

| <b>SPECIFICATIONS - Medical Gas Pipe Line System on turnkey basis at Emergency Care Unit at Thrissur Medical College</b> |   |
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|  | <b>GENERAL INSTRUCTIONS</b>   |
|  | Bidder shall be responsible for complete design, supply, installation, testing and commissioning of MGPS System .The bidders are required to survey the site before furnishing the quotations   |
|  | Hospital will provide electrical supply in the plant. The wiring inside the plant has done by the bidder. Control panel for Vacuum system and Air plant system has to be supplied by the bidder.  |
|  | The bidder shall be responsible for the complete works including the submission of working Drawings, and isometric views, detailed work schedule and materials. Bidder shall be responsible for installation and commissioning of medical gas supply system in coordination with Consignee authorities and HLL. Bidder shall be responsible for free maintenance of Gas pipeline system, other plants and manifolds during warranty period  |
| <b>I</b>   | <b>OXYGEN SYSTEM</b>  |
| <b>1</b>   | <b>Oxygen Manifold</b>  |
| 1.1  | <b>10 + 10</b> Size Oxygen Manifold should be configured with <b>2 x 10</b> nos. of class D Cylinders and should be suitable to withstand working pressure of 145 Kg/cm <sup>2</sup> , along with 20 nos. of high-pressure copper annealed tail pipes with end brass adapter suitable for oxygen cylinders and manifold.10 cylinder manifold bank as left side and 10 cylinder manifold bank as right side complete with 20 nos. of pig tail pipes and 20 nos. of non-return valves.  |
| 1.2  | Top frame should comprise of high pressure copper pipes of size 1/2" NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely. The manifold must be tested (hydraulically) at 150 bar and necessary test certificates should accompany along with the supply. |
| 1.3  | The manifold system should conform to IS 12827 standard   |
| 1.4  | Should be upgradable to include more cylinder banks.  |
| <b>2</b>   | <b>Fully Automatic Oxygen Control Panel</b>   |
| 2.1  | The Manifold control panel should be digital/analog, fully automatic type and switches from "Bank in Use" to "Reserve bank " without fluctuation in delivery supply line pressure.  |

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| 2.2      | The changeover system should be taken place pneumatically and without the need for external power so that even during power failure the changeover can be taken place automatically if the “Bank in Use” becomes empty. After the switch-over, the “Reserve bank “ then becomes the “Bank in Use” and the “Bank in Use” becomes the “Reserve bank”.  |
| 2.3      | The control panel should have a microprocessor based digital /analog display panel.  |
| 2.4      | The control panel should be incorporated with three large, red, illuminated LED displays for the Left Bank, the Right Bank and for the Supply Pressure. The control panel also should have six LED’s, two Green for “Bank in Use”, two Amber for “Bank Ready” and two Red for “Bank Empty”.  |
| 2.5      | Should have fully automatic self-contained shuttle-valve with no electrical power required for switching   |
| 2.6      | Input power: 240 VAC, 50 HZ  |
| 2.7      | Control panel display should be readable even in poor lighting conditions  |
| 2.9      | Two limit switches for indication of bank in use   |
| 2.10     | Dual line pressure regulators  |
| 2.11     | Delivery flow capacity : Approx <b>1000 l/min</b> at 50-60 psi pressure  |
| <b>3</b> | <b>Oxygen Emergency Reserve Manifold - 2 X 2 Manifold</b>  |
| 3.1      | Should include 4 cylinder manifold bank as either side complete with 4 nos.pig tail pipes and 4 nos. non return valves.  |
| 3.2      | Top frame should comprise of high pressure copper pipes of size 1/2” NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4” NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely. |
| 3.3      | The emergency reserve manifold shall provide an uninterrupted supply of medical oxygen from equally sized high pressure cylinder banks via a suitable arrangement of pressure regulators, providing a constant downstream nominal pipeline gauge pressure of 400 kPa.  |
| 3.4      | Cylinder bank shall be fitted with an isolation valve to enable continuity of supply in the vent of primary supply failure.  |
| 3.5      | The manifold control panel shall provide a minimum flow of <b>1000 l/min</b> to the nominal 400 kPa medical oxygen pipeline system.  |
| 3.6      | There shall be two separate stages of pressure regulation to enable high peak flow rates without a reduction in line pressure.   |

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| 3.7       | All pressure regulators shall be protected from over-pressurisation by relief valves that are vented to atmosphere.   |
| 3.8       | The line pressure relief valve shall be provided  |
| 3.9       | A non-return valve shall be provided within a line pressure manifold block and shall provide gas tight isolation in the event of any upstream component failure. The non-return valve shall automatically bring the emergency reserve manifold into service when the primary supply fails.  |
| 3.10      | The emergency reserve manifold shall be provided with a lockable isolation valve to enable positive tamperproof isolation for maintenance. The emergency reserve manifold shall be supplied fully assembled and tested.   |
| 3.11      | The manifold system should conform to IS :12827 standard.   |
| <b>II</b> | <b>NITROUS OXIDE SYSTEM</b>   |
| <b>1</b>  | <b>Nitrous Oxide Manifold</b>   |
| 1.1       | <b>4 +4</b> Size Nitrous Oxide Manifold should be configured with <b>2 x 4</b> nos. of class D Cylinders and should be suitable to withstand working pressure of 145 Kg/cm <sup>2</sup> , along with 8 nos. of high-pressure copper annealed tail pipes with end brass adapter suitable for nitrous oxide cylinders and manifold. 4 cylinder manifold bank as left side and 4 cylinder manifold bank as right side complete with 8 nos. of pig tail pipes and 8 nos. of non-return valves.  |
| 1.2       | Top frame should comprise of high pressure copper pipes of size 1/2" NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4" NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely. The manifold must be tested (hydraulically) at 150 bar and necessary test certificates should accompany along with the supply. |
| 1.3       | The manifold system should conform to IS 12827 standard   |
| 1.4       | Should be upgradable to include more cylinder banks.  |
| <b>2</b>  | <b>Fully Automatic Nitrous Oxide Control Panel</b>  |
| 2.1       | The Manifold control panel should be digital/analog, fully automatic type and switches from "Bank in Use" to "Reserve bank " without fluctuation in delivery supply line pressure.  |

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| 2.2      | The changeover system should be taken place pneumatically and without the need for external power so that even during power failure the changeover can be taken place automatically if the “Bank in Use” becomes empty. After the switch-over, the “Reserve bank “ then becomes the “Bank in Use” and the “Bank in Use” becomes the “Reserve bank”.  |
| 2.3      | The control panel should have a microprocessor based digital /analog display panel.  |
| 2.4      | The control panel should be incorporated with three large, red, illuminated LED displays for the Left Bank, the Right Bank and for the Supply Pressure. The control panel also should have six LED’s, two Green for “Bank in Use”, two Amber for “Bank Ready” and two Red for “Bank Empty”.  |
| 2.5      | Should have fully automatic self-contained shuttle-valve with no electrical power required for switching   |
| 2.6      | Input power: 240 VAC, 50 HZ  |
| 2.7      | Control panel display should be readable even in poor lighting conditions  |
| 2.8      | Two limit switches for indication of bank in use   |
| 2.9      | Dual line pressure regulators  |
| 2.1      | Delivery flow capacity : Approx <b>500 l/min</b> at 55-60 psi pressure   |
| <b>3</b> | <b>Nitrous Oxide Emergency Reserve Manifold - 2 X 1 Manifold</b>   |
| 3.1      | Should include 2 cylinder manifold bank as either side complete with 2 nos.pig tail pipes and 2 nos. non return valves.  |
| 3.2      | Top frame should comprise of high pressure copper pipes of size 1/2” NB x 15 swg with high pressure brass fittings made of high tensile brass and connections through non- return valves; high pressure copper tail pipes, made of high pressure copper pipe of size 1/4” NB x 15 swg. The design of middle and bottom frames should be provided to fit both round and flat bottom cylinders safely. |
| 3.3      | The emergency reserve manifold shall provide an uninterrupted supply of Nitrous Oxide from equally sized high pressure cylinder banks via a suitable arrangement of pressure regulators, providing a constant downstream nominal pipeline gauge pressure of 400 kPa.   |
| 3.4      | Cylinder bank shall be fitted with an isolation valve to enable continuity of supply in the vent of primary supply failure.  |
| 3.5      | There shall be two separate stages of pressure regulation to enable high peak flow rates without a reduction in line pressure.   |

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| 3.6        | All pressure regulators shall be protected from over-pressurisation by relief valves that are vented to atmosphere.   |
| 3.7        | The line pressure relief valve shall be provided  |
| 3.8        | A non-return valve shall be provided within a line pressure manifold block and shall provide gas tight isolation in the event of any upstream component failure. The non-return valve shall automatically bring the emergency reserve manifold into service when the primary supply fails.  |
| 3.9        | The emergency reserve manifold shall be provided with a lockable isolation valve to enable positive tamperproof isolation for maintenance. The emergency reserve manifold shall be supplied fully assembled and tested.   |
| 3.1        | The manifold system should conform to IS :12827 standard.   |
| <b>III</b> | <b>MEDICAL AIR SYSTEM</b>   |
| <b>1</b>   | <b>General</b>  |
| 1.1        | The medical gas system contractor shall supply, install and commission the compressed air plant (for medical air duplex type) with plant and associated equipment including control equipment , monitoring and alarm instrumentation, after coolers, receivers, filters and dryers, regulators, drain taps and relief valves. The Air system shall in all respects comply with the recommendation made in HTM 2022/HTM 02-01 standards.   |
| 1.2        | The installed system shall be of oil free, non lubricated, dust free. Generating pressure of medical air (4 bar) shall be as per HTM 2022/HTM 02-01 standards .Isolating valve shall be fitted wherever appropriate to enable maintenance of duplex units and 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  |
| <b>2</b>   | <b>Air Compressor Pumps</b>   |
| 2.1        | The Duplex medical air system package shall include <b>two oil-free reciprocating/rotary vane/rotary screw/scroll type , air cooled, air compressors</b> each having capacity over <b>1000 LPM at 4 bar</b> with common <b>1000 litres receiver tank</b> along with filter, non-return Valve, isolation valves, dual desiccant air dryer, dual pressure reducing station, etc. Compressor should be from high quality internationally approved manufacturer.  |
| 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 inlet filter and silencer shall be fitted to the outlets 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. |

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| 2.3       | The compressor units shall be fitted with after coolers which shall be of the air blast type and shall be fitted with an automatic drain with manual by-pass valves.   |
| 2.4       | The manufacturer of air compressor should be ISO 13485: 2003 certified. The copy of certificate should be attached along with technical bid.   |
| <b>3</b>  | <b>Control and Instrumentation</b>   |
| 3.1       | The compressor plant shall be supplied with a three compartment control panel with protection to IP65, two compartments shall contain equipment individual to each compressor i.e. motor starters, isolators, control circuit, fuses, ammeter and an hour run meter. The central compartment shall contain any common equipment including control pressure switches, alarm pressure switches, and the control logic circuitry.   |
| 3.2       | The compressed air plant shall link with the alarm and monitoring system to provide alarm system as mentioned below.   |
|           | Pressure Fault caused by low pipeline pressure, high pipeline pressure   |
| <b>4</b>  | <b>Air Receiver</b>  |
| 4.1       | The air receiver shall be constructed to HTM 2022/HTM 02-01 standards. The vessel shall incorporate all suitable lifting lugs and mounting feet and shall be complete with a relief valve, fusible plug, an inspection/access panel and an automatic drain with manual by pass. Receiver capacity should not be less than <b>1000 litre (Approx)</b> .   |
| <b>5</b>  | <b>Filtration/Dryer System</b>   |
| 5.1       | On leaving the air receiver the air shall pass through either leg of a duplex pre-filter, oil removal filter and twin column dryer assembly, each leg shall be capable of passing the full flow of one air compressor. The pre-filters shall be in accordance HTM 2022/HTM 02-01 standards with an efficiency of 95%. Oil filters shall be of the coalescing absorption type, removing 99% of oil and water particles between 5 and 40 microns. Filtering should ensure complete oil removal so that only oil free air enter the desiccant dryer.      |
| 5.2       | The dryers shall be the double absorber 'heatless' type, fully automatic and use activated alumina 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 after the dryer to ensure that air quality complies with HTM 2022/HTM 02-01 standards. Each dryer assembly shall incorporate a dew point alarm to enable automatic changeover to the stand by dryer, in the event of the dew point rising to above 0°C at 7.2 bar or - 26°C at atmospheric pressure.. |
| <b>6</b>  | <b>Pressure Control</b>  |
| 6.1       | The compressor shall be supplied with regulator arrangements to regulate the pressure to: 4 bar +/-0.12 medical air.   |
| <b>IV</b> | <b>VACUUM PLANT</b>  |

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| <b>1</b> | <b>General</b>   |
| 1.1      | The medical gas system contractor shall supply, install and commission the vacuum plant and associated equipment. This shall include a packaged duplex pump and reservoir(s) system complete with all necessary controls, drainage traps, bacterial filters and individual exhaust lines. The vacuum system shall in all respects comply with the recommendation made in HTM 2022/HTM 02-01 standards.   |
| 1.2      | The medical vacuum pipeline system should be designed to maintain a vacuum of at least 300 mm Hg (40 kPa) at each terminal unit during the system design flow tests. List of vacuum outlets are provided to calculate flow requirements.   |
| <b>2</b> | <b>Vacuum Pump Units</b>   |
| 2.1      | The pump installation shall be duplex system consisting of <b>two identical rotary vane/Reciprocating/Rotary Screw/Scroll pumps</b> each of which shall be capable of independently producing designed systems flow rate. The pump shall be clearly marked with its performance, both its free air displacement and its volumetric throughput. Each pump should have capacity of minimum <b>1000 LPM</b> . Pump should be capable of providing a vacuum of not less than 650 mm Hg (87 kPa). |
| 2.2      | The driving motor shall directly drive the pump unit and it shall be manufactured in accordance with HTM 2022/HTM 02-01 recommendations.   |
| 2.3      | Each pump shall have a built in non-return valve and pressure switch such that inadvertent reversal of the motor will not pressurize the reservoir or the distribution system. Pump should be of reputed make as per international standards.  |
| 2.4      | The manufacturer of vacuum pump should be ISO 13485: 2003 certified. The copy of certificate should be attached along with technical bid.  |
| <b>3</b> | <b>Control and Instrumentation</b>   |
| 3.1      | The vacuum plant control panel shall consist of three separate compartments, two compartments shall hold the motor starters, isolators, ammeters, and hours run-meters, for each pump. The remaining compartment shall house the vacuum switches, status monitoring equipment, delay timer and interlock material (to prevent simultaneous starting of the pumps) and the duty selector switch with automatic change over.   |
| 3.2      | Indication of vacuum level shall be provided for line vacuum and reservoir vacuum  |
| <b>4</b> | <b>Reservoir Vacuum</b>  |

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| 4.1      | A differential pressure indication shall be provided across the filter and drainage trap assemblies. These indications shall be provided by gauges of at least 100 mm diameter and calibrated in mm Hg. The working pressure of gauges shall not exceed 65% of the full scale range. The duplex installation shall be such that each pump is capable of operating in either the duty mode or the standby mode ensuring that wear is equal to both pumps.   |
| 4.2      | The vacuum plant shall have alarm conditions as input to the alarm system and these shall be as follows:   |
|          | Pressure Fault caused by: Pipeline vacuum less than 360 mm Hg.   |
| <b>5</b> | <b>Reservoir &amp; Filters</b>   |
| 5.1      | The reservoir shall be manufactured in accordance with HTM 2022/HTM 02-01 standard tested to a minimum pressure of 3 bar and the test certificate shall be supplied to the user.   |
| 5.2      | The reservoir shall be provided with a manual drain valve. The reservoir shall be designed according to the recommendation made on HTM 2022/HTM 02-01. Reservoir capacity should not be less than <b>1000 Litres</b> .   |
| 5.3      | A bacterial 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.   |
| 5.4      | The filters shall have a penetration not exceeding 0.05% when tested by the sodium flames test in accordance with BS3928. Moisture traps shall also be fitted on each leg. These may be combined with the filter units. The traps shall have removable transparent drain bowls which can be removed without affecting plant operation. The bowls shall be sterilisable by using moist steam at 2.2 bar and 138 degree Celsius in porous load sterilizer.   |
| <b>6</b> | <b>Vacuum Pump Exhaust</b>   |
| 6.1      | The exhaust gas shall be discharged outdoors 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 constitute a health hazard. Each pump shall have its own exhaust line and each shall be fitted with suitable drain valves and transparent jars at the lowest points. The outlets shall be suitably protected to prevent the ingress of rain, and wind pressure. A weatherproof notice shall be provided at the discharge points which states: "Medical Vacuum Discharge Point – DO NOT OBSTRUCT." The exhaust system shall be designed so that the back pressure does not exceed 80 mm Hg (1.0 psi) at the design flow rate. A length of flexible pipe work shall be included before the exhaust passes through a wall in order to isolate the building structure from pump vibration. Antivibration mountings shall be used for the pumps. |



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| <b>7</b>   | <b>Scope</b>  |
| 7.1        | The sub-contractor of Medical Gas shall supply, install, test and commission a complete and fully operational medical vacuum plant as per recommendation of HTM 2022/HTM 02 -01 standard.   |
| <b>V</b>   | <b>Oxygen flow meter with Humidifier Bottle</b>   |
| 1          | Back Pressure Compensated flow meter should be of accurate gas flow measurement with following feature .  |
| 2          | Control within a range of 0 – 10 LPM.   |
| 3          | It meets strict precision and durability standard.  |
| 4          | The flow meter body is made of brass chrome plated materials.   |
| 5          | The flow tube and shroud components are made of clear, impact resistant polycarbonate.  |
| 6          | Inlet filters of stainless steel wire mesh to prevent entry of foreign particles.   |
| 7          | The humidifier bottle should be made of unbreakable polycarbonate material and autoclavable at 121 <sup>o</sup> Centigrade temperature  |
| 8          | Should be supplied with suitable connector probe to match with Oxygen outlets.  |
| <b>VI</b>  | <b>Ward Vacuum Unit</b>   |
| 1          | Should be of light weight and compact. The unit will consist of-  |
| 2          | A regulator with 0 – 760 mm gauge.  |
| 3          | A 600 ml. reusable collection jar, made of unbreakable poly carbonate /poly sulfone material and fully autoclavable at 121 degree centigrade.   |
| 4          | A wall bracket for mounting the jar assembly on the wall.   |
| 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. Safety trap must be provided inside the jar to safeguard the regulator from overflowing. |
| 6          | Should be supplied with suitable connector probe to match with Vacuum outlets.  |
| <b>VII</b> | <b>Portable Theatre Vacuum unit</b>   |
| 1          | It must consist of the following: - 1no. Suction Regulator and 2nos. 4000ml polysulfone/polycarbonate collection jar and both to be mounted on a trolley.   |
| 2          | Suction Regulator: Suction regulator should be supplied with a safety jar, including an anti-bacterial filter and an anti-overflow safety device. Should have wide membrane continuous suction controller   |

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| 3           | Should have vacuum levels : 0-760 mm of Hg  |
| 4           | Should have vacuum gauge fitted with a protective bumper device.  |
| 5           | Should have on/off knob allowing for the quick restoration of a readjusted vacuum level.  |
| 6           | Must have central adjustment knob with a color coded for 0-760 mm of Hg. Should have polysulfone/polycarbonate safety jar, autoclavable at 134° C, unbreakable, fitted with an anti-overflow safety device and equipped with a plastic antibacterial filter.  |
| 7           | Collection jar should be totally transparent, to ensure perfect sucked liquid visibility.   |
| <b>VIII</b> | <b>Gas/Vacuum Outlets</b>   |
| 1           | Front loading type terminal outlets should be designed to dispense medical gases (or an inlet for medical vacuum) to the secondary equipment (flow meters, Surgical Tools, Suction regulators, etc.) at the point of use and it should be gas specific so that secondary devices cannot be “attached” to the wrong gas. |
| 2           | When not in use, the gas should be in a non-flowing state within the Outlet (Terminal unit) sealed by “O” ring. The adapter when inserted pushes the poppet inside and the gas starts flowing and sealing is ensured by the “O” ring or a seat.   |
| 3           | The outlets should Quick Connect Type . The outlets should have following features:   |
| 4           | Push to insert and press-to-release mechanism for probes.   |
| 5           | Allows plugging of probes from front.   |
| 6           | Self-sealing valve on disengaging the probe (Quick disconnect)  |
| 7           | Smooth quite action.  |
| 8           | Non return valve for on line servicing/ repairing   |
| 9           | Indexed to eliminate inter-changeability of gas services  |
| 10          | Color-coded gas specific front plate  |
| 11          | Flow rate exceeds the requirements of ISO 9170 – 1.   |
| 12          | Totally leak proof, safe & easy to operate  |
| 13          | Configurations possible: surface, flush & Bead-head.  |
| 14          | The terminal outlets should comply with ISO 9170-1:2008 certification   |
| <b>IX</b>   | <b>Copper Pipes</b>   |
| 1           | Solid drawn, seamless, deoxidised, non- arsenical, half hard, tempered and degreased copper tubes manufactured to metric outside diameters and should have mechanical properties in accordance with HTM 2022/HTM 02-01.   |

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| 2         | All indigenous copper pipes should be inspected and certified by Third Party Inspecting Agency Lloyds' Register Services before despatch and the pipes will be delivered capped at both ends. Imported Copper pipe should have equivalent certification. Copper Fittings should be as per. HTM 2022/HTM 02-01. All plastic saddles will have brass screws.   |
| a         | 42mm OD X 1.2 mm thick   |
| b         | 28mm OD x 0.9 mm thick   |
| c         | 22mm OD x 0.9 mm thick   |
| d         | 15mm OD x 0.9 mm thick   |
| e         | 12mm OD x 0.7 mm thick   |
| 3         | Rates of above mentioned copper pipes should be mentioned in the price bid so that variable quantity can be calculated and paid accordingly. Valves and lines additional sizes if required, may be quoted as optional.   |
| <b>X</b>  | <b>VALVES – LINE VALVES</b>  |
| 1         | Line Valves shall be provided for use in plant rooms and to facilitate the isolation of areas or areas where area zone valve are unnecessary. These shall be of the ball valve type and shall be constructed of a nickel plated brass body, PTFE seats and brass chrome plated ball. The valve shall be operated by a manual operating lever by 90° turn. All medical gas line ball valves shall provide a full bore flow and shall be cleaned for oxygen service and fully tested. The valve assembly shall terminate in copper stub pipes to enable brazing directly into the distribution system using the flux less brazing technique. A locking device shall be provided to lock the valve in either the fully open or fully closed position. Line valves shall be located in readily accessible areas of ducts and shafts, however care should to ensure safety to prevent danger from leakage. Line valve installation should be carried out as per HTM 2022/HTM 02-01 standards. |
|           | Valve Size are indicated   |
| a         | 15mm Ball Valve  |
| b         | 22mm Ball Valve  |
| 2         | Number of Valves are mentioned in BOQ. Unit rate should be quoted in the price bid so that variable quantity can be calculated and paid accordingly. Valves and lines additional sizes if required, may be quoted as optional.   |
| <b>XI</b> | <b>Area Valve Service Units (AVSU)</b>   |

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| 1 | The Area Valve Service Unit (AVSU) shall provide area isolation facility for use either in an emergency or for maintenance purposes. It shall be possible to insert a physical barrier (spade) on either side of the valve when required without the necessity to totally dismantle the line valve. The area valve service unit shall be fully gas specific, permanently labeled to identify the Medical gas service and shall incorporate gas specific NIST connections to BS5682:1984 on each side of the line valve. Pressure gas services (not vacuum) NIST connections shall incorporate self sealing valves which are normally held closed by gas pressure. |
| 2 | The line valve shall be brass ball valve with PTFE seats operated by a quarter turn handle with a pin to prevent over travel in both directions. The ball valve shall be connected by pipes to the distribution system by either top, bottom, side or rear entry pipes.   |
| 3 | The assembly shall be housed in a valve box which shall be capable of both surface or concealed mounting incorporate a hinged lid which opens through 180 degree, to provide maximum access. The hinged door shall be fitted with a glass panel to enable a visual check on the line valve selected position and for access in an emergency.  |
| 4 | Area or Zone identification facilities shall be provided. The hinged door shall normally be locked closed and area zone valves installed adjacent to each other shall be operated by different key lock combinations.   |
| 5 | The area zone valve assembly shall provide for natural ventilation to prevent any localized build up of gas within the valve box.   |
| 6 | The valve box and door shall have a white finish. Area/Zone service units shall be fitted in readily accessible locations adjacent to the area which they serve and shall be clearly labeled to indicate function, valve position and area. Each valve box shall accommodate only one valve, several valve boxes may however be grouped together within a single housing.   |
| 7 | <b>Scope:</b>   |
|   | a. The contractor of Medical gas shall supply, install, test and commission all safety required for the medical gas system safety relief valves as specified in HTM 2022 /HTM 02-01 standards.  |
|   | b. The sub-contractor of Medical Gas supply shall install test and commission all area valve and service unit AVSU in the hospital as shown on the drawing and as specified in HTM 2022 /HTM 02-01, to all necessary equipment, pipe work fittings, boxes, accessories, connectors pressure gauges, switches including the zone pressure alarm panel and all related electrical works to have complete and full operational AVSU unit. The contractor shall clearly specify the number of zone wall units comprising of AVSUs area alarm panel pressure switches and pipe works.  |

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|             | c. The sub-contractor of Medical Gas shall supply, install, test and commission all required valves, check valves for the medical gases and vacuum system.  |
| <b>XII</b>  | <b>Area Line Pressure Medical Gas Alarm</b>   |
| 1           | The area line pressure alarm should be micro-processor based digital / analog which monitor the pressures of medical gases like oxygen, compressed air and vacuum levels at a specific area of piped gas system in the hospital. The electronic circuitry should be such that if the pressure / vacuum in the gas pipeline drops below the present limit, the equipment should give an audio-visual alarm. Visual alarm should remain active even after pressing of "Mute" button. It should come to normal condition only when gas pressure / vacuum return to normal level. |
| 2           | Three Channel Alarm for Oxygen, Air & Vacuum should have the following features:  |
| 3           | Digital / Analog Display of Line Pressure for all the services with factory calibrated pressure sensors.  |
| 4           | Color coded LED Display of Line pressure status (High – Caution – Normal – Caution– Low )   |
| 5           | Audible Alarm for High & Low pressure condition.  |
| 6           | Test and Alarm Acknowledge (Mute) facility.   |
| 7           | Small and compact design.   |
| 8           | Mounted on a powder coated MS box.  |
| 9           | Nut & Nipples should be provided for connection with Pneumatic supply line.   |
| 10          | Low voltage internal operation for safety with input power supply of 230 V,50 Hz AC.  |
| 11          | Wall mounting facility.   |
| 12          | High / Low indication with Test facility  |
| <b>XIII</b> | <b>Horizontal Bed Head Panel</b>  |
| 1           | It should be made of High Strength Anodised Aluminium Profiles with single railing and should have the following features :   |
| 2           | Should be powder coated as per the customer's choice.   |
| 3           | The panel should be designed to have provision to accommodate the following:  |
| a           | <b>Gas Outlets</b> - Provision for two Oxygen ,two Vacuum and One air   |
| b           | <b>Electrical Sockets / Switches</b> -at least 6 nos. with individual switches  |
| c           | <b>Data Socket</b> -RJ 45-01 no   |
| d           | Should be supplied with monitor mounting solution   |
| <b>XIV</b>  | <b>Rigid Ceiling Pendant</b>  |
| 1           | The heavy-duty pendant will be mounted on ceiling and the column length to be fabricated for the specified ceiling height.  |

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| 2          | Pendant head should accommodate the required nos. of gas outlets and electrical sockets with complete separation between gas outlets and electrical Sockets.   |
| 3          | The pendant head will have following features:   |
| a          | • Made of stainless steel  |
| b          | • 2 sets of 230 V, 5/15 Amp electrical sockets with individual On / Off switches   |
| c          | • Provision to accommodate 8 Nos. of Gas / Vacuum outlets .  |
| <b>XV</b>  | <b>INSTALLATION &amp; TESTING</b>  |
| 1          | Installation of piping shall be carried out with utmost cleanliness. Only pipes, fittings and valves, which have been degreased and brought in polythene sealed bags, shall be used at site. Pipe fixing clamps shall be of non-ferrous or non-deteriorating plastic suitable for the diameter of the pipe.  |
| 2          | All pipe joints shall be made using flux less brazing method. Inert gas welding technique must be used by passing Nitrogen gas at the flow of 6 LPM (min.) inside the copper pipes during silver brazing in order to avoid carbon disposition inside the copper pipes. All joints should be made of copper to copper and shall be brazed by silver brazing filler material without flux. |
| 3          | Adequate supports shall be provided while laying pipelines to ensure that the pipes do not sag. The spacing of supports shall not exceed 1.5 meter for any size of pipe. Suitable sleeves shall be provided wherever pipes cross through walls / slabs. All pipe clamps shall be non-reactive to copper.   |
| 4          | After erection, the pipes should be flushed with dry nitrogen gas and then pressure tested with dry nitrogen / Medical Air at a pressure equal to twice the working pressure for a period of not less than 24 hours. All leaks and joints revealed during testing should be rectified and re-tested till the pressure in pipes stands for at least 24 hours.                             |
| 5          | Installation, Testing and Commissioning of Medical gas pipelines should be carried out as per HTM 2022/HTM 0201 standards.   |
| 6          | All the piping system should be tested in the presence of the engineer or his authorized representative.   |
| <b>XVI</b> | <b>Colour Coding</b>   |
| 1          | All exposed pipes should be painted with two coats of synthetic enamel paint and colour codification should be as per British standards.   |
| a          | Oxygen Line-----White Colour   |
| b          | Air Line-----Black and White   |
| c          | Vacuum Line-----Yellow Colour  |

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|  | <b>APPROVED MAKES</b>                       |
|  | Copper tube - Mehta tube                    |
|  | Vacuum Pump - Ingersoll Rand/Anest Iwata    |
|  | Air Compressor - Ingersoll Rand/Anest Iwata |