Technical Specification

CENTRALIZED MEDICAL GAS PIPELINE SYSTEM

A. OXYGEN SYSTEM

1.0	**Oxygen Manifold - 6 + 6**
1.1	Manifold shall consist of two high pressure header bar assemblies to facilitate connection of 6 nos. of primary and 6 nos. of secondary cylinder supplies. Each header bar shall be provided with 6 numbers of copper cylinder pigtail connections to suit cylinder valves as per IS.3224 incorporating a brass check valve at each of 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. The manifold should be suitable to withstand working pressure of 150 Kg/cm2.
1.2	Manifold Top Frame Header Bar should be fabricated from high pressure seamless copper pipe of size 15 mm OD x 10 mm ID with high pressure brass fittings made of free cutting brass. Each Manifold connection will be through non- return valve and high pressure copper tail pipes, made of high pressure seamless copper pipe of size 10 mm OD x 6 mm ID. The manifold should be so designed that it should facilitate easy cylinder changing and positioning. Middle frame with cylinder holding chains should be provided to hold cylinders safely. The manifold must be tested (hydraulically) at 3000 psig and necessary test certificates should accompany along with the supply. Non return valves supplied along with manifold. Inspection of manifolds & tail pipes must be done before carrying out the brazing of brass fittings at the end of the manifold to ensure compliance with specified pipe diameter and thickness.
2.0	**Oxygen Control Panel**
2.1	The Control Panel should be designed for uninterrupted Supply of medical gas with minimum human intervention.
2.2	Control panel should have two first stage regulators each capable of delivering 100 - 200 psig outlet pressure. Control Panel should have delivery flow capacity of minimum 1000 LPM at 60-70 psi pressure. Control Panel should have Piston Type Pressure Regulators.
2.3	Both the first stage regulators in the oxygen control panel should have non halogenated polymer in the high pressure side to ensure that there will be no ignition due to adiabatic compression.
2.4	40 micron filter should be provided at the inlet of each high pressure regulators of the oxygen control panel.
2.5	The first stage regulators should be connected to a common pre-set second stage regulator capable of delivering stable outlet pressure 60 to 70 psig.
2.6	The changeover from depleted cylinder bank to reserve cylinder bank should be automatic through pneumatic switching for uninterrupted supply to the medical gas network.
2.7	The automatic changeover mechanism should not be dependent on external power source.
2.8	The control panel should have digital display to indicate cylinder pressure in the two banks of the manifold and final delivery / line pressure.
2.9	The control panel should have audio-visual signal lamp or alarm for indication of Cylinder Bank Status.
2.10	The audio-visual signal lamp or alarm should work on low voltage, preferably 12 VDC or less.
2.11	The control panel shall have suitable cover indicating the respective services. The cover should be removable type to facilitate easy access for maintenance.
3.0	**Oxygen Emergency Reserve Manifold – 4 Cylinder**
3.1	Manifold shall consist of high pressure header bar assembly to facilitate connection of 4 nos. of cylinder supplies. The header bar shall be provided with 4 numbers of copper cylinder pigtail connections to suit cylinder valves as per IS.3224 incorporating a brass check valve at each of 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. The manifold should be suitable to withstand working pressure of 150 Kg/cm2.
3.2	Manifold Top Frame Header Bar should be fabricated from high pressure seamless copper pipe of size 16 mm OD x 10 mm ID with high pressure brass fittings made of free cutting brass. Each Manifold connection will be through non- return valve and high pressure copper tail pipes, made of high pressure seamless copper pipe of size 10 mm OD x 6 mm ID. The manifold should be so designed that it should facilitate easy cylinder changing and positioning. Middle frame with cylinder holding chains should be

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	provided to hold cylinders safely. The manifold must be tested (hydraulically) at 3000 psig and necessary test certificates should accompany along with the supply. Non return valves supplied along with manifold. Inspection of manifolds & tail pipes must be done before carrying out the brazing of brass fittings at the end of the manifold to ensure compliance with specified pipe diameter and thickness.
3.3	The emergency reserve manifold shall provide an uninterrupted supply of medical oxygen from high pressure cylinder banks via a suitable arrangement of pressure regulators, providing a constant downstream nominal pipeline gauge pressure of 4.2 Kg/cm2.
3.4	The emergency manifold shall provide a minimum flow of 1000 LPM to the medical oxygen pipeline system at gauge pressure of 4.2 Kg/cm2
3.5	All pressure regulators shall be protected from over-pressurisation by relief valves that are vented to atmosphere.
3.6	Non-return valves shall be provided at the outlet of the emergency manifold. The non-return valve shall automatically bring the emergency reserve manifold into service when the primary manifold supply fails.
3.7	The emergency reserve manifold shall be provided with an isolation valve to enable positive tamperproof isolation for maintenance.
B.	**NITROUS OXIDE SYSTEM**
1.0	**Nitrous Oxide Manifold - 1 + 1**
1.1	Manifold shall consist of high pressure header bar assemblies to facilitate connection of 1 nos. of primary and 1 nos. of secondary cylinder supplies. Each header bar shall be provided with 1 numbers of copper cylinder pigtail connections to suit cylinder valves as per IS.3224 incorporating a brass check valve at each of 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. The manifold should be suitable to withstand working pressure of 150 Kg/cm2.
1.2	Manifold Top Frame Header Bar should be fabricated from high pressure seamless copper pipe of size 16 mm OD x 10 mm ID with high pressure brass fittings made of free cutting brass. Each Manifold connection will be through non- return valve and high pressure copper tail pipes, made of high pressure seamless copper pipe of size 10 mm OD x 6 mm ID. The manifold should be so designed that it should facilitate easy cylinder changing and positioning. Middle frame with cylinder holding chains should be provided to hold cylinders safely. The manifold must be tested (hydraulically) at 3000 psig and necessary test certificates should accompany along with the supply. Non return valves supplied along with manifold. Inspection of manifolds & tail pipes must be done before carrying out the brazing of brass fittings at the end of the manifold to ensure compliance with specified pipe diameter and thickness.
2.0	**Nitrous Oxide Control Panel**
2.1	The Control Panel should be designed for uninterrupted Supply of medical gas with minimum human intervention.
2.2	Control panel should have two first stage regulators each capable of delivering 100 - 200 psig outlet pressure. Control Panel should have delivery flow capacity of minimum 500 LPM at 4.2 bar pressure. Control Panel should have Piston Type Pressure Regulators.
2.3	Both the first stage regulators in the oxygen control panel should have non halogenated polymer in the high pressure side to ensure that there will be no ignition due to adiabatic compression.
2.4	40 micron filter should be provided at the inlet of each high pressure regulators of the oxygen control panel.
2.5	The first stage regulators should be connected to a common pre-set second stage regulator capable of delivering stable outlet pressure 60 to 70 psig.
2.6	The changeover from depleted cylinder bank to reserve cylinder bank should be automatic through pneumatic switching for uninterrupted supply to the medical gas network.
2.7	The automatic changeover mechanism should not be dependent on external power source.
2.8	The control panel should have digital display to indicate cylinder pressure in the two banks of the manifold and final delivery / line pressure.
2.9	The control panel should have audio-visual signal lamp or alarm for indication of Cylinder Bank Status.
2.10	The audio-visual signal lamp or alarm should work on low voltage, preferably 12 VDC or less.
2.11	The control panel shall have suitable cover indicating the respective services. The cover should be removable type to facilitate easy access for maintenance.
3.0	**Nitrous Oxide Emergency Reserve Manifold – 1 Cylinder**

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3.1	Manifold shall consist of high pressure header bar assembly to facilitate connection of 1 nos. of cylinder supplies. The header bar shall be provided with 1 numbers of copper cylinder pigtail connections to suit cylinder valves as per IS.3224 incorporating a brass check valve at each of 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. The manifold should be suitable to withstand working pressure of 150 Kg/cm2.
3.2	Manifold Top Frame Header Bar should be fabricated from high pressure seamless copper pipe of size 16 mm OD x 10 mm ID with high pressure brass fittings made of free cutting brass. Each Manifold connection will be through non- return valve and high pressure copper tail pipes, made of high pressure seamless copper pipe of size 10 mm OD x 6 mm ID. The manifold should be so designed that it should facilitate easy cylinder changing and positioning. Middle frame with cylinder holding chains should be provided to hold cylinders safely. The manifold must be tested (hydraulically) at 3000 psig and necessary test certificates should accompany along with the supply. Non return valves supplied along with manifold. Inspection of manifolds & tail pipes must be done before carrying out the brazing of brass fittings at the end of the manifold to ensure compliance with specified pipe diameter and thickness.
3.3	The emergency reserve manifold shall provide an uninterrupted supply of nitrous oxide from high pressure cylinder banks via a suitable arrangement of pressure regulators, providing a constant downstream nominal pipeline gauge pressure of 4.2 Kg/cm2.
3.4	All pressure regulators shall be protected from over-pressurisation by relief valves that are vented to atmosphere.
3.5	Non-return valves shall be provided at the outlet of the emergency manifold. The non-return valve shall automatically bring the emergency reserve manifold into service when the primary manifold supply fails.
3.6	The emergency reserve manifold shall be provided with an isolation valve to enable positive tamperproof isolation for maintenance.
C. COMPRESSED AIR SYSTEM	
1.0	**General**
1.1	Scope of work should include supply, installation, testing and commission of compressed air plant, receivers, filters, dryers, regulators, drain traps and relief valves along with interconnecting piping.
1.2	The installed system should have duplex reciprocating, two stage, air cooled, oil free, air compressors capable of generating pressure of 10 Bar to ensure supply of medical air at 4.2 Bar and surgical air at 7 bar. Duplex system of - desiccant type air dryer, 4 stage filtration, pressure reducing station for 4 bar & 7 bar supply along with isolation valve shall be provided to enable maintenance of duplex units and without completely shutting down of plant. Common air receiver of adequate capacity with auto drain arrangement should be provided. Safety relief valves shall be fitted at suitable positions to protect plant from damage and shall vent to a safe place.
2.0	**Air Compressor System: Reciprocating – 5 Hp**
2.1	**The Duplex medical air system shall include two nos. of 5 Hp., oil-free, reciprocating, two stage, air cooled, air compressors,** each having capacity **of 22.93 CFM (Free Air Delivery). The compressed air system should be supplied with common 1000 litres receiver tank. Each air compressor should be supplied with motor along with starter, V Belts, Pressure Switch & inlet air filter.** Duplex system of desiccant type air dryer of adequate capacity, Duplex 4 stage filtration, Duplex pressure reducing station for 4 bar & 7 bar supply along with isolation valves shall be provided to enable maintenance of duplex units without completely shutting down of plant. Safety relief valves shall be fitted at suitable positions to protect plant from damage and shall vent to a safe place. The compressed air system should be suitable for both continuous and frequent start / stop operation.
2.2	The medical air compressor shall operate in a "Duty" and "standby mode", with each compressor being able to be selected to carry out either role. Each compressor shall be capable of supplying the system design flow rate on its own. An air filter shall be fitted to the inlet of each compressor. The contractor shall take all suitable precautions to prevent vibration being transmitted from compressor/motor units to the building structure. Suitable anti vibration mountings shall be provided wherever required.
2.3	**Total air receiver capacity shall be 1000 Litres.** The receiver should be fitted with automatic drain valve. The receiver shall be fitted with a pressure safety valve capable of releasing the maximum flow output of the compressor at 10% receiver overpressure. The receiver shall be fitted with a pressure gauge of adequate range. Receiver test certificate to be provided.
3.0	**Filtration System**

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3.1	The filters should have maximum contaminant removal efficiency with minimum pressure drop. **Total 4 stages of filters should be used in case of OIL FREE RECIPROCATING COMPRESSORS** as mentioned below: Stage 1: Coalescing filter for removing liquid water particles down to 1 micron and oil removal down to 0.1 mg/m3. Stage 2: Particulate filter for removing particles down to 0.01 micron and oil removal down to 0.01 mg/m3. Stage 3: Particulate filter for removing particles down to 0.01 micron and oil removal down to 0.001 mg/m3. Stage 4: Final filter for removing odour & and oil removal down to 0.001/0.003 mg/m3.
4.0	**Dryer System**
4.1	Duplex system of Desiccant Type Air Dryers of 60 CFM capacity each should be used for safe operation and maintenance of the compressed air system. The dryers shall be the double absorber 'heatless' type, fully automatic and use activated alumna desiccant. Re-activation shall be on a time cycle using a bleed of purge air from the in-service dryer assembly. Dust filters shall be fitted before & after the dryer to ensure air quality.
5.0	**Pressure Regulating System**
5.1	The compressed air system shall be supplied with duplex pressure regulator arrangement to regulate the pressure to 4 bar for medical air. Adequate number of isolation valves should be provided to isolate each regulator separately during maintenance without shutting down the entire compressed air system.
5.2	The compressed air system shall be supplied with duplex pressure regulator arrangement to regulate the pressure to 7 bar for surgical air. Adequate number of isolation valves should be provided to isolate each regulator separately during maintenance without shutting down the entire compressed air system.
D.	**VACUUM SYSTEM**
1.0	**General**
1.1	To design, supply, test & install medical vacuum system comprising of **Duplex** System of Lubricated, Air-cooled, Reciprocating Vacuum Pumps each having desired capacity with suitable Motor, common Receiver Tank, Filter, Non-Return Valve, Auto Switch Gear to set minimum & maximum operating vacuum and interconnecting piping to take care of the requirements of desired no. of vacuum outlets.
1.2	The medical vacuum pipeline system should be designed to maintain a minimum vacuum of at least 300 mm Hg at each terminal unit during the system design flow tests. The filtration system shall be duplexed such that each filter can be isolated for maintenance.
2.0	**Vacuum Pump Units – 2 Hp.**
2.1	**Type of Vacuum Pumps:** Lubricated, Air-cooled, Reciprocating Vacuum Pumps along with TEFC squirrel cage induction motors (V-belt driven).
2.2	The Vacuum Pump will be complete with Base Plate, Belt Guard, V-Belts, Motor and Starter.
2.3	The system will be of Automatic Start and Stop Type.
2.4	The Pumps will be connected to a common vertical receiver/receivers of suitable capacity through interconnecting piping. The receiver will have a drain valve at the bottom. The receiver should also have a vacuum gauge of 4 inch dial size.
2.5	**Other System details**: Pump Type: Reciprocating. Type of Lubrication: Oil Lubricated. Type of Cooling: Air Cooled. Flow Rate of Each Vacuum Pump in terms of Piston Displacement: 34.60 CFM. Motor Rating: 2 Hp. Type of Drive: V Belt Drive.
2.6	**Bacteria Filters**: The plant shall be fitted with duplex bacteria filter system. Each individual filter shall have the capacity to deliver full design flow such that one set is designated duty and the other will be standby. Bacteria filters shall have efficiency at least 99.999% when tested in accordance with BS 3928.
2.7	Each bacteria filter shall be provided with a transparent sterilisable collection jar to collect condensate.

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2.8	Each vacuum pump shall be fitted with anti-vibration pads if required to prevent vibration being transmitted from pumps/motor units to the building structure.
3.0	**Vacuum Receiver**
3.1	**Total vacuum receiver capacity shall be 1000 Litres.** The reservoir shall be provided with a manual drain valve and vacuum gauge.
3.2	The vacuum receiver shall be of Vertical type and construction should be as per IS 2825 and material as per IS 2062. Receiver Test Certificate to be provided.
4.0	**Filters**
4.1	A filter shall be fitted between each pump and the reservoir, which shall have replaceable elements and each shall be capable of passing the total design flow. The filters shall be arranged such that one filter can be taken out for servicing without interrupting or restricting the vacuum service as a whole.
5.0	**Vacuum Pump Exhaust**
5.1	The exhaust gas shall be discharged outdoors to a safe location preferably above the roof level of the plant room, and not in the building in the immediate vicinity, windows and air intakes in order to ensure that the discharge does not create a health hazard. Each pump shall have its own exhaust line.
E.	**Electrical Panel**
1.1	A dedicated electrical panel should be provided with following features:
1.2	The panel should be designed to facilitate operation both in Automatic as well as Manual mode.
1.3	Manual selection switch for selection of Running & Standby Compressor to facilitate manual operation.
1.4	Manual selection switch for selection of Running & Standby Vacuum Pump to facilitate manual operation.
1.5	The control system should provide automatic changeover from Running to Standby Compressor every 2 hours of operation in automatic mode.
1.6	The control system should provide automatic changeover from Running to Standby Vacuum Pump every 2 hours of operation in automatic mode.
1.7	The panel should have Ammeter for individual machines.
1.8	The panel should have Voltmeter for incoming power supply.
1.9	The panel should have Indication lamps for all 3 phases of incoming power supply.
2.0	The panel should have Single phase preventer.
2.1	The panel should have Hour run meter to be provided for individual machines.
2.2	The panel should have Emergency Push Button for individual machines to stopping the machines
2.3	The panel should have **On – Off – Trip indication** for individual machines.
2.4	The panel should have a common hooter for indication of trip through audio alarm.
2.5	MCCB of adequate rating to be provided at incoming power supply for the panel.
2.6	MCB / MCCB of adequate rating to be provided at incoming power supply for individual machines.
F.	**Oxygen flow meter with Humidifier Bottle - Standard**
1.1	Back Pressure Compensated flow meter should be of accurate gas flow measurement with following feature.
1.2	Control within a range of 0 – 15 LPM. (Calibration within ±10%). Calibration Certificate to be provided. Calibration by Mass Flow Meter preferred.
1.3	It should meet strict precision and durability standard.
1.4	The flow meter body should be made of brass chrome plated materials.
1.5	The flow tube and shroud components should be made of clear, impact resistant polycarbonate
1.6	The flow tube should have large and expanded 0-5 lpm range for improved readability at low flows
1.7	Inlet filters of stainless steel wire mesh to prevent entry of foreign particles.
1.8	The humidifier bottle should be made of unbreakable polycarbonate material and autoclavable at 121 Degree Centigrade temperature
1.9	The humidifier bottle shall be provided with an integral safety valve for protection from over pressurization.
1.10	Should be supplied with suitable connector probe to match with Oxygen outlets.
G.	**Oxygen flow meter with Humidifier Bottle - Paediatric or Neo Natal**
1.1	Back Pressure Compensated flow meter should be of accurate gas flow measurement with following feature
1.2	Control within a range of 0 – 5 LPM. (Calibration within ±10%). Calibration Certificate to be provided. Calibration by Mass Flow Meter preferred.
1.3	It should meet strict precision and durability standard.
1.4	The flow meter body should be made of brass chrome plated materials.

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1.5	The flow tube and shroud components should be made of clear, impact resistant polycarbonate
1.7	Inlet filters of stainless steel wire mesh to prevent entry of foreign particles.
1.8	The humidifier bottle should be made of unbreakable polycarbonate material and autoclavable at 121 Degree Centigrade temperature
1.9	The humidifier bottle shall be provided with an integral safety valve for protection from over pressurization.
1.10	Should be supplied with suitable connector probe to match with Oxygen outlets.
H.	**WARD VACUUM UNIT**
1.1	Should be of light weight and compact.
1.2	Should have a regulator with analogue type gauge having range 0 – 760 mm Hg.
1.3	Should have a 600 ml. reusable collection jar, made of unbreakable poly carbonate /poly sulfone material and fully autoclavable at 121 degree centigrade. An integral Safety Trap shall be provided inside each of the jars to prevent overflowing of collected body fluids.
1.4	Should have wall bracket for mounting the jar assembly on the wall.
1.5	The vacuum regulator with instant ON / OFF Switch should be infinitely adjustable and with vacuum gauge which will indicate suction supplied by the regulator.
1.6	Should be supplied with suitable connector probe to match with Vacuum outlets
I.	**THEATRE VACUUM UNIT**
1.1	Theatre Vacuum Unit shall be trolley / stand mounted and shall consist of following:
1.2	Suction regulator with ON / OFF Switch, which will be step-less adjustable with analogue type vacuum gauge having range of 0 – 760 mm Hg for providing indication of the suction supplied by the regulator.
1.3	The unit should consist of two numbers of 2000 ml capacity reusable jar. The collection jars shall be shatter resistant, made up of polycarbonate material and shall be fully autoclavable at 121 degree centigrade. An integral Safety Trap shall be provided inside each of the jars to prevent overflowing of collected body fluids.
1.4	A 3-way valve to be provided to facilitate selection of collection jars: Left, Right or Both.
1.5	All the above items should be mounted on Trolley having free moving castor wheels.
J.	**Gas/Vacuum Outlets**
1.1	The outlet points shall conform to BS Standard and also the norms prescribed
1.2	Outlets shall be manufactured with a 12 mm OD, 165-mm length, Copper inlet pipe stub which is silver brazed to the outlet body.
1.3	Body shall be of one-piece brass construction.
1.4	For positive pressure gas services, the outlet shall be equipped with a primary and secondary check valve.
1.5	Outlet should have double locking mechanism to facilitate maintenance without disrupting the gas supply.
1.6	Totally leak proof, safe and easy to operate.
1.7	Should be equipped with non-return valve to facilitate on-line servicing.
1.8	Should be identifiable with colors for specific gas besides name of the gas engraved on its face.
1.9	Outlet assembly should accept only corresponding gas specific adapters.
1.10	The gas outlets should be Front Loading type.
K.	**Copper Pipes**
1.1	The copper pipes shall be manufactured from phosphorous de-oxidised non-arsenical copper of grade CW024A (Cu-DHP), manufactured EN 13348:2008 to metric outside diameters and having mechanical properties, pipes shall be of R250 (half hard)temper. Pipes shall be degreased suitable for oxygen use and cleanliness is to be maintained by filling each pipe with dry, clean, oil and oxygen free nitrogen, fitting suitable end caps and protectively wrapping. All pipe work materials shall be manufactured by BS EN ISO 9001:2000 registered companies marking for sizes up to 108 mm, copper pipes shall be permanently and durably marked at regular intervals along its length with the following information:

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	- The harmonised standard number EN 13348; - Lloyds approved to EN 13348:2008 - Nominal dimensions, diameter x wall thickness; - Temper designation to EN 1173; - Manufacturer's identification; - Date of production: year and month (1 to 12) - Confirmation of degreasing for oxygen;
1.2	The following pipe sizes should be used: **Outer Dia.** **Thickness** 1. 12 mm 0.7 mm 2. 15 mm 0.9 mm 3. 22 mm 0.9 mm 4. 28 mm 0.9 mm 5. 42 mm 1.2 mm 6. 54 mm 1.2 mm
1.3	**Copper fittings** - Medical Gas Pipeline Fittings shall be end feed type, manufactured from the same grade of copper as the pipes and be in accordance with the requirements of BS EN 1254-1:1998 Part 1. The manufacturing company should comply with BS EN ISO 9001:2000 and should be Kite Marked to EN 1254-1 (up to 54mm). Fittings should be factory degreased suitable for oxygen use and be supplied individually sealed in protective polythene bags. Fittings should be certified for medical use and accompany with oil analysis certificate and conformity certificate indicating suitability for medical use.
1.6	Brazing shall be carried out using Oxy-acetylene flame source capable of achieving brazing temperatures of above 600 degrees and below the melting point of the base metal. LPG should not be used to braze copper pipes and fittings. Brazed Pipeline Joints (Copper to copper) should be made using a silver-copper-phosphorous brazing alloy CP104 (5% Silver Brazing Filler metals Rod) to BS EN 1044-1999, no flux to be used. Brazing Copper to Brass/ Gun Metal/ Bronze is not carried out on site; use AG 203 (43% Brazing Filler metal Rod) to EN 1044 with an appropriate flux. The flux residue should be chemically removed and if necessary the complete assembly is cleaned and degreased for oxygen service. Where pipes are cut on site, the wheel cutter should be used (avoid using hacksaw blade) and should be cut square and de-burred, re-rounded and cleaned off before use. Expanded joints shall not be used as this will reduce tube wall thickness and precise capillary space will not be made for capillary attraction to occur for achieving a leak free joint. Also bending of pipes shall not be carried out as this will result in reduction of pipe wall thickness. Brazing should be carried out using Oxygen free Nitrogen as an internal inert gas shield to prevent the formation of oxides on the inside of the pipes and fittings. Oxygen Free Nitrogen should be passed through the pipeline while brazing and supply should not be stopped until the joints cool down, please use wet cloth the cool the joints faster. A slight burnishing may occur in some cases; however purging post brazing is still required to remove internal shield gas and the other particulate matter not associated with Brazing operation.
1.7	All pipe jointing fittings and sub-assemblies of fittings for connection to pipes must be cleaned and degreased for oxygen service and be free of particulate matter and toxic residues. They must be individually sealed in bags or boxes and delivered to site identified as medical gas fittings.
1.8	All pipe joints shall be made using inert gas using flux less silver brazing method (silver brazing). Continuous purging with oil-free nitrogen to be carried out while brazing is done. Adequate supports shall be provided while laying pipelines to ensure that the pipes do not sag. Suitable sleeves shall be provided wherever pipes cross through walls/slabs. All pipe clamps shall be non-reactive to copper.

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1.9	Brazing should be carried out using oxygen-free nitrogen as an internal inert gas shield to prevent the formation of oxides on the inside of the pipes and fittings. This method leaves a bright, clean bore. Purging shall be required to remove the internal shield gas and the other particulate matter not associated with the brazing operation.
1.11	Heat Source for Brazing: Oxy-acetylene gas or LPG should be used for achieving proper working temperatures for brazing
1.12	All the piping system shall be tested in the presence of the site-engineer or his authorized representative.
1.13	**Painting**: All exposed pipes should be painted with two coats of synthetic enamel paint and color codification should be as per IS:2379 of 1990.
1.14	In addition to painting, pipes to be clearly labelled indicating service and flow direction.
L.	**ISOLATION VALVES**
1.1	The isolation valve shall be 2 piece ball-type design with a brass forging body and a chrome-plated brass ball. Ball seat, stem seals and stem washer shall be of Reinforced Teflon (PTFE). Valves shall be operated manually by a lever-type handle requiring only a quarter turn from a fully open position to a fully closed position. All medical gas line ball valves shall provide a full bore flow and shall be factory cleaned for oxygen service and fully tested. Degreasing certificate to be provided. Line valves shall be located in readily accessible areas of ducts and shafts. However care should to ensure safety to prevent danger from leakage. Valve sizes from 12 mm to 54 mm should have minimum rating of PN40. Valve sizes of 76 mm & 108 mm should have minimum rating of PN25. Following valve sizes to be used: a. 12mm Ball Valve b. 15mm Ball Valve c. 22mm Ball Valve d. 28mm Ball Valve e. 35 mm Ball Valve f. 42 mm Ball valve g. 54 mm Ball Valve
M.	**AREA VALVE SERVICE UNITS (AVSU) or ZONE VALVE BOX**
1.1	The Area Valve Service Unit (AVSU) shall provide area isolation facility for use either in an emergency or for maintenance purposes.
1.2	Each 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, required number of two piece design Full Bore Brass Ball Valve (refer specification of isolation valve for details), Pressure Gauge of adequate range for individual gas service, an aluminium frame, and a pull-out removable window.
1.3	The valve box shall be constructed of 18 gauge steel complete with a baked enamel finish. The doorframe assembly shall be constructed of anodised aluminium 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.
1.4	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 only after the valve handles have been returned to the open position.
1.5	The window shall be marked with the following : **"CAUTION: MEDICAL GAS VALVES"** **"CLOSE ONLY IN CASE OF EMERGENCY"**
1.6	The Area Valve Service Unit should incorporate a ball valve with NIST connectors either side mounted in a lockable box with emergency access. It should be reliable and easy to operate and must have NIST connectors facilitate easy purge, sample & pressure testing and emergency supply system.
1.7	Each valve shall be supplied with an identification tag for easy identification of service. A package of labels shall be supplied with each valve box assembly for application by the installer.
1.8	Valves shall be available with line pressure gauges, as required. Gauges shall be 51 mm (2") diameter and back entry type.
1.9	The valve box should be supplied in fully assembled condition with valves and pressure gauges.
N.	**Master / Area Line Pressure Medical Gas Alarm**
1.1	The area alarm should have digital display. The alarm shall be microprocessor based. Sensors shall be mounted locally (in the rough-in box) by installing the copper pipe provided or mounted remotely. Sensors will be automated for gas specific detection.
1.2	Each sensor unit is gas specific. An indicator shall be provided for each service indicating a green

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	"NORMAL" and a red "HIGH" or "LOW" alarm condition. For vacuum service only "LOW" alarm condition to be provided.
1.3	If an alarm occurs, the green indicator will change to red and a continuous audible alarm will sound. Pushing the mute button will cancel the audible alarm, but the unit will remain in the alarm condition until the problem is rectified.
1.4	The default set-points shall be +/- 20% variation from normal condition. In the calibration mode High/Low set-points shall be adjustable by on board push buttons. Provision to adjust alarm set points should be provided.
1.5	Push to test button to be provided for testing the alarm.
O.	**Horizontal Bed Head Panel: for ICU, HDU & CCU**
1.1	Minimum length 1.2 metres. Maximum length 1.8 meters.
1.2	It should have the following features:
1.3	Efficient, Safe & Robust design in extruded aluminium section.
1.4	Smooth curved surfaces, and choice of base colour and fascia plates.
1.5	Unit should have integrated rail system to mount accessories.
1.6	The headwall system should be constructed of aluminium extrusions joined together to form a carcass to suit the particular application. Unit should be factory assembled for electrical and mechanical components.
1.9	The panel should be designed to accommodate the following: a) **Gas Outlets** – Oxygen - 2 nos., Medical Air 4 Bar – 2 nos., Vacuum – 2 nos. b) **Electrical Sockets with Switches 6/16 Amps** - 6 nos. c) Should be supplied with integrated rail for mounting accessories.
1.10	Each bed-head panel unit shall be supplied with medical and electrical outlets pre-fitted and internally wired
R.	**Ceiling Pendants for Anaesthesia**
1.1	Heavy duty Anaesthesia Pendent System should have the facility to provide convenient positioning of medical gas terminal units, electrical and specialty services in operation theatre.
1.2	Pendant should be single arm type having arm length of approx. 900 mm. The pendant should be ceiling mounted and **shall have provision to mount at least 1 monitor.**
1.3	The pendant shall be provided with 6 nos. of electrical 6/16 Amps / 230V, AC power socket having individual switch.
1.4	The pendant shall be provided with **Imported 6 nos gas outlets** as approved by the HOD/Doctor
1.5	Shall be provided with 1 no. of I.V pole with mounting bracket.
1.6	Weight carrying capacity of the arm shall not be less than 90 Kgs.
1.7	The pendant shall provide adequate clearance above finished floor level after mounting the anaesthesia machine.
1.8	Each pivot point in the pendant should have 330 degree rotation.
1.9	Segregation of services i.e. Electrical supply and Medical gases should be maintained throughout.
1.11	Should be supplied with integrated arrangement for mounting accessories.
1.13	The pendant shall be supplied with medical and electrical outlets pre-fitted and internally wired.
S.	**Ceiling Pendants for Surgeon**
1.1	Heavy duty Ceiling Pendent System should have the facility to provide convenient positioning of medical equipment, medical gas terminal units, electrical and specialty services in operation theatre.
1.2	Pendant should be single arm type having arm length of approx.. 900 mm. The pendant should be ceiling mounted.
1.3	Should have aluminium powder coated body with 3/4 trays for keeping instruments and one drawer.
1.4	The pendant shall be provided with 6 nos. of electrical 6/16 Amps / 230V power socket having individual switch
1.5	The pendant shall be provided with **Imported 6 nos gas outlets** as approved by the HOD/Surgeon
1.6	Shall be provided with 1 no. of I.V pole with mounting bracket.
1.7	Weight carrying capacity of the arm shall not be less than 70 Kgs.
1.8	The pendant shall provide adequate clearance above finished floor level.
1.9	Each pivot point in the pendant including the pendant head should have 330 degree rotation.

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1.10	Segregation of services i.e. Electrical supply and Medical gases should be maintained throughout.
1.12	Should be supplied with integrated arrangement for mounting accessories.
1.13	The pendant shall be supplied with medical and electrical outlets pre-fitted and internally wired
T	**Terms**
1.1	This includes spare parts for gas control panel, gas outlets, alarms and zone valve box. Sufficient spares to be maintained at hospital's end by the MGPS Vendor at their own cost to meet emergency situations during warranty period. Items used by MGPS Vendor to be replenished.
1.2	All Civil expenses to be borne by the vendor for laying of Copper Pipes which includes breakage, re plastering, erection of scaffoldings etc
1.3	Manifold Room pump laying base and other required items to be done by Vendor at his own cost
1.4	Cylinders & Gas for entire job to be arranged and cost to be borne by the vendor themselves
1.5	Dismantling of old manifold room to be done by vendor
1.6	**Vendor should have local registered office in Imphal, Manipur to provide after sales service support**
1.7	**Service call logged should be entertained within 36 hours as the area involves Operation theatre and ICU.**

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S.No	Description of Items	Unit	Qty
A	**OXYGEN SYSTEM**		
1	6+6 size Primary Main Oxygen Manifold complete with NRvs and pig tail pipes.	Set	1
2	Fully Automatic control panel for Oxygen Having a constant flow out put of over 1500 lpm at 4.2 bar pressure	Set	1
3	2+2 cylinder Oxygen emergency manifold complete with NRVs and pig tail pipes.	Set	1
4	Oxygen Gas Outlets	Nos	67
5	Indigenous BPC Oxygen flow meter with Humidifier Bottle. 0-15 L/min standard flow rate.	Nos	42
6	Indigenous Oxygen High Pressure Rubber tube white color.	Mtr.	20
B	**NITROUS OXIDE SYSTEM**		
1	1+1 size Primary Main Nitrous Oxide Manifold complete with NRvs and pig tail pipes.	Set	1
2	Fully Automatic control panel for Nitrous Oxide Having a min. flow out put of 500 LPM at 4.2 bar pressure	Set	1
3	1 cylinder size of N2O Emergency cylinder manifold complete with NRvs & Pig tail pipes.	Set	1
4	Nitrous Oxide Gas Outlets	Nos	5
5	Indigenous Nitrous Oxide High Pressure Rubber tube Blue color.	Mtr.	20
C	**VACUUM SYSTEM**		
1	Vacuum Central System Complete with 2 nos Vacuum Pumps , Model V244 each having 34.60 cfm PD with 2 HP motor Filter, interconnecting pipes, NRV, auto switch gear assy., exhaust silencer And Receiver – 1 nos of capacity 1000 liter each etc.	Set	1
2	Bacterial Filter (Imported)	Set	1
3	Vacuum Gas Outlets	Nos	67
4	Indigenous Ward Vacuum Unit with Regulator, Collection Jar of 600 ml with Bracket.	Nos	42
5	Theatre vacuum unit trolley mounted complete with 1no. of high suction regulator along with twin vacuum collection jar of Polysulphone of 2000ml with lid.	Nos	4
6	Indigenous Vacuum High Pressure Rubber tube Yellow color.	Mtr	50
D	**COMPRESSED AIR SYSTEM**		
1	Compressed Air system complete with 2 nos. 22.93 CFM capacity Non-lubricated, Reciprocating Air cooled type Base Frame mounted Air compressors with 5 HP motors with a 1 no. of Receiver of 1000 liter water capacity	Set	1
2	Air Dryer	Nos	1
3	4-stage Air Filtration System	Set	2
4	Pressure Reducing System	Set	2
5	Medical Air 4 Bar Gas Outlets	Nos	31
6	Surgical Air 7 Bar Gas Outlets	Nos	5
7	Indigenous Compressed Air High Pressure Rubber tube Black color.	Mtr	50

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E	**MISCELLANEOUS ITEMS**		
1	Combined Electrical Control Panel for Vacuum System and Compressed Air System(Cascading / seq.) complete with plant Room wiring.	Nos	1
F	**Distribution Copper Pipe**		
1	42 mm OD x 1.2 mm thick	Mtr	80
2	28 mm OD x 0.9 mm thick	Mtr	315
3	22 mm OD x 0.9 mm thick	Mtr	540
4	15 mm OD x 0.9 mm thick	Mtr	650
5	12 mm OD x 0.7 mm thick	Mtr	180
G	**Zonal Valve Box with Ball Valve & Pressure Gauge**		
1	5 Gas	Nos	3
2	3 Gas	Nos	5
3	2 Gas	Nos	1
H	**Medical Gas Digital Alarm System**		
1	5 Gas	Nos	3
2	3 Gas	Nos	5
4	2 Gas	Nos	1
I	**Isolation Valve**		
a	12 MM.	Nos	33
b	15 MM.	Nos	10
c	22 MM.	Nos	23
d	28 MM.	Nos	7
e	42 MM.	Nos	6
J	Single Arm Aneasthesia Pendant for Operation Theatre with Imported Outlets @6 nos, Electrical Switch Socket @6 nos, Drawer @ 1nos & Tray @2nos	Nos	2
K	Single Arm Surgeon Pendant for Operation Theatre with Imported Outlets @6 nos, Electrical Switch Socket @6 nos, Drawer @ 1nos & Tray @4nos	Nos	2
L	Horizontal Bed Head Panel as per Specs	Nos	16

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