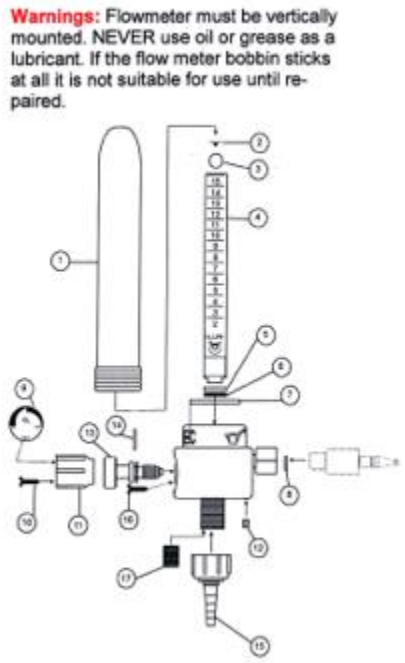
Gas Outlet Arrangement



Flowmeters

- The hospital holds in stock two sizes of flowmeters for ease of delivery of oxygen at the correct rate. In most cases 0-4.5 litre flow meters will be used but for patients requiring higher levels of oxygen a 0-15litre flowmeter can be obtained from clinical stores. Flowmeters are not left in patients rooms when there is not a requirement for oxygen delivery but a startup kit containing all items required for oxygen delivery will be kept at all times in clean holding. It is the responsibility of the Ward Sister to request additional units from the Clinical Stores Department.
- The serial number of all flowmeters must be recorded on the equipment database on receipt together with the flowmeter location. It is the Ward Sister's responsibility to ensure that location of the flowmeters is correctly recorded. (O:Equipment/Medical equipment/MEDICAL DEVICE INVENTORY)
- All flowmeters that are in use must be subject to a weekly check to ensure that they are working correctly. The Clinical Stores Coordinator will issue a weekly checking record sheet with each flowmeter and it is the Ward Sister's responsibility to ensure that the weekly checks are carried out and documented.

Diagram of a flowmeter



Medical Vacuum

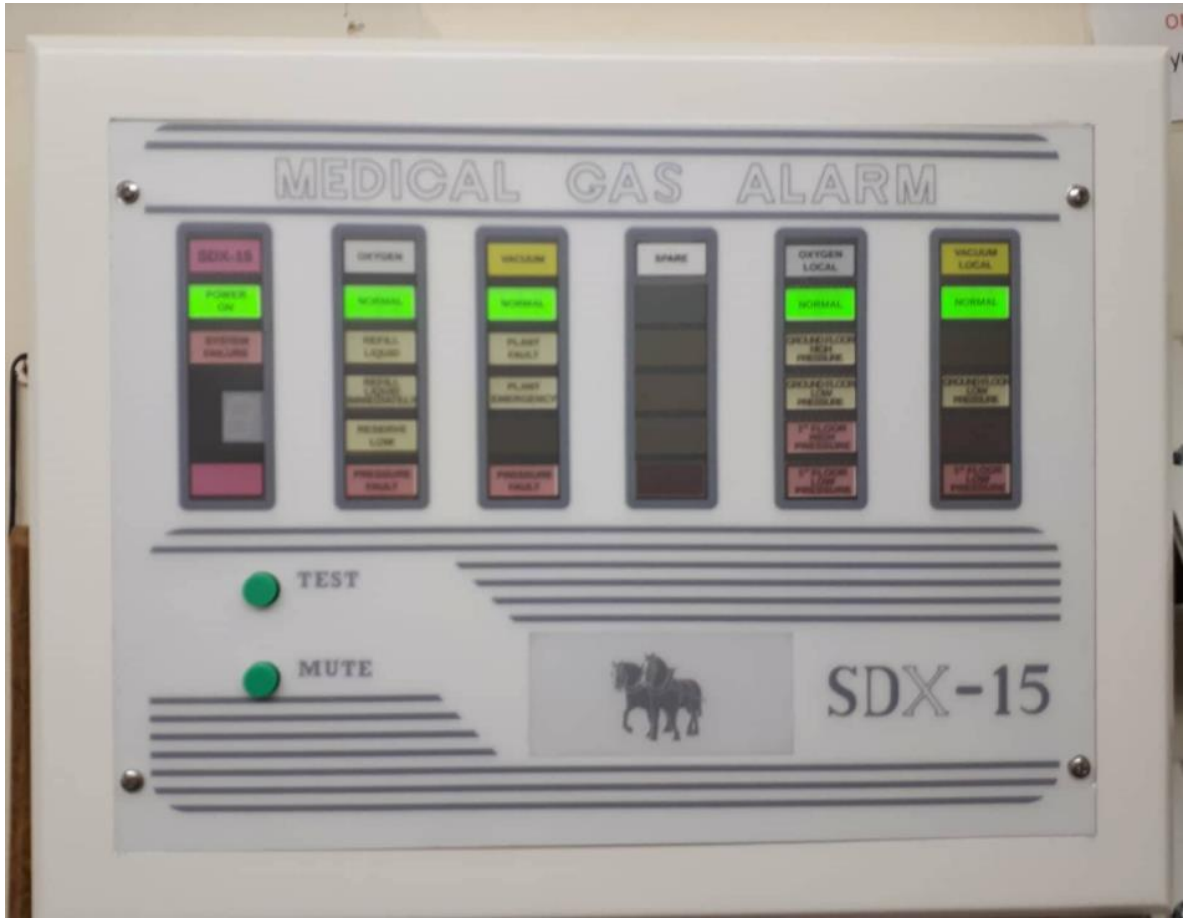
Suction Controllers

- High suction controllers are provided for the delivery of medical vacuum to patients. Any patient who requires suction will have a suction controller, tubing and collection canister permanently installed in their room. A supply of additional suction start up kits are located in the clean holding area so they can be accessed at any time. The serial number of all suction controllers must be recorded on the equipment database on receipt, the suction controller location must also be recorded. It is the Ward Sister's responsibility to ensure that location of the suction controller is correctly recorded. (O:Equipment/Medical equipment/MEDICAL DEVICE INVENTORY)
- The Clinical Stores Coordinator should be informed if the equipment in clean holding is used so it can be replenished.

Central Alarm Panel

- These alarm panels are designed to relay any faults occurring on the supply units (manifolds, compressors etc.) to the alarm system, and then transmit that information to all areas where a panel is situated. It is essential that a daily check is made to ensure that the alarm panel is displaying an illuminated “Normal” legend at the top of each gas column.
- If any of the gas alarms are activated the alarm panel will display a flashing light accompanied by a two-tone audible signal, corresponding to the problem.
- Pressing the “Mute” button on the front of the panel, will silence the alarm. If the supply plant problem is not rectified within 15 minutes, the alarm panel will reset itself and the audible signal will be re-instated.
- The Nurse In Charge is responsible for carrying out and documenting daily checks of the panel.

Central Alarm Panel



Alarm panel Information

Medical Oxygen Pipeline system Alarms & Actions

Alarm Panel			
		Meaning	action
Normal	Normal	Normal	No action
1	Liquid low	Primary supply is at 50%	Normal working hours: inform Caretaker to contact BOC to arrange delivery Out of hours – note to inform caretaker at 8am (Monday to Friday) Weekends – call duty caretaker
2	Liquid Very Low	Primary Supply is at 25%. When this is depleted the supply will automatically switch over to Emergency supply manifold	Call duty Caretaker irrespective of time.
3	Reserve Low	The reserve manifold has depleted to its alarm level of 50%. Replace cylinders as soon as possible. If this message is in addition to conditions 1 and 2 then the supply is in danger of imminent failure. Action required immediately.	Call duty Caretaker irrespective of time.
	Pressure Fault	Emergency. Pressure Fault on Oxygen System. The system pressure is outside the set limits, this could mean that the system is over-pressurised or that all gas has been exhausted. Action is required immediately.	AT ALL TIMES: Urgently inform AP (MGPS) and Duty Caretakers of the situation. DNO will need to ensure Caretakers are given precise information about number of cylinders that should be delivered to ward areas

Alarm Position	Alarm Indication	Meaning	Action required
Green	**Normal**	**Normal**	**No action required**
1Yellow	**Plant Fault**	An error has been detected on a medical vacuum pump. The system is still functional but could be running on the standby pump set.	If alarm persists then alert duty caretaker
2Yellow	**Plant Emergency**	The fault in the medical vacuum system has escalated to a point where system integrity could be Compromised. There might be minimal medical vacuum Remaining before the system is completely depleted.	Notify Caretaker
NOTE: There is no 3rd level alarm condition with vacuum systems as there is no emergency reserve manifold			
4Red	**Pressure Fault**	Emergency. Pressure Fault on Medical Air System. The system pressure is outside the set limits, this could mean that the system is outside the set limits, this could mean that the system low on vacuum capacity or that has already run out immediately	Notify Duty Caretaker, ensure all patients requiring medical vacuum have a portable unit ready for use

Safety Considerations

Patient hurt in explosion at Bath Royal United Hospital

23 November 2011

A hospital patient is being treated for burns after an explosion in an intensive care ward at Bath's Royal United Hospital (RUH).

A statement from the hospital said an oxygen cylinder exploded and there was a "small fire in a single bay".

Staff transferred 12 patients to other wards in the hospital and extra staff were called in to help care for them.

Several RUH staff were treated for the effects of smoke inhalation after the blast on Tuesday night.

The ward is expected to reopen later.

'Scorch marks'

James Scott, the hospital's chief executive, said the patient who sustained injuries was burnt on the leg and was transferred to the regional burns unit at Frenchay Hospital, in Bristol.

Mr Scott said the patient had a "stable night" following the incident.

The 11 patients in intensive care were transferred to other wards.

"There's quite a lot of scorch marks on the wall and the unit is currently closed but we're working hard to get it reopened," Mr Scott added.

A cause for the explosion has not yet been identified.

Avon and Somerset Police said the force, the fire service and the Health and Safety Executive were carrying out a joint investigation.

Safety Considerations

Prevention of waste of resources and safety considerations

- Care should be taken to ensure that devices that are not being used are not left on the beds or armchairs which will pass high oxygen concentrations into the bedding and mattress, or into surrounding atmosphere. Not only is this an extremely dangerous practice from fire risk point of view, it is wasteful and will mean that oxygen supplies will need replenishing more frequently than they would otherwise. After use, Oxygen must be switched off at the flow meter in the terminal unit by a member of staff who has received the correct training. If Oxygen is no longer regularly required the flow meter should be removed from the outlet. It is the Nurse's responsibility to ensure the Patient is receiving the correct flowrate via the correct device to correlate with the patients' oxygen saturations. This should be routinely checked and recorded on the patient's medication chart.

Lets talk about Fire

- Procedures in accordance with the Hospital's Fire Policy should be followed in the event of a fire involving, or likely to involve the MGPS. During a fire the Fire Service Incident Controller, the DNO and Fire Team Leader will assume full control of the area(s) affected.
- If a fire occurs in a ward or department covered by the piped medical gas system, the DNO must evaluate the oxygen usage within that area and wherever possible isolate the medical gases at the area valve service unit (AVSU).
- UNDER NO CIRCUMSTANCES SHOULD MEDICAL GAS SUPPLIES BE ISOLATED UNTIL THE DESIGNATED MEDICAL NURSING OFFICER HAS CONFIRMED THAT ALL PATIENTS LIKELY TO BE AFFECTED HAVE BEEN EVACUATED AND /OR HAVE ALTERNATIVE GAS PROVISION

Area valve service units

Description of Permit to Work system and the DNO role within it.

- There are two classifications of permit in accordance with defined hazard levels.
- A High Hazard Permit is divided in to five parts and will require signatures from Authorised Person (MGPS), Competent Person (MGPS), Designated Nursing officer (MGPS) and QC (MGPS). The Low hazard permit is simpler as it does not require QC testing of the work.

For 99% of jobs an low hazard permit will be used