

TECHNICAL SPECIFICATIONS

FOR

MEDICAL GAS PIPELINE SYSTEM

1. OXYGEN SYSTEM

1.1 Oxygen Manifold CE Marked

Oxygen manifold should be extendable type, of size 10 + 10 or Indian type bulk cylinders and it should be suitable to withstand a working pressure of 145 kg/cm² and should be tested at 380 kg/cm².

The Manifold shall have the following characteristics:

- Manifold should have high pressure copper annealed tail pipes with one end having brass bull nose suitable for oxygen cylinders and other end suitable for Manifold non- return Valves.
- It should have middle frame of manifold of 10+ 10 size along with chain for individual bulk oxygen cylinder.
- Manifold should have Non – return valves.

1.2 Fully Automatic Control Panel for Oxygen (Imported) as per NFPA99 / HTM 02-01 , UL Listed where applicable / CE marked with notified no.

- Fully automatic in operation and requiring no action, Automatic Control Panel is pneumatically operated by the service gas and needs no electrical supply to operate. It will continue to function therefore, should there be a failure in the electricity supply. It takes on automatically from the empty cylinder bank to filled cylinder bank.
- The panel is enclosed in a metal cabinet with a hinged front cover. The cover is fitted with a lock to prevent unauthorized access, and can be swung open for maintenance. The Box Shall be made of 18 gauge SS 304 sheet.
- A visual indication of the state of the manifold is provided by 3 gauges within the control panel, clearly visible through the transparent cover, these gauges indicate the pressure of the right and left hand banks, and the supply pressure from the control panel to the distribution system.
- The panel is supplied with sensing facilities to provide visual signals and other ancillary services such as heaters. A heater block is fitted to the inlet pipes for Nitrous Oxide.
- In addition the panel is fitted with audio alarm indication for changeover of empty cylinder bank to filled cylinder bank.

The entire manifold will be hydraulically tested at 250 Kg/Cm² pressure, duly degreased for Nitrous Oxide service, and supplied in sealed cover, ready for assembly at site.

NOTE: The above referred system does not comprise the supply of cylinders, which are to be separately arranged by the Hospital.

1.3 Emergency Oxygen Manifold CE Marked.

It comprises of Double cylinders bank of 3 (three) number of cylinders each bank which shall be connected to the main line through Automatic Control Panel isolating the main control panel to ensure uninterrupted supply of medical oxygen in case main manifold/control panel is inoperative (supplied without cylinders).

2. **NITROUS OXIDE SYSTEM**

1.4 Nitrous Oxide Manifold CE Marked.

The Nitrous Oxide cylinder manifold shall comprise of two cylinder banks which should be extendable type, of size 3 + 3 for Indian type bulk cylinders.

The Manifold shall have the following characteristics:

- Manifold should have high pressure copper annealed tail pipes with one end having brass bull nose suitable for Nitrous Oxide cylinders and other end suitable for Manifold non- return Valves.
- Nut nipple fitting of R.H. internal threading suitable for cylinder valves conforming to **IS:3224 (Nitrous oxide Service)**, and cylinder support system.
- It should have middle frame of manifold of 6+6 size along with chain for individual bulk oxygen cylinder.
- The copper tail pipes are fitted with individual non-return valves to the cylinder manifold for easy removal of cylinders, without any disturbance to system operation.

Each manifold will have one terminal header and a NPT connection for the Automatic Control Panel.

NOTE: The above referred system does not comprise the supply of cylinders,

1.5 Nitrous Oxide Automatic Control Panel (Imported) as per NFPA99 / HTM 02-01 , UL Listed where applicable / CE marked with notified no.

- Fully automatic in operation and requiring no action, Automatic Control Panel is pneumatically operated by the service gas and needs no electrical supply to operate. It will continue to function therefore, should there be a failure in the electricity supply. It takes on automatically from the empty cylinder bank to filled cylinder bank.
- The panel is enclosed in a metal cabinet with a hinged front cover. The cover is fitted with a lock to prevent unauthorized access, and can be swung open for maintenance. The Box Shall be made of 18 gauge SS 304 sheet.
- A visual indication of the state of the manifold is provided by 3 gauges within the control panel, clearly visible through the transparent cover, these gauges indicate the pressure of the right and left hand banks, and the supply pressure from the control panel to the distribution system.
- The panel is supplied with sensing facilities to provide visual signals and other ancillary services such as heaters. A heater block is fitted to the inlet pipes for Nitrous Oxide.

- In addition the panel is fitted with audio alarm indication for changeover of empty cylinder bank to filled cylinder bank.

The entire manifold will be hydraulically tested at 250 Kg/Cm² pressure, duly degreased for Nitrous Oxide service, and supplied in sealed cover, ready for assembly at site.

1.6 Emergency Nitrous Oxide Manifold CE Marked.

The emergency stand by manifold should provide a stand by nitrous oxide gas supply from Double cylinders bank of 2 (two) number of cylinders each bank which shall be connected with copper tail pipes, safety valves, NRV's. Each bank shall be connected with main line, through Automatic Control Panel isolating the main control panel to ensure uninterrupted supply of medical Nitrous Oxide in case main manifold/control panel is inoperative (supplied without cylinders).

3. COMPRESSED AIR SYSTEM

It should be consist of oil-less, stationery air cooled silenced (Reciprocating) air compressor. It should be equipped with four electrical motors, one Air reservoir Tank, Air filters, Pressure Regulator-cum-filter, No-heat Air Dryer with moisture separator. Interconnecting pipes with necessary valves and fittings thereof.

3.1 Air Compressors

- Specifications:
 - Air Compressors : 2 Nos.
 - Type : Reciprocating, Non-lubricated Double stage.
 - Capacity : 57.18 cfm at 9 Kg/Cm².
 - Cooling : Air cooled.
- Drive
 - Electric Motor : 2 Nos.
 - Motor : 15 HP
 - Type : Induction Motor, TEFC.
 - Speed : 1440 rpm (syn.)
 - Drive : Belt drive.
 - Electricity supply : 440 Volt, 50 Hz. 3 phase.
- Starter : Star/Delta Control & Switchgear/L&T Technical with over load protection.
- Air Receiver : 4000 Ltrs.
- Air Dryer : 60 cfm
- Filters : Ultrafilters.

Air Compressors are mounted on base frame. The Compressor shall discharge into the after cooler, moisture separator and then to the air receiver. The Air Receiver is connected to inlet of the Air Dryer and outlet is connected to the hospital pipeline system through pressure regulator-cum-filter. The compressor are air cooled.

3.2 Filter and reducing system

The first stage is a prime efficiently coalescer with particle removal down 0.5 micron with 99.9999% retention. This filter removes aerosol and solid particles.

Air dryer

It should be equipped with moisture separator, auto drain wall. Desiccant heatless air dryer, twin tower with automatic electronic change over with following specifications: -

Dryer capacity	:	60 cfm
working pressure	:	10 kg/ cm ² .
Pre filter	:	5 micron
After filter	:	5 micron.
Dew Point	:	(- 40 degree)

Air Receiver Tank

The pressure storage tank should be made of ASME construction rated for 200-PSI MWP. The tank shall be equipped with a pressure gauge, safety relief valve, 3-way by pass gauge glass and automatic electronic tank drain with manual override.

4. **VACUUM SYSTEM**

The Vacuum System should include two medical Vacuum pumps each with electrical motors, silencers, bacteria filters and one vacuum tank. They should be capable of removing more than 99.9% of oil and smoke particles from the exhaust.

4.1 Vacuum Pumps

- Specification:

- Vacuum Pump	:	2 Nos.
Type	:	7V, reciprocating, single stage.
Vacuum	:	737 mm Hg.
Cooling	:	Air Cooled.
Starting	:	Unloaded.
- Drive Data		
Motors	:	2 Nos.
Capacity	:	7.5 H.P.
Type	:	Induction motor, TEFC
Make	:	Crompton Greaves/Siemens/ ABB/Kirloskar.
Speed	:	1440 rpm (Syn).
Drive	:	Belt drive
Electric supply	:	440 Vac., 50 Hz, 3 Ph.
- Starter	:	DOL/Star delta Crompton Graves/L&T with single phase Preventor, and over load protection.
- Vacuum Switch	:	(0-750 mm HG)
- Bacterial Filter & Traps	:	2 Nos.

The system to provide duplex/cascade vacuum system for automatically start and stop and 480 mm and 650 mm HG. Provision shall be made so that when one pump stops, the second pump is set to automatically start on the next starting pulse and vice versa. In the event any pump fails, the system would automatically revert to the other pump.

4.2 Vacuum Tank/ Reservoir:

One number welded type reservoir made of steel plate as per IS:2062 and fabricated as per IS:2825 for a vacuum pressure of 760 mm of mercury. The tank should be equipped with drain valve and vacuum gauge the inside of the tank should be coated for rust protection with a double component coating which should provide a hard, durable lining.

4.3. **BACTERIA FILTERS (AS PER HTM 2022)**

The bacteria filters should be designed for critical applications involving the removal of liquid, solid and bacterial contamination from the suction side of vacuum pump systems, preventing damage to the pump and the potential biological infection of the surrounding environment.

Filtration Performance exceeds requirements of HTM2022. Filter efficiency should be tested with a bacterial challenge test and BS: 3928 sodium flame test. It should be internally and externally epoxy coated, easily removable, sterilisable drain flask

5. **WAGD / ANESTHESIA GAS SCAVENGING SYSTEM (IMPORTED)**

The Anesthesia Gas Scavenging (AGS) System shall comply with NFPA 99 / HTM 02-01. the WAGD / AGSS system shall be a dedicated. Specifically designed active extraction and disposal system for waste anesthetic gas. It shall provide a maximum flow rate of 130 l/min with a 1 kPa resistance to flow. and a minimum of 80 l/min with a 4 kPa resistance to flow at each terminal unit. irrespective of the number of terminal units in use the AGS system shall use dedicated radial blowers in a simplex or duplex configuration. The AGS pump assemblies shall be skid mounted and included on the skid shall be the simplex or duplex pump. (s), motor control unit(s) with starter/isolator, moisture drain flask and flexible connector(s) to connect the plant to the pipeline, Each pump shall include an electric motor and directly coupled impeller assembly, Impeller bearings in the pump(s) shall not require lubrication. The pump(s) shall be air cooled and rated for continuous

6. **COPPER PIPE WITH REQUIRED COPPER FITTINGS**

6.1 **Medical Grade Copper Pipe (as per NFPA 99/LATEST HTM/CE MARKED AS APPLICABLE)**

All pipes shall be drawn half hard temp., solid drawn, seamless, phosphorous deoxidised, non-arsenic and degreased copper pipe conforming to EN 13348 Kite Marked

The supplies of copper pipe would be accompanied with manufacturers test certificate for the physical properties of copper pipes and their Chemical composition. The supply of pipes be further substantiated with **inspection certificate from the third party like KITE.**

The Pipeline will be laid as per NFPA 99.
Supply to the following sizes of pipe:

- i) 54 mm Outer Dia, 1.2mm thick
- ii) 42 mm Outer Dia, 1.2mm thick
- iii) 28 mm Outer Dia, 0.9mm thick.
- iv) 22 mm Outer Dia, 0.9mm thick.
- v) 15 mm Outer Dia, 0.9mm thick.
- vi) 12 mm Outer Dia, 1.0mm thick.

6.2 **Fittings:** All copper fittings shall be manufacture to the highest standards complying with EN1254-1. The fittings should be manufactured in accordance with EN 1254-1 and 4 (formerly BS 864: part 2). Copper pipes would be secured to wall with LDPE saddles or to ceiling fixed MS bracket wherever necessary.

6.3 **Brazing:** For copper joints, brazing material to be used will be silver-copper phosphorous alloy which shall be used without flux. For copper to brass joints 43% silver brazing rods with flux would be used. Flow of nitrogen gas would be provided to avoid oxidization inside the pipeline during brazing.

6.4 Fabrication

Cleaning: Before putting for erection all pipes, valves and fittings are cleaned and degreased.

Pipe and tube joints

For copper fittings in the copper pipeline, the brazing for copper joints shall be done without using flux and the material for jointing used will be silver-copper-phosphorous alloy. For brass joints for jointing outlet points and area/zonal valves material used is 43% silver brazing rod with specified flux. For installation of equipments threaded connections equipped with nut, nipple & adaptors are used.

Bends

All bends are made of copper pipe of higher dia than the pipe requiring change of direction and these bends will be made out of thicker size pipe to avoid thinning and flattening at any point.

Erection:

The erection of the copper pipe shall be done only after cutting the pipes to size as per site requirements. It does not leave any scope for springing.

Supports:

To avoid weight of the pipe on the joints supports (saddles made of LDPE material) are provided at a distance of every 4-6 feet as prescribed by HTM-2022 and NFPA 99.

6.5 Testing

Blowing:

After erection all the pipes are blown with nitrogen or compressed air. This blowing of the pipeline with nitrogen or compressed air under pressure clean the pipeline thoroughly.

Joints tests:

The entire pipeline after erection is put to test for checking leakage of brazing joints at a pressure one and a half times of the working pressure for 24 hours. In case of drop in pressure the joints are examined with soap solution.

Final test:

After repairing the joints in case leakages are found, the pipeline shall again be put to test with compressed air at a pressure of one and a half times the working pressure for 24 hours and then thereafter entire pipeline will be tested with specific gas for ant-confusion tests.

6.6 Painting

All pipes after laying shall be painted as per colour specification "IS CODE" 2379:1963 amended 1990.

1.1 7. VALVES WITH VALVE BOX AND PRESSURE GAUGE CE Marked.

Area service unit module should consist of 1 to 5 AVSU(Area Valve Service Units). It should incorporate a valve with NIST connection at either side. The valve boxes would be made of Zinc coated Mild Steel and shall be powder coated for housing area/zonal valves. The valve box would be lockable having glass cover, the valve will be complete with stub pipes that extend to the outside of the box to enable easy connection to the MGPS. The valve box should be equipped with gauge for the gases.

8. COMBINED ELECTRICAL CONTROL PANEL FOR COMPRESSOR AND VACUUM PUMPS

Electrical control panel is made of MS Sheet having thickness 16 SWG and should be epoxy powder coated. The electrical control panel would be equipped with auto manual selector, 2 nos. Star-Delta starters each compatible to 15 HP motors for compressors and 2 nos. DOL starters compatible to 7.5 HP each electric motors for Vacuum pumps.

The electrical control panel would be further equipped for duplex/cascade system for vacuum pumps & Air Compressors and also be equipped with safety equipment for the air compressors. Safety equipment for air compressors would include temperature controller, temperature indicator.

9. BED HEAD PANEL CE Marked.

The bed head panel is made of high strength extruded aluminum. It is powder coated to make it aesthetically appealing and long lasting. The panel is divided into different sections to segregate low voltage, high voltage and medical gas chamber. The panel consist of special railings to hang various items like humidifier bottles, vaccine basket, examination lamp, suction jar, IV pole, etc. which facilitates patient treatment.

The bed panel should have provision for Medical Gas outlet points (2 Gas outlet, 3 gas outlet, 4 gas outlet as per requirement) and Nurse call system, It should be equipped with Electrical Switch Socket of 5/15 Amp., data socket and Telephone socket.

Make:- MPS /Supreme / Maxon Healthcare

10. MEDICAL GAS ALARM CE Marked.

1. Area alarm and Main Alarm/ Master Alarm

The Medical Gas alarm should be capable of monitoring up to 6 medical gas services by mean of pressure sensors which detect deviation from the normal operating limits of either pressure or medical vacuum. The area alarms should have a digital display of pressure and should be displayed by standardized coloured LED's. It should have audible Alarm for high – caution – normal – caution – Low). It should have programming facility from front panel. Facility to connect to remote alarm box by potential free contacts provided in the alarm box. Operated by 230V ac power supply.

The alarm limits: High, caution, Normal, Caution, Low limits are set as below at factory testing:

FOR 1,2,3 Channels: (PSI)

HIGH	:75	RED
CAUTION(nH)	:70	Yellow
NORMAL (n)	:60	Green
CAUTION (nL)	:50	Yellow
LOW (L)	:45	Red

For Vacuum Channel : (mmHg)

NORMAL (n)	:450	Green
CAUTION (nL)	:300	Yellow
LOW (L)	:250	RED

ALARMS ACKNOWLEDGE RESETTIME: Factory setting 10 minute.

Pneumatic Service Selection:

Factory setting all 4 Pneumatic are activated (unless specification mentioned in the order).

Pressure switch for High & Low pressure signals:

Pressure switches as sensing devices in audio visual alarms for Oxygen, Nitrous Oxide & Compressed Air System. Pressure switches are equipped with NO/NC contacts. These are properly cleaned & fit for use with medical gases. These would be used with 220V Ac electric supply & have a rating upto 15 Amps, tested with 100 & 200 PSIG pressures.

The pressure switch constructed of a rugged cast, weather proof housing with mounting bracket, and a 1/4" BSP gas service line connection at the bottom of the assembly.

Vacuum Switch:

Vacuum switches used to make cut in or out connections on either increasing or decreasing vacuum. These would be cleaned for use with medical gases & have a adjustable range upto 29" of mercury vacuum. It has both NO & NC contacts & fit for use with 230V electric supply.

The vacuum switch constructed of a rugged cast, weather proof housing with mounting bracket, and a 3/8" BSP gas service line connection at the bottom of the assembly.

11. FLOOR ISOLATION VALVE

It should having ball type valves with PTFE seat Brass body with Nickel plating valves having quarter turn handle opening. Size suitable for 12mm OD copper pipe to 54mm OD copper pipe should have brass adopter suitable for copper pipe. The valve are designed for a working pressure of 27" Hg vacuum to 300 psi.

12. MEDICAL GAS OUTLET POINTS/ TERMINAL UNIT FOR OXYGEN, N2O, COMPRESSED AIR AND VACUUM, WAGD (IMPORTED) as per NFPA 99 /HTM 02-01, UL Listed /CE Marked with notified body No.

The outlets shall be modular singles, and shall incorporate nameplate color-coding in accordance with NFPA 99./ HTM 02-01 The single modular outlets shall be of a design that provides for ganging of rough-in plates in the field to form multiples. The gas services shall be sequentially arranged and located as shown on the plans with a minimum centerline spacing of 5 inches (12.5 cm) between outlets. The outlets shall be capable of supporting dispensing equipment without the use of slide brackets.

The medical gas outlets shall be designed so that, once installed, routine service of both the primary and secondary check valves can be accomplished without removing the nameplate or gas specific portions. The primary check valve shall be unitized and of the cartridge type. So that the primary check valve can be removed for service without shutting off the gas supply to the outlet, the secondary check valve shall operate automatically to stop the free flow of the pressure gas. There shall be no secondary check for vacuum or gas evacuation service. Medical gas outlets that require the removal of the nameplate or gas specific components for routine service shall not be acceptable. The outlets shall incorporate the following features:

- UL Listed to UL 1331 and CSA Z9170-1.
- Conforms to NFPA 99 and CGA standards
- Accepts DISS gas specific nut & nipple adapters
- Ease of maintenance without removing the faceplate using a cartridge insertion tool.
- Compensates for variation in wall thicknesses from ½" to 1 ¼"
- Modular design
- All outlets are 100% tested for flow and leaks
- Nameplate color coding per NFPA 99
- 5" centers
- 360° swivel inlet tube
- Metal back and nameplate
- Strength of connections provides support for dispensing equipment without the use of additional brackets
- Made in the U.S.A.

The outlet nameplate shall be permanently color coded with a durable scratch-resistant and protective label. The outlet trim plate shall be durable plastic or powder coated aluminum, attached with the nameplate to the rough-in assembly, and provide automatic plaster adjustment from 1/2 to 1-1/4 of an inch (1.3 to 3 cm). The outlet's rough-in supply tube shall be a 7 inch (18 cm) length of 1/2" O.D. copper Type K for all gas services and labeled with the name of the gas service.

Medical gas outlets shall be cleaned for oxygen service in accordance with the current Compressed Gas Association (CGA) Pamphlet G-4.1, capped and placed in a protective container for shipment. The outlets shall be installed in strict accordance with manufacturer's instructions, and tested before use in conformance with local and federal codes.

13. OTHER MEDICAL PIPELINE ACCESSORIES

13.1 Oxygen Flow Meter with humidifier bottle CE Marked.

The flow meter must be constructed with chromium plated brass body, extremely robust, to take care of the day to day usage demand. Flow meter cartridge type knob : easy to maintain, offers optimum adjustment quality and superior designing and engineering to provide high level of accuracy, with no significant affect from restrictions caused by down-stream equipments. The flow meters should be 0-15 LPM range for oxygen. Humidifier bottle should be unbreakable, reusable to disinfectants and complements. It should be autoclavable at 134 degree centigrade

and made of polycarbonate material. The capacity of the bottle should be approximately 200ml.

13.1 High pressure tube for O₂, N₂O, Compressed Air & Vacuum

The high pressure tube should be made of antistatic rubber as per ISO standards and colour coded white for Oxygen, Blue for N₂O, Yellow for Vacuum and Black for Compressed Air.

13.2 Ward Vacuum Unit with Regulator CE Marked.

Consisting of one no. Suction Regulator connected with 1000/600 CC pot of collection. The jar and the lid are made of polycarbonate which are autoclavable and unbreakable. The jar is fitted with an overflow safety trap & the regulator fitted with an ON/OFF valve and a knob to regulate the online suction.

13.3 Theater suction Trolley with Regulator for Operation theaters CE Marked.

It is equipped with two polycarbonate jars of 2000 CC each having lid and float assembly. Mounted on a dormodule type trolley fitted with free running castors. It would be fitted with a vacuum regulator, gauge and overflow safety trap and a three way valve to control the suction either in left jar/right jar/both the jars.