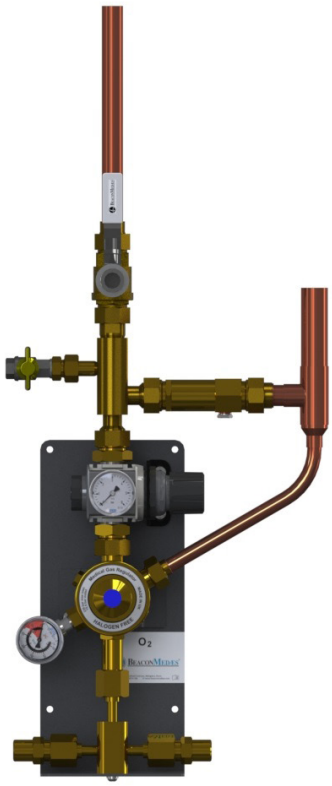
Operation and Maintenance Instructions



Manifold Control Systems

Manual Manfiold

Part number 2006230
Revision 03
May 24, 2019

BeaconMedæs®

Operation and Maintenance Manual

Manual Manifold

This unit is purchased from:

Date purchased:

Model number:

Serial number:

Option(s) included:

Any information, service or spare parts requests should include the serial number and be directed to:

BeaconMedæs
Telford Crescent, Staveley
Derbyshire S43 3PF

Telephone: +44 (0) 1246 474242
Email: gbn.info@beaconmedaes.com
Website Contacts: www.beaconmedaes.com

BeaconMedæs reserves the right to make changes and improvements to update products sold previously without notice or obligation.

Atlas Copco Ltd. trading as Atlas Copco Medical
Unit 18 Nuffield Way, Abingdon, Oxfordshire, UK OX14 1RL

Personnel must make themselves familiar with the contents of this manual and the function of the unit before installing, operating or maintaining.

Abbreviations			
Abbreviation	Full Description	Abbreviation	Full Description
BS	British Standard	kPa	Kilo pascals
BSP	British Standard Pipe	Max	Maximum
CO2	Carbon dioxide	Med	Medical
°C	Degree Celsius	m	Meter
ø	Diameter	mm	Millimetres
ERM	Emergency reserve manifold	Min	Minimum
EN	European Standards	N2	Nitrogen
1st	First	N2O	Nitrous oxide
HTM	Health Technical Memorandum	NRV	Non-return valve
ID	Identification	OD	Outside Diameter
“	Inch	O2	Oxygen
ISO	International Standard Organisation	%	Percentage
Kg	Kilograms	2nd	Second

Table of Contents

0. Safety Precautions

This section gives safety, storage and handling information for the BeaconMedæs Emergency Reserve Manifold only. Component parts lists and descriptions are available on request.

Operators should have carefully read and become familiar with the contents of this manual before maintaining the Emergency Reserve Manifold.

Operators are expected to use common sense safety precautions, good workmanship practices and follow any related local safety regulations.

0.1 Identification of symbols

The following symbols apply to this product and are used in these instructions and on the product in question. The meanings of these symbols are as specified below: -

	Read instructions
	Ambient temperature range
	Ambient humidity range
	Ambient pressure range
	Date of manufacture
	Do not dispose of in general waste

0.2 Environmental Transport and Storage Conditions

Ambient temperature: 0°C to 40°C
Relative humidity (non-condensing): 10%-95%

0.3 Environmental Operating Conditions

Ambient temperature: 0°C to 40°C
Relative humidity (non-condensing): 10%-95%
Atmospheric pressure range - 70-110 kPa

0.4 Environmental Protection

Discard the unit and/or components in any standard refuse facility. The unit does not contain and hazardous substances.

0.5 Electromagnetic Interference

Not applicable

0.6 Cleaning

The manifold should be wiped over with a damp cloth frequently to remove any dust or foreign substances

0.7 Safety Notice

Persons undertaking any installation and/or maintenance must be fully trained in specialist work of this nature.

Oil, grease and jointing compounds must not be used.

Do not attempt to prove the pressure relief valve, under any circumstances, by altering the regulator. Pressure relief valves must be removed and tested off site by a registered test centre and a certificate of conformity issued.

1. General Information

1.1 Introduction

The BeaconMedæs Manual Manifold is designed to supply piped medical gas where continuity of supply is desired, and where the gas is to be supplied from high pressure gas cylinders. The manual manifold is ideal for small installation with low flow demands. The unit should be monitored from a close by location for quick reaction times to manually changeover the cylinder banks when empty. All individual components conform to ISO and HTM requirements to form a medical gas control panel to which maximises safety requirements with a simplified function.

See figure 1 and Table 1 for general arrangement, **figure 2** shows the schematic diagram.

The duty bank is determined by operating the cylinder valves or optional high pressure bank valves is fitted.

The duty bank will run down until the pressure drops below alarm switch parameters. The supply will then be manually changed over to the standby bank. A signal can be taken to a remote alarm from the contact gauge to alert the requirement to change cylinders. This cycle is then repeated to maintain continuous supply.

⚠ **CAUTION - Change empty cylinders as soon as possible**

The control panel is available as standard to suit two main distribution system pressures, 4 bar and 7 bar. **See table 1** for list of critical components included and optional extras supplied as bolt on kits.

The manual manifold can be used as either main supply or emergency reserve manifold (ERM). When used as a emergency backup manifold the line pressure regulator should be set slightly lower than the primary supply pressure . This will prevent it from feeding to the pipeline during normal operation of the primary system. The line pressure regulator can be increased to nominal distribution pressure in the event of emergency.

Figure 1 - Manual Manifold General Arrangement

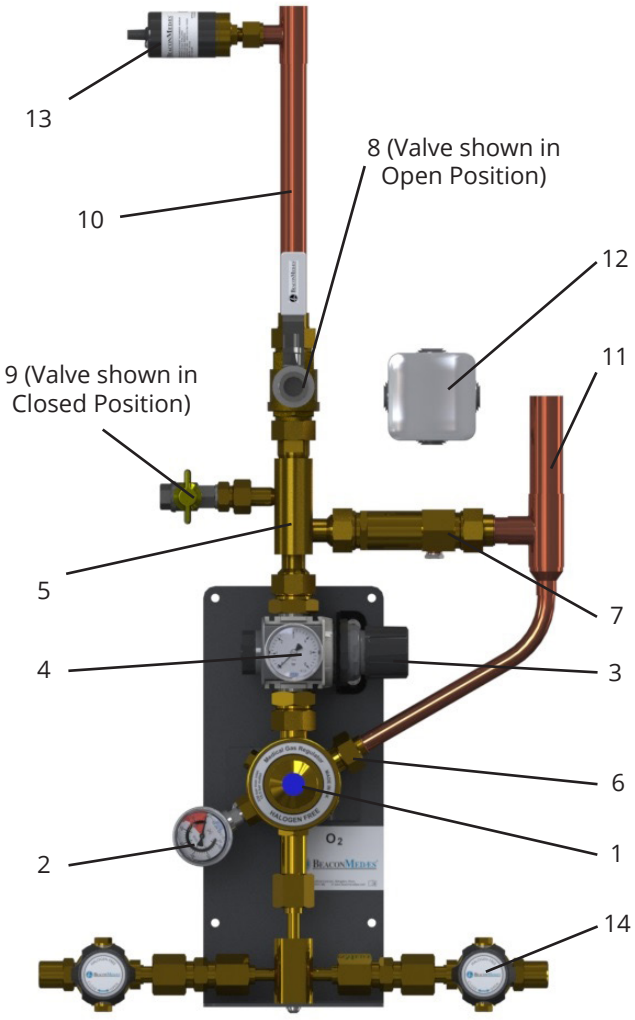


Table 1: Main features/components

Item No	Description	Basic Unit	Optional Supply
1	1 stage regulator	✓	
2	Cylinder content/contact gauge	✓	
3	Line regulator	✓	
4	Line gauge	✓	
5	Integral Non-return Valve Assembly	✓	
6	1st Stage Pressure Relief Valve	✓	
7	Line Pressure Relief Valve	✓	
8	Lockable Isolation Valve	✓	
9	Test point Isolation Valve	✓	
10	Pipeline connection point (22mm OD Copper Tube)	✓	
11	Pressure Relief Exhaust Connection point (28mm OD Copper Tube)		✓
12	Termination Box For Remote Alarm		✓
13	Pressure Switch		✓
14	High pressure bank valves		✓
15	Single Line contact Module (Not shown)		✓
16	Double Line contact Module (Not shown)		✓
17	Manifold Headers C/W NRVs		✓
18	Tailpipes		✓

Notes...
Item 11 is recommended for indoor installations.

Item 15 & 16 are used to connect alarm outputs to a Medipoint medical alarms.

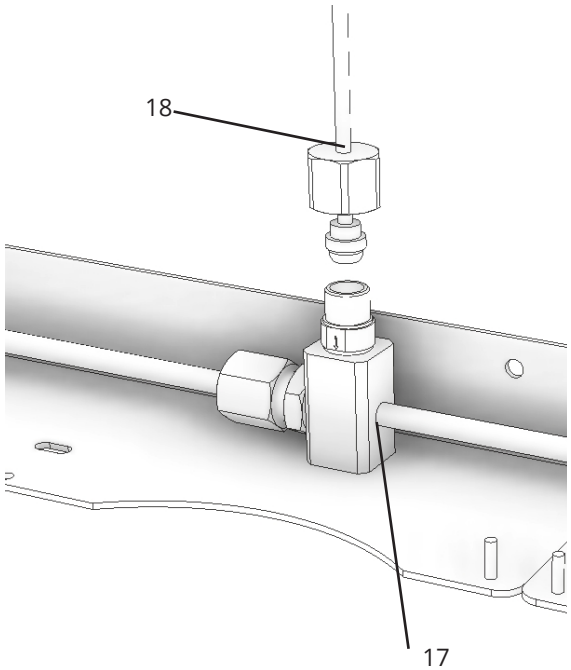
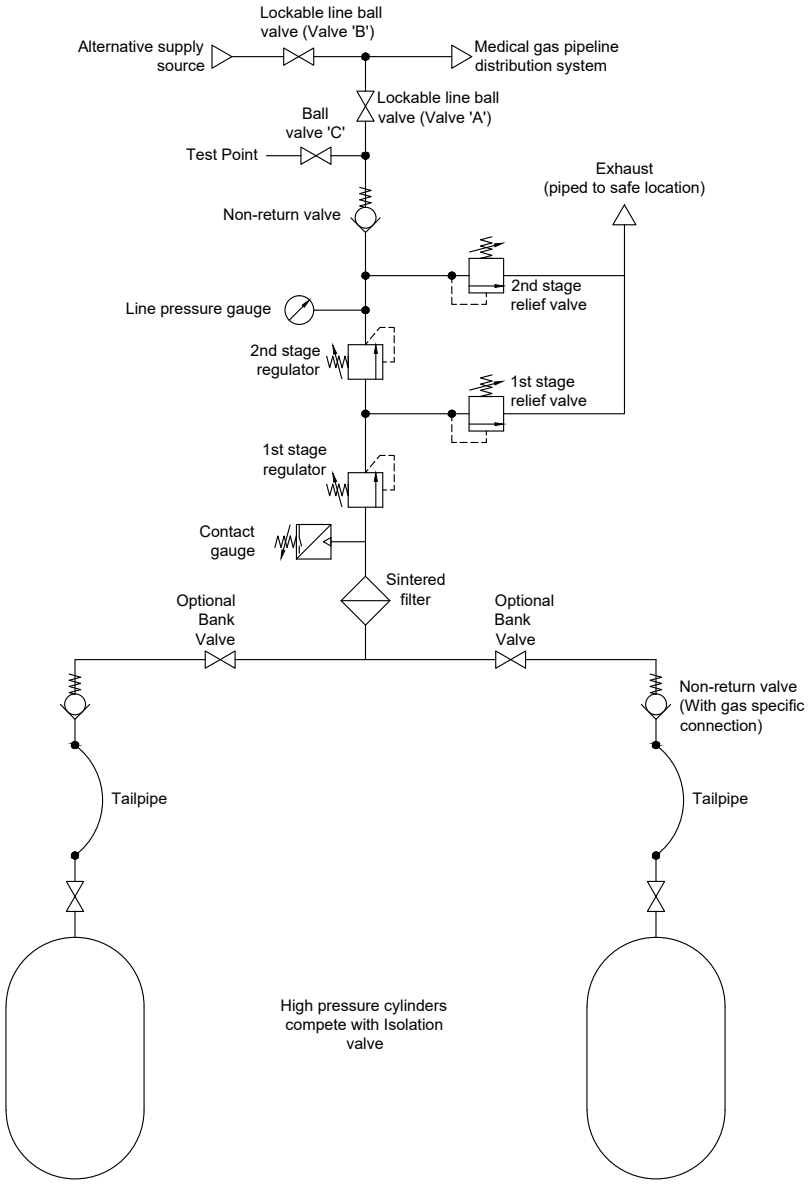


Figure 2 - Schematic Diagram



Symbols to BS2971 & ISO 1219-1

1.2 Manifold Control Panel

The manifold control panel is supplied as nominally 4 bar (5 bar max.) and 7 bar (8.5 bar max), (see table 1 for details). The 4 bar manifold is available with 100 or 250 bar contents gauges depending on the pressure of the cylinders to be used. Table 2 shows the supply variations.

Table 2: Manifold Panel, typical cylinder supply plus Options

Panel Description	Gas Type	Typical Cylinder	Part Number
4 bar standard unit (100 bar Contents Gauge)	N2O	G - 44 bar	2006003
	CO2	VF - 50 Bar	
4 bar standard unit (250 bar Contents Gauge)	O2	J - 137 bar	2006004
	O2/N2O	J - 137 bar	
	AIR	J - 137 bar	
7 bar standard unit (250 bar Contents Gauge)	AIR	J - 137 bar	2006005
	N2	J - 137 bar	

Option Description	Part Number
Exhaust Pipe Connection Kit	2006233
Termination Box For Remote Alarm	2006219
4 Bar Pressure Switch with Line Contact Monitor	1829936
4 bar Pressure Switch without Line Contact Monitor	2000131
7 Bar Pressure Switch with Line Contact Monitor	1829937
7 bar Pressure Switch without Line Contact Monitor	2000132
Single Line contact Module	1826618
Double Line contact Module	1826499

1.3 1st Stage Pressure Regulator

For safe operation with regard to performance, mechanical strength, resistance to ignition in pure high pressure oxygen supply and cleanliness, the unit fully conforms to BS EN ISO 10524-2. A pressure relief valve connected to the regulator protects the downstream pressure and is set at 2000 kPa (20 bar).

1.4 2nd Stage Pressure Regulator

For safe operation with regard to performance, mechanical strength and contamination the unit fully conforms to BS EN ISO 10524-2, the second stage pressure regulator is a manually set diaphragm type and is used to set the system pressure to suit typical nominal values for 4 & 7 bar pipeline systems.

1.5 Line Pressure Relief Valve

The line pressure relief valves are preset to the values shown in table 3 for the different distribution pressures.

Table 3: Relief Valve Set Points

Relief Valve Set Point	Nominal Distribution Pressure
530 kPa (5.3 bar)	400 kPa (4 bar)
900 kPa (9.0 bar)	700 kPa (7 bar)

The line pressure relief valve is installed between the pressure regulator and the isolation valve (just before the integrated non-return valve, see **figure 1)**, thus protecting the delivery system from over pressurisation by discharging to atmosphere in the event of regulator failure.

Note - Use of optional exhaust connection (figure 1, item 12) is recommended for indoor installations for piping away to a safe location.

1.6 Header Extension For Cylinders connection

The control panel is compatible with standard BeaconMedæs cylinder headers and tail pipes. See **table 4** for list of standard manifold assemblies.

Note tailpipes are supplied separate and may vary depending on required national standards, enquire for details.

Additional cylinder capacity can be added by using the standard BeaconMedæs secondary header extensions kits referenced in table 4.

1.7 Halogen Free Components

The control panel contains NO HALOGENATED polymers located in the gas stream that may experience pressurised oxygen in excess of 3000 kPa (30 Bar) in normal operation or single fault condition, as recommended for safe practise of the medical gas pipeline system.

Customised arrangements

For a custom arrangement where independent assemblies are required, accessories like the loop connection, corner connection and free standing configuration are available, more information could be found on the latest Manifold Header System installation manual.

Table 4: Manifold Headers

Gas Type	2x1	2x2	2x3	2x4	2x5	2x6
Oxygen	8102371280	8102371281	8102371282	8102371283	8102371284	8102371285
Nitrous Oxide	8102371286	8102371287	8102371288	8102371289	8102371290	8102371291
Entonox O2/N2O	8102371292	8102371293	8102371294	8102371295	8102371296	8102371297
Medical Air	8102371298	8102371299	8102371300	8102371301	8102371302	8102371303
Nitrogen	8102371304	8102371305	8102371306	8102371307	8102371308	8102371309
Carbon Dioxide	8102371310	8102371311	8102371312	8102371313	8102371314	8102371315

2. Installation

2.1 Installation procedure for Panel

⚠ CAUTION: Ensure no contaminates, oil or grease come into contact with any of the gas connection/internals.

2.1.1 Unpack and inspect all items for damage.

2.1.2 Check wall for suitability.

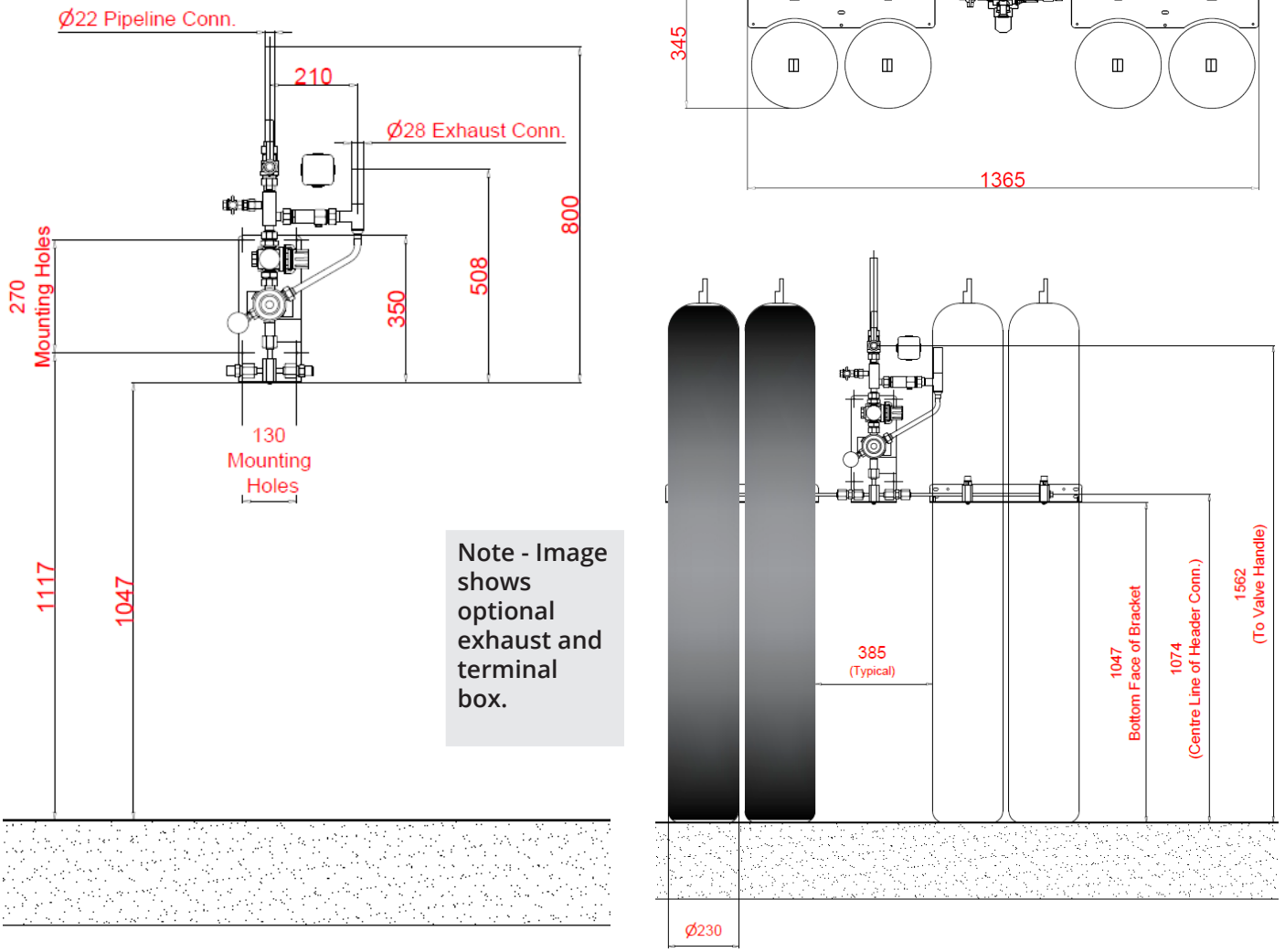
⚠ CAUTION: Supplied fixings are for use with solid masonry walls only. Alternative fixing types are not suppled with the unit. For securing to alternative wall types, ensure that wall structure and selected fasteners are suitable for supporting the typical 15 kg weight of the panel.

2.1.3 Identify the centre position of the control panel on the wall and mark.

2.1.4 Check **figure 3 & 4** for typical mounting heights and mounting hole details. Drill wall and fit wall plugs. Screw the panel to the wall, checking that it is firmly attached.

2.1.5 Loosely connect the supplied ø22mm OD stub pipe to the main pipeline isolation valve **(Item 9, figure 1).** Do not fit the O'ring seal till after brazing is complete to prevent damaging the seal.

Figure 3 - Typical Installation For Use With 'J' & 'G' Type Cylinder



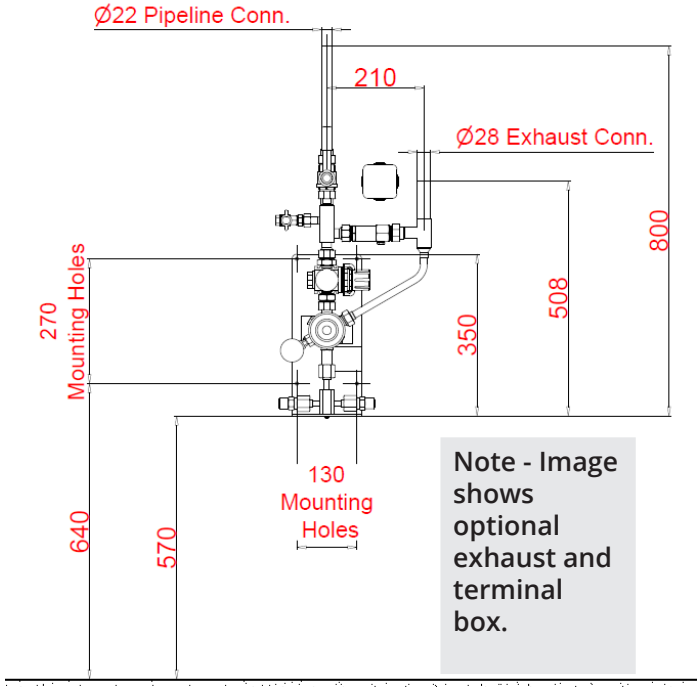
Note - Image shows optional exhaust and terminal box.

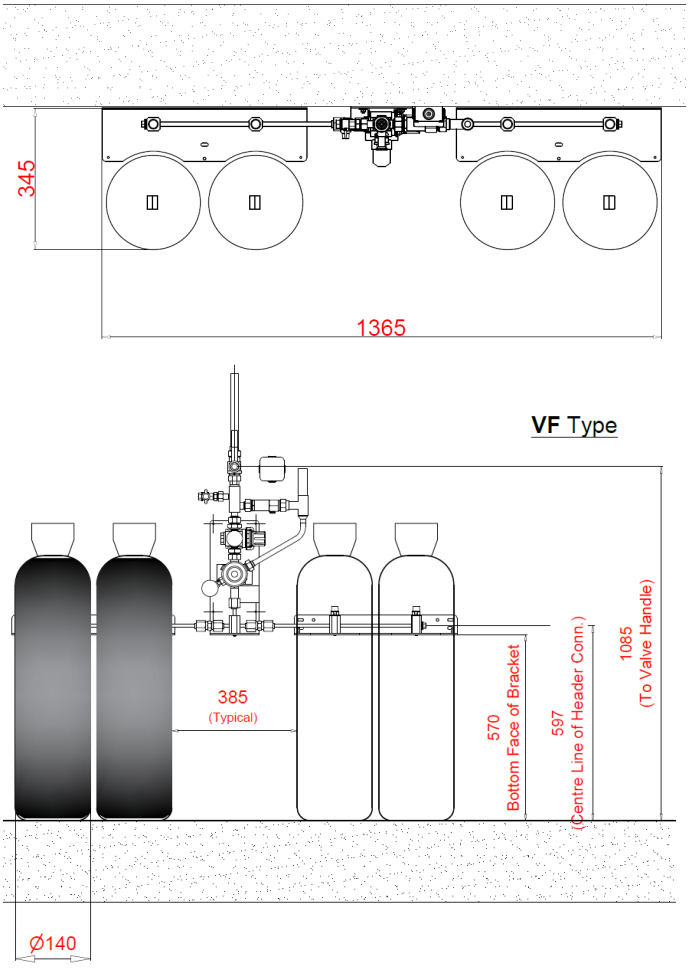
⚠ CAUTION: Supplied fixings are for use with solid masonry type walls only. Typical panel weight is 15kg.

Note - 'J' type cylinders typically for Oxygen and Medical Air. 'G' type cylinders typically for Nitrous Oxide and N2O/O2 mix (Entonox).

Note - If option high pressure bank valves are used (see figure 1, item 14) the manifold width increases by 110mm per side.

Figure 4 - Typical Installation For use with 'VF' Type Cylinders





⚠ CAUTION: Supplied fixings are for use with solid masonry type walls only. Typical panel weight is 15kg.

Note - 'VF' size cylinders are typically used for CO2.

Note - If option high pressure bank valves are used (see figure 1, item 14) the manifold width increases by 110mm per side.

2.1.6 Braze the pipework using the fluxless brazing technique with a nitrogen purge.

⚠ CAUTION: Ensure the brazed connection point is isolated from any other pipeline source of supply.

2.1.7 Undo the securing nuts on the pipeline connection and insert the 'O' ring supplied into the connection grooves and tighten.

2.1.8 The pipework should be secured to the wall using munsen rings (not supplied). It is recommended to install the first pipe support to the supplied ø22mm OD stub pipe **(Item 10, figure 1)**. The next support fixture should typically be installed within 2m of the first.

2.1.9 The ø28mm exhaust line **(Optional supply - Item 11, figure 1)** shall be brazed using fluxless brazing technique with nitrogen purge.

⚠ CAUTION: The ø28mm exhaust line (Item 11, figure 1) needs to be piped away from the manifold room to a safe location, to prevent buildup of waste gas in an enclosed space in the event of a regulator failure.

⚠ CAUTION: Do not reduce the diameter of the pipe used for the exhaust line. For long runs the pipe diameter may need to be increased to prevent back pressure.

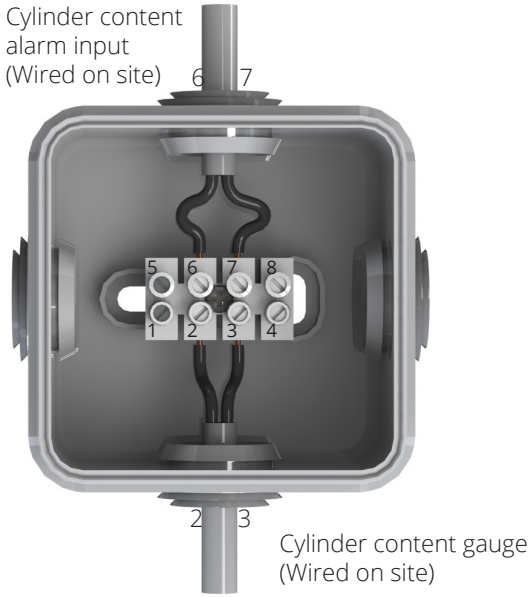
2.2 Cylinder Content Alarm Terminal Box (Optional Supply)

2.2.1 Use a flat bladed screw driver to open the terminal cover at the corners.

2.2.2 Wire the cylinder content alarm as shown in **figure 5**.

Note - Line contact module must be used when connecting to a Medipoint alarm panel.

Figure 5 - Optional Cylinder Content Alarm Wiring



2.3 Installation procedure for Modular Manifold Header - See figure 6

⚠ **CAUTION: Ensure that all the header rails supplied are the correct gas type. The gas ID is stamped onto the flat section of the NRV caps.**

Note - All header runs start with a primary header unit with short stub pipe, secondary headers with longer stub pipes are used for any additional units. See figure 6 for typical examples.

2.3.1 Fit the cylinder header to the mounting bracket with the M6 button head screws and washers supplied in kit. Line up the first header to the manifold 5/8" connection point.

2.3.2 Ensure the bracket is level, mark the mounting hole positions and drill. Fit the wall plugs and secure the header bracket with the No. 10 pan heads supplied with the kit.

⚠ **CAUTION: Supplied fixings are for use with solid masonry type walls only. Typical cylinder header Including bracket is 1.5kg per side.**

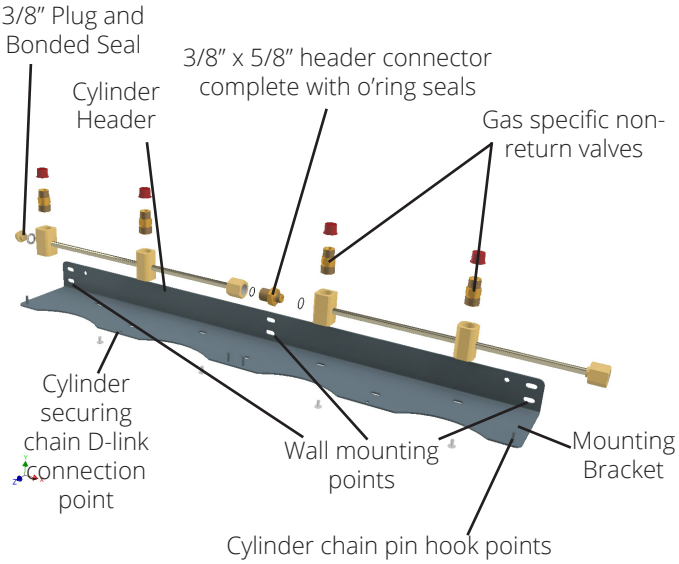
2.3.3 For additional cylinder headers remove the 3/8" BSP blanking plug and bonded seal from the end of the primary header block and fit 3/8" x 5/8" BSP fitting (supplied with kit) complete with O-ring seals for connection of the next header.

2.3.4 Fit the next cylinder header to the mounting bracket with the M6 button head screws and washers supplied in the kit. Offer the unit up to previous bracket and secure using the M6 x 16 hex head set screws and flange nut supplied with the extension kit. Secure the header stub pipe to the previously fitted 5/8" connector.

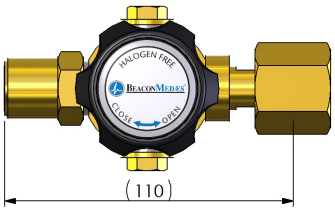
2.3.5 Mark the wall mounting points **(see figure 6)**, drill and secure in place. Repeat previous steps until all headers have been fitted.

2.3.6 When all header extensions are installed, blank off the end of the most remote header with the 3/8" BSP plug and bonded seal that was removed in s**tep 2.3.3**.

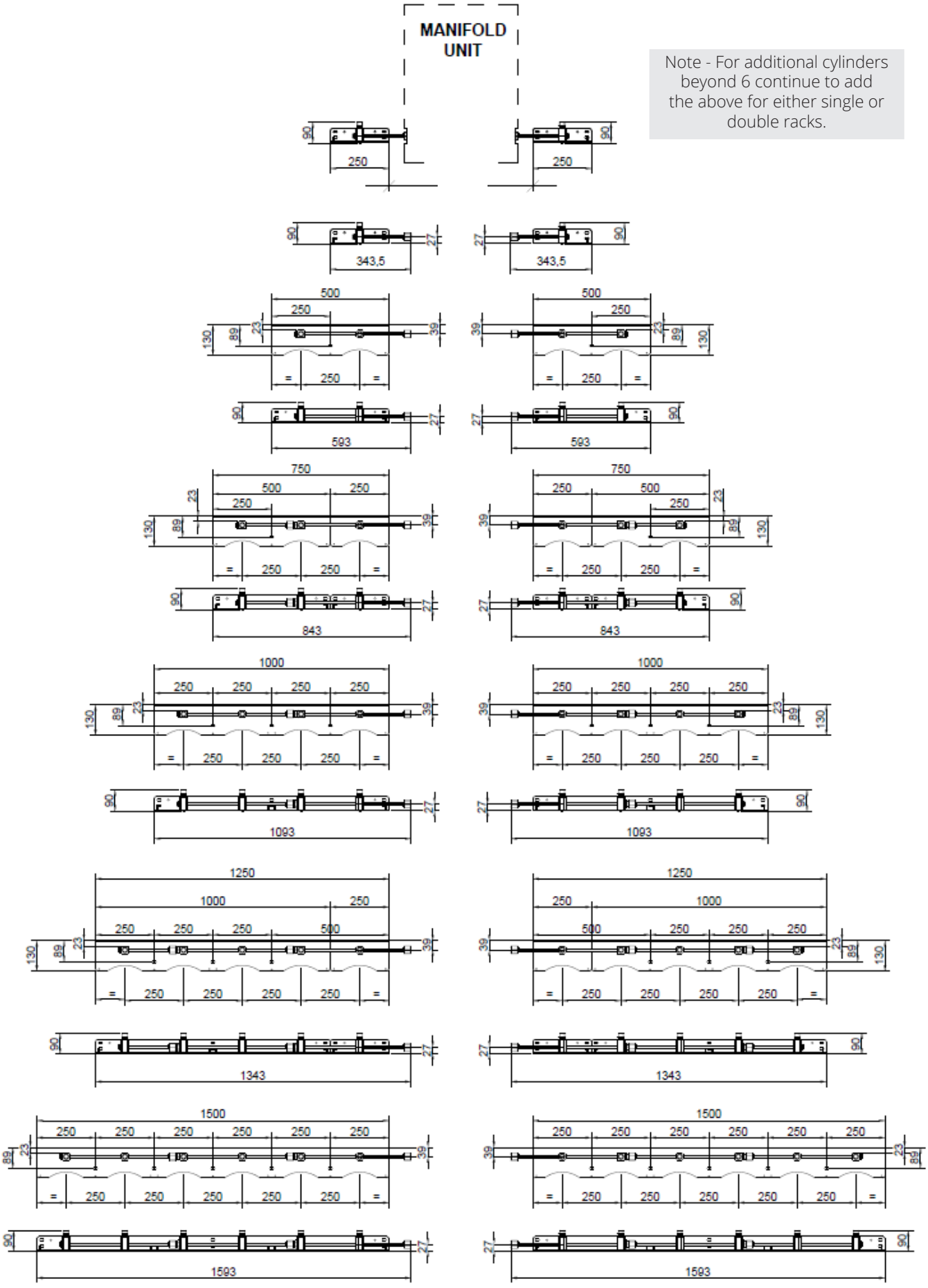
Figure 6 - Typical cylinder header & extension layout details (See table 4 for part number references).



Note - 3/8" plug and bonded seal is required on the last cylinder header on each bank.



Note - If optional high pressure bank valves are installed, add typically 110mm per side for manifold assembly length



Note - For additional cylinders beyond 6 continue to add the above for either single or double racks.

2.4 Cylinder Connection

⚠ **CAUTION: Ensure that all tailpipes supplied are the correct gas type. The gas ID is stamped onto the nut that connects to the header non-return valve (see figure 7).**

2.4.1 Connect the tailpipes to the non-return valves on the header racks as shown in **figure 7**.

2.4.2 Refer to hospitals/site policy for safe cylinder handling (See section 4.5 for typical cylinder handling safety check list), move the cylinders into place **(see figures 3 or 4 & 7)** ready for connection to the tailpipes.

⚠ **CAUTION: Only persons who have undertaken specific training in the safety of medical gases, manual handling techniques and cylinder changing procedures should be allowed to change cylinders on medical gas manifolds or medical equipment.**

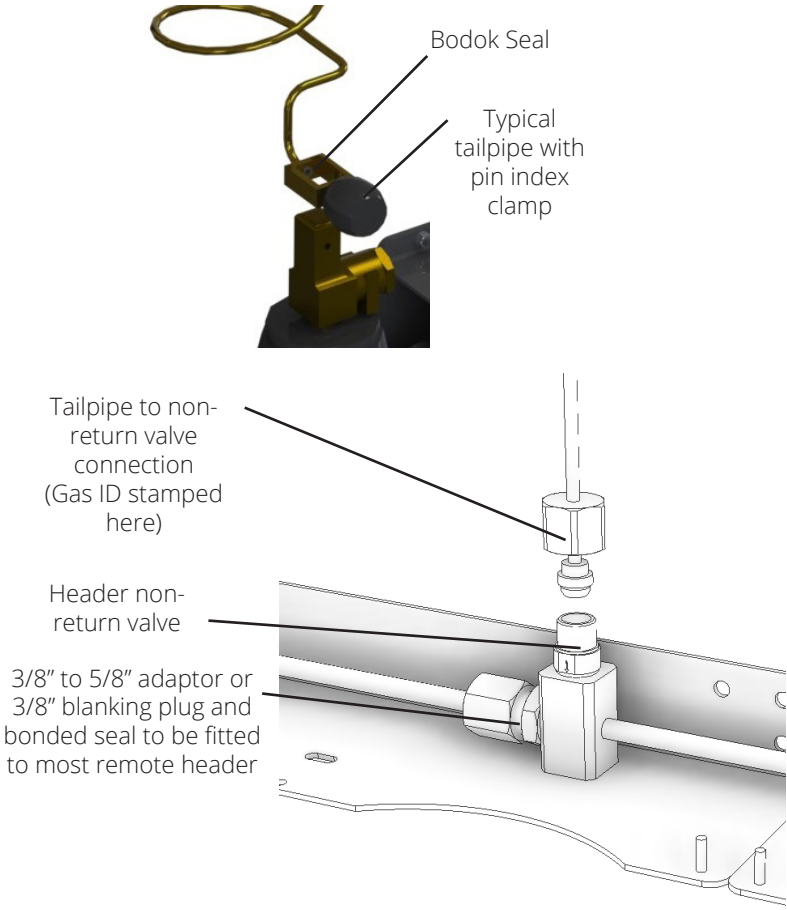
2.4.3 Install the cylinder chains to the header brackets using the D-link where shown on **figure 6**. Loop the chain around the cylinder to secure in place and hook onto the pin on the header bracket.

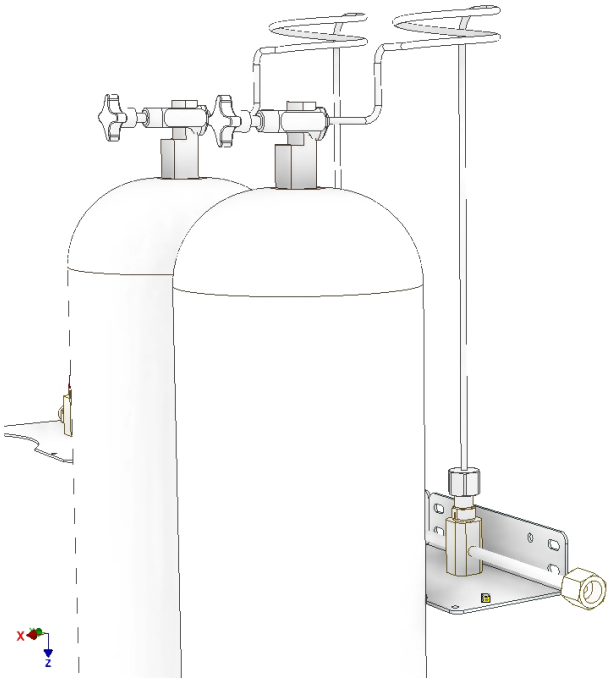
2.4.4 Connect the cylinders to the pin indexed clamp on the tail pipe, as shown in **figure 7**. Ensure the bodok seal is in place at the opposite side to the thumb screw on the pin index clamp before connection.

Note - Pipe index tailpipes to BE EN ISO 21969 are supplied as standard. Alternative connection types are available on request.

2.4.5 See **section 4.6** for cylinder operation procedure

Figure 7 - Typical tailpipe and cylinder connection





2.5 Installation check

2.5.1 Ensure that all tailpipes are connected to the gas cylinders and manifolds on both sides and that the restraining chains are secure around the cylinders.

2.5.2 Isolate the panel from the pipeline by closing the line valve 'A' shown in **figure 8**.

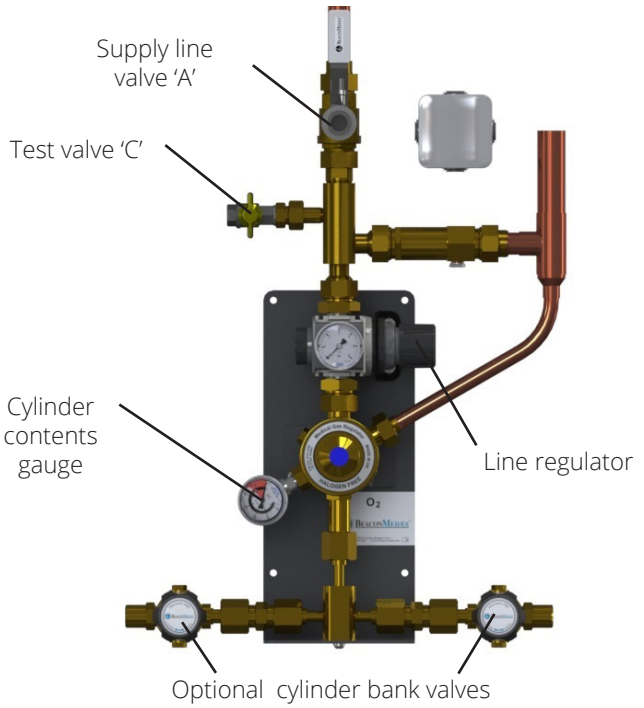
2.5.3 Using one cylinder per side, slowly pressurise the control panel **(see section 4.6 - Cylinder operation)**. The bank content gauge should indicate full cylinder pressure. The distribution system pressure gauge on the regulator (adjust as necessary, see section 3.3.2) should read typically as per **table 5 (Section 4 - Principle of Operation)**.

⚠ **CAUTION: If the control panel is used as a emergency reserve manifold (ERM) it is recommended to set the line pressure at least 0.2 bar below the main supply source pressure at full design flow to ensure the emergency manifold does not supply the pipeline during normal primary source operation.**

2.5.4 Check for leaks. Now ensure all bank cylinders are closed.

2.5.5 Slowly open the test point valve 'C', see **figure 8**. The duty bank of cylinders should drain to typically 14-25 bar depending on the contact gauge switch point **(see table 2)**. After which the contact gauge should trigger. This will send a signal to notify that cylinders are empty and require changing. If the control panel is not currently connected to an alarm, this can be checked with a multimeter across the contacts which will change from a closed to an open circuit.

Figure 8 - Manual Manifold Controls



2.5.6 The installation must now be purged as per HTM 02-01 for UK installations, or as per relevant standards if installed outside the UK.

3. Commissioning

3.1 General

Commissioning of the control manifold must be carried out in full after initial installation. The object of the commissioning procedure is to ensure that all components are serviceable and that the overall system is operable and set to the correct distribution pipeline pressure. Suitably qualified competent personnel who are familiar with this manual must only undertake commissioning of the panel.

3.2 Preparation

3.2.1 Ensure that all tailpipes are connected to the cylinders and manifolds on both sides and that the restraint chains are secure around the cylinders.

3.2.2 Ensure that the outlet pipeline connection from the manifold panel is connected to the distribution system of the same gas service, and isolation valve 'A' **(see figure 8)** is present and closed.

3.2.3 Ensure that the panel's isolation valve 'C' (shown in figure 8) is installed and in the closed position.

3.2.4 Open all cylinder valves on the duty bank and close all cylinders on the standby bank.

3.2.5 Check connections on the headers, tailpipes, regulator and associated pipework for leaks.

3.3 Pressure Checks

3.3.1 Ensure that full gas cylinder pressure is shown on the cylinder content gauges (see figure 8).

3.3.2 With Valve 'A' closed exhaust a small amount of gas from the sampling outlet valve 'C'. Check that the pressure on the pipeline distribution pressure gauge is typically as per **table 5**. Adjust as necessary.

Note - The line regulator is of the non-relieving type as required for medical gas control. Any excess gas pressure needs to be manually exhausted in order to see the effects of reducing the regulator set point. This is achieved by slightly opening the sampling outlet isolation valve 'C' to produce a gentle bleed from the panel.

3.3.3 Complete the steps in **section 4.4** - Procedure to prime the control panel, to bring the unit online.

4. Principles of Operation

4.1 General

The control panel line pressure is set in line with table 5 depending on normal operating range and whether used as a primary supply or as an emergency reserve system. When the primary supply is functioning within it's design limits, the backup panel will not feed gas into the pipeline. If the primary supply fails, causing the pipeline pressure to fall to the emergence reserve manifolds (ERM) set point it will automatically start feeding gas to the pipeline.

Table 5: Typical pressure settings for HTM02-01 primary and emergency medical gas supply system, during normal pipeline system operation.

	Pressure (Bar)		
Nominal System Design	4	7	11
Max. Static Pressure Primary Supply	4.6	8.2	11.5
Min. Dynamic Pressure Primary Supply	4.2	7.4	10.3
Max. Static Pressure ERM Supply	4.0	7.2	10.0
Min. Dynamic Pressure ERM Supply	3.5	6.5	9.0

Note - Table 5 shows typical examples. These figures may differ depending on the hospital's pipeline management policy.

CAUTION: It is recommended to set the emergency reserve manifold's (ERM) line pressure at least 0.2 bar below the main supply source pressure at full design flow. This is to ensure the emergency manifold does not supply gas into the pipeline during normal primary source operation.

4.2 Operation as a primary supply manifold

4.2.1 For use as a primary supply manifold open all cylinder valves on the duty bank and close all on the standby bank (See section 4.6 for cylinder operation)

4.2.2 When the duty bank of cylinders depletes to the changeover pressure the contact switch on the cylinder contents gauge will signal the requirement to change cylinders if connected to a suitable alarm system.

4.2.3 In response to the requirement to change cylinders, open all cylinder valves on the standby bank and close all cylinder valves on the empty bank. The empty cylinders must then be replaced **(See section 4.5 for cylinder handling, and section 4.6 for cylinder operation)**.

4.2.4 These steps must be repeated for continuous supply

4.3 Operation as a emergency reserve manifold (ERM)

4.3.1 In the event of the primary system failing to supply (Awareness of the Primary supply failure is typically from a central alarm system) the ERM line regulator (see figure 8) should be manually increased to match the primary supply's nominal values, so that the full distribution pressure is restored.

4.3.2 For use as a ERM supply manifold all cylinder valves on the duty bank should be open, and close all on the standby bank **(See section 4.6 for cylinder operation)**

4.3.3 When the duty bank of cylinders runs down to the changeover pressure, the contact switching on the cylinder contents gauge will signal the requirement to change cylinders if connected to a suitable alarm system.

4.3.4 In response to the requirement to change empty cylinders, open all cylinder valves on the standby bank and close all cylinder valves on the empty bank. The empty cylinders can them be replaced **(See section 4.5 for cylinder handling, and section 4.6 for cylinder operation)**.

4.3.5 These steps must be repeated for continuous supply.

4.3.6 Once the primary supply of cylinders is restored and running reset the emergency manifold line pressure regulator as per the commissioning steps in **section 3.3**.

⚠ **CAUTION: The following procedures 4.4 to 4.6 are only typical guides, where there are conflicts with the hospital's emergency procedure, the hospital's policy will take precedence.**

4.4 Procedure to prime manifold control panel.

4.4.1 The following procedure must be carried out once the commissioning **(section 3)** is complete and the system is ready to be put into use.

4.4.2 Open all cylinder valves on the duty bank and close all on the standby bank. Correct as required, see **section 4.6 Cylinder Operation**.

4.4.3 Ensure the connecting pipeline is ready for use. Slowly open the line valve 'A' **(see figure 8)**.

4.5 Typical Cylinder Handling Checklist

⚠ CAUTION: Only persons who have had specific training in the safety of medical gases, manual handling techniques and cylinder changing procedures should be allowed to change cylinders on medical gas manifolds or medical equipment.

Safety shoes must be worn at all times. When moving larger cylinders, wear heavy protective gloves (preferably textile or leather). Keep all items clean and grease/oil free.

Do not smoke or use naked lights.

When handling smaller cylinders, the use of protective gloves may be inconvenient. Extra care should be taken to avoid injury and to make sure that hands are free from oil or grease before the cylinders are handled.

Do not knock cylinders against each other or other solid objects.

Do not drop or drag the cylinders.

Do not use cylinders as rollers or wheel chocks.

Do not lift any cylinder by its valve or cap

Use an appropriate trolley for larger cylinders.

4.6 Cylinder Operation

⚠ CAUTION: Undue force should not be used to open or close cylinder valves, or to attach connectors to cylinders.

⚠ CAUTION: ALL cylinder valves should be opened gently. TAPPING the operating key GENTLY with a soft-faced (copper) mallet is acceptable but undue force should not be used. If it is obvious that injury or damage could arise from trying to open a sticking valve, the cylinder should be removed from service and returned to the supplier as a faulty cylinder.

⚠ CAUTION: Opening cylinder valves SLOWLY will prevent a sudden rise in pressure in the system. It is at this time when there will be most stress on components and when most explosions will occur due to adiabatic compression of any oil or grease that may be present.

4.6.1 The cylinder valve should be FULLY opened (slowly, anticlockwise) using the appropriate cylinder key or handwheel where fitted and then turned clockwise a quarter turn.

⚠ CAUTION: If there is any leakage of gas the cylinder should be removed from service and returned as faulty. DO NOT attempt to tighten gland nuts etc, as this may cause damage to the valve.

4.6.2 To close the valve, turn the spindle or handwheel clockwise. Hand pressure only should be used to close the valve.

5. Maintenance Procedures

A competent person who is conversant with the maintenance of high-pressure medical gas installations and any special national conditions, which may apply, must carry out all maintenance. Preventative maintenance contracts are available from **BEACONMEDÆS** for installations within the U.K., overseas distributors will be able to supply similar contracts in other areas.

⚠ **WARNING: OBTAIN A WORK PERMIT (OR EQUIVALENT FOR OVERSEAS) BEFORE COMMENCING ANY WORK ON A MEDICAL GAS INSTALLATION.**

5.1 Daily Inspection

5.1.1 Check visual indicators for correct function and damage.

5.1.2 If the control panel is observed to be operating on its backup bank, replacements for the empty cylinders must be made available immediately.

5.1.3 Check manifold pressure gauges for abnormal conditions.

5.1.4 Check control panel for unusual noises or vibrations.

5.2 Weekly

5.2.1 Check that all cylinders are properly secured and that batch labels are correct and in date.

5.3 Quarterly

5.3.1 Ensure that:

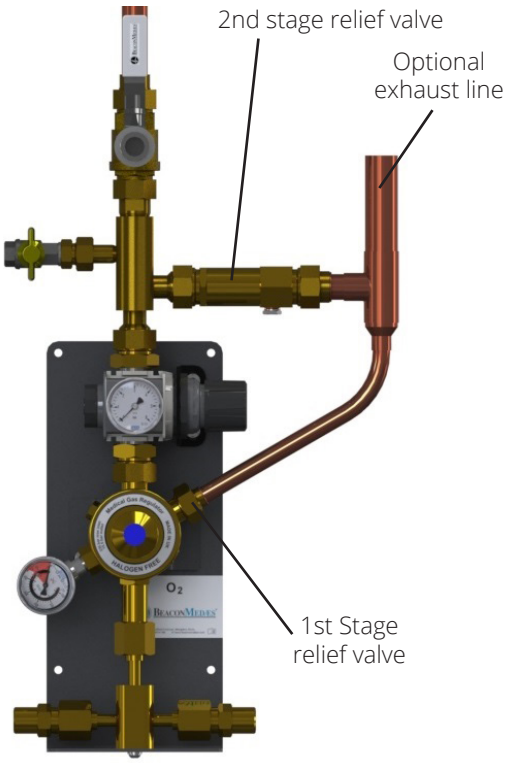
(a) when the duty (primary) manifold is running the reserve (secondary) manifold cylinders are full;
(b) all system pressures are normal;
(c) all alarms are showing as normal;
(d) the manifold line isolating valve is open; and

(e) the manifold is supplying the hospital.

5.3.2 If the control panel is used as an ERM, close the isolating valve slowly and check that there is no effect on the line pressure to the hospital. Open the isolation valve when finished.

5.3.3 Check that the manifold safety valves are not passing, by disconnecting their downstream exhaust coupling (Optional supply) and inspecting for a gas leak and check the condition of the seals **(See figure 9)**. Replace the valve or seals as necessary **(see section 6 for component replacement)**. Reconnect the exhaust pipework (optional supply), ensure the O-ring seals correctly in place.

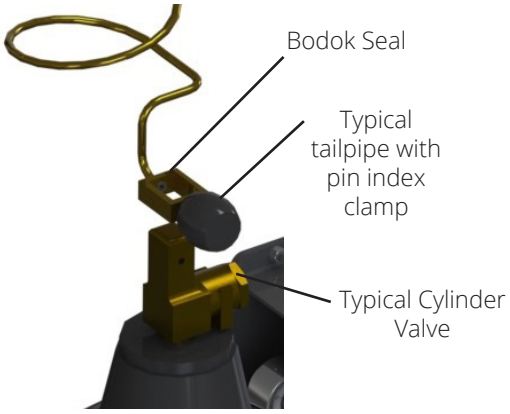
Figure 9 - Relief Valve Maintenance (Image shown with optional exhaust)



Note - All relief valve and optional exhaust connections are flat face unions complete with o-ring seals for ease of removal.

5.3.4 Close one cylinder valve and disconnect the tailpipe at the cylinder end **(see figure 10)**. Once the tailpipe has drained listen for a leak. A minor leak is permissible and likely but an obvious major leak denotes failure of the manifold non-return valve (NRV). If the latter happens, do not totally detach the tailpipe but instead retighten it and test other tailpipes in the same way. Any failed NRV's can be replaced **(see section 6.7)** after all cylinder valves have been closed and the system has been depressurised. Repeat this test when the new NRV's have been fitted **(See figure 10 and section 4.6 - Cylinder Operation)**.

Figure 10 - Cylinder Connection



5.3.5 Check the line pressure regulator set point.

⚠ **WARNING: This check requires momentarily isolating the manifold from the pipeline. Ensure it is safe to carry out this test before proceeding.**

Ensure the line valve 'A' is closed. Open Valve 'C' to produce a steady flow and check the pressure on the line gauge does not drop by more than 10%. If possible attach a flowmeter to the test valve and pipe away the exhaust gas to a safe location when performing this test. Close valve 'C' and open valve 'A' when finished.

⚠ **WARNING: For anaesthetic and oxygen manifolds ensure that the manifold room is well ventilated and no potential ignition sources are present whilst performing this test. Carry out this test for as short a time as possible. Oxygen can be absorbed into clothing etc., so once the test is complete it is recommended to spend at least 20 minutes out doors to ensure the oxygen has released. During this time stay away from naked flame, do not smoke etc. Do not perform this test unless the risks can be kept within an acceptable level.**

5.3.6 Check the static pressure of the regulator **(this should be typically as per table 5 in section 4)**.

⚠ **WARNING: This test requires momentarily isolating the manifold from the pipeline. Ensure it is safe to carry out this test before proceeding.**

Ensure that line valve 'A' is closed, observe the pressure for typically 10-20 minutes to ensure that there is no regulator creepage. Excessive creepage will necessitate replacement of the regulator **(see section 6.3)** and a repeat of this test.

5.3.7 To test the empty cylinder contact gauge close the duty bank cylinder valves and observe the alarm condition as the pressure drops.

⚠ I**MPORTANT! Open the cylinder valves on the original duty bank once the test is completed.**

Note - If there is no demand on the supply you can simulate this by opening the test valve 'C'.

⚠ **WARNING: If venting gas from valve 'C', for anaesthetic and oxygen manifolds ensure that the manifold room is well ventilated and no potential ignition sources are present while running this test.**

⚠ **WARNING: This check may effect the continuity of gas supply, ensure it is safe to carry out this test before proceeding.**

5.3.8 Finally, tighten all joints, and inspect with suitable leak detection fluid.

5.3.9 Perform the steps in **section 4.2 - Procedure to prime the control manifold**.

5.4 5 Years

Replace the pressure safety valve for a new certified relief valve, **see section 6**. Replacement of the regulators is also recommended at this time.

5.5 As Required

Replace tailpipes, pressure safety valve, pressure regulator, high-pressure isolation valve, isolation valves, contact gauges, non-return valve etc. as and when required **(see section 6.0)**.

6.0 Component Replacement Procedures

⚠ **WARNING: IT IS ESSENTIAL THAT ONLY GENUINE BEACONMEDÆS SPARE PARTS ARE FITTED DURING MAINTENANCE.**

⚠ **CAUTION: Ensure no contaminates, oil or grease come into contact with any of the gas connection/internals.**

6.1 Preparation For Component Replacement

⚠ **CAUTION: For primary manifolds ensure an adequate backup supply is available and operating correctly before taking the main supply off line for maintenance.**

⚠ **CAUTION: For emergency backup manifolds ensure the main supply is functioning correctly before taking off line for maintenance.**

6.1.1 Close the manifold line isolation valve 'A' **(See figure 8)**. Close all the cylinder isolation valves.

6.1.2 Open the sampling outlet valve 'C', to depressurise the system.

⚠ **CAUTION: When exhausting anaesthetic and oxygen manifolds ensure that the manifold room is well ventilated and no potential ignition sources are present.**

Note - If the cylinder contents gauges are not rapidly falling in pressure, stop draining the system and check all cylinders are correctly isolated.

6.2 Replace line non-return valve (P/N: 2005951)

6.2.1 Complete steps in **section 6.1** before carrying out any component replacement on the manifold control panel.

6.2.2 Slowly turn the swivel nut of the top 1" connection. If you hear gas escaping do not fully unscrew the joint until the system is fully drained.

6.2.3 Fully disconnect all three joints as shown in **figure 11** and gently remove the unit by sliding it towards you. Take care not to damage the seals.

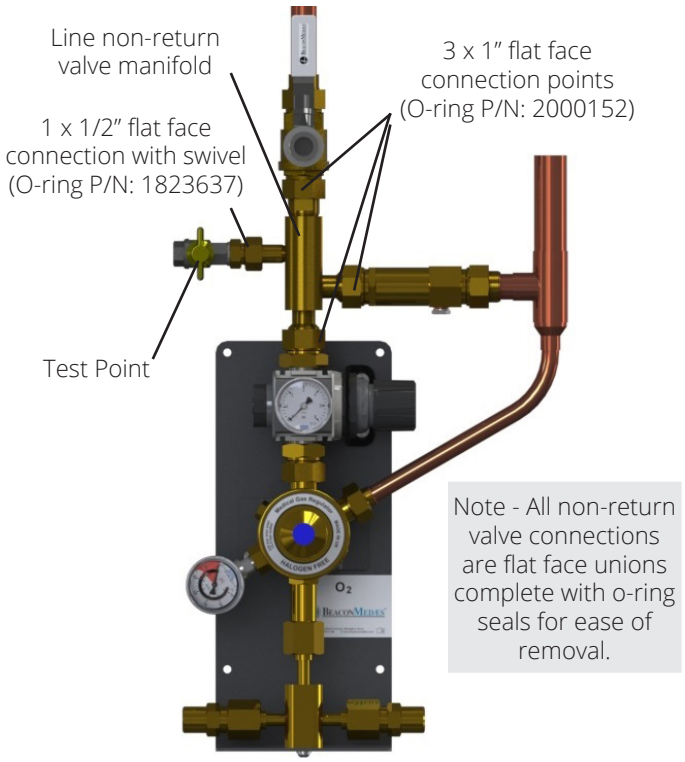
6.2.4 Inspect the existing seals and replace if required, **see figure 11** for seal part numbers.

6.2.5 Taking care not to damage the O-ring seals replace the new non-return valve as shown in **figure 11**, and fasten the 3 flat face joints.

6.2.6 Disconnect the test point valve from the original non-return manifold and fit to the new unit.

6.2.7 Follow steps in **section 6.11** to bring the manifold back online.

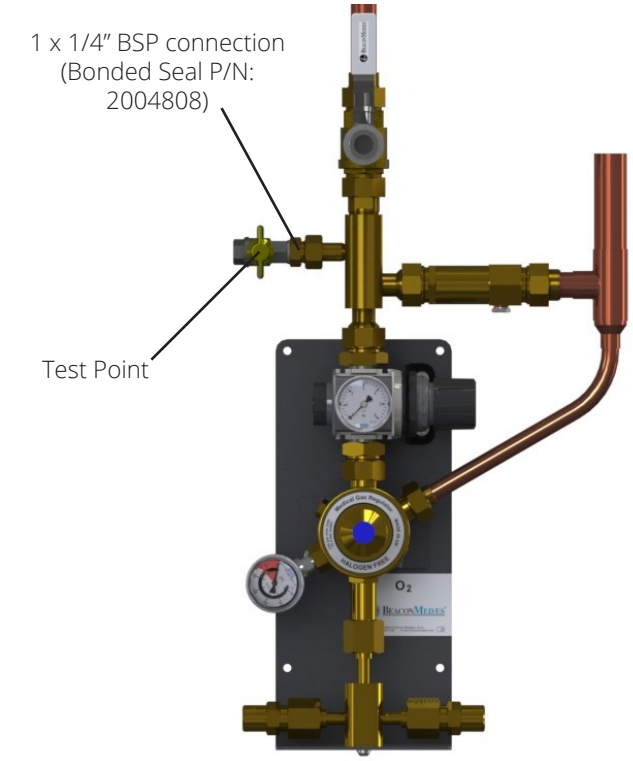
Figure 11 - Line Non-return Valve Replacement



6.3 Replace Test Sampling Valve (P/N: 2000172)

6.3.1 Complete steps in **section 6.1** before carrying out any component replacement on the manifold control panel.

Figure 12 - Test Sampling Point Valve Replacement



6.3.2 Disconnect the valve at the 1/4" connection **(see figure 12)**. Check the bonded seal and replace if necessary. Fit the new valve.

6.3.3 Follow steps in **section 6.11** to bring the manifold back online.

6.4 Replace 2nd stage regulator (See table 6 for part numbers)

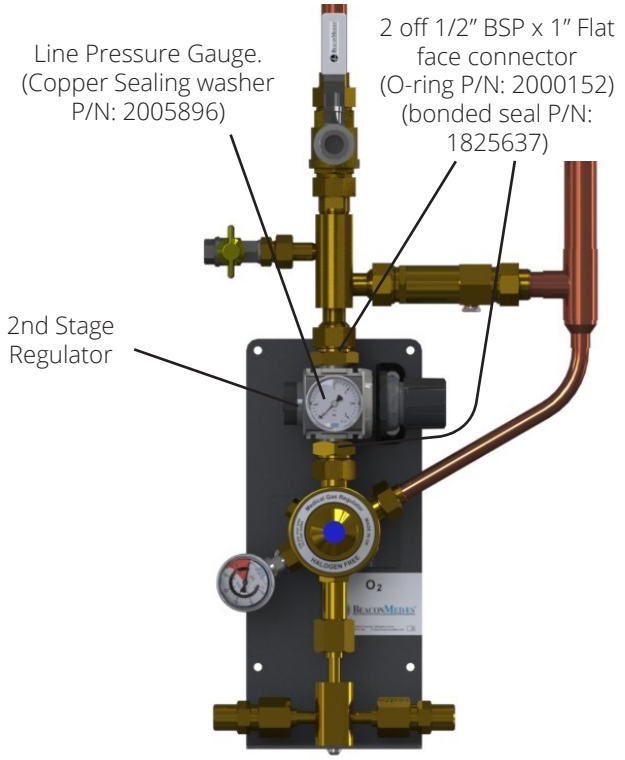
Table 6: 2nd Stage Regulator Part Numbers

Regulator Nominal Pressure	Part Number
4 Bar	2005689
7 Bar	2005690

6.4.1 Complete steps in **section 6.1** before carrying out any component replacement on the control panel.

6.4.2 Slowly turn the swivel nut of the top 1" connection **(see figure 13)**. If the you hear gas escaping do not fully unscrew the joint until the system is fully drained.

Figure 13 - 2nd Stage Regulator Replacement



6.4.3 Fully disconnect the two 1" joints as shown in **figure 13** and gently remove the unit by sliding it towards you. Take care not to damage the seals.

6.4.4 Remove the two 1/2" BSP x 1" flat face connectors and gauge, and fit to the new regulator.

6.4.5 Inspect the existing seals and replace if required, **see figure 13** for seal part numbers.

6.4.6 Taking care not to damage the O-ring seals replace the new regulator as shown in **figure 13**, and fasten the 2 flat face joints.

6.4.7 Follow steps in **section 6.11** bring the control panel back online.

6.5 1st stage regulator replacement (See table 7 for part numbers)

Table 7: 1st Stage regulator Part Numbers

Regulator	Part Number
1st Stage Regulator	2005383

6.5.1 Complete steps in **section 6.1** before carrying out any component replacement on the control panel

6.5.2 Slowly turn the swivel nut of the 1" connection. If you hear gas escaping do not fully unscrew the joint until the system is fully drained.

6.5.3 Fully disconnect the 1" connection, the 5/8" header connection and the bracket M6 flange nuts as shown in **figure 14,** and gently remove the unit by sliding it towards you. Take care not to damage the seals.

6.5.4 Remove the gauge, minimum leak fitting, blanking plugs, relief valve and mounting bracket form the old regulator and fit to the new unit.

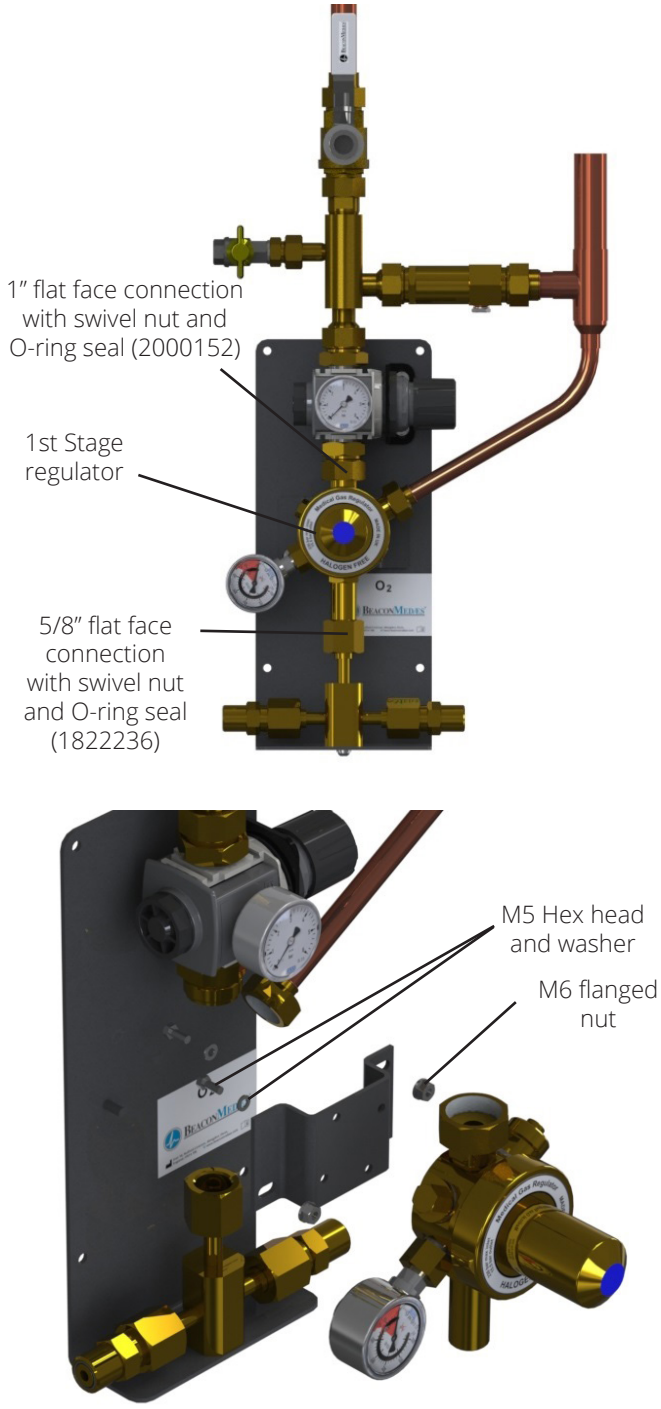
6.5.5 Inspect the existing seals and replace if required, see figure 14 for seal part numbers.

Note - If the gauge orientation needs adjusting, disconnection the gauge from the minimum leak connection and refit using a new copper sealing washer 2005896.

6.5.6 Taking care not to damage the O-ring seals replace the new regulator as shown in **figure 14**, and fasten the 1" and 5/8" flat face connections.

6.5.7 Follow steps in **section 6.11** to bring the control panel back online.

Figure 14 - 1st Stage Regulator Replacement



6.6 Replace 2nd stage relief valve (See table 8 for part numbers)

Table 8: 2nd Stage Relief Valve Part Numbers

Nominal Line Pressure	Relief Set Pressure	Part Number
4 Bar	5.3 bar	2000122
7 Bar	11 bar	2000123

6.6.1 Complete steps in **section 6.1** before carrying out any component replacement on the control panel.

6.6.2 Slowly turn the left hand 1" swivel nut connection. If the you hear gas escaping do not fully unscrew the joint until the system is fully drained.

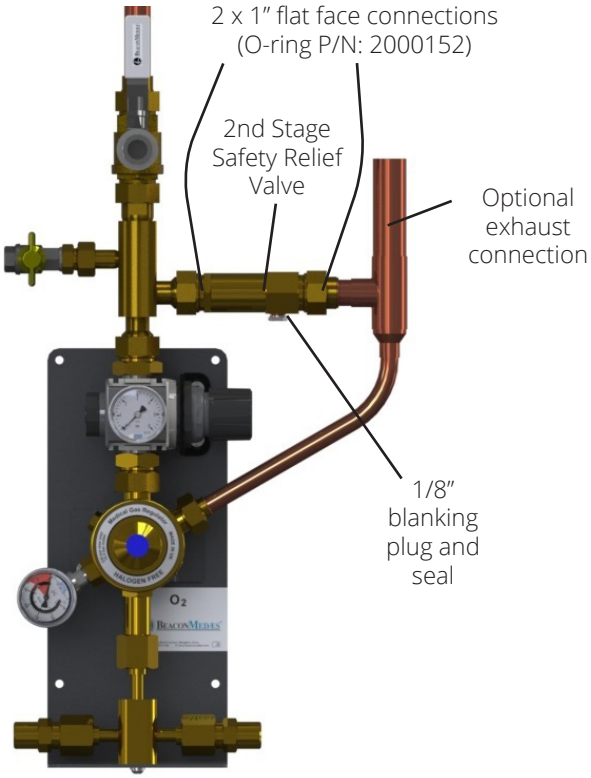
6.6.3 Fully disconnect the 1" joints plus optional exhaust connection if fitted, as shown in **figure 15,** and gently remove the unit by sliding it towards you. Take care not to damage the seals.

6.6.4 Inspect the existing seals and replace if required, see **figure 15** for seal part numbers. Remove the 1/8 blanking plug from the old relief valve and fit to the new unit.

6.6.5 Taking care not to damage the O-ring seals replace the new relief valve as shown in **figure 15**, and fasten the 2 flat face joints.

6.6.6 Follow steps in **section 6.11** to bring the control panel back online.

Figure 15 - 2nd Stage Relief Valve Replacement

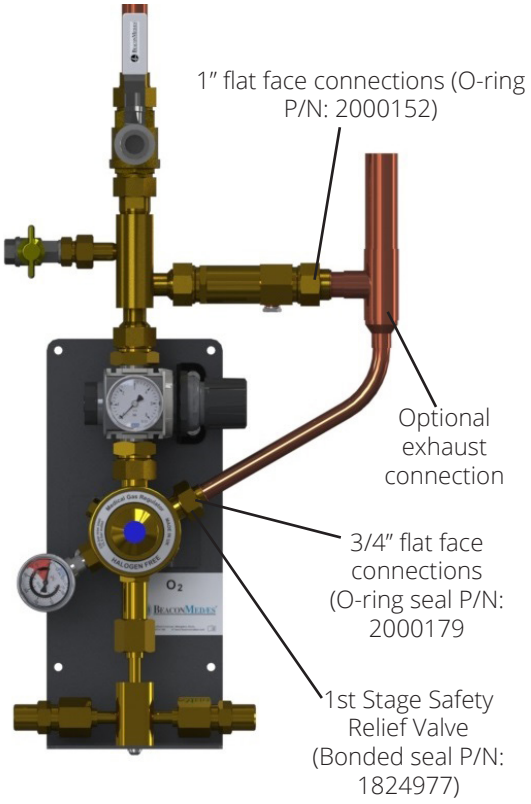


6.7 Replace 1st stage relief valve (P/N: 2005384)

6.7.1 Complete steps in **section 6.1** before carrying out any component replacement on the control panel.

6.7.2 If the optional exhaust assembly is installed disconnect the 3/4" and 1" swivel nut connection. Ensure there is adequate space for removing the valve without spraining the pipe work **(as shown in figure 16)**. Pipe line clamps may need to be unfastened to achieve this.

Figure 16 - 1st Stage Relief Valve Replacement



6.7.3 Start to unscrew the 1st stage relief valve, if you hear gas escaping do not fully remove until the system is fully drained.

6.7.4 Inspect the existing seals and replace if required, **see figure 16** for seal part numbers.

6.7.5 Taking care not to damage the O-ring seals replace the new relief valve as shown in **figure 16**, and fasten the 2 optional exhaust pipe flat face joints if previously fitted.

6.7.6 Follow steps in **section 6.11** to bring the control panel back online.

6.8 Replace Cylinder Header Non-return Valves (see table 9 for part numbers)

Table 9: Header Non-return Valve Part Numbers

Gas Type	Part Numbers
Oxygen (O2)	2000288
Nitrous Oxide (N2O)	2000289
Oxygen/Nitrous Oxide (O2/N2O)	2000290
Medical Air	2000291
Nitrogen (N2)	2000292
Carbon Dioxide (CO2)	2005850

6.8.1 Complete steps in **section 6.1** before carrying out any component replacement on the control panel.

6.8.2 Slowly turn the swivel nut of the tailpipe connection. If you hear gas escaping do not fully unscrew the joint until the system is fully drained, **see figure 17**.

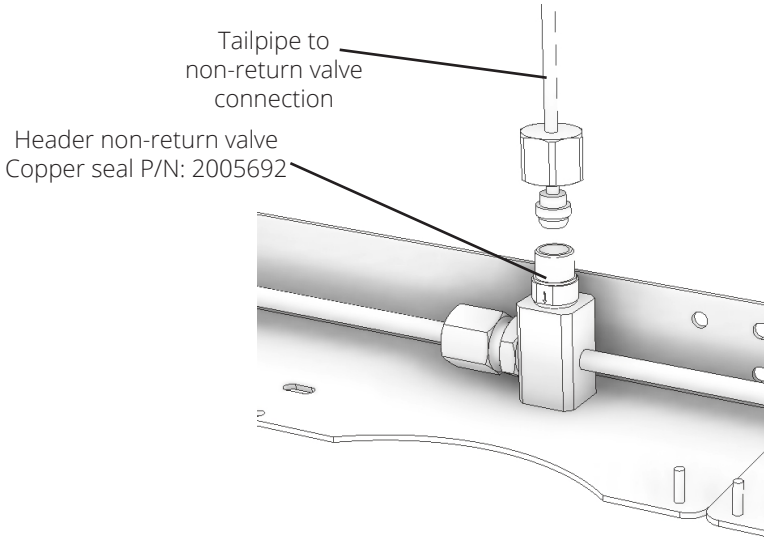
6.8.3 Fully disconnect the tailpipe joints as shown in **figure 17**. Start to unscrew the non-return valve, if you hear gas escaping do not fully unscrew the joint until the system is fully drained. Fully disconnect the non-return valve.

6.8.4 Inspect the existing seals and replace if required, **see figure 17** for seal part numbers. Fit the new non-return valve.

6.8.5 Reconnect the tailpipe to the non-return valve.

6.8.6 Follow steps in **section 6.11** to bring the control panel back online.

Figure 17 - Header Non-return Valve Replacement



6.9 Replace Line Pressure Gauge (see table 10 for part numbers)

Table 10: Line Pressure Gauge Part Numbers

Nominal Line Pressure	Part Number
4 Bar	2005765
7 Bar	2005766

⚠ **CAUTION: Ensure the new gauge has the same scale as the one being replaced.**

6.9.1 Complete steps in **section 6.1** before carrying out any component replacement on the control panel.

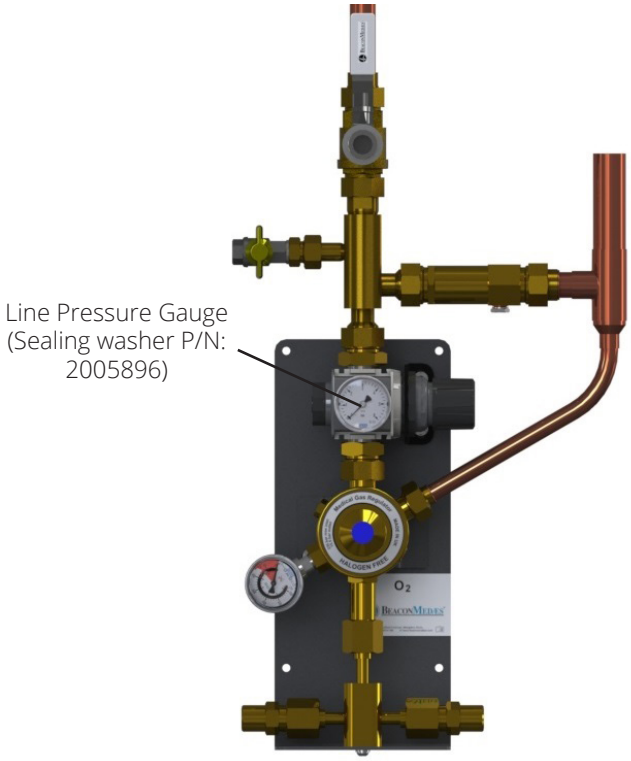
6.9.2 Start to unscrew the line pressure gauge, if you hear gas escaping do not fully remove until the system is fully drained **(see figure 18)**.

6.9.3 Replace the old seals with those supplied with the new gauge.

6.9.4 Fit the new gauge as per the old unit.

6.9.5 Follow steps in **section 6.11** to bring the control panel back online.

Figure 18 - Line Pressure Gauge Replacement



6.10 Replace Cylinder Contents contact Gauge (See table 11 for part numbers)

Table 11: Cylinder Contents Gauge Part Numbers

Switch point	Part Number
14 Bar (100 Bar Scale)	2005772
25 Bar (250 Bar Scale)	2005961

Note - A 14 bar switch point is typically used on N2O and CO2. A 25 bar switch point is typically used for O2, O2/N2O, Medical Air, Surgical Air and N2O.

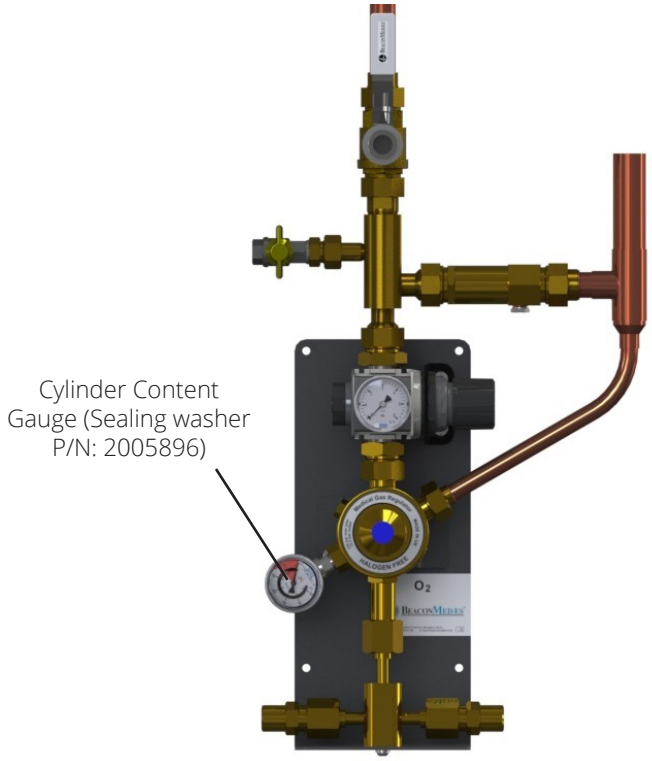
⚠ **CAUTION: Ensure the new gauge has the same scale and alarm contact as the one being replaced.**

6.10.1 Complete steps in **section 6.1** before carrying out any component replacement on the manifold control panel.

6.10.2 Disconnect the contact alarm wire, see figure 20**.**

6.10.3 Start to unscrew the contact gauge, if you hear gas escaping do not fully remove until the system is fully drained **(see figure 19)**.

Figure 19 - Cylinder Content Gauge Replacement

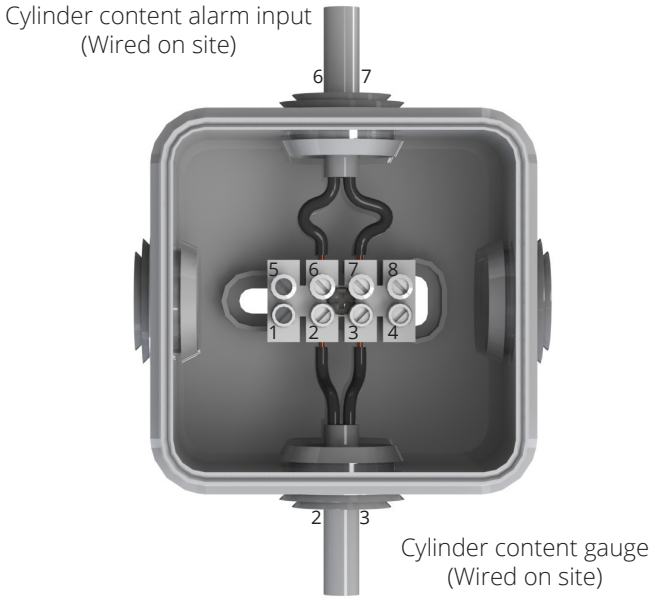


6.10.4 Replace the old seals if required.

Note - A new seal will allow for greater adjustment when aligning the gauge.

6.10.5 Install the new gauge as per the old unit including wiring as per **figure 20**.

Figure 20 - Contact Gauge Alarm Wiring



6.10.6 Follow steps in **section 6.11** to bring the control panel back online.

6.11 Returning the Control Panel Back online

6.11.1 After completing any repair work on the control panel complete the step in **section 3 - Commissioning**, followed by s**ection 4.4 - Procedure to prime control panel**.

Note - The panel may need to be purged as per HTM 02-01 for UK installations, or as per relevant standards if installed outside the UK.

7. Recommended Spares and Accessories

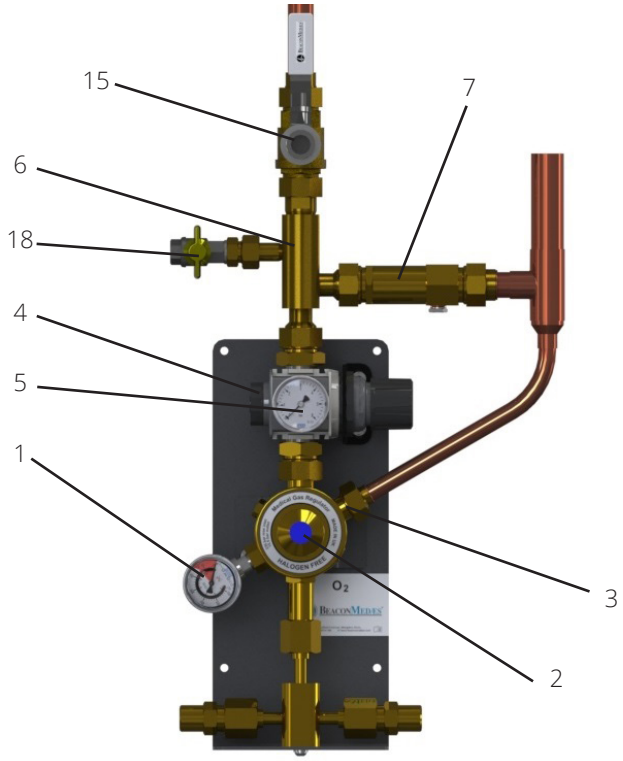
7.1 Spares scheduling

The following table is the recommended spares holding, the number of recommended spares for overseas customers are expressed in brackets and take into account expected transport delays **(see table 12, figure 21)**.

Note - It is mandatory to replace 1st and 2nd stage relief valves every 5 years.

Note - industrial regulators are recommended to be replaced every 5 years. Although the medical standards do not specifically identify the need to replace the regulators within this time scale it is considered good practice to do so. By replacing the regulators when the relief valves are being replaced, interruption of the gas supply is minimised.

Figure 21 - Control panel item details



Note - See section 6 for replacement component and seal type details.

Table 12: Spares scheduling

Item ID	Part Number	Description	QTY req./ Number of Panels	
			<5	>5
1	2005961	Contact Gauge – 0-250 bar/25 bar Falling	1(2)	2(4)
	2005772	Contact Gauge – 0-100 bar/14 bar Falling	1(2)	2(4)
2	2005383	1st Stage Regulator	1(2)	2(3)
3	2005384	1st stage relief valve - 20 bar	1(2)	2(3)
4	2005689	Line Regulator – 4.6 bar Outlet	1(2)	2(3)
	2005690	Line Regulator – 8.6 bar Outlet	1(2)	2(3)
5	2005765	Line Gauge – 6 bar	1(1)	1(2)
	2005766	Line Gauge – 10 bar	1(1)	1(2)
6	2005951	Manifold block c/w Non-Return Valve	2(2)	4(8)
7	2000122	Relief Valve – 5.3 bar	2(2)	3(4)
	2000123	Relief Valve – 11 bar	2(2)	3(4)
8	1823637	'O' Ring – 12.1 I/D x 1.6 CSA	2(4)	4(8)
9	1822236	'O' Ring – 15.1 I/D x 1.6 CSA	2(4)	4(8)
10	2000179	'O' Ring – 17.1 I/D x 1.6 CSA	2(4)	4(8)
11	2000152	'O' Ring – 22.1 I/D x 1.6 CSA	2(4)	4(8)
12	2004808	1/4" Bonded Seal	2(4)	4(8)
13	1824977	3/8" Bonded Seal	2(4)	4(8)
14	1825637	1/2" Bonded Seal	2(4)	4(8)
15	2005820	Line Valve Assembly	1(2)	2(2)
16	2000288	Header Non-Return Valve Kit, O2	1(2) per Cylinder	
	2000289	Header Non-Return Valve Kit, N2O	1(2) per Cylinder	
	2000290	Header Non-Return Valve Kit, O2/N2O	1(2) per Cylinder	
	2000291	Header Non-Return Valve Kit, AIR	1(2) per Cylinder	
	2000292	Header Non-Return Valve Kit, N2	1(2) per Cylinder	
	2005625	Header Non-Return Valve Kit, CO2	1(2) per Cylinder	
17	2005775	Alarm Terminal Box	1(1)	1(1)
18	2000172	Sample Test Point	1(1)	1(1)
19	2005896	Copper Sealing Washer - Gauge	2(4)	4(6)
20	2005692	Copper Sealing washer NRV	2(4)	4(8)

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