Medical Gas Pipeline Systems (MGPS) & Medical Gases Operational Procedures

NOTE THIS MEDICAL GAS PIPELINE OPERATIONAL PROCEDURE IS TO BE READ IN CONJUNCTION WITH MEDICAL GASES OPERATIONAL POLICY NO: PP(17)291
Contents

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### 1.0 Hospital Medical Gas Systems

#### Oxygen

<table>
<thead>
<tr>
<th>No</th>
<th>Plant type</th>
<th>Location</th>
<th>Serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Primary BOC VIE, 9000 litres capacity) supported by a secondary VIE system (3320 litres capacity)</td>
<td>VIE compound, rear of main hospital</td>
<td>Whole site</td>
</tr>
</tbody>
</table>

It is the responsibility of the Estates Department to record the reading on the vessels contents gauges and the adjacent pressure gauge on a weekly basis. Records will be kept by the Estates Department.

i) The VIE(s) is/are the responsibility of BOC Medical. Valves on the unit will only be operated by BOC personnel, except in an emergency when, in the absence of BOC personnel, an Authorised Person (MGPS) will carry out the correct valve operations in accordance with the emergency procedure posted in the compound. It is the responsibility of BOC to ensure that this procedure is prominently displayed on the installation. The Co-ordinating Authorised Person (MGPS) should ensure that these HTM 02 requirements are fulfilled. The ordering of liquid oxygen is via the Telemetry link.

ii) Pharmacy are responsible for:
   - Maintenance of liquid stock records/invoices

iii) The Estates Department is responsible for:
   - the weekly checks on the contents of the VIEs;
   - the tanker hard standing and access;
   - keeping the compound clear of flammable rubbish
   - provision of compound services (lighting/electricity/telephone line)

#### Medical air

<table>
<thead>
<tr>
<th>No</th>
<th>Plant type</th>
<th>Location</th>
<th>Serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Penlon Triplex Air Plant with Compair compressors, supported by an automatic East Med/Surg Air ERM 2 x 2</td>
<td>Under ramp</td>
<td>Whole site</td>
</tr>
</tbody>
</table>

Portering are responsible for:
- **a)** replacing ERM cylinders when the central medical gas alarm panel indicates "Reserve Fault";
- **b)** replacing the ERM cylinders before the cylinder expiry date has been reached;
- **c)** ordering replacement cylinders;
- **d)** ensuring that the manifold areas are kept clean and tidy;
- **e)** providing appropriate tools and personal protective equipment;
- **f)** ensuring that all cylinders are supported and secured by restraints.

#### Medical vacuum

<table>
<thead>
<tr>
<th>No</th>
<th>Plant type</th>
<th>Location</th>
<th>Serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MIM Duplex Vac Plant with Busch pumps</td>
<td>Day Surgery Vac Plant Room</td>
<td>Day Surgery Theatres 1 &amp; 2 &amp; Treatment Centre</td>
</tr>
<tr>
<td>2</td>
<td>Millennium Medical Duplex Vac Plant with Becker U4.20 pumps</td>
<td>Day Care Theatre 3</td>
<td>Day Care Temp.Theatre 3</td>
</tr>
<tr>
<td>3</td>
<td>Penlon Duplex Vac Plant with Busch pumps</td>
<td>B6 Plant Room</td>
<td>Main Site</td>
</tr>
</tbody>
</table>
### Manifolds

<table>
<thead>
<tr>
<th>No</th>
<th>Plant type</th>
<th>Location</th>
<th>Serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>East Nitrous Oxide Automatic Manifold 2 x 4 with a 2 x 1 manual ERM</td>
<td>Under Ramp</td>
<td>Whole site</td>
</tr>
<tr>
<td>2</td>
<td>Millennium Oxygen Automatic Manifold 2 x 2 with a 2 x 1 manual ERM</td>
<td>Day Care Temp. Theatre 3</td>
<td>Day Care Temp. Theatre 3</td>
</tr>
<tr>
<td>3</td>
<td>Millennium Nitrous Oxide Automatic manifold 2 x 2 with a 2 x 1 manual ERM</td>
<td>Day Care Temp. Theatre 3</td>
<td>Day Care Temp. Theatre 3</td>
</tr>
<tr>
<td>4</td>
<td>Millennium Med/Surg Air Automatic Manifold 2 x 4</td>
<td>Day Care Temp. Theatre 3</td>
<td>Day Care Temp. Theatre 3</td>
</tr>
<tr>
<td>5</td>
<td>Penlon Entonox Automatic Manifold 2 x 6 with a 2 x 2 manual ERM</td>
<td>Maternity - Joyce Parker</td>
<td>Maternity</td>
</tr>
</tbody>
</table>

The Estates Department is responsible for:
- a) ensuring that the temperature of the Entonox® cylinders on the manifold does not fall below 10°C.

Portering are responsible for:
- a) replacing cylinders when the central medical gas alarm panel indicates “Change Cylinders”;
- b) replacing the ERM cylinders before the cylinder expiry date has been reached or when the medical gas alarm panel indicates “Reserve Fault”;
- c) ordering of replacement cylinders;
- d) ensuring that the manifold rooms are kept clean and tidy;
- e) providing appropriate tools and personal protective equipment;
- f) ensuring that all cylinders are supported and secured by restraints;

### Anaesthetic gas scavenging systems

<table>
<thead>
<tr>
<th>No</th>
<th>Plant type</th>
<th>Location</th>
<th>Serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 Rietschle SKG 275 pump &amp; 1 Becker pump, acting as a Duplex plant</td>
<td>Day Care Theatre 1&amp;2</td>
<td>Day Care Th 1&amp;2 Plant Room</td>
</tr>
<tr>
<td>2</td>
<td>Rietschle SKG 275 Simplex</td>
<td>MRI, outside compound</td>
<td>MRI</td>
</tr>
<tr>
<td>3</td>
<td>Becker Duplex</td>
<td>Theatre 7 (G/F Store)</td>
<td>Theatre 7</td>
</tr>
<tr>
<td>4</td>
<td>Electror Duplex</td>
<td>Theatre roof (1-6)</td>
<td>Theatres</td>
</tr>
<tr>
<td>5</td>
<td>Becker Simplex</td>
<td>A&amp;E Roof</td>
<td>A&amp;E</td>
</tr>
<tr>
<td>6</td>
<td>Becker Simplex</td>
<td>Rear of X-Ray</td>
<td>X-Ray</td>
</tr>
<tr>
<td>7</td>
<td>Becker Simplex</td>
<td>Theatre 9 Roof</td>
<td>Theatre 9</td>
</tr>
<tr>
<td>8</td>
<td>Becker Duplex</td>
<td>Day Care Temp. Theatre 3</td>
<td>Day Care Temp. Theatre Vac Plt Room</td>
</tr>
<tr>
<td>9</td>
<td>Becker Duplex</td>
<td>Treatment Centre Plant Room</td>
<td>Treatment Centre Theatres A &amp; B</td>
</tr>
<tr>
<td>10</td>
<td>Becker Duplex</td>
<td>Theatre 9 Roof</td>
<td></td>
</tr>
</tbody>
</table>

### Performance
It is the responsibility of the Health and Safety Advisor to provide evidence, at least annually, that the concentrations of pollutants in the areas served by AGS systems comply with COSHH regulations. Linked with Occupational Health for advice on exposure levels under COSHH legislation.

2.0 Manifolds and Plant rooms

2.1 Security – access
The air plant and its emergency reserve manifold, the vacuum plants, active anaesthetic gas scavenging system, oxygen, medical/surgical air, Entonox® and nitrous oxide manifolds are located in locked rooms. Contractors’ Competent Persons (MGPS) should be allowed on proof of identity and accompanied by a permit to access the roof and plant rooms which is issued by the Estates department, to gain access by signing out the relevant keys from Estates.

2.2 Security – key-holders
Keys for these rooms are available from Estates. See Appendix A for list of contacts.

<table>
<thead>
<tr>
<th>Plant / manifold</th>
<th>Location</th>
<th>Key Holder</th>
<th>Key No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical air compressor</td>
<td>Under ramp</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Medical vacuum</td>
<td>B6 Plant Room</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Medical vacuum</td>
<td>Temp Theatre 3 Plant Room</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Medical vacuum</td>
<td>Day Surgery Theatres 1 &amp; 2 Plant Room</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Anaesthetic gas scavenging plant</td>
<td>As above</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Nitrous oxide manifold</td>
<td>Under ramp</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Nitrous oxide manifold</td>
<td>Outside rear Day Care Temp Theatre 3</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Oxygen manifold</td>
<td>Outside rear Day Care Temp Theatre 3</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Medical/Surgical air manifold</td>
<td>Outside rear Day Care Temp Theatre 3</td>
<td>Estates</td>
<td></td>
</tr>
<tr>
<td>Entonox® manifold</td>
<td>Maternity Manifold Room</td>
<td>Estates</td>
<td></td>
</tr>
</tbody>
</table>

2.3 Emergency contact
In an emergency, contact the Estates department see Appendix A for contact details.

2.4 Signage
Appropriate identification and safety warnings are displayed at entry points and internally at all plant / manifold rooms, in accordance with current requirements. A notice, stating the location of the keys, is fixed to the plant / manifold room door.

2.5 Safety
Plant and manifold rooms are fitted with fire detection systems and locally mounted fire extinguishers. In the event of fire in any of these areas, the hospital fire Policy should be used to determine actions.

DO NOT ATTEMPT TO FIGHT A FIRE IN WHICH CYLINDERS ARE INVOLVED.

3.0 Cylinder storage

3.1 Four storage areas are identified
a) The Main Hospital gas store, divided into ‘Full’ and ‘Empty’ areas.
b) Day Surgery – Oxygen and medical air only
c) By Mortuary – Nitrous oxide only
d) Entonox – within Entonox manifold room

Ready-to-use cylinder storage
Due to the relatively high usage of G-size oxygen cylinders (piped oxygen only to a limited number of beds) there are a number of ready-to-use stores throughout the hospital. These are regularly replenished (Full for Empty) by the Portering staff.

3.2 Security – access
Medical gas cylinder stores are kept locked at all times except during cylinder changes and essential maintenance. Access is limited to Designated Porters and Estates/Contractors’ personnel for maintenance purposes.

3.3 Security – key-holders
Keys for the store are available from Portering. See Appendix A for list of contacts.

3.4 Emergency contact
**IN THE EVENT OF FIRE DIAL 2222**
In any other emergency, see Appendix A for contact details.

3.5 Signage
Appropriate identification and safety warnings are displayed in and outside the stores, in accordance with current requirements. This includes an up to date cylinder identification chart. A notice indicating the location of the keys is fixed to the cylinder store door.

3.6 Safety
Cylinder stores are fitted with locally mounted fire extinguishers. In the event of fire in any of these areas, the hospital fire Policy should be used to determine actions. Do NOT attempt to fight a fire in which cylinders are involved.

4.0 Area valve service units (AVSUs) and Line Valves

4.1 Area valve service units (AVSUs)
Locked valve boxes containing isolating valves in enclosures with breakable glass fronts are provided at the entrance to wards and departments. Some of these valve boxes do not comply with the requirements of HTM 02. Boxes which do comply are called area valve service units (AVSU). Compliant valve boxes contain an emergency inlet port, which is gas specific. This may be used by Estates to supply gas to a ward when the main supply fails or is shut down for essential engineering work.

A description of the gas and the area served, along with valve box and box key numbers, must be provided adjacent to each valve box or AVSU, so that they can be consulted **before** any valve is turned off. The Estates department hold the keys for these valves.

Emergency isolation can be effected by breaking the glass cover and closing the valve.

4.2 Access
Operation of AVSUs for work on the system will be controlled under a permit to work system controlled by the Authorised Person (MGPS) and the Designated Medical or Nursing Officer.

**NO SUCH ISOLATION WILL TAKE PLACE WITHOUT WRITTEN PERMISSION OF THESE PERSONS**

Only the Authorised Persons (MGPS) using the appropriate key from the Estates medical gases key cabinet should access AVSUs and any other locked line valves, under the control of a permit-to-work.

The key cabinet is located in the Estates Department Office. The key cabinet contains a list identifying all AVSUs and valves, with corresponding key numbers.

4.3 Key-holders
Key-holders are listed in Appendix A.
4.4 Emergency access to AVSUs
In the event of an emergency, access to AVSUs may be gained by smashing the breakable glass fronts, using a shoe etc, to prevent personal injury. With the broken glass removed, the valve should be turned to the ‘OFF’ position. The ‘OFF’ position and the direction in which to turn the valve handle are usually marked inside the AVSU box. If no marking is present, the ‘OFF’ position is achieved by turning the valve handle through a quarter of a turn (usually clockwise), such that it assumes a position at 90° to the valve body.

A member of the Medical or Nursing staff will perform this action ONLY after steps have been taken to ensure that no patient is compromised by isolation of the gas supply. Staff should be trained in these actions.

Note: With the older valve box designs great care needs to be taken, when breaking glass, to avoid injury to personnel from shards of broken glass.

4.5 Line valves
Line valves for use by Estates personnel for isolation of sections of the medical gas installation are provided at strategic points in the system.

4.6 General rules and conditions for control of Line Valves
Line valves installed in ducts, risers, ceiling spaces etc shall be locked in the normal operating position. Line valves will normally be left unlocked if they are sited in a locked plant room. Estates will hold keys for these valves.

5.0 The MGPS Permit-to-Work System
5.1 The MGPS permit-to-work system
The aim of the MGPS permit-to-work system is to safeguard the integrity of the medical gas system and, therefore, the safety of the patients.

It is the policy of the Trust that, with the knowledge and permission of the Authorised Person (MGPS) – a permit must be raised before any work (except changing of manifold cylinders, refilling the liquid oxygen vessels, QC testing of medical/surgical air or emergency isolation by a member of the medical/nursing staff) can be undertaken on any part of any the Trust’s medical gas systems.

Granting of a permit-to-work and the way in which the work is carried out must follow the directions of Health Technical Memorandum 02 unless otherwise defined in this policy. Responsibilities for signing a permit-to-work lie with the Designated/Medical Nursing Officers in each department. Officers should ensure that colleagues are advised of the interruption to the gas supply and its estimated duration. Officers should also ensure, via Estates, that all affected terminal units are appropriately labelled.

5.1.1 Planned interruption
A planned interruption will be needed for repair, extension or modification to the existing MGPS.

An Authorised Person (MGPS) shall supervise any planned interruption in strict accordance with the permit-to-work system in Health Technical Memorandum 02.

The Quality Controller (MGPS) shall be involved in any planned interruption from the initial planning stage.

The Authorised Person (MGPS) shall assess the hazard level of the work to be carried out in accordance with the definitions that are given in the following sections for high and low hazard work.

5.1.2 High hazard work
Any work on the MGPS, such as cutting or brazing, that will introduce hazards of cross-connection and pollution will be classified as high hazard. Cross-connection, performance, identity and quality tests shall be required before the MGPS is taken back into use.

High hazard work might require, at the least, a planned interruption to a single ward or department or, at worst, a major shut-down of a system to any of the Trust's sites. In such events, an Authorised Person...
(MGPS) must ensure that key personnel for each ward or department are informed; if necessary, by holding a site meeting, if deemed necessary.

5.1.3 Liaison time

Before the planned interruption, the Authorised Person (MGPS) shall liaise in person with the Designated Nursing/Medical Officer(s) of the ward(s) or department(s) concerned and present a Written Plan (See Appendix H).

At the same time, the Authorised Person (MGPS) will complete Part 1 of the permit-to-work form and the Designated Nursing/Medical Officer(s) of the ward(s) or department(s) involved will be made aware that their signatures will be required on the date on which the work is due to take place.

The requirement for portable gas cylinders or vacuum units will be determined and confirmed, with details of the interruption, by a memorandum from the Estates department to the Designated Nursing/Medical Officer(s) on the ward(s) or departments concerned.

It is the responsibility of the Authorised Person (MGPS) to arrange, through the Pharmacy, EBME or an appropriate hire firm, for portable cylinders and regulators if required (emergency-use regulators are held by EBME). Any additional portable vacuum units to be supplied are the responsibility of the wards/departments concerned. Estates (See Appendix A) should be contacted for advice.

The Authorised Person (MGPS) will provide all details of the work to be carried out in Part 1 of the permit-to-work form, including any other permits (for example for “hot works” or for entry into confined spaces). At the discretion of the Authorised Person (MGPS), method statements and risk analyses shall be prepared and accompany the permit.

Work shall only commence when the senior Duty Nurse(s)/medical officers for the ward(s) or department(s) are satisfied that no patients will be put at risk by the shut-down of the MGPS and they have signed Part 1 (White copy) of the permit to work form.

The Authorised Person (MGPS) will then supervise isolation of the AVSU(s) by the Competent Person (MGPS) after:

a. confirming isolation details by consultation with the Competent Person (MGPS); and
b. preparing a sketch on the fourth sheet of the permit and any additional drawings (if available).

Once the system(s) has/have been isolated and depressurised, the Competent Person (MGPS) will sign:

a. Part 2 and
b. (together with the Authorised Person (MGPS)) the fourth sheet of the permit-to-work form, and then commence work.

The Competent Person (MGPS) will sign Part 3 of the permit to certify that work has been completed and contact the Authorised Person (MGPS) so that the installation may be examined and tested.

Depending on the extent of high hazard work, the Authorised Person (MGPS) will determine and carry out, with the assistance of the Competent Person (MGPS), the necessary engineering tests and examination of the system(s) in accordance with Chapter 15 “Validation and verification” in Part A of Health Technical Memorandum 02.

When the results of these tests are deemed satisfactory, the Authorised Person (MGPS) will initial the relevant spaces and sign Part 3 of the permit.

The Quality Controller (MGPS), with the assistance of the Authorised Person (MGPS), will carry out identity and quality tests on the system(s) in accordance with Chapter 15 “Validation and verification” in Part A of Health Technical Memorandum 02.
When the results of these tests are deemed satisfactory, both will sign Part 4 of the permit. Unsatisfactory results may lead to cancellation of the permit.

The Quality Controller (MGPS) will receive the pink copy of the permit-to-work form from the Authorised Person (MGPS) which will constitute the record of tests performed.

**Note:** It should be the normal practice of Estates to retain the white top copy and the Fourth (green) sheet in the permit-to-work book. The yellow copy may be retained by the Competent Person (MGPS).

The Designated Nursing/Medical Officer(s) will accept the system(s) back into service by signing Part 5 of the permit and will undertake to notify his/her colleagues that the system is fit for use.

### 5.1.4 Low hazard work
Any work on the MGPS which will not introduce any hazard of cross-connection or pollution will be classified as low hazard work.

A performance test will be required before the MGPS is taken back into use. If there is any doubt as to the hazard level classification of a particular permit-to-work, advice should be sought from the Coordinating Authorised Person (MGPS).

Low hazard work on terminal units is normally the result of a leak on an individual terminal unit due to a faulty valve or seal, but may also include work on plant which does not interrupt gas supplies. This type of work is usually carried out at short notice because of the need for minimum disruption to patient care.

The Authorised Person (MGPS) may have to arrange with Portering/Pharmacy/EBME for a portable cylinder or vacuum unit so that the terminal unit can be taken out of service. The Authorised Person (MGPS) will fill out the relevant section of Part 1 of the permit. The Authorised Person (MGPS) will liaise with, and fully brief, the senior Duty Nurse/medical officer of the ward/department, who will then sign Part 1, if required.

The Authorised Person (MGPS) will provide all details of the work to be carried out in Part 1 of the permit-to-work form. When satisfied with the extent of the work, the Competent Person (MGPS) will sign Part 2 and then commence work.

The Competent Person (MGPS) will sign Part 3 of the permit to certify that the work has been completed, and contact the Authorised Person (MGPS) for the installation to be examined and tested.

The Competent Person (MGPS), with the assistance of the Authorised Person (MGPS), if necessary, will carry out flow, pressure drop, mechanical function and gas-specificity tests on the serviced terminal unit(s). Other equipment function tests, for example on plant, will be made to the satisfaction of the Authorised Person (MGPS).

The Authorised Person (MGPS) and Competent Person (MGPS) will initial the relevant spaces and sign Part 3 of the permit.

When satisfied with the test results, the Authorised Person (MGPS) will sign Part 4 of the permit, or indicate that further work is necessary.

The senior Duty Nurse/medical officer of the ward or department will accept the MGPS back into service by signing Part 5 of the permit and will undertake to notify his/her colleagues that the system is fit for use or requires further work.

### 6.0 Actions in the event of a medical gas alarm

#### 6.1 System summary
A central alarm panel is served by remote transmitters from four medical gas installations, i.e. liquid oxygen VIE, nitrous oxide manifold, compressed air plant and medical vacuum plants. The central (master) alarm panel, is located at the Switchboard and gives indications of the status of these gas systems.
There is a central alarm panel for the Entonox® manifold located in the Central Delivery Suite and gives indications of the status of this gas system only.

Area alarm panels are provided locally in some wards to display high and low gas pressures downstream of the AVSUs in accordance with the requirements of HTM 02.

6.2 Local alarm indication

On detection of a local alarm indication during normal working hours, for example in a ward area, the Senior Duty Nurse, or other nominated person should contact Estates Help Desk to report that a fault has been signalled. Outside normal working hours the Switchboard should be contacted. (See Appendix A)

6.3 On all alarm panels there should always be a "normal" light. If there is no "normal" light, then there is a fault of some kind, possibly just with the alarm panel. However, Estates should investigate this fault.

6.4 Alarms should be tested quarterly by a Competent Person (MGPS). Nursing/medical staff should be advised of this test.

6.5 Safety Note for nursing/clinical staff:

Disabling the alarm system, other than when due authorisation has been obtained from an Authorised Person (MGPS), in any way is absolutely forbidden, as this action may compromise patient safety.

6.6 The diagrams below show the actions that should be taken for each alarm indication.

NWH = Normal Working Hours (08.00 – 16.30 Monday - Friday)
ONWH = Outside Normal Working Hours
### Bulk liquid oxygen system (VIE)

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Switchboard</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NWH</td>
<td>ONWH</td>
<td>NWH</td>
</tr>
<tr>
<td><strong>NORMAL</strong></td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td><strong>REFILL LIQUID</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
</tr>
<tr>
<td><strong>(VIA TELEMETRY)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>REFILL LIQUID</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
</tr>
<tr>
<td><strong>IMMEDIATELY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RESERVE LOW OR</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
</tr>
<tr>
<td><strong>RESERVE FAULT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PRESSURE FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Medical air plant

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Switchboard</th>
<th>Portering</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NWH</td>
<td>ONWH</td>
<td>NWH</td>
<td>ONWH</td>
</tr>
<tr>
<td><strong>NORMAL</strong></td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td><strong>PLANT FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
<td>Investigate/ Call PPM provider</td>
</tr>
<tr>
<td><strong>PLANT EMERGENCY</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
<td>Investigate/ Call PPM provider</td>
</tr>
<tr>
<td><strong>RESERVE LOW OR</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Change cylinders</td>
<td>Investigate/ Call PPM provider</td>
</tr>
<tr>
<td><strong>RESERVE FAULT</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>PRESSURE FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
<td>Investigate/ Call PPM provider</td>
</tr>
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<td></td>
</tr>
</tbody>
</table>

### Main medical vacuum plant (B6 plant room)

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Switchboard</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NWH</td>
<td>ONWH</td>
<td>ONWH</td>
</tr>
<tr>
<td><strong>NORMAL</strong></td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td><strong>PLANT FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
</tr>
<tr>
<td><strong>PLANT EMERGENCY</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
</tr>
<tr>
<td><strong>PRESSURE FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
## Medical vacuum plants (Day Surgery Theatres 1&2 + Wards and Temp Theatre 3)

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Duty Nurse</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NWH</td>
<td>ONWH</td>
</tr>
<tr>
<td>NORMAL</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td>PLANT FAULT</td>
<td>Call Estates Help Desk</td>
<td>(null)</td>
</tr>
<tr>
<td>PLANT EMERGENCY</td>
<td>Call Estates Help Desk</td>
<td>(null)</td>
</tr>
<tr>
<td>PRESSURE FAULT</td>
<td>Call Estates Help Desk</td>
<td>(null)</td>
</tr>
</tbody>
</table>

Note: Day Surgery is only manned during normal working hours 07.30-18.00

## Nitrous Oxide Manifold system

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Switchboard</th>
<th>Portering</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NWH</td>
<td>ONWH</td>
<td>NWH</td>
<td>ONWH</td>
</tr>
<tr>
<td>NORMAL</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td>CHANGE CYLINDERS</td>
<td>Call Portering</td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td>Change cylinders</td>
</tr>
<tr>
<td>CHANGE CYLINDERS IMMEDIATELY</td>
<td>Call Portering</td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td>Change cylinders</td>
</tr>
<tr>
<td>RESERVE LOW OR RESERVE FAULT</td>
<td>Call Portering</td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td>Change cylinders</td>
</tr>
<tr>
<td>PRESSURE FAULT</td>
<td>Call Estates Help Desk</td>
<td>Site Manager</td>
<td>Call on-call engineer</td>
<td>Investigate/ Call PPM provider</td>
</tr>
</tbody>
</table>

## Entonox® manifold system

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Central Delivery Suite (Duty Nurse)</th>
<th>Portering</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NWH</td>
<td>ONWH</td>
<td>NWH</td>
<td>ONWH</td>
</tr>
<tr>
<td>NORMAL</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td>CHANGE CYLINDERS</td>
<td>Call Portering</td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td>Change cylinders</td>
</tr>
<tr>
<td>CHANGE CYLINDERS IMMEDIATELY</td>
<td>Call Portering</td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td>Change cylinders</td>
</tr>
<tr>
<td>RESERVE LOW OR RESERVE FAULT</td>
<td>Call Portering</td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td>Change cylinders</td>
</tr>
<tr>
<td>PRESSURE FAULT</td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Call on-call engineer</td>
<td>Investigate/ Call PPM provider</td>
</tr>
</tbody>
</table>

Source: Medical Gas Committee
PP(17) 290
Issue date: Nov 2017
Review Date: Nov 2019
Manifold systems (Temp. Theatre 3 – Oxygen, Nitrous Oxide & Surgical/Medical Air)

### Manifold systems (Temp. Theatre 3 – Oxygen, Nitrous Oxide & Surgical/Medical Air)

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Duty Nurse</th>
<th>Portering</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td>NWH</td>
<td>No action</td>
<td>No action</td>
<td>NWH</td>
</tr>
<tr>
<td>ONWH</td>
<td>No action</td>
<td>No action</td>
<td>ONWH</td>
</tr>
<tr>
<td><strong>NORMAL</strong></td>
<td>No action</td>
<td>No action</td>
<td>NWH</td>
</tr>
<tr>
<td><strong>CHANGE CYLINDERS</strong></td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td></td>
</tr>
<tr>
<td><strong>CHANGE CYLINDERS IMMEDIATELY</strong></td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td></td>
</tr>
<tr>
<td><strong>RESERVE LOW OR RESERVE FAULT</strong></td>
<td>Call Portering</td>
<td>Change cylinders</td>
<td></td>
</tr>
<tr>
<td><strong>PRESSURE FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Investigate/ Call PPM provider</td>
<td></td>
</tr>
</tbody>
</table>

Note: Day Surgery is only manned during normal working hours 07.30-18.00

### Local alarm panel display (Wards)

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Senior Nurse</th>
<th>Switchboard</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td>NWH</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>NWH</td>
</tr>
<tr>
<td>ONWH</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>ONWH</td>
</tr>
<tr>
<td><strong>NORMAL</strong></td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>NWH</td>
</tr>
<tr>
<td><strong>HIGH PRESSURE</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Switchboard</td>
<td>Call Site Manager</td>
<td>Investigate/ Call PPM provider</td>
</tr>
<tr>
<td><strong>LOW PRESSURE</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Switchboard</td>
<td>Call Site Manager</td>
<td>Investigate/ Call PPM provider</td>
</tr>
</tbody>
</table>

### System fault indication (Main Panel)

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Switchboard</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td>NWH</td>
<td>No action</td>
<td>No action</td>
<td>NWH</td>
</tr>
<tr>
<td>ONWH</td>
<td>No action</td>
<td>No action</td>
<td>ONWH</td>
</tr>
<tr>
<td><strong>POWER ON</strong></td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td><strong>SYSTEM FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Site Manager</td>
<td>Investigate/ Call PPM provider</td>
</tr>
</tbody>
</table>

### System fault indication (Local Panel)

<table>
<thead>
<tr>
<th>ALARM INDICATION</th>
<th>Senior Nurse</th>
<th>Switchboard</th>
<th>Site Manager</th>
<th>Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td>NWH</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>NWH</td>
</tr>
<tr>
<td>ONWH</td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>ONWH</td>
</tr>
<tr>
<td><strong>POWER ON</strong></td>
<td>No action</td>
<td>No action</td>
<td>No action</td>
<td>NWH</td>
</tr>
<tr>
<td><strong>SYSTEM FAULT</strong></td>
<td>Call Estates Help Desk</td>
<td>Call Switchboard</td>
<td>Call Site Manager</td>
<td>Investigate/ Call PPM provider</td>
</tr>
</tbody>
</table>

It is the responsibility of the Co-ordinating Authorised Person (MGPS), to ensure that a procedure for each alarm indication is displayed next to the respective alarm panel.
7.0 Cylinder management

7.1 Cylinder storage - General information and safety instructions

a) Cylinders for manifold use are as follows:
   i) Day Surgery manifolds (oxygen & medical air) are in the store alongside the block of manifold housings/cages.
   ii) For the main nitrous oxide manifold (with one spare bank) and Day Surgery manifold (no spare bank), the spare cylinders are in the nitrous oxide store near the Mortuary.
   iii) The Entonox® manifold room contains the spare Entonox® cylinders (just one spare bank of cylinders).

Other cylinders for the Main Hospital are stored in the Main Cylinder Store. Cylinder delivery and collection by BOC is from outside the Main Store.

b) Cylinder storage areas must NOT be used for storage of anything other than medical gas cylinders, personal protective equipment, fire fighting equipment, appropriate tools, leak detection spray and cylinder trolleys.

c) Stores must be kept locked when not in use. Portering hold keys.

d) Receipt, monitoring of stock levels, handling and storing of cylinders is only carried out by suitably trained Porters, defined as DESIGNATED PORTERS.

e) Access to the Stores is restricted to persons directly involved in the handling and transporting of medical gas cylinders and essential maintenance personnel.

f) Suitable protective gloves and safety footwear are available and must be worn when moving cylinders. Responsibility for the provision and serviceable condition of this equipment rests with the Portering Manager.

g) Firefighting equipment, as specified by the Fire Safety Advisor, is available inside the Manifold Rooms and in the Cylinder Stores.

h) All cylinders must be moved only on trolleys designed to BS 2718. Responsibility for the provision and serviceable condition of these trolleys rests with Portering.

i) Any loss or damage to this equipment must be reported IMMEDIATELY to the Portering Manager (See Appendix A).

j) The names and telephone numbers of all Key holders and Authorised Persons (MGPS) are posted near the doors of the Stores. These will be updated whenever any changes are made.

k) Up-to-date medical gas cylinder identification charts are displayed in the Stores and Manifold Rooms.

l) Emergency instructions, including fire safety, no smoking / naked lights and compressed gas warning notices are displayed within the store and in prominent positions adjacent to all Stores.

m) It is the responsibility of Portering to ensure that the following storage conditions are maintained:

   - Separate bays, clearly labelled, for full and empty cylinders;
   - Separate areas for the storage of non-medical gas cylinders;
   - F, G and J-size cylinders, full or empty, are restrained in an upright manner by safety chains;
   - Smaller cylinders are stored horizontally on racks, suitably protected to prevent damage to cylinder paint-work;
   - Protective clothing and cylinder trolleys are used when moving cylinders;
   - The Stores are kept clean, dry and free from flammable materials and other rubbish;
   - The areas around the Store are kept free of combustible material, including dried vegetation;
   - Cylinder trolley and vehicle delivery access kept clear at all times;
   - Unsecured cylinders must be reported immediately to the Portering Manager by Portering staff.
   - The Portering Manager will liaise with Estates to ensure the provision of services to the stores and their security are maintained.

7.2 Cylinder stock control and rotation

a) Care should be taken to ensure that excessive stocks of cylinders are not kept in storage, as this will lead to instances where refill dates are exceeded.

b) Attempts should be made to store cylinders so that they are accessible, so that the most recently acquired cylinders will be used last and vice versa.
c) Portering will advise on appropriate cylinder stock levels, which will take into account normal daily usage and any contingency plans of the Authorised Person (MGPS) and other hospital specialties.

7.3 Manifold cylinder changing procedure  
(To be displayed in Manifold Rooms)  
a) Only Designated Porters will be allowed to change cylinders on the hospital manifolds. Other staff must not touch the manifold without specialist training.  
b) It is the responsibility of the Portering Manager to ensure that all the Portering staff who carry out these duties are suitably trained and comply with the manifold cylinder changing procedure. See Appendix C.

7.4 ERM cylinder pressure  
The pressure of cylinders connected to ERMs must be recorded in the Cylinder Change Register at each cylinder change. If this pressure has fallen to 100 bar for all pressure gases except nitrous oxide which is 14 bar, Estates should be notified of a possible leak. Obvious leakage of gas (e.g. a hissing sound) from ERMs should be notified to the Estates immediately for further action.

7.5 Ensuring ERM cylinders are not used beyond refill date  
Every 10 manifold cylinder changes, remove the ERM cylinders and connect them to the main manifold as part of the cylinder change routine. Fit the ERM with fresh cylinders. This will prevent cylinders being left on the ERM for longer than about 3 months.

7.6 Annual cylinder check  
A check of all cylinder stock will be carried out by a BOC representative.

7.7 Changing cylinders on medical equipment  
In this operation the equipment is connected to the cylinder via a pressure regulator, high pressure flexible hose and cylinder yoke or, in the case of star valves (or other integral flow-controller type), a flexible low pressure tube. See Appendix D.

7.8 Delivery of medical gas cylinders to the Cylinder Store  
For normal and emergency deliveries:  
a) Delivery driver reports to Portering on arrival.  
b) Wearing safety shoes and gloves, Portering staff assist with unloading cylinders at the Cylinder Store.  
c) When unloading is completed the driver gives the Delivery Note to the Porters.  
d) Wearing safety shoes and gloves, the Porters transfer the unloaded cylinders to the Cylinder Store, and arrange them in a safe manner, by use of the appropriate restraints/racks.  
e) Porters lock the Stores and take the Delivery Note to the Portering Manager,  
f) Portering Manager forwards Delivery Notes for examination by Pharmacy or QC (MGPS) after making a copy if required.

7.9 Delivery of gas cylinders to wards, departments and manifolds:  
a) There are a number of Ready-to-Use stores throughout the hospital. Porters regularly check the stock and replace empty cylinders.  
b) Alternatively the Ward Clerk telephones requests for cylinders on wards to Portering. Details of cylinder size, gas and number of cylinders must be given. If replacement or extra regulators are required, details should also be given, as these will have to be obtained from EBME.  
c) Porters deliver cylinders to the wards in accordance with the gas delivery job list.  
d) Portering staff change cylinder regulators on empty cylinders.  
e) Porters report any faulty regulators to the Portering Manager (These are then reported to EBME).  
f) Porters return empty cylinders to Cylinder Store.  
g) Manifold Room stock replacements are to be made by Portering when changing cylinders following a “Change cylinders” alarm.  
h) Cylinder stock movement must be logged using the Approved Procedure.

8.0 MGPS record drawings and documentation
The Authorised Person (MGPS) will maintain copies of the following documents:

a) up-to-date and accurate schematics/as-fitted record drawings (including valve/key numbers/TU identification) for all MGPS;

b) any necessary MGPS insurance/statutory documentation (e.g. Statutory Inspection certificates);

c) MGPS safety valve replacement schedule (on a five-yearly basis);

d) new and completed permit-to-work books for work on the systems

e) plant history/maintenance records;

f) manufacturer’s technical data sheets/manuals for all MGPS components;

g) Health Technical Memorandum 02, all latest editions of any associated supplements and related NHS Model Engineering Specifications;

h) MGPS contractors’ service contracts and ISO 9001 (or equivalent) certificates, staff training records, equipment calibration certificates (copies);

i) a list of all personnel associated with the MGPS, especially the permit-to-work system;

j) emergency and other useful telephone numbers;

k) MGPS staff training records;

l) calibration certificates of the Trust’s held test equipment;

m) the MGPS operational policy & procedures.

9.0 Delivery of liquid oxygen

a) Delivery of liquid oxygen can take place at any time of day or night. The delivery driver has a key for the VIE compound lock and has instructions to leave the appropriate paperwork at the Porters office.

b) The paperwork will be delivered to the Pharmacy Department at the earliest opportunity.

c) During normal working hours it is the responsibility of Estates to check that the VIE compound remains locked and that all compound lighting is working.

10.0 Shut-down of the MGPS for maintenance, extension etc

a) Pre-planned work on the MGPS requiring isolation of a plant, or part of the system, will be covered by the MGPS permit-to-work system.

b) No isolation should take place without full liaison between the Authorised Person (MGPS) and all other disciplines.

c) All necessary emergency/additional gas supplies should be in place before the work starts. This may involve the provision of portable emergency supply systems and/or additional provision of cylinder regulators from Estates.

d) Attempts should be made by users to reduce gas consumption during the work.

11.0 Loss of electrical mains supply

a) During changeover from electrical mains to emergency generator supplies, there is always a possibility that spurious MGPS alarms, or changes in plant indications, may be generated.

b) These alarms must be investigated immediately as they could represent real, rather than false, conditions.

c) The status of equipment such as pumps and compressors should also be regularly inspected and maintained under a PPM regime to ensure they are operating as selected.

d) Failure of both generator and mains supplies simultaneously will result in failure of the central medical vacuum system. It is important that clinical/nursing staff are aware of this risk to the vacuum system and to any patients requiring it.

e) All relevant staff must undertake training in the use of emergency vacuum equipment.

f) In areas where vacuum supply is considered critical, locally-generated vacuum will have to be provided. However, with a failed electricity supply, this will not be possible using the normal electrically-driven portable suction units.

g) For critical care use, Injector-driven suction units can be used. These are usually powered from the main oxygen supply via a terminal unit or from a separate compressed gas cylinder (oxygen or medical air).

h) An alternative would be a battery-driven suction unit, but it is important that, with this type of unit, the battery is maintained in a fully-charged condition. To locate portable vacuum units, call EBME. Out of hours call the Senior engineer on call via switchboard or bleep the Charge hand porter.
i) Failure of both mains and electricity supplies will also mean that the medical air compressors will not function.

j) Emergency supplies of medical air will be provided from the automatic cylinder manifold unit, but clinical staff must attempt to conserve air wherever possible so that essential supplies to patient ventilators are maintained.

k) Estates/EBME staff must ensure that all plant, equipment and alarms have reset to full operating conditions on restoration of power.

12.0 Use of oxygen at high concentrations

a) Where oxygen is in use in large quantities and/or in higher than normal concentrations, for example in oxygen tents and incubators, warning notices indicating “High concentration oxygen in use – danger of fire” should be posted at the treatment site.

b) The Hospital Fire Advisor should be consulted on the use of toys in oxygen tents, and a notice worded “Only toys, cosmetics etc approved by the fire advisor are allowed in this area” must be posted at the entrance to the treatment area.

c) It is the responsibility of all staff in such areas to be vigilant in all aspects of the treatment, and appropriate safety training must be given in the use of oxygen under these conditions.

13.0 Immune-suppressed Patients

a) Many of the patients within Trust will have suppressed immune systems or will be receiving medicine to suppress their immune systems. In such cases the European Pharmacopoeia standards for medical gas quality may not be stringent enough.

b) On clinical advice it may be necessary to install additional bacteria filters at the point of delivery. The Infection Control Team, in conjunction with the relevant clinicians, should make this decision.

c) The Coordinating Authorised Person (MGPS) should be informed of any additional equipment of this type being put into use, regardless of any perceived lack of impact on the Medical Gas Pipeline Systems.

14.0 Changing bacteria filters on medical vacuum plant

a) Before carrying out the work, advice should be sought from the user on any toxic or infectious materials that may have entered the system.

b) All staff, including contractors, should observe local safety procedures as set out in the Trust’s safety policy.

c) NOTE: The MGPS permit-to-work can be used for general work on vacuum systems. However, an additional permit should be used which allows for the intervention of the Infection Control in cases where additional infectious/toxic hazards have been identified.

14.1 Preparing for the work

a) Two heavy-duty polythene bags will be required.

b) All staff should wear the following protective clothing when carrying out a filter change:
   - disposable mask;
   - disposable apron, which should be discarded after use in the outer bag for disposal;
   - disposable gloves made of strong latex or other non-allergenic material;
   - safety goggles.
   - disposable overshoes should be worn if required by hospital infection control policy.

14.2 Filter and protective clothing disposal

The used filter is placed directly into a heavy-duty polythene bag, which is then sealed. This bag is placed, with the gloves, masks and overalls, inside a second bag, which is also sealed and labelled: “Clinical waste – to be incinerated”. The staff carrying out the filter change should notify the waste disposal department and/or the Authorised Person (MGPS), as appropriate, so that bags can be collected and disposed of.

A standard operating procedure for filter changes and a filter change procedure suitable for posting on/near vacuum plant are shown in Appendix E and Appendix F respectively.
15.0 Emergency procedures

15.1 Emergency Reserve Manifolds (ERMs)

Emergency supply manifolds are attached to the Hospital medical gas systems as follows.

15.1.1 Oxygen

Important:
- In the event of failure of the primary (VIE) oxygen supply, the secondary (VIE) supply will automatically provide the Hospital with oxygen.
- Secondary supplies have limited capacity in relation to the normal Hospital demand supplied from a VIE.
- The Day Care Temporary Theatre 3 is not connected to the VIE oxygen supply and has its own manifold and ERM.

Actions to be pursued by engineer on-call

<table>
<thead>
<tr>
<th></th>
<th>Pharmacy should ensure that the gas supplier is able to provide regular vessel refills to keep up with demand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The <strong>Co-ordinating Authorised Person</strong> (MGPS) will ensure that repairs to the primary vessel are affected as quickly as possible.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Users</strong> to take measures to reduce gas consumption – speak with Bronze/Silver managers for help with this.</td>
</tr>
<tr>
<td>4</td>
<td>Work with Bronze/Silver manager to assess potential need for additional ward-based cylinder supplies.</td>
</tr>
<tr>
<td>5</td>
<td>Arrange to effect repairs to faulty equipment as soon as possible and keep Bronze/Silver informed of progress/issues.</td>
</tr>
</tbody>
</table>

15.1.2 Medical and surgical compressed air

Important:
- The automatic manifold supporting the medical air plant will come on line automatically and will change banks automatically.
- The manifold capacity is EXTREMELY low by comparison with plant demand. The Day Surgery Temporary Theatre 3 is not connected to the main medical/surgical air supply and has its own manifold and ERM.

Actions to be pursued by engineer on-call

<table>
<thead>
<tr>
<th></th>
<th>Porters to take responsibility for Cylinder replacement, but they will need to know there is a problem - communication is vital – long-term loss will require frequent changes to be established.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Portering Services manager to establish sufficient manpower to cope with the increased need to change manifold cylinders etc</td>
</tr>
<tr>
<td>2</td>
<td>Work with Bronze/Silver to ensure that users make every effort to reduce consumption in the event of plant failure.</td>
</tr>
<tr>
<td>3</td>
<td>Ensure that additional cylinders are available for ward use</td>
</tr>
<tr>
<td>4</td>
<td>Arrange to effect repairs to faulty equipment as soon as possible and keep Bronze/Silver informed of progress/issues.</td>
</tr>
</tbody>
</table>

15.1.3 Nitrous oxide and Entonox®

Important:
- The main nitrous oxide and Entonox® automatic manifold systems are fitted with manually-operated emergency reserve manifolds (ERMs).
• Electricity supply failure will not prevent delivery of gas. However, mechanical failure of the primary (automatic) manifold will result in the automatic operation of the manual reserve manifolds.

• When in use, the manual ERM will not change from left to right cylinder banks automatically. A manual changeover will have to be effected.

• The Day Surgery Temporary Theatre 3 is not connected to the main nitrous oxide supply and has its own manifold and ERM.

• Estates and Portering staff should be fully trained in the operation of the ERMs

**Actions to be pursued by engineer on-call:**

<table>
<thead>
<tr>
<th></th>
<th>Porters to follow detailed instructions identifying which valves to turn and in which order. These shall be posted adjacent to each ERM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Engineers to ensure that cylinder pressure is monitored continuously while the ERM is in use – this is due to very limited Capacity.</td>
</tr>
<tr>
<td>3</td>
<td>Porters to ensure that ‘change-over’ occurs before the ‘in use’ cylinder is completely empty. This is to prevent any loss of pressure. Manual Change-over must always be to a full cylinder.</td>
</tr>
<tr>
<td>4</td>
<td>Portering to liaise with Pharmacy to ensure that sufficient cylinders are available to maintain supply</td>
</tr>
<tr>
<td>5</td>
<td>Arrange to effect repairs to faulty equipment as soon as possible and keep Bronze/Silver informed of progress/issues.</td>
</tr>
</tbody>
</table>

### 15.1.4 Medical vacuum

**Important:**

- The medical vacuum systems are DUPLEX in nature.
- Failure of one side will cause the other to maintain vacuum until repairs have been made.
- Failure of both plants for any reason will result in total failure of the vacuum services.

**Actions to be pursued by engineer on-call:**

<table>
<thead>
<tr>
<th></th>
<th>Work with Bronze/Silver manager to ensure that Nursing staff are aware of any failure – they will then need to assess appropriate response</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Engineer/Bronze/Silver to assess the need for alternative portable suction machinery, establishing supply to priority areas (Theatre, Recovery, ITU etc) first.</td>
</tr>
<tr>
<td>3</td>
<td>Work with EBME and Supplies to locate all available portable units.</td>
</tr>
<tr>
<td>4</td>
<td>Arrange repairs, refurbishment as a matter of urgency, communicating updated position to Bronze/Silver as things change</td>
</tr>
</tbody>
</table>

### 15.2 Emergency cylinder ordering procedure

For emergency ordering, the following procedure should be followed:

<table>
<thead>
<tr>
<th></th>
<th>Portering to telephone the emergency number of the medical gas supplier (see Appendix A).</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Portering will tell the medical gas supplier that “new issues” are needed, if no empties are to be returned</td>
</tr>
<tr>
<td>3</td>
<td>Upon delivery by the medical gas supplier, the Duty Porter should check the delivery against the request and sign the driver’s delivery note</td>
</tr>
<tr>
<td>4</td>
<td>The note should then be passed to Pharmacy.</td>
</tr>
</tbody>
</table>

### 15.3 Failure of mains electricity supply
The medical compressed air plant, vacuum plants, oxygen system, all manifolds and medical gas alarm systems are connected automatically to the “essential” electricity supply and will continue to provide and monitor gas supplies as normal.

In the event of failure of both mains and generator supplies:

- The oxygen system will continue to supply gas from its main VIE system
- The vacuum plants will not operate, and central vacuum services will be lost
- “Normal” portable vacuum units can be used only if local electricity supplies are available. Injector- or battery-driven units will have to be used where vacuum provision is essential for critical care
- The air compressor will fail, but air will be supplied from the air ERM
- The nitrous oxide and Entonox® manifolds will continue to supply gas
- All the temporary Theatre 3 manifolds (oxygen, nitrous oxide and air) will continue to supply gas
- Alarm panels will display a “system failure” red warning light and give an audible alarm
- If the electricity supply to an alarm panel only is interrupted, the panel will display a “system failure” red warning light and emit an audible alarm; gas supplies will not be affected.

In any of these events:

<table>
<thead>
<tr>
<th></th>
<th>The Authorised Person (MGPS) will be informed of the situation via the Nursing staff/Switchboard or via BMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Portering and Estates will arrange for staff to monitor manifold gas consumption, replacing empty cylinders as necessary until the electricity supply is restored</td>
</tr>
<tr>
<td>3</td>
<td>Estates will arrange emergency cylinder/regulator (via EBME) supplies as necessary</td>
</tr>
<tr>
<td>4</td>
<td>The Authorised Person (MGPS) will monitor the situation and confirm resetting of compressor and vacuum plants and system alarms following restoration of supply.</td>
</tr>
</tbody>
</table>

15.4 A serious leak of medical gases

In this event:

<table>
<thead>
<tr>
<th></th>
<th>During normal working hours the Estates Help Desk will be contacted by the person discovering the leak;</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Outside normal working hours, the person discovering the leak will notify Switchboard, who in turn will notify the Bronze Manager, who will contact the on-call engineer;</td>
</tr>
<tr>
<td>3</td>
<td>Details of the leak should be confirmed: that is, the floor level, department, room number, the gas or gases involved and whether patient ventilators are in use;</td>
</tr>
<tr>
<td>4</td>
<td>It is the responsibility of the Duty Nurse to carry out isolation of medical gases to the area after ascertaining that no patients will be put at risk in any area(s) affected by the isolation;</td>
</tr>
<tr>
<td>5</td>
<td>The Duty Nurse will issue appropriate instructions to make the situation safe, in accordance with the Hospital fire policy;</td>
</tr>
<tr>
<td>6</td>
<td>The Duty Porter will remain on stand-by to provide extra gas cylinders as required;</td>
</tr>
<tr>
<td>7</td>
<td>The Authorised Person (MGPS) / on-call engineer will arrange for repairs to the system(s) affected to be carried out under the permit-to-work system.</td>
</tr>
</tbody>
</table>
15.5 Total or partial failure of a medical gas supply

In either of these events:

1. during normal working hours the Estates Help Desk will be contacted by the person discovering the failure. Estates Help Desk will inform the Switchboard, the Bronze Manager, the Duty Porter and the Duty Authorised Person (MGPS) of the leak;

2. outside normal working hours, the person discovering the failure will notify Switchboard, who in turn will notify the Bronze Manager, who will contact the on-call engineer and then appraise him/her of the situation. The Duty Porter will also be informed.

3. details of the failure should be confirmed: that is, floor level, department, room number(s), the gas or gases involved and whether patient ventilators are in use;

4. as a precautionary measure, the Switchboard will also notify critical care areas that a failure has occurred on part of the system so that they are prepared in the event of the fault extending to their departments;

5. it is the responsibility of the Duty Nurse to check which patients may have been put at risk by the failure and, if necessary, to arrange immediate emergency medical action;

6. depending on the reason for the failure and its possible duration, the Authorised Person (MGPS) will decide the most appropriate method of long-term emergency gas provision. This may involve establishing locally regulated cylinder supplies at ward/department entrances;

7. nursing and medical staff should attempt to reduce gas consumption to a minimum during the emergency;

8. Portering staff will be required to monitor/replenish cylinders at any emergency stations and/or plant room emergency supply manifolds; Portering will arrange emergency cylinder deliveries as necessary;

9. the Authorised Person (MGPS) will liaise with the Competent Person (MGPS) to complete emergency repairs needed to reinstate the gas supply, using the permit-to-work system;

10. when the supply is fully restored, the Authorised Person (MGPS) will complete an Incident Report Form and produce a full report, which will be given to the Clinical / Non-Clinical Risk Managers within 24 hours of the incident.

In situations where it is envisaged that there will be long-term loss of oxygen or medical air service, the Duty Senior Manager will liaise with clinical colleagues, including the Senior Nurse Manager, the Medical Director and the Authorised Person (MGPS) on the need for transfer of critically ill patients to other Hospitals, as department closure may be warranted in extreme events.

15.6 Contamination of a medical gas supply

- It is not unusual for a smell to be noticed when using “plastic” equipment hoses to deliver gas to a patient. This smell usually disappears rapidly after first use of the hose, and will generally be familiar to operatives.

- However, if either operatives or patients complain of any unusual or strong smells from equipment, the situation must be treated seriously and immediate action taken to ascertain the cause.

- Contamination of the medical vacuum system will usually be detected during routine maintenance inspection and evidenced by the presence of liquid in the on-line bacteria-filter drain flask.

1. Where it is obvious that the smell is coming from the pipeline rather than a piece of connected equipment, the gas supply must not be used.

2. In such an event, the fault should be treated as a complete gas failure to that area and the actions described above taken immediately.
<table>
<thead>
<tr>
<th>3</th>
<th>It is very important that, if such an incident occurs, that Engineer contacts Bronze Manager and asks for all departments (especially theatre and critical care) cease using supply immediately.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>The Infection Control Team (ext.3688) should be informed immediately and should advise on any additional precautions to effect filter change safely.</td>
</tr>
<tr>
<td>5</td>
<td>Portable suction units may be used in areas where there is a possibility of the vacuum system being contaminated. (The need for portable suction units should be discussed with the Infection Control Team and EBME.)</td>
</tr>
<tr>
<td>6</td>
<td>It is the responsibility of the Competent Person (MGPS) to change the filter in accordance with the procedure described in Health Technical Memorandum 02-01, which is presented elsewhere in this Policy.</td>
</tr>
<tr>
<td>7</td>
<td>The associated HTM 02-01 Bacteria filter change permit should be used and any additional advice from the Infection Control Officer taken into account.</td>
</tr>
<tr>
<td>8</td>
<td>If the contamination is due to system misuse, the Authorised Person (MGPS) must complete an Incident Report Form.</td>
</tr>
<tr>
<td>9</td>
<td>The form is to be sent to the appropriate Clinical Risk Manager so that the appropriate Nurse Manager can be informed and remedial action taken.</td>
</tr>
<tr>
<td>10</td>
<td>Decontamination of pipework (if necessary) should be carried out in accordance with the procedure described in Health Technical Memorandum 02-01, before filters are changed.</td>
</tr>
</tbody>
</table>

15.7 Failure of an anaesthetic gas scavenging system

| 1 | Failure of an AGSS results in spillage of gaseous/vaporised anaesthetic agents into the area of use of the system and can be hazardous to health. |
| 2 | In theatres, it is likely that staff exposure to the spilled gases will exceed the COSHH recommended occupational exposure standards, when working in the area for extended periods, even though theatre ventilation rates are high. |
| 3 | A local alarm "system fail" warning and failure of the air receiver flow indicator will indicate failure of the scavenging system. |
| 4 | Both should be inspected by operating department staff on a regular basis. |
| 5 | The Authorised Person (MGPS) and the Theatre Manager will be informed of the failure by the Theatre Technician and all attempts should be made to reduce staff exposure, if operations continue with a failed system. |
| 6 | When repairs have been completed under a permit-to-work signed by the Theatre Manager, or their nominated deputy, theatre staff should be made aware (by the person signing off the permit-to-work) that the system is back in use. |

15.8 Over- or under-pressurisation of one or more gas systems

| 1 | Local alarms are designed to indicate when system pressure(s) is/are outside the normal operating range. Excessively high or low pressures may cause medical equipment to malfunction. |
| 2 | The Duty Nurse should report all instances of local alarm operation to the Estates Help Desk / Switchboard. |

15.9 Fire

Fire can occur when the following three conditions are present;
a. flammable materials;
b. oxygenated atmosphere;
c. ignition source.

Flammable materials should not be present in cylinder stores, manifold rooms or liquid oxygen compounds. It may not, however, be possible to avoid the presence of flammable materials in the vicinity of the patient when medical gases are being used.

Flammable materials which may be found near patients include some nail-varnish removers, oil-based lubricants, skin lotions, cosmetic tissues, clothing, bed linen, rubber and plastic articles, alcohols, acetone, certain disinfectants and skin-preparation solutions.

An oxygen-enriched atmosphere may be present when medical oxygen or nitrous oxide/oxygen mixtures are used. Nitrous oxide also supports combustion.

Further guidance should be obtained from the Fire Safety Officer.

Ignition sources are numerous, and include:

a. open flames, burning tobacco, sparks (which may also be produced by some children’s toys); high-frequency, short-wave and laser equipment; hair dryers; arcing; and excessive temperatures in electrical equipment. The discharge of a cardiac defibrillator may also serve as a source of ignition.

b. electrical equipment not specifically designed for use in an oxygen-enriched atmosphere;

c. some non-electrical equipment. For example, a static discharge, which may be created by friction, may constitute an ignition source if easily ignited substances such as alcohols, acetone, some nail-varnish removers, oils, greases or lotions etc are present.

A mixture of breathing gases will support combustion. In an oxygen- or nitrous oxide-enriched atmosphere, materials not normally considered to be flammable may burn vigorously. Flammable materials will burn much more vigorously than in air.

Clothing may become saturated with oxygen, Entonox® or nitrous oxide and constitute a fire risk. When returned to normal ambient air, clothing takes about five minutes for oxygen enrichment to reduce to normal conditions. Blankets and similar articles should be turned over several times in normal ambient air following suspected oxygen enrichment.

Oil, grease and hand creams etc, even in minute quantities, are liable to ignite in the presence of high pressure oxygen, Entonox® or nitrous oxide. No oil, grease or hand creams etc should be used in any part of the MGPS. In particular, oil-based lubricants should not be used, and all fittings, pipes etc should be supplied degreased, sealed and labelled for MGPS. Details of these requirements are given in Part A of HTM 02-01.

The siting and general structural principles for the design of liquid oxygen storage accommodation are stated in Chapter 6 of Part A of HTM 02-01 and for oxygen gas manifold rooms in Chapter 14 of part A. Cylinder storage should be as recommended in Chapter 8 of Part B of HTM 02-01.

Fire precautions

The general guidance on fire precautions given in ‘Firecode’ should be followed. Specific guidance on fire precautions relating to cylinders is given in Chapter 8 of Part B of HTM 02-01. Guidance is also available from the gas supplier; any specific recommendations should be followed. For actions in the event of a fire involving, or likely to involve, the MGPS, procedures in accordance with the West Suffolk Hospital fire policy should be followed. During a fire, the Senior Fire Service Officer will assume full control of the area(s) affected.

Under no circumstances should medical gas supplies be isolated until the Designated Nursing Officer(s) has / have confirmed that all patients likely to be affected have been evacuated and/or have alternative gas provision.
Appendix A

Designated Hospital Personnel and Policy Circulation List

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Medical gas role</th>
<th>Tel. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust Chief Executive</td>
<td>Prof. Dr Stephen Dunn</td>
<td>*Executive Manger</td>
<td>3013</td>
</tr>
<tr>
<td>Executive Chief Nurse</td>
<td>Rowan Procter</td>
<td>*Senior Designated Nursing Officer</td>
<td>3500</td>
</tr>
<tr>
<td>Clinical Director</td>
<td>C/O General Manager</td>
<td>Lead Consultant, Anaesthetics (Chair Med Gas Comm)</td>
<td>2751</td>
</tr>
<tr>
<td>Health, Safety &amp; Risk Manager</td>
<td>Mike Dixon</td>
<td>Health &amp; safety Officer</td>
<td>3944</td>
</tr>
<tr>
<td>Estates Manager</td>
<td>Ian Stuchbury</td>
<td>Estates Manager Co-ordinating Authorised Person (MGPS)</td>
<td>3946</td>
</tr>
<tr>
<td>Estates specialist service manager</td>
<td>Roger Gembis</td>
<td>*Authorised Person (MGPS)</td>
<td>3375</td>
</tr>
<tr>
<td>Estates team leader</td>
<td>Keith Jones</td>
<td>*Authorised Person (MGPS)</td>
<td>3852</td>
</tr>
<tr>
<td>EBME Manager</td>
<td>David Wilson</td>
<td>Medical Gas Equipment</td>
<td>2856</td>
</tr>
<tr>
<td>Chief Pharmacist</td>
<td>Simon Whitworth</td>
<td>Chief Pharmacist</td>
<td>3230</td>
</tr>
<tr>
<td>Pharmacy QC</td>
<td>James Curtis</td>
<td>*Quality Controller (MGPS)</td>
<td>3232</td>
</tr>
<tr>
<td>Portering Manager</td>
<td>Darren Cooksey</td>
<td>Designated Person</td>
<td>3533</td>
</tr>
<tr>
<td>Estates &amp; Facilities Compliance Officer</td>
<td>Jason Bolton</td>
<td>Compliance Officer</td>
<td>3468</td>
</tr>
<tr>
<td>Clinical Team Manager</td>
<td>Eddie Crighton</td>
<td>Operating Theatre Representative</td>
<td>3433</td>
</tr>
</tbody>
</table>

* Persons nominated under the Permit to Work System

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Medical gas role</th>
<th>Tel. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Directorate Chief Nurse</td>
<td>Rowan Proctor</td>
<td>*Designated Nursing Officer</td>
<td>3269</td>
</tr>
<tr>
<td>Head of Nursing-Surgical &amp; Acute Med., Surgical Services</td>
<td>Helen Beard</td>
<td>*Designated Nursing Officer</td>
<td>2804</td>
</tr>
</tbody>
</table>

Keyholders

Estate holders keys for valves, plant and manifold rooms.

Contact an Authorised Person (MGPS) for details.

A ‘Fire Key’ is held at Switchboard for use by the Fire Service during emergencies. This key will open the Estates MGPS key cabinet.

Designated Nursing Officers
## Contact details

<table>
<thead>
<tr>
<th></th>
<th>Daytime contact</th>
<th>Out of hours contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estates</td>
<td></td>
<td>01284 713000</td>
</tr>
<tr>
<td>Estates – On call Engineer</td>
<td></td>
<td>01284 713000 (on-call engineer)</td>
</tr>
<tr>
<td>Portering</td>
<td></td>
<td>01284 713522</td>
</tr>
<tr>
<td>Portering</td>
<td></td>
<td>01284 713000</td>
</tr>
<tr>
<td>Trust Pharmacy</td>
<td></td>
<td>01284 713232</td>
</tr>
<tr>
<td>Trust Pharmacy</td>
<td></td>
<td>01284 713000</td>
</tr>
<tr>
<td>Risk Management</td>
<td></td>
<td>01284 713944</td>
</tr>
<tr>
<td>Risk Management</td>
<td></td>
<td>01284 713000</td>
</tr>
<tr>
<td>Medical gas cylinder orders, BOC</td>
<td>Daytime contact Emergency (Office hours) (After hours)</td>
<td>Tel No 0800 111 333</td>
</tr>
</tbody>
</table>

### MGPS CONTRACTORS and Authorising Engineer (MGPS)

| Name                      | Title                                                                 | Medical Gas Role                                                  | Telephone No.                                                                 |
|---------------------------|----------------------------------------------------------------------|===================================================================|----------------------------------------------------------------------------|
| K & H Medical Ltd         | Approved medical gas Competent Persons (MGPS)                         | *Competent Person (MGPS)                                          | TEL Emergency: -
|                           |                                                                      |                                                                    | (Office hours) 01279 757835
|                           |                                                                      |                                                                    | (After hours) 07699 785293                                               |
| BOC                      | Medical gas supplier Liquid Oxygen & Cylinders                       | Medical gas supplier - Liquid Oxygen & Cylinders                  | Liquid Oxygen.VIE
|                           |                                                                      |                                                                    | Normal supplies will be via the Telemetry link.                          |
|                           |                                                                      |                                                                    | In event of failure telephone: (Liquid Oxygen) 0800 861861               |
|                           |                                                                      |                                                                    | Liquid Oxygen VIE tank BOC Engineer’s No: 0800 222888                     |
|                           |                                                                      |                                                                    | BOC Medical Gas Cylinders                                                |
|                           |                                                                      |                                                                    | (Office hours) Tel 0800 111333 (Cylinders)                               |
|                           |                                                                      |                                                                    | Emergency: -
|                           |                                                                      |                                                                    | (After hours) Tel 0800 222888                                           |
| MGPS Services Ltd         | Steve Goddard                                                        | Authorising Engineer (MGPS)                                       | Tel: 08454 6524901Mob: 07789 868477 (SG)                                |
| (pending appointment)     |                                                                      |                                                                    |                                                                           |
Appendix B

Site plans

The A4/A3 site plan(s) show the locations of medical gas plant, manifolds, anaesthetic gas scavenging systems and cylinder storage at West Suffolk Hospital. These plans are now available on the Estates & Facilities part of the hospital servers – or on the Engineer On Call tablet.
Appendix C

Manifold cylinder changing procedure
(To be displayed in Manifold Rooms)

Note: Only Designated Porters will be allowed to change cylinders on the hospital manifolds. Other staff must not touch the manifolds without specialist training. It is the responsibility of the Portering Supervisor to ensure that all the Portering staff who carry out these duties are suitably trained and comply with the manifold cylinder changing procedure as below:

a) Ensure that hands are clean and grease-free before handling any medical gas cylinders or equipment and, where cylinders are handled on a regular basis, that safety footwear is being worn.
b) Use heavy protective gloves (preferably textile or leather) and eye / face protection.
c) IMPORTANT – when a bank of cylinders requires changing, all cylinders in that bank must be changed.
d) Remove empty cylinders from the medical gas manifold one at a time and replace each empty cylinder with a full cylinder immediately.
e) Check the name of the gas on the collar of the cylinder, the expiry date and the cylinder colour code. If in doubt, refer to the cylinder data sheet displayed in the manifold room.
f) Remove the plastic seal but always retain the valve cover caps fitted to bull-nose cylinder valves, for re-fitting after use.
g) Inspect the Bodok seal in the cylinder yoke for wear or damage. Change if necessary, taking care not to expose the surfaces to grease or oil; use only one Bodok seal on each cylinder yoke.
h) Connect the cylinder to the manifold and tighten firmly by hand. DO NOT put undue strain on the manifold tail pipe and use no lubricant or sealing compounds.
i) Using the correct cylinder key (or hand-wheel/ knurled knob where fitted), open the cylinder valve anticlockwise SLOWLY to its fullest extent and then turn it back by a quarter turn.
j) Check there are no leaks between the cylinder valve and the manifold. This can usually be determined by listening. If in doubt, leak-detection fluid can be used but always wipe off excess fluid with a clean damp cloth.

Note: Only leak detection fluid suitable for use with all types of medical gas should be used.

k) Once the bank has been fully changed, check that the contents gauge is reading 137 bar (137kPa x 100) except for nitrous oxide (45kPa x 100) or FULL.
l) Complete the Cylinder Change Register held in the manifold room stating date, time and number of cylinders changed and readings on line pressure and contents gauges. Remember to sign the register.
m) If a problem or fault is detected or suspected, inform the Portering Manager immediately.
n) Ensure that any faulty cylinders e.g. leaking or damaged, are NOT left in the manifold room. They must be labelled “FAULTY” and kept separate from all other cylinders. Pharmacy must be notified.
o) Outside normal working hours it is the responsibility of the Portering Manager to ensure that all appropriate Portering staff comply with the above manifold cylinder changing procedure.
Appendix D

Changing cylinders on medical equipment

In this operation the equipment is connected to the cylinder via a pressure regulator, high pressure flexible hose and cylinder yoke or, in the case of star valves (or other integral flow-controller type), a flexible low-pressure tube.

1.0 To ensure patient and staff safety it is essential that;

a) Porters and users ensure a high standard of cleanliness when storing, transporting or connecting medical gas cylinders to regulators or other medical devices, particularly with respect to the presence of oil and/or grease (e.g. barrier creams);
b) Users open medical gas cylinders slowly;
c) If resistance to opening of the cylinder is excessive, the cylinder should not be used and should be returned to the manufacturer/supplier with a label to indicate the problem (Pharmacy must be informed);
d) Users read, understand and follow all instructions and labelling provided by the manufacturer/supplier.

2.0 Always make sure that you are connecting equipment designed for the gas

a) Oxygen and medical air flowmeters read differently if interchanged.
b) The threads connecting different gas flowmeters to a regulator may be the same.
c) Entonox® (N₂O/O₂ mix, 50%/50%) flowmeters have a different thread from others.
d) Do not use a normal ward flowmeter when a paediatric type should be used.

3.0 Connection procedure

a) Prepare the cylinder for use as above.
b) Check the expiry date on the cylinder collar.
c) Check the sealing washer at the valve/connector interface.
d) Connect the cylinder to the equipment and tighten firmly with the correct spanner or by hand as appropriate. Do not use excessive force.
e) Before opening the cylinder, check the equipment and other flow control valves are turned off.
f) For two-stage regulators, turn the outlet pressure control to “OFF”, usually fully ANTI-CLOCKWISE.
g) Using the correct key (or knurled valve knob), open the cylinder valve slowly, fully anti-clockwise and then back a quarter turn.
h) Check for leaks, either by using leak detection fluid, or by closing the cylinder valve and observing to see if the high pressure gauge on the regulator starts to fall. Correct if possible, replacing a faulty cylinder where necessary.
i) Slowly adjust the pressure regulator/flow controller to the correct setting.
j) Open equipment flow control valve(s) slowly, checking for correct equipment operation.

4.0 Taking a cylinder out of use (from equipment or manifold)

a) Turn off the valve and vent excess gas from the equipment regulator and connecting hoses by opening the equipment flow control valves for a few seconds. On a manifold, gas from the tailpipe will vent as the cylinder connection is loosened.
b) Shut off any equipment control valves.
c) Using the correct spanner or manually, disconnect the cylinder from the equipment or tailpipe.
d) Do not vent the cylinder or leave the cylinder valve open.
e) Replace plastic valve covers on F and G size cylinders.
f) The cylinder should be returned to the EMPTY rack in the Cylinder Store as soon as possible, checking that any contents status label has been amended as appropriate.
Appendix E

Standard operational procedure for bacterial filter changing
(To be affixed on/near the vacuum plant)

WARNING!

THE VACUUM SYSTEM MUST BE CONSIDERED POTENTIALLY CONTAMINATED AND YOU MUST TAKE THE PRECAUTIONS LISTED BELOW

If you observe any suspicious contaminant, such as mucus or blood, stop work immediately and report the situation to the duty nurse.

Biological contamination may appear crystalline or organic. Do not be deceived by appearance; treat all foreign material as a possible hazard.

DO NOT: - commence any work on a vacuum system suspected of contamination without authorisation and guidance of the infection control nurse.

DO NOT: - eat or smoke when working on vacuum systems or components.

DO: - before putting on waterproof gloves, inspect your hands carefully for cuts or abrasions. Apply waterproof dressing as necessary to effectively cover all lesions.

DO: - wear waterproof gloves provided and ensure that they remain intact throughout all work stages.

DO: - wear standard issue overalls and ensure that they remain fully buttoned.

DO: - wear eye protection, face mask and disposable plastic apron provided.

DO: - wear all protective clothing throughout all work stages.

DO: - take care not to cut yourself.

If you do happen to cut yourself, carry out the following procedures:-

- If a glove is punctured, remove glove.
- Allow wound to bleed freely.
- The contaminated area should be washed gently under running water and not scrubbed.
- Inform the duty nurse of the incident immediately.
- Seek medical advice on appropriate action, i.e. the need to administer Hepatitis B vaccine.
- Report the incident in accordance with local or company rules.

DO: - dispose of all removed infected material and oil in accordance with care centre procedures. i.e. sealed within a bag marked ‘contaminated’ and entrusted to the hospital authorities for safe disposal.

DO: - request guidance from the duty nurse if in doubt about disposal procedures.

DO NOT: - remove contaminated materials from site.

DO NOT: - dispose of potentially contaminated material in ordinary rubbish bins.

DO NOT: - place contaminated tools or equipment into your toolbox.

DO: - immediately on completion of work, remove any contaminated outer clothing and always
wash your hands and, if necessary, contaminated tools, in an approved disinfectant and then rinse under running water.

**WARNING**

Potentially contaminated material must not be blown through an open ended pipeline.
Appendix F

Bacterial Filter Change Procedure
(To be affixed on/near the vacuum plant)

- Select 'Standby' Bacteria Filter for on-line use. Select the Bacteria filter that is not going to be changed by fully opening the inlet and outlet isolating valves.

- Isolate the 'In-use' Bacteria Filter. Isolate the Bacteria Filter that is going to be changed by fully closing the inlet and outlet Isolating Valves.

- Isolate the 'In-use' Drainage Flask. Close Drainage Flask manual isolating Ball Valve.

- If any liquid is present inform the Duty Nurse immediately, otherwise, remove the drainage flask.

- Remove the Filter Housing. Unscrew/unclamp Filter Housing and remove.

WARNING

FILTER ELEMENTS CANNOT BE CLEANED OR RE-USED.
DISPOSE IN ACCORDANCE WITH HOSPITAL PROCEDURES FOR CONTAMINATED WASTE.

- Fit Filter Element. Position 'O' Ring Seal and Filter Element secure Element within Filter Head Seat. Position lower

- 'O' Ring seal in Element Retaining Nut locating groove. Fit Element Retaining Nut and tighten by hand.

CAUTION

Do not over tighten Filter Element, as distortion of the 'O' Ring Seals may occur and prevent an effective seal.

- Re-fit Filter Housing. Ensure that 'O' Ring Seal is correctly positioned on Filter Housing

- Fit to Filter Head and tighten. Do not over torque.

- Re-fit Drainage Flask. Screw the Flask back on to the adapter ensuring the 'O' Ring is compressed to form a seal.

- Open Flask manual isolating Ball Valve.
Appendix G

Pipeline connected equipment

1.0 This Policy is not intended to cover in any detail descriptions of or technical operation of equipment that may be connected to a medical gas system. However, there are several instances where inappropriate use of equipment can compromise system integrity and/or patient and staff safety. The more important of these are dealt with in the Emergency Procedures Section of this Policy. Other examples may well be found and should be discussed with an Authorised Person (MGPS).

The EBME Dept should be contacted on advice for the operating and safety requirements of particular items of equipment. No person should operate any equipment unless properly trained or supervised.

2.0 Medical equipment repair / purchase / replacement – MGPS limitations

2.1 Equipment purchase

Purchase of new or replacement medical gas equipment is as per Trust Policy PP024 Management of Medical Equipment Policy.

The EBME, Estates and Purchasing departments can advise on equipment approved by the Clinical Replacement Panel.

Some equipment, such as CPAP devices and some high power air tools, imposes a heavy demand on gas supplies in terms of flow and capacity. Patient safety could be compromised if unauthorised connection of such equipment to the medical gas pipeline system takes place.

Prospective purchasers of gas-consuming medical equipment are, therefore, required to contact an Authorised Person (MGPS) before such purchases are made, to establish whether a suitable gas supply is available for that equipment.

2.2 Equipment replacement

Purchase of new or replacement medical gas equipment is as per Trust Policy PP024 Management of Medical Equipment Policy.

The EBME, Estates and Purchasing departments can advise on equipment approved by the Clinical Replacement Panel.

Damaged equipment found by Portering staff during routine cylinder replacement should be returned to the EBME Dept, as appropriate, with details of its origin (on a form completed by the Duty Nurse).

2.3 Medical equipment repair

This Operational Policy does not cover the repair of medical equipment. Repair requests should be made to the EBME Dept.

All nursing and clinical staff should be aware that prior to sending equipment to the EBME Dept appropriate decontamination measures must be taken and the equipment accompanied by: a signed equipment decontamination certificate.

Advice can be obtained from EBME Dept and Infection Control.

3.0 Gas conservation

All staff should be encouraged to reduce wastage of medical gases. Unnecessary costs, increased pollution and high fire risks are just some of the consequences of excessive gas spillage.
Particular care should be taken to ensure the following
- Turn off flowmeters when not in use
- Adjust flowmeters to prevent excessive gas delivery to face masks, nebulisers etc
- Turn off cylinder valves all cylinders except emergency-use cylinders e.g. on crash trolleys, when not in use
- Use gas from a cylinder until the pressure/contents gauge enters the red section
- Do not deliberately “waste” a cylinder to ensure a replacement
- When using high flow equipment such as CPAP units make sure that they are working at peak efficiency

4.0 Safe use of hoses and terminal units
Terminal units and the equipment hoses that plug into them are designed as hard-wearing gas-specific components. However, damage can be caused by careless or improper use. The guidelines below will help prevent interruption to gas services and improve safety in the use of the equipment. It is Hospital policy that hoses can be made up or repaired on site. Specialist suppliers will also supply hoses to the appropriate Standard (BS EN 739).

5.0 Safety warning – Gas pressures

Terminal units & hoses carry gas at high pressures
When released from the automatic locking mechanism of the terminal unit, equipment may be ejected with some considerable force.

This in particularly possible with high pressure equipment, which may cause serious injury if not held firmly while being disconnected.

Rarely, a hose may burst during use. The section connected to the terminal may well thrash around as the gas escapes from it. The first action is to ensure patient safety, particularly if the hose was driving a ventilator. The burst hose can be dealt with by disconnecting at the terminal unit. If the risk of personal injury is considered too high, then it will be necessary to isolate the gas supply at the department isolating valve. This can be performed as an emergency isolation (see below) by a member of the nursing / clinical staff, or if the situation is not considered critical, by the Authorised Person (MGPS). In all instances, the Authorised Person (MGPS) and EBME Dept should be informed of the hose failure.

6.0 Avoiding damage to terminal units, hoses and connected equipment
- Take care when raising or moving patient beds – check that the bed will not collide with either terminal units or the equipment plugged into them
- Do not attach too many items to a single terminal unit. If extra gas supplies are needed for high numbers of equipment, consult an Authorised Person (MGPS) for advice.
- If a fitting is damaged in any way, do not attempt to force, for example, a probe into a terminal unit or screw the fitting together or apart. Do NOT use any form of tool to force components together. You will only cause further damage.
- Avoid cuts and burns to hoses.
- Do not stand on or run wheeled equipment, including beds, over hoses.
- Do not drop hose fittings onto the floor or knock them against metal or other hard objects. Damage to these fittings will cause subsequent damage to the terminal units.
- Do not remove the coloured sleeves from the hose ends. These are an important part of the hose identity.
- Do not swing on hoses, especially those attached to pendant units.
o Do not use hoses as 'towropes' to move equipment.

o **NEVER** attempt repairs to any of the hose fittings, especially if parts appear to have fallen off, or the fittings are coming loose. In particular, **NEVER** try to reattach fittings using such items as jubilee clips or similar devices.

o Report all damage and problems e.g. leaks, **IMMEDIATELY**, particularly if you notice that any hose has suspicious swellings.

7.0 **Avoiding contamination of the medical vacuum system**

Vacuum system contamination can be serious and may even warrant a complete system shutdown. It also poses additional risks to maintenance personnel who are responsible for changing bacteria filters on the main plant, or who may have to work on contaminated terminal units or pipework.

Modern equipment, if used correctly, will eliminate the risk of contamination of a medical vacuum system by body fluids etc. but it is worthwhile following the rules below to ensure that risks are minimised.

- Never use a vacuum controller without a receiving jar connected between it and the patient.
- Use hydrophilic filters between the suction jar and the controller
- Inspect the level of fluid in the receiver on a regular basis. Empty the jar before it overflows.
- Always use the correct type of controller for the task. Some are LOW suction types and some are HIGH suction types. The correct choice may be particularly important in paediatric work.
- Always use an ANTI-FOAMING agent in the receiver jar if the manufacturer specifies this. This will help prevent carry over of froth into the controller.
- Always change filters on the controller **IMMEDIATELY** if they become wet, or at specified intervals.
- Never leave the float out of the receiver jar (if fitted) OR insert it upside down: liquid will be carried over to the controller when the jar overfills.
- Never connect the vacuum system directly to the receiver or to the patient without a controller in the circuit, as this will certainly contaminate the system and could prove fatal to the patient.

**If contamination is known to have taken place.**

- **ALWAYS** report any contamination of the vacuum system to Estates **IMMEDIATELY**.

This will help save spread of the fluid into the system and also make the decontamination process easier.
West Suffolk NHS Foundation Trust
REQUEST FOR INTERRUPTION TO SERVICE FORM

Issued by Estates Department

Purpose Approval for an Interruption of a service affecting the hospital site

Service to be affected
(* require a permit to work)

<table>
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<th>Service</th>
<th>Electricity</th>
<th>Natural Gas</th>
<th>Water</th>
<th>Drainage</th>
<th>Medical Gas</th>
<th>Heating</th>
<th>Hot Water</th>
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Dates and Duration

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<td>hrs</td>
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<td>Completion by</td>
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Areas Affected

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<th>Area</th>
<th>Whole Site</th>
<th>Partial Site (list)</th>
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</table>

Reason for Interruption

Areas Not Affected

For additional information

Please contact

Name [Please specify]
Tel [Please specify]
Email [Please specify]
Ref [Please specify]

Request to disrupt services locally is approved by
The Estates Manager or Deputy
Print [Please specify]
Sign [Please specify]

For Major interruptions additional authorisation is required from a Delegated Officer of the Emergency Preparedness Team

Request to disrupt service is approved by the
Chief Operations Officer or Deputy
Print [Please specify]
Sign [Please specify]
<table>
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<th>Author(s):</th>
<th>Estates Manager</th>
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<tbody>
<tr>
<td>Other contributors:</td>
<td>Medical Gas Committee</td>
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<td></td>
<td>External specialist consultant MGPS Services Ltd.</td>
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<td>Approval and endorsements:</td>
<td>Medical Gas Committee, Health &amp; Safety Committee.</td>
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<td>Implementation:</td>
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<td>Monitoring: (give brief details how this will be done)</td>
<td>Regular reports from Medical Gas Committee to Health &amp; Safety committee, Corporate Risk Committee. Audits on cylinder usage and medical gas usage at ward level. Control of ‘permit to work’ by AP’s &amp; QC’s.</td>
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<td>Other relevant policies/documents and references:</td>
<td>HTM 02-01 Medical Gases Operational Management.</td>
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<td>Additional information:</td>
<td>Review frequency increased to every two years.</td>
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