

**Ministry of Health & Family Welfare
(GOVERNMENT OF INDIA)
Ministry of Health & Family Welfare
Nirman Bhavan, Maulana Azad Road
New Delhi – 110011**

Tender for

**Design, Supply, Installation, Commissioning
of Medical Gas Pipeline and Manifold System
for Nizam's Institute of Medical Sciences,
Hyderabad
under PMSSY**

**Volume -IV
Technical Specification**

Tender No. MoHFW/HSCC/PMSSY/HYD /MGMS/2010

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Consultant

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Technical Specifications
For Medical Gases Pipeline System

A. Oxygen System

1. Oxygen Manifold - Imported

The Oxygen Manifold shall be size of 20+20 bulk cylinders. Manifold shall consist of two high-pressure header bar assemblies to facilitate connection of primary and secondary cylinder supplies. Each header bar shall be provided with 10 numbers of cylinder pigtail connections to suit cylinders valves as per IS 3224 incorporating a check valve at the header connection. The high-pressure header bar shall be designed in such a manner that it can be extended to facilitate additional cylinder connections. Each Header bar assembly shall be provided with a high-pressure shut-off valve.

The manifold should be so designed that it shall suit easy cylinder changing and positioning.

The cylinder should be placed with the help of cylinder brackets and fixing chains which should be zinc plated.

The manifold should be suitable to withstand a pressure of 140 kg/cm². The manifold should be tested (hydraulically) at 3500 psig pressure and to be supplied along with necessary test certificate.

The oxygen manifold system shall be compatible to allow integration with the Liquid Oxygen Tank.

2. Fully Automatic Control Panel (for Oxygen) - Imported

The Oxygen Control Panel shall be of microprocessor based and preferably Digital Display Type. Pressure reduction shall be in two stages. Panel shall be integrated with pressure gauges inside panel on down stream of pressure regulator. Panel shall be fitted with standby line regulator. Line regulators shall have pressure relief mechanism for testing and servicing purpose.

Panel shall be full automatic and shall switch over from 'Bank in Use' to Reserve Bank' without fluctuation in delivery line pressure and without the need of external electrical power. After the switch-over the "Reserve Bank" shall become the "Bank in Use" shall become the "Reserve Bank". The Control Panel will be powered by a microprocessor.

A Microprocessor circuit board assembly shall provide a relay output to give indication when or just before the manifold switches from one bank of cylinders to another. The switch over shall be mechanically controlled, not electrically.

To avoid excess pressure being supplied to the distribution system, a pneumatically relief valve for the line regulator shall be incorporated. An intermediate pressure relief valve shall be installed between the high-pressure regulators and the line delivery regulators.

The Control panel incorporates six coloured LED - three for the left bank and three for the right bank. Green for Bank in use. Amber for Bank ready and Red for Bank empty. Both the left and

Right bank pressures and the main line pressure should be displayed on the front door of the cabinet by means of LED's. All pressure transducers, micro switches, and display LED's shall be pre-wired to an internal microprocessor circuit board.

All components inside the Control Panel like Pressure Regulators, piping and control switching equipment shall be cleaned for Oxygen Service and installed inside the cabinet to minimize tampering with the regulators or switch settings.

The control Panel should be made to provide Heavy Duty with a Flow capacity of over 1000 lpm at 60 psig.

3 Oxygen 10+10 Cylinders Emergency System – Imported

It should have emergency arrangement of 10+10 cylinder configuration with Copper Tai Pipes, Non-Return Valves & High flow regulator with pressure gauges for Cylinder & line pressure and safety valve. Pressure regulator shall be detachable from the manifold.

4 Terminal Units (Gas Outlets) with probes/Adaptors - Imported for O₂, N₂O, C Air, Vacuum & AGSS.

Outlets shall be manufactured with a 165mm long Copper inlet pipe stub which is silver brazed to the outlet body. The inlet pipe should be capable of swiveling by 360 degrees for enabling the same to be connected to the pipeline system.

Outlet shall be equipped with a primary and secondary check valve and the secondary check valve shall be rated at minimum pressure of 200 psi. In the event the primary check valve is removed for maintenance there should not be any leakage (on-line maintenance should be possible w/o disrupting the functioning of other outlets). Outlet bodies shall be gas specific by indexing each gas service to a gas specific dual pin indexing arrangement on the respective identification module.

There should be push button release mechanism for disconnecting apparatus accessible from top, bottom and side of outlets.

A large color-coded front plate shall be used for ease of gas identification and aesthetic appeal.

With the back rough in mounted the outlet shall adjust up to 25mm variation in wall thickness.

The latch valve assembly should accept only corresponding gas specific adaptors.

All outlets shall be cleaned and degreased for medical gas service, factory assembled and tested.

5. Oxygen Flow meter with Humidifier Bottle - Imported

Black Pressure Compensated flow meter should be of accurate gas flow measurement with following features:

- A) Control within a range of 0-15 LPM .
- B) It should meet strict precision and durability standard .

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- C) The flow meter body should be made of brass chrome plated materials.
 - D) The flow tube and shroud components should be made of clear, impact resistant polycarbonate.
 - E) Flow tube should have large and expanded 0-15 LPM range for Improved readability at low flows.
 - F) Inlet filter of stainless steel wire mesh to prevent entry of foreign particles
 - G) The humidifier bottle is made of unbreakable & reusable polycarbonate material and autoclavable at 134 degree centigrade

**6. High pressure tube - Imported
for O₂, N₂O, C.Air, Vacuum & AGSS**

It should be imported colour coded for individual services i.e. white for Oxygen, Blue for N₂O and Yellow for Vacuum, Black for C.Air antistatic rubber tube as per ISO standards.

7. Oxygen Cylinders : - (D Type)

- Gas : Medical Oxygen
 - Capacity of Gas : 7.00 CUM
 - Capacity of Water: 46.7 ltrs.
 - Standard : one to IS : 7285, BS : 1045
 - Working Pressure : 150 KGF/CM²
 - Test Pressure : 250 KGF/CM²
 - Outside Diameter : 232 mm
 - Wall Thickness : 5.5 mm
 - Length : 1370 mm
 - Tear Weight: 54 kg. (approx.)
- The vales fitted to these cylinders should confirm to specification IS:3224 & IS:3745
 - The Cylinder being offered should be manufactured within the country or imported from abroad and should conform to IS Specification 7285 and BS 5045 Part I respectively
 - They should also have approval of the Chief Controller of Explosives, Govt. of India, Nagpur
 - Each Cylinder Shoulders should be stamped with GG : Symbol for Gas, Mfgr. : Identification Mark, MMY Y : Month & Year of Hyd. Test, XYZ : Serial No. of Cylinder, IS 7285: B.I.S. Specification, TW : Tear Weight, TP : Test Pressure FP:

8. Liquid Oxygen Container:-

Capacity - 10,000 liters. It will consist of double wall made of stainless steel and carbon steel. It should be fitted with standard accessories. Inspection certificate should be submitted along with bid.

B Nitrous Oxide System

1 N₂O Manifold - Imported

The N₂O Manifold shall be size of 6 + 6 bulk cylinders. Manifold shall consist of two high-pressure header bar assemblies to facilitate connection of primary and secondary cylinder

supplies. Each header bar shall be provided with 10 numbers of cylinder pigtail connections to suit cylinders valves as per IS 3224 incorporating a check valve at the header connection. The high-pressure header bar shall be designed in such a manner that it can be extended to facilitate additional cylinder connections. Each Header bar assembly shall be provided with a high-pressure shut-off valve.

The manifold should be so designed that it shall suit easy cylinder changing and positioning.

The cylinder should be placed with the help of cylinder brackets and fixing chains which should be zinc plated.

The manifold should be suitable to withstand a pressure of 140 kg/cm². The manifold should be tested (hydraulically) at 3500 psig pressure and to be supplied along with necessary test certificate.

2. Fully Automatic Control Panel (for N₂O) - Imported

The N₂O Control Panel shall be of microprocessor based and preferably Digital Display Type. Pressure reduction shall be in two stages. Panel shall be integrated with pressure gauges inside panel on down stream of pressure regulator. Panel shall be fitted with standby line regulator. Line regulators shall have pressure relief mechanism for testing and servicing purpose.

Panel shall be full automatic and shall switch over from “Bank in Use” to Reserve Bank’ without fluctuation in delivery line pressure and without the need of external electrical power. After the switch-over the “Reserve Bank” shall become the “Bank in Use” shall become the “Reserve Bank”. The Control Panel will be powered by a microprocessor.

A Microprocessor circuit board assembly shall provide a relay output to give indication when or just before the manifold switches from one bank of cylinders to another. The switch over shall be mechanically controlled., not electrically.

To avoid excess pressure being supplied to the distribution system, a pneumatically relief valve for the line regulator shall be incorporated. An intermediate pressure relief valve shall be installed between the high-pressure regulators and the line delivery regulators.

The Control panel incorporates six coloured LED three for the left bank and three for the right bank. Green for Bank in use. Amber for Bank ready and Red for Bank empty. Both the left and Right bank pressures and the main line pressure should be displayed on the front door of the cabinet by means of LED’s. All pressure transducers, micro switches, and display LED’s shall be pre-wired to an internal microprocessor circuit board.

All components inside the Control Panel like Pressure Regulators, piping and control switching equipment shall be cleaned for N₂O Service and installed inside the cabinet to minimize tampering with the regulators or switch settings.

The control Panel should be made to provide Heavy Duty with a Flow capacity of over 1000 lpm at 60 psig.

3 **N2O 2+2 Cylinders Emergency System**

– Imported

It should have emergency arrangement of 2 + 2 cylinder configuration with Copper Tai Pipes. Non-Return Valves & High flow regulator with pressure gauges for Cylinder & line pressure and safety valve. Pressure regulator shall be detachable from the manifold.

4. **Nitrous Oxide Cylinders**: - (D Type)

- Gas : Nitrous Oxide
 - Capacity of Gas: 30 Kg.
 - Capacity of Water: 45.0 ltrs.
 - Standard : one to IS : 7285, BS : 1045
 - Working Pressure : 150 KGF/CM²
 - Test Pressure : 250 KGF/CM²
 - Outside Diameter : 232 mm
 - Wall Thickness : 5.5 mm
 - Length : 1380 mm
 - Tear Weight: 53 kg. (approx.)
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- The vales fitted to these cylinders should confirm to specification IS:3224 & IS:3745
 - The Cylinder being offered should be manufactured within the country or imported from abroad and should conform to IS Specification 7285 and BS 5045 Part I respectively
 - They should also have approval of the Chief Controller of Explosives, Govt. of India, Nagpur
 - Each Cylinder Shoulders should be stamped with GG : Symbol for Gas, Mfgr. : Identification Mark, MMY : Month & Year of Hyd. Test, XYZ : Serial No. of Cylinder, IS 7285: B.I.S. Specification, TW : Tear Weight, TP : Test Pressure FP:

C Compressed Air System

- Imported

- a. The medical air compressors shall be of the totally oil less reciprocating air cooled design. Connecting rod and bearings shall be packed with lifetime lubrication and sealed.
- b. Each compressor shall be belt driven by a suitable HP , 3 phase, 50 cycle, 415 volt, ODP NEMA construction motor. Slide bases for convenient belt tension adjustable and totally enclosed OSHA approved belt guards shall be provided.
- c. The capacity of each compressor module at 50 PSIG should be 58 SCFM. Each compressor should be belt driven by a 15 HP, drip proof type motor for operation on 220 Volts 60 Hz-3 phase.
- d. The system shall include individual compressor inline intake filters, discharge check valves of bronze construction, safety relief valves, bronze intake and discharge flexible connectors safety relief valves, bronze intake and discharge flexible connectors, solenoid unloaders, isolation valves, air cooled after coolers for each compressor, high discharge temperature shut down switches on each cylinder , pressure control switches, as well as copper tubing with shut-off cock for gauge and switches. The system shall include a 3000 ltrs. Pressure storage tank of ASME construction rate fro 200 psci MWP service. 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. The inside of the tank shall be coated for rust protection with a two component coating which provides a hard, durable lining,. Provide spring vibration isolators for each compressor.

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- e. The system shall include a UL listed control panel in a NEMA 12 enclosure with the following access ores for each pump.
 - f. Externally operable fusible disconnect with door interlock control circuit transformer with fused primary and secondary coils, H-O-A switch magnetic starter with 3 leg overload protection, hour meter and motor running light. Provide the panel with a multiple position selector switch for selection of normal operation (automatic alternation) or manual selection of lead and lag pumps if one of the pumps is taken out of service due to scheduled maintenance,. Provide audible and visual local alarm (complete with indicating lights and individual sets of auxiliary contact wired to the terminal strip for remote alarm indication) for the following compressor temperature malfunction and reserve compressor in use. Provide manual reset for thermal malfunction shutdown. All control and alarm functions shall remain energized while any compressor in the system remains electrically on-line. The lag compressor shall be able to start automatically if the lead compressor fails to operate.
 - g. Dual desiccant air dryers, 0.5 micron pre-filters, dual 0.5 micron after filters, line pressure regulating valves, dew point monitor, Co monitor and other accessories required to meet and exceed the current code requirements shall be mounted on the compressor system base.]
All components shall be completely pre-piped and pre-wired to single point service connections as per latest international standards.
 - h. There shall be two identical banks of air treatment equipment, piped in parallel and proved with valves to by pass either filter set for element replacement, maintenance and repair work on one of the sets while still treating medical compressed air through the other set without any sacrifice in air quality. Each bank should consists of three stages of treatment.
 - i. The first stage is a prime efficiency coalescer the particle removal down to 0.5 micron with 99.9999% retention. This filter removes aerosols and solid particles. The filter is equipped with electronic drain and element change indicator.
 - j. The second stage is a desiccant heatless air dryer. Equipment with purge control Built in purge saver control will automatically minimize and adjust the amount of purge air to match the variable airflow. The dry compressed air is discharged from the On line tower into the third stage.
 - k. The third stage is a prime efficiency particulate after filter with particle removal down to 0.5 micron The after filter element is provides high particle rete4ntion, low pressure drop and long element life.
 - l. Down stream pressure regulators will maintain constant discharge pressure of 55 PGIS (field adjustable)
 - m. Digital dew point and CO monitors with alarm set points at + 39 degree F and 10 PPM are provided with dry contacts for connection to remote alarm panels. A demand check for maintenance should as per current code requirements of latest international standards.

D Vacuum System

- Imported

- a. The Stack Mounted Quadruplex Medical Vacuum System shall consist of four electric motor driven pumps, a Vertical ASME receiver and a U.L listed Quadruplex electrical control system mounted in a NEMA 12 enclosure.
- b. The package shall include lubricated rotary vane vacuum pumps and associated equipment, one vertical ASME tank and one control panel. The only field connections required would be system intake, exhaust and power connection at the control panel. All components shall be completely pre-piped and pre-wired to single point service connections. All interconnecting piping and wiring shall be completed and operationally tested at the site of manufacturer. Provide liquid tight conduit, fittings and junction boxes for all control and power wiring.

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- c. The medical vacuum pumps shall be of the rotary vane air cooled design with integral, fully recirculating oil supply and sight gauge to indicate oil level. The oil separation system shall be integral and shall consist of no less than four stages of internally installed oil and smoke eliminators. The system shall be capable of removing 99.9 of oil and smoke particles from the exhaust. Each pump shall include a built in anti suck back valve mounted at the pump inlet and each pump shall be quipped with three non – asbestos vanes, each having a minimum life of 30000 to 40000 hours.
 - d. The capacity of each pump shall be 172 SCFM when direct driven 25 Hp, TEFC motor, operating on Volts 60 Hz.
 - e. The system shall include the following accessories for each pump, inlet check valve, inlet isolation valve, inlet isolation valve, vacuum control switch, oil temperature gauge, thermal malfunction switch and vacuum control switch. Provide flexible connectors on inlet and exhaust of each pump, exhaust tee with union, drip-leg with cock valve as well as copper tubing with shut-off cock for gauge and vacuum switches. The system shall include a 3000 liters vacuum storage tank of ASME construction. The tank shall be rated for full vacuum services and shall be equipped with a valve by pass vacuum gauge and manual tank drain. The inside of the tank shall be coated for rust protection with a two component coating which provides a hard, durable lining.
 - f. Provide vibration mounting per NFPA 99.
 - g. The Underwriters Laboratories listed Triplex electrical motor control system shall be of a fuseless design in a NEMA 12 (dustproof) enclosure. The system shall include a UL Listed control panel in a NEMA – 12 enclosure with the following accessories for each pump.
 - h. Externally operable fusible disconnect with door interlock, control circuit transformer with fused primary and secondary coils, HO-A switch, magnetic starter with 3 leg overload protection, hour meter, motor running light and minimum run timer to prevent short cycle operation.
 - i. Provide the panel with a plug-in type programmable controller with removable terminals to allow quick and easy replacement in the field. The system should be designed to function even if the programmable controller fails. IF one of the pumps is out of service the system control shall omit the pump from the alternating cycle, automatically alternating between the remaining pumps only. The system shall revert to normal alternation automatically when the condition is corrected. In addition to standard automatic alternation, the system shall be equipped with forced time alternation in the event that the 4 pump is unable to satisfy the demand in 30 minutes. The system shall be quipped with a flashing light pump failure alarm/shutdown at any of the following conditions, motor overload tripped, main disconnect is off, blown fuse, control transformer failure, starter coil failure, HOOP-A is off.
 - j. Provide audible and visual local alarm (Complete with indicating lights and individual sets of auxiliary contacts wired to the terminal strip for remote alarm indication) for the following : “vacuum pump thermal malfunction and reserve vacuum pump in use. Provide manual reset for thermal malfunction shut-down. All control and alarm functions shall remain energized while any vacuum pump in the system remains electrically on – line. The lag vacuum pump shall be able to start automatically if the lead vacuum pump fails to operate.

2 Ward Vacuum Unit

- Imported

The Ward Vacuum Unit should be only Digital and color coded display type regulator having large, easy to read gauge providing unmatched gauge accuracy $\pm 1\%$ of full scale color coded

range and should have no analogue mechanism. The unit should have 3-Mode High feature and equipped with push to set technology which should automatically establish vacuum limit with each vacuum level setting. A unique dual spring regulator module ensure precision in the critical care range (0-200 mmhg) while also providing unusually fast adjustment with in 2 turns of the knob up to full wall vacuum instantly facilitating regulated and continuous suction for tracheal and pharyngeal airway management, surgical procedure and continuous nasogastric drainage. The ward vacuum unit should be equipped with max mode features which should facilitate unrestricted full time vacuum for emergency providing range of 0-760mm hg). The unit should be equipped with Positive Pressure Relief Valve to protect patient and unit both in case if accidentally connected to pressurized gas (O₂, Air etc.)

The unit should be made of rugged, shatter-resistant ABS case and corrosion & lubrication free having service free back plate

The Unit should have following :

- High Three Mode Continuous
Modes I(On), O(Off), MAX
Gauge : High Vacuum (0-760mm Hg)
Regulated Vacuum 0-Full Vac
Instantaneous Full Wall Vacuum Mode
Recommended for OR/ER use

The Ward Vacuum Unit should conform to ISO 19979-3 and ASTM F 960.

Suction Jar Should have the following - Imported

The 1200 ml Suction Jar Should be capable to autoclave up to 160 degree C.

All seals and splatter tube should be in silicone for long life.

The filter trap in the jar Should be designed to ensure maximum efficiency in preventing overflow and incorporates design features to ensure the breakdown of foam.

3) Theatre Suction unit - Imported

A sturdy trolley with 5 castor base complete with angled high suction controller. The unit should be powered from the medical vacuum supply and with 5 meter of vacuum hose and matching probe suitable for vacuum outlet. It should have two secretion jars with below mentioned specifications.

Vacuum Regulator (Continuous/Intermittent) should have the following:

The Vacuum Unit should be only Digital and color coded display type regulator having large, easy to read gauge providing unmatched gauge accuracy $\pm 1\%$ of full scale color coded range and should have no analogue mechanism. The unit should have 3-Mode High feature and equipped with push to set technology which should automatically establish vacuum limit with each vacuum level setting. A unique dual spring regulator module ensure precision in the critical care range (0-200 mmhg) while also providing unusually fast adjustment with in 2 turns of the knob up to full wall vacuum instantly facilitating regulated and continuous suction for tracheal and pharyngeal airway management, surgical procedure and continuous masogastric drainage. The ward vacuum unit should be equipped with max mode features which should facilitate unrestricted full time vacuum for emergency providing range of 0760mm hg). The unit should be equipped with Positive Pressure Relief Valve to protect patient and unit both in case if accidentally connected to pressurized gas (O₂, Air etc.)

The unit should be made of rugged, shatter-resistant ABS case and corrosion & lubrication free having service free back plate

The Unit should have following :

- High Three Mode Continuous Modes I(On), O(Off), MAX
- Gauge : High Vacuum (0-760mm Hg)
- Regulated Vacuum 0-Full Vac
- Instantaneous Full Wall Vacuum Mode
- Recommended for OR/ER use

The Vacuum Unit should conform to ISO 19979-3 and ASTM F 960.

Suction Jars should have the following:

- Imported

The 3200 ml Suction Jar made of polysurthane should be capable to autoclave up to 160 degree C. All seals and splatter tube should be in silicone for long life. The filter trap in the jar should be designed to ensure maximum efficiency in preventing overflow and incorporates design features to ensure the breakdown of foam.

E. Anesthetic Gas Scavenging System

- Imported

The Duplex Medical Vacuum System must be fully compliant with the latest edition of NFPA 99 standard and should be suitable for anesthetic Gas Scavenging for 5 nos. Operation Theatres, 1 minor OT< MRI Room and CT Scan Room. One pump should be stand by with the other in operation.

The package should consist of two oil less rotary vane vacuum pumps, a control panel and a receiver all mounted on a common base frame.

Vacuum Pump

- Each Vacuum pump shall operate completely dry and shall be equipped with self lubricating carbon / graphite vanes.
- Bearings shall be permanently lubricated and sealed.
- No oil shall be permitted in any pump.
- Each pump should be completely air cooled and have absolutely no water requirements.
- Each pump should have a 5 micron inlet filter and should be equipped with a vacuum relief valve, check valve to prevent back-flow through off-cycle units, flexible connector, isolation valve and vibration isolators at each mounting location
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The receiver should be ASME coded, rate for a minimum 150 psig design pressure, having 30.42 cfm capacity and have a three valve by pass system to allow for draining of the receiver without interrupting the vacuum service.

Control System

- The duplex control system should be NEMA 12 and UL labeled.
- The control system should provide automatic lead/lag sequencing with circuit breaker disconnects for each vacuum pump with external operators, full voltage motor starters with overload protection, control circuit transformers, visual and audible reserve unit

alarm with isolated contacts for remote alarm hand off auto lighted selector switches and runtime hour meters.

- A programmable logic controller (PCL) should control the automatic alteration of both vacuum pumps with provision for simultaneous operation if required, and automatic activation of reserve unit if required.

F Zonal Valve - Imported

The Zonal valve should have a bronze body, and a blowout proof stem. The zonal valve ball should be bronze chrome plated, and the seats and packing should be Teflon (PTFE). Each valve in valve box should have a pressure rating of 600 psig, meet NFPA standard and be hydrostatically tested. Type "K" copper pipe extensions that are cleaned for medical gas service should be fitted into each side of the valve. A gauge port should be drilled into one of the pipe extensions for the purpose of inserting a gauge. The gauges should have a 2" (50 mm) dial, be ASME B40.1 Grade B. The valve assembly should be plugged or capped to prevent contamination.

G Copper Piping - Indigenous

- 1.1 **Copper pipes (material):** Copper Pipes used should be solid drawn, seamless, deoxidized, non arsenical, half hard, tempered and degreased, manufactured as per EN 737/BS 2871 part I, Table -X of 1971 and chemical composition as per BS-6017 of 1981, Table 2, Cu-DHP.

The supplier should provide Manufacturer's Test Certificate of copper pipes for physical properties and chemical composition. Further, the pipes should be tested by a reputed third party i.e. Lloyds Register Services and certificates for the same should also be furnished.

Pipe sizes should be used as per HTM 2022 standards:

76mm OD X 1.2mm thk
54mm OD X 1.2mm thk
42mm OD X 1.2 mm thk
28mm OD X 0.9 mm thk
22mm OD X 0.9 mm thk
15mm OD X 0.9 mm thk
12mm OD X 0.7 mm thk

Pipeline Installation: Before erection, all copper pipes, valves, fittings like bends, tees, reducers etc. should be cleaned for dirt, and Should be degreased.

Proper pipe cutters, and bending machine should be used during installation of copper pipes.

All copper pipes and fittings like bends, Tees, reducers and straight couplings Should be as per BS 864 and joined by silver brazing method for copper to copper. Inert gas welding technique should be used by passing Nitrogen gas inside the copper pipes during silver brazing, in order to avoid carbon deposition inside the copper pipes. Copper pipes of the diameter up to 42mm OD Should be installed on the wall with the help of plastic saddles at the required span, as per HTM-2022 of U.K. and metallic white powder coated clamps Should be used for pipe sizes above

54mm OD. Wherever the pipes cross brick walls, it should be covered with plastic pipes. All pipes should be installed without springing or forcing. All pipes should be protected against mechanical injury in a manner satisfactory to authorities having jurisdiction.

Test: After erection, all the pipes should be cleaned or purged with the help of dry nitrogen gas, & Should be tested with dry nitrogen at a pressure of 10 Bar for 48 hours.

Painting: All installed pipes should be painted with two coats of synthetic enamel paint & colour codification as per IS-2379 of 1963.

H & I Master Alarm/ Area Alarm

- Imported

- a. The Master and area alarms as per required locations.
- b. Alarm shall be microprocessor based with individual microprocessors on each area display and sensor board. The sensors shall be capable of local or remote mounting. Each area display module / sensor unit shall be gas specific. With an error message display for an incorrect connection.
- c. The Alarms shall be filed expandable with the addition of extra modules. Up to six services can be accommodated per standard box.
- d. Each specific service shall be provided with an LED digital read out comprising of 0-250 psi for positive pressure and 0-30 inch Hg for vacuum. The digital read out shall provide a constant indication of each service being measured. A bar graph trend indicator shall be provided for each service indicating a green "NORMAL" yellow CAUTION and a red "HIGH" or "LOW" alarm condition. Under normal operation the bar graph display shall move up and down in the green range depending on service usage. IF an alarm occurs the RED alarm light should flash and the audible alarm should sound. Pushing the ALARM SILENCE" button should cancel the audible alarm should sound. Pushing the ALARM SILENCE Button should cancel the audible alarm but the unit should remain in the alarm condition until the problem is rectified.
- e. The default set points shall be +/-20% variation from normal condition.
- f. In the calibration mode the following parameters shall be field adjustable.
 - High/Low set points.
 - Imperial / Metric Units
 - Repeat alarms enable / disable.
- g. Set points shall be adjustable by two on board push boards.
- h. In addition PUSH TO TEST & ALARM SILENCE buttons shall be easily accessible to operated and test the unit.
- i. Combination master/area alarms shall have no moving parts and shall require no maintenance after initial installation.

J Valve Box

- Imported

Each recessed zone valve box shall consist of the following components. A steel valve box which can house single or multiple shut-off ball valves with tube extensions. A three piece design valve, an aluminum frame, and a pull-out removable window.

The valve box shall be constructed of 18 gauge steel complete with a backed enamel finish.

The doorframe assembly shall be constructed of anodized aluminum and shall be mounted to the back box assembly by screws as provided . The removable front shall consist of a clear window with a pull out ring pre-mounted to the centre of the window.

Access to the zone shut off valves shall be by merely pulling the ring assembly to remove the window from the doorframe. The window can be reinstalled without the use of tools after the valve handles have been returned to the open position.

The window shall be marked with the following :-
CAUTION : MEDICAL GAS CONTROL VALVE
CLOSE ONLY IN EMERGENCY.

Valve shall be a 4 bolt design, bronze body, double seal, union ball-type, with Teflon(TFE) seats and Vinton seals, “O” ring packing, and ball which seals in both directions, blow out proof item, with a pressure rating of 2760 kPa(400 psig). Valves shall be operated by a lever-type handle requiring only a quarter turn from a fully open position to a fully closed position. All valves shall be equipped with type “K” washed and degreased copper pipe stub extensions of sufficient length to protrude beyond the sides of the box.

The entire valve body and pipe stubs shall be plated to a minimum of 25mm (1”) beyond the sides of the back box but in no instance shall the plating be extended to the ends of the pipe stubs. All pipe stub extensions shall be supplied with suitable plugs or caps to prevent contamination of the assembly prior to installation.

Each valve shall be supplied with an identification bracket bolted directly on to the valve body for the purpose of applying an approved medical gas identification label. A package of labels shall be supplied with each valve box assembly for application by the installer.

Valves shall be available with line pressure gauges, as required. Gauges shall be 51 mm (2”) diameter, with metal case and ring.

Pressure gauge shall read 0-700kPa (0-100 psig) for all gases except nitrogen, which shall read 0-2000 kPa (0-300 psig) and vacuum which shall read -100 kPa (0-30” Hg).

K Horizontal Bed Head Panel

- Imported

- Efficient, safe & Robust design in extruded aluminum section.
- Smooth, curved surfaces, and choice of base color and fascia plates.
- Unit should have integrated rail system to mount accessories & CE marked.
- The headwall system should be constructed of aluminum extrusions joined together to form a carcass suit the particular application. Unit shall be factory assembled for electrical and mechanical components.
- Segregation of services i.e. Low voltage supplies, High Voltage supply and Medical Gases shall be maintained throughout.
- Front fascia plate should be removable individually to access for respective service.
- Bed space management system with optional equipment rail.
- With all Equipment Rail mount Accessories.
- All Down drops shall be installed at one end preferably & Vertical drop installed at one end should be covered with Aluminum boxing with matching color.
- Entire pipe line shall run in continuous horizontal panels with no break for each unit & length as per area where it has to be installed.

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- Medical Gas Outlet.
 - Facility per unit as under :
 - 6/15 Amp Modular Electrical Sockets with switches – 6 sets.
 - IV Pole – 2 nos.
 - Vacuum Slide – 1no.
 - Sliding blocks – 2 nos.
 - Nurse Call System Module – 1 no.

L PENDANT

(i) Single Arm Moveable Pendant for Operation Theatre - Imported

The Ceiling Pendant Systems designed to provide convenient positioning of medical equipment, medical gas terminal units, electrical and speciality services. The Ceiling Pendants should comply with NFPA 99 , USA . The support arms should be extremely robust and revolve on high quality bearings, so that the pendant head glides smoothly and quickly to any desired position. Should be UL listed. (CE marked)

The Pendant should be available as follows :

- 1000 mm moveable arms each with 340 deg. Horizontal and vertical movements. Vertical movement should be motorised
- The weight carrying capacity of the arm should not be less than 200 Kgs.
- Each arm should be capable of 340 degrees of rotation, which can be easily adjusted to suit the desired mode of operation.
- The arms may be fitted with pneumatic brakes to prevent inadvertent movement.
- The Pendant Service Heads should have modular head. The head should be capable of accepting a range of shelves, draItrs and infusion poles or other accessories. The Pendant Head should support the range of Physiological Monitor Mounting Solutions.
- The Pendant Service Head should be supplied with medical gas terminal units and 5/15 Amps. Sockets. The medical gas outlets should be provided with pendant as per specification of gas outlets .
- Each pendant should have:
 - Oxygen Outlets– 2, Nitrous Oxide Outlet – 2, Air (4 bar) Outlets – 1, Air (7 bar) Outlets – 1, Vacuum Outlets– 2
 - Electrical Sockets – 8 nos.
 - Shelf with two rails one on each side – 1 no.& Monitor input & Output – 1no.

(ii) Rigid Retractable Type - Imported

The Pneumatic section of the column should be activated by a pneumatic cylinder mounted in the internal shell of the column, with the aid of a wall mounted switch or with a bull nose (head) mounted switch. The column can be lowered or raised to the desired position.

The upper and lower section shrouds should be made of 16 gauge 304 stainless steel with a # 4 satin finish and complete with:

- Removable access panel
- Stainless steel ceiling collar
- A heavy gauge steel mounting plate, equipped with console gas outlets for all medical gas connections above the ceiling line.

All devices should be factory installed on either the sides or on the bottom of the column housing by means of flexible hoses and flexible metal conduit. All threaded connections comply with NFPA,CGA and DISS recommendations preventing interchanging of connections.

All services should be pre-assembled and factory tested.

Standard dimensions are 13-9/16" X 13-9/16" [345 X 345 mm] for the upper section and 12" X 12" [305 X 305 mm] for the lower section. Electrical devices should be pre-wired, unless otherwise stated.

The Pneumatic Column accommodates:

- Pendant should be fitted with Gas outlets

Oxygen – 2 no, Nitrous oxide – 2 no, CA (4 bar) – 2 no Vacuum – 2 no, AGSS – 2 no

Electrical sockets (5/15 Amps.) without switches – 8 no

Infusion management system – 1 set

Heavy duty ceiling fixture – 1 set

Provision to fix data point – 2 no

Holder for vacuum collection – 2 no

Inspection light with arm and bracket for rail – 1 no

The Ceiling Column should be UL Listed to U.S. and Canadian safety standards.

Comply with NFPA-99.

Features

The Pneumatic Retractable ceiling column provides a modern efficient method of supplying gas and electrical services in surgery or special care areas.

For use in anesthetizing locations, the gas outlets are bottom mounted. Units for specialized care areas have side mounted outlets to facilitate the use of secondary equipment.

When not in use, it can easily be stored away by raising the telescopic section, to avoid possible accidental contact with medical personnel.

When required, the face of the column can be lowered to facilitate hook-up of services. The pendant can be extended up to 18 inches.